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Agriculture

Forest
Service

**Southwestern
Region**

Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds

Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona

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Final Environmental Impact Statement for the Integrated Treatment of Noxious or Invasive Weeds

Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona

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Abstract: The Coconino, Kaibab, and Prescott National Forests propose to implement a control program for noxious or invasive weeds within central Arizona. Alternative 1 is the Proposed Action; Alternative 2 is the No Action; Alternative 3 has no herbicidal weed treatments; and Alternative 4 is the Agency's preferred alternative with less herbicidal use than the Proposed Action.

Map 1-1. Location map

Contents

Summary **1**
Proposed Action 1
Purpose and Need 1
Decision to be Made 1
Public Involvement 2
Issues 3
Alternatives 3
Proposed Action – Alternative 1 3
No Action – Alternative 2 4
No Herbicide Alternative – Alternative 3 4
Preferred Alternative – Alternative 4 4
Summary of Potential Environmental Impacts 5
Watersheds, Vegetation, Special Designation Areas, and Weeds 5
Endangered, Threatened, Candidate, Sensitive, and Management Indicator Plant Species 5
Endangered, Threatened, Proposed, Candidate and Sensitive Fish Species 6
Endangered, Threatened, Proposed, Candidate, Sensitive and Management Indicator Wildlife Species 7
Public Health, Access to Vital Services, Forest Service Recreation Sites, and Plant Collection 7
Agency Preferred Alternative 8

Chapter 1 - Purpose of and Need for Action **9**
Introduction 9
Background 10
Purpose of and Need for Action 12
Weed Definitions and Regulations 13
Proposed Action 14
Management Direction 18
Tiering 19
Permits and Agency Approvals Required 20
Decision Framework 20
Public Involvement 21
Issues 22
Issue 1 23
Issue 2 23
Issue 3 24

Chapter 2 – Alternatives Including the Proposed Action **25**
Introduction 25
Alternatives Considered in Detail 25
Alternative 1: Proposed Action 25
Alternative 2: No Action 26
Alternative 3: No Herbicide 26
Alternative 4: Preferred 26
Alternatives Considered but Eliminated from Detailed Study 27
Integrated Weed Treatment Strategy 28
Manual Control 30
Mechanical Control 30
Cultural Control 31

Biological Control 31
Herbicide Control 33
Consistency with the Coconino, Kaibab, and Prescott National Forests Plans 38
Agency Preferred Alternative 38
Summary Comparison of Alternatives 38

Chapter 3 - Affected Environment 49
Introduction 49
Soil, Water and Air 49
Watersheds 49
Soil Condition 51
Water Quality 52
Air Quality 52
Vegetation 53
Terrestrial Ecosystems 53
Weeds 59
Plant Species — Endangered, Threatened, Candidate, and Sensitive 66
Wildlife 76
Fish Species – Endangered, Threatened, Proposed, Candidate, and Sensitive 76
Terrestrial and Aquatic Wildlife Species – Endangered, Threatened, Proposed, Candidate, and Sensitive 79
Management Indicator Species 90
Migratory Birds 95
Public Health 96
Background 96
Public Health 96
Social Concerns and Economic Influences 98
Access to Vital Services and Recreation Sites 98
Plant Collection 100
Economic Setting 101
Cultural Resources 102
Archaeological Sites 102
American Indian Traditional Cultural Properties and Resources 103
Areas with Special Designation 103
Wilderness, Wild and Scenic Rivers, and Research Natural Areas 103
Grand Canyon Game Preserve 105
Inventoried Roadless Areas 106
Potential Wild and Scenic Rivers 106

Chapter 4 - Environmental Consequences 115
Introduction 115
Soil, Water and Air 115
Watersheds and Soils 115
Water Quality 122
Air Quality 123
Vegetation 124
Weeds 124
Threatened, Endangered, Candidate, and Sensitive (TEC&S) Plant Species 136
Wildlife 152

Threatened, Endangered, Proposed, and Sensitive Fish Species and Designated Critical Habitat 152
Threatened, Endangered, Sensitive and Management Indicator Wildlife Species 157
Public Health 195
Background 195
Herbicide Risk Assessments 196
Uncertainty 198
Direct and Indirect Effects 199
Cumulative Effects 206
Impurities, Surfactants, Adjuvants, and Inert Ingredients in Herbicide Formulations 208
Synergistic Interactions 210
Endocrine Disruption 211
Social Concerns and Economic Influences 213
Direct and Indirect Effects on Access to Vital Services, Recreation Sites, and Plant Collection 213
Cultural Resources 219
Environmental Consequences 219
Environmental Justice 219
Short-term Uses and Long-term Productivity 220
Unavoidable Adverse Effects 220
Irreversible and Irretrievable Commitments of Resources 220
Areas with Special Designation 221
Environmental Consequences to the Wilderness Resource 221
Environmental Consequences to the Grand Canyon Game Preserve 223
Environmental Consequences to Inventoried Roadless Areas 224
Environmental Consequences to Potential Wild and Scenic Rivers 225

Chapter 5 - Consultation and Coordination 227

List of Preparers and Consultants 227
Lead Agency – Coconino, Kaibab, and Prescott National Forests 227
List of Agencies, Organizations, and Persons to Whom Copies of the DEIS and FEIS Were Sent 231

Chapter 6 - Adaptive Management and Monitoring 237

Adaptive Management 237
Adaptive Management Strategy 237
Addressing New Information and Changed Circumstances 239
Project Monitoring 239
Implementation Monitoring 239
Treatment Effectiveness Monitoring 240
Environmental Effects Monitoring 240

Literature Cited 243

Appendix A – Proposed Amendment for Noxious or Invasive Plant Management for the Coconino, Kaibab, and Prescott National Forest Plans 265

Appendix B - Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures 273

Design Features for Integrated Weed Treatment Projects 273

Integrated Weed Management Practices (Coconino, Kaibab, & Prescott National Forests Noxious and Invasive Weed Strategic Plan 1998, Amended 2002).....274

Introduction 274

Soil, Water and Air Best Management Practices 287

Weed Control Pesticide Safety and Spill Plan 289

Information and Equipment 289

Mitigations for Herbicide Use.....289

Procedures for Herbicide Spill Containment.....290

Notification List of Key Personnel.....291

Integrated Treatment for Noxious or Invasive Weeds on Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties 292

Endangered Species Act Section 7 Consultation #2-21-01-I-0335.....292

Species Conservation Measures (Project Design Features) 292

Appendix C - Maps 311

Appendix D - Susceptibility of TE&S Plant Species to Proposed Herbicides 323

Appendix E - Cumulative Impacts Project List 333

Forest Service Activities.....333

1. Roads and Rights-of-Way Management 333

2. Vegetation Management 333

3. Range Management.....334

4. Fire Management 335

5. Recreation Management and Activities 336

6. Stewardship Resources.....340

7. Lands and Mineral Resources 340

Off-Forest Activities.....340

8. Rights-of Way Development and Treatments 340

9. Other Pesticide Use 341

Current Project List.....342

Multiple Forest Projects 342

Coconino National Forest Projects (10-01-04 thru 12-31-04).....343

Kaibab National Forest Projects (10-1-04 thru 12-31-04).....344

Prescott National Forest Projects (10-1-04 thru 12-31-04) 345

Appendix F. Biological Assessments and USFWS Consultation 347

Appendix G. Response to Comments and Government/Agency Letters 501

Government and Agency Comment Letters.....556

Index..... 589

List of Figures

1 Comparison of alternatives by weed control method in estimated total acres to be treated over 10 years. 39
2 Percentage of total acres used in each integrated weed management technique in Alternative 1-High 119
3 Percentage of the total treatments by type for Alternative 1-Low 119
4 Total new acres treated in Alternative 1 (High and Low) by watershed 120
5 Treatment levels by watershed for Alternative 3 121
6 Total new acres treated in each watershed for Alternative 4 122
7 Percent of total costs by watershed for Alternative 1-High 128
8 Percent of total costs by watershed for Alternative 1-Low 129
9 Total acres infested in Alternative 2 131
10 Percent of total acres used in each integrated weed treatment technique in Alternative 3 132
11 Percent of total costs by watershed for Alternative 3 133
12 Percent of total acres using each integrated weed treatment technique in Alternative 4 133
13 Percent of total costs by watershed for Alternative 4 134
14 Total acres of proposed herbicidal treatments scheduled for Alternatives 1 and 4 200
15 Total pounds per acre of active ingredient in proposed herbicidal treatments 201
16 Cumulative impacts on access and collection of plants 217

List of Tables

1 Weeds of concern and proposed treatment priorities and objectives 16
2 Rangeland weeds and proposed biological control agents 32
3 Typical and maximum herbicide and carrier application rates (in pounds active ingredient per acre) 37
4 Summary comparison of alternatives 38
5 Summary of impacts on the purpose and need, issues, and resource elements 40
6 Ground water monitoring for watersheds associated with the Coconino, Kaibab, and Prescott National Forests 52
7 Terrestrial ecosystems present within the Coconino, Kaibab, and Prescott National Forests 53
8 Current weed infestations by watershed 60
9 Known and potential endangered, threatened, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests 66
10 Threatened, endangered, proposed, and sensitive fish species known on the Coconino, Kaibab, and Prescott National Forests 76
11 Threatened, endangered, sensitive animal species for the Coconino, Kaibab, and Prescott National Forests 79
12. Management indicator species 90
13 Estimated miles of highways and acres infested with weeds within the Coconino, Kaibab, and Prescott National Forests 98
14 Known weeds within 1 mile of campgrounds, trailheads, and scenic overlooks on the Coconino, Kaibab, and Prescott National Forests 100

15 Designated wilderness, wild and scenic river corridors, and research natural areas and estimated sizes of weed populations 104
16 Herbicide characteristics in water and soil 117
17 Direct and indirect effects of alternatives on the spread of weeds 125
18 Comparative costs of the four alternatives 125
19 Target weed species meeting treatment objectives by alternative 126
20 Proposed distribution of herbicide treatment for each chemical by species if authorized in the decision 130
21 Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative 138
22 Toxicity level categories as established by the EPA 158
23 Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative. 172
24 Direct and indirect effects on access and the collection of plants 213
25 Adaptive management treatment objectives and priorities. 238
26 Required protection measures for pesticide applications in identified species habitats. 297
27 Adjuvant summary table and required protection measures 310

Summary

This final environmental impact statement (FEIS) documents the analysis of the potential environmental consequences of the implementation of an integrated weed treatment (IWM) program for the Coconino, Kaibab, and Prescott National Forests. The FEIS has been prepared in compliance with the National Environmental Policy Act (NEPA) guidelines as set by the Council of Environmental Quality in 40 CFR 1500-1508 and Forest Service Handbook 1909.15. The six main chapters of this document describe the proposed action, purpose and need and significant issues, alternatives including the proposed action, affected environment, environmental effects, list of preparers, and adaptive management as well as monitoring. The appendix material includes such items as the proposed forest plan amendment; design features, best management practices, and mitigation measures; maps of noxious weed infestations; herbicide susceptibility of rare plants, cumulative impacts project list, agency letters, and response to comments.

Proposed Action

The Proposed Action would authorize treatment of noxious and invasive weeds ranging from a low of 2,000 acres per year to a high of 10,000 acres per year of which 65 percent is projected to include some herbicidal use. The various methods analyzed include manual, mechanical, cultural, biological, and herbicidal. The majority of treatments will be found along major roads and within the ponderosa pine type in the Verde River and Little Colorado River basins. Adaptive management—where treatment of new species that may become established, new herbicides which are not considered in this analysis, and the concept if the proposed treatment identified fails, alternative strategies will be developed to address this problem—is also a component of the Proposed Action.

Purpose and Need

Existing conditions within the project area indicate that weeds have expanded to 187,500 acres or 3 percent of the land area. Bull thistle, leafy spurge, various knapweed species, and Dalmatian toadflax have made dramatic increases over the past 20 years. Riparian corridors, especially the Verde River, have been noted with increases in tamarisk, Russian olive and tree of Heaven, as well as some of the knapweeds. There are currently 25 known weeds found within the 3 national forests and 4 species adjacent to them. The desired condition is to prevent any new plants from becoming established on national forest lands. Eleven species (98 percent of the infested acres) have been assigned a contain/control objective; an additional 10 species are targeted for complete eradication; and 1 species (representing about 1 percent of the infested acres) is assigned an eradicate/control objective. The control of these plants would promote ecosystem health and prevent losses in the productive capacity of the land. These actions would also avoid a decline in riparian values within the project area.

Decision to be Made

The forest supervisors of the Coconino, Kaibab, and Prescott National Forests are the responsible officials for this proposal. They will decide whether to implement the Proposed Action or another action alternative as defined, or not at all (no action).

In addition, within Forest Service lands where the Federal Highway Administration (FHwA) is authorized to maintain right-of-way clearings or noxious weed control through the use of

herbicides under the Decision Notice and Fonsi[1] signed by Karl Sidarits, Tonto National Forest Supervisor, on May 27, 2004, FHwA will make the decision regarding use of herbicides and ask for concurrence from the appropriate forest supervisor(s).

Public Involvement

Scoping shall be an early and open process for determining the scope of the issues to be addressed and for identifying the significant issues related to the Proposed Action (40 CFR 1501.7). Initial scoping began on August 31, 1998, when a proposal for the treatment of noxious weeds was mailed to concerned citizens, Federal, and State agencies, and environmental organizations identified within the forests' NEPA mailing lists. The 1998 proposed action called for the herbicidal treatment of noxious weeds at the rate of 2,000 acres per year over a 5-year period confined solely to major transportation and utility corridors, which are the most prone to invasion.

Based upon public comment received during the first round of scoping, the forests decided to formulate a new Proposed Action and submit it for further public review, and to prepare an environmental impact statement instead of an environmental assessment. Since the 1998 proposal did not address noxious weeds at an adequate level to establish sufficient control, the purpose and need for action was expanded from right-of-way corridors to the entire land base within the 3 national forests.

In May 2001, prior to the development of the new proposal, we mailed a project update letter to over 1,900 individuals, groups, and other governmental organizations in which we detailed the process and timelines the agency was going to follow. We received about 450 responses from people who indicated they wanted to continue their involvement in this process.

In early June 2001, we mailed the new proposal to those responding to our first update letter. We also filed the Notice of Intent to Prepare an Environmental Impact Statement with the Federal Register that was published on June 26, 2001. On June 11, 2001, we sent a news release to local papers and completed interviews with several television and radio stations about the project. The Associated Press conducted several interviews concerning the proposal and submitted those articles for national release.

We conducted four informational meetings with people concerned about multiple chemical sensitivities. These meetings were held on March 19, 1999, February 13, 2002, April 14, 2004, and April 31, 2004 to solicit issues regarding the Proposed Action and gather information related to the use of herbicides.

The Forest Service initiated tribal consultation in August 1998, when the first Proposed Action was mailed. In June of 2001 the Forest Service sent the revised proposal to a total of 13 American Indian tribal governments that are located in central and northern Arizona. The project has been listed in the forests' annual NEPA project consultation lists since 1999 (Pilles 2004, Schroeder 2004). Thirteen tribal entities are routinely sent a copy of the consultation list and letter. As a followup to the consultation letters, the forests usually held annual meetings with the Havasupai Tribe, Hopi Tribe, Kaibab Band of Paiute Indians, Yavapai-Apache Nation, and the Yavapai-

[1] Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona.

Prescott Tribe. The use of herbicides has been routinely mentioned and discussed at those meetings (Pilles 2004). Through the consultation process, the forests received responses and information from several American Indian tribal governments concerning the potential effects of herbicides on the health of individuals who collect and use traditional plants.

At the conclusion of the second round of scoping, the Forest Service Interdisciplinary Team prepared a list of issues to be used in the development of alternatives and to assist in the focus of the analysis. From this effort one alternative was formulated to address Native American concerns related to the use of herbicides and the health of individuals collecting plants from these zones or adjacent to them. At the conclusion of the analysis in March 2004, the draft environmental impact statement was released. This was sent to 12 American Indian tribal governments and 9 chapters of the Navajo Nation, and comments were invited from tribal authorities.

Issues

Based on the assessment of comments, the interdisciplinary team identified three significant issues that were subsequently approved by the responsible officials. The issues used in the development of alternatives for this FEIS are as follows:

1. Use of herbicides could limit individuals with multiple chemical sensitivity (MCS) and other people vulnerable to chemicals from using travel corridors and National Forest System lands in general, thus limiting their access to vital services and recreational opportunities.

2. The use of herbicides for noxious weed control may cause varying health effects for people who come into contact with the herbicides and/or treated areas.

3. The proposed application of herbicides for noxious weed control may affect the ability of American Indians and others to collect plants for traditional uses or medical reasons in specific areas.

Alternatives

All action alternatives include a nonsignificant forest plan amendment for the Coconino, Kaibab, and Prescott National Forests (Appendix A).

Proposed Action – Alternative 1

The Coconino, Kaibab, and Prescott National Forests would authorize new treatments of weeds on a series of infestations ranging from an estimated low of 2,000 acres per year to a projected high of 10,000 acres per year (depending on annual budgets) scattered throughout the 3 national forests. Because a range was presented in the Proposed Action, both ends of the range were analyzed separately to show the extent of effects. The analysis of treating 2,000 acres per year is referred to as Alternative 1-Low and correspondingly 10,000 acres per year is referred to as Alternative 1-High. The various methods that will be analyzed under an integrated weed treatment approach include manual, mechanical, cultural, biological and herbicidal. This includes wilderness and other special designated areas. There will be no aerial application of herbicides by either fixed-wing or rotary aircraft. In addition, there will be no aquatic applications of herbicides. The majority of treatments will be found along major travel corridors (e.g., railroads, interstates, and state highways as well as Level 3 and 4 roads on the forests) and within the

ponderosa pine vegetation type in the Verde and Little Colorado watersheds. If approved, project operations would begin in fiscal year 2005 and would continue for the next 5 to 10 years, barring any significant environmental changes. Adaptive management is a component of this alternative.

No Action – Alternative 2

This alternative is required by regulation (Code of Federal Regulations 1502.8) and would call for no IWM treatments applied to any National Forest System lands except for those Forest Service parcels under authority of the Federal Highway Administration. In this situation, the authority to undertake treatments are vested within the Federal Highway Administration, and the only requirement is that they consult with the appropriate forest supervisor prior to the action being implemented.

No Herbicide Alternative – Alternative 3

This alternative would rely on all treatment methods except for herbicidal. This alternative does not have any cap on the acres treated, as Alternative 1, and was formulated to fully address the comments related to the use of herbicides on national forests as well as multiple chemical sensitivity concerns associated with access and tribal issues concerning collection of traditional plants (significant issues 1, 2, and 3). Adaptive management is a component of this alternative although herbicide use is excluded. It was also designed, to the best degree possible, to meet the purpose and need of the proposed project. This alternative would treat 23,410 weed infested acres on the ground with repeat treatments over the next 10 years. This would require 211,475 acres of total treatments (or more than 8 revisits per site); the amount of manual, mechanical, cultural, and biological treatments is roughly 39,000 acres, 132,000 acres, 23,000 acres, and 17,000 acres, respectively.

Preferred Alternative – Alternative 4

This alternative was also established to address the three significant issues; however, unlike Alternative 3, this action includes the option of herbicide use. Herbicide treatments within the rights-of-ways on interstates, U.S. highways, and State highways are covered under the "Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona" (USFS 2003a).

This alternative would treat 31,047 weed infested acres on the ground with repeated visits over next 10 years. This would require 124,050 acres of total treatments (or approximately 4 revisits per site); about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally (including revegetation), 16,000 biologically, and 57,000 acres with herbicides. Adaptive management principles apply.

Limited spray zones would be established adjacent to and within 1 mile of communities, recreation sites, trailheads, and scenic overlooks. Sites where nonherbicidal treatment methods will be effective due to species, population size, or site factors will be targeted for all integrated weed treatment methods except herbicides. Herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds where treatment objectives cannot be met using manual techniques. Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met.

Communication systems will be established to notify individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled for use. Proposed treatment plans will be posted on the World Wide Web and updated regularly to show time periods during which certain areas could be treated. This information will also be available on a 1-800 phone number. Specific actions will also be included and identification of alternative routes around the treated zones, if available.

Summary of Potential Environmental Impacts

Analysis of potential impacts and mitigation associated with the Proposed Action and alternatives is presented in Chapter 4 of the FEIS. The following is a summary of the potential impacts, by resource area, that we predict will result from implementation of either the Proposed Action or one of the other alternatives.

Watersheds, Vegetation, Special Designation Areas, and Weeds

Selection of Alternative 1 (high and low levels of treatment), Alternative 3, and Alternative 4 would begin treatments on weeds found in the project area. The total amount of treatments would range from 76,515 acres for Alternative 1-Low to 211,475 acres scheduled for Alternative 3. Both Alternatives 1-High and 4 are similar in the total amount of work with Alternative 1-High projected at 115,515 acres whereas Alternative 4 is targeted at 124,050 acres. Over 90 percent of all treatments are confined to the riparian, ponderosa pine/oak, and high elevation grassland terrestrial ecosystems of the Verde River and Little Colorado River watersheds. Herbicide treatments for Alternatives 1 (High and Low) and 4 account for 65 percent, 51 percent, and 50 percent of all scheduled work, respectively.

Watershed and vegetation conditions, as well as special designation areas' values, will be maintained at current levels or improve slightly under Alternatives 1-High and 4. Projected declines in these resources are predicted if Alternatives 1-Low, 2 (No Action), or 3 are selected. Only Alternatives 1-High and 4 treat enough area with the appropriate integrated weed treatment techniques to achieve the identified control objectives for most species and begin a reversal in the total area infested by these plants. Alternative 1-Low, which caps the new treatments to 2,000 acres per year, and Alternative 3, which eliminates the use of herbicides, encourages the expansion of noxious weeds by 133,775 acres and 8,370 acres over the next 10 years. Alternative 4 also calls for 4,000 acres of treatments of nonnative annual grasses.

Of the 22 noxious weeds proposed for treatment, Alternatives 1 (High and Low), 3, and 4 achieve control objectives on 20, 15, 13, and 22 weeds, respectively. Alternative 2 would allow the increase of weeds from the current level of 187,500 acres to approximately 340,600 acres at the conclusion of the planning period. All four weeds that are currently found adjacent to the project area are predicted to eventually infest the forests if Alternative 2 is implemented. Costs associated with Alternative 1 (High and Low) are about $9,526,000 and $6,800,000 whereas Alternative 3 is determined to be $24,485,300. Alternative 4 costs are estimated at $12,213,200, with an additional $451,000 tied to the control work of nonnative annual grasses.

Endangered, Threatened, Candidate, Sensitive, and Management Indicator Plant Species

There will be no measurable direct or indirect impacts from the treatment methods planned for Alternatives 1, 3, and 4 with design features and mitigation in place, although implementation of

any action considered could result in minor effects on rare plants. We foresee a low likelihood of herbicides impacting these species since the herbicides proposed for use in and around these populations are the most effective products for treatment of the weed species while at the same time would have the least impact on listed, candidate, or sensitive plants. Those rare species habitats where weeds are presently found and have herbicides scheduled include Arizona cliffrose, Rusby milkvetch, Disturbed rabbittbrush, Arizona bugbane, Mogollon thistle, Heathleaf-wild buckwheat, Ripley's wild buckwheat, Flagstaff pennyroyal, Arizona sneezeweed, giant lupine, Sunset Crater beardtongue, Flagstaff beardtongue, Hualapai milkwort, and Mearns sage. Manual or mechanical treatments may pose a slightly higher risk, since seedlings are extremely difficult to identify and they may be accidentally pulled when treatments of this type occur. We foresee habitat for rare plants improving as control objectives are met. We predict that Alternative 4 would improve habitat for rare plants to the highest degree, and next in order of improvement would be Alternative 1-High, Alternative 3, and Alternative 1-Low. Control of invasive weed species will maintain or improve the overall native plant diversity within habitats of rare plants allowing them to grow without interference of aggressive nonnative competitors. We predict that Alternative 2 (No Action) will have the greatest negative impact since all 25 weed species will expand in their densities and, we suspect, begin influencing the reproductive success of rare plants. Except for Alternative 4, treatments on nonnative annual grasses are not a component of any other action. These species will continue to expand over the next 10 years and eventually change the frequency of wildfire events contributing to declines in rare plant habitat.

Endangered, Threatened, Proposed, Candidate and Sensitive Fish Species

There would be no direct effects to TE&S fish species for Alternatives 1, 3, and 4 because no treatments would occur within the aquatic habitat. Herbicidal treatments in Alternatives 1 and 4 would implement project design features that would minimize the toxicity and exposure of herbicides to such small levels as to have an immeasurable effect to the species or its habitat. Use of manual, mechanical, or cultural treatments for Alternatives 1, 3, and 4 would result in short-term, localized impacts to vegetation and soil. Implementing Best Management Practices would minimize runoff and soil erosion off of treatment areas so that any sediment moving into species' habitat would be such small amounts as to have an immeasurable effect to the species or its habitat. Restoration and/or maintenance of native plant communities as a result of invasive weed control would benefit TE&S fish aquatic habitats in the long term. Alternatives 1-High, 3, and 4 would maintain aquatic habitat conditions for TE&S fish and/or critical habitats (CH) and would not impact existing fish species composition and population trends of TE&S fish in the project area.

Selection of Alternative 1-Low or 2 would result in the continued expansion of weeds throughout the project area and riparian corridors. This could result in small changes in existing aquatic habitat conditions from expansion of weeds leading to long-term degradation of riparian conditions and the potential for increased fire frequency that could increase sediments and nutrients into streams and impact TE&S fish and their habitat. These impacts are expected to be small in size and localized across the project area. Alternative 1-Low and 2 would have minimal impacts to CH and existing fish species composition and population trends of TE&S fish in the project area.

Endangered, Threatened, Proposed, Candidate, Sensitive and Management Indicator Wildlife Species

The primary impact from implementing the action alternatives 1, 3 and 4 is disturbance from people and or equipment during treatments. Most treatment areas are small and do not have essential wildlife habitat. For those treatments located in or near breeding areas where disturbance is a concern, the design features in Appendix B would reduce the impacts from the treatments to a level that would not likely have detrimental impacts to the species using those areas. The design features include nest buffers, breeding season timing restrictions, and limiting application methods.

Impacts from herbicides in Alternatives 1 and 4 are also reduced or eliminated by the design features in Appendix B. Through intensive consulting with the USDI Fish and Wildlife Service, Table 26 lists which herbicides may be used in particular Federally listed species' habitats. This information was also used to set the parameters for herbicide use in sensitive species' habitats.

Impacts from biological controls in the action alternatives 1, 3 and 4 would be limited to the disturbance associated with putting the agents in place. Approved agents have been documented not to have unwanted effects to nontarget species.

Impacts from cultural treatments would vary by method and be addressed in a site specific analysis.

Impacts from no treatments in the No Action Alternative 2 would result in the small limited noxious or invasive weed populations expanding into more important wildlife habitat areas. There is great potential for extensive weed populations to change the plant species composition so drastically as to influence many animal species directly and indirectly. Loss of forage production would have a direct negative impact on grazing ungulate MIS species. Loss of grasses and forbs may have a direct negative impact on small mammals and birds with regard to their food and cover. This would then have an indirect negative impact to some predatory raptors, most notably northern goshawks and Mexican spotted owls. Lack of tamarisk treatments in riparian corridors could lead to loss of entire native riparian ecosystems along the Verde and other rivers. Loss of nesting, feeding and hiding habitat could have negative impacts to a wide variety of riparian dependent species. Lack of action now to control the existing weed populations could forego opportunities to do so in the future.

The preferred alternative would not have any adverse effects to any Federally listed or proposed species. The preferred alternative would not trend toward listing any Forest Service sensitive species. The preferred alternative would not have a negative impact to the population trend or available habitat for any MIS on any forest. The preferred alternative would not have any damaging impacts to any migratory bird species.

Public Health, Access to Vital Services, Forest Service Recreation Sites, and Plant Collection

Implementation of Alternative 1 (High and Low) would authorize 12,675 acres of right-of-way treatments on major road corridors like Interstates 40 and 17 with an additional 2,550 acres scheduled for roads under Forest Service jurisdiction. The amount of herbicide treatments within these travel influence zones under the FHwA and Forest Service control is 11,265 acres and 1,240 acres, respectively.

Additional herbicide treatments are targeted mainly for the riparian, ponderosa pine/oak, and high elevation meadow ecosystems and account for 90 percent of the 74,920 acres scheduled at the high level of Alternative 1 and 38,735 acres projected for the low. We anticipate that 62,035 acres of herbicide treatments, of which 1,240 acres are associated with paved Forest Service roads, in Alternative 4 to reach treatment objectives.

Human health effects resulting from application of herbicides are not expected due to this project. The low application rates and total area where treatments will occur are not going to exceed the reference dose or allow enough exposure time to even remotely approach no observable effect level (NOEL). Those individuals undertaking the applications are the most at risk; proper training and the use of personal protective gear will reduce the hazard to these individuals to very low levels. The potential will always exist for individuals to inadvertently move into a recently sprayed zone. However, with appropriate design features related to signing and public notification (see Appendix B), contact with recently sprayed sites will be reduced to a minimum.

Alternative 4 establishes approximately 818,000 acres of limited spray zones around communities and Forest Service recreation sites to limit potential reactions for those individuals who have compromised immune systems. Within these zones, except where we find deep-rooted perennials, we will use other integrated weed treatment techniques like manual or mechanical first and limit the use of herbicides. Only 10 percent of the project area recreation facilities are predicted to be impacted at any point in time by the application of herbicides, and alternate routes around these zones will be designed. Alternatives 2 and 3 would not limit individuals from accessing campgrounds, trailheads or overlooks since herbicide use is not a component of either action.

Collection of plants by American Indians or others will not be impacted with implementation of any action alternative. Health risks will be mitigated under Alternatives 1 and 4 as discussed above. New treatments range from a minimum of 20,395 acres for Alternative 1-Low to a high of 34,130 acres associated with Alternative 1-High. This includes all integrated weed treatment techniques. This extremely limited amount of treatment acres spread out over 4.9 million acres of the project area is not expected to cause a decline in plant species collected for medical or ceremonial purposes. Those species are typically native plants that would not be targeted in any of the proposed treatments. Control of weeds would enhance the availability of plants desired for medical or ceremonial purposes by improving their habitat and removing the possibility of weeds replacing desired native plants. The highest probability for losses of native plants will occur if either Alternative 1-Low or Alternative 2 is selected. Under both actions weeds are predicted to expand to 340,000 acres or 321,000 acres, respectively. At some point the nonnatives will begin influencing the reproductive success of our native plants causing an overall decline in diversity population numbers of native plants.

Agency Preferred Alternative

The agency preferred action is Alternative 4.

Chapter 1 - Purpose of and Need for Action

Introduction

The Coconino, Kaibab, and Prescott National Forests have prepared this final environmental impact statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws to determine the most appropriate methods to implement integrated treatment of noxious or invasive weeds. For the purposes of this document, the term "weed" will refer to alien plants in the project area whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, 1999). This final environmental impact statement discloses the direct, indirect, and cumulative environmental impacts of weed treatment techniques that would result from the Proposed Action and alternatives. These weed treatment techniques will provide the forests with the tools to implement an integrated weed treatment program. The document is organized into six chapters:

- Chapter 1 - Purpose and Need for Action: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the Agency's proposal for achieving that purpose and need. This section details how the Forest Service informed the public of the proposal and how the public responded.
- Chapter 2 - Alternatives, including the Proposed Action: This chapter provides a more detailed description of the Agency's Proposed Action and alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion includes integrated weed treatment strategy, weed control techniques, a summary table, and charts of the environmental consequences associated with each alternative.
- Chapter 3 - Affected Environment: This chapter summarizes the physical, biological, social and economic environments of the project area.
- Chapter 4 - Environmental Consequences: This chapter describes the environmental effects of implementing the Proposed Action and the other alternatives. The disclosure of environmental impacts covers items related to the purpose and need, issues identified as significant, and specific resource areas that are required to be disclosed in an environmental analysis (e.g., wildlife).
- Chapter 5 - Consultation and Coordination: This chapter provides a record of preparers and list of agencies, organizations, and persons to whom copies of the statement are sent.
- Chapter 6 - Monitoring and Adaptive Management: This chapter outlines the basic monitoring procedures necessary to meet national adaptive management standards.
- Literature Cited
- Appendix. The appendix consists of seven parts that provide detailed information to support the analyses presented in the final environmental impact statement.
- Index. The index provides page numbers by document topic.

It should be clarified that the Proposed Action sent out for scoping is considered that point when the NEPA process is initiated. The preferred alternative (Alternative 4) is what we are currently proposing to implement across the Coconino, Kaibab, and Prescott National Forests to reach treatment objectives. To implement this strategic plan, the Coconino, Kaibab, and Prescott National Forests would amend their respective forest plan to include management direction concerning invasive species prevention and control. This nonsignificant amendment is found in Appendix A.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the supervisors' offices for the Coconino, Kaibab, and Prescott National Forests.

Background

Early recognition of the weed invasion in the project area started in 1986 when noxious weeds were discovered along roadways in northern Arizona, but it was not until initiation of surveys on the Coconino National Forest in 1995 that the overall seriousness of the problem was recognized. Over the past 50 years, several weed species have been introduced into northern Arizona. Some of these species, such as bull thistle, Dalmatian toadflax and diffuse knapweed, began to expand in their ranges with little, if any, action being undertaken to control their spread. Surveys conducted on the Coconino and Kaibab National Forests in 1997 revealed more locations of noxious or invasive weeds. This same year surveys began on the Prescott National Forest. The Southwest Exotic Plant Mapping Program began in 1997 as a collaborative effort between the Coconino, Kaibab, and Prescott National Forests, U.S. Geological Survey's Colorado Plateau Field Station, and others as well. The objective of this effort was to develop regional information on the distribution and abundance of invasive exotic species in the southwest. The three national forests have worked together and submitted their field records to this program each year. The Southwest Exotic Plant Mapping Program team receives the results of field surveys and compiles this data into a master regional database, and generates exotic species distribution maps that are published on the Internet and are located on the Southwest Exotic Plant Mapping Program Web site *(http://www.usgs.nau.edu/swemp)*.

A "Noxious Weeds Strategic Plan Working Guidelines" (Phillips et al. 1998) was drafted as a cooperative effort of the Coconino, Kaibab and Prescott National Forests, and signed by the three forest supervisors in 1999. This plan outlined a strategy for the protection and restoration of native plant communities through implementation of a weed control policy. Prevention of the vectors that bring weeds onto national forest lands and the disturbance regimes that promote their establishment is a major part of this plan. The National Weed Prevention Measures (USDA Forest Service 1998a) were updated and tailored to the three national forests in a document titled, "Integrated Weed Management Practices" (Moser and Phillips 2002); this is incorporated into Appendix B.

In 1998, the Northern Arizona Chapter of The Nature Conservancy, under a challenge/cost-share agreement with the Kaibab National Forest, developed an education and training program on invasive weed management, conducted four public workshops, and developed a "Weed Warrior" program and "Adopt-a-Neighborhood" concept (The Nature Conservancy 1999).

The North Kaibab Ranger District became a partner in the Arizona Strip Weed Management Area (WMA) north of the Grand Canyon in 1998. In January 1998, the Northern Arizona Weed Council (NAWC), a public-private partnership for habitat restoration and public education related to weeds, was formed to identify, map and monitor weed problems. This organization also promotes strategies to prevent and control weed populations, develop awareness of invasive plant issues in the region south of the Grand Canyon and prioritize the species targeted for eradication or control. The council has surveyed for new infestations as well as coordinated education programs and volunteer projects. The Northern Arizona Weed Council submitted a grant proposal to the National Fish and Wildlife Foundation in November 1998, and the 1999 grant (Coconino

NF Weed Control Project) formed the San Francisco Peaks Weed Management Area, encompassing the city of Flagstaff and extending north and east to the Little Colorado River.

Surveys during 1999 revealed that the rate of spread of these invasive exotics was higher than suspected along transportation corridors and throughout areas north and south of the weed management area. This included recognition of a large population of leafy spurge, musk thistle, Russian knapweed and other plants in sites considerable distances from previously known populations. The San Francisco Peaks Weed Management Area was expanded to include all of the Coconino National Forest above the Mogollon Rim and in 2003 was funded under a fourth National Fish and Wildlife Foundation grant. The San Francisco Peaks Weed Management Area maintains a part-time coordinator for the project and has hired crews to conduct inventories, control or eradicate high priority weed populations, monitor effects of treatments, and restore disturbed areas.

The Western Yavapai and Verde Valley Weed Management Areas were formed in 2000 and 2001, respectively. The overall goals are to initiate education and training programs regarding weeds, coordinate control efforts on infestations of recently introduced weeds, restore native vegetation, and protect wildlife, national parks/monuments, Forest Service lands, and private holdings from being overrun by invasive exotic species. Members of the WMAs have presented programs to a variety of community groups, sponsored weed pull days and field trips, and produced brochures. All weed management areas promote policies to ensure cooperation with the local land management agencies and landowners.

Each year the weed management areas teach invasive plant identification and basic survey and control techniques to local land management field personnel and the general public through workshops, weed pulls, and meetings. Staff from the San Francisco Peaks Weed Management Area have worked with various organizations (e.g., Arizona Department of Agriculture, Arizona State Land Department, Coconino National Forest, The Arboretum at Flagstaff, and National Park Service) to present a series of “Integrated Weed Management Practices” workshops in the fall of 2001, funded in part by a Conservation Education Grant to the Coconino National Forest managed by B. Phillips and L. Moser.

Training and coordination provided by the Pulling Together Initiative (funded through San Francisco Peaks Weed Management Area) has resulted in Coconino County including line item budgets to survey and treat weed infestations. In addition, the Coconino County Supervisors have started an annual public forum and weed walks in the larger local communities. Other actions undertaken by Coconino County Maintenance and Public Works are addressing weeds by working with their planning department to draft language for weed prevention and control. The City of Flagstaff has budgeted to survey all lands within the community and treat known infestations. They are currently working on development of an ordinance that will help support the State law regarding weeds found on private land.

In addition, The Arboretum at Flagstaff supported a position of invasive plants education coordinator and created an invasive plants display in their visitor center and has sponsored weed identification walks and local community weed pulls. They have established a long-term monitoring project to restore grasslands after weed invasion and establishment. The education position adapted and tailored national outreach materials and methods to reach a significant portion of the general public within the San Francisco Peaks Weed Management Area, incorporating these materials into state education programs (universities, colleges, Agricultural

Extension, Master Gardeners, etc.), city and county neighborhood programs, and local school programs.

Purpose of and Need for Action

The purpose of this project is to eradicate, contain, control or prevent weeds within the Coconino, Kaibab, and Prescott National Forests. The desired goal is to contain or control the spread of 14 known invasive species, eradicate 8 species that are the most invasive and pose the greatest threat to the biological diversity within the project area, and prevent any new weeds from becoming established. Control of these plants will promote the ecosystem health of forested and rangeland habitats by maintaining or improving native forbs and grass species, increasing the regeneration of cottonwood and willow trees in riparian corridors, and ultimately preventing the loss of wildlife habitat and overall species diversity.

This action is needed because existing conditions within the 3 national forests indicate that weed populations have expanded from a few, small infestations to over 187,000 acres. Experience in other parts of the country demonstrates that many invasive plants have the ability to eliminate all native plants within a given area and over 3 to 10 years (Sheley & Petroff 1999, Lessica & Shelly 1996, Tyser & Key 1988, Rikard & Cline 1980). These species pose a serious threat to ecosystem diversity and have a high potential to harm native plants and wildlife, especially threatened, endangered and sensitive species. Bull thistle, leafy spurge, knapweeds, and Dalmatian toadflax have made significant increases in their overall population size in the project area over 10 years. Leafy spurge, yellow starthistle, and the knapweeds (Russian, diffuse, and spotted) are of particular concern due to their invasiveness. These plants tend to form monocultures (become the only plants found within a site) and eventually eliminate all other native plants. These plants often alter physical conditions or disturbance regimes that allow the invasive species to spread further and form monocultures. Invasive weeds have been documented to alter soil temperature, soil salinity, water availability, nutrient cycles and availability, native seed germination, infiltration and runoff of precipitation, fire severity and frequency (Brooks et al. 2004, DiTomaso 2000, Sheley & Petroff 1999, Lacey et al. 1989).

In addition, leafy spurge, Russian knapweed, yellow starthistle, and other species produce toxic substances that can pose threats to humans, livestock, and wildlife. The effects of weed population growth on native plants include a decline in ecosystem diversity and health, increases in bare soil resulting in declines in watershed condition, a decrease in the overall capacity of the land to support wild and domestic ungulates, and a reduction in the quality of habitat for many wildlife species that require native plants for either cover or food (Rice et al. 1997, Thompson 1996, Trammell & Butler 1995, Hein and Miller 1992, Kelsey & Mihalovich 1987, Lym & Kirby 1987).

Another concern is the current infestation in and along riparian corridors. Roughly 2,500 acres, mostly along the Verde River and Kanab Creek, are infested with tamarisk and other species. These plants will limit and eventually cause a decline in quality of wildlife habitat by reducing native cottonwood and willow regeneration potential. Instream flows can be reduced since these nonnative, woody plants draw more water out of the water table in their life processes than native trees (Hart 1999, DiTomaso 1998, Zimmerman 1997, DiTomaso 1996, Tesky 1992).

Weed Definitions and Regulations

Noxious weed is a legal term applied to plants regulated by Federal and State laws.

Arizona Administrative Codes R3-4-244, R3-4-245 (Arizona Department of Agriculture 1999) regulate certain invasive species in the state: "A noxious weed is defined as any species of plant that is detrimental or destructive and difficult to control or eradicate and includes plant organisms found injurious to any domesticated, cultivated, native or wild plant." The director of Arizona's noxious weed program uses five biological criteria to describe noxious weeds: (1) exotic, (2) invasive, (3) competitive, (4) persistent, and (5) aggressive. "Biological invaders, environmental pollutants, plant plagues, botanical monsters or ecological time bombs, aptly describe the nature of noxious weeds" (Northam, 2001).

Noxious Weed Coordination and Plant Protection Act 2000 (Public Law 106-224)

> "NOXIOUS WEED - The term 'noxious weed' means a plant or plant product that has the potential to directly or indirectly injure or cause damage to a plant or plant product through injury or damage to a crop (including nursery stock or a plant product), livestock, poultry, or other interest of agriculture (including irrigation), navigation, natural resources of the United States, public health, or the environment."

The National Invasive Species Council defines "invasive species" as a species that is: (1) nonnative (or alien) to the ecosystem under consideration; and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Other laws, regulations, and policies related to noxious weed management that are addressed by this project include, but are not limited to:

- Executive Order 13112 of 1999 states Federal Agency duties are as follows:
  - Identify actions that may affect the status of invasive species.
  - Use relevant programs and authorities to: (a) prevent the introduction of invasive species; (b) detect and respond rapidly to and control populations in a cost-effective and environmentally sound manner; (c) monitor; (d) restore; (e) research; and (f) promote public education on invasive species.
  - Not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species.
  - Coordinate these duties with the National Invasive Species Council that coordinates Federal strategies to address the problem of noxious weeds.
- Plant Protection Act of 2000, Public Law 106-224, and the 1990 Farm Bill, Public Law 101-624, which directed the Forest Service to develop and coordinate management programs for controlling undesirable plants.
- USDA Policy 9500-10 directs the Agency to integrate noxious weed management into all programs and activities and to develop, demonstrate, and apply the essential science, technology, and stewardship to effectively manage and prevent the spread of these plants.
- National Prevention Strategy for Invasive Plant Management (USDA Forest Service 2001a).
- Forest Service "Pulling Together Initiative" for noxious weed and nonnative invasive plant management that directed the Agency to set goals of education, implement

integrated weed management as a high priority, include management of noxious weeds in all planning processes, and develop partnerships.

- Forest Service Manuals 2080 and 2150 and Regional Supplement No. 2100-98-1 establish policy and implement programs for noxious weed management.
- Southwestern Region's Strategy for the Protection and Restoration of Native Plant Communities (USDA Forest Service, Regional Office 1999a).
- Noxious Weeds Strategic Plan Working Guidelines – Coconino, Kaibab, and Prescott National Forests (Phillips et al. 1998), which emphasizes mitigation to prevent the spread of noxious weeds and includes education, inventory, and control guidelines.
- Arizona State regulations R3-4-244, R3-4-245 require that the landowner must have an active management program to prevent further spread of these species and reduce numbers of existing populations.

Proposed Action

The Coconino, Kaibab, and Prescott National Forests, administered by the United States Department of Agriculture, are located in central and north-central Arizona and encompass about 4.9 million acres (see Map1-1, opposite "Contents"). Major communities within or adjacent to national forest lands include Flagstaff, Williams, Ashfork, Chino Valley, Prescott, Prescott Valley, Camp Verde, Cottonwood, Rimrock, and Sedona.

The project location includes all reserved public lands, wilderness, and nonwilderness, within the three national forests. Of the 4.9 million acres, about 187,500 acres (or 3 percent of the land area) have been identified as being impacted with noxious weeds. Five watersheds have been inventoried within the project area and include the Verde River (2,139,405 acres), Little Colorado (1,089,255 acres), Colorado/Grand Canyon (1,011,660 acres), Middle Gila (480,835 acres), and Bill Williams (186,635 acres). Numerous private parcels are found within or adjacent to the three national forests.

Major paved roads include Interstates 40 and 17 and State Routes 260, 180, 179, 169, 89, 89A, 87, 67, 64 and Lake Mary Road (FR 3). Numerous unpaved forest roads are found within the project area with the highest road concentration being found in the Little Colorado and Verde watersheds. The high number of forest roads found in these watersheds is the result of past activities, such as timber sales, camping, hunting, and off-road vehicle use.

The 3 national forests propose to authorize annual treatments of weed infestations ranging from an estimated 2,000 to 10,000 new acres (first time treatment) per year scattered throughout the 3 national forests. The project area includes both wilderness and other specially designated areas. The various methods analyzed under an integrated weed treatment approach are defined below and include:

- manual: digging and hand rogueing (selectively removing invasive plants from a native plant population);
- mechanical: clipping, mowing, steaming and burning;
- cultural: grazing by livestock, seeding of competitive native plants, and the use of weed seed-free seed mixes and mulches;
- biological: use of approved insects and pathogens; and

- herbicidal: spot treatments, backpack, and broadcast applications. Aerial application is not being considered in this analysis.

The annual combination of methods to be used would vary depending on specific conditions. There will be no aquatic applications of herbicides on submergent and emergent invasive aquatic species; aquatic species control will be addressed in the future in a separate NEPA analysis. However, riparian invasive weeds could be treated up to water's edge using methods approved for this type of application. The majority of treatments will occur within the ponderosa pine ecosystem in the Verde and Little Colorado watersheds as well as along major travel corridors (e.g., railroads, interstates, and state highways as well as Maintenance Level 3 and 4 roads on the 3 national forests[2]). Although weeds are considered a problem along the highway system, the 3 national forests have experienced an expansion of these species to over 187,500 acres estimated for the project area today. It is now projected that over 90 percent of the weed infestations are presently found outside the major road corridors.

Over the planning horizon of 10 years, it is estimated that 0.7 percent of the total national forest lands would be treated. Repeated treatments or retreatments would be necessary for most weed species because seeds in the soil can be viable for 10 or more years. Therefore, recurring actions would be authorized until the desired control objective is reached.

There are currently 25 species of weeds found within the project area and 4 new species that have been found adjacent to national forest lands (Table 1). One of the 25 is an aquatic weed species; control of aquatic weeds will be addressed in a separate NEPA analysis in the future. Infestation sites range in size from single plants to a population of one species covering several thousand acres. In most cases, the weed infestations do not involve 100 percent of the ground, so actual control efforts for noxious weeds may be confined to a smaller area than reflected in the total affected acres[3].

These weed species were prioritized by first categorizing them into Category A, B or C. Category A weeds are those species that not only have small, isolated populations but also are extremely invasive and the treatment objective of complete eradication is possible. Category B weeds are those weeds that have some small, isolated populations that can be eradicated but other sites can only be contained or controlled. Category C weeds are those weeds that, due to large population size or their lower level of threat, have a treatment objective of contain. Then for this analysis all the species were ranked, starting with 1 as the most important to control, down to the least important (Phillips et al. 1998).

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[2] "Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona" is a separate NEPA analysis that has been done to authorize the Arizona Department of Transportation (ADOT) to use herbicides to control noxious weeds and hazardous vegetation along interstate, Federal, and State highways on all National Forest System lands in Arizona. The Forest Service contact person is Bill Woodward at (505) 842-3827. The project developed treatment(s) for the control and removal of vegetation safety hazards along major roadways throughout Arizona that cross national forest lands. This project approved the use of herbicide applications and a variety of nonchemical methods to treat invasive and noxious weed species in the easement/right-of-way areas.

[3] Infested vs. Affected: An infested acre is defined as an actual acre of canopy cover of the species of concern; in contrast, an affected acre (gross area) is the total area of the polygon drawn around the population. For small dense populations and linear (roadside) populations these two calculations will not vary by much.

Within the context of this analysis, prevention means minimizing introduction of a weed species into the project area and is usually combined with eradication to allow for elimination of spot populations as they arise. Eradication means attempting to totally eliminate a species from the forests. Control means preventing seed production throughout a target patch and reducing the area covered by a species, whereas contain means to prevent the species from expanding beyond the perimeter of existing patches. Over a period of time a species assigned a control objective will experience a decline in overall population size. The "contain" and "control" strategies are often combined due to different sized populations found in different areas. For some species it may not be possible to limit the spread of the infestation, and it may only be possible to control a portion of the outbreak on high-value sites. In the implementation phase, an individual population may be assigned a different treatment goal than the species as a whole to produce the species management objective.

Table 1. Weeds of concern and proposed treatment priorities and objectives

Common Name	Species*	Species Rank	Estimated Acres (2001) ■	Estimated Acres (2002) ●	Objective
leafy spurge	*Euphorbia esula*	1	3,210	1,010	Eradicate
yellow starthistle	*Centaurea solstitialis*	2	165	165	Eradicate
Malta starthistle	*Centaurea melitensis*	3	∇	20	Eradicate
camelthorn	*Alhaghi pseudoalhagi*	4	40	25	Contain/Control
Russian knapweed	*Acroptilon repens*	5	210	210	Contain/Control
whitetop	*Cardaria draba*	6	200	200	Eradicate
Mediterranean sage	*Salvia aethiopis*	7	505	200	Eradicate
musk thistle	*Carduus nutans*	8	15	40	Eradicate
diffuse knapweed	*Centaurea diffusa*	9	965	965	Contain/Control
spotted knapweed	*Centaurea maculosa*	10	10	85	Eradicate
Scotch thistle	*Onopordum acanthium*	11	1,085	1,085	Eradicate/Control
Russian olive	*Elaeagnus angustifolia*	12	75	75	Contain/Control
tamarisk	*Tamarix* spp.	13	1,450	1,450	Contain/Control
Himalayan blackberry	*Rubus procerus*	14	200	200	Contain/Control
houndstongue	*Cynoglossum officinale*	15	5	5	Eradicate
giant reed	*Arundo donax*	16	5	5	Contain/Control
sulfur cinquefoil	*Potentilla recta*	17	Near forests	5	Prevent/ Eradicate
Dalmatian toadflax	*Linaria dalmatica*	18	155,800	155,800	Contain/Control
tree of Heaven	*Ailanthus altissima*	19	160	160	Contain/Control
bull thistle	*Cirsium vulgare*	20	23,130	23,130	Contain/Control

Table 1. Weeds of concern and proposed treatment priorities and objectives

Common Name	Species*	Species Rank	Estimated Acres (2001) ■	Estimated Acres (2002) ●	Objective
Siberian elm	*Ulmus pumila*	21	20	20	Contain/Control
cheatgrass	*Bromus tectorum*	22	∇	(Unknown) needs more survey	Contain/Control specific populations
wild oats	*Avena fatua*	23	500	500	Contain/Control
common teasel	*Dipsacus fullonum*	24	5	5	Eradicate
oxeye daisy	*Chrysanthemum leucanthemum*	Unassigned	∇	NA	Prevent/Eradicate
Canada thistle	*Cirsium arvense*	Unassigned	Near forests	NA	Prevent/Eradicate
halogeton	*Halogeton glomeratus*	Unassigned	Near forests	NA	Prevent/Eradicate
dyers woad	*Isatis tinctoria*	Unassigned	Near forests	NA	Prevent/Eradicate
Eurasian water milfoil	*Myriophyllum spicata* ♦	Unassigned	5	♦	♦

* Species added to an individual forest's or the Region 3 noxious weed list in the future that are found on the forest or nearby will be considered for treatment if the scope of application methods and effects are within the range of the selected alternative (See Chapter 6).

■ Acres; taken from 2001 scoping letter.

● 2002 estimated acres. Some acreages decreased due to measurement of actual weed infested acres versus total affected acres on national forest lands.

∇ Species added since publication of 2001 scoping letter

♦ Aquatic species control will be addressed in separate NEPA analysis.

Under the Proposed Action (Alternative 1), 22 weed species will be authorized for some level of treatment. Eleven species (98 percent of the infested acres) have been assigned a contain/control objective; an additional 10 species (representing 1 percent of the infested acres) are targeted for complete eradication; and 1 species (also representing about 1 percent of the infested acres) is assigned an eradicate/control objective. The remaining four species, which are currently not inventoried within the national forest boundaries, have been assigned a prevent/eradicate objective.

A total of 21 herbicides and 4 additives (adjuvants and surfactants) that have been approved and documented in the Risk Assessment for Herbicide Use for Forest Service Regions 1, 2, 3, 4, and 10 (1995) and on Bonneville Power Administrative Sites (1992) will be considered for use. Based on historical usage of past and current noxious weed control programs in the West, the following herbicides have been used to the greatest extent: chlorsulfuron, clopyralid, '2,4-D', dicamba, glyphosate, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr (Parker personal communication 2001). In addition, since the herbicide imazapic has been approved for use in rangeland situations and a risk assessment has been completed, it will also be considered for use under this analysis.

Implementation. If approved, treatments would begin in Fiscal Year 2005 and would continue for up to 10 years. An implementation plan will be developed based on the predictive models created for this FEIS. These models calculate the effect of different treatment regimes proposed for a species within an alternative. Since little has been published about weed treatments within the project area, annual results will be evaluated and used to validate the predictive model. The forests will review their program of projects to evaluate any changes in the effects described in the final environmental impact statement (FEIS) predictions and will review new information about invasive plants and treatment effectiveness. Annual treatment programs will be coordinated with other Federal and State agencies and private individuals doing similar or adjacent projects. Communication systems will be set up to contact individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled to be used. These include, but are not limited to, notification by phone before treatment, legal notices in newspapers of record prior to treatment, signing of proposed treatment zone, and identification of alternative routes.

Adaptive Management. Adaptive management is part of the proposed action. Weed infestations are dynamic; even the most complete inventory will never cover the actual infested area and will quickly be out of date. New infestations and new species are the highest priority for treatment. New methods or materials may become available that are better suited to a situation than those currently recognized. Adaptive management allows flexibility in changing treatment methods, such as adjusting the timing or frequency of treatments. Adaptive management includes the following:

- Treatments of infestations of weeds that may become established but which are not currently identified on the species list or known to occur on the forests;
- The use of approved herbicides, adjuvants, and surfactants that may not be specifically listed in the Proposed Action, and;
- If prescribed management fails to result in desired outcome, alternative strategies will be developed, and management will be adapted until the desired conditions are achieved. New alternative strategies will be reviewed on a site-specific and case-by-case basis. If it is demonstrated through analysis that the environmental impacts of a new approach falls outside the impacts as disclosed in this document, then additional environmental analysis will be undertaken under NEPA.

Management Direction

The National Forest Management Act (1976) specifies that National Forest System land "provide for a diversity of plant and animal communities based on the suitability and capacity of the specific land area in order to meet overall multiple-use objectives." The implementing regulations (36 CFR 219.26) for the National Forest Management Act state "forest planning shall provide for a diversity of plant and animal communities and tree species consistent with the overall multiple-use objectives." In addition, 36 CFR 219.27 (a) (g) states that "management prescriptions shall preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species so that it is at least as great as that which would be expected in a natural forest."

The Noxious Weed Management Act (1974) contains provisions to prevent the dissemination of noxious weeds. Other sections in the act authorize the cooperation of Federal agencies with agencies of the State, districts, farmers' associations and similar organizations or individuals in

carrying out operations and measures to eradicate, suppress, control or retard the spread of any noxious weed. The Plant Protection Act of 2000, Public Law 106-224, and the 1990 Farm Bill, Public Law 101-624, directed the Forest Service to develop and coordinate management, programs for controlling undesirable plants. In addition, 36 CFR 222.8 acknowledges the Agencies' obligation to work cooperatively in identifying noxious weed problems and developing control programs in areas where National Forest System lands are located.

The Coconino, Kaibab, and Prescott National Forests plans, as amended, set forth broad programmatic management direction for the individual forests. This FEIS is a project-level analysis, designed in conformance with applicable forest plan management direction (goals, objectives as well as standards and guidelines).

Current standards and guidelines or resource objectives for the control of noxious weeds are not a component of any of the forest plans except for:

- The 1986 Prescott National Forest Plan that stated, "control noxious weeds on rangelands to prevent significant population buildups."
- The 1996 amendment where the Kaibab National Forest recognized the importance of close coordination with private landowners on the treatment of weeds.
- The 1998 Sedona Area Amendment (12) where the Coconino National Forest Plan has the following goal along with additional direction for the lands covered by this amendment: the impacts of nonnative plant and animal species are controlled and the introduction of new nonnatives is discouraged.
- The 2002 Flagstaff/Lake Mary Area Amendment (17) where the Coconino National Forest has the following objective along with additional direction for the lands covered by this amendment: the impacts of nonnative plant and animal species are controlled and introduction of new nonnatives is discouraged.

The three forest plans do not consistently cover weed control to any great degree, since the problem was not evident during the initial development of those documents in the mid-1980s. The three national forests have developed working guidelines "Noxious Weeds Strategic Plan Working Guidelines – Coconino, Kaibab, and Prescott National Forests" (Phillips et al. 1998), which established protocols that the forests will follow to establish an integrated weed management program. The amendments to the Coconino, Kaibab, and Prescott National Forests' plans to include management direction concerning invasive species prevention and control are in Appendix A.

Numerous goals, objectives, standards, and guidelines are found in the forest plans that direct all three forests to manage riparian corridors in satisfactory or better condition, improve wildlife habitat quality as well as protection of key habitats, and maintain or increase soil productivity. The management direction from the three forest plans that apply to the project described in this FEIS is primarily those regarding protection and improvement of wildlife habitat, soil and water resources, and riparian habitat.

Tiering

Tiering refers to the coverage of general matters in broader environmental impact statements with subsequent narrower statements incorporating the general discussion of those documents as well as decisions made and subsequently concentrating solely on the issues specific to the statement

being prepared (40 CFR 1508.28). Environmental documents tiered by this FEIS include the following:

- "Environmental Impact Statement for the Coconino National Forest Plan" (USDA Coconino National Forest 1987a) and amendments.
- "Environmental Impact Statement for the Kaibab National Forest Plan" (USDA Kaibab National Forest 1987b) and amendments.
- "Environmental Impact Statement for the Prescott National Forest Plan" (USDA Prescott National Forest 1987c) and amendments.

Prior to the release of a new biological agent for weed control an environmental analysis is prepared by APHIS (Agricultural Plant Health Inspection Service). It is intended that this analysis will satisfy the intent of NEPA for the release and distribution of the agent in the United States and they are incorporated by reference in Chapter 2.

Permits and Agency Approvals Required

The following permits or authorizations would be required for project decision:

- Prior to burning, obtain a burn permit from Arizona Department of Environmental Quality.
- Consult and obtain concurrence or a biological opinion from the U.S. Fish and Wildlife Service on the biological assessment, addressing listed threatened, endangered, proposed and candidate species, if the biological assessment and evaluation makes a "May Affect" determination.
- If applicable, consult and obtain concurrence from the Arizona State Historic Preservation Officer regarding identification, evaluation, and determination of effect of the project on heritage resources.
- If required, obtain a discharge permit either through the Arizona Department of Environmental Quality or the Corps of Engineers prior to application of any herbicide along navigable waters.

If the application of herbicides is authorized, all herbicide applicators will be required to meet State and Federal standards for licensing for use of these products.

Decision Framework

The forest supervisors of the Coconino, Kaibab, and Prescott National Forests are the responsible officials for this proposal. They will decide whether to implement the Proposed Action or other action alternatives as defined, or not at all (no action). The Proposed Action (Alternative 1) was developed to meet the purpose and need and initiate the NEPA process. The preferred alternative (Alternative 4) is the Agency's recommended course of action to treat weed populations based on the issues identified in the scoping process. Any action alternative (Alternatives 1, 3, and 4) will require an amendment to each of the three forest's land and resource management plans. This amendment will include management direction covering invasive species prevention and control.

In addition, within Forest Service lands where the Federal Highway Administration (FHwA) is authorized to maintain right-of-way clearings or noxious weed control through the use of herbicides under the Decision Notice and FONSI[4] signed by Karl Sidarits, Tonto National Forest Supervisor, on May 27, 2004, FHwA will make the decision regarding the use of herbicides and ask for concurrence from the appropriate forest supervisor(s).

The final environmental impact statement (FEIS) is not a decision document. The FEIS displays the results of an analysis of the Proposed Action and alternatives with respect to the key issues as well as the ability of those actions to meet the purpose and need. A Record of Decision (ROD) signed by the forest supervisors will document the decision and rationale for selection.

Public Involvement

Scoping shall be an early and open process for determining the scope of the issues to be addressed and for identifying the significant issues related to the Proposed Action (40 CFR 1501.7). Initial scoping began on August 31, 1998, when a proposal for the treatment of noxious weeds was mailed to concerned citizens, Federal, and State agencies, and environmental organizations identified within the forests' NEPA mailing lists. The 1998 Proposed Action called for the herbicidal treatment of noxious weeds at the rate of 2,000 acres per year over a 5-year period confined solely to major transportation and utility corridors, which are the most prone to invasion.

Based upon public comment received during the first round of scoping, the forests decided to formulate a new Proposed Action and submit it for further public review, and to prepare an environmental impact statement instead of an environmental assessment. Since the 1998 proposal did not address noxious weeds at an adequate level to establish sufficient control, the purpose and need for action was expanded from right-of-way corridors to the entire land base within the 3 national forests.

In May 2001, prior to the development of the new proposal, we mailed a project update letter to over 1,900 individuals, groups, and other governmental organizations in which we detailed the process and timelines the Agency was going to follow. We received about 450 responses from people who indicated they wanted to continue their involvement in this process.

In early June 2001, we mailed the new proposal to those responding to our first update letter. We also filed the Notice of Intent to Prepare an Environmental Impact Statement with the Federal Register that was published on June 26, 2001. On June 11, 2001, we sent a news release to local papers and completed interviews with several television and radio stations about the project. The Associated Press conducted several interviews concerning the proposal and submitted those articles for national release.

Due to the climate and other environmental factors, Arizona has a high proportion of vulnerable populations, such as the elderly, people with respiratory conditions, and people with multiple chemical sensitivity or MCS. The Arizona Technology Access Program (1996) noted 28 possible afflictions including asthma, chronic exhaustion, headaches, mental confusions, and seizures that could be reactions to chemicals. They also stated that individuals suffering from these more

[4] "Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona."

serious symptoms have a condition known as multiple chemical sensitivity. We conducted four informational meetings with people concerned about multiple chemical sensitivities on March 19, 1999; February 13, 2002, April 14, 2004 and April 31, 2004 to solicit issues regarding the Proposed Action and gather information related to the use of herbicides.

The Forest Service initiated tribal consultation in August 1998, when the first Proposed Action was mailed. In June of 2001 the Forest Service sent the revised proposal to a total of 13 American Indian tribal governments that are located in central and northern Arizona. The project has been listed in the forests annual NEPA project consultation lists since 1999 (Pilles 2004, Schroeder 2004). Thirteen tribal entities are routinely sent a copy of the consultation list and letter. As a followup to the consultation letters, the forests usually held annual meetings with the Havasupai Tribe, Hopi Tribe, Kaibab Band of Paiute Indians, Yavapai-Apache Nation, and the Yavapai-Prescott Tribe. The use of herbicides has been routinely mentioned and discussed at those meetings (Pilles 2004). Through the consultation process the forests received responses and information from several American Indian tribal governments concerning the potential effects of herbicides on the health of individuals who collect and use traditional plants.

At the conclusion of the second round of scoping, the Forest Service Interdisciplinary Team prepared a list of issues to be used in the development of alternatives and to assist in the focus of the analysis. From this effort one alternative was formulated to address Native American concerns related to the use of herbicides and the health of individuals collecting plants from these zones or adjacent to them. At the conclusion of the analysis in March 2004, the draft environmental impact statement was released. This was sent to 12 American Indian tribal governments and 9 chapters of the Navajo Nation and comments were invited from tribal authorities.

Issues

Scoping of the initial 1998 and the new 2001 proposals resulted in about 350 letters, e-mails, or documented phone conversations. All letters received during 1998 and 2001 scoping were processed and comments placed into 1 of 8 categories:

1. Resolved by forest plan land use designations.
2. Addressed through implementation of forest plan standards and guidelines as well as best management practices.
3. Addressed through implementation of project-specific best management practices.
4. Addressed during the analysis conducted by the interdisciplinary team.
5. Addressed through special location of activities during alternative design.
6. Used to drive or partially drive an alternative.
7. Beyond the scope of the project.
8. Addressed through existing law, regulation, and policy.

This analysis indicated that over 95 percent of the comments identified were either outside the scope of the Proposed Action, would be a component of the analysis itself, or were addressed by law, regulation, or policy.

Based on the assessment of comments, the interdisciplinary team identified three significant issues that were subsequently approved by the responsible officials. The issues used in the development of alternatives for this FEIS follow.

Issue 1

Use of herbicides could limit individuals who have identified themselves to have sensitivities to chemicals from using travel corridors and National Forest System lands and limit their access to vital services and recreational opportunities. Over the past 15 or 20 years, hundreds of people have moved to the project area to limit their exposure to chemicals and enjoy a quality of life that is not found in many other parts of the country (March 19, 1999 Project Record 272). Except for a few areas of Arizona where intensive agriculture is practiced, large scale applications of chemicals is not common. Implementation of any action to control noxious weeds that uses herbicides could cause people who have identified themselves with sensitivities to chemicals to be confined to their homes.

Measures used to display the effects of the alternatives on access to vital services and recreation opportunities are:

- Total acres identified to be treated by each integrated weed treatment method by vegetation type within a specific watershed and the total for the project area.
- Scheduled acres of herbicide treatments on roads that are under the jurisdiction of the Federal Highway Administration or another public entity.
- Acres of limited spray zones by watershed and total for the project area. Limited spray zones are a 1-mile buffer identified around Forest Service campgrounds, trailheads, and scenic overlooks. Where Forest Service lands are found adjacent to communities, there will also be a 1-mile buffer established. Within these areas the preferred integrated weed treatment approach will include manual, mechanical, cultural, and biological. This does not include road rights-of-way under the authority of another public authority.
- Number of campgrounds, trailheads, and overlooks within limited spray zones on national forest lands.

Issue 2

The use of herbicides for invasive weed control may cause health problems for people who come into contact with the herbicides and/or treated areas. Although the risk assessments currently in use by the Forest Service review available scientific literature concerning a particular herbicide and build in several safety features prior to any use (e.g., a minimum and maximum amount that can be applied), some people have concerns about the use of these products. If an alternative is selected which authorizes the use of herbicides, there is a potential that health problems could surface.

Measures used to disclose the effects of the alternatives on herbicide use and potential human health effects include:

- Total acres identified to be treated by each integrated weed treatment method by vegetation type within a specific watershed and the total for the project area.

- Scheduled acres of herbicide treatments on roads that are under the jurisdiction of the Federal Highway Administration or another public entity.
- Number of proposed weed species and acres treated by selected herbicides.

Issue 3

The proposed application of herbicides for weed control may affect the ability of American Indians and others to collect plants for traditional uses or medicinal reasons in specific areas. As with Issue 2 above, this concern relates to potential human health problems that may be caused by the application of herbicides. In order to determine if food plants are ready to harvest, or if basketry materials are ready for use, people must pick and often strip leaves or bark off stems, using their hands, mouth and teeth (Pilles 2004). In addition, herbicides may eliminate specific plants that are collected and eventually used for medical or traditional purposes in specific areas.

The same evaluation criteria as shown in Issues 1 and 2 above will be used to measure the differences among alternatives.

Chapter 2 – Alternatives Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the integrated weed treatment proposal to control weeds on the Coconino, Kaibab, and Prescott National Forests. It includes a description of each alternative considered and the appropriate design features and mitigation measures. We present the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., herbicide weed treatment versus mechanical weed treatment) and some of the information is based upon the environmental, social, and economic effects of implementing each alternative (e.g., the effectiveness of herbicide treatment versus mechanical treatment). Each alternative is described with one or two constraining factors based on the significant issues identified; however, budget constraints could alter the total acres treated in any of the alternatives.

Alternatives Considered in Detail

Four alternatives, including no action, are fully analyzed in the FEIS. Each action alternative (Alternatives 1, 3, and 4) was designed to meet the purpose of and need for action (desired conditions) in whole or in part by implementing some level of an integrated weed management program. Variations between alternatives are the result of the action addressing specific significant issues. One of the differences between alternatives is the number of acres treated; this depends on the effectiveness of the treatment and how many return visits and treatments are required.

Alternative 1: Proposed Action

The Coconino, Kaibab, and Prescott National Forests, administered by the United States Department of Agriculture, propose to authorize new treatments of weeds on a series of infestations ranging from an estimated low of 2,000 acres per year to a projected high of 10,000 acres per year. Because of this range specified in the Proposed Action, we analyzed the strategy of treating 2,000 new acres per year, which is referred to as Alternative 1-Low. Similarly, Alternative 1-High refers to the analysis of a weed treatment strategy of 10,000 acres of new weed treatments per year. This would treat 34,131 weed infested acres on the ground in Alternative 1-High and 20,394 acres in Alternative 1-Low, with 3 to 4 repeat visits to each site over 10 years. The various methods that will be analyzed under an integrated weed treatment approach include: (a) manual; (b) mechanical; (c) cultural; (d) biological; and (e) herbicidal. At the high level, we estimate that the amount of manual, mechanical, cultural, biological, and herbicidal treatments would be about 8,000 acres, 5,000 acres, 14,000 acres, 14,000 acres, and 75,000 acres, respectively. At the low level, we project that 9,000 acres will be manual, 5,000 acres mechanical, 23,000 cultural, no biological, and 39,000 acres of herbicidal treatments.[5] This includes both wilderness and other specially designated areas. The annual combination of methods used is expected to vary depending on specific conditions. There will be no aerial application of herbicides. In addition, there will be no aquatic application of herbicides. Communication systems will be set up to

[5] These acres were represented in the original proposed action as a range of percents.

contact individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled to be used. Adaptive management is a component of this alternative.

This alternative includes a nonsignificant forest plan amendment for the Coconino, Kaibab, and Prescott National Forests (Appendix A).

Alternative 2: No Action

This alternative is required by regulation (Code of Federal Regulations 1502.8) and would call for no integrated weed treatments applied to any National Forest System lands, except for those Forest Service parcels under authority of the Federal Highway Administration. In this situation the authority to undertake treatments is vested within the Federal Highway Administration. The Federal Highway Administration is required to notify the Regional Forester prior to the action being implemented.

Alternative 3: No Herbicide

This action would rely on treatment methods of manual, mechanical, cultural, and biological, but not herbicidal. This alternative does not have any cap on the acres treated, as Alternative 1 does. It was formulated to fully address three separate issues: (1) people who have identified themselves with sensitivities to chemicals and have concerns associated with access; (2) general health objections to use of herbicides on national forests; and (3) tribal issues related to collection of traditional plants. Adaptive management is a component of this alternative although herbicide use is excluded. It was also designed, to the best degree possible, to meet the purpose and need of the proposed project. This alternative would treat 23,410 weed infested acres on the ground with repeated visits over 10 years. This would require 211,475 acres of total treatments (or more than 9 revisits per site); the amount of manual, mechanical, cultural, and biological treatments are about 39,000 acres, 132,000 acres, 23,000 acres, and 17,000 acres, respectively.

This alternative will also include nonsignificant forest plan amendments (Appendix A).

Alternative 4: Preferred

This alternative was also established to address the three significant issues; however, unlike Alternative 3, this action includes the option of herbicide use. This alternative was designed by combining the most effective treatment regimes from Alternative 3 (integrated weed treatment without herbicides) with some treatment regimes from Alternative 1 (integrated weed treatment with herbicides) to increase effectiveness and reduce overall costs. Therefore, the descriptions of Alternatives 1 and 3 presented above are relevant to Alternative 4 with exceptions and modifications as described below. Interstates, U.S. highways, and State highways will be covered under the “Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona” and, therefore, were deleted from this alternative.

This alternative would treat 31,047 weed infested acres on the ground with repeated visits over 10 years. This would require 125,050 acres of total treatments (approximately 4 revisits per site); about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally (including revegetation), 16,000 biologically, and 57,000 acres with herbicides. Adaptive management strategies (see Chapter 6) apply and if the selected integrated weed treatment method does not work, then other methods, including herbicides, could be used. For example, this

alternative emphasizes either using nonherbicidal weed treatment methods first until proven ineffective, or nonherbicidal weed treatment methods in combination with herbicides to use the least amount of chemical required for an effective treatment.

Limited spray zones would be established adjacent to and within 1 mile of communities, recreation sites, trailheads, and scenic overlooks. Sites where nonherbicidal treatment methods will be effective due to species, population size or site factors will be targeted for all integrated weed treatment methods except herbicides. Plant species in this category include yellow starthistle, Malta starthistle, Mediterranean sage, musk thistle, Scotch thistle, and bull thistle. Herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds where treatment objectives cannot be met using manual techniques. Plant species in this category included camelthorn, Russian knapweed, leafy spurge, tamarisk, and tree of Heaven. Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met, so individuals with multiple chemical sensitivities and other people vulnerable to chemicals could still access recreational and other facilities found within the project area.

Limited spray zones do not include rights-of-way under the jurisdiction of the Federal Highway Administration or other public entities (State and county roads). Therefore, even if a limited spray zone is established around a community, a road under Federal Highway Administration, State, or county jurisdiction that traverses the area is not considered part of the zone. However, if the Arizona Department of Transportation (ADOT) does not treat a priority infestation in one of these roadway easements, the Forest Service would undertake this work. Under situations where the limited spray zones do fall under the jurisdiction of the Forest Service, the preferred methods will be mechanical, manual, cultural, or biological.

Communication systems will be established to notify individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled for use. Proposed treatment plans will be posted on the World Wide Web and updated regularly to show time periods during which certain areas could be treated. This information will also be available on a 1-800 phone number. Specific actions will also be included and identification of alternative routes around the treated zones, if available. Appendix B describes these features for communication and awareness under "Design Features for Integrated Weed Treatment Projects."

This action, like Alternatives 1 and 3, includes a nonsignificant forest plan amendment for the Coconino, Kaibab, and Prescott National Forests (Appendix A).

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not analyzed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these methods may have been outside the scope of eradicating, containing, controlling or preventing weeds within the Coconino, Kaibab, and Prescott National Forests, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Two alternatives were considered but eliminated from

detailed study for reasons summarized below. These alternatives would not address the continual expansion of weeds on national forest lands because they were determined to have a limited scope.

Alternative 5 (current action) was eliminated from detailed analysis since it would not meet the purpose and need. This alternative would only authorize manual and cultural treatments on approximately 1,000 to 2,000 total acres per year. It also does not reach an adequate level of coordination between the various private or public entities to achieve control objectives of the weed species. The exclusion of the use of mechanical, biological, and herbicidal weed treatment techniques, in addition to the low amount of acres treated would promote the expansion of all weed species inventoried within the three national forests.

Alternative 6, the original Proposed Action scoped in 1998, was dropped to avoid duplication of efforts from the separate NEPA analysis, "Environmental Assessment for the Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona." The primary purpose of this latter document is driver safety. Its focus on right-of-ways along major roads limits weed treatment control efforts to those travel corridors and it does not treat other forest infestations. This EA has a Decision Notice and Finding of No Significant Impact signed on May 27, 2004.

Integrated Weed Treatment Strategy

An integrated combination of methods will be needed to control such aggressive and adaptable weeds. Our adaptive management strategy will include extensive mapping and consistent monitoring using the Forest Service National Resource Information System (NRIS) protocols following treatments and revegetation to determine which control methods continue to be most effective (Elzinga et al.1998, Haber 1997).

Prevention is the most effective and least expensive method of control (these practices are detailed in Appendix B and the Noxious Weed Strategic Plan and Working Guidelines (Phillips et al. 1998)). Maintenance of a vigorous, competitive plant community will reduce invasive weed seedling establishment. Cleaning tires, boots and hooves when leaving infested areas will prevent the creation of new infestations. Extensive disturbances often give invasive weed species another advantage over native plants. Revegetation of large disturbed sites with vigorous, hardy native grass and perennial plants will also prevent establishment of new invasive weed populations. Using only certified weed-free seed, straw, mulch and hay products on the three forests will also reduce new introductions of invasive weeds.

The key to dealing with new exotic weeds involves early detection and rapid response. Information and education programs to show people how to recognize species of concern are helpful in detecting infestations when they are still small. Repeated surveys also will be needed to locate new infestations. After detection, selection of the treatment method will depend on the growth characteristic of each species, size of the infestation, and efficacy of the methods. An eradication strategy is a step-by-step procedure to stop spread, prevent reproduction, and deplete viable seeds or plant parts in the soil (Sheley and Petroff 1999). It is hoped that new infestations will be detected when they are less than 1 acre in size. Early detection and rapid response to exotic weed infestations in areas with special designation will be a top priority in all action alternatives.

Scattered plants and spot infestations around the perimeter of the infestation need to be treated first to contain spread of the infestation. To limit seed dispersal, treatment of infestations along roads and trails should be done at the same time as treatment around the infestation perimeter. Treatments should then move inward toward the core of the infestation. Treatments will need to be repeated until the seed bank is depleted. For yellow starthistle, fire can be used to stimulate germination of a high proportion of the seedbank allowing the manager to use another technique to come in and remove these seedlings; using this technique the invasive weed seedbank can be depleted in 3-5 years instead of the 10-20 years of its full potential (DiTomaso 1999).

No single control method, nor any 1-year treatment program will ever achieve effective control of an area infested with invasive weeds. The fast growth, extensive root system and high reproductive capacity of these plants requires long-term cooperative integrated management programs and planning to contain and reduce invasive weed populations in northern Arizona. Combining the use of herbicides with other control techniques can reduce the amount of herbicide needed and increase the efficiency of a treatment (Tu et al. 2001). Mechanical control followed by an herbicide treatment can be more effective than either treatment alone. Herbicide treatment followed by seeding with competitive grasses has been successful in many parts of the western U.S. Prior to seed set, hand pulling or grubbing is effective for small infestations and also following a mechanical or an herbicide treatment to insure no plants set seed that year. Appropriate timing of a weed control technique is the most important factor to improve/ensure effectiveness. Most annual and biennial plants should be treated early in the season before the plants bolt and flowering occurs. In contrast, many perennials are most effectively treated with systemic herbicides in fall when the plant is actively transporting nutrients into its root system (Beck, personal communication 2003).

Insects alone will not eliminate an infestation; however, they will enhance control and reduce the rate of expansion of large existing infestations. Biological control is most appropriate in populations large enough to be beyond control by any other means. The use of herbicides in combination with insect control is successful on large populations of several weed species. One example of this technique would be to release the insects near the center of the infestation, and then spray the edges to reduce or prevent spread of the infestation.

Introductions of new exotic plants are expected to occur within the next 10 years. In fact, some species may already be present on the three national forests, but they have not been found. At lower elevations, Sahara mustard (*Brassica tournefortii),* buffelgrass (*Pennisetum ciliare*), and fountain grass (*Pennisetum setaceum*) are present in southern Arizona and they possibly may be on the Prescott National Forest, and African rue (*Peganum harmala*) could be introduced along roadways or in campgrounds where heavy vehicle traffic occurs. The following species could be introduced at higher elevations, including wilderness areas: perennial pepperweed (*Lepidium latifolium*), dyer's woad (*Isatis tinctoria*), halogeton (*Halogeton glomeratus*), oxeye daisy (*Chrysanthemum leucanthemum*), purple loosestrife (*Lythrum salicaria*), yellow toadflax (*Linaria vulgaris*), and St. Johnswort (*Hypericum perforatum*).

Design features, best management practices, and mitigation measures for all action alternatives are found in Appendix B.

Weed Control Techniques

The control techniques described below are common to all action alternatives.

Manual Control

The forests have used manual control frequently over the last 8 years. This integrated weed treatment technique includes digging, hand pulling, and hoeing. Numerous weed pulls have occurred within the project area on such species as musk thistle, Scotch thistle, and bull thistle, Mediterranean sage, Dalmatian toadflax, diffuse knapweed, starthistle species, and others. It is estimated that about 4,000 acres have been treated within the forests. This treatment has worked well for control of biennial thistles (musk, Scotch, and bull thistles) and annual plants like yellow starthistle. This technique has not been successful on other plants like camelthorn, the tree species, giant reed, leafy spurge, and Russian knapweed.

Mechanical Control

This weed treatment technique includes such activities as mowing, steaming and burning. This method has not been used extensively for any weed control projects in this project area. The main reason for this reluctance is the initial investment costs to purchase the equipment. Another compounding factor is that this method has achieved only a limited amount of success.

Mowing: Sheley and Petroff (1999) stated that mowing could reduce seed production on annuals but timing of the treatment is critical to success. Their study also stated that in some cases mowing could actually increase the amount of seed produced by diffuse knapweed. The physical nature of the project area has limited the use of this technique since many weed sites are inaccessible to tractors and other equipment. In contrast, the Arizona Department of Transportation has routinely used this method to limit the spread of weeds on their rights-of-way corridors. However, Sheley and Petroff (1999) noted the success of mowing has been limited and there has been a decline in the area scheduled for mowing by ADOT over the past several years (Eckler, personnel communication, 2002).

Steaming: In this document steaming includes hot water treatment and foam treatment of invasive weeds. The Nature Conservancy (Tu et al. 2001) reviewed several hot water techniques as described below. Using the hot water method, hot water is delivered to the plant by the use of a hand held wand or a device attached to equipment such as a tractor or truck. Water is heated in a tank and delivered to the plant through a wand and series of hoses. This method was developed as an alternative to herbicide treatment especially around sensitive public areas. Hot water contacts the plant and kills the plant by heat or by removing the protective cuticle allowing the plant to wither and die. The hot water also reaches the roots on shallow rooted species such as grass. However, it may not kill the roots of deep-rooted perennials. This system is best suited for use along roadways and parking lots but has been successfully used in parks, playgrounds, schools, orchards, golf courses, zoos, cemeteries and other places where herbicide use is not desirable. Most machines fit on trucks or trailers and are hauled around to various locations. A more recent development is a hand-held wand that runs off electricity and water. This model is designed for use by the homeowner for weed control.

Hot foam weed control systems rely on a diesel generator and a computer to mix a biodegradable surfactant with boiling water and then deliver this super heated foam through a wand. The foam produces a thin film that prevents the heat from dissipating immediately. Due to the heat retention properties of the foam mixture, soil surface temperatures are temporarily stabilized resulting in more effective weed control (IPM Practitioner 2001). The surfactant used and sold by one company, Waipuna™ USA, is a mixture of corn and coconut sugars. The Nature Conservancy (Tu et al. 2001) tested and reviewed The Waipuna™ Hot Foam system and reported it as a large and

expensive set of equipment that may be especially useful along roads, near visitor centers, or where there are limitations on herbicide use. They also reported that its utility was limited in wildland settings due to the noise, limited backcountry access, and revisits needed to kill perennials.

Burning: Fire can sharply reduce the abundance of some species. The weather, topography, and available fuel will determine the temperature and intensity of the prescribed burn, and this along with the timing of the treatment, largely determine how the burn impacts the vegetation and the abundance of particular species (Tu et al. 2001).

The most effective fires for controlling invasive plant species are typically those administered just before flower or seed set, or at the young seedling/sapling stage. Most successful weed control efforts that result from burning are due to the restoration of historical (natural) fire regimes, which had been disrupted by land use changes, urban development, firebreaks, or fire suppression practices. Repeated burns are sometimes necessary to effectively control weedy plants, and herbicide treatments may be required to kill the flush of seedlings that germinate following a burn (Tu et al. 2001).

The Arizona Department of Transportation has undertaken some limited burning on Russian knapweed, camelthorn, and diffuse knapweed and this treatment generally was followed up by an herbicide application. The forests will follow standard guidelines and procedures outlined in the individual forest's burn plan.

Cultural Control

Cultural treatments include grazing by livestock and the seeding of competitive plants. Grazing by livestock and the seeding of competitive plants have had limited use to control the spread of noxious weeds within the project area. Phillips (personnel communication, 2003) stated that the grazing of sheep on leafy spurge has made a noted drop in the spread and density of the species; however, the area encompassed by this weed has remained fairly constant since treatments began. It appears this technique has reduced the ability of the plant to produce seeds and spread out from the core population but it has not killed the plants. Livestock grazing for treatment of weeds would occur within the parameters of the NEPA document for the specific project or allotment.

Biological Control

Biological control agents include approved insects and pathogens that undergo a rigorous testing procedure prior to being available for release. Initial testing occurs in quarantined laboratories abroad and in the United States. The agents are tested for their effectiveness in controlling the target organism and for their host specificity. Testing includes potential effects on economic crops, rare plants, and similar species found in North America. An agent can be released only after is has been determined that it is unlikely that the agent will feed or cause injury to any native or agronomic species. It generally takes between 10 and 15 years for an agent to be cleared for release. Prior to the release of a new agent an environmental analysis is prepared by APHIS (Agricultural Plant Health Inspection Service). The analysis assumes that agents will spread throughout North America to wherever the target species exists. It is intended that this analysis will satisfy the intent of NEPA for the release and distribution of the agent in the United States. The only action the Forest Service is taking by releasing an agent is changing the location and influencing the rate of spread of the agent.

Sheley and Petroff (1999) noted that since 1920 a total of 69 invertebrate species have been introduced into the United States to control invasive weeds. Table 2 provides a listing of the biological control agents proposed for use within the three forests.

Table 2. Rangeland weeds and proposed biological control agents

Target Weed Common Name	Species Rank for Treatment	Proposed Agent	Type
Leafy Spurge	1	*Brachypterolus pulicariusl* *Calophasia lunula* *Eteobalea intermediella* *Eteobalea serratella* *Gymnetron antirrhini* *Gymnetron linariae* *Gymnetron netum* *Mecinus janthinus*	Ovary-feeding beetle Defoliating moth Root-boring moth Moth Seed-capsule feeding weevil Seed-capsule feeding Seed-capsule feeding weevil Stem-mining weevil
Yellow and Malta Starthistle	2 and 3	*Bangasternus orientalis* *Larinus curtus* *Eustenopus villosus* *Urophora sirunaseva* *Chaetorellis australis* *Chaetorellis australis*	Seed-head weevil Flower weevil Hairy weevil Seed-head weevil Peacock fly False-peacock fly
Russian Knapweed	5	*Subanguina picridis*	Nematode
Spotted and Diffuse Knapweed	9 and 10	*Urophora affinis* *Urophora quadrifasciata* *Larinus minutus* *Metzneria paucipunctella* *Agapeta zoegana* *Sphenoptera jugoslavica* *Cyphocleonus achates*	Seed-head fly Seed-head fly Flower weevil Seed-head moth Root moth Root-gall beetle Root weevil
Dalmatian Toadflax	18	*Brachypterolus pulicarius* *Calophasia lunula* *Eteobalea intermediella* *Eteobalea serratella* *Gymnetron antirrhini* *Gymnetron linariae* *Gymnetron netum* *Mecinus janthinus*	Ovary-feeding beetle Defoliating moth Root-boring moth Moth Seed-capsule feeding weevil Seed-capsule feeding weevil Seed-capsule feeding weevil Stem-mining weevil
Bull Thistle	20	*Urophora stylata*	Bull thistle gall fly

Prior to release of any biological control agent, the forests would have to obtain a permit from APHIS and start the treatments on a trial basis to determine viability and effectiveness. Information gained from this monitoring would then be used to determine if that particular agent would be recommended for additional use within the project area.

To date, of all the integrated weed treatment practices that could be applied, this method has probably received the least amount of interest. There are several reasons for this but probably the most influential is that even with the large increases in weed population levels we typically do not

have large continuous infestations, except for possibly leafy spurge, where this method has proven successful. For propagation insects need a continual source of host plants to feed on, reproduce, and then move to newer sites. These new populations of weed plants need to be relatively close to the first sites, otherwise the biological control agent will not be able to spread.

There is at least one successful release of a biological control agent in the project area. In 1994 Dalmatian toadflax was identified as a serious problem on the A-1 Mountain Allotment, Coconino National Forest. Two agents, the ovary feeding beetle (*Brachypterolus pulicarius*), and a defoliating moth (*Calophasia lunula*) were released and followup monitoring indicates that they were successful in reducing both the total number of plants and acres (Wickham 2004 personal communication). Apparently, this infestation had the population structure that allowed these two insects to survive and spread throughout a large area occupied by the toadflax species.

The Arizona Department of Transportation has also tried biological agents, and like the Forest Service these treatments have been very limited in nature. In 1992 they released several seed head gall flies and one root-mining moth on populations of Russian knapweed and spotted knapweed along Interstate 40. They followed this up with treatments for diffuse knapweed and Dalmatian toadflax in 1998 though the exact locations of these treatments are unknown. In both cases it appears the insects did not survive, and the treatments were generally considered failures.

Herbicide Control

Chlorsulfuron is registered for general use and is used to control many broadleaf weeds and some annual grasses. Some weeds might become resistant to chlorsulfuron after extended use. This herbicide prevents the target plant from producing an essential amino acid that controls cell division and has a half-life in the soil of 30 to 90 days depending on pH. (The half-life of an herbicide is the period of time required for the active ingredient to decompose to one-half of that which was applied.) Chlorsulfuron tends to leach into soils with a textural range from sand to silt loam and degrades more rapidly at higher temperatures with adequate moisture contents. It is broken down to smaller compounds by soil microorganisms. To date this herbicide has never been used within the three forests. Chlorsulfuron may be used to treat bull, musk, and Scotch thistles and Dyer's woad.

Clopyralid is a selective post-emergence herbicide controlling broadleaf species in the sunflower, legume, and smartweed family. This herbicide affects the target weed by mimicking the plant hormone auxin and causes uncontrolled plant growth and eventual death. It has an average half-life in the soil of 20 days, ranges from 15 to 287 days depending upon soil type and climatic conditions (Infoventures 1995a). It is degraded primarily by microbial metabolism. Once applied to the ground, it rapidly disassociates and does not bind strongly with soil particles, which results in clopyralid having a high potential to contaminate ground or surface water. Commercial formulations of clopyralid are approximately 41 percent clopyralid and 59 percent inert ingredients (water, isopropyl alcohol, and a surfactant). Clopyralid was used by the Prescott National Forest to treat resin bush in 2003. It may be used to treat biennial thistles, Canada thistle, diffuse knapweed, Mediterranean sage, Russian knapweed, spotted knapweed, yellow starthistle and malta starthistle.

2,4-D is a selective herbicide that is used to control broadleaf weeds by interfering with the metabolism of the plant. It may remain active for up to 6 weeks, though it ultimately metabolizes into harmless products (Infoventures 1995b). The average half-life of 2,4-D is 10 days in soil and

less than 10 days in water, dependent upon other factors (e.g., temperature, soil condition) (Tu et al. 2001). It is moderately to highly mobile in the soil, which restricts its use in and around high ground water tables or open water. This herbicide is one of the oldest, most studied, and extensively used herbicides across the United States for over 50 years, though it does not appear it was used to any extent in the project area. Most previous herbicide work was targeted for control of grasses to increase reforestation success, so 2,4-D was not warranted. This herbicide is one of the most versatile in the control of weeds and has been proven successful in the treatment of biennial thistles, Canada thistle, diffuse knapweed, Dyer's woad, leafy spurge, Mediterranean sage, oxeye daisy, rush skeletonweed, Russian knapweed, spotted knapweed, sulfur cinquefoil, Dalmatian toadflax, whitetop, and yellow and Malta starthistles.

Dicamba is considered a general use herbicide for forestry, rangeland and rights-of-way uses. It is a selective herbicide used to control broadleaf weeds, brush, and vines and it affects target plants by regulating growth. About half of this product is broken down by microbial activity in 10 and 35 days once applied. Breakdown is slower with low soil moisture and low temperatures. The main metabolite of dicamba breakdown in soil is 3,6-dichlorosalicylic acid (Infoventures 1995c). Dicamba is highly mobile in the soil and does have the potential to contaminate ground or surface water. This herbicide is very versatile in weed control and has been proven successful in treatment of biennial thistles, Canada thistle, Dyer's woad, leafy spurge, rush skeletonweed, spotted knapweed, sulfur cinquefoil, and yellow and Malta starthistles. It does not appear this herbicide has been used within the three forests on any vegetative control projects in the past.

Glyphosate is a broad-spectrum, nonselective herbicide used for control of annual and perennial plants including grasses, sedges, broadleaf weeds, and woody plants. This herbicide is used on a variety of crops and its method of action is to inhibit amino acid and protein synthesis. It is moderately persistent in the soil and has an estimated half-life of 30 to 50 days. Glyphosate is strongly absorbed in most soils and normally does not leach out of the profile. Microbes are primarily responsible for the breakdown of this herbicide in the environment. Glyphosate has been successful in controlling Canada thistle, cheatgrass, leafy spurge, spotted knapweed, Dalmatian toadflax, and yellow as well as Malta Starthistles. It appears that this product was used to some degree for reforestation site preparation in the 1970s and early 1980s on the Coconino National Forest and North Kaibab Ranger District. Records on the Kaibab National Forest indicate that Roundup (glyphosate) and Dowpon M were used to treat about 2,000 acres to control unwanted vegetation prior to planting.

Imazapic is a selective herbicide for both pre- and post-emergent control of some annual and perennial grasses and broadleaf weeds. It affects plants by inhibiting the production of amino acids that ultimately reduces cell growth. Its half-life in the soil is 120 days, and it is considered moderately persistent. The primary mechanism of degradation is through microbial action. It does not volatilize when applied. Imazapic is known to be effective in control of Canada thistle, leafy spurge, and cheatgrass. It has never been used within the three forests.

Imazapyr is also a broad-spectrum herbicide that can be applied pre- or post-emergence. It is appropriate to use this herbicide on rangelands, forestlands and rights-of-way, although cropland use is excluded. Imazapyr is absorbed by the leaves and roots, and moves rapidly through the plant. It acts by accumulating in the meristem region and disrupting protein synthesis by interfering with cell growth and DNA synthesis. Unlike most other herbicides proposed for use by the forests, it can remain active in soil for 6 months to 2 years. (Infoventures 1995d) It has a strong affinity to bind to soils and rarely moves beyond the top few inches of the soil. As such, it

has a low potential for leaching to ground water, but may reach surface water during storm events over recently treated land. Sunlight and microorganisms break down Imazapyr. Very little is lost to evaporation. There are no records to indicate this herbicide has been authorized for use at anytime on the three forests.

Metsulfuron methyl is used to control brush and certain unwanted woody plants, annual and perennial broadleaf weeds, and annual grassy plants. This herbicide has a half-life of 120 to 180 days and affects plants by inhibiting cell division in the roots and shoots, thereby stopping growth. Generally, soil microorganisms break down this herbicide into nontoxic products, although chemical hydrolysis can also break it down (Infoventures 1995e). Metsulfuron methyl dissolves easily in water and can leach through the soil to contaminate ground water, but this situation is confined to soils that are either sandy or porous. This herbicide has been proven successful in control of biennial thistles, Canada thistle, Dyer's woad, Russian knapweed, and whitetop. This herbicide has never been used within the project area.

Picloram is considered a "Restricted Use" herbicide and, as such, can only be sold and used by a licensed pesticide applicator. This classification is due to this herbicide's mobility in water combined with the sensitivity of many crops that can be damaged with the use of picloram. It is used to control broadleaf plants, brush, conifers, and broadleaf trees. It interferes with the weed's ability to make proteins and nucleic acids and is broken down to carbon dioxide by sunlight and microorganisms. The half-life of picloram is 90 days and it dissolves easily in water. This herbicide works well in control of biennial thistles, Canada thistle, Dalmatian toadflax, diffuse knapweed, Dyer's woad, leafy spurge, Mediterranean sage, oxeye daisy, rush skeletonweed, Russian knapweed, Scotch thistle, spotted knapweed, sulfur cinquefoil, whitetop, and yellow and Malta starthistles. In 1983 the Kaibab National Forest completed an analysis that authorized the use of this herbicide and tebuthiuron as well to control pinyon and juniper trees on 15,000 acres of rangeland located on the Double A, Juan Tank, Smoot, Moritz, Hat, and Moqui Allotments. This decision was short lived, and the program was suspended in 1984 when the forest was enjoined from further applications of herbicides. Except for the Smoot Allotment and some studies undertaken by Arizona State University this herbicide does not appear to have been used extensively on the forests.

Sulfometuron methyl is considered a general use registered herbicide. It is applied to control annual and perennial grasses as well as broadleaf weeds. Sulfometuron methyl stops plant growth by inhibiting cell division in the growing tips, roots and shoots of target plants. This herbicide has a half-life of about 30 days and is broken down to carbon dioxide by microorganisms, sunlight, and chemical hydrolysis. Sulfometuron methyl is insoluble in water. In acidic soils it has a low potential for movement, whereas in alkaline soils, where it is close to ground water, it has some potential for movement (Infoventures 1995f). It does not appear this product has ever been used within the three forests.

Triclopyr is a pyridine and works by disrupting plant growth. It is absorbed by green bark, leaves, and roots and moves to the meristem of the plant. It is active in soil, and is rapidly broken down by microbes, particularly in warm climates. It has a half-life in the soil of 30 to 90 days, the ester and amine salt formations covert to the acid, which degrades into carbon dioxide, a relatively nontoxic salt and organic matter through microbial action. Triclopyr has a moderate to low solubility in water and normally binds to clay and organic matter, so its potential to contaminate ground water is slight. Triclopyr is effective in the treatment of tamarisk, tree of

Heaven, Russian olive, and Siberian elm. It does not appear this herbicide has been used within the three forests.

Surfactants are commonly used in herbicide formulations to ensure even distribution and improve absorption or permeation of the herbicide into the plant. Surfactants play a key role in the effectiveness of an herbicide formulation. There is limited information on the types of surfactants used and the toxicity of surfactants, especially since the industry considers these formulations to be proprietary information.

Table 3. Typical and maximum herbicide and carrier application rates (in pounds active ingredient per acre)

Herbicide/Carrier	Rangeland	Forestland	Facilities	Right-of-Way	Recreation/ Administration	Riparian
Chlorsulfuron *	0.75 to 3	0.75 to 3	0.75 to 3	0.75 to 3	0.75 to 3	0.75 to 3
Clopyralid	0.25 to .5	0.25 to .5	0.25 to .5	0.25 to .5	0.25 to .5	0.25 to .5
2,4-D	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
Dicamba	2 to 4	2 to 4	2 to 8	2 to 4	2 to 4	2 to 4
Glyphosate	1 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
Imazapyr	1 to 1.5	1 to 1.5	1 to 1.5	1 to 1.5	1 to 1.5	1 to 1.5
Metsulfuron methyl	0.5 to .75	0.5 to 1.8	0.5 to 1.8	0.5 to 1.8	0.5 to 1.8	0.5 to 1.8
Picloram	1 to 2	1 to 2	2 to 3	2 to 3	1 to 2	1 to 2
Sulfometuron methyl	2 to 9	2 to 6	2 to 9	2 to 9	2 to 9	2 to 9
Triclopyr	1.5 to 2	3 to 6	4 to 9	4 to 9	1.5 to 2	4 to 8
Imazapic	.03 to .06	.03 to .06	.03 to .06	.03 to .06	.03 to .06	0
Carriers						
Mineral Oil	2 to 4	4 to 8	2 to 8	2 to 14	2 to 4	2 to 4
Vegetable Oil	2 quarts	2 quarts	2 quarts	2 quarts	2 quarts	2 quarts
Methylated Seed Oil	1-2 pints	1-2 pints	1-2 pints	1-2 pints	1-2 pints	1-2 pints

* This application rate is provided in ounces of active ingredient per acre.

Consistency with the Coconino, Kaibab, and Prescott National Forests Plans

If Alternative 1, 3, or 4 is selected and the nonsignificant plan amendment is adopted then these actions are consistent with forest plan direction. Alternative 2 (No Action) does not achieve the goals and objectives of the plans as it relates to improvement in riparian and range resource conditions or direction to improve ecological diversity. Alternative 2 would allow the spread of existing populations and the introduction of new species that ultimately would result in a decline in the overall ecological health of the forests.

Agency Preferred Alternative

Alternative 4 is the forest supervisors' preferred alternative.

Summary Comparison of Alternatives

Table 4 summarizes proposed treatments by integrated weed management (IWM) technique for the four alternatives and outputs for several other resource areas including costs. Table 5 summarizes effects of the actions according to the purpose and need, significant issues, and several other key resources that are important to disclose such as wildlife and watershed impacts.

Table 4. Summary comparison of alternatives

Projected Treatments for 10-Year Planning Period					
Units of Measure	**Alternative 1-High**	**Alternative 1-Low**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Total Infested Forest Land (acres) Under Treatment	34,131	20,395	0	23,410	31,047
Total Acres Treated and Retreated by Specified IWM Method Manual	8,105	9,355	0	39,415	13,800
Mechanical	4,825	5,210	0	131,720	17,940
Cultural	13,660	23,215	0	22,970	14,315
Biological	14,005	0	0	17,370	15,990
Herbicidal	74,920	38,735	0	0	62,035
Total Acres Treated and Retreated	115,515	76,515	0	211,475	124,080
Annual Nonnative Grasses Treated	No	No	No	No	Yes
Acres of Rights-of-Way Treated with Herbicides by the Forests	11,265	11,265	0	0	2,645
Acres of Limited Spray Zones	0	0	0	0	818,000
Total Number of Recreational Facilities within Limited Spray Zones	0	0	0	0	395
Total Infested Acres	186,770	321,275	340,645	195,870	180,700

Table 4. Summary comparison of alternatives

Projected Treatments for 10-Year Planning Period					
Units of Measure	**Alternative 1-High**	**Alternative 1-Low**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Change over Current Acres	- 730	+ 133,775	+ 153,145	+ 8,370	- 8,800
Number of Weed Species Meeting Control Objectives	20	15	0	13	22
Costs					
Total	$9,526,100	$6,796,345	0	$24,485,290	$12,213,200
Nonnative Grass Treatments	$0	$0	$0	$0	$451,200

A model was developed to predict the effectiveness of weed treatments proposed in the different alternatives. Unless otherwise indicated, a rate of spread (growth rate) of 14 percent was applied to each species. We used this rate as the average of generally accepted rates of spread that range from 5-20 percent per year (Sheley and Petroff 1999). Rates of spread of 5 percent, 7 percent, and 10 percent were applied to bull thistle, Dalmatian toadflax and all tree species, and Himalayan blackberry, respectively. These species in our area generally do not spread as fast due to low seed viability and woody species have lower growth rates.

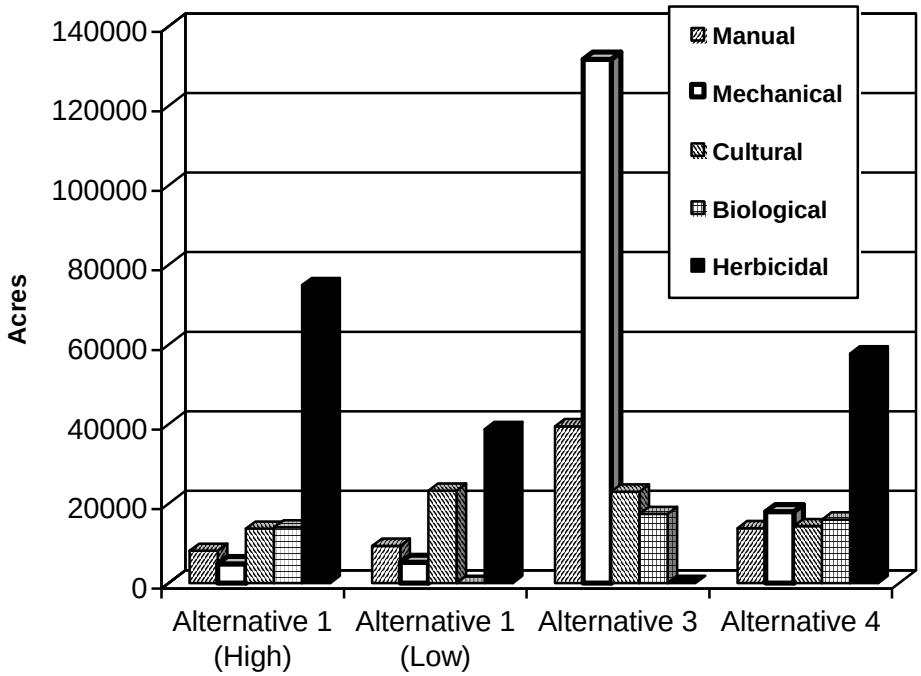


Figure 1. Comparison of alternatives by weed control method in estimated total acres to be treated over 10 years.

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
Prevent introduction and establishment of new weeds onto the forests.	At either the high or low level of new treatments oxeye daisy, Canada thistle, halogeton, and dyers woad would be prevented from becoming established within the project area. Right-of-way corridors associated with major roads would be treated regularly for weeds, therefore, reducing the potential for new introductions.	All four species currently adjacent to the national forests would become established over the next 10 years.	Oxeye daisy and halogeton would be prevented from establishing populations; Canada thistle and dyers woad are projected to infest forests in next 10 years.	Oxeye daisy, Canada thistle, halogeton, and dyers woad would be prevented from becoming established within the project area. Because forest roads would be treated regularly for weeds, most Forest Service roads would lack the most invasive plants and most new introductions would be eliminated.
Eradicate 8 species and contain/control 14 species.	At the high level, 20 species will meet treatment objectives whereas at the low level this drops to 15. Species not meeting objectives at both the high and low level include bull thistle and leafy spurge. Additional species not meeting objectives at the low level include Dalmatian toadflax, diffuse knapweed, Himalayan blackberry, tamarisk, and whitetop.	All 24 species proposed for treatment under the other alternatives would continue to expand.	Thirteen species would reach treatment objectives. Those species not meeting objectives include bull thistle, Dalmatian toadflax, leafy spurge, Russian olive, Siberian elm, spotted knapweed, tree of Heaven, whitetop, and yellow starthistle.	Only one species, leafy spurge, would not meet treatment objectives.
Maintain or improve ecosystem health and native plant community structure.	At the high level, improvement in ecosystem health and native plant diversity is projected on about 700 acres. The most invasive weeds with greatest threat to ecosystem diversity are controlled. At the low level treatments we anticipate an increase in weeds to 321,275 acres. Losses of	Infestations of weeds will increase to 341,000 acres. Declines in native plants and ecosystem diversity are predicted on 153,000 acres. Higher losses in ecosystem health, ungulate wildlife habitat, and biodiversity will	Declines in ecosystem diversity are projected on 8,370 acres. Control of the invasive tree species is limited with expansion of tree of Heaven and Siberian elm anticipated. As with Alternative 2,	Overall weed population size drops to 181,000 acres within the project area. Improvements in ecosystem health and native plant densities will occur on 8,800 acres. Annual invasive grass populations will continue to expand although limited treatments will improve about 150,000 acres of key

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
	ecosystem health are foreseen on 133,000 acres. Almost all of this increase is due to three species: Dalmatian toadflax, bull thistle and diffuse knapweed. Annual nonnative grass populations will continue to expand.	occur if populations of Dalmatian toadflax and bull thistle infill. Annual invasive grass populations will continue to expand.	potential losses in ecosystem health and overall carrying capacity of the land will occur if populations of Dalmatian toadflax and bull thistle expand and infill. Riparian conditions will decline with the expansion of woody trees. Annual nonnative grass populations will continue to expand.	habitats.
Prevent increases in bare soil and declines in watershed conditions on infested acres.	Compared to Alternative 2 (no action), the high level will prevent the spread of noxious weeds on 154,000 acres whereas at the low level of treatments this value will drop to 19,000. The acres of impaired watershed condition for the high and low levels are 187,000 and 321,000 respectively.	Alternative 2 would result in an expansion of the impaired category by roughly 153,000 acres or 80 percent over current levels. Watershed conditions are considered impaired on 341,000 acres if this alternative is implemented. Declines in effective ground cover and increases in erosion will occur.	Some impairment of land productivity may occur on the estimated 23,500 acres of steaming that is prescribed in this action because steam sterilizes the soil and could cause temporary loss of plant cover. Impaired watershed condition class is projected at 196,000 acres for this alternative.	Compared to Alternative 2, this alternative will prevent the spread of weeds on 160,000 acres. Improvements in watershed variables will occur on 8,800 acres, the highest of any alternative considered. Acres in the impaired category are estimated at 180,700.

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
Prevent expansion and eventually cause a reduction of weeds in riparian corridors.	Under both the high and low level of this alternative all weeds found in the corridors will be treated at the minimum level except for Dalmatian toadflax. All species (bull thistle, giant reed, Himalayan blackberry, Russian knapweed and olive, Siberian elm, tamarisk, teasel, tree of Heaven, and whitetop) reach treatment objectives. Dalmatian toadflax will continue to increase at the low level of Alternative 1.	All species continue to expand, especially Dalmatian toadflax, bull thistle, Siberian elm and tree of Heaven. Increases in woody species within corridors will promote declines in the regeneration of native trees. As tamarisk increases in density, the potential exists that water flows in the Verde River and other perennial streams could decline.	Treatments are scheduled for all species except for Siberian elm. A total of 9,000 treatment acres are projected in the riparian zone with most of it being mechanical (steaming, burning) and cultural. Treatment objectives for species found in riparian zones that are not met include bull thistle, Dalmatian toadflax, Siberian elm, tree of Heaven, and whitetop.	Treatment objectives are met for all weeds found in riparian corridors. About 6,000 acres are scheduled for treatment, with 3,000 acres herbicidal and 3,000 mechanical. Riparian health will be improved and potential reductions in base flows averted.
Limit spread of weeds into and within areas with special designation	All specially designated zones will have weeds treated at essentially the same rate at both the high and low levels. These areas will be treated aggressively and will reach treatment objectives for all species. Wilderness and special designation values will be maintained or improved under this alternative.	Weeds in specially designated zones will continue to increase. Declines in wilderness values are foreseen especially in the Kachina Peaks and Red Rock-Secret Mountain Wilderness areas, and Verde Wild and Scenic River Corridor over the next 10 years.	Treatment objectives will be met for diffuse knapweed, Giant reed, Himalayan blackberry, musk thistle, Scotch thistle, and tamarisk. Treatment objectives will not be met for bull thistle, Dalmatian toadflax, Siberian elm, and whitetop. Some declines in wilderness values are anticipated.	Same as Alternative 1.

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
Use of herbicides could limit individuals who have identified themselves with sensitivities to chemicals from using travel corridors and National Forest System lands, limiting their access to vital services and recreational opportunities.	Potential impacts limiting access will occur under this alternative while major travel corridors are sprayed for weeds. This will be offset to some degree by the timing of spraying so not all roads are treated during the same period. Where practical, alternate routes will be identified around spray zones on national forest roads. Campgrounds, scenic overlooks, and trailheads will also be identified and signed prior to any treatments. We predict that at no time will more than 10 percent of all recreation sites be impacted, preventing use by individuals who have had their immune system compromised.	No impact related to access is foreseen if this alternative is selected. Implementation of a weed control strategy will not occur and use of herbicides will not be authorized.	Same as Alternative 2. No herbicides will be authorized under this alternative.	Similar to Alternative 1, though limited spray zones would be established within 1 mile of recreation sites and communities. Limited spray zones do not apply to roads under the control of the Federal Highway Administration. About 818,000 acres or 15 percent of the project area falls under limited spray zone designation and to the best degree possible other IWM methods excluding herbicides will be used. The potential for access limitations is less compared to Alternative 1-High since the amount of herbicide treatments is 18,000 acres less over the 10-year planning cycle.
Issue: Impacts of Herbicides on Human Health	Low risks to human health from applications are expected at either the high or low level of proposed treatments. The use of personal protective equipment, application rates that are below the routine typical scenario, appropriate herbicide for the site characteristics, and other mitigation practices will inhibit the reference dose from ever	No herbicides will be authorized so there is no potential for health problems due to herbicides.	Same as Alternative 2.	Minimal risks to human health from applications are expected from proposed treatments. The use of personal protective equipment, application rates that are below the routine typical scenario, appropriate herbicide for the site characteristics, and other mitigation practices will inhibit the reference dose from ever being exceeded. Public exposure

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
	being exceeded. Public exposure would be low.			would be minimal.
Issue: Impacts of Herbicides on Plant Collectors.	Some temporary losses of native plants are projected for the ponderosa pine ecosystem in the Little Colorado and Verde Watersheds and the riparian corridors due to herbicide treatments. Typically the method of application will limit losses; the plants most impacted would be herbaceous species such as globe mallow, goosefoot, white aster, and tobacco.	Losses of native plants from treatments will not occur. However, the projected increase of weeds by 153,000 acres over current levels will impact the regeneration and propagation of native plants used by American Indians and others.	Temporary loss of native plants and invasive weeds is projected on 23,500 acres treated by steaming. Most of these treatments are scheduled for the ponderosa pine/oak vegetation types. The high temperatures associated with this method will remove all plants for a period of time.	Some temporary losses of native plants are projected similar to Alternative 1 although losses will be less due to the establishment of limited spray zones and treatment of 18,000 fewer acres by herbicide.
Impacts on Cultural Resources	There will be no measureable direct or indirect impacts from manual, herbicides, or cultural weed treatment methods. Significant historic properties will be protected from mechanical treatment methods in consultation with affiliated tribes and the Arizona State Historic Preservation Office.	There will be no direct or indirect impacts due to lack of weed treatments.	There will be no measureable direct or indirect impacts from manual or cultural weed treatment methods. Significant historic properties will be protected from mechanical treatment methods in consultation with affiliated tribes and the Arizona State Historic Preservation Office.	There will be no measureable direct or indirect impacts from manual, herbicides, or cultural weed treatment methods. Significant historic properties will be protected from mechanical treatment methods in consultation with affiliated tribes and the Arizona State Historic Preservation Office.

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
Impacts on Threatened, Endangered, Candidate & Sensitive (TEC&S) and Management Indicator Species (MIS) Plant Species	Impacts to individual plants could potentially occur; however, with mitigation (Appendix B) we do not predict this would lead to adverse effects for listed species or Federal listing for any sensitive or rare species. Meeting control objectives for 20 weeds, at least at the high level, will improve overall habitat for rare plants. At the low level of treatments, not achieving objectives on leafy spurge, whitetop, diffuse knapweed, tamarisk, Himalayan blackberry, Dalmatian toadflax, and bull thistle will eventually cause losses of habitat quality for rare plants. Forest recovery and conservation plans' objectives for TEC&S and MIS plant species are met under Alternative 1-High but not under Alternative 1-Low.	Losses of native plants associated with treatments would not occur. However, the increase of weeds to roughly 341,000 acres could impact the reproductive success of rare plants and eventually reduce their overall population extent and densities. Compared to other alternatives, we foresee this action causing the highest losses in habitat for rare plants. Forest recovery and conservation plans' objectives are not met under this action for TEC&S and MIS plant species.	Impacts to individual plants could potentially occur although with appropriate mitigation we do not believe this would lead to adverse effects for listed species or Federal listing for any sensitive or rare species. Steaming will not be used as a treatment method where TEC&S and MIS plant species occur. However, not meeting control objectives for 9 weeds will eventually cause a decline in habitat quality for rare plants. Forest recovery and conservation plans' objectives for TEC&S and MIS plant species are partially met under this alternative.	Similar to Alternative 1-High, although attaining the treatment objective for bull thistle results in 21 out of the 22 noxious species reaching treatment objectives. This will provide for the greatest improvement in rare plants' habitats and result in improved conditions. Forest recovery and conservation plans' objectives are met for TEC&S and MIS plant species under this alternative.
TE&S Fish & Their Critical Habitats	With no treatments occurring in the aquatic habitat, there would not be any direct effects to any fish species. Project design features limit which herbicides can be applied and under which conditions. This would result	With no treatments, there would not be any direct effects to fish or their habitats. Uncontrolled weed population could lead to increased frequency of fire in riparian	With no treatments occurring in the aquatic habitat, there would not be any direct effects to any fish species. Indirect effects to fish and or their	With no treatments occurring in the aquatic habitat, there would not be any direct effects to any fish species. Project design features limit which herbicides can be applied and under which conditions. This would result

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
	in indirect effects to fish and or their habitats from herbicides and sediment from mechanical treatments that would be at such low levels as to be immeasurable.	and upland habitats which could lead to increased sediment which could negatively impact fish and their habitat quality including available prey.	habitats from sediment from mechanical treatments would be at such low levels as to be immeasurable.	in indirect effects to fish and or their habitats from herbicides and sediment from mechanical treatments that would be at such low levels as to be immeasurable.
Terrestrial T&E Wildlife and Their Critical Habitats	Minimal impact to MSO, SWWF, Yuma clapper rail and Chiricahua leopard frog from treatments. Design features limiting treatment methods relative to breeding seasons and nesting areas for the birds makes impacts from disturbance unlikely to occur or immeasurable. Design features limiting herbicide applications in Chiricahua leopard frog habitat based on toxicity and forecasted precipitation (weather) reduce any impacts to be immeasurable.	Uncontrolled expansion of noxious or invasive weeds could reduce or eliminate existing or potential habitat for black-footed ferret, Southwest willow flycatcher, and prey habitat for Mexican spotted owl. Uncontrolled expansion of noxious or invasive weeds could reduce or eliminate existing or potential riparian habitat for Southwest Willow flycatcher.	Minimal impact to MSO, SWWF, Yuma clapper rail and Chiricahua leopard frog from treatments. Design features limiting treatment methods relative to breeding seasons and nesting areas for the birds makes impacts from disturbance unlikely to occur or immeasurable.	Minimal impact to MSO, SWWF, Yuma clapper rail and Chiricahua leopard frog from treatments. Design features limiting treatment methods relative to breeding seasons and nesting areas for the birds make impacts from disturbance unlikely to occur or immeasurable. Design features limiting herbicide applications in Chiricahua leopard frog habitat based on toxicity and forecasted precipitation (weather) reduce any impacts to be immeasurable.

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
Forest Service Region 3 Sensitive Animal Species	Breeding season timing restrictions and nesting area buffers for certain bird species reduces disturbance impacts from treatments to an immeasurable level. Limiting herbicides around riparian habitats prevents toxic impacts to the aquatic amphibians and reptiles and invertebrates.	Uncontrolled expansion of noxious or invasive weeds could reduce existing or potential habitat for animal and plant species in the forests. It could reduce or eliminate existing or potential habitat for riparian species. Long-term potential to lose Wupatki Arizona pocket mouse subspecies if habitat lost to weeds. Increased fire frequency from extensive weed populations could also reduce available habitat for forest and grassland species.	Breeding season timing restrictions and nesting area buffers for certain bird species reduces impacts of disturbance from treatments to an immeasurable level.	Breeding season timing restrictions and nesting area buffers for certain bird species reduces impacts of disturbance from treatments to an immeasurable level. Limiting herbicides around riparian habitat prevents toxic impacts to the aquatic amphibians and reptiles and invertebrates.
Management Indicator Species (MIS)—animals	Given the comparatively small areas of treatments relative to the entire project area, none of the treatments would change vegetation structural stage or disturb individuals enough to impact the population trend for any MIS.	Uncontrolled expansion of noxious or invasive weeds could reduce or eliminate limited existing or potential habitat for riparian species. Uncontrolled expansion of noxious or invasive weeds could reduce available forage for ungulate species. All of these effects would have negative impacts to the population trends for these species.	Given the comparatively small areas of treatments relative to the entire project area, none of the treatments would change vegetation structural stage or disturb individuals enough to impact the population trend for any MIS.	Given the comparatively small areas of treatments relative to the entire project area, none of the treatments would change vegetation structural stage or disturb individuals enough to impact the population trend for any MIS.

Table 5. Summary of impacts on the purpose and need, issues, and resource elements

Purpose of and Need for Action	Alternative 1 (High and Low) Proposed Action	Alternative 2 No Action	Alternative 3 No Herbicide	Alternative 4 Preferred Alternative
Migratory Birds	Breeding season timing restrictions and nest area buffers for various species would reduce disturbance or toxicity impacts from treatments for those and other species. Limiting the use of Dicamba to September through February would reduce the occurrence of toxicity impacts to migratory birds during the breeding season.	Uncontrolled expansion of noxious or invasive weeds could reduce existing or potential habitat for plant and animal species in the forest. It also could reduce or eliminate existing or potential habitat for riparian species. The primary impact would be loss of nesting habitat and loss of forage species as native plants with seeds are replaced by weeds.	Breeding season timing restrictions and nest area buffers for various species would reduce impacts from disturbance from treatments for those and other species.	Breeding season timing restrictions and nest area buffers for various species would reduce impacts caused by disturbance or toxicity from applying herbicides. Limiting the use of Dicamba to September through February would reduce the occurrence of toxicity impacts to migratory birds during the breeding season.

Chapter 3 - Affected Environment

Introduction

This chapter is organized into six major sections:

- Soil, Water and Air
- Vegetation
- Wildlife
- Public Health
- Social Concerns and Economic Influences
- Areas with Special Designation

Soil, Water and Air

Watersheds

The five major watersheds (ADEQ 2002) associated within the forests are the Verde (2,139,404 acres), Little Colorado (1,089,254 acres), Colorado/Grand Canyon (1,011,657 acres), Middle Gila (480,836), and Bill Williams (186,636). Over 90 percent of the stream channels in the project area are classified as ephemeral, with the majority of the perennial streams located in the Verde River basin (see Map 3-1).

All stream courses are evaluated on their ability to meet or "support" State water quality standards (ADEQ 2002) using data collected by State and Federal agencies. These water quality standards vary and are based on the designated use of a particular stream. These designated uses include, but are not limited to, cold water aquatic, fish consumption, domestic, or agricultural irrigation. Many streams will have more than one designation, with the most restrictive criteria applied for water that is for domestic water supplies. Some of the tests commonly run are for bacteria, turbidity, temperature, dissolved oxygen, salts, and heavy metals. It appears that the one parameter that is not measured is herbicides, although in wells this item is routinely assessed.

The **Verde Watershed** is roughly 6,625 square miles and represents about 6 percent of the State's land area (ADEQ 2002). The Verde River drainage area defines this watershed and roughly 50 percent of it is designated national forest. Major perennial streams in the project area include the Verde River, Sycamore Creek, Oak Creek, Wet Beaver Creek, West Clear Creek, and Fossil Creek. Ground water basins include the Verde River and the northeast portion of the Prescott Active Ground Water Management Area (AMA). Unique waters include the mainstem and the West Fork of Oak Creek. Of the 493 miles of streams assessed, 234 miles were in full support (48 percent) of the designated uses, 224 miles (45 percent) were deemed inconclusive (insufficient information to determine if a designated use is attaining or impaired), 34 miles were classed as impaired (7 percent) and 1 mile (less than 1 percent) as not attaining designated use objectives. Those stream courses classified as not attaining include a segment of Oak Creek near Slide Rock State Park and Beaver Creek. Major stressors in these two stream segments appear to be turbidity (ADEQ 2002), although high fecal coliform counts have been recorded at Slide Rock State Park in the past (ADEQ 2000).

Weeds impact about 98,000 acres, or 5 percent, of the Verde Watershed. The most prevalent species found in this watershed are Dalmatian toadflax and bull thistle, although all three of the knapweed species, camelthorn, yellow and Malta starthistle and tamarisk are also present.

The **Little Colorado-San Juan Watershed** occupies 26,794 square miles or 24 percent of the State's land area (ADEQ 2002). The project area encompasses about 6 percent of this watershed, or about 1,700 square miles. The Little Colorado River drainage area, from its headwaters to the Colorado River, defines this watershed. Part of the Little Colorado Watershed occurs on the Coconino and Kaibab National Forests, with the only perennial stream being East Clear Creek. Ground water basins include the Little Colorado River and a portion of the Coconino Plateau. There are no unique waters identified for this basin. Of the 271 miles of streams assessed, 127 miles were classed as attaining (47 percent), 127 miles as inconclusive (47 percent), and the remaining 17 miles identified as impaired (6 percent) (ADEQ 2002). The ADEQ (2002) report identified the Little Colorado River (which is outside the project area), from Porter Tank Draw to McDonalds Wash, as the only impaired stream course and the major stressor was identified as metals (copper and silver).

The Little Colorado-San Juan Watershed has a high density of weeds, at least on the Coconino National Forest portion. There is an estimated 84,000 acres (about 8 percent of the total watershed area) impacted by these plants. Less than 100 acres are tied to the Kaibab portion of this basin. Most of those acres are associated with Dalmatian toadflax and bull thistle, although leafy spurge, Mediterranean sage, and tamarisk have also been inventoried.

The **Colorado-Grand Canyon or Lower Colorado Watershed** occupies 16,437 square miles or 14 percent of the total land area within the State (ADEQ 2002). The project area makes up about 10 percent of the basin or about 1,662 square miles. This watershed is defined as the Colorado River drainage area from Lake Powell to Hoover Dam at Lake Mead. This watershed is restricted to the Kaibab National Forest. The only perennial streams are North Canyon Creek and the lower portions of Kanab Creek within Grand Canyon National Park. Ground water basins include Coconino Plateau, Detrital Valley, Grand Wash, Hualapai Valley, Kanab Plateau, Meadview, Paria, Peach Springs, Shivwits Plateau, Virgin River and minor portions of Big Sandy, Lake Mohave, and Little Colorado. Of the 94 miles of streams assessed within this watershed, 46 miles were in attainment (49 percent) of the designated uses, 10 miles identified as inconclusive (11 percent), and the remaining 38 miles or 40 percent classed as impaired (ADEQ 2002). The two stream segments identified with the impaired classification were the Virgin River and one segment along the Colorado River. The stressors were identified as turbidity and fecal coliforms. Another study did note that North Canyon Creek was found in full attainment (ADEQ 2000).

Weeds impact 9,000 acres or 1 percent of this basin. Some species found include tamarisk, leafy spurge, Scotch thistle, Dalmatian toadflax, bull thistle, and cheatgrass.

The Gila River area below Coolidge Dam in the east to Painted Rock Dam in the west defines the **Middle Gila Watershed**, excluding the Santa Cruz River and San Pedro River drainages and the Salt River above Granite Reef Dam. This watershed occupies 12,249 square miles or 11 percent of the total land area within the state (ADEQ 2002). The project area encompasses roughly 750 square miles of this basin. The forests represent about 5 percent of the total for this watershed. This basin is found only on the Prescott National Forest with no perennial streams being identified, although numerous intermittent streams are present. These include Big Bug Creek, Turkey Creek, Sycamore Creek, Little Sycamore Creek, Indian Creek, and Little Ash Creek. Ground water basins include the Agua Fria, Donnelly Wash, Dripping Springs, Gila Bend, Harquahala Valley, McMullen Valley, Phoenix Active Ground Water Management Area, Tiger Wash, and the Upper Hassayampa basins. There are no unique waters identified. Of the 432 miles of streams assessed within the watershed, 52 miles were in full attainment (12 percent), 305 miles

identified as inconclusive (70 percent), and the remaining 75 miles or 18 percent as impaired (ADEQ 2002). There were no segments identified as not attaining. Intermittent streams within the project area with the impaired classification include Mineral, Turkey, and Queen Creeks as well as the Hassayampa River that all have high levels of metals and corresponding low pH. The cause for these high levels of heavy metals is historical mining that occurred in this watershed (ADEQ 2002).

This basin has not been surveyed intensively for weeds and the current estimate is 2,000 acres or less than 1 percent. Species found include tamarisk, tree of Heaven, Dalmatian toadflax and the biennial thistles. We believe that this area has a low incidence of weeds, although additional inventory work needs to be completed.

The **Bill Williams Watershed** occupies 5,373 square miles or 5 percent of the State total (ADEQ 2002). The Bill Williams River drainage area defines this watershed. The project area represents roughly 5 percent of the total basin area or roughly 290 square miles. This watershed is found on the far western portion of the Prescott National Forest and there are no perennial streams inventoried. Intermittent streams include Sycamore Creek and Cottonwood Creek. Unique waters identified for this watershed include Burro, Francis, and Peeple Creeks, none of which are located in the project area. Ground water basins include Bill Williams, Big Sandy, and Sacramento Valley. Of the 179 miles of streams assessed, 129 miles are attaining (72 percent), 18 miles considered inconclusive (10 percent), and 32 miles or 18 percent classed as impaired (ADEQ 2002).

We believe this basin has a low incidence of weeds, although, like the Middle Gila, intensive survey work has not been completed. The current estimate is 110 acres split between Dalmatian toadflax, bull thistle, and tamarisk.

Overall, watershed condition is considered satisfactory for the riparian, low elevation grasslands, ponderosa pine forest, mixed conifer forest and alpine tundra (USDA Kaibab National Forest 1988a, USDA Coconino National Forest 2003b, USDA Prescott National Forest 2001b). Normally there is sufficient ground cover to prevent any soil loss above the tolerance level. The remaining terrestrial ecosystems are classed in the impaired category and include the shrublands or shrub-grasslands, chaparral and woodland-chaparral, pinyon-juniper woodlands and high elevation grasslands. In some cases soil erosion is not the problem in these ecosystems, but rather the high density of shrub or tree species that results in a poor cycling of soil nutrients. This high density of tree or shrub canopy cover is attributed to past management that excluded fire and emphasized livestock grazing in these vegetation types.

Soil Condition

Soils within the project area on the Colorado Plateau typically are moderately deep to deep, fine textured, strongly developed, and display a wide range of both internal and surface rock fragments. Soils within the Mogollon Rim area and below indicate younger soils and are typically moderately deep to shallow, coarse textured, and also contain a high amount of rock in the soil profile and on the surface. Soils in the ponderosa pine and mixed conifer vegetation types in the Mogollon Rim area and below are similar to those on the Colorado Plateau and are moderately deep to deep over bedrock and have higher amounts of clay and silt (USDA Coconino National Forest 1992b, USDA Kaibab National Forest 1991a, and USDA Prescott National Forest 2000a).

Water Quality

Pesticide monitoring, which includes not only herbicides but insecticides and other chemicals as well, is routinely carried out in select wells around the State to fulfill the requirements of the Clean Water Act of 1977, as amended. The following table summarizes all the wells within the project area and notes whether the standard for pesticides was exceeded.

Table 6. Ground water monitoring for watersheds associated with the Coconino, Kaibab, and Prescott National Forests

Monitoring Data Type	Watershed	Parameter	Number of Wells Sampled	Synthetic Constituent Detected	Exceeding Standards	Percent of Wells Exceeding Standards
Index Wells Sampled By: ADEQ ADWR	Verde	Pesticides	2	0	0	0
	Little Colorado	Pesticides	0	NA	NA	NA
	Colorado-Grand Canyon	Pesticides	21	0	0	0
	Middle Gila	Pesticides	2	0	0	0
	Bill Williams	Pesticides	7	0	0	0
Targeted Monitoring Wells Sampled By: ADEQ ADWR USGS SRP	Verde	Pesticides	75	0	0	0
	Little Colorado	Pesticides	3	0	0	0
	Colorado-Grand Canyon	Pesticides	0	NA	NA	NA
	Middle Gila	Pesticides	226	0	0	0
	Bill Williams	Pesticides	4	0	0	0
Totals			**340**	**0**	**0**	**0**

(Information from Arizona Department of Environmental Quality 2002)

Of the 340 wells monitored, none exceeded the established standard as it relates to pesticides (ADEQ 2002). This same analysis noted that the Verde River Valley has had extensive agricultural production in the past and to date it appears that use has not resulted in any ground water contamination, at least based on current standards.

Air Quality

Air quality over the three forests is generally good. The major sources of air pollutants from forest activities are smoke from both planned and unplanned fires and dust from unpaved roads. Metropolitan areas such as Phoenix, Prescott, and Flagstaff are sources of additional pollution. The Clean Air Act and its amendments give most of the responsibility for managing air quality to the State. The forests coordinate with the Arizona State Department of Environmental Quality to maintain and enhance air quality.

Air quality is divided between two classes on the forests. The Class II designation allows for moderate degradation of air quality within certain limits above baseline air quality. A Class I designation provides the most protection to pristine land, limiting the increment above baseline levels. Class I areas located near or within the project area include the Grand Canyon National Park, Sycamore Canyon Wilderness on all three forests and Pine Mountain Wilderness on the Prescott. Other wildernesses found on the three forests are managed for Class I air quality although they are designated Class II airsheds.

Vegetation

Terrestrial Ecosystems

Elevations range from 2,800 feet in Tangle Creek, Prescott National Forest, to 12,633 feet on San Francisco Mountain located within the Coconino National Forest. This large difference in elevation has resulted in diverse assemblages of plant communities. Nine broad terrestrial ecosystems have been identified (USDA Coconino National Forest 1992b, USDA Kaibab National Forest 1991a, and USDA Prescott National Forest 2000a, see Map 3-2 and Table 7).

Table 7. Terrestrial ecosystems present within the Coconino, Kaibab, and Prescott National Forests

Terrestrial Ecosystems	Acres in Project Area	Percent of Project Area
Riparian	42,140	Less than 1
Shrublands and/or shrub-grasslands	339,380	7
Low elevation grasslands	383,660	8
Chaparral and woodland/chaparral	600,760	12
Pinyon-juniper woodlands	1,585,940	32
Ponderosa pine forests	1,463,850	30
High elevation grasslands	161,175	3
Mixed conifer forests	329,860	7
Alpine tundra	915	Less than 1

Characteristics of the terrestrial ecosystems in the project area follow.

Riparian – This is normally associated with perennial streams including the Verde River, Oak Creek, Wet Beaver Creek, and West Clear Creek, although this habitat type is also found along intermittent systems like Walnut Creek, Ash Creek, and Hells Canyon. Overstory trees include alder, conifers, cottonwood, maple, sycamore and willows, and understory species include hackberry, New Mexico locust, and soapberry. Herbaceous plants like sedges, spike rush, bull rush, little bluestem, blue grama, Canadian wildrye, sand bluestem, squirreltail, smartweed, and curlydock are found in varying concentrations in this type. Weed infestations range from zero acres in the Bill Williams basin to over 1,300 acres in the Verde River Watershed. The highest percentage (20 percent) recorded for weed species within a riparian corridor is in the Colorado/Grand Canyon Watershed, all of it tied to the species tamarisk. Other weeds found in

this ecosystem include Himalayan blackberry, tree of Heaven, giant reed, Russian knapweed, whitetop, yellow starthistle, Malta starthistle, Scotch thistle and bull thistles.

Shrublands and Shrub/Grasslands – These ecosystems are found on all three forests and are represented by the blackbrush, big sagebrush, and four-wing saltbush communities within the Colorado/Grand Canyon and Little Colorado Watersheds. In the Upper Sonoran Desert scrub, which is confined to the Verde Watershed, plants include mesquite, catclaw acacia, creosotebush and mimosa. Understory grasses like black grama, bush muhly, blue grama, side-oats grama, needle and thread, tobosa, Indian ricegrass and a variety of native annual grasses are also inventoried. Dominant forbs include globe mallow, buckwheats, and nightshades. Noxious or invasive weeds are estimated to occupy over 7,000 acres, consisting mostly of cheatgrass and other exotic annual grasses, though camelthorn, Scotch thistle, Dalmatian toadflax, bull thistle, and tamarisk have established populations.

Low Elevation Grasslands – This represents the semidesert grasslands in the pinyon-juniper ecosystem and below. Grasses include mutton bluegrass, Junegrass, western wheatgrass, spike muhly, blue grama, side-oats grama, ring muhly, vine-mesquite, and three-awns. Forbs such as western yarrow, western ragweed, Louisiana wormwood, globe mallow, and babywhite aster are found though they normally make up less than 10 to 20 percent of the overall composition. Infestations of weeds vary from a low of zero reported for the Bill Williams Watershed to a high of 115 acres in the Verde River Watershed. This ecosystem has not been well inventoried for the total number of weeds or population sizes. Known plants include sweet resinbush, yellow starthistle, Malta starthistle, Russian knapweed and whitetop. Current estimates indicate less than 1 percent of this ecosystem is infested with weeds.

Chaparral and Woodland/Chaparral – Typically this type is found at the lower elevations on the Coconino and Prescott National Forests. Dominant shrub species include manzanita, silktassel, mountain mahogany, cliffrose, and evergreen oaks. Both two-needle pinyon pine and Arizona pinyon pine are associated with the chaparral species and junipers are represented by Utah juniper, oneseed juniper, and redberry juniper. Usually the tree species make up less than 10 to 15 percent of the composition and in some cases are totally absent. This terrestrial ecosystem is mostly in the Verde River basin but also occurs on the Middle Gila and Bill Williams Watersheds. Infestations of weeds are also minimal in this ecosystem. Seven weeds are known, for a combined area of 120 acres. The most dominant species are tamarisk, yellow starthistle, Dalmatian toadflax, and diffuse knapweed.

Pinyon-Juniper Woodlands – This is one of the largest vegetation types found in the project area. It occupies 1,585,940 acres or 32 percent of the project area. Tree species including two-needle pinyon pine, Utah juniper, one seed juniper and, at the higher elevations, alligator juniper are found in varying densities, though the average canopy cover is over 40 percent. Understory grass plants include blue grama, pinyon ricegrass, side-oats grama, mutton bluegrass, ring muhly, mat muhly, and three-awns. Infestations of weeds range from 15 acres on the Gila Watershed to 1,550 acres on the Colorado/Grand Canyon basin. The most common weed is cheatgrass, although other species including Scotch thistle, Dalmatian toadflax, diffuse knapweed, yellow starthistle, Malta starthistle, bull thistle, and Russian knapweed have also been noted. Although the list of weeds found in this ecosystem represents some of the most aggressive taxa, current populations are estimated at less than one-tenth of 1 percent.

Ponderosa Pine/Oak – This ecosystem represents the second largest type associated with the project area. Gambel oak can have canopy cover percentages as high as 30 or 40 percent though generally it averages around 15 percent. Understory vegetation includes Fendler's ceanothus, Oregon grape, Arizona fescue, mountain muhly, squirreltail, western wheatgrass, pine dropseed, junegrass, dry land sedge, blue grama, globemallow, lotus, and asters. This type has an estimated 179,000 acres of weeds, or 12 percent of the total area. Dominant weed species include bull thistle, Dalmatian toadflax, diffuse knapweed, spotted knapweed, leafy spurge, and Scotch thistle.

High Elevation Grasslands – This vegetation type is confined to the Coconino and North Kaibab Plateaus and is estimated to occupy 3 percent of the project area. Government Prairie, Garland Prairie, Anderson Mesa, Mormon Lake, Davenport Lake, Little Pleasant Valley, De Motte Park, and numerous small grasslands interspersed within the ponderosa pine or mixed conifer ecosystems make up this type. It is considered nonforest, supporting no more than 10 percent tree cover. Major plants include Arizona fescue, Kentucky bluegrass, mountain muhly, western wheatgrass, spike muhly, deergrass, yarrow, Rocky Mountain iris, cinquefoil, blue grama, globemallow, and rabbitbrush. Infestations range from 15 acres within the Colorado/Grand Canyon basin to 815 acres within the Verde River Watershed. This type is not found in the Gila or Bill Williams Watersheds. The Little Colorado Watershed is projected to have 785 acres occupied by weed species. Most of the leafy spurge occurs within this ecosystem, and bull thistle, Dalmatian toadflax, Scotch thistle, and spotted knapweed have become established.

Mixed Conifer – Found on 7 percent of the project area, substantial areas of mixed conifer occur on the Mogollon Rim Ranger District, Coconino National Forest, North Kaibab Ranger District, Kaibab National Forest, and the isolated volcanic peaks such as Kendrick, Bill Williams, San Francisco Mountain, and Sitgreaves Mountain. Dominant plants include white fir, corkbark fir, Engleman spruce, blue spruce, Douglas-fir, limber pine, ponderosa pine, and aspen. The high levels of canopy cover ultimately restrict the production of grass and forbs plants. Less than one-tenth of 1 percent of this ecosystem has weeds established. No weeds have been inventoried in the Colorado, Gila, and Bill Williams Watersheds in this vegetation type. The Verde River Watershed has only 5 acres reported and the Little Colorado Watershed has an estimated 225 acres. Dalmatian toadflax is the most common species but bull thistle, musk thistle, houndstongue, and Scotch thistle have been found.

Alpine Tundra – This is the smallest and most restricted vegetation type identified within the three forests. There are 915 acres confined to San Francisco Mountain, Coconino National Forest, found entirely in the Little Colorado River Watershed. A distinctive feature of this ecosystem is a very cold soil temperature regime with characteristics similar to permanently frozen soils. This type contains unique vegetation, including mountain avens, sandwort, and the San Francisco Peaks groundsel, a threatened species.

Weeds

The 3 national forests have experienced an expansion of weeds from a few isolated populations along roads to over 187,500 acres today. These plants are now widely dispersed over the project area. The forests started to inventory for weeds in 1995 and have conducted surveys each year that are documented in the SWEMP database and in the forests' geographical information systems. Inventories were concentrated at first along major travel corridors (e.g., Interstate 40) and forest roads, campgrounds, and other areas where disturbances occur. The Prescott National Forest included all plants in their contracted botanical surveys so extensive areas of the forest

have been inventoried. Since 1997 more general surveys have been conducted for projects on grazing allotments, timber sales, and inventories associated with the National Fire Plan and forest health. In addition, trained volunteers have provided information. The acreages for all species except bull thistle and Dalmatian toadflax are considered accurate estimates. The acreages for bull thistle and Dalmatian toadflax are estimates based on observations and projections.

Table 8. Current weed infestations by watershed

Watershed Name	Total Acres	Strata Definition	Acres	Total Weed Species	Acres Infested	Percent of Strata Infested
Verde	2,139,404	Riparian	28,569	11	1,345	5%
		Chaparral and Woodland/Chaparral	484,177	7	120	Less than 1%
		Grasslands-Low Elevation	323,602	2	115	Less than 1%
		PJ Woodlands	551,502	9	745	Less than 1%
		Ponderosa Pine	621,435	7	95,110	15%
		Grasslands-High Elevation	65,253	4	815	1%
		Mixed Conifer	64,866	1	5	Less than 1%
		Totals	**2,139,404**		**98,255**	**5%**
Little Colorado	1,089,254	Riparian	2,730	0	0	0
		Shrublands and Shrub/Grassland	132,600	2	220	Less than 1%
		PJ Woodlands	334,206	7	560	Less than 1%
		Ponderosa Pine	455,185	6	82,285	18%
		Grasslands-High Elevation	58,109	6	785	1%
		Mixed Conifer	108,204	4	225	Less than 1%
		Tundra	914	0	0	0
		Totals	**1,091,948**		**84,075**	**8%**
Colorado-Grand Canyon	1,011,657	Riparian	1,197	1	250	21%
		Shrublands and Shrub/Grasslands	206,784	3	7,030	3%
		PJ Woodlands	318,262	3	1,550	1%
		Ponderosa Pine	345,179	5	90	Less than 1%
		Grassland-High Elevation	40,813	3	15	Less than 1%
		Mixed Conifer	99,422	-0-	-0-	NA
		Totals	**1,011,657**		**8,685**	**1%**
Middle Gila	480,836	Riparian	8,344	3	80	1
		Chaparral	78,452	1	15	Less than 1%
		Grasslands-Low Elevation	56,640	3	20	Less than 1%
		PJ Woodland	252,080	1	15	Less than 1%
		Ponderosa Pine	35,442	3	1,745	5
		Mixed Conifer	49,878	-0-	NA	-0-
		Totals	**480,836**		**1,875**	**1%**

Table 8. Current weed infestations by watershed

Watershed Name	Total Acres	Strata Definition	Acres	Total Weed Species	Acres Infested	Percent of Strata Infested
Bill William's	186,636	Riparian	1,297	-0-	NA	-0-
		Chaparral	38,129	-0-	NA	-0-
		Grassland-Low Elevation.	3,420	-0-	NA	-0-
		PJ Woodlands	129,886	2	80	Less than 1%
		Ponderosa Pine	6,411	1	30	1
		Mixed Conifer	7,493	-0-	NA	-0-
		Totals	**186,636**		**110**	**Less than 1/100 of 1%**

The highest concentrations of weeds are found within the Little Colorado and Verde River Watersheds. Of the estimated 187,500 acres infested with weeds, roughly 182,335 acres, or 97 percent, occur within these two basins. Two species, bull thistle and Dalmatian toadflax, represent 177,085 acres of the area impacted. The remaining watersheds—Colorado-Grand Canyon, Gila, and Bill Williams—have not been thoroughly inventoried and are estimated to have low densities of weeds.

Of particular concern due to their invasiveness are the three knapweed species (Russian, diffuse, and spotted), yellow starthistle, Malta starthistle, and leafy spurge. These plants tend to form dense infestations that eventually eliminate all native species. There are 190 acres and 4,135 acres of these 6 species within the riparian and ponderosa pine ecosystems, respectively. Most of the yellow starthistle, Malta starthistle, and leafy spurge populations are found within the Verde River Watershed, with two patches of leafy spurge occurring on the Kaibab National Forest within the Colorado-Grand Canyon Watershed. The three knapweed species follow this same pattern, with over 90 percent of their estimated acres found within the Verde and Little Colorado Watersheds, and 5 and 10 acres identified for the Colorado-Grand Canyon and Middle Gila Watersheds, respectively. Inventories for these six species have not been conducted to date in the Bill Williams Watershed, located within the Prescott National Forest.

We estimate that 80 percent of the total occurrences of weeds are 5 acres or less, with many less than 1 acre. The remaining 20 percent are over 5 acres in size and are associated with tamarisk, cheatgrass, Dalmatian toadflax, diffuse knapweed, spotted knapweed, Mediterranean sage, and one large population of leafy spurge on the Coconino National Forest.

Species Descriptions

The following are descriptions and characteristics of the weeds found within or adjacent to the project area. As defined in this project, weeds are exotic, invasive, aggressive, competitive, and persistent.

Leafy spurge is an insidious weed from Eurasia reproducing from adventitious root buds and seeds. Roots of this species form extensive underground systems that can extend over 30 feet into the soil, and laterally as well. Seeds, forcefully expelled, can travel up to 15 feet from the original

plant. These factors make the species very difficult to control. The milky latex found in leafy spurge causes lesions around the eyes and mouth when eaten by cattle. There are three known populations in the planning area: Brolliar Park on the Coconino National Forest, and Hull Cabin and the Big Springs Administrative Site on the Kaibab National Forest.

Yellow starthistle is an annual introduced from Europe, which grows 2 to 3 feet tall. The roots grow at least 3 feet deep, and it seeds prolifically. Horses grazing large quantities of this plant are susceptible to "chewing disease," a neurological disorder preventing the horse from swallowing. There is no cure for chewing disease; it is fatal. Small infestations are found on Forest Service lands in Cottonwood, Camp Verde, and Flagstaff. The majority of yellow starthistle is on private lands.

Malta starthistle is an annual from Europe, growing 1 to 2 feet tall. Flower heads are yellow, located on single ends of branches and armed with small, sharp spines that are branched at the base. Infestations are found bordering Forest Service land in Cottonwood and Camp Verde, at a few isolated spots on the Coconino National Forest, and on Black Canyon Creek on the Prescott.

Camelthorn is from the Mediterranean area and Asia, and is considered one of the most difficult to eradicate and, therefore, could result in serious economic impacts. It is an aggressive perennial that sends thick rhizomes out 12 meters or more from the parent plant. Seeds may be viable for years, although reproduction is mostly vegetative. It can grow through pavement, and the thorns can flatten car tires. Infestations are found in and around Flagstaff along Leupp Road, Townsend-Winona Road, Sunset Crater, service roads in the Wupatki National Monument, and Highway 87 on the Mogollon Ranger District. Additional populations are found along Highway 64 within the Tusayan Ranger District, Kaibab National Forest.

Russian Knapweed is a deep-rooted perennial that reproduces from seed and vegetative root buds. These buds develop into adventitious roots enabling the species to colonize large areas quickly. Russian knapweed produces compounds that suppress growth in native plants, which allows it to form dense monocultures. In 2 years the roots can grow 10 feet deep and 10 to 12 feet in diameter. In the project area, this species grows in the parking lot at the junction of Highway 180 near Snow Bowl Road, on the Blue Ridge Ranger District, near Cottonwood adjacent to and in Dead Horse Ranch State Park, along the Verde River between Chino Valley and Perkinsville, and at Mingus Lake.

Whitetop is a deep-rooted perennial in the mustard family, native to Russia. It often grows up to 2 feet tall, with roots going 12 to 30 feet deep. It can produce 50 shoots in a square yard. One plant can spread 12 feet in its first year. It is toxic to cattle. It reproduces by seed and by root segments. This plant is found on alkaline, disturbed soils and is highly competitive once it becomes established. Populations have been recorded in Prescott, Camp Verde, Flagstaff, and Cottonwood, and on the upper Verde River.

Mediterranean sage is a member of the mint family, growing to 3 feet tall. Mediterranean sage can be a serious rangeland weed, reducing forage production for both native wildlife and domestic livestock. Mediterranean sage is unpalatable to grazing animals, causing them to eat other species, contributing to the invasion. Reproduction is solely from seed. A single Mediterranean sage plant can produce up to 100,000 seeds. Known locations of this species include the Lower Lake Mary area on the Coconino National Forest and a population on private land in Peeples Valley, near the Prescott National Forest.

Musk thistle is a biennial member of the sunflower family. In one growing season a single plant can produce over a 100,000 seeds. Therefore, it can increase from a single plant to a rather large infestation within 2 or 3 years. The seeds can remain viable in the soil for roughly 15 years, which necessitates intensive monitoring of sites and repeat treatments. There are isolated populations of musk thistle found throughout the project area including the North Kaibab Ranger District at Little Mountain, Forest Road 427, and Jacob Lake Campground. In addition populations have been inventoried around Fort Valley, Aspen Meadows, along several trails on San Francisco Mountain, and Lake Mary Road on the Coconino National Forest.

Diffuse knapweed is an annual or short-lived perennial from the Mediterranean region, growing 1 to 2 feet tall. Knapweeds are members of the sunflower family, with a single strong taproot. It reproduces by seed, and seeds can remain viable to 12 years. Dead plants break off at ground level and tumble around, spreading seed in the wind. Plots of knapweed have been shown to have more erosion (sediment in runoff) than comparable plots of bare ground (Duncan 1999). It produces chemical compounds that inhibit other species (even other knapweeds) from growing around it. Infestations are found throughout the Flagstaff area, Highway 89A, and Highway 179 in Sedona.

Spotted knapweed is a biennial or short-lived perennial from central Europe, growing 1 to 3 feet tall; it is also a member of the sunflower family. If allowed to spread, it forms a monoculture and reduces desirable plant populations. This species inhibits other plants from growing near it. Infestations are found along Highway 89A and Highway 179 in Sedona. It is also known to occur on the Northern Arizona University Campus, on A-1 Mountain, and along Lake Mary Road at Diversion Park. A few plants have been found around Prescott.

Scotch thistle is a large biennial thistle, native to Europe. Characteristics of this species include broad, spiny stems with vertical ribs, large, spiny leaves with dense hairs and violet to reddish flowers. The plants can create an impenetrable thicket. Seeds are viable for 6 years. This species grows in disturbed habitats along roadsides and in waste areas. There are many populations of this thistle along the interstate and State highway systems in the project area and a few infestations on the North Kaibab Ranger District, Kaibab National Forest. There is one population on the Prescott National Forest and more in the Prescott area.

Russian olive is a woody species forming large shrubs to medium-sized trees. Until recently, this species was promoted for windbreaks and erosion control. It has been planted extensively in areas throughout northern Arizona and can invade riparian areas where it eventually replaces native tree species. There are a few trees along the Verde River.

Tamarisk is found in many riparian areas throughout the West. It was introduced as an ornamental and for erosion control. It out-competes native riparian trees by forming deep root systems that can remove underground water not available to native species. It can dry up springs and creeks. The foliage of tamarisk can add salt deposits to the soil, inhibiting growth of other species. It can also increase the risk of fire in riparian ecosystems through deposition of flammable fuels. Tamarisk is found along several waterways in the Verde Valley. Scattered individuals have been found along roadways in Flagstaff, Tusayan, Prescott, and the Ashfork area. Tamarisk is scattered along the Verde River, and along many perennial and ephemeral streams on the Prescott. It grows densely in Kanab Creek.

Himalayan blackberry is an exotic species found throughout many parts of the country. The Himalayan blackberry typically grows in open weedy sites, such as along field margins, railroad rights-of-way, roadsides, and on abandoned farms. It has escaped cultivation or remains on formerly human occupied sites in various locations on the Coconino, Kaibab, and Prescott National Forests. Himalayan blackberry can form dense patches, which exclude other plant species and animals. Himalayan blackberry is present in the West Fork of Oak Creek, and at several sites in the Verde Valley. It is present at several old homesteads on the Prescott National Forest.

Houndstongue is a biennial herb with bright reddish-purple flowers. Houndstongue can cause injury or death in grazing animals because it contains a substance that can cause liver failure. One population of this species on national forest land is known from the area of the Arizona Snow Bowl. Other populations are known from the North Rim of the Grand Canyon and from private property at Jacob Lake.

Giant reed grass is a tall, perennial, bamboo-like grass that prefers streambanks and other wet areas. It is from the Mediterranean region, and was introduced as an ornamental and for erosion control. Giant reed can attain heights of 25 feet and once established will crowd out all other native vegetation. Its ability to developing hundreds of stems in one clump, and rapidly expand outward makes it a threat to riparian zones. Roots can form mats and debris dams, leading to flood damage. The roots can float downstream for miles and establish new populations. The species has been found mostly along the Verde River, although populations have also been found along other stream corridors.

Sulfur cinquefoil is a perennial species that grows to a height of 1 to 1½ feet. It has a well-developed underground root system and a woody stem. Regeneration is mostly from seeds. However, mature plants can reproduce vegetatively. Each year new shoots form along the edges of the woody stem. The species grows in disturbed areas, but can invade undisturbed sites. Sulfur cinquefoil can occupy a wide variety of habitats and can compete successfully with plants such as yellow starthistle. Sulfur cinquefoil can become a dominant member of the plant community. Most grazing animals will avoid eating sulfur cinquefoil due to the presence of high levels of tannin. A few plants have been found in the Rio de Flag and along Lake Mary Road on the Coconino National Forest.

Dalmatian toadflax is an introduced ornamental, perennial weed from the Dalmatian region of Eastern Europe. It can grow up to 3 feet tall, and reproduces from both seed and underground rootstalks. One plant can produce up to one-half million seeds, as well as lateral roots up to 10 feet from the plant. Dalmatian toadflax can crowd out native plants and reduce forage on rangelands. This species is widespread throughout the ponderosa pine type on all three forests.

Tree of Heaven is a deciduous tree from China that can grow up to 90 feet tall. It can reproduce from seed or from root sprouts that create an extensive root system forming dense colonies that out-compete native trees like box elder. Infestations are found at the mouth of the West Fork of Oak Creek, and in small spots in the Prescott National Forest around Camp Verde, Cottonwood, and Jerome. It is mostly found in towns.

Bull thistle is a stout biennial thistle with purple flowers from Eurasia. It invades disturbed sites including slash piles, old log decks, and roadsides. Regeneration is solely from short-lived seed. Bull thistle grows in numerous areas of the Coconino National Forest and eastern part of the

South Zone of the Kaibab National Forest. There are isolated populations on the North Kaibab Ranger District in the Jacob Lake area. It is found in old firewood sales in the northwest part of Prescott National Forest and at Camp Wood.

Siberian elm is widely grown in many areas of northern Arizona as a shade tree. However, it is not appropriate in wildland settings where it can out-compete native tree species in riparian zones and other sensitive areas. The trees reproduce through winged seeds that can be transported long distances on the wind or by vehicles to new locations. The abundant production of seed will make this species difficult to control. There are scattered trees on the Coconino National Forest east of Flagstaff and only a few trees on the Prescott National Forest, including the Verde River, Lynx Lake, and Thumb Butte.

Cheatgrass is an erect winter and spring annual grass from Europe that can grow to a height of 2 feet. The plant is a prolific seed producer and the density of this species has more to do with available sites (bare soil) for germination than the number of seeds produced. The presence of cheatgrass has increased the fire frequency, similar to the wild oats infestations. This will cause a loss in native plants. Large infestations are commonly found throughout the planning area. One major threatened area is the North Kaibab Ranger District within the key winter habitat of mule deer.

Wild oats is an annual grass from Europe that grows up to 4 feet tall. It was planted along roadsides in the Verde Valley (I-17) because it establishes so quickly, providing ground cover and reducing erosion. However, the grass has spread from the roadsides into the wildlands in low elevation grasslands. The presence of this grass has increased the fire frequency where it is found because the plant completes growth early in the spring and then dries out and remains standing. Seeds can remain viable for up to 10 years. It is found along Highways 69 and 169 and I-17.

Teasel is a biennial species that grows to a height of 6 feet with a deep taproot. Teasel can form large monocultures and the area around the base of the mature plant becomes bare ground as the rosette dies. This area provides an excellent “nursery” for the next generation. Currently there are only a few known isolated populations of teasel in northern Arizona. One patch is at Watson Woods on Granite Creek.

Oxeye daisy is a prolific producer of wind-borne seeds. Large colonies can out-compete native plants and reduce the plant species diversity. Oxeye daisy is unpalatable to cattle; this can favor the oxeye daisy plants, allowing them to spread even more quickly. When oxeye daisy, with small taproots, replaces perennial grasses with fibrous root systems, soil erosion can increase. Bare soil is more common in the oxeye daisy colonies. There are no known infestations on the forests but it does occur in Flagstaff and Kachina Village. This species is available as a landscaping plant and may escape from cultivation into nearby forested areas.

Canada thistle is a colony-forming perennial species. It has extensive underground roots, which are capable of producing new plants. It can also reproduce from seeds. There are no known populations on the national forests but it has been found in some landscaped areas in Flagstaff.

Halogeton favors disturbed sites and can reach a height of 18 inches or more. The species has numerous upright stems that branch from the base. The leaves are small, fleshy, and tubular and end in a needle-like spine. Halogeton is not extremely competitive but invades disturbed and overgrazed areas. It produces oxalates, which are toxic to livestock. It is approaching Coconino

National Forest along I-40 east of Flagstaff and along State Route 89 north of Wupatki National Monument.

Dyers woad is not known in the project area. Dyers woad invades forest and rangelands, dominating native species and causing serious economic losses. It can thrive in rocky areas and on alkaline soil. The species has a deep taproot, which can access water and nutrient reserves not available to other species. It also produces large amounts of seed. Removal of the leaves causes the plant to regenerate from the taproot.

Eurasian water milfoil is an emergent, herbaceous aquatic plant from Eurasia and Africa. It can form large floating mats of vegetation on the surface of lakes, rivers and other water bodies, preventing light penetration for native aquatic plants and impeding water traffic. This species is not covered under this environmental document. Aquatic species control will be addressed in separate NEPA analysis.

Plant Species — Endangered, Threatened, Candidate, and Sensitive

The project area contains populations or designated critical habitat for 42 endangered, threatened, candidate, and sensitive plant species. Of the total, 12 species have never been found on the forests although they occur immediately adjacent to the project area and, thus, are on the Forest Service Region 3 list to be surveyed for any project proposal. Of the seven species listed as either threatened or endangered, only two are found within the project area. They are the San Francisco Peaks groundsel and Arizona cliffrose.

Table 9. Known and potential endangered, threatened, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Weeds in Habitat	Invasive Species in Habitat (P=potential)
Astragalus cremnophylax var. *cremnophylax*	Sentry milkvetch	E	Grand Canyon National Park adjacent to Kaibab National Forest.	Yes	cheatgrass
Pediocactus bradyi	Brady pincushion cactus	E	Bureau of Land Management adjacent to North Kaibab RD	Yes	cheatgrass
Purshia subintegra	Arizona cliffrose	E	Coconino NF	Yes	(Russian knapweed-P, yellow starthistle-P, Malta starthistle-P), annual bromes
Asclepias welshii	Welsh's milkweed	T	Southern Utah and Northern Arizona	Yes	Cheatgrass

Table 9. Known and potential endangered, threatened, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Weeds in Habitat	Invasive Species in Habitat (P=potential)
Cycladenia humilis var. *jonesii*	Jone's Cycladenia	T	Bureau of Land Management adjacent to North Kaibab RD	No	NA
Pediocactus sileri	Siler pincushion cactus	T	Bureau of Land Management adjacent to North Kaibab RD	Yes	cheatgrass, Scotch thistle
Senecio franciscanus	San Francisco Peaks groundsel	T	Coconino NF	Unknown	(Dalmatian toadflax-P)
Spiranthes romanzoffiana var. *diluvialis*	Ute ladies tresses	T	Utah	Unknown	NA
Pediocactus peeblesianus var. *fickeiseniae*	Fickeisen Pincushion cactus	C	Kaibab NF	Yes	cheatgrass
Agave delamateri	Tonto Basin agave	S	Coconino and Prescott NFs	Yes	annual bromes
Arenaria aberrans	Mt. Dellenbaugh sandwort	S	Kaibab, Coconino and Prescott NFs	Yes	cheatgrass
Astragalus ampullarius	Coppermine milkvetch	S	Utah and Northern Arizona	Unknown	NA
Astragalus cremnophylax var. *hevronii*	Marble Canyon milkvetch	S	Navajo Nation adjacent to North Kaibab RD	Yes	cheatgrass
Astragalus cremnophylax var. *myriorraphis*	Cliff milkvetch	S	Kaibab NF	Unknown	NA
Astragalus rusbyi	Rusby milkvetch	S	Kaibab and Coconino NFs	Yes	Dalmatian toadflax, bull thistle,Scotch thistle, cheatgrass
Botrychium crenulatum	Crenulate moonwort	S	Coconino NF	Unknown	NA
Carex ultra	Cochise sedge	S	Coconino and Prescott NFs	Unknown	NA
Castilleja kaibabensis	Kaibab paintbrush	S	Kaibab NF	Unknown	NA.
Chrysothamnus molestus	Disturbed rabbitbrush	S	Kaibab and Coconino NFs	Yes	bull thistle, cheatgrass

Table 9. Known and potential endangered, threatened, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Weeds in Habitat	Invasive Species in Habitat (P=potential)
Cimicifuga arizonica	Arizona Bugbane	S	Kaibab and Coconino NFs	Yes	bull thistle, Dalmatian toadflax, Himalayan blackberry
Cirsium parryi ssp. *mogollonicum*	Mogollon thistle	S	Coconino NF	Yes	bull thistle
Desmodium metcalfei	Metcalfe's ticktrefoil	S	Coconino and Prescott NFs	Unknown	NA
Eremocrinum albomarginatum	Utah solitaire lily	S	Southern Utah and Northern Arizona	No	NA
Erigeron saxatalis	Cliff fleabane	S	Coconino, Kaibab and Prescott NFs	Yes	cheatgrass
Eriogonum ericifolium var. *ericifolium*	Heathleaf wild buckwheat	S	Coconino and Prescott NFs	Yes	Russian knapweed, yellow starthistle, Malta starthistle annual bromes
Eriogonum mortonianum	Morton wild buckwheat	S	Adjacent to North Kaibab Ranger District	Yes	cheatgrass, halogeton
Eriogonum ripleyii	Ripley's wild buckwheat	S	Coconino and Prescott NFs	Yes	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes
Eriogonum thompsonae var. *atwoodii*	Atwood wild buckwheat	S	Adjacent to North Kaibab Ranger District	Yes	cheatgrass, halogeton
Gentiana barbellata	Bearded Gentian	S	Coconino NF	Unknown	(Dalmatian toadflax-P)
Hedeoma diffusum	Flagstaff pennyroyal	S	Coconino and Prescott NFs	Yes	Dalmatian toadflax, Mediterranean sage, musk thistle, diffuse knapweed, Scotch thistle
Helenium arizonicum	Arizona Sneezeweed	S	Coconino NF	Yes	leafy spurge, spotted knapweed, Dalmatian toadflax

Table 9. Known and potential endangered, threatened, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Weeds in Habitat	Invasive Species in Habitat (P=potential)
Heuchera eastwoodiae	Eastwood alumroot	S	Coconino and Prescott NFs	Unknown	NA
Lesquerella kaibabensis	Kaibab bladderpod	S	Kaibab NF	Unknown	NA
Lupinus latifolius ssp. *leucanthus*	Giant lupine	S	Prescott NF	Yes	Dalmatian toadflax, tamarisk
Pediocactus paradinei	Kaibab Plains Cactus	S	Kaibab NF	Yes	cheatgrass
Penstemon clutei	Sunset Crater beardtongue	S	Coconino NF	Yes	diffuse knapweed, cheatgrass, yellow starthistle, camelthorn
Penstemon distans	Mt. Trumbull beardtongue	S	Bureau of Land Management adjacent to North Kaibab District	No	NA
Penstemon nudiflorus	Flagstaff beardtongue	S	Coconino and Kaibab NFs	Yes	diffuse knapweed, Dalmatian toadflax, Mediterranean sage
Phlox amabilis	Arizona phlox	S	Prescott NFs	Unknown	NA
Polygala rusbyi	Hualapai milkwort	S	Coconino and Prescott NFs	Yes	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes
Rosa stellata ssp. *abyssa*	Grand Canyon rose	S	Bureau of Land Management adjacent to North Kaibab District	Yes	cheatgrass
Salvia dorrii ssp. *Mearnsii*	Mearns sage	S	Coconino and Prescott NFs	Yes	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes

* T = Threatened, E = Endangered, C = Candidate species as classified by the U.S. Fish and Wildlife Service according to the Endangered Species Act; S = Sensitive species according to Forest Service Region 3 listing.

Of the 42 species that are considered special status taxa, 29, or roughly 75 percent, have weeds within or adjacent to known populations. Arizona cliffrose, Arizona bugbane, Flagstaff beardtongue, Flagstaff pennyroyal, Heathleaf wild buckwheat, Hualapai milkwort, Mearns sage,

Ripley wild buckwheat, and Sunset Crater beardtongue are of concern since all nine species have been found with a high number of weeds associated with them. Another threat posed to these special status plants is the expansion of the annual cheatgrass, which eventually increases the fire frequency. Roughly 30 percent of the special status plants have cheatgrass mixed in with their populations. Eventually, as the time between fires decreases and cheatgrass becomes more prevalent, native plants could be eliminated from these sites through losses attributed to fire.

More complete documentation on these taxa can be found in the botany specialists' report (Phillips and Crisp 2004) on file in the project record and at the Coconino National Forest supervisor's office.

Species Descriptions

Sentry milkvetch is a Federally listed endangered plant (U.S. Fish and Wildlife Service 1990a). It is a small perennial endemic plant growing in crevices or shallow soil of exposed ledges on white to gray-white Kaibab limestone (a very specific Kaibab limestone member) with abundant large nodules and fossils habitat (Barneby 1948; Phillips et al. 1982a). It grows on the rims of the Grand Canyon in Grand Canyon National Park and in pinyon-juniper woodlands about 5 miles from Kaibab National Forest where its population is limited to a few hundred plants.

Brady pincushion cactus is Federally listed as endangered (U.S. Fish and Wildlife Service 1979). It is a small single globose cactus usually no more than 2-1/2″ tall above ground (U.S. Fish and Wildlife Service 1985a). It retracts into the soil during periods of drought and becomes slightly covered with soil and pebbles. Flowering generally occurs in late April. Scattered populations occur along both sides of the rim of Marble Canyon and tributary canyons for about 25 miles below Lee's Ferry, about 15 miles north of the North Kaibab Ranger District.

Arizona cliffrose is Federally listed as endangered (U.S. Fish and Wildlife Service 1984). Plants are small shrubs, often less than 3 feet tall, with pale gray bark and entire or three-lobed leaves (U.S. Fish and Wildlife Service 1994a). The species grows on low arid hillsides associated with a unique white outcrop, which appears to be a shallow gravelly loam that develops over white Tertiary limestone lakebed deposits high in lithium and magnesium from 2,500 to 3,650 feet. This species is known only from the Coconino National Forest near Cottonwood in the project area. Populations occur also at Burro Creek, Horseshoe Lake, and Bylas, Arizona.

Welsh's milkweed is Federally listed as threatened (U.S. Fish and Wildlife Service 1987a). This is a local endemic that grows in sand dunes in sagebrush, juniper, pine and oak communities from about 4,700 to 6,200 feet in elevation (USDA Forest Service 1991b). The closest known population is about 5 miles north of the far northern boundary of the North Kaibab Ranger District.

Jones' cycladenia is Federally listed as threatened (USDA Forest Service 1991b). The species is a low perennial herb, 4 to 12 inches tall with ovate leaves and rose purple flowers. It is endemic to southern Utah and Coconino County, Arizona. It grows on gypsiferous saline soils in the Chinle, Cutler, and Summerville Formations in cool desert shrub and juniper communities between 4,400 to 6,000 feet (USDA Forest Service 1991b).

Siler pincushion cactus is Federally listed as threatened (U.S. Fish and Wildlife Service 1993). It is a small solitary, occasionally clustered, globose cactus about 4 to 18 inches tall (U.S. Fish and Wildlife Service 1986a). This species grows in red or gray gypseous badlands from 2,800 to

5,800 feet in elevation. The substrate is gypsum, seleniferous, calcareous soils high in soluble salts. Its range is northern Arizona in Mohave County from the Hurricane Cliffs to the vicinity of Pipe Springs and Fredonia, and Utah in the vicinity of St. George (U.S. Bureau of Land Management 1987). Potential habitat on the North Kaibab Ranger District may occur in Kanab Canyon.

San Francisco Peaks groundsel is Federally listed as threatened (U.S. Fish and Wildlife Service 1983). Critical habitat has been designated in the alpine tundra on portions of San Francisco Mountain. The species is a small perennial clonal herb 1 to 3 inches tall with yellow composite flowers in June-August (U.S. Fish and Wildlife Service 1987b). It inhabits the alpine talus cracks and crevices of fine to medium grained volcanic soils between 11,000 to 12,300 feet in elevation.

Ute ladies tresses is Federally listed as threatened. It is a perennial herb that arises from a fleshy underground root (Sheviak 1984). Its leaves are linear and sheathed at the base. The inflorescence is a spike with white, cream, or greenish-white flowers arranged in spiraling, longitudinal rows; it has a very pretty flower. A member of the orchid family, it grows in bogs, seeps, and along small mountain streams in cottonwood, tamarisk, willow, and pinyon-juniper communities at elevations of 4,500 to 6,800 feet (USDA Forest Service 1991b). The range of this plant includes Utah and perhaps northern Arizona, but there are no known locations on Arizona national forest lands.

Fickeisen pincushion cactus is a small solitary or clustered globose cactus with corky spines (Benson 1962). It retracts into the soil during periods of drought. The habitat of this plant is gravelly soils derived from Kaibab limestone on flat ridgetops and benches, from 4,200 to 5,400 feet (Phillips et al. 1982b). This species mostly occurs in scattered populations on the canyon rims of the Little Colorado and Colorado Rivers on the Navajo Reservation and on Bureau of Land Management lands in House Rock Valley and Mohave County. Two populations have been reported from the North Kaibab Ranger District (Phillips and Phillips 1980, Phillips and Roth 2004 personal observation).

Tonto Basin Agave is a large suckering agave with a very tall, open, unfruited flower stalk, and a dense rosette (Hodgson and Slauson 1995). Known locations in the project area are in the Verde River Watershed where the plants occur on south and southwest-facing slope edges and atop benches, occasionally on northeast-facing gentle slopes. The species occupies cobbly and gravelly, deep and well-drained soils at elevations from 2,300 to 5,100 feet.

Mount Dellenbaugh sandwort is a perennial species with a somewhat woody caudex from 2 to 5 inches tall known only from northern and north-central Arizona (Maguire 1947). The habitat of the species includes pine-oak forests and meadows. In the project area, the species has been collected north of Williams, at the South Rim of the Grand Canyon, and in De Motte Park on the North Kaibab Ranger District (Phillips and Crisp 2002).

Coppermine milkvetch is a perennial herb, sprouting from a stout subterranean caudex. It grows in the “badlands” habitat of the Chinle Formation and other formations in clay or silt soil between 3,200 to 5,400 feet (USDA Forest Service 1991b). It is a member of the desert scrub plant community within pinyon-juniper woodlands. Although known only from Utah and extreme northern Coconino and Mohave Counties in Arizona, potential locations include North Canyon near the Cockscomb on the North Kaibab Ranger District.

Marble Canyon milkvetch is a small perennial endemic plant growing in crevices or shallow soil on Kaibab limestone in Great Basin desert scrub habitat (Barneby 1992). It grows on cliffs

and canyon edges on the rim of Marble Canyon on the Navajo Reservation, where its population is limited to a few hundred plants (Roth 2002 personal communication). The plant is included because there is a location within 1 mile of the North Kaibab Ranger District.

Cliff milkvetch is a low growing, mat-forming endemic of the Buckskin Mountains at the north end of the North Kaibab Ranger District and adjacent Bureau of Land Management lands (Phillips 1992a). Plants grow on Kaibab limestone ledges at the tops of cliffs or rounded pillars, restricted to a specific member of Kaibab limestone that is white to gray-white in color and contains nodules and fossils. The elevation range for the species is 6,000 to 6,500 feet.

Rusby milkvetch is an upright perennial herb with pinnately compound leaves of oval leaflets (Barneby 1964). The species is found between 6,500 to 9,000 feet on basalt soils in northern and central Arizona on the Coconino and Kaibab National Forests. It is known from the San Francisco Mountain and north of Williams and Mount Trumbull.

Crenulate moonwort is a fern in the moonwort family that is considered one of the most primitive of living ferns (Farrar 2002). Individual plants are no taller than 4 inches and produce only one pale green frond per year from an underground rhizome. It is above ground in the spring and summer and very inconspicuous. A single specimen was collected on Agassiz Peak at 11,000 feet elevation in 1884 by J. G. Lemmon in the tundra (Rutman 1992). The typical habitat for this species is meadows or marshes on hillsides or flat lands. The known distribution of this species includes central and southern California to central Arizona and Montana (Wagner and Wagner 1981).

Cochise sedge grows in dense clumps 20-60 inches tall with stout erect stalks (Correll and Correll 1972). The range of this species is generally regarded as southern Arizona and southern New Mexico but it has been recently reported for the Sedona area, Coconino NF (Licher 2004 personal communication), and the Verde Ranger District, Prescott NF (EnviroSystems Management, Inc. 2003). It grows in wet areas such as springs and irrigation ditches.

Kaibab paintbrush is a perennial herb that flowers from early July until the end of the growing season (Holmgren 1973). The range of this species is limited to De Motte Park, Pleasant Valley, Upper Little Park and other small nearby parks on the Kaibab Plateau at elevations between 8,200 and 9,000 feet where the soils consist of fine silts and clay, to rocky, gravelly meadow soils derived from weathered Kaibab limestone (Reichenbacher 1986). Populations occur in the driest, most exposed sites in open meadows on rounded ridgetops and small knolls relatively free from competition with forbs and grasses.

Disturbed rabbitbrush is a perennial subshrub, 4 to 8 inches tall, with several to many stems per plant (Anderson 1964, 1978). Plants bloom from August through October. Disturbed rabbitbrush is found exclusively on calcareous soils derived from Kaibab limestone or basalt with accumulations of calcium carbonate within pinyon-juniper woodlands and grasslands on the north end of the Peaks Ranger District on the Coconino National Forest, and portions of the South Zone of the Kaibab National Forest, and adjacent nonforest lands (Galeano-Popp 1987; Hevron 1994). The elevation range is 5,000 to 7,000 feet.

Arizona bugbane has a conservation agreement between the U.S. Fish and Wildlife Service and the USDA Forest Service for the management of this rare species (U.S. Fish and Wildlife Service and USDA Forest Service 1999). This is a large perennial herb up to 6 feet tall with ternately compound (divided into three parts) leaves, flowering in July and August (Phillips and Popowski

1995). Habitat includes canyon bottoms and lower canyon slopes and seeps and springs in moist loamy soil of the ecotone between the coniferous forest and riparian habitat. The known elevation range is between 4,800 and 8,600 feet. This species is known only from Bill Williams Mountain, Kaibab National Forest, and Oak Creek Canyon and West Clear Creek Canyon, Coconino National Forest, in the project area (Phillips and Popowski 1998). It is also known from the Sierra Ancha Mountains on the Tonto National Forest (USDA Forest Service 1993a).

Mogollon thistle is a short-lived perennial herb from the Dane Spring area on the Mogollon Ranger District, Coconino National Forest (Schaack and Goodwin 1990). The plants bloom from July through September. The plant grows in moist soils with riparian understory plants associated with a spring and perennial stream at about 7,200 feet in mixed conifer forest.

Metcalfe's ticktrefoil is a perennial upright herb that grows from 12 to 36 inches tall. Leaves are in groups of three, generally 4 to 5 times longer than wide. The habitat is described as rocky slopes and canyons in grasslands and oak/pinyon-juniper woodlands at elevations from 4,000 to 6,500 feet. Distribution was thought to include southern Arizona, southern New Mexico, and perhaps northern Mexico (Bleakly 1999). This species was added to the Regional Foresters' List in 1999 and has recently been reported from the Sedona area, Coconino NF (Licher 2004 personal communication), and the Bradshaw Mountains, Prescott NF (Baker 2003).

Utah solitaire lily is 5 to 14 inches tall with linear leaves and flowers borne on a leafless stalk in a raceme (USDA Forest Service 1991b). Individual plants arise from underground rhizomes and bloom April through June. This species grows in deep sandy places such as on or near sand dunes between 3,600 and 4,800 feet found within the Glen Canyon area, Capitol Reef and Grand Staircase-Escalante National Monuments, and Monument Valley. Little is known about the distribution of this species in northern Arizona but there is probably no habitat on the North Kaibab Ranger District, according to Daniella Roth, botanist, Navajo Natural Heritage Program (Roth 2002, personal communication).

Cliff fleabane is a small perennial herb no taller than 2 inches with linear-oval leaves (Nesom 1990). Flowering occurs from May through July. The habitat is canyon walls and cliffs with moist slopes at elevations between 4,400 and 7,000 feet (Phillips 1991).

Heathleaf wild buckwheat is a low subshrub with spreading branches that flowers late summer to fall. This plant grows in the Verde Formation on low arid hillsides associated with unique white outcrops of the Verde Formation, a shallow gravelly loam that develops over white Tertiary limestone lakebed deposits. The elevation range for this species is 2,500 to 3,650 feet. This species is known only from northern and central Arizona on the Coconino (Denham and Fobes 1994; Baggs 2000) and Prescott National Forests in the project area (Baker and Wright 1996).

Morton's wild buckwheat is a perennial shrub with smooth alternate elliptical leaves (Reveal 1974). The flowers are pale yellow to white. The plants grow to about 2 ½ feet tall on red clay hills of shallow gypseous soil on sandstone and shale uplands in Great Basin Desert shrub. This species is currently known only from an area southwest of Fredonia along Highway 389 on the Kaibab-Paiute Reservation and Arizona State Land Department lands at 4,670 feet in elevation (Phillips 1979; Phillips et al. 1980). Potential habitat may exist on the project area in Kanab Canyon.

Ripley's wild buckwheat is a woody mat-forming subshrub that grows 2 to 8 inches tall with numerous branches (Howell 1944). It flowers April through June on heavily calcareous soils in

Sonoran desert scrub and pinyon-juniper woodlands on low arid hillsides of the Verde Formation in the project area. The species ranges from Peach Springs to Horseshoe Lake on Tertiary lakebeds between 2,000 and 6,000 feet (Phillips and Phillips 1991; Baker and Wright 1996).

Atwood wild buckwheat is a low, spreading herbaceous perennial with linear leaves that taper to an indistinguishable petiole (Reveal 1974). The inflorescence is a broad umbel with white flowers. This species grows with Morton's wild buckwheat on red clay hills or shallow gypseous soils on sandstone and shale uplands in Great Basin Desert shrub (Phillips 1979). Atwood wild buckwheat hybridizes with Morton's wild buckwheat (Phillips et al. 1980).

Bearded gentian is a small perennial herb 2 to 6 inches tall with basal leaves and opposite leaves along the stem (Engelmann 1863). The flowers are funnel shaped and blue to purple and usually occur singly at the tips of the stems during August and September. The range of this species is Wyoming, Utah, northern New Mexico, and northern Arizona (Cronquist et al. 1984). The species is known only on San Francisco Mountain within the project area, where it has been collected in several locations ranging from 10,500 to 12,000 feet (Schaack 1970).

Flagstaff pennyroyal is a small aromatic perennial herb that grows as a prostrate mat. It has square, wiry stems and small oval opposite leaves (Irving 1980). The plants bloom from May to August on dolomite limestone outcrops or soils in ponderosa pine forests in the Walnut Canyon drainage system and rims of tributaries to Oak Creek Canyon, Coconino National Forest (Boucher 1984; Phillips 1984). Some populations grow on sandstone in Sycamore Canyon Wilderness of the Prescott National Forest (Baker and Wright 1993). The elevation range is 4,500 to 7,000 feet.

Arizona sneezeweed is a perennial herb that grows up to 4 feet tall with several stems. Each flower head consists of yellow to orange 3-lobed ray flowers and purplish-brown globular disk flowers. It blooms July through September. This species is known only from central Arizona, growing in moist soil near drainages, lakes, ponds, or roadsides. The elevation range is 7,000 to 9,000 feet (Kearney and Peebles 1960).

Eastwood alumroot is a perennial with a rosette of rounded leaves growing from a woody root crown. Plants reach heights of 20 inches; small flowers are yellowish green, often without petals. It blooms from May to August. It is found only in central Arizona from 5,000 to 8,000 feet, occupying moist slopes in ponderosa pine forests and canyons (Baker 2003; EnviroSystems Management 2003).

Kaibab bladderpod is a perennial prostrate herb with oval, mostly basal leaves (Rollins 1982). It grows on limestone knolls with a high percentage of exposed rock on the surface, within open subalpine grassland meadows. Most of the known habitat for this species is in meadows along Highway 67 and on the road shoulders from 8,400 to 8,800 feet on the North Kaibab Ranger District (Fletcher 1987; Phillips 1993).

Giant lupine is an herbaceous perennial, 20 to 48 inches tall, branched into several stems above. The flowers are white to cream-white with some blue to lavender flowers reported from Utah. This species grows with various chaparral species and boxelder, velvet ash, Arizona sycamore, and alligator juniper along creeks or near springs. In the project area it is found on the Prescott National Forest between 4,800 to 7,000 feet (Baker 2003; Baker and Wright 1994).

Kaibab plains cactus has a conservation agreement between the U.S. Fish and Wildlife Service, USDA Forest Service, and U.S. Bureau of Land Management for the management of this rare species (USFWS et al. 1998). It is a small single, green globose cactus usually no more than 1 1/2 inches tall above ground, with half of its stem underground. It retracts into the soil during periods of drought and becomes slightly covered with soil and pebbles (Phillips et al. 1996). Flowering generally occurs in late April. Kaibab plains cactus is known exclusively from the eastern slopes of the Kaibab Plateau (East Kaibab monocline) and small portions of adjoining House Rock and Coyote valleys.

Sunset Crater beardtongue is a perennial herb 12 to 30 inches tall with bright pink flowers in June and July (Nelson 1927). The soil in which it grows is typically a layer of cinders 2 to 5 inches deep with a layer of silty soil below, important for water retention at the root level of this species (Phillips et al. 1992). The habitat is flat or gently sloping sites in open ponderosa pine forest between 6,500 and 8,500 feet in the Sunset Crater volcanic field near Flagstaff.

Mt. Trumbull beardtongue is a perennial herb arising from a woody base (Holmgren 1980). Individuals are 12 to 24 inches tall. The known range of Mt. Trumbull beardtongue is limited to the southeastern edge of the Shivwits Plateau, near Mt. Trumbull on Bureau of Land Management lands (Reichenbacher 1986; Hughes 2003, personal communication). It grows in gravelly soils derived from Kaibab limestone or from sandy soils derived from Hermit shale in the Great Basin conifer woodland, Great Basin Desert shrub, and the Mohave Desert shrub. It has not been found on the North Kaibab Ranger District to date.

Flagstaff beardtongue is a perennial herb 20 to 40 inches tall, with leathery leaves and lavender flowers. The species grows on dry slopes in the ponderosa pine forest on light, dry neutral soils in eroded or mountainous lands south of the Grand Canyon, 4,500 to 7,000 feet (Hazen 1978; Schilling 1980; Baker and Wright 1994; Green and Nagiller 1999).

Arizona phlox is a perennial herb about 2 to 6 inches tall with one to several stems arising from a taproot. The species grows on limestone and basalt soils associated with prickly pear, Yucca, beargrass, hackberry, and pinyon pine. This species is endemic to central Arizona, from Juniper Mountain Wilderness, Table Top Mountain, and Granite Dells in the Prescott area (Baker and Wright 1993, 1994), Mingus Mountain (EnviroSystems Management 2003) and near Cornville and Montezuma Castle National Monument between 3,200 and 6,850 feet.

Hualapai milkwort is woody toward the base, herbaceous above, and 2 to 6 inches tall. The plants bloom April through July. In some areas of its range this species occurs on the Verde Formation (Denham and Fobes 1994; Baggs 2000). This species is known to occur only in northern and central Arizona, including locations on both the Coconino and Prescott National Forests between elevations of 3,500 and 5,000 feet. The distribution of the species ranges from near Peach Springs on the Hualapai Reservation to areas of the Verde Valley near Camp Verde and Montezuma Castle National Monument (Arizona Game and Fish Department 1999; Baker 2001).

Grand Canyon rose is a clonal shrub with numerous stiff upright stems that have numerous long, straight, paired thorns and scattered bristles and prickles (Phillips 1992b). It is associated with singleleaf pinyon pine, Utah juniper, and big sagebrush in the Great Basin Conifer Woodland and Great Basin Desert scrub. Populations are usually found at the edges of major canyons on the Timoweap Formation in depressions caused by breccia pipes, a substrate containing uranium

deposits. The elevation range is 4,500 to 7,500 feet. Potential habitat occurs on the North Kaibab Ranger District in the vicinities of Marble Canyon and Kanab Creek Canyon.

Mearns sage is a small woody shrub with a low spreading habit (Reichenbacher et al. 1993). It has linear to oval leaves with silvery pubescence and purple flowers and emits a sage-like smell when crushed. It is found on the Verde Formation within Verde Valley on white limestone and gypsum soils and on sandstone, and Redwall limestone on Prescott National Forest east of Paulden to the Verde River (Baker and Wright 1993, 1996).

Wildlife

Fish Species – Endangered, Threatened, Proposed, Candidate, and Sensitive

The project area contains populations and/or designated critical habitat for nine threatened (T), endangered (E), proposed (P), and sensitive (S) fish species. The status of these species is described in Table 10. The terrestrial noxious or invasive weed species known in or adjacent to TE&S fish habitats are also listed. These fish species are Federally listed due to habitat alteration or destruction, not due to the spread of noxious and invasive weeds. Another compounding factor to their Federal listing is the introduction of nonnative fish species that are a source of competition and predation to native fish populations.

Table 10. Threatened, endangered, proposed, and sensitive fish species known on the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location Stream/Forest	Weeds in Habitat	Invasive Species in Habitat
Poeciliopsis o. occidentalis	Gila topminnow	E	Currently not found on forests; potential reintroduction sites on Coconino and Prescott NFs.	Unknown	NA
Ptychocheilus lucius	Colorado pikeminnow	E/XN	Verde River – Coconino and Prescott NF	Yes	tamarisk, giant reed, Russian olive.
Xyrauchen texanus	Razorback sucker	E	Verde River – Coconino and Prescott NF; critical habitat – Verde River.	Yes	tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven
Lepidomeda vittata	Little Colorado spinedace	T	East Clear Creek – Coconino NF; critical habitat – East Clear Creek	Unknown	NA
Meda fulgida	spikedace	T	Upper Verde River – Prescott NF.	Yes	tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven

Table 10. Threatened, endangered, proposed, and sensitive fish species known on the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location Stream/Forest	Weeds in Habitat	Invasive Species in Habitat
Oncorhynchus apache	Apache trout	T	North Canyon Creek – Kaibab NF	No	NA
Rhinichthys (=Tiaroga) cobitis	Loach minnow	T	No occupied habitat; potential reintroduction site in Fossil Creek, Coconino NF.	Yes	tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven
Gila intermedia	Gila chub	P	Spring Creek, Red Tank Draw, Walker Creek, – Coconino NF. Sycamore Creek, Little Sycamore Creek, Indian Creek – Prescott NF. Proposed critical habitat for above occupied stream reaches.	Yes	tamarisk
Gila robusta	Roundtail chub	S	Verde River, Oak Creek, Wet Beaver Creek, West Clear Creek, Fossil Creek – Coconino NF. Verde River – Prescott NF	Yes	tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven

* T = Threatened; E = Endangered; XN = Experimental nonessential population; P = Proposed as classified by the U.S. Fish and Wildlife Service according to the Endangered Species Act; S = Sensitive species according to a USDA Forest Service Region 3 listing.

All the perennial streams within the project area have some invasive tree species found intermixed with the riparian vegetation. However, the system considered at most jeopardy from noxious or invasive weeds is the Verde River. Not only are the tree species present but also Russian knapweed, giant reed, and whitetop.

The status of TE&S fish species found in the project area is described below.

Gila topminnow is Federally listed as endangered with no designated critical habitat (U.S. Fish and Wildlife Service 1967). Five sites on the Coconino National Forest and 24 sites on the Prescott National Forest were introduced with Gila topminnow in the early 1980s (Weedman and Young 1997). The majority of these sites failed due to various factors. Several sites on the two forests are recommended for restocking (U.S. Fish and Wildlife Service 1999).

Colorado pikeminnow is Federally listed as endangered with designated critical habitat (U.S. Fish and Wildlife Service 1967, 1994b). Populations within the Salt and Verde Rivers in Arizona are designated as “experimental nonessential” under Section 10(j) of the Endangered Species Act

(U.S. Fish and Wildlife Service 1985b). There is no critical habitat designated for this species in or near the project area. Re-establishment of a population in either the Salt or Verde Rivers is an identified action in the recovery plan (U.S. Fish and Wildlife Service 1991a). Colorado pikeminnow were extirpated from the Lower Colorado River Basin (U.S. Fish and Wildlife Service 1994b). Small re-introduced populations occur in the project area in the lower Verde River from stockings of hatchery-raised fish made from 1985 to the present. These populations are maintained by continued stocking of hatchery-raised fish. There has been no documented reproduction in the wild. The annual goal of the reintroduction program is to stock 2,000 large individuals into the Verde River system (Jahrke and Clark 1999). Stockings occur in the lower Verde River at Beasley Flat and Childs river access points. Predation and competition by nonnative fish are considered the greatest threat to these populations.

Razorback sucker is Federally listed as endangered with designated critical habitat (U.S. Fish and Wildlife Service 1991b, 1994b). Critical habitat in or near the project area includes the Verde River and its 100-year flood plain from Perkinsville (T18N, R2E, Section 31) downstream to Horseshoe Dam. Razorback suckers were extirpated from the Verde River drainage. Small re-introduced populations occur in the project area in the lower Verde River from stockings of hatchery-raised fish made from 1981 to the present. Current populations in the lower Verde River are maintained by continued stocking of hatchery-raised fish. There has been no documented reproduction in the wild. The annual goal of the reintroduction program is to stock 2,000 large individuals into the Verde River system (Jahrke and Clark 1999). Stockings occur in the lower Verde River at Beasley Flat and Childs river access points. Predation and competition by nonnative fish are considered the greatest threat to these populations.

Little Colorado spinedace is Federally listed as threatened with designated critical habitat (U.S. Fish and Wildlife Service 1987c). Critical habitat in or near the project area includes the East Clear Creek drainage on the Coconino National Forest. The spinedace is endemic to the Little Colorado River drainage. Populations occur in the project area in the East Clear Creek drainage on the Coconino National Forest. The entire East Clear Creek drainage is considered occupied spinedace habitat (USDA Forest Service 1999b). Populations fluctuate seasonally and annually. They have been recently recorded in Poverty Draw, Coldwater Springs, Cienega Draw, Jones Crossing, and Miller Canyon above the Blue Ridge Reservoir; and 95 Crossing, Barbershop Canyon, Kinder Crossing/Horse Crossing, Hamilton Crossing, Leonard Canyon, West Leonard Canyon, Willow Creek, and Bear Canyon below Blue Ridge Reservoir. Predation and competition by nonnative fish are considered the greatest threat to these populations.

Spikedace is Federally listed as threatened (U.S. Fish and Wildlife Service 1986b). Spikedace are endemic to the Gila River Basin in Arizona and New Mexico. Populations are recently known in the project area throughout the upper Verde River from the confluence with Granite Creek downstream to the confluence with Sycamore Creek (Rinne and Stefferud 1998). This population has become recently rare due to various factors, most notably predation and competition by nonnative fish and lack of flooding (Rinne 1999). It was historically known from the lower ends of West Clear Creek and Wet Beaver Creek being last recorded in 1937 and 1938, respectively (Minckley 1993).

Apache trout is listed as threatened (U.S. Fish and Wildlife Service 1975). There is no critical habitat designated for this species. Apache trout are native to the headwater regions of the Little Colorado, Black, and White River drainages of the White Mountains located in eastern-central Arizona. An Ord Creek strain was introduced into North Canyon, North Kaibab Ranger District,

during the 1970s after all the nonnative trout were removed. This population is a genetically pure strain and the population is considered stable.

Loach minnow is Federally listed as threatened (U.S. Fish and Wildlife Service 1986c). Loach minnow is endemic to the Gila River Basin in Arizona and New Mexico. This minnow is considered extirpated from the Verde River Basin (U.S. Fish and Wildlife Service 2000). In the Verde River drainage it was last recorded in the Verde River above Camp Verde, and from Beaver Creek near its confluence with the Verde River in 1938 (Minckley 1993, Girmendonk and Young 1997).

Gila chub is listed as a Forest Service Region 3 sensitive species. This species is also being proposed as Endangered with critical habitat (U.S. Fish and Wildlife Service 2001). This fish is endemic to the Gila River Basin in Arizona and New Mexico. It is known from six locations in the project area. The location and status of these populations are: Indian Creek (Unstable-Threatened), Little Sycamore Creek (Unstable-Threatened), and Sycamore Creek (Stable-Threatened) all in the Agua Fria River drainage (Middle Gila Watershed) within the Prescott National Forest; Red Tank Draw (Unknown), Spring Creek (Stable-Threatened), and Walker Creek (Stable-Threatened) all in the Verde River drainage within the Coconino National Forest. Nonnative fish pose a threat to some populations but the status is mainly due to lack of information on species trends and distribution (Weedman et al. 1996).

Roundtail chub is listed as a Forest Service Region 3 sensitive species. This species is known from tributaries and portions of mainstem rivers of the Colorado River Basin. Populations occur in the project area in the Verde River drainage throughout the mainstem, Oak Creek, Beaver Creek, West Clear Creek, and Fossil Creek and in the Little Colorado River drainage within East Clear Creek (Voeltz 2002). The majority of these populations are considered Unstable-Threatened mainly due to predation and competition by nonnative fish.

Terrestrial and Aquatic Wildlife Species – Endangered, Threatened, Proposed, Candidate, and Sensitive

There are five endangered, three threatened, and two candidate terrestrial and aquatic wildlife species that are either found in the project area or have designated critical habitat. An additional 23 species are classed as sensitive and currently found on the USDA Forest Service Region 3 list for terrestrial and aquatic wildlife.

Table 11. Threatened, endangered, sensitive animal species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat	Invasive Species in Habitat
Oxyloma haydeni Kanabensis	Kanab ambersnail	E	Possibly in Kanab Creek	Riparian	Yes	tamarisk
Empidonax traillii extimus	Southwest willow flycatcher	E	Kanab Creek, and along Verde River and tributaries.	Riparian	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk,

Table 11. Threatened, endangered, sensitive animal species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat	Invasive Species in Habitat
						Siberian elm
Gymnogyps californianus	California condor	E	North Kaibab District	Shrubland, high elevation grassland, pinyon-juniper, Ponderosa/ oak	Possibly	Potential for weeds to occur along roads where condors may roost and feed on road kills.
Rallus longirostris yumanensis	Yuma clapper rail	E	Coconino NF, wetlands and Verde River	Riparain	Yes	water primrose, Eurasian water milfoil, giant reed
Mustela nigripes	Black-footed ferret	E	Currently not found on forests.	High elevation grassland	Unknown	Unknown
Rana chiricahuensis	Chiricahua leopard frog	T	Coconino NF	Riparian	Yes	Eurasian water milfoil, water primrose
Haliaeetus leucocephalus	Bald eagle	T	Coconino, Kaibab and Prescott NF along Verde and Colorado Rivers and lakes	Riparian	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm, water primrose, Eurasian water milfoil, bull thistle, Scotch thistle, spotted knapweed
Strix occidentalis lucida	Mexican spotted owl	T	Coconino, Kaibab and Prescott NFs in mature mixed conifer and ponderosa/oak.	Ponderosa-oak, mixed conifer	Yes	bull thistle, Dalmatian toadflax, diffuse knapweed, Scotch thistle, spotted knapweed, leafy spurge, houndstongue, cheatgrass
Coccyzus americanus occidentalis	Yellow-billed cuckoo	C	Verde River, tributaries, and small creeks in Agua Fria drainage	Low elevation Riparian	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Pyrgulopsis	Page	C	Page Springs	Riparian	Yes	Himalayan

Table 11. Threatened, endangered, sensitive animal species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat	Invasive Species in Habitat
morrisoni	springsnail					blackberry
Anodonta californiensis	California floater	S	East Clear Creek	Riparian	Unknown	Unknown
Pyrgulopsis simplex	Fossil Springsnail	S	Fossil Creek	Riparian	Yes	Himalayan blackberry
Pyrgulopsis glandulosa	Verde Rim Springsnail	S	Sycamore Creek (Pine Mtn.)	Riparian	Unknown	Unknown
Cicindela oregona maricopa	Maricopa Tiger Beetle	S	Verde River, Prescott area, Agua Fria drainage, Hassayampa Creek	Low elevation Riparian	Yes	Tamarisk
Agathymus aryxna	Giant Aryxna Skipper	S	Coconino NF	Shrubland, woodland-chaparral, pinyon-juniper	Unknown	Unknown
Agathymus baueri freemani	Freeman's Agave Borer	S	Coconino NF	Shrubland, woodland-chaparral, pinyon-juniper	Unknown	Unknown
Agathymus neumoegeni	Neumogen's Giant Skipper	S	Coconino NF	Shrubland, low elevation grassland, woodland-chaparral	Unknown	Unknown
Callophrys comstocki	Comstreak's hairstreak	S	Coconino NF	Shrubland, ponderosa-oak, mixed conifer, woodland-chaparral	Unknown	Unknown
Incisalia fotis	Early Elfin	S	Coconino NF	Woodland-chaparral	Yes	Dalmatian toadflax
Limenitis archippus obsolete	Obsolete Viceroy Butterfly	S	Oak Creek and Verde River	Low elevation Riparian	Unknown	Unknown

Table 11. Threatened, endangered, sensitive animal species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat	Invasive Species in Habitat
Bufo microscaphus microscaphus	Southwestern (Arizona) toad	S	Coconino, Kaibab and Prescott NFs	Low elevation Riparian	Yes	water primrose
Rana pipiens	Northern Leopard Frog	S	Coconino and Kaibab NFs	High elevation Riparian	Yes	tamarisk
Rana yavapaiensis	Lowland Leopard Frog	S	Verde River and Agua Fria drainages	Low elevation Riparian	Yes	tamarisk
Thamnophis eques megalops	Mexican garter snake	S	Verde River, Oak Creek	Low elevation Riparian	Yes	water primrose, Eurasian water milfoil, Himalayan blackberry, giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Thamnophis rufipunctatus	Narrow-headed garter snake	S	Coconino and Prescott NFs	Riparian	Unknown	Unknown
Xantusia vigilis arizonae	Arizona Night Lizard	S	Coconino NF	Woodland-chaparral	Unknown	Unknown
Accipiter gentilis	Northern goshawk	S	Coconino, Kaibab and Prescott NFs	Ponderosa-oak, mixed conifer	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles
Buteogallus anthracinus	Common Black Hawk	S	Coconino and Prescott NFs	Low elevation Riparian	Yes	giant reed, tamarisk, tree of Heaven, Russian olive, Siberian elm, Russian knapweed, whitetop
Falco peregrinus anatum	American Peregrine Falcon	S	Coconino, Kaibab, and Prescott NFs	Cliffs	Yes	bull thistle
Vireo bellii	Bells' vireo	S	Coconino NF	Low elevation Riparian	Unknown	Unknown
Lutra canadensis sonora	Southwestern river otter	S	Verde River	Riparian	Yes	giant reed, tree of Heaven, Russian knapweed,

Table 11. Threatened, endangered, sensitive animal species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat	Invasive Species in Habitat
						whitetop, Russian olive, tamarisk, Siberian elm
Microtus mexicanus navaho	Navajo Mexican vole	S	Coconino and Kaibab NFs	Riparian, high elevation grassland, ponderosa-oak	Yes	Dalmatian toadflax, bull thistle
Perognathus amplus cineris	Wupatki Arizona Pocket Mouse	S	Coconino NF	High elevation grasslands, pinyon-juniper	Unknown	Unknown

*T = Threatened; E = Endangered; C = Candidate species as classified by the U.S. Fish and Wildlife Service according to the Endangered Species Act; S = Sensitive species according to the Forest Service Region 3 Regional Foresters' List.

The above-listed species are described below.

Kanab ambersnail measures up to 23-mm (nearly 1 inch) in shell size. KAS are air breathing mollusks but are able to survive underwater for up to 32 hours in cold, highly oxygenated water. Historic floods in the Colorado River basin may have dispersed KAS downstream to new sites or other populations. KAS live in association with watercress, monkeyflower, cattails, sedges, and rushes. KAS populations in the Grand Canyon region occur in areas with water sources originating from limestone or sandstone geologic strata). Kanab ambersnail has suitable habitat within the Kanab Creek Wilderness.

Southwestern willow flycatcher prefers nesting in dense riparian thickets along river, streams, irrigation ditches, sloughs, beaver ponds, and abandoned river channels. The breeding season occurs from May through August. Canopy covers are consistently high (>90 percent) throughout the range (Spencer et al. 1996). In the Verde Valley, nesting willow flycatchers occur in tamarisk and mixed riparian habitats. The tamarisk habitat type consists of dense, mature tamarisk (35 to 40 feet tall) that may or may not be interspersed with few scattered willow or cottonwood trees. Mixed riparian habitat types are varied and can be dominated by a variety of willow species, young cottonwood, box elder, Arizona alder, the introduced salt cedar, and Russian olive. Patch size varies from 5 to 121 acres in mixed riparian and tamarisk (Spencer et al. 1996). Willow flycatchers have been found along the Verde River and its tributaries. While tamarisk thickets are not the natural habitat, breeding has been documented there.

California condors feed on carrion, eating 2 to 3 pounds per day. Habitat is mountainous country at low and moderate elevations, especially rocky and brushy areas with cliffs available for nest sites. The California condor forages also in grasslands, oak savanna, mountain plateaus, ridges, and canyons. They roost in snags or tall open branched trees near important foraging grounds. In 1996, USFWS designated the planned reintroduced population in northern Arizona

and southern Utah as a nonessential experimental (XN) population; the California condor is listed as Endangered elsewhere in U.S. The California condor was reintroduced to the Arizona Strip starting in 1996, with releases in House Rock Valley on the eastern border of North Kaibab Ranger District. Additional releases have occurred in both the House Rock Valley and Hurricane Cliffs to the west of North Kaibab Ranger District; they could be found on the district.

Yuma clapper rail is an elusive bird that occupies marsh-like habitat around rivers, ponds, and bogs where emergent vegetation such as cattails, bulrush, and reed grass occur. The Yuma clapper rail climbs around on flattened, floating materials and feeds mainly on crayfish although other invertebrates, arthropods, and fish are eaten as well. Nests can be found in a variety of habitats within emergent wetland habitats as long as stable substrates are available. The only occurrence of Yuma clapper rail near the project area is a bird at Tavasci Marsh in 1997/1998 (Agyagos, 2004). There are no documented occurrences within the project area. Although the project area is typically outside the range for this species, there is potential habitat on the Coconino NF.

Black-footed ferrets occupy burrows made by prairie dogs and use prairie dogs as a main food source. There is 1,952 specimen from an area 7 miles northeast of Williams, Arizona (Hoffmeister, 1986). Other historic locations are Government Prairie near Parks, and 12 miles west of Winona, which would likely be on or within the Coconino National Forest. It is assumed that current prairie dog colonies are large enough to support ferrets, although none are known on the three national forests at this time. The reintroduction site near Seligman is well off the national forests.

Chiricahua leopard frog occurs locally in central Arizona in rocky streams and wetlands. Although it is an opportunistic breeder, it generally breeds in the early spring at elevations below 5,900 feet and in the summer at elevations higher than 5,900 feet. Chiricahua leopard frog distribution overlaps with northern leopard frog.

Bald eagles are winter visitors above the Mogollon Rim, and they breed below the Rim. Wintering eagles are found along major rivers, reservoirs, or in areas with available food, and depend on suitable night and severe weather roosts in sheltered timber stands. They feed on fish, waterfowl, terrestrial vertebrates, and carrion. Bald eagles in central Arizona prefer to nest on cliff ledges or pinnacles or in tall trees (USDI 1982). Reproductive success can be negatively impacted by recreation. Threats to bald eagles include loss of existing or potential roosts due to catastrophic fires, fire suppression or past timber sales and loss of perches, particularly snags, due to firewood collecting, hazard tree removal, fire or wind. Nesting bald eagle reproduction has been affected historically by heavy metal accumulation causing eggshell thinning along the Verde River, and loss of young due to nest parasites (USDI 1982). It is proposed for delisting in all lower 48 states (6/8/1999) except portions of the American southwest (64 FR 36453-36464). Bald eagles are known to nest along the Verde River and at Lynx Lake. Winter roosts occur at Lynx Lake, Mormon Lake and scattered around several small water bodies south of Williams.

Mexican spotted owl occupies mixed conifer and ponderosa pine/Gambel oak vegetation types, usually characterized by high canopy closure, high stem density, multilayered canopies within the stand, numerous snags, and downed woody material. Steep slopes and canyons with rocky cliffs also characterize much suitable nesting/roosting owl habitat. Owls primarily roost in dense, unlogged, uneven-aged stands with large tree components. Foraging habitat is more variable and use varies among owls. MSO prey mainly on small mammals, although birds, insects, and reptiles are taken as well. The primary threats cited for the owl in most recovery units include large-scale

catastrophic wildfire and timber harvest. Other potential threats include recreation, improper grazing, and firewood harvest. A recovery plan was published in December 1995 (USDI 1995). The management recommendations of the recovery plan were incorporated into all forest plans in the Southwestern Region of the Forest Service in 1996. Final critical habitat was designated for the MSO on August 31, 2004, and does occur on all three forests. Owls have been intensively surveyed on all three forests, and found on the south Kaibab, Coconino, and high elevations of the Prescott. Protected activity centers have been established, and monitoring continues.

Western yellow-billed cuckoo is a late migrant and summer resident requiring large tracts of undisturbed riparian deciduous forests where willow, cottonwood, sycamore, or alder occur. Yellow-billed cuckoos in higher elevations can be found in mesquite and tamarisk. They prefer dense vegetation, which creates a humid environment. Nests are loose twig structures built on a horizontal limb of trees, shrubs, and sometimes vines. Nests are in thick undergrowth or in trees, typically 4 to 8 feet above ground. The yellow-billed cuckoo feeds on cicadas, katydids, caterpillars, and other large prey. The breeding season for this bird begins around June 15. They have been found along the Verde River and low elevation small streams.

Page springsnail is restricted to six extant populations in the Verde Valley, on the Coconino NF, and possibly a few more populations on State or other lands, such as the Page Springs Fish hatchery. The snail is found attached to firm substrates (e.g., rock, wood) in spring fed areas. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate water currents. Springsnail species are usually limited to a small geographic area.

California floater is a freshwater clam with an extremely thin, large shell, about 80 mm in length, with no teeth. It is a bivalve with larval, parasitic, juvenile, and adult stages. It depends on fish to be moved around. Diet may be comprised of detritus, animal plankton, and bacteria. Habitat is shallow areas, less than 2 meters deep, in unpolluted lakes, reservoirs, and perennial streams. Adults typically live in mud or sand and juveniles live in loose sand. The elevation range is 4,000 to 8,000 feet. Clams are historically found in Arizona in the Black, Salt, Santa Cruz, Verde, Gila, and Colorado Rivers. There is a record of the species from East Clear Creek on the Mogollon Rim Ranger District (AGFD 2004). Alteration and destruction of riverine habitats, including channelization, dredging, impoundment, erosion, siltation, water diversion, ground water pumping, pollution, and watershed modifications are threats to the species. Status may also be tied to a specific fish or group of fishes that serve as hosts for the larval stage. Many of the native fishes within the range of the floater have been depleted by habitat alteration, competition, and predation by nonnative fishes.

Fossil springsnail is found in springs and seepages feeding Fossil Creek, including Fossil Springs in Yavapai and Gila Counties, elevation 4,310 feet. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area. The shell is 2 to 2.5 mm tall.

Verde Rim springsnail is found in the Nelson Place Spring complex in the headwaters on Sycamore Creek, Pine Mt. Wilderness, in central Arizona. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.

Maricopa Tiger Beetle occurs in open sand or mud flats and stone terraces along permanent or intermittent streams and near temporary and permanent ponds, open soil such as dirt roads and

parking lots near water to some distance from water. They have been reported near leaky faucets and pipes, cattle tanks and ponds. They are generally not found on sand or mud bars with dense low-growing vegetation or on streams where cobblestone predominates. The main vegetative association at collection sites in riparian corridors is ash, sycamore, cottonwood, and willow. Vegetation outside the immediate riparian corridor varies from juniper-chaparral to grassland and Upper Sonoran desert scrub. The elevation at collection sites ranges from 1,092 to 6,880 feet. Beetles are generally active from March to mid-June and September to mid-November. The diet is mainly other insects. Threats to this species include drought, trampling, and soil compaction.

Giant Aryxna skipper are fall-flying large skippers, and the immature burrow into the leaves and stalks of various species of agave. In southeastern Arizona, the best flights occur around the first of October. Adults do not take nectar, but are often found at puddles and other sources of moisture, and prefer steep cliff faces and road cuts. The larvae are well documented leaf borers of *Agave palmeri*. In southeast Arizona, it occurs mostly in canyons with good stands of agave. Host plants are *Agave chrysantha* and *A. deserti. Agave chrysantha* is found between 2,300 and 7,000 feet in Yavapai County. Blooming from May through August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with *A. parryi* var. *couesii* and *A. delamateri* in Yavapai County. *Agave deserti* is not known from Coconino or Yavapai Counties.

Freeman's agave borer requires an agave host, but is also far ranging with wider habitat use. Its host, *Agave chrysantha* is found between 2,300 and 7,000 feet in Yavapai County. Blooming from May to August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with *A. parryi* var. *couesii* and *A. delamateri* in Yavapai County and inhabits canyons. Adults fly from September through November.

Neumogen's giant skipper occurs in upper Sonoran, open woodland or shrub-grassland. The larvae feed on *Agave parryi*. There are three varieties of this Agave species in Arizona. *Agave parryi* var. *couesii* (Coues agave) is found in Coconino and Yavapai Counties. It blooms from May to July and can be found on open slopes of grassland, chaparral, and pine-oak woodlands between 3,650 and 7,000 feet. *Agave parryi* var. *parryi* is found in Coconino County between 4,000 and 9,200 feet. Blooming between June and July, this variety is found on open slopes of grassland, chaparral and pine-oak woodland. There are confirmed records of the *A. neumoegeni* complex from Coconino and Yavapai Counties; reported from the upper Sonoran or lower transition zone in open woodland or shrub-grassland. Range is central Arizona to west-central New Mexico, southern New Mexico to west Texas.

Comstock's hairstreak butterfly is reported mostly from the Upper Sonoran Zone desert canyons and from transition to Canadian Zone (rarely alpine) woodland, sagebrush and chaparral in the Rockies. Favors dry, rocky areas of foothills and canyons of the Upper Sonoran plateaus from 5,000 to 6,000 feet. Their larvae feed on buckwheat. They have a single brood with adults present from March to May.

Early elfin favors roadsides with flowering cliffrose. Eggs are laid singly on flower buds of the host; larva feed on cliffrose buds, flowers, and young fruits. It is locally uncommon among arid plateaus and desert mountains from 6,000 to 7,000 feet. They have a single brood with adults present from March to April.

Obsolete viceroy butterfly habitat includes riparian areas generally below 4,500 feet where willows persist. Habitat includes subtropical to Canadian Zone watercourses. Host plants include coyote willow, and Goodding willow is a confirmed food plant for this butterfly. Red willow is a suspected food for Obsolete Viceroy Butterfly. Habitat for this butterfly includes riparian areas generally below 4,500 feet where willows persist. Other host plants include cottonwood, aspen, wild cherry, and serviceberry. Apparently tied to cottonwood/willow habitat. It frequents irrigation canals, water tanks, and other areas that border humid, semidesert bottomlands. It flies 12 to 15 feet above ground. Larvae feed at night on the twigs, leaves, and other plant parts of host species in the families Salicaceae, Fagaceae, and Rosaceae. Adults are on the wing from May to August. Known from Oak Creek and the Verde River.

Southwestern toad occurs in rocky streams, canyons, and flood plains, usually with dense riparian vegetation. Found in the upland desert and pine/oak communities south of the Mogollon Rim between 2,000 and 6,000 feet in elevation. They are known in East Clear Creek and portions of all four counties within the project area (AGFD, HDMS 2004). They use loose, gravelly areas of streams and arroyos or the sandy banks of quiet water. They breed in gently flowing waters, generally with well developed riparian vegetation, from February through July. They may be abroad until September. This toad feeds on insects, arthropods, and snails. Generally, they occupy habitat similar to that of leopard frogs.

Northern leopard frog occurs in the northeastern quarter of Arizona, usually in montane streams and wetlands that have aquatic vegetation and in wet meadows at higher elevations. This frog is generally restricted to permanent waters. It is an opportunistic breeder, with most breeding occurring in late spring. The Northern leopard frog is known from all ranger districts of the Coconino except Redrock, and from the Kaibab NF.

Lowland leopard frog prefers permanent stream pools, springs, stock tanks, and side channels of major rivers within desert scrub, grassland, and oak and pine/oak woodland habitats. It is found from sea level to 4,800 feet in elevation but more commonly less than 3,300 feet. It is seldom found in association with bullfrogs. The lowland leopard frog is an opportunistic breeder, but generally breeds from February through April. Its habitat includes open areas with high herbaceous vegetation along the margins for cover. The diet is mainly small invertebrates. The lowland leopard frog historically inhabited Redrock Ranger District, and is found on the Prescott NF in Walnut Creek, Government Springs, Indian Creek, Cienega Creek, Turkey Creek, Hassayampa River, Blind Indian Creek and Dry Creek. There is also one historic sighting of lowland leopard frog at Perkinsville along the Verde River.

Mexican garter snake is usually found in or near streams, ponds, and cienegas in the highland canyons (up to 6,200 feet in elevation) with pine/oak or pinyon/juniper woodland, but may follow streams into lower desert grasslands. It is most closely linked to shallow, slow moving or impounded waters, although it also occurs in other aquatic environments. The Mexican garter snake's diet consists of leopard frogs, toads, tadpoles, small mammals, and various native fishes. Large adults can take lizards and small rodents during occasional terrestrial forays. The Mexican garter snake is known to be associated with leopard frogs, which are a major prey species. Bullfrogs are a significant predator. It is known from the Agua Fria River, Oak Creek, Verde River, and Sycamore Creek Wilderness. Threats to this species include lowered water tables, habitat degradation and destruction, and predation by bullfrogs and introduced fishes.

Narrow-Headed garter snake is the most aquatic of the garter snakes. It is found near cool, well lit, quiet, rocky pools. It is usually within a meter of water. Preferred habitat is along large streams and rivers in pinyon/juniper and oak woodlands and ponderosa pine forests. Important habitat components are bank vegetation including shrub-sized and sapling Arizona alder (the most conspicuous species), velvet ash, willows, and canyon grape. Food items include fish, frogs, tadpoles, and salamanders. The range is the mountains of central and eastern Arizona and west-central New Mexico in the Mogollon Rim area, from 5,000 to 6,000 feet in elevation. There are disjunctive populations in Mexico. Good populations can be found in Oak Creek Canyon and the East Verde River. Threats to the species are lowered water tables, habitat modification, and increased recreational use in riparian areas.

Arizona night lizard is a secretive lizard found in arid and semiarid lands in the chaparral-oak belt in central Arizona. This lizard occupies the spaces beneath fallen branches, logs, and dead clumps of agave, dead brush, cow dung, and in rock crevices. It is a Sensitive species on the lower elevation districts of the Coconino NF and may occur at the lower elevations of the Prescott NF.

Northern goshawk occupies ponderosa pine, mixed species, and spruce-fir forest types in the Southwest. The goshawk is a forest habitat generalist that uses a wide variety of forest seral stages. It prefers stands of intermediate canopy cover for nesting, while more open areas are used for foraging. All forested (ponderosa pine and mixed conifer) habitat above the Mogollon Rim is considered to be goshawk habitat, as well as any associated pine or mixed conifer stringers that may extend below the Rim. Mature conifers and cottonwoods are primary nest trees in Arizona. The northern goshawk eats birds up to the size of a grouse, and mammals up to and including jackrabbit size. There is a concern that populations and reproduction of the goshawk are declining in the western United States, although, after reviewing several petitions requesting listing, the U.S. Fish and Wildlife Service has determined that listing is not warranted at this time. These declines may be associated with forest changes caused by timber harvesting, but fire suppression, livestock grazing, drought, and toxic chemicals may also be involved (Reynolds et al. 1992). "Management Recommendations for the Northern Goshawk in the Southwestern United States" (RM-217) was published in 1992. Many of the recommendations were incorporated into all forest plans in the Southwestern Region with the 1996 forest plan revisions. The northern goshawk occurs on all three forests within the project area. The highest densities occur on the North Kaibab Ranger District.

Common black-hawk occurs in the southwestern United States as a summer resident. It nests along the Verde River and its tributaries in low elevation cottonwood/sycamore riparian areas, and in Sycamore Creek (Pine Mtn.), Indian Creek, Little Sycamore Creek. It is dependent upon a mature, relatively undisturbed habitat supported by a permanent flowing stream. Groves of tall trees (75 to 100 feet) must be present along the streamcourse for nesting. They hunt from tree and cliff perches. In addition, they often wade into water and chase after prey on foot. Shallow streams of low to moderate gradient provide ideal hunting conditions. Food items include crayfish, frogs, tadpoles, reptiles, birds, small mammals, and fish.

Peregrine falcons are found in Arizona wherever sufficient prey is found near cliffs. Optimum peregrine habitat is generally considered to be steep, sheer cliffs overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance. Prey is mainly doves and pigeons, and incidentally shorebirds, waterfowl, and songbirds. Peregrines may forage up to 20 km from the nest site, but normally stay within 12 km. Peregrines are frequently associated with

large rivers or waterfowl refuges during the winter. Nest sites average 200 to 300 feet high on a cliff. They are found in five locations on the Prescott, also on the Coconino and north Kaibab NFs. The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (USDI 1999) and continues to be a Forest Service Sensitive species.

Bell's vireo occupies dense riparian thickets as well as mesquite and oak thickets near water in semiarid areas. They eat insects. The decline in the Bell's vireo population is largely due to brood parasitism by the brown-headed cowbird. They are a Sensitive species on the lower elevations of the Coconino NF and may also occur on the Prescott NF.

Southwestern river otter is highly aquatic, occurring along rivers where they hunt, travel, take refuge, and frolic. Otters feed on fish, amphibians, turtles, crayfish, and other aquatic animals. The Southwestern river otter is historic to the Verde River, Wet Beaver Creek, Oak Creek, and other major tributaries in the Verde Valley. Evidence suggests that a few populations persisted at least into the 1960s and likely to the present. In 1981 and 1982, Arizona Game and Fish Department introduced a Louisiana subspecies into Fossil Creek and the Verde River near the Fossil Creek and East Verde confluences. This introduced species is successfully reproducing and may eventually cause genetic swamping of the native form, if any still exist.

Navajo Mountain Mexican vole has range from Navajo Mountain southward to the western part of the Mogollon Plateau from near Mormon Lake westward to the vicinity of Williams. Locations have been reported from 3,800 to 9,700 feet in elevation with a number of locations around the San Francisco Mountains from Williams to Mormon Lake (Hoffmeister 1986). Voles occupy meadows and riparian areas above the Mogollon Rim. They also occur within the forested areas where tree densities are low. They rely on grasses and other herbaceous vegetation for food and cover.

Wupatki Arizona pocket mouse is a subspecies known from the Wupatki area on the Peaks Ranger District. This subspecies is not distinguishable from *P. a. ammodytes* by external or cranial characteristics but is geographically isolated from other *P. amplus* subspecies. Habitat for this pocket mouse is similar to *P. a. ammodytes*. This pocket mouse feeds almost exclusively on seeds. It is most commonly associated with Merriam's kangaroo rat.

The following species were suggested for consideration by the U.S. Fish & Wildlife Service but are not being considered for the given reasons:

Desert Tortoise is not found on any of the forests. The Prescott National Forest has surveyed for Desert tortoise and not found any.

Hualapai Mexican vole is not considered a listed species for the Coconino, Kaibab, and Prescott NFs by the FWS (USDI 1998). Per the May 29, 1998 USDI FWS memo, the service will carry out Section 7 consultations on the Hualapai vole only in the Hualapai Mountains, which is outside the project area.

Brown Pelican it is only accidental (does not nest) on the Coconino and Kaibab National Forests. It is not found on the Prescott National Forest.

Management Indicator Species

Management indicator species (MIS) are those species selected for emphasis in planning, and are monitored during forest plan implementation to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent (FSM 2670.5). Species are selected, in part, because their population changes are believed to indicate the effects of management activities (36 CFR 219.19). Each forest has completed an MIS report, which contains further information. Within the project area there are 19 species, most of which are common between the three national forests. The exceptions are that the Prescott National Forest has identified the rufous-sided towhee as an indicator of late-seral chaparral, and the Kaibab National Forest has recognized Arizona bugbane as a sign of late-seral mixed conifer associated with sky islands. The Prescott National Forest does not have elk, Arizona bugbane, Mexican spotted owl, cinnamon teal, red squirrel, red-naped sapsucker, Lincoln's sparrow or yellow-breasted chat as management indicator species, although both the Kaibab and Coconino National Forests use these species. Goshawk and Mexican spotted owl are discussed in detail in the previous section.

Table 12. Management indicator species

Scientific Name	Common Name	Habitat	MIS for these forests	Weeds in Habitat	Invasive Species in Habitat
Sphyrapicus varius	Red-naped sapsucker	Late seral and snags in aspen	Coconino and Kaibab NFs	Unknown	Unknown
Cimicifuga arizonica	Arizona bugbane	Late seral mixed conifer	Kaibab NF	No	NA
Strix occidentalis lucida	Mexican spotted owl	Late seral mixed conifer and spruce-fir	Coconino and Kaibab NFs	Yes	bull thistle, Dalmatian toadflax, diffuse knapweed, Scotch thistle, spotted knapweed, leafy spurge, houndstongue, cheatgrass
Tamiasciurus hudsonicus	Red squirrel	Late seral mixed conifer and spruce fir	Coconino and Kaibab NFs	Yes	Dalmatian toadflax, biennial thistles
Picoides villosus	Hairy woodpecker	Snags in ponderosa, mixed conifer, and spruce fir	Coconino, Kaibab, and Prescott NFs	No	NA

Table 12. Management indicator species

Scientific Name	Common Name	Habitat	MIS for these forests	Weeds in Habitat	Invasive Species in Habitat
Cervus elaphus	Rocky Mountain elk	Early seral ponderosa, mixed conifer, and spruce-fir	Coconino and Kaibab NFs	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles
Accipiter gentilis	Northern goshawk	Late seral ponderosa	Coconino, Kaibab and Prescott NFs	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles
Sitta pygmaea	Pygmy nuthatch	Late seral ponderosa	Coconino, Kaibab, and Prescott NFs	No	NA
Meleagris gallopavo merriami	Wild turkey	Late seral ponderosa	Coconino, Kaibab, and Prescott NFs	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles
Sciurus aberti	Tassel-eared squirrel	Early seral ponderosa	Coconino, Kaibab, and Prescott NFs	Yes	Dalmatian toadflax, diffuse knapweed, bull thistle, leafy spurge
Parus inornatus	Juniper titmouse	Late seral and snags in pinyon-juniper	Coconino, Kaibab, and Prescott NFs	Yes	cheatgrass, biennial thistles, Dalmatian toadflax
Odocoileus hemionus	Mule deer	Early seral pinyon juniper, chaparral, and aspen	Coconino, Kaibab, and Prescott NFs	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles, camelthorn

Table 12. Management indicator species

Scientific Name	Common Name	Habitat	MIS for these forests	Weeds in Habitat	Invasive Species in Habitat
Pipilo erythrophthalmus	Spotted (rufous-sided) towhee	Late seral chaparral	Prescott NF	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles
Antilocapra Americana	Pronghorn	Early and late seral grassland and desert shrub	Coconino, Kaibab, and Prescott NFs	Yes	knapweed species, biennial thistle, Dalmatian toadflax, Mediterranean sage, leafy spurge
Various	Aquatic macroinvertebrates	Aquatic and riparian	Coconino, Kaibab, and Prescott NFs	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Vermivora luciae	Lucy's warbler	Late seral riparian	Coconino, Kaibab, and Prescott NFs	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Anas cyanoptera	Cinnamon teal	Late seral wetlands and aquatic	Coconino and Kaibab NFs	No	NA
Melospiza lincolnii	Lincoln's sparrow	Late seral riparian	Coconino and Kaibab NFs	Yes	cheatgrass, biennial thistle, Dalmatian toadflax
Icteria virens	Yellow-breasted chat	Late seral riparian	Coconino and Kaibab NFs	Yes	tamarisk

Red-naped sapsucker (yellow-bellied sapsucker) nests primarily in aspen within deciduous or deciduous/mixed-conifer forests and often near water. Live trees are preferred. Dead trees,

usually spruces or other conifers are used at times. They excavate a new hole each year. They extricate sap and the soft cambium layer around willows, cottonwoods, aspens, and walnuts. They also feed on ants, forest tent caterpillar moths, spruce budworm moths, buds, fruit, berries, and nuts. Nest trees minimum diameter is 10 inches with a minimum height of 15 feet. They favor groups of large aspens near heads of higher elevation canyons during the summer. Trend is stable for the Coconino and upward for the Kaibab National Forest.

Arizona bugbane was not listed as a management indicator species in the EIS for the Kaibab Forest Plan. However, it is listed in the Kaibab National Forest Plan for EMA 6, which is a botanical area established for the protection of this species. It is a Forest Service Region 3 Sensitive species, and the Arizona Native Plant Law classifies it as Highly Safeguarded. There is a conservation agreement between the USDI Fish and Wildlife Service and the USDA Forest Service for the management of this rare species (U.S. Fish and Wildlife Service and USDA Forest Service 1999). It is found in montane riparian habitat characterized by Douglas-fir, maples, aspen, and numerous herbs in moist loamy soil. The trend is considered stable.

Mexican Spotted Owl - See biology in previous section. The trend is unknown on the Coconino National Forest and downward on the Kaibab National Forest.

Red squirrel is found in Arizona in mixed conifer above 7,500 feet. Red squirrel nests are often in tree cavities. Preferred mean tree diameters are 14 inches. Red squirrels must store and maintain a winter food supply in centralized caches. Red squirrels need adequate food supply, protective cover, and moisture and shade for cone storage (Vahle and Patton 1983). The primary foods for red squirrels are the seeds of Engelmann spruce, Douglas-fir, and white fir. Other food items consist of mushrooms and fungi, buds, and fruits (Hoffmeister 1986). Key habitat elements include density of cone bearing trees, canopy cover, shading, insulation, and suitable cache sites. The trend is unknown for the Coconino and stable on the Kaibab National Forest.

Hairy woodpecker is a primary cavity-excavator. It primarily eats insects. The desired condition is to have adequate numbers of snags or trees with dead/decaying parts throughout the landscape (DeGraff et al. 1991). Hairy woodpeckers nest in holes in live or dead trees, 5 to 60 feet (average 30 feet) above ground. In most areas, they favor dead or dying parts of live trees, especially where fungal heart rot has softened the heartwood. Trend is considered stable for this species for all three national forests.

Elk represents early-seral stage ponderosa pine, mixed-conifer and spruce-fir habitat types. Grasslands and early-seral stage woodlands are also important to this species. Elk are associated with deciduous thickets and early-seral stages of forests that contain an interspersion of grasses and forbs. Elk typically summer in mountain meadows and montane coniferous forests, and winter in the lower elevation pinyon-juniper woodlands and grasslands (Hoffmeister 1986). However, there are herds living year-round in pinyon-juniper. Elk prefer grasses, and they also eat forbs and browse. Trend is considered stable on the Coconino and upward on the Kaibab National Forest.

Northern Goshawk - See biology in previous section. Trend is unknown on the Coconino, stable on the Kaibab, and unknown on the Prescott.

Pygmy nuthatch is common throughout its range in North America. It is a primary cavity-excavator, using wood that is dead and well rotted. It is a cavity-nester, using large tree cavities

for colonial roosts. The nuthatch primarily eats insects (DeGraff, 1991). Trend is stable on the Coconino and Kaibab, and upward on the Prescott National Forest.

Wild turkey depends on the interspersion of habitat types within the forest to provide roosting, nesting and foraging habitats. It requires large, open-crowned trees for roosting, and mature ponderosa pine trees that produce abundant cones for seeds as a food source. In addition, it requires meadows for seed and insect production. It uses large logs as cover. Trend for this species is up on the Coconino and down on the Kaibab and Prescott National Forests.

Tassel-eared squirrel was chosen to represent the early seral ponderosa pine habitat. Since its selection, additional research has shown that this species' best habitat is the intermediate-aged forest (trees 9 to 18 inches dbh), intermixed with larger trees, where groups of trees have crowns that are close together or interlocking. It also depends on the upper layer of the forest floor associated with tree litter, roots, and mycorrhizal fungi. This species also depends on mature trees to provide cones as a food source. Therefore, this species depends on the interspersion of habitat types within the forest to provide treetop travel, food on the ground, and food in the trees. Trend is unknown for the Coconino, stable for the Kaibab, and various for the Prescott National Forest.

Juniper titmouse is an obligate secondary cavity nester that is highly restricted to pinyon-juniper woodlands. Juniper titmice are major pine seed predators that may consume large numbers of seeds. Juniper titmice are probably insectivorous during the warmer half of the year, and eat seeds in the fall (Latta, et al. 1999). Juniper titmice are year-round residents of Arizona. Nesting occurs between mid-May and the end of June; most nest cavities are in juniper trees. Trend is stable to down on the Coconino and stable for the Kaibab and Prescott National Forests.

Mule deer represents the early-seral stage of the chaparral and pinyon-juniper habitats within the Prescott National Forest, and early-seral stages of aspen and pinyon-juniper woodlands on the Coconino and Kaibab National Forests. Early-seral stages of ponderosa pine, mixed-conifer, and chaparral habitats are also important for this species. Mule deer are not limited to any one type of terrain, being found from sparse, low deserts to high, forested mountains. Generally they use the more rugged country. Deer feed on grasses and forbs in the spring and summer; however, they are primarily browsers. Current trend for this species is down for the entire project area.

Spotted towhee (rufous-sided towhee) uses dense brush for nesting and foraging. Nest site is usually a cup-depression in litter under brush. The spotted towhee feeds primarily on insects and seeds. The trend is stable on the Prescott National Forest.

Pronghorn live in open, flat to rolling grasslands. They will travel through wooded, forested areas and hills. Pronghorn primarily browse on forbs and occasional shrubs, and sometimes eat grasses. Fawn survival is probably the main factor limiting herd size; adequate tall grass cover is necessary. Some individuals live at lower elevations all year, and some migrate up and down the Rim. Trend is down on the Coconino and Kaibab, and various on the Prescott National Forest.

Macroinvertebrates represent riparian/aquatic areas. They are an important component of aquatic ecosystems and are used to evaluate water quality and the effects of management changes on stream and riparian conditions. By monitoring what aquatic macroinvertebrates are present in the system and in what abundance, the health and productivity of the system can be assessed. Aquatic macroinvertebrates include mayflies, stoneflies, caddisflies, blackflies, beetles, midges, freshwater earthworms, snails, and many others. Each species has specific habitat needs, so they respond differently to changes in the chemical, physical, and biological components of their

habitat. Some are intolerant to pollution, such as excessive fine sediments, low dissolved oxygen, high water temperatures, and nutrient enrichment. Trend is unknown on the Coconino, stable on the Kaibab, and various on the Prescott National Forest.

Lucy's warbler represents low elevation riparian habitat. It lives among larger mesquites and willows. Males are among the earliest warblers to appear in spring; by late March they sing loudly from tops of mesquites and cottonwoods (Phillips et al. 1964). They feed mainly on insects in foliage and flowers of mesquites and other desert trees and shrubs. This warbler nests in natural cavities, under loose bark, in abandoned woodpecker holes and deserted verdins' nests. The female builds a nest of bark, weeds, mesquite leaf stems, lined with fine bark and fur and she is shy around the nest and may desert if disturbed. Trend is unknown on the Coconino and Prescott and stable on the Kaibab National Forest.

Cinnamon teal represents late-seral lakes and wetlands. It lives in shallow tule-bordered lakes, freshwater ponds, sluggish creeks, reservoirs, and irrigation ditches. This species nests on the ground, concealed in tall grass or weeds, often on high ground 100 feet or more from water, in a hollow in the ground lined with grasses and down; also, in thick beds of cattails or reeds in a marsh, above water. Dense cover 12 to 15 inches high is important for nest sites (Harrison 1979). The teal surface feeds by skimming water with its bill or reaching down with head and neck to feed on favorite plant foods (approximately 70 percent of its diet) such as seeds of sedges, pondweeds, grasses, and smartweeds, especially in fall and winter. It also eats algae, duckweed leaves, mollusks, aquatic insects and crustaceans. This species is a summer resident and breeds on the Coconino National Forest in waters and stock tanks with the above characteristics. Species trend is unknown on the Coconino and downward on the Kaibab National Forest.

Lincoln's sparrow is a secretive bird that skulks through the underbrush, especially along watercourses, scrub of cutover forest, and brush along the edges of marshes. The male has a 1-acre territory containing trees, shrubs, and tall grass. The species scratches in leaves on the ground to eat insects and seeds. It nests on the ground in shallow depressions, hidden in moss in a marsh, on the ground under shrubs, at the edge of marshes, in mountain meadows, sometimes low in alder bushes, or in grass clumps under bushes at the edge of a road near forest habitats. Both nesting and wintering habitat within the project area are limited. Trend is unknown on the Coconino and upward on the Kaibab National Forest.

Yellow-breasted chat is secretive and elusive, usually staying under cover in dense thickets. The chat eats primarily insects, such as grasshoppers, beetles, bugs, ants, weevils, bees, wasps, moths, mayflies, tent caterpillars, and currant worms. In addition the bird consumes blackberries, raspberries, strawberries, elderberries, and wild grapes. Their nests are built in small bushes, vines, and briers, about 2 to 8 feet above the ground, occasionally on the ground. This species is a frequent host to brown-headed cowbird. Trend is unknown on the Coconino and upward on the Kaibab National Forest.

Migratory Birds

Some neotropical migratory birds (NTMBs), which typically breed in the United States and winter in Central and South America, are currently a concern due to reported declines in numbers. Numerous species of NTMBs use the forests for breeding, rearing young, or migrating at various times of the year. Riparian habitats in good ecological condition, supporting deciduous woody

vegetation, have been identified as the single most important habitat type to these birds throughout the western United States.

In order to address the topic of migratory birds, this analysis will assess the impacts to Arizona Partners in Flight (PIF) priority bird species that occur on the threatened and endangered species lists for the three forests, as well as PIF species on the Regional Forester's Sensitive Species lists for the forests, and any MIS that are also PIF species. These indications are made in Chapter 4.

Public Health

Background

In 1984, the Ninth Circuit Court of Appeals enjoined the Arizona national forests from the use of herbicides. By 1986, the Forest Service formulated a policy to address the Court's concern by developing a risk assessment that was completed and approved in 1992 (USDA 1992a). However, little, if any applications of herbicides have been undertaken by the three national forests since 1992. Arizona Department of Transportation has used herbicides to control weeds along roughly 1,500 to 2,000 acres of national forest lands immediately adjacent to major roadways per year (Brewer 2002). This equates to roughly 10 percent of the land area in highway corridors. Minor herbicide applications have occurred on some small administrative sites and with some research plots. One site-specific environmental assessment on the Prescott National Forest authorized herbicide application on 30 acres of sweet resinbush (USDA Prescott National Forest 2001c).

Although the use of herbicides or any other chemicals has been quite limited on National Forest System lands, even with the rights-of-way considered, uses of these compounds by private individuals, golf courses, and other organizations have probably increased over the last 20 years. How much of an increase is difficult to determine since herbicides sold in most stores are not considered restricted, so there are no requirements that the retailer provide information to the State on the amounts sold. Herbicides such as Roundup (glyphosate), Weed be Gone (2,4-D), and Trimeck (combination of 2,4-D, banval, and dicamba) are sold with no means of determining how much, where they were used, or when. The large increase in population and the subsequent construction of homes and other infrastructure have created a demand for these chemicals to control unwanted vegetation in lawns, golf courses, and parks.

Public Health

People can have various responses to chemicals. Felsot (2001) noted that there is a percentage of the population that will be hypersensitive and/or allergic to any one or more of a variety of substances. Allergic and hypersensitive reactions occur by a different mechanism than toxicity. An allergic reaction is the system overproducing antibodies to a specific foreign substance, which are often proteins. Hypersensitive responses are unusual nontoxic overreactions likely associated with irritations to certain tissues in the nose or skin. Typical allergic or hypersensitive symptoms include runny nose, watery eyes, swelling and hives (Felsot 2001).

Toxic reactions result when chemical doses become high enough to interfere with the normal physiological functions of cells and tissues (Felsot 2001). What may have no apparent effect on one person may have grave consequences for another person, even in minute quantity. Some people's livers or kidneys have less capacity to eliminate toxins, either because of genetics or injury. Some peoples' neurological or immune systems are especially susceptible (Munson 2004).

Chemical sensitivity is defined as an adverse reaction to ambient doses of toxic chemicals, at levels that are generally accepted as subtoxic, in our air, food, and water (Rea 1994).

Populations recognized as having particular susceptibility to herbicides include (Munson 2004):

- Infants, children, and fetuses, whose developing brains, nervous and immune systems are subject to developmental disabilities caused by herbicides, and whose detoxification systems are not fully developed, according to the U.S. National Research Council;
- The elderly;
- People with respiratory conditions such as asthma, emphysema, reactive airways disease, or lung damage (such as from pneumonia, valley fever, lung cancer, or injury);
- People with certain neurological conditions such as Parkinson's and Parkinsonism, epilepsy, and other neurological conditions;
- People with liver function impairments, such as porphyria and porphyrinopathies, including those which are chemically induced; hepatitis; cirrhosis; low levels of liver enzymes or other dysfunction of the detoxification pathways due to genetics, liver damage, or use of certain prescription medications;
- People with kidney function impairments (e.g., dialysis patients);
- People with heart problems;
- Those with impaired or suppressed immune systems (e.g., people receiving cancer chemotherapy, transplant patients, those with HIV/AIDS, autoimmune disorders, and other immune imbalances);
- People with multiple chemical sensitivity (MCS)(Calabrese 1978);
- Native American Indians, who have a greater chance of developing chemical sensitivities (Voorhees 1999);
- Pesticide applicators, farm workers, and landscape workers;
- People who are homeless, both urban and rural; and
- People on some medications which may interact with herbicides, or which may reduce the person's ability to eliminate toxins.

Risk factors range from sex, phase of life, and genetic predisposition to disease and organ system damage or impairment. Some vulnerabilities are temporary, others permanent.

In Arizona, children constitute 22 percent of the population, the elderly 13 percent, and pregnant females 1.8 percent. Ten percent of the population is or has been afflicted with liver or biliary diseases, according to the American Liver Foundation. A recent Center for Disease Control (CDC) study found incidence of epilepsy at 1.8 percent. The Arizona Chapter of the American Lung Association reports that 10.2 percent of Arizonans have lung cancer, emphysema, chronic bronchitis, or adult asthma. About 16 percent of the population has multiple chemical sensitivities, 4 percent with more serious cases. Together, these numbers show that a substantial percentage of Arizona residents are especially vulnerable to herbicide exposures (Munson 2004).

Though Felsot (2001) acknowledged at least 4 allergic reactions to the exposure to herbicides, the Arizona Technology Access Program (1996), in contrast, noted 28 possible afflictions including asthma, chronic exhaustion, headaches, mental confusion, and seizures. Not only herbicides cause

reactions, but also such substances as antibiotics, cleaning supplies, natural gas, house paint, and new building materials. Since there is no real cure for MCS, most people create situations where they are not exposed to chemicals that could cause a reaction. This includes living in communities that are not impacted to a great degree by chemical use and living in specially built homes.

Social Concerns and Economic Influences

Access to Vital Services and Recreation Sites

Access to vital services and to the three forests in general by individuals who have had their immune systems compromised could be affected if an herbicide alternative is selected. Felsot (2001) noted that there is a percentage of the population that will be hypersensitive and/or allergic to any one of the herbicides proposed for use.

The reasons that existing or proposed herbicide treatments along interstates, state highways, or forest roads and recreation sites concern people with MCS are: 1) people with MCS would not be able to access vital services like medical facilities or shopping areas, and 2) the ability of these individuals to use Forest Service recreation sites would be severely curtailed. Many people with MCS look at the national forest as an area that they can use and not be worried about any chemicals since Federal lands, historically, have had limited use of these products. This is especially true with respect to past activities on the Coconino, Prescott, and Kaibab National Forests, as mentioned above.

The reason why land managers are so concerned about treatment of weeds along Federal and State routes and forest roads and trails is that these serve as conduits for the dispersal of many weed species (Roche & Roche 1999). Weed seeds and plant parts are moved along road systems by vehicles and people, allowing the establishment of plants into previously uninfested areas (Gelbard and Belnap 2003, USDA Forest Service, Sandpoint Ranger District, 1998c). Table 13 displays current conditions related to weed infestations on the three forests on Level 4 and Level 5 roads.

Table 13. Estimated miles of highways and acres infested with weeds within the Coconino, Kaibab, and Prescott National Forests

Road/Highway	Miles	Acres of Right-of-Way	Estimated Percent of ROW with Noxious Weeds	Estimated Acres of Weeds
Interstate 17	117.6	8,560	5	430
Interstate 40	98.8	7,200	10	720
US 89A	68.4	2,060	10	210
US 89	66.1	1,970	10	200
US 180	49.4	1,515	10	150
State Route 64	13.7	425	1	5
State Route 67	30.9	940	1	20
State Route 69	.5	30	1	0
State Route 87	41.7	1,270	20	250
State Route 96	8.5	270	2	5

Table 13. Estimated miles of highways and acres infested with weeds within the Coconino, Kaibab, and Prescott National Forests

Road/Highway	Miles	Acres of Right-of-Way	Estimated Percent of ROW with Noxious Weeds	Estimated Acres of Weeds
State Route169	8.5	260	1	5
State Route 179	9.8	300	10	30
State Route 260	28.9	910	20	180
State Route 269	5.2	150	1	5
Lake Mary Road (FH 3)	50.4	1,515	30	450
Perkinsville Road	17.6	545	1	5
Snow Bowl Road	7.9	240	40	100
Townsend Winona Road	5.9	180	45	325
Walnut Canyon Road	3.2	90	20	20
Totals	**633**	**28,430**		**3,110**

We predict that weeds infest an estimated 11 percent of the total area associated with the major paved roads within the project area, or 3,110 acres. Except for Lake Mary, Perkinsville, Snow Bowl, Townsend/Winona, and Walnut Canyon Roads, the authority for decisions on roadway-related issues resides with the Federal Highway Administration. Over 50 percent of the total miles of road corridors are on Interstate 17 and Interstate 40. On a percentage basis, the road with the most severe weed problems is Lake Mary Road, where 450 acres are inventoried.

Current infestations along forest roads also pose an opportunity for the spread of weeds as traffic moves on and off the forests. On the Kaibab National Forest these include Forest Roads (FRs) 90, 100, 108, 129, 139, 171, 194, 747, and 786 where populations of Dalmatian toadflax and biennial thistles have been found. The Coconino National Forest has extensive populations of Dalmatian toadflax, biennial thistles, Mediterranean sage, Russian knapweed, leafy spurge, Scotch thistle, diffuse knapweed and some yellow starthistle along its major roads. These include FRs 4 and 81 and associated side roads, 82, 95, 96, 139, 142, 171, 191C, 193, 211, 303, 760, and 767. On the Prescott National Forest, 10 percent of the Level 3 roads have weeds. These include FRs 56, 57, 65, 71, 87, 101, 102, 104B, 120, 125, 374C, and 9401T. Dalmatian toadflax, biennial thistles, Russian knapweed, tamarisk, tree of Heaven, and whitetop are generally found in isolated populations of less than 1 acre generally spread along entire routes.

Table 14. Known weeds within 1 mile of campgrounds, trailheads, and scenic overlooks on the Coconino, Kaibab, and Prescott National Forests

Forest Name	Number of Recreation Sites	Number of Sites Infested with Weeds	Noxious Weed Species and Estimated Acres
Coconino	213	113	Dalmatian toadflax: 7,500 bull thistle: 4,600 Russian knapweed: 15 diffuse knapweed: 200 yellow starthistle: 20 camelthorn: 25 tree of Heaven: 100 Scotch thistle: 200 musk thistle: 40 Russian olive: 25 Mediterranean sage: 200 houndstongue: 5 giant reed: 5 tamarisk: 50 Himalayan blackberry: 195
Kaibab	90	30	Dalmatian toadflax: 200 Bull thistle: 100
Prescott	92	33	Dalmatian toadflax: 830 cheatgrass: Unknown Himalayan blackberry: 1 Russian knapweed: 1 bull thistle: 1 yellow starthistle: 1
Totals	**395**	**176**	**14,315 acres of weeds**

Recreation use at campgrounds, trailheads, and scenic overlooks also create a potential avenue for the spread of weeds. Table 14 discloses the infestations within these sites.

Almost half of all recreation sites have weeds within 1 mile of the facility. The potential for visitors to spread these plants through use of all-terrain vehicles, domestic autos, and getting seeds stuck on their clothing or pets is high.

Plant Collection

Since the application of herbicides on national forests has been virtually nonexistent for the last 20 years and extremely limited before that, these products have not influenced the collection of native plants by American Indians or other individuals for traditional or medical purposes. Unless a person collects plants beside highways that are currently being treated for weeds, people who gather native plants are not being impacted within the project area.

American Indians and others collect a wide array of native plants to use in ceremonial events or for medical reasons. A recent analysis documented well over 150 plants (USDA Forest Service

unpublished data 2003c) that are collected by the Navajo, Yavapai and Yavapai-Apache, Hopi and others for use in a wide assortment of activities. Plants including agave, sagebrush, pine, juniper, thistles, paintbrush, buckwheat, tobacco, prickly pear, and globemallow are collected and used for food, shade structures, firewood, construction, and pigments.

The Navajo use large juniper boughs in dances and to construct shade structures (USDA Forest Service 1993b). Aspen, oak, fir, juniper, ponderosa, and pinyon pine are used to construct hogans, corrals, and shade houses. Spring water and soil from San Francisco Mountain are collected and used for ceremonial events throughout the year. Herbs and roots are collected and used for ceremonies, dyes, basket weaving, and food. They include tobacco, locoweed, rabbitbrush, barberry, walnut, sycamore, paintbrush, willow, cottonwood, and pinyon pine nuts.

The Hopi also use the three forests for collection of plant material including fir boughs for ceremonial uses and logs to construct kivas (USDA Forest Service, Coconino National Forest 1993b). Bee weed is used extensively for making paint to decorate pottery, and green oak for construction of bows. Minerals and sand are collected for ceremonies and paint pigments, especially in Oak Creek Canyon and the Camp Verde Salt Mine. Both the Yavapai and Yavapai-Apache have historically collected plant material including yuccas, bear grass, various willows, skunkbush, and devil's claw from the Prescott National Forest (USDA Forest Service, Coconino National Forest 1993b).

This is not an inclusive list; other American Indians including the Paiute Pai and Zuni collect plants within the project area though the exact species and amounts are not well known (USDA Forest Service, Kaibab National Forest 2003c). Plant collecting is a very personal thing, and people have their own, private collecting areas. Without conducting detailed personal interviews, it is difficult for tribal governments to identify specific locations of potential concern (Pilles 2004).

Economic Setting

Although the project area falls within four different counties, only a very small acreage of Gila and Mojave Counties will be influenced and these are in wilderness areas that contain no major communities. Coconino and Yavapai Counties have experienced a tremendous rate of growth over the last 12 years (Arizona Department of Commerce 2002a and 2002b). Yavapai County alone has more than doubled in size from 68,145 in 1990 to 180,260 projected in 2002, whereas Coconino County has grown considerably less (30 percent) during this same time period going from 96,590 to 125,420 people. This upward trend in growth is expected to continue as the population ages in the United States and people retire and move to the project area for its scenic qualities and climate.

Principle industries include retail trade, public administration, and the service industries with manufacturing, agriculture, and mining making up less than 10 percent of the jobs in the employment sector (Arizona Department of Commerce 2002a and 2002b). The Grand Canyon Trust (1996) stated that there has been a shift over the past 30 years from a commodity-based industry that depends on the extraction of timber, water, energy and mineral wealth for job creation to one that is more amenity based. They reasoned that jobs located in the service-based sector are higher because of increased affluence, leisure time, and mobility. This has fueled the demand for more recreation-dominated experiences and has promoted the development of tourism-related industries.

Average wages for Coconino County range from a low of about $7.10 per hour for food preparation and serving-related jobs to $27.85 per hour projected for management. Yavapai County follows this same trend with the food preparation and serving as well as management being estimated at $7.20 and $25.40, respectively. Over 50 percent of the jobs found in the counties have an average wage of about $11 per hour or less.

The unemployment rate is calculated at 3.5 percent and 5.5 percent for Yavapai and Coconino Counties (Arizona Department of Commerce 2002a and 2002b). The two percent increase in Coconino County over Yavapai is a function of the high unemployment figures associated with the reservations.

The Federal Government, State Trust lands, or the Navajo, Hopi, Paiute, Havasupai, and Hualapai Nations own almost 75 percent of Coconino County. About 40 percent of the land encompassed in Coconino County is considered part of an Indian reservation with this value dropping to less than 1 percent for Yavapai. The breakdown for publicly owned land versus privately owned parcels in Coconino County is roughly 50 percent and 10 percent, whereas Yavapai County is determined to be 90 percent and 10 percent. The high degree of public ownership in both counties should promote retention of the rural characteristics of the area.

Cultural Resources

Cultural resources are broadly defined as evidence of human behavior or activities and include prehistoric and historic archaeological sites and traditional cultural properties and resources. Both historic and prehistoric resources reflect cultural traditions beginning with the Archaic groups from ca. 6500 BC, continuing through the Puebloan peoples ca. AD 500-1200, Cohonina and Sinagua peoples AD 700-1200, Prescott tradition ca. AD 900-1200, and the Cerbat tradition from ca. AD 1300-1700 to present day use by some tribes in the region. Athapaskan or Apachean speaking people (Apache and Navajo) entered the area sometime after 1600, and historic Anglo-American use of the area began after the 1880s with ranch and mining sites and railroad activities.

Archaeological Sites

Thousands of archaeological sites have been identified and recorded within 4.9 million acres of Forest Service lands. Of the 4.9 million acres, approximately 187,000 acres are proposed for noxious weed treatment. Manual, herbicides or cultural weed treatment methods are considered Federal undertakings that do not have the potential to significantly affect archaeological sites (USDA Forest Service 2003). Mechanical treatment methods (mowing, steaming, burning) have the potential to directly impact archaeological sites. The total maximum of 5, 210 acres are proposed for mechanical treatment for Alternative 1, 131,720 acres for Alternative 3, and 17,940 acres are proposed for Alternative 4. Mechanical treatment methods are not proposed for Alternative 2. The majority of locations proposed for noxious weed treatment are along major travel corridors (e.g. railroads, interstates, and State highways, as well as Level 3 and 4 forest roads) and within the ponderosa pine vegetation type in the Verde and Little Colorado Watershed. Also areas near communities, recreation sites, trailheads and scenic overlooks are identified for weed treatment in Alternative 4. Many of these locations and travel corridors have been previously surveyed for historic properties and traditional cultural properties.

American Indian Traditional Cultural Properties and Resources

Twelve American Indian peoples represented by 13 separate tribal governments have ancestral ties to lands within the Coconino, Kaibab and Prescott National Forests. Forest Service consultations with appropriate members of each tribe can identify the tribe's historic and present day traditional uses and sacred places of the area. The lands, resources, and archaeological sites within the forests are considered traditionally significant to all affiliated tribes and, in some cases, certain resources or areas are considered sacred to a specific tribe(s). These traditional use areas and resources are cultural historic properties that may be eligible to the National Register of Historic Places because of their association with cultural practices and beliefs rooted in history and their importance in maintaining the cultural identity of ongoing American Indian communities. Consultations about these uses and places are governed and/or mandated by the NHPA, as amended in 1992 (U.S.C. 470 et seq.), the American Indian Religious Freedom Act 1978 (42 U.S.C. 1996), and the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.) and Executive Order 13007 of 1996. The following American Indian tribes are known to have ties to the forests: Acoma, Havasupai, Hopi, Hualapai, Kaibab Paiute, San Juan Paiute, Navajo, San Carlos Apache, Tonto Apache White Mountain Apache, Yavapai, and Zuni. Throughout the consultation process to the present, the tribes have not identified any known or previously unknown properties of traditional cultural and religious value that will be affected by the proposed action activities.

When the exact weed treatment project locations are identified for mechanical treatments, the project area will be surveyed for properties of historic and traditional cultural and religious significance prior to weed treatment activities. Before each forest authorizes an individual noxious weed treatment project that includes mechanical treatment to proceed, all historic properties will be identified and evaluated and an assessment of effect shall be completed. If significant properties are identified, they will be protected from mechanical treatment methods that have the potential to adversely impact the property in consultation with the affiliated tribes and the Arizona State Historic Preservation Office.

Areas with Special Designation

Wilderness, Wild and Scenic Rivers, and Research Natural Areas

Weeds are now a common occurrence in our wilderness, wild and scenic rivers and research natural areas, as demonstrated in Table 15. Invasive plant populations are typically less than 10 percent of any wilderness, and frequently less than 1 percent. Table 15 summarizes by noxious weed species and the extent of known infestations within wilderness, wild and scenic river corridors, and research natural areas. While the known infestations are small, they are growing. The natural integrity and apparent naturalness of some wilderness areas are beginning to be compromised. As the infestations expand in size and number, the complexity of the logistics of treatment will increase.

Table 15. Designated wilderness, wild and scenic river corridors, and research natural areas and estimated sizes of weed populations

Forest	Area Designation	Acres	Noxious Weed Species and Acres
Coconino	Casner Canyon Research Natural Area	609	bull thistle
	G. A. Pearson Research Natural Area	154	Unknown
	Rocky Gulch proposed Research Natural Area	950	Unknown
	Fossil Springs Wilderness	10,433	Tamarisk: 1 Annual bromes
	West Clear Creek Wilderness	15,449	Bull thistle: 130 Dalmatian toadflax: 190
	Strawberry Crater Wilderness	10,760	Dalmatian toadflax: 2
	Kachina Peaks Wilderness	18,963	Dalmatian toadflax: 870 Diffuse knapweed: 2 Musk thistle: 2 Bull thistle: 2 Annual bromes:
	Kendrick Mountain Wilderness	2,200	Bull thistle: 20 Dalmatian toadflax: 10
	Red Rock-Secret Mountain Wilderness	48,400	Bull thistle: 50 Scotch thistle: 5 Dalmatian toadflax: 5 Himalayan blackberry: 3 Tree of Heaven: 1 Diffuse knapweed: 25 Spotted knapweed: 1 Annual bromes
	Munds Mountain Wilderness	18,311	Bull thistle: 30 Dalmatian toadflax: 30
	Sycamore Canyon Wilderness (Coconino portion)	22,864	Bull thistle: 90 Dalmatian toadflax: 130
	Verde Wild and Scenic River	3,351	Bull thistle: 14 Dalmatian Toadflax: 1 Giant reed: 1 Himalayan blackberry: 23 Russian knapweed: 23 Russian olive: 1 Siberian elm: 2 Tamarisk: 60 Teasel: 1 Tree of Heaven: 12 Whitetop: 24 Annual bromes

Table 15. Designated wilderness, wild and scenic river corridors, and research natural areas and estimated sizes of weed populations

Forest	Area Designation	Acres	Noxious Weed Species and Acres
Kaibab	Kendrick Mountain Wilderness	6,651	Bull thistle: unknown
	Kanab Creek Wilderness	68,340	Tamarisk: 200 Cheatgrass:
	Saddle Mountain Wilderness	40,610	None observed
	Sycamore Canyon Wilderness (Kaibab portion)	7,600	None observed
	Garland Prairie Research Natural Area	300	Dalmatian toadflax Cheatgrass:
Prescott	Verde Wild and Scenic River	2,138	Bull thistle: 9 Himalayan blackberry: 14 Russian knapweed: 14 Giant reed Russian olive: 1 Siberian elm: 1 Tamarisk: 43 Tree of Heaven: 7 Whitetop: 14 Annual Bromes
	Cedar Bench Wilderness	14,950	Tamarisk: 25
	Pine Mountain Wilderness	20,061	Tamarisk: 3
	Sycamore Canyon Wilderness (Prescott Portion)	25,473	Tamarisk: 40
	Castle Creek Wilderness	26,030	Tamarisk: 5
	Granite Mountain Wilderness	9,800	Dalmatian toadflax: 3 Tamarisk: 3
	Juniper Mesa Wilderness	7,600	Dalmatian toadflax: 1
	Apache Creek Wilderness	5,420	Tamarisk: 20
	Woodchute Mountain Wilderness	5,600	No weeds inventoried in 1993

Grand Canyon Game Preserve

On November 28, 1906, President Theodore Roosevelt established the Grand Canyon Game Preserve (GCGP) by Presidential Proclamation. It was his intention that some areas within the existing Grand Canyon Forest Reserve “be set aside for the protection of game animals and be recognized as a breeding place forever.” The GCGP is part of the Kaibab National Forest and includes approximately 655,000 acres on the North Kaibab Ranger District (north of Grand Canyon National Park) and approximately 640 acres on the Tusayan Ranger District (south of Grand Canyon National Park).

Current weed surveys have documented few weed infestations on the Tusayan portion of the GCGP. These acres are not accessible by vehicular traffic due to broken and steep topography. While there is some public use of them, it is limited.

There are numerous, mostly small weed infestations in the GCGP north of the Grand Canyon on the North Kaibab Ranger District. The largest is an approximate 200 acres infestation of tamarisk within Kanab Creek Wilderness.

Inventoried Roadless Areas

In late 2000, 243,000 acres of the three forests were designated as "Inventoried Roadless Areas" (IRAs). This includes 50,000 acres on the Coconino, 53,000 acres on the Kaibab, and 140,000 acres on the Prescott. All of these acres have been included in management areas designated by the respective forest's land and resource management plans that allow for road construction and reconstruction. None of the acres have been recommended for wilderness designation.

Throughout the areas, there are currently scattered but unknown quantities of weed infestations. Due to the limited access within the areas, they are generally more difficult to survey for infestations and will be comparably more difficult to control infestations.

Potential Wild and Scenic Rivers

The four watersheds in this project (Little Colorado River Basin, Colorado River Basin, Bill Williams River Basin, and the Verde River Basin) were included in a preliminary analysis of eligibility and classification for wild/scenic/recreational river designation. Barbershop Canyon, East Clear Creek, and Leonard Canyon, Kanab Creek, Cottonwood Creek, Upper Verde River and Fossil Creek have been evaluated and found eligible for potential wild and scenic river designation in the preliminary report from 1993 (USDA Forest Service 1993c).

East Clear Creek

Approximately 38 miles of East Clear Creek from the crossing of Forest Road 96 north to the forest boundary have been evaluated for potential eligibility for a "Scenic River" designation (USDA Forest Service 1993c). This segment begins about 2 ½ miles downstream of the Blue Ridge Reservoir Dam and is free flowing to the point where it leaves the forest. Two outstandingly remarkable values were identified:

- Fish Species Habitat Values - East Clear Creek contains populations of Little Colorado spinedace. The creek has been designated as critical habitat for this species, designated threatened under both State and Federal species classifications.
- Scenic Values - East Clear Creek is noted for its scenic beauty. It has formed a narrow canyon with rocky cliffs and a variety of colors and textures due to the vegetative species variation and geologic formations. This segment was determined to be potentially eligible with a "scenic" classification. A total of 9,800 acres are contained within the stream corridor. Of this, 4,000 acres are on the Apache-Sitgreaves National Forests, 4,100 acres are on the Coconino National Forest, and 1,700 acres are on private land.

Leonard Canyon

Approximately 17 miles of Leonard Canyon from below the dam at Knoll Lake to the confluence with East Clear Creek have been evaluated for potential Wild and Scenic River designation. Leonard Canyon is impounded to form Knoll Lake about 3 miles below its headwaters. It is free flowing from below the dam to its confluence with East Clear Creek. Approximately 15 miles of Leonard Canyon are under Forest Service management as it forms the border between the Coconino and Apache-Sitgreaves NFs. A single outstandingly remarkable value was recognized in this stream segment:

- Fish Species Habitat Values - The segment contains populations of the Little Colorado spinedace. This segment was determined to be preliminarily eligible and classifies as "recreational." About 6,100 acres are contained within the stream corridor. Of this, 640 acres are on private land, 2,860 acres are on the Apache-Sitgreaves National Forests, and the remaining 2,600 acres are on the Coconino National Forest.

Barbershop Canyon

Approximately 10 miles of Barbershop Canyon from the center of section 16, T12N, R11E to its confluence with East Clear Creek have been evaluated for potential eligibility for a Wild/Scenic/Recreational River designation (USDA Forest Service 1993c). This segment lies entirely within the Coconino National Forest. Two outstandingly remarkable values were identified:

- Fish Species Habitat Values - Barbershop Canyon contains populations of Little Colorado spinedace. The creek has been designated as critical habitat for this species, designated threatened under both State and Federal species classifications.
- Scenic Values - Barbershop Canyon is noted for its scenic beauty. It has formed a narrow canyon with rocky cliffs and a variety of colors and textures due to the vegetative species variation and geologic formations. This segment was determined to be potentially eligible with a "wild" classification.

Kanab Creek

A total of 19.7 miles of Kanab Creek from the forest boundary with BLM on the north to the Kaibab NF boundary with Grand Canyon National Park on the south have been evaluated for potential eligibility for a Wild/Scenic/Recreational River designation (USDA Forest Service 1993c). This segment lies entirely within Kanab Creek Wilderness, Kaibab National Forest. This segment was determined to be potentially eligible with a "wild" classification. Five outstandingly remarkable values were identified: fish species habitat, scenic, wildlife habitat, geology and recreation.

Cottonwood Creek

A total of 6.5 miles of Cottonwood Creek from the headwaters at Cottonwood Spring to Prescott National Forest boundary have been evaluated for potential eligibility for a Wild/Scenic/Recreational River designation (USDA Forest Service 1993c). This segment lies entirely within the Prescott National Forest. This creek segment was found ineligible and no outstanding wilderness values were identified.

Oak Creek

A total of 14 miles of Oak Creek from Sterling Springs Fish Hatchery on the north to the private land (Section 5, T17N, R6E) on the south have been evaluated for potential eligibility for a Wild/Scenic/Recreational River designation (USDA Forest Service 1993c). This creek segment is managed both by private landholders (4 miles) and the Coconino National Forest (10 miles). This segment was determined to be preliminarily eligible and classifies as "recreational." Seven outstandingly remarkable values were identified: fish species habitat, scenic, historic, geologic, recreational, riparian and ecological.

Eight miles of Oak Creek from the private land in Section 33, T17N, R5E to the private land in Section 14, T16N, R4E have been evaluated for potential eligibility for a "scenic" river designation (USDA Forest Service 1993c). This creek segment was found ineligible in this classification, however, Oak Creek has been designated an Arizona State Unique Water.

West Fork of Oak Creek

Eight miles of the West Fork of Oak Creek from the headwaters (Section 14, T19N, R5E) to its confluence with Oak Creek have been evaluated for potential eligibility for a Wild/Scenic/Recreational River designation (USDA Forest Service 1993c). The Coconino National Forest manages this creek segment, which lies completely within Red Rock Secret Mountain Wilderness. This segment was determined to be potentially eligible with a "wild" classification. Seven outstandingly remarkable values were identified: wildlife habitat, scenic, historical, geologic, recreational, riparian and ecological.

Sycamore Creek

Four miles of Sycamore Creek from Parson Springs to the confluence with the Verde River have been evaluated for potential eligibility for a Wild/Scenic/Recreational River designation (USDA Forest Service 1993c). This creek segment is managed both by private landholders (one-half mile) and the Coconino National Forest (3.5 miles), 75 percent of the segment is in Sycamore Canyon Wilderness. This segment was determined to be potentially eligible with a "wild" classification. Three outstandingly remarkable values were identified: fish species habitat, recreational and riparian.

Chapter 4 - Environmental Consequences

Introduction

The description of the affected environment and disclosure of effects concentrates on not only the significant issues generated through scoping, but also on the purpose and need of the proposed project. This includes such items as the capacity of an action to control the spread of invasive and noxious weeds, access to vital services, potential health impacts with the use of herbicides, and the ability of American Indians and others to collect plants for traditional purposes if the use of herbicides is authorized. In addition, several other key resources are fully analyzed within the scope of this FEIS including threatened, endangered, and sensitive plant and animal species as well as management indicator plants and animals.

For items within this analysis, the effects assessment consolidates the discussion of the impacts where appropriate, and highlights the relationship between local short-term uses of the environment, and the maintenance as well as enhancement of long-term ecosystem productivity.

Cumulative effects are those that result from the incremental impact of this Proposed Action and alternatives when added to other past, present, and reasonably foreseeable future actions regardless of who undertakes those activities (40 CFR 1508.7). The cumulative effects analysis is found after the discussion of direct and indirect effects for the major groupings and if none are predicted, this will be documented. Cumulative effects analysis is keyed to the major issues, purpose and need, and other resource areas disclosed in this chapter and must: (1) be additive with other activities found within the project impact zone, and (2) the effect of the proposed action and alternatives must overlap in time and space with these other activities. The project impact zone for this analysis is considered the land area of the three national forests and other Federal, State, or county lands adjacent to or within the forests. It also includes the private inholdings and municipal areas such as Prescott, Prescott Valley, Sedona, and Flagstaff, Arizona.

Soil, Water and Air

Watersheds and Soils

Different treatment techniques will have different effects on watersheds and soils. Manual treatment methods are highly selective to the target species. Scheduled work in the riparian zones would result in minimal impact to soil resources because of small treatment areas and low level of of ground disturbance. Implementaion of BMPs would minimize sediment input into streams.

Mechanical treatment methods are not selective to the target species except for hand clipping. Application would primarily be on accessible and level areas (e.g., mowing in rights-of-way). There would be localized vegetation removal/reduction and soil disturbance. Steaming and prescribed burning may have a short-term impact on vegetative cover. There is a slight probability that this could result in sediment and nutrient input into streams; however, sites will be seeded immediately after completion of repeat treatments. Tilling and the use of heavy machinery to remove woody weeds would have the greatest impact on soil stability and vegetative ground cover. BMPs would be implemented and would minimize soil erosion and runoff from treatment areas.

Cultural treatments are generally selective to the target species. Grazing in a riparian corridor to achieve treatment objectives could result in localized vegetation removal. Other methods included in this integrated weed management technique (seeding with native plant species and the use of weed free hay and mulch) generally result in higher vegetative cover.

Biological treatments using only approved insects and pathogens are selective to the target species and result in subtle changes to the target species and environmental conditions.

Herbicides range in their selectivity to target species based on their chemical composition and application method and may affect species directly if coming in contact with the species, or indirectly if use results in changes in habitat composition, cover, abundance of insects, or other habitat changes.

Direct and Indirect Effects Common to Alternatives 1, 2, and 3

Invasive exotic annual grasses would not be treated in Alternatives 1, 2, or 3. The grasses known to occur within the project area include wild oats, cheatgrass and other exotic bromes. These are found in varying concentrations in the watersheds, primarily in pinyon-juniper woodlands, lower elevation grasslands, shrublands and riparian vegetation types. Increases of current population levels of cheatgrass are not projected since existing populations and densities are unknown. Phillips (personal communication 2001) noted that estimates range from under 100,000 acres to over 500,000 acres within the project area. However, some of the highest concentrations of cheatgrass in the project area are currently found on the North Kaibab Ranger District, Kaibab National Forest. Generally, cheatgrass is confined to the grassland and shrub/grassland ecosystems associated with pinyon-juniper habitat although it has been found in dense concentrations in portions of the woodland zone. Alternatives 1, 2, and 3 would allow the continued spread of cheatgrass, which would decrease the time between wildfire events. This would cause a loss of native perennial plants and replacement of these species with even more exotic annuals, which will further decrease the amount of time between fire events. Eventually, this will reduce browse and native bunch grasses, most notably cliffrose and needle and thread, and eventually reduce the quality of mule deer and antelope winter ranges. This will lead to declines in effective ground cover on the sites infested; increase erosion rates, and result in a reduction in productive capacity of the soils. We also project that many sites will convert from shrub/grassland ecosystems to annual grass ecosystems, resulting in a general decline in ecological conditions.

Direct and Indirect Effects Common to Alternatives 1-Low, 2, and 3

One concern is the inability to reach management objectives for tamarisk and Himalayan blackberry. These species are projected to expand rapidly in the next 10 years. Since most of the tamarisk and Himalayan blackberry are found in riparian corridors, especially the Verde River, declines in riparian health can be expected. This will manifest itself in a reduction of cottonwoods and other native riparian species and possibly a decrease in flow levels of the Verde River as populations of these trees and shrubs expand and withdraw additional soil moisture.

Other species that have been found within these riparian zones include Russian olive, tree of Heaven, Siberian elm, and giant reed. Though tamarisk is an extremely aggressive plant in riparian areas, giant reed has demonstrated explosive growth once established. Left unchecked, giant reed can grow rapidly and eventually crowd out most native riparian plants. The indirect effect of the expansion of these nonnative woody species would be a reduction in the regeneration of willow, cottonwood, and other native trees causing a reduction in the diversity of riparian areas. Expansion of tamarisk within riparian ecosystems would also increase water consumption, since this tree species uses more water during its life processes (Sheley and Petroff 1999). A potential impact of this could be a lowering of base water flows and subsequent reduction of

riparian, fisheries and aquatic habitat, though this impact is not projected to happen within the next 10 years.

Direct and Indirect Effects Common to Alternatives 1, 3, and 4: All action alternatives

There would be localized vegetation removal/reduction and soil disturbance. Treatments in the uplands may result in indirect sediment input into streams.

Direct and Indirect Effects Common to Alternatives 1 and 4: Alternatives with Herbicides

The most important factors in determining the chemical fate of herbicides in soil is mobility and degradation. The extent to which these factors influence herbicides in soil are dependent on a variety of herbicide characteristics, such as adsorption, solubility, degradation, and volatilization. Soil characteristics also influence the fate of herbicides, such as organic matter, pH, temperature, moisture content, clay content, and microbial activity. Most herbicides degrade over time as a result of physical and chemical processes in soil and water. Herbicide degradation rate generally decreases with increasing soil depth. General mobility and persistence characteristics of the 11 herbicides are summarized in Table 16.

The information presented in Table 16 shows that most herbicides that may be used for this weed treatment project are highly soluble in water (i.e., greater than 1,000 parts per million (ppm)). Some herbicides—clopyralid, dicamba, and picloram—are more susceptible to leaching and, therefore, could impact ground water where soil is permeable (e.g., sandy soil) and water is shallow. Following BMPs presented in Appendix B would reduce the potential impacts to ground water or surface waters.

Table 16. Herbicide characteristics in water and soil

Herbicide Name	Solubility (parts per million)	Mobility Potential	Half Life
2,4-D	890 to 800,000	High	30 days or less
Chlorsulfuron	300 (pH 5) 7,000 (pH 7)	High (increases with pH)	30 to 120 days
Clopyralid	1,000	High	15 to 287 days
Dicamba	4,500	High	7 to 42 days to more than 1 year
Glyphosate	12,000 to 900,000	Low	3 days to several years
Imazapic	2,200	Moderate (increases with pH)	31 to 233 days
Imazapyr	11,272	Moderate to high	Several months to 2 years
Metsulfuron methyl	1,750 (pH 5.4) 9,500 (pH 7)	High (increases with pH)	14 to 180 days
Picloram	430	High (increases with pH)	20 to 300 days to more than 1 year
Sulfometuron methyl	10 (pH 5) 300 (pH 7)	Low (increases with pH)	30 days
Triclopyr	23 to 2,100,000	Moderate	30 to 46 days

Source: Infoventures 1995a-e; Wauchope et al. 1992; Tu et al. 2001; Parker 2002.

Persistence of herbicides in soil also varies widely and is dependent of soil conditions. Half-life for most herbicides included in Table 16 is less than 3 months. Dicamba, glyphosate, imazapyr, and picloram have half-lives that can extend for more than a year.

Monitoring results of two sites in Montana documented persistence of picloram in soil. A site near Fort Missoula and the Bitterroot River was treated at a rate of 1 pint per acre. A 44 percent photo-decay was recorded after 7 days. After 15 months, no herbicide was detected in soil deeper than 20 inches (USDA FS 2001d). A second site, 35 miles east of Missoula, was treated with picloram at a concentration of 2 quarts per acre (four times the concentration applied at Fort Missoula). The herbicide was applied along 2½ miles of road adjacent to the North Fork of Elk Creek. Some treated areas were within 3 feet of the stream. Monitoring results showed about 20 percent photo-decay during the first 7 days, or half that observed at Fort Missoula. The difference was attributed to tree canopy cover and less available sunshine. Although soil sampling detected picloram at depths to 40 inches, there was no detection of herbicide in ground water or the nearby stream (Watson et al. 1989 in USDA FS 2001d).

Impacts of Herbicides on Soil Organisms

Studies of potential impacts on soil organisms show that herbicides could cause a temporary shift in soil microbial populations by reducing biodiversity and relative biomass of individual species (Bitterroot EIS 2004). There is potential for inhibiting growth of some micro-organism species. Declining numbers of some macro-organism species were observed at herbicide application test sites. These effects, however, are not expected to persist because the negative effects are temporary and populations generally recover after a few days or weeks (Brady and Weil 1999).

Direct and Indirect Effects of Alternative 1: Proposed Action

Alternative 1 proposes a range of new treatment levels between 2,000 acres to 10,000 acres per year. The estimated number of acres treated on the three forests over 10 years is projected at 34,130 acres at the high level, whereas 20,395 acres are expected for the low. About 25 percent of the total treatments are considered new for both the high and low levels with the remaining 75 percent targeted to repeat work on the same populations. Figure 2 shows percentages of the total treatments by type for Alternative 1-High, and Figure 3 shows percentages of the total treatments by type for Alternative 1-Low.

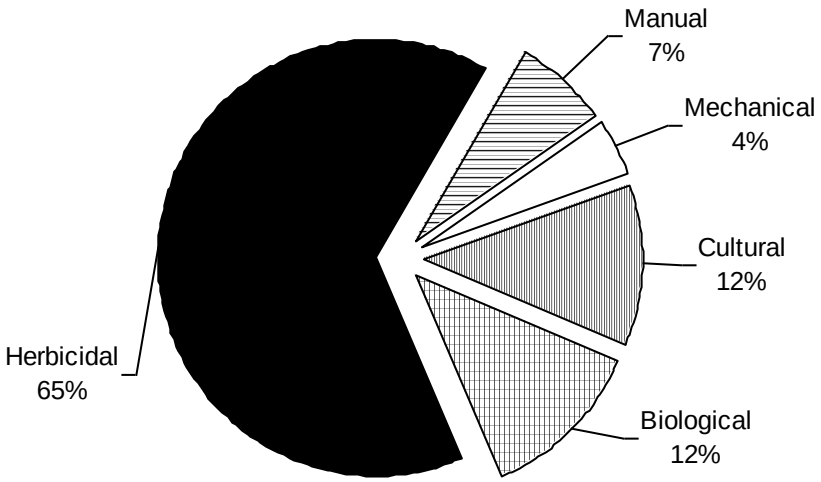


Figure 2. Percentage of total acres used in each integrated weed management technique in Alternative 1-High

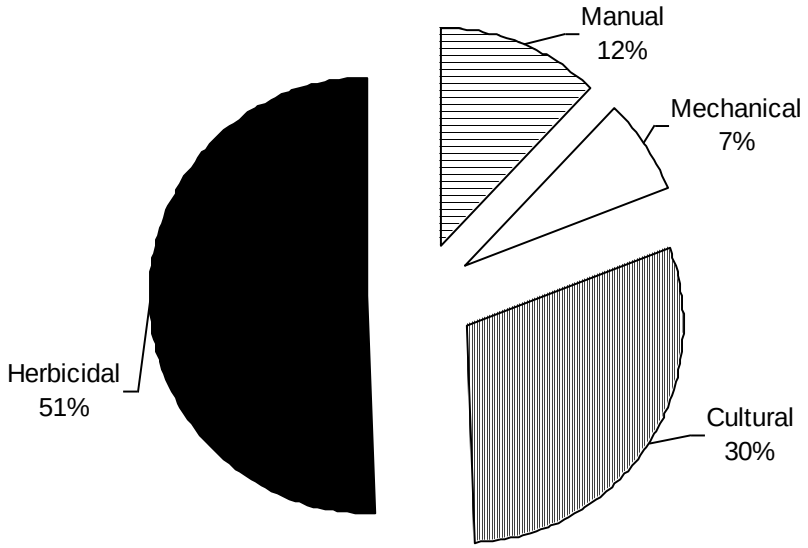


Figure 3. Percentage of the total treatments by type for Alternative 1-Low

Over 90 percent of the treatments are found in the Verde River and Little Colorado River Watersheds as displayed in Figure 4. Although not a component of this figure, almost all those treatments are confined to the ponderosa pine type or the riparian corridor associated with the Verde River or Little Colorado Watersheds (80 percent at the high level; 50 percent at the low level). The reason for less at the low level is that Dalmatian toadflax is not scheduled for treatment. The constrained level of new treatments of 2,000 acres per year forecloses use of any control strategies for this species.

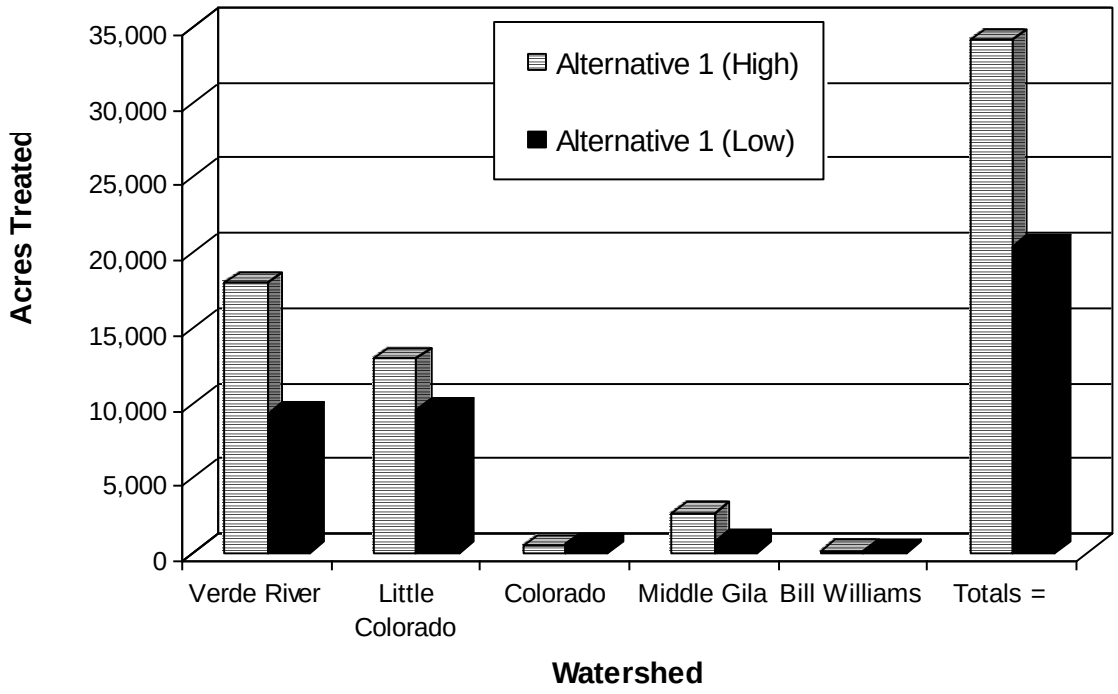


Figure 4. Total new acres treated in Alternative 1 (High and Low) by watershed

Another concern at the low end of Alternative 1 is the projected increase in diffuse knapweed of 45 percent (965 acres to 1,405 acres). Most of this expansion would occur in the ponderosa pine ecosystems of the Little Colorado Watershed. Diffuse knapweed grows in such a manner that it will out-compete native flora resulting in declines in biodiversity, wildlife habitat, and biodiversity on 500 additional acres.

Direct and Indirect Effects of Alternative 2: No Action

Increases in weed populations due to no treatment would cause declines in native grasses and herbs and eventually decrease watershed conditions in the project area. Sheley and Petroff (1999) noted that the spread of weeds influences watershed conditions in several ways which includes: (1) a loss of effective ground cover in the form of plants and litter; (2) a corresponding increase in soil erosion and sedimentation; and lastly (3) a gradual loss in the productive capacity of the soil. This decline in herbaceous understory will be generally confined to the ponderosa pine ecosystems, high elevation grasslands, and riparian corridors in the Verde River and Little Colorado Watersheds. Tamarisk would increase from its current level of 1,450 acres to about 2,600 acres over the next 10 years.

Currently, populations of weeds within the Colorado-Grand Canyon, Gila, and Bill Williams Watersheds have been inventoried at reasonably low levels with a range going from 75 acres (Bill Williams) to 1,863 acres (Gila). Alternative 2 would accelerate the expansion of weed species within these watersheds and foreclose options to totally eliminate these weeds. The populations of Dalmatian toadflax and bull thistle in the project area are now to the point that contain strategies are the only viable options. Over a longer period of time (estimated at 20 to 30 years) without

major control efforts we project that these species will expand to cover all potential habitat within the project area.

Direct and Indirect Effects of Alternative 3

Ninety-eight percent of the acres treated will be in the Verde River and Little Colorado Watersheds (Figure 5).

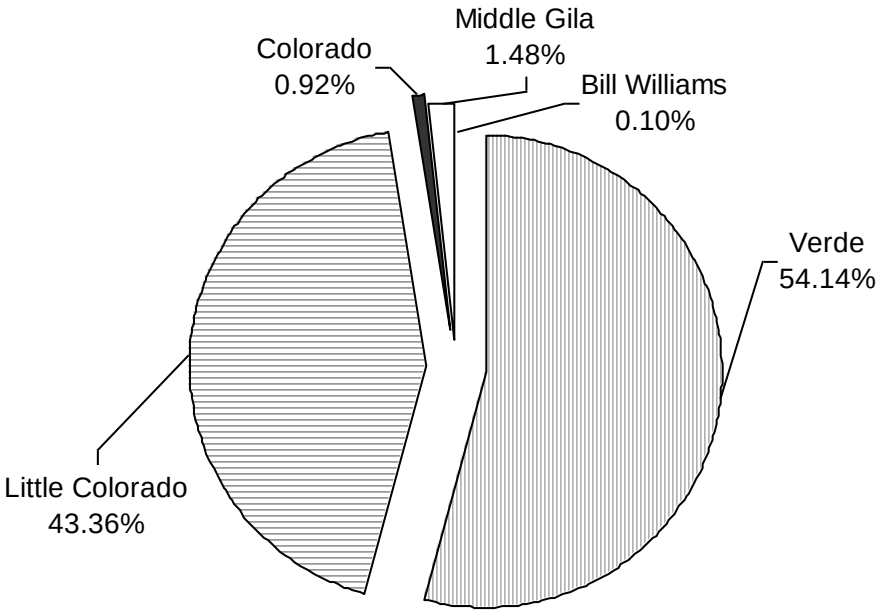


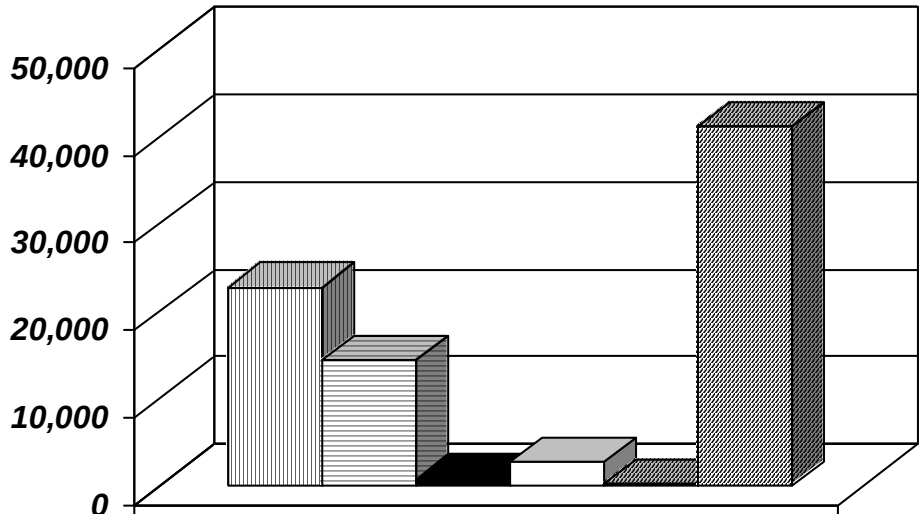
Figure 5. Treatment levels by watershed for Alternative 3

Some improvement in effective ground cover and vegetation diversity is projected by meeting treatment objectives for 13 species; however, the situation where 5 weed species continue to expand will hamper greater gains.

Direct and Indirect Effects of Alternative 4

As depicted in Figure 6, and consistent with all the action alternatives, the greatest amount of work will occur in the Verde River and Little Colorado basins. Current known infestations of weeds on Forest Service lands within the Bill Williams, Gila, and Colorado-Grand Canyon would be eradicated. In the Little Colorado and Verde Watersheds, leafy spurge will still be present though its overall infestation will decline dramatically.

We anticipate that native plants—including important grasses, herbaceous plants and shrubs—will be maintained or improved over the planning period. We also anticipate improved watershed conditions including higher effective ground covers and a subsequent reduction in soil erosion rates as weeds are controlled in the project area. As weeds decline from current levels, native plants are expected to expand in their frequency and density. These factors should improve ground cover conditions and reduce the potential of overland flow to move soil.



	Alternative 4
Verde	22,842
Little Colorado	14,543
Colorado	855
Middle Gila	2,815
Bill Williams	203
Totals	41,258

Figure 6. Total new acres treated in each watershed for Alternative 4

Water Quality

Discussions with the Arizona Department of Environmental Quality (ADEQ) and the United States Environmental Protection Agency (EPA) have been held and are ongoing in reference to project coordination needed to comply with the Safe Drinking Water Act and 40 CFR Part 141.

For the ADEQ, mitigation measures involved following herbicide label instructions and correct container disposal procedures, and cleanup of personnel and equipment away from wellheads were added to the mitigations (see Appendix B). While herbicides can be used around wellheads, it is more desirable to use manual or cultural methods for about 100 feet around wellheads. Extensive use of grazing around wellheads can raise nitrate levels in the water, so manual methods of treatment will be the preferred method in this project. If herbicides must be used, the treatment should be timed with the driest periods to prevent leaching of any herbicides directly back into the wellhead.

For EPA, we identified sources of drinking water and prepared a map of drinking water sources. This document is within the project record. In addition, the Safe Drinking Water Act and 40 CFR Part 141 provides a mechanism to protect public health from contaminants in water provided by public water systems. EPA has health standards, called maximum contaminant levels (MCLs) for many water contaminants, including synthetic organic contaminants such as herbicides. Of the

herbicides proposed to be used in this project, picloram, 2,4-D, and glyphosate have specific MCLs.

Picloram potentially causes damage to the central nervous system, weakness, weight loss and diarrhea in persons exposed to levels exceeding the MCL. Drinking water levels considered "safe" for short-term exposure are, for a 10 kilogram (22 pound) child consuming one liter of water per day, a 1- to 10-day exposure to 20 mg/L or up to at 7-year exposure to 0.7 mg/L. EPA's MCL for picloram is 0.5 parts per million (PPM). If picloram is released to soil, it will not be expected to adsorb to the soil and may leach to ground water, a conclusion supported by detection of picloram in ground water samples.

Glyphosate potentially causes lung congestion and increased breathing rate at levels exceeding the MCL. Drinking water levels considered "safe" for short-term exposure are, for a 10-kilogram child consuming 1 liter of water per day, up to a 10-day exposure to 20mg/L or up to a 7-year exposure to 1 mg/L. EPA's MCL for glyphosate is 0.7 ppm. After glyphosate is applied to land, it strongly adsorbs to soil, remains in upper soil layers, and exhibits a low propensity for leaching. Glyphosate may enter aquatic ecosystems and drinking water sources via runoff.

2,4-D potentially causes nervous system damage from short-term exposures at levels above the MCL. Drinking water levels of 2,4-D considered "safe" for short-term exposures are, for a 10-kilogram (22-pound) child consuming 1 liter of water per day, a 1-day exposure of 1mg/L, or a 10-day exposure of 0.3 mg/L. EPA's MCL for 2,4-D is 70 parts per billion (ppb).

For additional information regarding these or the other herbicides proposed to be used in this project, please refer to the project record risk assessments. The record also includes the full discussion from EPA's technical bulletins for 2,4-D, picloram, and glyphosate from which the above summaries are taken.

Mechanical vegetation control methods can increase sediment losses by more than one order of magnitude over natural losses (Neary & Michael 1996). The authors concluded that herbicides do not increase natural erosion rates although low peaks of nitrate-nitrogen concentrations in streamflows were detected in chaparral forests of Arizona. Use of herbicides can reduce water quality deterioration by erosion and sedimentation compared to mechanical vegetation control (Neary & Michael 1996).

Air Quality

There would be some impacts to the air resource under any of the action alternatives. In addition to the treatment of weeds, it is necessary to consider the impacts to air during transportation of the workers who are treating the infestations as they travel to and from the worksite.

Gaseous emissions—including sulfur dioxide, carbon monoxide, oxides of nitrogen, and volatile organic compounds—would result from the combustion of gas and diesel in vehicles used to transport workers to and from the worksite. The amounts of these emissions would depend upon the type, size, age, fuel efficiency and loads hauled by the engines used for transportation and during the treatment operation. Air pollutant emissions of newer, more efficient engines are less than older models, but even the emissions from these older, less efficient engines would constitute minor sources of air pollution.

Road dust will be generated during travel to and from the worksites and during treatment applications which use motorized vehicles. Since speeds are generally slow during treatments, the impact during treatment would be minimal. Depending upon the mileage driven on gravel roads going to and from the project site, the speed driven while traveling, the number of vehicles traveling, and the weight of the loads being carried, there could be a good amount of dust generated during the travel to and from the worksites.

During ground applications of herbicides, some spray drift will occur. This drift is not expected to produce any ambient air quality impacts since this spray drift is short term in nature and limited to areas immediately adjacent to the plant populations being sprayed. The quantity of herbicide released to the atmosphere would not be expected to have any long-term impact on air quality.

Prescribed burning of weed infested areas within the three national forests could have some negative effects to air quality, but since particulate and smoke dispersal are given consideration prior to the ignition of a burn, this impact should be minimized. In the event that the particulate and smoke dispersal conditions didn't meet necessary criteria, the burn would be postponed until such conditions were conducive to conduct the burn.

Overall, the impacts to the air resource under any of the action alternatives are minimal.

Alternative 1 would have some negative impacts to the air resource from both spray drift and dust generated during transportation. With treatments limited to 10,000 acres per year, this impact would be less than Alternative 4. There would be more spray drift associated with this alternative than there would be with Alternative 2 or 3, but less than with Alternative 4.

Alternative 2 is the "No Action" alternative. There would be no spray drift or dust generated since no treatments would be done.

Alternative 3 would generate no spray drift but would generate the most road dust. With increased amounts of mechanical treatments and additional travel to and from the worksite necessary by additional, multiple treatments, there would be more dust created by this treatment and, thus, more negative impact to the air resource than any other treatment.

Alternative 4 would generate more spray drift than Alternative 1, but less road dust than either Alternative 1 or 3 given that less repeat treatments would be necessary with this alternative than with Alternative 1.

Vegetation

Weeds

The evaluation criteria in Tables 17 and 18 were developed to assess impacts of the proposed alternatives on the control or spread of weeds through the planning period.

Table 17. Direct and indirect effects of alternatives on the spread of weeds

	Alt. 1-High	Alt. 1-Low	Alt. 2	Alt. 3	Alt. 4
Total Infested Acres Currently *	187,500	187,500	187,500	187,500	187,500
Number of Species Meeting Control Objectives	20	15	0	13	22
Total First-time (New) Treatments Scheduled (acres)	34,131	20,395	0	49,605	41,260
Total Infested Forest Land (acres) under Treatment	34,131	20,395	0	23,410	31,047
Repeat Treatments Scheduled (acres)	81,380	56,100	0	161,870	77,750
Total Acres Treated	115,515	76,495	0	211,475	124,051
Total Acres of Rights-of-Way (ROWS) Treated	12,675	12,675	0	5,100	4,055
Annual Nonnative Grasses Treated in Acres					
Manual	0	0	0	0	0
Mechanical	0	0	0	0	0
Cultural	0	0	0	0	2,750
Biological	0	0	0	0	0
Herbicidal	0	0	0	0	4,000

* These acres do not include acres of nonnative annual grasses since there is no current inventory of them.

Table 18. Comparative costs of the four alternatives

	Alt. 1-High	Alt. 1-Low	Alt. 2	Alt. 3	Alt. 4
Cost New Treatment	$2,715,980	$1,875,120	0	$5,318,100	$4,033,250
Cost Repeat Treatment	$6,810,125	$4,921,230	0	$19,167,190	$8,179,950
Cost Total	$9,526,105	$6,796,345	0	$24,485,290	$12,213,200
Cost of New Nonnative Grass Treatments	$0	$0	$0	$0	$135,375
Costs of Nonnative Grass Repeat Treatments	$0	$0	$0	$0	$315,825

Direct and Indirect Effects Common to Alternatives 1, 3, and 4

Alternatives 1, 3, or 4 would all result in meeting treatment objectives for at least 13 of the 24 species found within the project area (Table 19).

Table 19. Target weed species meeting treatment objectives by alternative

Common Name	Objective	Alt. 1-High	Alt. 1-Low	Alt. 2	Alt. 3	Alt. 4
leafy spurge	eradicate	No	No	No	No	No
yellow starthistle	eradicate	Yes	Yes	No	No	Yes
Malta starthistle	eradicate	Yes	Yes	No	Yes	Yes
Camelthorn	contain/control	Yes	Yes	No	Yes	Yes
Russian knapweed	contain/control	Yes	Yes	No	Yes	Yes
Whitetop	eradicate	Yes	No	No	No	Yes
Mediterranean sage	eradicate	Yes	Yes	No	Yes	Yes
musk thistle	eradicate	Yes	Yes	No	Yes	Yes
diffuse knapweed	contain/control	Yes	No	No	Yes	Yes
spotted knapweed	eradicate	Yes	Yes	No	No	Yes
Scotch thistle	eradicate/control	Yes	Yes	No	Yes	Yes
Russian olive	contain/control	Yes	Yes	No	No	Yes
Tamarisk	contain/control	Yes	No	No	Yes	Yes
Himalayan blackberry	contain/control	Yes	No	No	Yes	Yes
Houndstongue	eradicate	Yes	Yes	No	Yes	Yes
giant reed	contain/control	Yes	Yes	No	Yes	Yes
sulfur cinquefoil	prevent/eradicate	Yes	Yes	No	Yes	Yes
Dalmatian toadflax	contain/control	Yes	No	No	No	Yes
tree of Heaven	contain/control	Yes	Yes	No	No	Yes
bull thistle	contain/control	No	No	No	No	Yes
Siberian elm	contain/control	Yes	Yes	No	No	Yes
cheatgrass	contain/control specific populations	No	No	No	No	Yes
wild oats	contain/control	No	No	No	No	No
Teasel	eradicate	Yes	Yes	No	Yes	Yes
Number of Species Meeting Treatment Objectives		**20**	**15**	**0**	**13**	**22**

Since invasive weeds like camelthorn, diffuse knapweed, musk thistle, Scotch thistle and Russian Knapweed represent some of the most aggressive invasive species found within the planning area, the ability to meet control objectives will promote native grass and forbs species within those acres treated and maintain or improve the overall biodiversity, wildlife habitat, biodiversity, and watershed conditions of these areas.

All three action alternatives would authorize biological controls. Five species would be targeted: Dalmatian toadflax, diffuse knapweed, spotted knapweed, Russian knapweed, and leafy spurge. Dalmatian toadflax has eight species of insects that have been tested and approved for rangeland use, including a flower beetle, a toadflax moth, a stem-galling weevil, a root-boring moth, a seed-capsule-feeding weevil, and a root-galling weevil. Success in the use of these insects is very dependent on the size and density of existing populations of Dalmatian toadflax. In general, populations that are continuous, fairly dense, and occupy a rather large area (1 acre or larger) are

more successful biological control sites. Typically, the insects crawl, jump, or fly from one plant to the next so scattered, less dense populations influence the reproductive success of the insect and the overall ability of biological control to achieve treatment objectives. Diffuse and spotted knapweed can be treated with seven insects (flies, moths, a beetle and weevils). Russian knapweed has one approved insect, a gall nematode, which has demonstrated good success in the control of this plant. Coombs (personnel communication 2003) noted that the problem with this species is that it only spreads at a rate of 6 inches per year and it needs cool, moist springs to propagate. Both conditions will limit the use of this agent in our weed treatment strategy. Tamarisk is typically controlled with the Chinese leaf beetle and this beetle has been approved for release in several states, though not in Arizona. Research results indicate that excellent control can be achieved on tamarisk but until issues related to the Southwestern willow flycatcher are resolved with the U.S. Fish and Wildlife Service, the use of the beetle is precluded in the project area.

Vallentine (1980) noted that before introduction, insects must be determined to be highly damaging to the target plants while at the same time being virtually harmless to native plants. Since all of the above mentioned species have gone through extensive research and environmental analysis by APHIS prior to approval, we foresee no adverse impacts with the introduction of these insects on native plants. Normally, a period of 15 to 20 years is necessary to build up sufficient insect populations to bring about an economic treatment level (USDA Forest Service 1992a).

Direct and Indirect Effects of Alternative 1: Proposed Action

At the high level of Alternative 1, 20 species would reach their desired level of either contain, control, or eradication. Forest Service lands located within the Bill Williams, Gila, and Colorado-Grand Canyon Watersheds would be essentially clear of currently known populations of weeds. Although infested acres at the conclusion of the planning period (186,770 acres) would be only slightly less than current acreage, they are substantially less than that calculated without treatment (340,645 acres). Except for the ponderosa pine ecosystem in the Verde River and Little Colorado Watershed, the remaining ecosystems (riparian, shrublands, shrub/grassland, pinyon-juniper woodland, grasslands, mixed conifer and tundra) will reach adequate control and have low population levels of invasive species. Though we show that 186,770 acres would still be infested, the most invasive weeds would be controlled.

In contrast, at the low end of treatments we would reach the desired levels of either contain, control, or eradication on 15 species. Treatments in the Bill Williams, Colorado/Grand Canyon and Gila Watersheds would be maintained at high enough levels to remove currently known infestations, although total infested acres in the whole project area at conclusion of the planning period would increase to 321,275 acres, or 70 percent over existing conditions. Ninety-eight percent (or 316,210 acres) of the total infested area would be bull thistle or Dalmatian toadflax.

If the low end of Alternative 1 is implemented, we will meet treatment objectives on less than 75 percent of the weeds. Problems with several species, including Dalmatian toadflax, could become evident by the end of the planning period in both watersheds. Under current conditions Dalmatian toadflax is quite scattered in small populations of generally 1 acre or less. In many cases populations are less than one-tenth of 1 acre. As these populations begin to grow together we predict that there will be a decline in ecosystem health as this plant begins to out-compete native grasses and forbs.

Prevention of weeds from spreading off major road corridors onto the forests would be achieved through treatments on rights-of-way. A total of 12,675 acres is scheduled mostly on Interstates 40 and 17, U.S. Routes 89A, 89, and 180, and State Routes 87 and 180. Treatments on Level 5 forest roads (paved roads) would also occur with the highest percentage of treatments being targeted to the Lake Mary, Townsend-Winona, and Snow Bowl Roads. We predict that control objectives for Dalmatian toadflax, bull thistle, Scotch thistle, camelthorn, whitetop, Russian, diffuse and spotted knapweeds, as well as yellow starthistle, will be met along the roads. This would not only promote a decline in total weed populations but, more importantly, it would begin to limit the road corridors' influence on reinfesting forest lands. Eventually, this would result in a decreased need for new treatments since the roadsides would be relatively free of weeds and movement of viable seed from the rights-of-way into the project area would decline.

Other effects associated with both the high and low level of treatments include the prevention of those invasive species that have not been found within the project area but are nearby, including oxeye daisy, Canada thistle, halogeton, and Dyers woad.

Not surprisingly, considering that most of the known invasive species and greatest areas infested are in the Verde River and Little Colorado Watersheds, the costs for those two watersheds far outweigh those for other watersheds (Figure 7). Over 95 percent of the total costs will be expended in the Verde River and Little Colorado Watersheds.

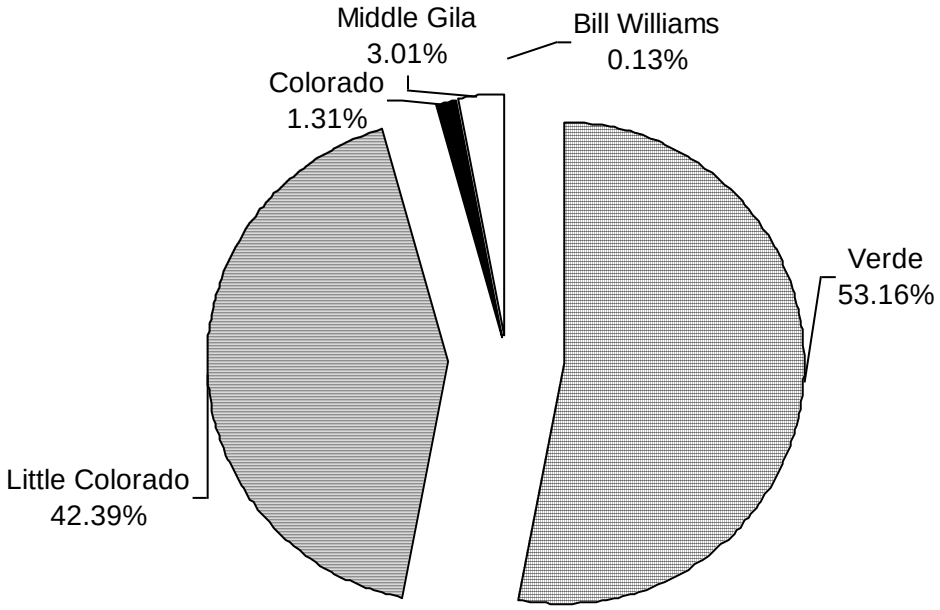


Figure 7. Percent of total costs by watershed for Alternative 1-High

Total cost of implementation at the high end of scheduled work results in an estimated cost per acre of $108. Of the total, $5,387,320 (59 percent) is associated with control of bull thistle and Dalmatian toadflax. Other species with high treatment costs are leafy spurge ($576,660), Mediterranean sage ($299,215), Russian knapweed ($264,625), Scotch thistle ($919,935), spotted knapweed ($135,055), whitetop ($177,320), and yellow starthistle ($263,120). The combined

costs for treatment of invasive tree species is projected at $217,585. Treatment of the remaining species is generally under $10,000.

At the low level we estimate that the total cost of implementation will drop to $6,796,345, or 28 percent less than the high level. Most of this reduction in cost is associated with no treatments scheduled for Dalmatian toadflax. Of this total, $1,875,120 is for new treatments and $4,921,230 for repeat treatments. As with the high level, over 95 percent of the costs will be expended in the Verde River and Little Colorado Watersheds (Figure 8).

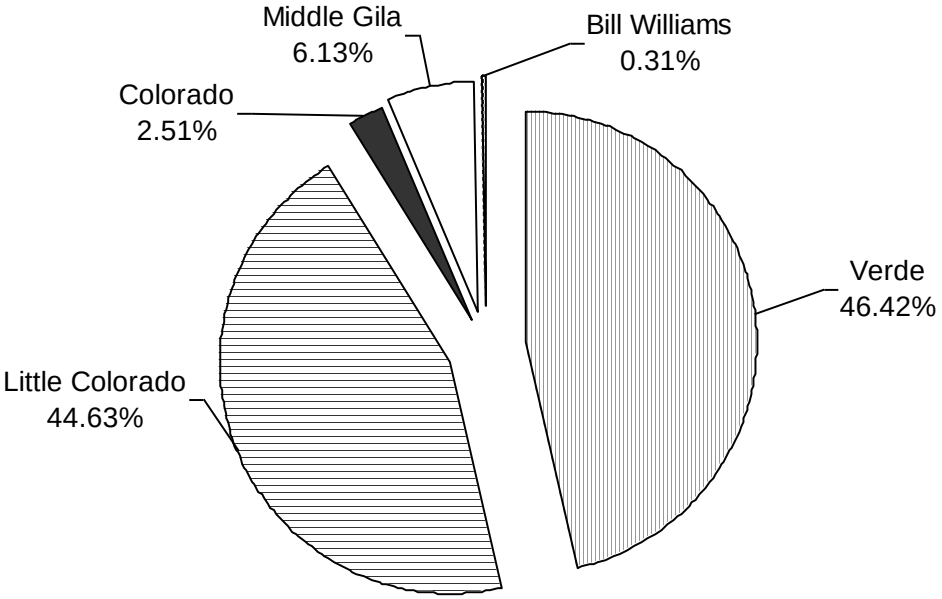


Figure 8. Percent of total costs by watershed for Alternative 1-Low

Herbicidal control can be an appropriate tool for treatment of large infestations, especially when desirable plants are in the understory. Table 20 indicates the relative percent of each herbicide proposed for use on each invasive species over the total time of the project. Individual populations would be treated with one or more of the chemicals indicated for that species at any one point in time depending on site conditions, sensitivities, effectiveness and efficiency.

Table 20. Proposed distribution of herbicide treatment for each chemical by species if authorized in the decision

			Herbicide Active Ingredients										
Invasive Plant by Priority	**Alternative 1 High Infested Acres Treated**	**Alternative 4 Infested Acres Treated**	**2, 4 D**	**chlorsulfuron**	**clopyralid**	**dicamba**	**glyphosate**	**Imazapic**	**imazapyr**	**metsulfuron methyl**	**picloram**	**sulfometuron methyl**	**triclopyr**
leafy spurge	1,212	1,212	20%				10%	40%	5%		25%		
yellow starthistle	165	165	14%		40%	14%	15%				17%		
Malta starthistle	20	0	14%		40%	14%	15%				17%		
camelthorn	25	25	10%			10%	5%		10%	20%	25%		20%
Russian knapweed	210	210	10%		15%	10%	5%	20%	20%		20%		
whitetop	200	200	10%				5%			85%			
Mediterranean sage	75	40	30%		40%	10%					20%		
muskthistle	25	10	20%	10%	30%		15%			15%	10%	0%	
spotted knapweed	85	10	25%		25%	10%			5		35%		
diffuse knapweed	1,030	50	20%		25%	15%	5%				25%		10%
Scotch thistle	1,085	150	15%	10%	30%	10%	5%			15%	15%		
Russian olive	92	92	15%				10%		25%				50%
Siberian elm	25	25	15%				10%		25%				50%
tamarisk	1,976	1,747	15%				10%		25%				50%
Himalayan blackberry	250	25	20%				10%						70%
giant reed	5	5					100%						
sulfur cinquefoil	5	5	60%								40%		
Dalmatian toadflax	6,012	6,241	10%			15%	5%	35%	5%		20%		10%
tree of Heaven	183	183	15%				10%		25%				50%
bull thistle	7,400	9,394	10%	10%	20%	10%	10%			10%	30%		
annual grasses		4,000					20%	60%				20%	

Direct and Indirect Effects of Alternative 2: No Action

Alternative 2 would not implement a weed control program. Knapweeds, starthistles, and leafy spurge would increase from their current population size of 1,260 acres, 185 acres and 1,000 acres to 4,100 acres, 600 acres, and 3,280 acres, respectively. Dalmatian toadflax would expand from 155,800 acres to about 286,400, and bull thistle would increase by over 12,000 acres during the next 10 years to 35,880 acres. These increases would cause declines in native grasses and herbs and eventually decrease watershed conditions in the project area. Figure 9 displays the total acres currently infested with weeds compared to the total acres predicted to be infested with weeds after 10 years of no treatments.

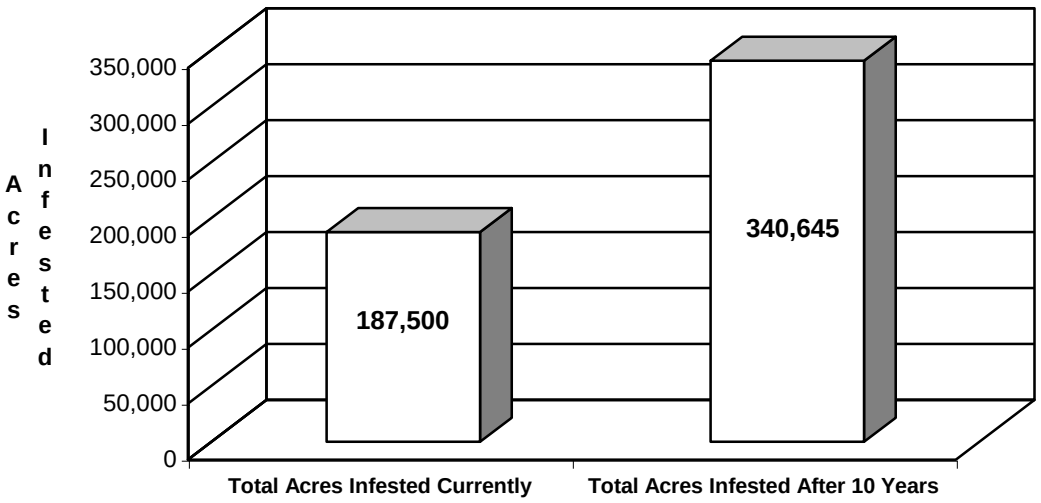


Figure 9. Total acres infested in Alternative 2

Treatments on paved road systems under control of the Forest Service would not be implemented. The species of weeds—Mediterranean sage, Dalmatian toadflax, bull thistle, Scotch thistle, camelthorn, whitetop, Russian, diffuse and spotted knapweeds and yellow starthistle—currently inventoried along Lake Mary, Perkinsville, Snow Bowl, Townsend-Winona, and Walnut Canyon Roads would expand. This situation would continue the current trend of major road corridors acting as conduits for the spread of weeds into the major ecosystems found within the project area. This would promote the continual spread of these weeds and eventually result in declines in biodiversity in the project area within the next 10 to 15 years.

Other effects associated with this alternative include the establishment and spread of those species that have not been found within the project area including, but not limited to, oxeye daisy, Canada thistle, halogeton and Dyers woad within the next 10 years.

Direct and Indirect Effects of Alternative 3

Alternative 3 would authorize 49,605 acres of new treatments and 161,870 acres of repeat treatments on those same acres. This large increase in total treatments as compared to Alternatives 1 and 4 is the result of excluding the use of herbicides. Numerous repeat treatments and

concurrent treatments on the same acreage are necessary to achieve desired treatment objectives using manual and mechanical techniques. Figure 10 shows the percentages of total treatments by treatment technique.

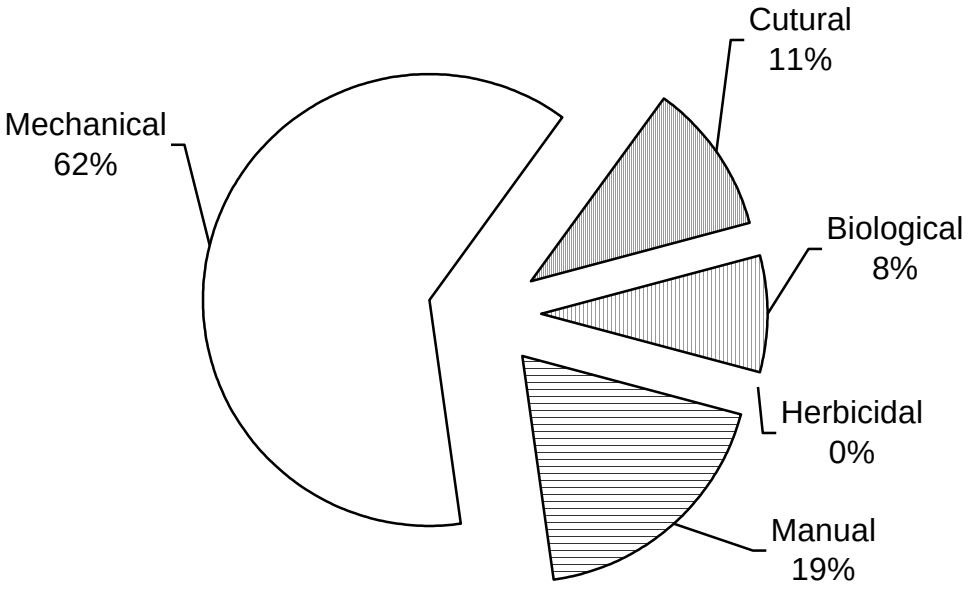


Figure 10. Percent of total acres used in each integrated weed treatment technique in Alternative 3

About 75 percent of the treatments are targeted for control of Dalmatian toadflax and bull thistle. Mechanical treatments include 1,300 new acres of burning and 23,450 new acres of steaming.

Ninety-five percent of the steaming is scheduled for containment of Dalmatian toadflax and bull thistle. Musk thistle, Scotch thistle, Mediterranean sage and sulfur cinquefoil receive this treatment, too. The costs associated with steaming are 50 percent of the total projected costs.

Treatments in road corridors are restricted to those outside the administrative control of the Federal Highway Administration. These include the Lake Mary, Perkinsville, Snow Bowl, Townsend-Winona, and Walnut Canyon Roads. The amounts of manual/mechanical work are estimated at 5,100 acres with most of the treatments being steaming.

Thirteen species would reach their objectives of contain, control, or eradication. At the conclusion of the 10-year planning period 195,870 acres would be infested with weeds. These include 29,335 acres of bull thistle, 162,780 acres of Dalmatian toadflax, and 3,755 acres spread between species not meeting treatment objectives: leafy spurge, Russian olive, Siberian elm, spotted knapweed, and tree of Heaven, whitetop, and yellow starthistle.

The total cost of implementation is estimated at $24,485,290. The increased cost of Alternative 3 over Alternative 1-High is about 250 percent. The higher cost is related directly to the increased use of manual and mechanical methods, and the need to retreat more often when using these methods. Figure 11 shows the percent of total costs by watershed for Alternative 3.

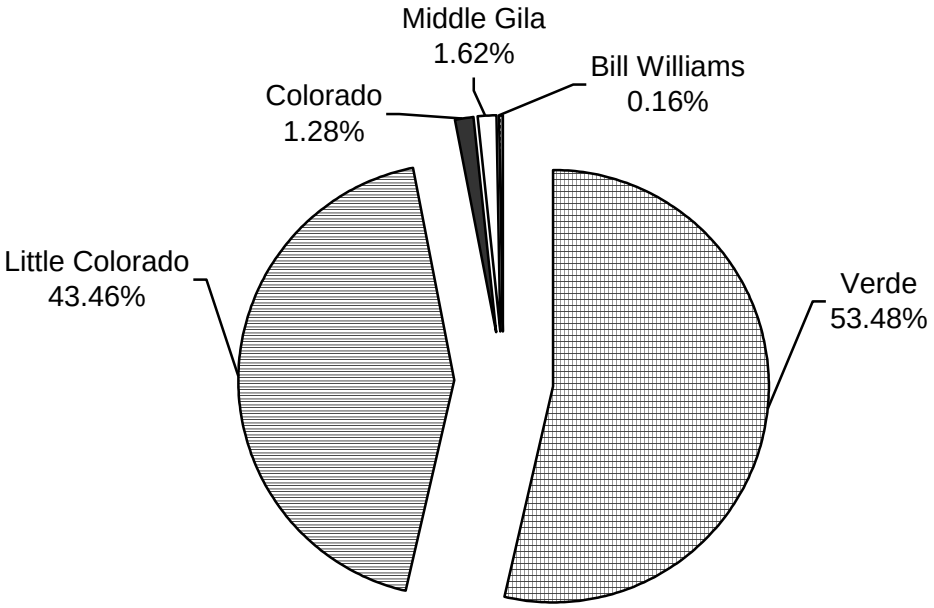


Figure 11. Percent of total costs by watershed for Alternative 3

Direct and Indirect Effects of Alternative 4

Alternative 4 would result in 41,260 acres of new treatments. Figure 12 shows the percentages of total treatments by type for Alternative 4.

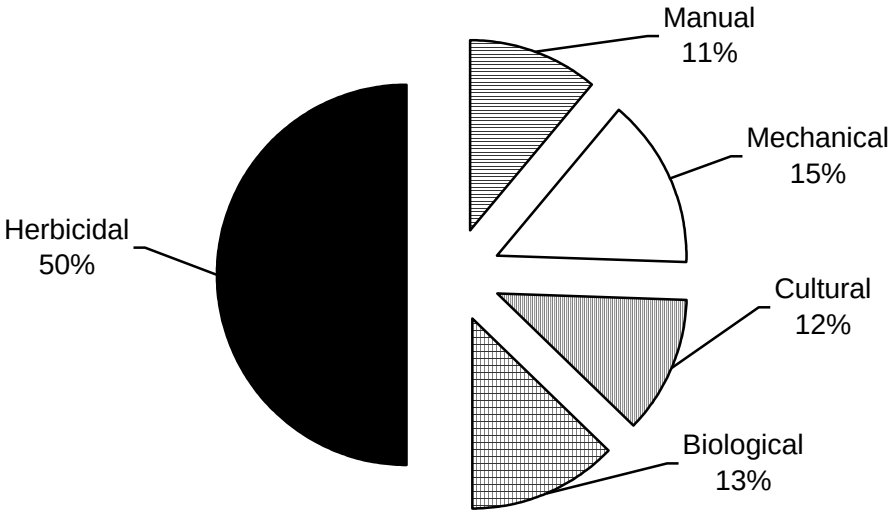


Figure 12. Percent of total acres using each integrated weed treatment technique in Alternative 4

In the preferred alternative (Alternative 4) 22 species would reach their objectives of contain, control, or eradication. Leafy spurge would not meet the identified treatment objective of eradication in the 10-year planning period though it would drop from its current population size of 1,010 acres to 40 acres. We estimate that the project area would contain about 180,700 acres of weeds of which 178,605, or 99 percent, would be bull thistle or Dalmatian toadflax. Thirteen species would be eliminated from the project area: giant reed, houndstongue, Malta starthistle, yellow starthistle, Russian olive, Russian knapweed, Siberian elm, spotted knapweed, sulfur cinquefoil, teasel, Tree of Heaven, and whitetop. The remaining species would have reductions of over 75 percent from their current population sizes, levels whereby total eradication is forecasted if treatments were continued for another 5 to 10 years.

Although this alternative calls for an increase of total treatment acres of about 8 percent over the high end of Alternative 1 (Proposed Action), it is 40 percent under Alternative 3. This is due to the necessity for an average of four retreatments per acre in Alternative 3 versus two to three retreatments in Alternatives 1 and 4. The increase is also partly due to a treatment of exotic invasive annual grasses (6,750 acres).

We predict a sharp decrease in the amount of herbicides needed for diffuse knapweed, Himalayan blackberry, Malta starthistle, Mediterranean sage, Scotch thistle, and spotted knapweed in Alternative 4. Under Alternative 1, the projection for total acres of herbicidal treatments of these species is 15,415 acres. In Alternative 4, the amount needed to reach treatment objectives is 710 acres.

As with Alternative 3, the only road rights-of-way treated are those outside control of the Federal Highway Administration. Total herbicidal treatments are scheduled on 2,645 acres with the majority associated with the Lake Mary, Townsend-Winona and Snow Bowl Roads.

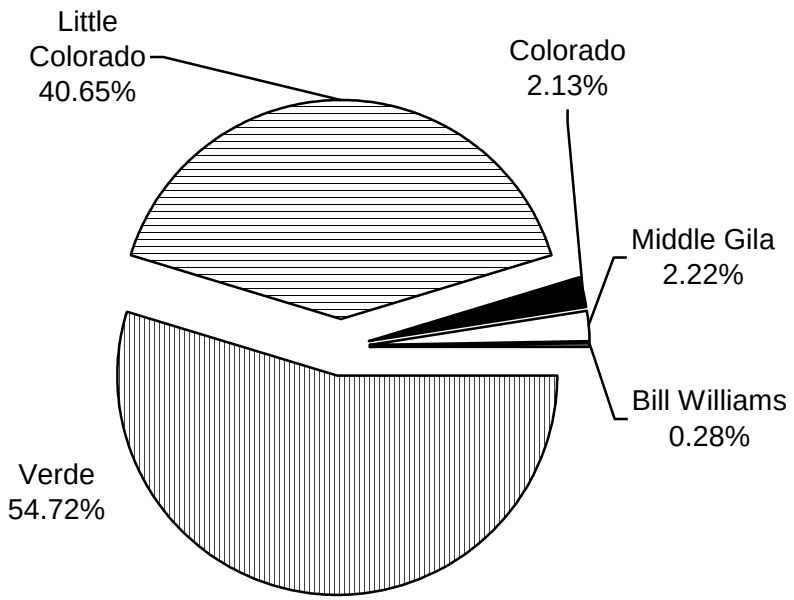


Figure 13. Percent of total costs by watershed for Alternative 4

Figure 13 displays the projected percentages of the total project cost by watershed. Total cost of implementation is estimated at $12,213,205, of which $4,031,190 is for new treatments and the remaining $8,182,015 is the cost of repeat treatments. The 35 percent higher cost over Alternative 1-High results from increased acres of manual and mechanical treatments and an additional $421,200 needed for control of invasive annual grasses on selected portions of high value forest habitats including portions of the North Kaibab Ranger District. About 95 percent will be spent in the Verde and Little Colorado Watersheds.

Cumulative Effects Common to Alternatives 1 (High and Low), 3, and 4

Implementation of any action alternative would initiate a coordinated approach in treatment of noxious weeds. The Chief of the USDA Forest Service, Dale Bosworth, recognized this growing problem and in 2003 declared invasive species as one of four major threats to the health of the national forests. Treatment objectives would be achieved on a range of plants going from a low of 13 disclosed for Alternative 3 to a high of 22 determined for Alternative 4.

Almost all activities that have occurred, are occurring, or will occur on the three national forests have or could potentially impact populations of invasive weeds either by introducing seeds or portions of weeds into noninfested areas, creating conditions favorable for germination or spread, or by reducing native plants that serve to compete with weeds. While not impossible, it would be extremely difficult to list all projects that have either occurred, are occurring, or are scheduled to occur on the three national forests. Appendix E is a best attempt effort at describing the types of projects that have either occurred, are occurring, or will likely occur in the reasonable future, and describes how each project type could impact weed populations in the vicinity of the project. Some current projects and eventually all future projects on the forests will be applying the use of design features, best management practices and mitigation measures (Appendix B), and the end result would be an overall reduction of noxious or invasive weeds.

In addition, a list of projects that are currently being planned on the three forests is included (Appendix E) to serve as a representative sample for a typical schedule of proposed actions for the three forests. Similar sorts of projects are expected to occur on private and other public lands.

Additional efforts to control the spread of weeds occur when weed management areas (WMAs) are established. Regions within the project area that now have (or are developing) weed management areas include the Arizona Strip, Flagstaff, Prescott, Camp Verde, Tusayan and Williams communities. Though weed management areas focus more on information gathering and educational aspects, they often complete small ground treatments. Typically, the integrated weed treatment methods used are manual and cultural, although WMA partners use herbicides on non-national forest lands.

Further management of weeds will occur under the present program of weed treatment along major travel corridors found in the project area and adjacent to it. This includes between approximately 3,000 acres per year of herbicidal treatments on the paved roads under jurisdiction of the Federal Highway Administration with easements executed to the Arizona Department of Transportation. This work will be completed on Interstates 17 and 40, State Highways 89, 89A, 260, and others as well.

Reductions in the spread of weeds would occur with implementation of a decision related to an environmental impact statement that looks at the cross-country use of motorized vehicles within

five national forests. The intent of the Proposed Action is to disclose the effects on the Kaibab, Coconino, Prescott, Tonto, and Apache-Sitgreaves National Forests on a reduction in the ability to travel cross country in vehicles. If implemented, this would reduce the potential of off-highway vehicles (OHVs) to pick up and spread weeds.

Control efforts on 35 acres of sweet resinbush and the reasonably foreseeable action on aquatic species found in the Verde River will further reduce the influence of weeds in the project area. Though the total amounts of treatments within the Verde River are not determined, it appears that 15 to 20 acres of Eurasian watermilfoil and water primrose may be treated over the next 10 years, predominately using aquatically labeled herbicides.

The State Land Department is also treating several species using predominately herbicides. Their major effort is to control Scotch thistle and yellow starthistle within the Rio de Flag. About 25 to 35 acres are being treated annually to control this plant and control will continue for 2 to 10 years to deplete the seed bank of the invasive species and treat the new populations found downstream.

Cumulative Effects for Alternative 2

Alternative 2 would not implement a noxious weed program and population levels of these plants would expand by about 153,000 acres over the next 10 years. All 24 weeds found in the project area would continue to grow and the 4 species adjacent to it will become established within the next 10 years.

Further expansion of weeds and potential additional treatments on forest lands will also result from implementation of numerous ground-disturbing projects including road construction and maintenance, timber sale activities, prescribed burning, revisions of allotment management plans, watershed restoration, road obliteration, and mining. Over the next 2 to10 years, about 676,530 acres of National Forest System lands will be included within proposed timber sale areas, grazing allotment management plan revisions, prescribed burning, mining, and watershed restoration proposals. Though this represents roughly 15 percent of the land base of the three national forests, inclusion of weed prevention best management practices in all project planning should reduce the potential of further introductions to very low levels though some expansion of these plants would occur.

Another potential for the spread of weeds is the nominal amount of treatments undertaken by local communities and landowners in the wildland-urban interface. Except for Flagstaff, communities like Camp Verde, Chino Valley, Clarkdale, Cottonwood, Prescott, Prescott Valley, Sedona, and Williams have not inventoried or established any municipal level control program for invasive and noxious weeds. As each local weed management area works closer with the communities to help identify and recommend treatments, this situation should improve. Currently, even though the three national forests and other governmental organizations are implementing integrated weed treatment strategies, we foresee continual spreading of weeds from local communities onto public lands.

Threatened, Endangered, Candidate, and Sensitive (TEC&S) Plant Species

Seventy-five percent of the 40 plant species that are considered special status taxa have weeds within or adjacent to known populations. Of particular concern are Arizona cliffrose, Arizona bugbane, Flagstaff beardtongue, Flagstaff pennyroyal, Heathleaf wild buckwheat, Hualapai

milkwort, Mearns sage, Ripley wild buckwheat, and Sunset Crater beardtongue since all nine species have been found with a high number of weeds associated with them.

More complete documentation on all the rare plant taxa can be found in the Botany Specialists' Report (Phillips and Crisp 2004) on file in the project record and at the Coconino National Forest.

Several listed and sensitive plant taxa listed in Table 9 currently are not known from the Coconino, Kaibab or Prescott National Forests. If one of these species is found in the future, consideration of the effects of treatments will occur at that time under adaptive management. No further discussion of effects will occur here on the following taxa: Welsh's milkweed, sentry milkvetch, Jones' cycladenia, Brady pincushion cactus, Siler pincushion cactus, Ute Ladies tresses, coppermine milkvetch, Marble Canyon milkvetch, lonely lily, Morton's wild buckwheat, Atwood wild buckwheat, Mt. Trumbull beardtongue, and Grand Canyon rose.

No noxious or invasive plant species are currently known in the habitats of the following taxa: San Francisco Peaks groundsel, cliff milkvetch, crenulate moonwort, Kaibab paintbrush, Cochise sedge, Metcalfe's ticktrefoil, cliff fleabane, Eastwood alumroot, Kaibab bladderpod, and Arizona phlox. Surveys for weeds will be conducted before any treatments in their habitats, and treatments would follow adaptive management principles.

Direct and Indirect Effects for All Action Alternatives

Table 21 presents a summary of the treatment effects on TECS plant species on the three forests by alternative. Direct, indirect and cumulative effects for the Preferred Alternative are developed in the biological assessment and evaluations for threatened, endangered, candidate, and sensitive plant species, located in the project record. Species conservation measures from the U.S. Fish and Wildlife Service consultation for all species and Arizona cliffrose, in particular, are listed in the required protection measures section of Appendix B in the FEIS.

The following effects discussion is based on use of the most effective herbicide for treatment of the noxious or invasive plant that would cause the least effect to listed or sensitive plant species in the same habitat. For example, the effects of herbicide treatment on threatened, endangered, candidate, and sensitive plants were divided into 3 categories: high, moderate, and low. If the herbicide would affect the species, possibly causing death, it received a rating of high. If the herbicide was not listed as a treatment for members of the family, closely related family or life form, it received a rating of low. Some herbicides do not affect grasses and monocots. Therefore, there would be no effect on monocot species such as *Eremocrinum albomarginatum.* The rationale used for assessing herbicide impacts on threatened, endangered, candidate and sensitive plant species is presented in Appendix D. Several herbicides treat broad categories of plants. Unless data in the document used stated otherwise, it was assumed there would be some impact to rare plant species in the same category.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
Arizona cliffrose	With imazapic and clopyralid low likelihood of killing plants if avoid direct spray; seedlings could be pulled accidentally; nonnative annual grasses would increase causing increased frequency of wildfires, detrimental to desert scrub community not adapted to wildfire.	No treatment of weeds: weeds would out-compete seedlings and kill some associated species; Russian knapweed and yellow starthistle could kill adult plants by allelopathy; nonnative annual grasses would increase with same effect as in Alternative 1.	Seedlings could be pulled accidentally; nonnative annual grasses would increase with same effect as in Alternative 1.	The incorporation of required protection measures (Appendix B) would make the probability very unlikely that yellow starthistle, Malta starthistle, and Russian knapweed would grow into the forest habitat of Arizona cliffrose so negative effects of weeds on both seedling and adult Arizona cliffrose and associated species and habitat would be prevented. There is a remote possibility of killing a seedling while uprooting a weed and there could be minor killing of some foliage on adult plants if use of imazapic and clopyralid are needed. Effects due to nontreatment of nonnative annual grasses would be same as Alternative 1.
San Francisco Peaks groundsel	No weed infestations currently exist in tundra habitat occupied by San Francisco Peaks groundsel; Dalmatain toadflax inhabiting areas surrounding tundra would be treated with imazapic. Manual control would be done in areas surrounding San Francisco Peaks groundsel habitat. Treatments would reduce the risk of weed infestation in tundra habitats.	Current and future weed infestations would expand without control. This could impact San Francisco Peaks groundsel and its habitat and lead to loss of individuals and degradation of habitat.	Manual treatments would be done on toadflax in the area surrounding the tundra habitat of San Francisco Peaks groundsel. Treatments would reduce the risk of weed infestation in tundra habitats.	The incorporation of integrated weed management practices and required protection measures (Appendix B) would likely prevent weed infestations in the habitat of San Francisco Peaks groundsel. Treatments and effects are the same as in Alternative 1.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
Fickeisen pincushion cactus	Cheatgrass at very low densities is the only weed known to exist in the habitat of Fickeisen pincushion cactus. It would not be treated. It is unlikely to increase due to lack of available substrate and minimal disturbance of the habitat.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Tonto Basin agave	Exotic annual grasses in the habitat will not be treated in this alternative. Infestations will continue to expand and could affect ecosystem functions such as increased frequency of wildfires.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Mt. Dellenbaugh sandwort	Same as Tonto Basin agave.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Rusby milkvetch	Dalmatian toadflax and bull thistle would be treated with imazapic, which would be a low risk to Rusby milkvetch. Biological control agents for Dalmatian toadflax would be used, but would pose no risk to Rusby milkvetch. Manual control would be used to control toadflax and bull thistle. There is a slight risk to individuals but would be mitigated by using careful application.	Same as for San Francisco Peaks groundsel.	Manual and mechanical control would be used and the risks are similar to those in Alternative 1. Steam treatment would be used to control toadflax and bull thistle. Risks to Rusby milkvetch include death of individuals but can be mitigated through careful application.	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Rusby milkvetch. Herbicide, manual and mechanical treatments used in this alternative are the same as those in Alternative 1. The risks and mitigations are the same. Burning is proposed in this alternative. Risks include damage/death of individual Rusby milkvetch plants; however, Rusby milkvetch grows in a habitat where fires occurred at frequent intervals so should be adapted to fire.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
Disturbed rabbitbrush	Infestations of cheatgrass would continue to expand, increasing the risk of wildfire in this habitat but disturbed rabbitbrush is somewhat adapted to fire. Imazapic would be used to treat bull thistle and would have low impact on Tusayan rabbitbrush. Manual control would be used to control weeds. Risks to Tusayan rabbitbrush are low because of its shrubby growth form.	Same as San Francisco Peaks Groundsel.	Same as Rusby milkvetch.	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Disturbed rabbitbrush. Manual and herbicide treatments similar to those in Alternative 1 would be used. Steam treatment similar to that in Alternative 3 would be used. The risks, benefits and mitigation would be the same.
Arizona bugbane	Imazapic would be used to treat bull thistle and triclopyr would be used to treat Himalayan blackberry. These herbicides were selected because they pose the least risk to Arizona bugbane. Manual treatment will be used for bull thistle, Himalayan blackberry and toadflax. Risks to Arizona bugbane include death/damage to individual plants. Using caution during treatment can mitigate this.	Same as San Francisco Peaks groundsel.	Most treatments are same as Rusby milkvetch. Angora goats would be used to treat Himalayan blackberry. Goats might eat Arizona bugbane plants. Having the goats tended by a herder could decrease this risk.	The chemical, manual and cultural treatments used in this alternative are similar to those in Alternatives 1 and 3. The incorporation of required protection measures and integrated weed management practices (Appendix B) would make the probability very unlikely that there would be effects to Arizona bugbane.
Mogollon thistle	Imazapic would not be used because it would also kill Mogollon thistle. Bull thistle in or near populations would need to be hand pulled to avoid damage to Mogollon thistle.	Bull thistle populations would continue to expand in or near the habitat of the Mogollon thistle, leading to possibly decreased	Manual treatments are the same as Alternative 1, the risks and mitigation would be the same. Due to the remoteness and	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Mogollon thistle. Effects are same as Alternative 1.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
		viability and possible extirpation of this species.	steepness of the habitat of Mogollon thistle, steam will probably not be used in the habitat of this plant.	
Cliff fleabane	Same as Tonto Basin agave	Exotic annual grasses will continue to expand in areas adjacent to the habitat of cliff fleabane.	Same as Alternative 1.	Same as Alternative 1.
Heathleaf wild buckwheat	Imazapic is proposed for control of Russian knapweed and clopyralid for control of yellow starthistle. Both would kill or damage wild buckwheats. These herbicides were selected because they would have fewer impacts on Arizona cliffrose, an endangered species, which can occur in the same habitat. Manual control such as hand pulling could be used but there is some risk to wild buckwheat plants, especially seedlings and young plants.	Same effects as Arizona cliffrose.	Same effects as Arizona cliffrose.	The incorporation of required protection measures (Appendix B) would make the probability very unlikely that yellow starthistle, Malta starthistle, and Russian knapweed would grow into the forest habitat of Heathleaf wild buckwheat so negative effects of weeds on both seedling and adult Heathleaf wild buckwheat and associated species and habitat would be prevented. The effects of herbicide and mechanical treatments are the same as Alternative 1. Effects due to nontreatment of nonnative annual grasses would be same as Alternative 1 for Arizona cliffrose.
Ripley's wild buckwheat	Same as Heathleaf wild buckwheat.	Same effects as Arizona cliffrose.	Same as Heathleaf wild buckwheat.	Same as Heathleaf wild buckwheat.
Bearded Gentian	Same as San Francisco Peaks groundsel.	Same as San Francisco Peaks groundsel.	Same as San Francisco Peaks groundsel.	Same as San Francisco Peaks groundsel.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
Flagstaff pennyroyal	Dalmatian toadflax, scotch thistle and musk thistle would be treated using imazapic. Mediterranean sage and diffuse knapweed would be treated using clopyralid. These herbicides were selected because they are the least toxic to Flagstaff pennyroyal. Manual treatments include such treatments as hand pulling. Biological control might also be used. Biological control agents are specific to the target species and pose little risk to nontarget species.	Same as San Francisco Peaks groundsel.	Mechanical treatments similar to those in Alternative 1 will be used. The risks and benefits are the same. Steam treatment is proposed in this alternative. There is a slight risk to individual Flagstaff pennyroyal plants from this treatment. This can be mitigated through careful application of steam.	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Flagstaff pennyroyal. The chemical, manual, and biological control treatments are the same as Alternative 1. Broadcast burning of diffuse knapweed infestations without reseeding would benefit Flagstaff pennyroyal since it responds favorably to fire. Mechanical treatment with steam has effects the same as Alternative 3.
Arizona Sneezeweed	Mechanical, biological and chemical control will be used in this alternative. Imazapic would be used in areas of Arizona sneezeweed, selected because it has the least impact on Arizona sneezeweed. Manual control, such as hand pulling or mowing may occur. Biological control agents (insects) will be used on Dalmatian toadflax; however, there is no risk to Arizona sneezeweed. Sheep will be used for control of leafy spurge. Risks include eating and trampling.	Populations of Dalmatian toadflax, spotted knapweed and leafy spurge will continue to expand, competing with Arizona sneezeweed and degrading habitat.	Mechanical and biological controls similar to those in Alternative 1 would be used in this alternative. The results, risks and mitigation would be the same. Steam treatment could be used for Dalmatian toadflax. This treatment is nonspecific and could damage Arizona sneezeweed plants if it contacts them, but this can be mitigated through careful	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Arizona Sneezeweed. The herbicides are the same as Alternative 1. Dalmatian toadflax would be treated using combinations of herbicides, manual treatments, and biological control, though herbicides are dominant. Spotted knapweed would be treated as in Alternative 3. Leafy spurge would be treated as in Alternative 1. Effects would be less due to required protection measures.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
			application. Burning individual spotted knapweeds may be used. There is a slight risk of escaped fire from this treatment.	
Giant lupine	Dalmatian toadflax would be treated using herbicide, manual, cultural treatments, and biological control agents. Clopyralid would be used in or near giant lupine populations because it would have the least impact on individual giant lupine plants. Manual treatment might also be used in populations of giant lupine. Tamarisk would be treated using triclopyr. There is moderate risk to giant lupine from triclopyr; however, by using cut and daub techniques, risk to individuals of giant lupine would be minimal.	No treatment of weeds will occur under this alternative; and Dalmatian and tamarisk will continue to grow unimpeded in the habitat of giant lupine. This will result in competition for resources between giant lupine and these exotic species, resulting in degradation of giant lupine habitat. This could lead to poor plant vigor, death of individual giant lupine plants, and possible loss of giant lupine populations.	No herbicides would be used in this treatment. Dalmatian toadflax would be treated using manual and mechanical control. The risks to giant lupine from manual control are similar to mentioned in Alternative 1. Steam would be used to treat Dalmatian toadflax. Steam is a nonspecific treatment. This can be mitigated through careful application of steam.	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of giant lupine. Chemical, manual and cultural controls are similar to those in Alternative 1. Biological control agents are selected to be species specific or limited to closely related species so there would not be effects to giant lupine.

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
Kaibab plains cactus	Same as Tonto Basin agave.	Same as Tonto Basin agave.	Same as Tonto Basin agave.	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Kaibab plains cactus. Some treatment of cheatgrass will occur, lessening frequency and intensity of wildfires. Kaibab plains cactus is somewhat adapted to low intensity fires.
Sunset Crater beardtongue	Diffuse knapweed and yellow starthistle would be treated using clopyralid. Camelthorn would be treated using picloram. There is risk to Sunset Crater beardtongue from this herbicide because it is used to control Dalmatian toadflax, which is in the same family as Sunset Crater beardtongue. Manual and cultural treatments would also be used. There is a slight risk to individuals but would be mitigated by using careful application.	Same as San Francisco Peaks groundsel.	Manual, mechanical and cultural treatments are the same as Alternative 1. Prescribed fire would be used to treat yellow starthistle. There is some risk of escaped fire, but this can be mitigated through caution and preparation and implementation of a prescribed fire plan. Sunset Crater beardtongue is adapted to fire.	The incorporation of Integrated Weed Management Practices and Required Protection Measures (Appendix B) would decrease the severity of weed infestations in the habitat of Sunset Crater beardtongue. The chemical, mechanical and cultural treatments and effects in this alternative are similar to Alternative 1. Prescribed fire would be used to treat diffuse knapweed. The benefits and mitigations are similar to those for yellow starthistle in Alternative 3.
Flagstaff beardtongue	Clopyralid would be used to treat diffuse knapweed and would have a low risk to Flagstaff beardtongue. Biological control would be used on Dalmatian toadflax and would pose little risk to Flagstaff beardtongue. Manual and cultural treatments	Same as San Francisco Peaks Groundsel.	Weed species would be treated using manual, cultural and biological control; similar to those in Alternative 1. Prescribed fire would be used to control diffuse knapweed. Penstemons	The incorporation of integrated weed management practices and required protection measures (Appendix B) would decrease the severity of weed infestations in the habitat of Flagstaff beardtongue. This alternative includes chemical, manual, cultural, biological control and prescribed fire similar to those in Alternatives 1 and 3. The effects and

Table 21. Treatment effects on threatened, endangered, candidate and sensitive plant species on the Coconino, Kaibab and Prescott National Forests by alternative

Common Name	Alternative 1, Proposed Action	Alternative 2, No Action	Alternative 3, No Herbicide Alternative	Alternative 4, Preferred Action
	include hand pulling and would be used for Dalmatian toadflax in Flagstaff beardtongue habitat. There is a slight risk to individuals but would be mitigated by using careful application.		in general are adapted to fire. Steam would be used to treat Dalmatian toadflax and Mediterranean sage. Steam is a nonspecific treatment. This can be mitigated through careful application of steam.	mitigations would be similar.
Hualapai milkwort	The treatments are the same as those in Arizona cliffrose. There is low risk to Hualapai milkwort from imazapic. Clopyralid may be moderately toxic to Hualapai milkwort, but the risk can be mitigated through careful application.	Same effects as Arizona cliffrose.	Same as Arizona cliffrose.	Same as Arizona cliffrose. Clopyralid may be moderately toxic to Hualapai milkwort, but the risk can be mitigated through careful application.
Mearns sage	Same as Arizona cliffrose. There is low risk to Mearns sage from imazapic. Clopyralid may be moderately toxic to Mearns sage, but the risk can be mitigated through careful application.	Same effects as Arizona cliffrose.	Same as Arizona cliffrose.	Same as Hualapai milkwort.

In summary, there will be positive effects to endangered, threatened, candidate and sensitive plant species because of declines of weeds in their habitats due to the proposed treatments. The action alternatives would result in meeting treatment objectives for 20 (Alternative 1-High), 15 (Alternative 1-Low), 13 (Alternative 3), or 22 (Alternative 4) weed species found within the project area (Table 19). This will maintain or improve the overall native plant diversity and watershed conditions within the habitats of endangered, threatened, candidate and sensitive plant species, allowing them to grow and reproduce under their natural habitat conditions without the interference of aggressive nonnative competitors and the deleterious effects on habitat that are the result of invasive plants (Sieg et al. 2003).

For the effects due to lack of treatments of nonnative annual grasses under Alternatives 1 and 3 see Table 21. Nonnative annual grasses will not be treated in some endangered, threatened, candidate and sensitive plants' habitats under Alternative 4. The lack of treatments of nonnative annual grasses will eventually have negative effects on those species. Nonnative annual bromes and wild oats would increase in the lower elevations, causing increased frequency of wildfires that are detrimental to desert scrub communities not adapted to wildfire. Arizona cliffrose, Tonto Basin agave, Heathleaf wild buckwheat, Ripley's wild buckwheat, Hualapai milkwort and Mearns sage could be impacted. The expansion of cheatgrass would change ecosystem processes such as fire regimes and hydrologic functions at higher elevations, impacting Tusayan rabbitbrush, Fickeisen pincushion cactus, Kaibab plains cactus and other sensitive plant species in open habitats. In addition, as wildfires open forest canopies and expose mineral soil, other weeds move into these disturbed sites (Crawford et al. 2001). We also anticipate if either Alternative 1-Low or Alternative 2 is implemented, that expansion of Dalmatian toadflax and bull thistle will occur dramatically in the ponderosa pine vegetation type. Several TEC&S plants, including Flagstaff beardtongue, Flagstaff pennyroyal, Sunset Crater beardtongue, Rusby milkvetch, and Arizona sneezeweed that grow in this terrestrial ecosystem would be impacted. This eventually will begin to influence the density of these plants and reduce the ability of these species to regenerate.

Cumulative Effects Common to Alternatives 1, 3, and 4

There will be no measurable direct effects from all treatment methods planned for Alternatives 1, 3 and 4 (the action alternatives) with integrated weed management and required protection measures in place. Therefore, there will be no incremental project impacts due to treatments to accumulate effects on endangered, threatened, candidate and sensitive plants.

Consideration of the cumulative effects of other actions on endangered, threatened, candidate and sensitive plant species within the project area under Alternatives 1, 3 and 4 will be discussed because of predicted positive effects due to declines of weeds from the proposed treatments, and the negative effects of not treating exotic annual grasses. Listed and candidate plant species are discussed first, followed by Arizona bugbane and Kaibab plains cactus, species for which there are conservation agreements with the U.S. Fish and Wildlife Service.

Arizona cliffrose – The Coconino Forest Plan (USDA Forest Service 1987a) designated the 470 ha (1,140 acres) Verde Valley Botanical Area for protection of the unique plant community, which includes Arizona cliffrose. The Forest Service has considered Arizona cliffrose and its habitat, including the botanical area, in its actions since 1987 and has implemented many favorable actions.

In 1991, areas known to contain an important part of the Cottonwood population were withdrawn from the Bar-T-Bar land exchange. The Coconino National Forest revised the Windmill Allotment Management Plan in 1992 to better accommodate Arizona cliffrose recovery needs, excluding livestock from some pastures and monitoring use in others (Ward personal communication 1996). The forest is currently working on the environmental documentation for a revised Windmill Allotment Management Plan.

Red Rock Ranger District initiated several actions since 1996 including trail rerouting and rock placement to protect Arizona cliffrose along several trails in the area of Dead Horse Ranch State Park, photo monitoring along trails, and maintenance of fences to exclude cattle and OHVs from the Verde Valley Botanical Area. Other beneficial actions included maintenance and enhancement of vehicle closures along Rocking Chair Road. The Forest Service closed and rehabilitated an unofficial target shooting range.

The Forest Service is working with State and local planners and other entities such as Dead Horse Ranch State Park, Arizona Department of Transportation, and private landowners to develop more comprehensive and ecosystem-based plans for the Verde Valley. A draft management plan for the Verde Valley Botanical Area has been prepared for the Forest Service (The Arboretum at Flagstaff, 2002). Modifications to the development plans of Dead Horse Ranch State Park Phase 3 Roadway Improvements resulted in increased protection for Arizona cliffrose and its habitat, both within the botanical area and adjacent to it (Phillips 1993).

In 1996 a 5-year research program on *Purshia subintegra* funded by ADOT as mitigation for the Hwy. 89A expansion project and Mingus Avenue Bypass project in the Verde Valley was begun and conducted by the Arboretum at Flagstaff research facility. As mitigation for these road expansions, in April 2003 personnel from the Arboretum and Forest Service along with numerous volunteers planted Arizona cliffrose plants and some associated Region 3 sensitive plant species on a Forest Service parcel. These plants will be cared for and irrigated through a cooperative effort with the Arboretum, USDA Forest Service, Dead Horse Ranch State Park, and volunteers.

Other management agencies have also considered Arizona cliffrose in their projects and implemented positive actions as well. Therefore, the positive results anticipated from implementation of any one of the three action alternatives will be additive to positive actions the forest has taken to date, and will counter stresses such as OHV activity and environmental conditions such as prolonged drought and, potentially, increased frequency of wildfires due to nontreatment of exotic annual grasses that would have deleterious effects on Arizona cliffrose and its habitat.

San Francisco Peaks groundsel – The Forest Service has considered the San Francisco Peaks groundsel and its habitat in its actions since the listing of San Francisco Peaks groundsel in 1983, and has implemented many favorable actions. Most of the management plan direction in the Alpine Tundra Management Plan (USDA Forest Service 1984) has been implemented and care has been taken that projects meet the intent for which they were proposed and do not adversely impact San Francisco Peaks groundsel and its habitat. The new hiking trail from Snow Bowl Lodge to the saddle north of Agassiz Peak was constructed to avoid physical impacts to San Francisco Peaks groundsel plants (Phillips 1994, Garcia 1996). The alpine area was closed to off-trail use in 1984. In 1985, the alpine tundra on Agassiz Peak was closed to trail hiking with a split-rail fence (U.S. Fish and Wildlife Service 1987b). New trails have been constructed to keep hikers on a minimum number of routes and give them access to Humphrey's Peak, the highest

point in Arizona. Continuous efforts to reduce the network of side trails have been effective but require ongoing efforts. Increased visitation to the alpine tundra provided by established trails is far greater than anticipated in the original consultation for San Francisco Peaks groundsel so public education about the importance of preserving San Francisco Peaks groundsel, the fragile nature of the tundra, and the purposes for the various regulations is an ongoing process.

The tundra and upper mixed conifer/spruce-fir slopes within Kachina Peaks Wilderness are closed to grazing and are not part of any grazing allotment (Coconino National Forest Plan, p. 110). The Kachina Peaks Wilderness and Snow Bowl Ski Area are permanently withdrawn from mineral exploration.

A Proposed Action (*www.fs.fed.us/r3/coconino/nepa*) has been developed that describes snowmaking, realignment of lifts, installation of lifts, a snowplay/tubing area, night lighting, and improved service facilities and resort infrastructure within Arizona Snow Bowl's existing Forest Service Special Use Permit boundary (USDA Forest Service 2002a). A Proposed Action (*www.fs.fed.us/r3/coconino/nepa*) has been developed that describes the construction and/or designation of the Arizona Trail corridor from Sandy Seep to Kelly Tanks in the San Francisco Peaks and Dry Lake Hills (USDA Forest Service 2002b). The trail would ascend the mountain in the vicinity of Snow Bowl Road to the base of the lease area and then contour to the north. This would let users access the Arizona Snow Bowl trails and lift.

In order to update the recovery plan, Coconino National Forest is currently conducting field reviews of the status of the San Francisco Peaks groundsel populations, including impacts to it and its habitat. A challenge/cost-share agreement between Coconino National Forest and Northern Arizona University was initiated in 2003 to develop a new monitoring protocol to monitor human impacts in the tundra area.

Some control efforts are occurring on Dalmatian toadflax in the Leroux Fire area, most of which is within Kachina Peaks Wilderness, and poses a potential threat to San Francisco Peaks groundsel if the weeds are allowed to spread into the alpine tundra.

The positive results anticipated from implementation of any one of the three action alternatives will be additive to the positive actions the forest has taken to date, and will counter stresses such as illegal access, environmental conditions, and prolonged drought that might have deleterious impacts on San Francisco Peaks groundsel and its habitat.

Fickeisen plains cactus – The Fickeisen plains cactus is known from desert scrub communities at two remote locations near the eastern and western boundaries of the North Kaibab Ranger District, Kaibab National Forest. These areas are part of grazing allotments where livestock may be present in the winter months, but cattle are not expected to spend much time in the desert scrub habitat that has relatively little forage. Also, dormant plants will be partly or completely retracted into the soil during winter and not susceptible to livestock trampling. The areas are accessible only by infrequently maintained roads that end at canyon rims on the forest boundary. There is little recreational activity in these areas. These areas have moderate potential for uranium, but the habitat near the western forest boundary is withdrawn from mineral entry and the forest plan has a standard and guideline to restrict use and occupancy yearlong in areas supporting populations of threatened, endangered, or sensitive plants.

Arizona bugbane – The Forest Service has considered Arizona bugbane and its habitat in its actions since 1987 and has implemented many favorable actions. The recreation levels in Lower

West Fork Oak Creek have been monitored since 1996 via trail counters and registration boxes. These populations, evaluated during numerous monitoring visits conducted each year, are known to receive some level of impact (trampling) from recreational hikers and backpackers. The addendum to the sensitive biological assessment and evaluation for the new footbridge built in 1998 (Agyagos 1998) addresses the effects on Arizona bugbane. Coconino Forest Plan Amendment 12, for the Sedona Ecosystem Management Area, listed several goals, objectives, standards, and guidelines developed to protect and enhance Arizona bugbane populations in West Fork, too.

The goals, objectives, standards and guidelines, along with terms and conditions and conservation recommendations from the USFWS, required the numerous trails in West Fork to be rerouted into one (or two) trails that avoid disturbing TE&S plants and animals; implementation of a day-use permit system by 1999; implementation of an overnight camping reservation permit system by 2000; restriction on overnight camping to 1,300 people per year; and monitoring of recreational use in Lower West Fork. Upon implementation of these measures, it is anticipated that impacts to Lower West Fork bugbane populations will be greatly minimized. Funds were available in fiscal year 1999 to design and install interpretive signs at the Lower West Fork Oak Creek Trailhead.

The biological assessment and evaluation (BA&E) for the Windmill Grazing Allotment has been developed and includes species evaluation for the five recorded locations for Arizona bugbane (Green 1998). It was determined that grazing may impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.

A lightning-caused wildfire burned in the summer of 2003 in the upper part of the Fry Canyon population. The short- and long-term effects of this fire have not yet been evaluated. However, the fire was fought with care for the natural resources due to the presence of both a spotted owl PAC in the area and Arizona bugbane population.

Benoit (1997) in the “Environmental Analysis (EA) for Good Enough and Tule Butte 10K Analysis Areas” documented the observations of recreation impacts to TE&S species including Arizona bugbane near Point Trail, which is a known Arizona bugbane site in the upper reaches of West Clear Creek. The EA proposed to implement Management Alternative 5 that differs from the rest of the alternatives in the amount of acres to be burned, total acres of timber harvest, and length of road closure for FR 142E. Closure of FR 142E will more likely reduce the use of Point Trail leading to the Arizona bugbane population.

A wildfire—named the Tram Fire—burned on the south rim of West Clear Creek Canyon in the summer of 2002. Preliminary reconnaissance (Taylor 2002 personal communication) indicated the fire did not impact the Level 1 site of Arizona bugbane, and there would probably be no impacts to the West Clear Creek population as a whole due to the fire.

The Bill Williams Mountain population, located within Bill Williams Botanical Area, is the only population known on the Kaibab National Forest. A planned bike race event in 1996 within the botanical area was rerouted outside the Bill Williams Botanical Area (USDA Forest Service 1996b). The “Biological Assessment and Evaluation (BA&E) (Sheppard, 1998) for the Kaibab National Forest Prescribed Natural Fire Plan” includes a species evaluation for Arizona bugbane. It was determined that the plan “May Impact” individuals of the plant, but is not likely to result in a trend toward Federal listing or loss of viability. A BA&E developed for the recreation site development plan on the Williams Ski Area proposed expansion (USDA Forest Service 1998d)

determined that proposed expansion of the Williams Ski Area would have no impact on Arizona bugbane.

Little variation in both the phenotypic and genetic level in four subpopulations of Arizona bugbane in the Oak Creek Canyon populations (DeWald and Phillips 1996) was attributed to genetic loss over time due to bottlenecks resulting from flood-caused mortality in the plants' riparian habitats. Compton et al. (1998), in a comprehensive worldwide morphologic and DNA genetic study, validated the extreme longevity of the genus and species and the importance of Arizona bugbane since the Tertiary. "The few highly isolated habitats for *A. arizonica* alongside wet streams in the bottoms of canyons or on north-facing mountain slopes of Arizona are probably the last refugia for a once widespread temperate flora" (Compton et al. 1998).

In summary, except for recreational impacts to Arizona bugbane populations in Lower West Fork and Point Trail, no specific human-caused adverse impacts to Arizona bugbane on the Coconino and Kaibab National Forests are known to have occurred. Most of the fluctuations in population numbers seen during monitoring appear to be caused by natural factors such as flooding, drought, wildfire, and windthrow. Natural impacts such as flood and drought cause fluctuations in subpopulations to some degree in the Oak Creek, West Clear Creek, and Bill Williams population areas. Therefore, the positive results anticipated from implementation of any one of the three action alternatives will be additive to the positive actions the forest has taken to date, and will counter stresses such as illegal access and environmental conditions such as prolonged drought that might have deleterious impacts on Arizona bugbane and its habitat.

Kaibab plains cactus – Detailed monitoring of population trends has been conducted from 1987 to present on 14 permanently marked plots in 6 study areas on national forest lands distributed throughout the range of the species (Warren et al. 1992; Frye 1995, 1996, 1998, 2000). Frye increased the number of plots in 1998 and 1999 to 19 to better encompass the range and habitats of the species. According to Frye (2003), the population of *Pediocactus paradinei* over its whole range appears to be declining. No new significant establishment episodes have occurred in the last few years and mathematical projections showing that only 1 of the 14 plots consistently demonstrated a high probability of persistence in the future (Frye 1996) are probably still valid (Frye 2003). Recent field surveys and monitoring in the spring and summer of 2000 showed an apparent sharp decrease in numbers of cacti throughout the range of the species (Phillips et al. 2001; Frye 2000). This decline has been tentatively attributed to conditions caused by the drought from 1998 to the summer of 2000 and substantial predation (presumably by wood rats (*Neotoma* spp.) and black-tailed jackrabbits (*Lepus californicus*)(Phillips et al. 1996)), often observed for Pediocacti during droughts (Phillips and Phillips 1996).

Mechanical treatments such as disking, harrowing and pushing were used extensively on the North Kaibab Ranger District within the pinyon-juniper and shrub/grassland vegetation types. Dozers, beginning in 1954 and ending in 1959, cleared the Kane Canyon area. In 1980 the area was burned and, in some cases, harrowed and seeded. Very few populations of Kaibab plains cacti are known from sites that were subjected to such mechanical vegetation treatments (Phillips et al. 1996). The Kane monitoring plots have very few plants in the plots and these plants are mostly in the largest size class; there has been little recruitment (Frye 2000).

Actions that have been taken on behalf of *Pediocactus paradinei* and its habitat by the Kaibab National Forest, Bureau of Land Management, and others between 1976 and 1996 are listed in Table 1 of the conservation assessment and strategy (Phillips et al. 1996). Actions since 1996

include: road closures; elimination of grazing within a population area under the Burro Allotment Plan; elimination of firewood collection along the East Side Game Road; consultation with Fish and Wildlife on road maintenance projects; and other actions (Anon. 1998; Phillips 1999).

"Manage ungulate grazing and browsing within Kaibab plains cactus habitat so that no long-term detriment to the species occurs" is the management direction applied to the Kane Ranch Allotment Management Project (USDA Forest Service 1999c). *Pediocactus paradinei* is susceptible to trampling by livestock when emergent, and livestock can also remove the grass cover needed by the species. If range conditions improve over the next 5 to 10 years as predicted under the Kane EA, Kaibab plains cacti populations in the project area should improve in numbers and vigor. However, factors such as drought and animal predation will continue to play important roles in the biological and ecological response of the species.

Actions such as past mechanical vegetation treatments have affected the quality of Kaibab plains habitat that occurs today. Other actions that have occurred may continue into the future. Deer antler gatherers frequent the east side of Kaibab Plateau in late winter and early spring when the plants are emergent and vulnerable, and OHVs or other vehicles can run over individual plants and destroy them. The pinyon-juniper woodland is utilized for dispersed recreational activities such as camping, picnicking and activities associated with hunting and pinyon nut harvesting. Cacti crushed and/or uprooted by vehicle wheels have been observed in several instances (Phillips et al. 1996). Illegal collection of the cactus would have detrimental effects on the populations. Changes in herbivore, browsing of understory vegetation, and trampling by ungulates such as deer and antelope, prescribed fires, and use of insecticides could also affect populations.

In summary, Kaibab plains cactus is currently in a very vulnerable state due to both natural and human-caused impacts. Use of herbicides for noxious weed control could also affect individual plants if not carefully regulated. Lack of treatment of cheatgrass could change ecosystem processes such as fire regimes and hydrologic functions in open habitats of Kaibab plains cactus and could add to the effects of severe wildfires in the pinyon-juniper woodlands. Although Kaibab plains cactus appears to be able to survive low intensity wildfires, hot fires kill plants. Also, as wildfires open forest canopies and expose mineral soil, habitat for other opportunistic weeds would increase (Crawford et al. 2001).

Cumulative Effects for Alternative 2 (No Action)

Under Alternative 2 weeds would expand from the current population of 187,500 acres to an estimated 340,645 acres, an 80 percent increase over the next 10 years. Weeds would expand and occupy sites currently occupied by native plants, including endangered, threatened, candidate and sensitive plants. The quality of habitats would continue to decline as weeds intersperse with native species. Weeds can and will alter nutrient cycling and other ecosystem functions and even change an ecosystem's flammability (Walker and Smith 1997). Some weeds out-compete native species by producing allelopathic compounds that inhibit the growth of other species (Callaway and Aschehoug 2000). Russian knapweed and yellow starthistle could kill plants by this means occur adjacent to Arizona cliffrose and Verde Valley sensitive species" habitats.

Expansion of current weed populations will also result from Forest Service implementation of numerous ground-disturbing projects including road construction and maintenance, timber sale activities, forest restoration projects, prescribed burning, revisions of allotment management

plans, watershed restoration, road obliteration, and mining. Inclusion of weed prevention best management practices in all project planning should reduce the potential of new introductions to low levels. Alternative 2 would foreclose any opportunity for a coordinated effort between the three forests, private landowners, and other State, Federal and local entities.

Of all of the ground-disturbing projects listed above, thinning and burning for forest restoration purposes and the associated activities (e.g., skidding, landing construction, and slash pile burning) are the most influential in inducing changes in understory composition and can promote the spread of invasive species (Sieg et al. 2003). Some weeds, such as Dalmatian toadflax and bull thistle, respond particularly well to disturbances like those created by forest restoration treatments. In some cases, especially in wildland-urban interface areas, restoration treatments will effectively break buffer zones that separate areas infested with weeds from those that are not, creating much larger expansion fronts for invasive plants (Sieg et al. 2003). Lack of treatment of all weeds under this alternative will be detrimental to Flagstaff beardtongue, Flagstaff pennyroyal, Sunset Crater beardtongue, Rusby milkvetch, and Arizona sneezeweed.

Severe wildfires open forest canopies and expose mineral soil, which provide habitat for opportunistic species such as invasive weeds (Crawford et al. 2001). Much of the increase in weeds will be due to Dalmatian toadflax and bull thistle, species present in the ponderosa pine vegetation type. Some TEC&S plants, including Flagstaff beardtongue, Flagstaff pennyroyal, Sunset Crater beardtongue, Rusby milkvetch, and Arizona sneezeweed grow in this vegetation type, and lack of treatment under this alternative will be detrimental to these species.

The lack of treatments for nonnative annual grasses will have negative effects on endangered, threatened, candidate and sensitive plants. Annual bromes and wild oats would increase in the lower elevations, causing increased frequency of wildfires that are detrimental to Desert scrub communities not adapted to wildfire. Arizona cliffrose, Tonto Basin agave, Heathleaf wild buckwheat, Ripley's wild buckwheat, Hualapai milkwort and Mearns sage could be impacted. Lack of treatment of cheatgrass would change ecosystem processes such as fire regimes and hydrologic functions at higher elevations, impacting Tusayan rabbitbrush, Fickeisen pincushion cactus, Kaibab Plains cactus and other sensitive plant species in open habitats. The lack of treatments for cheatgrass could add to the effects of severe wildfires in forested vegetation types.

Although other land managers in the project area would continue to be involved in actions to control or eradicate weeds (see discussion under "Direct and Indirect Effects of Alternatives on the Control of Weeds"), lack of sufficient effort and coordination on the part of the Forest Service would greatly hamper the success of such efforts.

Wildlife

Threatened, Endangered, Proposed, and Sensitive Fish Species and Designated Critical Habitat

Direct and Indirect Effects Common to Alternatives 1, 3 and 4

Effects from the treatment methods are analyzed based on their impacts to the following threatened, endangered, proposed and sensitive (TE&S) fish species and/or their designated or proposed critical habitat (CH): Gila topminnow, razorback sucker, Colorado pikeminnow, Apache

trout, Little Colorado spinedace, spikedace, loach minnow, Gila chub, and roundtail chub. There would be no direct effects to TE&S fish species because we are not proposing any treatments targeted toward weeds within aquatic habitats. Treatments would occur within or adjacent to CH for the razorback sucker, Little Colorado spinedace, spikedace, loach minnow, and Gila chub.

It is estimated that 80 percent of total weed occurrences on the 3 forests are 5 acres or less, with a substantial number being less than 1 acre in size. The remaining 20 percent are over 5 acres in size. The majority (~90 percent) of all treatments would occur in the ponderosa pine ecosystem within the Verde and Little Colorado Watersheds that make up the headwaters region of the perennial streams found in the project area. The majority of treatments in the riparian ecosystem would occur along the Verde River and its tributaries. Repeated treatments using various methods would be necessary for most weed species because seeds in the soil can be viable for 5, 10 or more years. Therefore, recurring treatments would be authorized until the desired control objective is reached. The annual combination of methods to be used is expected to vary depending on specific conditions.

Manual, mechanical, and cultural treatments in the upland and riparian areas would result in short-term, localized impacts to vegetation and soil. Best management practices (BMPs) would be applied to mitigate effects to species habitat. The use of biological treatments would have no direct effects to TE&S fish species or their habitat.

The 11 herbicides proposed for use are 2,4-D, Chlorsulfuron, Clopyralid, Dicamba, Glyphosate, Imazapic, Imazapyr, Metsulfuron methyl, Picloram, Sulfometuron methyl, and Triclopyr. All listed herbicides are characterized by relatively low aquatic toxicity under typical concentrations (USDA 1998). There would be no aerial application of herbicides by either fixed-wing or rotary aircraft and no aquatic applications of herbicides. All herbicide applications would follow required protection measures. These features restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. All treatments of weed tree species would be either cut and dab, or straight injection in the bark of the tree.

Direct and Indirect Effects of Alternative 1

There would be no direct effects to TE&S fish species because no treatments would occur within aquatic habitats. Treatments could occur up to the water's edge of aquatic habitat. Application of herbicides near occupied habitat would follow required protection measures. Implementing these features would minimize the toxicity and exposure of herbicides to such small levels as to have an immeasurable effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in upland and riparian areas would result in short-term, localized impacts to vegetation and soil. Implementing BMPs would minimize runoff and soil erosion off of treatment areas so that any sediment moving into species' habitat would be such small amounts as to have an immeasurable effect to the species or its habitat.

Treatments would occur within and adjacent to areas designated or proposed as CH for the razorback sucker, Little Colorado spinedace, spikedace, loach minnow, and Gila chub. Treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and/or soil. Implementing BMPs would minimize runoff and soil erosion off of treatment areas so that any sediment moving into CH would be such small amounts as to have an immeasurable effect to

CH. Implementing required protection measures would minimize the toxicity and exposure of herbicides to such small levels as to have an immeasurable effect to water quality of CH. These treatments would have minimal short-term impacts to the CH primary constituent elements of spawning, nursery, feeding, and rearing habitats, or access to these habitats when inundated. Long-term benefits to CH flood plain areas and its riparian vegetation include improved function due to return to native riparian vegetation.

Direct and Indirect Effects of Alternative 2

There would be no direct effects to TE&S fish species because no treatments would occur in the project area. Noxious weed infestations would continue to increase from the current 187,500 acres to an estimated 340,645 acres over the next 10 years.

The expansion of weeds would lead to long-term degradation of riparian conditions and would result in long-term alteration of the aquatic habitat by interrupting natural relationships of native plants to biological, geomorphologic and hydrologic processes and features such as: streambank maintenance; resistance to flooding; ground water recharge; maintaining channel morphology (e.g. stream width and depth); transport of sediments; maintaining riparian and aquatic habitat food chains; and maintaining stream temperatures. There would be increased fire potential from tamarisk and Russian olive infested areas that would further reduce native riparian vegetation that are not adapted to fire. An indirect impact of this effect would be faster expansion of tamarisk since this species is promoted by fire events. The effects to TE&S fish species and/or CH include a reduction in local populations and adverse changes to aquatic habitat because of direct fire related mortality or indirectly from sedimentation, nutrients, and ash input into the stream.

Upland areas would also be impacted by continued expansion of weeds. This would manifest itself typically by a reduction of native vegetation. The ponderosa pine ecosystem within the Verde and Little Colorado River drainages would be impacted the most since the majority of weed infestations occur in these two watersheds. The loss of native vegetation would reduce vegetative ground cover and infiltration rates and result in increased runoff and soil erosion in the affected areas. The spread of weeds would also alter the natural fire regime and cause an increased probability of wildfire events that would also increase runoff, soil erosion, and ash into streams. The effects to TE&S fish species and/or CH include a reduction in aquatic habitat quality and food supply (e.g. aquatic insects).

Implementation of this action would result in the greatest expansion of weeds throughout the project area and riparian corridors. Impacts are expected to be small in size and localized across the project area. This alternative would have minimal impacts to CH and existing fish species composition and population trends of TE&S fish in the project area.

Direct and Indirect Effects of Alternative 3

Treatment effects would be similar to Alternative 1 because of the implementation of BMPs for manual, mechanical, and cultural treatments. There would be no use of herbicides. Alternative 3 has the third highest effectiveness rate on invasive weeds. Noxious weed infestations would slightly increase from 187,500 acres to 195,870 acres over the next 10 years. This action is effective in controlling the rate of spread on 13 weeds though several woody species would continue to expand in riparian zones. Control/contain objectives for riparian ecosystems would be met on giant reed, Russian knapweed, Himalayan blackberry, and tamarisk. Russian olive, tree of

Heaven, and Siberian elm populations would expand at rates of 5 to 14 percent per year due to lack of treatments because these species can only be effectively treated with herbicides.

The slight increase in invasive weeds would have minimal changes to existing conditions in the project area. Overall, this alternative would maintain aquatic habitat conditions for TE&S fish and/or CH and would not impact existing fish species composition and population trends of TE&S fish in the project area.

Direct and Indirect Effects of Alternative 4

Treatment effects would be the same as for Alternative 1 because of the implementation of required protection measures and BMPs. This alternative has the highest effectiveness rate on invasive weeds of all the alternatives. Noxious weed infestations would be reduced from 187,500 acres to 180,700 acres over the next 10 years. Treatment objectives for riparian ecosystems would be met on Himalayan blackberry, bull thistle, Dalmatian toadflax, whitetop, Russian knapweed, teasel, and tamarisk. Populations of giant reed, Russian olive, and Siberian elm would be eradicated from riparian corridors.

Restoration and/or maintenance of native plant communities as a result of invasive weed control would benefit TE&S fish aquatic habitats in the long term. Overall, this alternative would maintain aquatic habitat conditions for TE&S fish and/or CH and would not impact existing fish species composition and population trends of TE&S fish in the project area.

Cumulative Effects of Alternatives 1-High, 3, and 4

Continued community growth and development in the Prescott area and Verde Valley would have impacts to the Verde River system. In addition, there are still unclaimed water rights by the City of Prescott, the Yavapai Apache Tribe near Camp Verde, and the Tonto Apache Tribe near Payson. Potential impacts include reduction in streamflow from increased water usage and reduced water quality from increased runoff and sediment input from development in the watershed. Reduction in streamflow would have direct effects to TE&S fish and/or CH by reducing habitat quantity (i.e. depth and/or width). Reduced water quality would have indirect effects by reducing habitat quality due to sedimentation that can impact spawning habitats and macroinvertebrate production (food source).

The Forest Service has acquired instream flow rights for the Verde Wild & Scenic River from Beasley Flat downstream 40 miles to the confluence of Red Creek. Application for instream flow rights has been made on the upper Verde River for the benefit of threatened and endangered fishes. Instream flow assessments are being conducted for several tributaries of the Verde River and for East Clear Creek with TE&S fish and/or CH for future application for instream flow rights. Acquisition of instream flow rights in the project area would have long-term beneficial effects to TE&S fish and/or CH by maintaining adequate water quantity to sustain populations.

Management of weeds occurs under the present program of invasive species treatment along the major travel corridors found in the project area and adjacent to it. We estimate that between 1,500 acres and 2,000 acres per year of herbicidal treatments are completed on paved roads under jurisdiction of the Federal Highway Administration with easements executed to the Arizona Department of Transportation. This work will be completed on Interstates 17 and 40, State Highways 89, 89A, 260, and others as well. There would be no direct effects to TE&S fish and/or CH based on the use of mitigation measures. These treatments would result in containment and/or

control of weeds within roadway corridors and would prevent, or at least reduce, the potential of these roadways from infesting the riparian/aquatic areas on the forests. This would have long-term beneficial effects to TE&S fish and/or CH by maintaining riparian/aquatic habitat with native riparian vegetation.

Livestock grazing occurs throughout the watersheds on NFS grazing allotments, State lands, and private lands. Livestock grazing has been excluded on forest lands along 40 miles of the upper Verde River, several of its tributaries, and along East Clear Creek for the benefit of threatened and endangered (T&E) fish and/or CH. This action has resulted in reducing or removing any direct effects to T&E fish populations and/or CH. Range utilization standards and guidelines are also in place on NFS lands and are expected to improve riparian and watershed conditions in the project area. There are short- and long-term beneficial effects to TE&S fish species and/or CH by improving aquatic habitat conditions and maintaining existing populations of fish.

The cross-country travel DEIS proposes to amend the forest plans for the three forests to limit use of off-highway vehicles (OHV) to designated roads and trails. Current management appears inadequate to regulate increasing OHV use on the forests and the impacts associated with these activities. This new direction would reduce impacts to TE&S fish and/or CH and improve watershed conditions by increasing vegetative ground cover and reducing runoff and soil erosion from affected areas. This action would have both short- and long-term beneficial effects to TE&S fish species and/or CH by improving aquatic habitat conditions in affected areas and reducing impacts to local populations of TE&S fish.

Wildland-urban interface projects on the three forests include 10 areas totaling 50,018 acres that drain into the Verde River drainage and 1 project totaling 600 acres that drains into the Little Colorado River. There would be no direct effects to TE&S fish and/or CH from these treatments because they do not occur within the species habitat. Treatment areas are located a distance of 30 to 70 miles from the Verde River; 4 to 37 miles from Oak Creek; 23 miles from Beaver Creek; and 35 miles from the Little Colorado River. This project would improve watershed conditions by returning upland vegetation communities to historic conditions and reducing the potential for severe wildfires. This would result in long-term beneficial effect to TE&S fish and/or CH by maintaining existing aquatic habitats.

The Childs/Irving FERC decommissioning project would return full flows of 43 cfs (cubic feet per second) back into Fossil Creek that are currently diverted and discharged to the Verde River at Childs. This would return the natural hydrograph to 3.75 miles of the Verde River and 14 miles of Fossil Creek, including 5 miles of CH. This would result in short- and long-term beneficial effects to TE&S fish species and/or CH by improving aquatic habitat conditions and increasing local populations of TE&S fish in Fossil Creek.

The Forest Service has completed a native fish restoration project assessment for Fossil Creek. This project would involve construction of a fish barrier in the lower reaches of Fossil Creek to restrict upstream migration of nonnative fish from the Verde River. The creek would be chemically renovated to remove nonnative fish above the barrier and then be repatriated with native species. This would result in short- and long-term beneficial effects to TE&S fish species and/or CH by improving aquatic habitat conditions and increasing local populations of TE&S fish in Fossil Creek.

The Forest Service has completed an environmental assessment and comprehensive river management plan for the Verde Wild & Scenic River within the project area. This project would amend the Prescott and Coconino forest plans for management direction along the 41-mile designated river corridor. Actions proposed to manage river access, recreational activities, livestock grazing, and water quantity and quality impacts would have short- and long-term beneficial effects to TE&S fish species and/or CH by improving aquatic habitat conditions and maintaining local populations of TE&S fish in this reach of the Verde River.

Cumulatively, the effects of these alternatives combined with these activities would not change existing aquatic habitat conditions and would not impact existing fish species composition and population trends of TE&S fish in the project area.

Cumulative Effects of Alternatives 1-Low and 2

Cumulatively, the effects of these alternatives combined with the above activities could have small changes in existing aquatic habitat conditions from expansion of weeds leading to long-term degradation of watershed and riparian conditions and the potential for increased fire frequency which could increase sediments and nutrients into streams and impact TE&S fish and their habitat. These impacts are expected to be small in size and localized across the project area. These alternatives would have minimal impacts to CH and existing fish species composition and population trends of TE&S fish in the project area.

Threatened, Endangered, Sensitive and Management Indicator Wildlife Species

Effects of Biological, Cultural, and Mechanical Weed Control on Wildlife

Weed control methods other than herbicide application that may be implemented, as follows, are presented in Chapter 2 of the EIS. Revegetating roadsides and cut slopes may be an integral part of weed management efforts. Discovery, screening, and release of new biological management agents could lead toward less reliance on herbicides in the future. There is no expected effect on wildlife across the forest from introduction of proposed biological control insects. There would not be any biological control of tamarisk in the project area. Hand pulling and mowing methods may also be implemented. This would involve the mobilization of pulling crews on sites that are difficult to treat by other methods. Long-term utilization of this method would not occur as it is not an effective way to control sizeable weed populations. Short term disturbance effects on wildlife could occur from this treatment method. Also, short term disturbance effects on wildlife from mowing small populations of weeds are expected due to the brief and limited use of this method. These methods, combined with existing educational and prevention programs on the forest long term would eventually further benefit wildlife resources through improved habitat.

Effects of Herbicides on Wildlife

Herbicides that may be used, target weed species or groups of weed species, and target locations where these various herbicides may be applied are presented in Chapter 2. Results of acute, subchronic, and chronic toxicity studies completed on the herbicides proposed for use by the forest are discussed below. The results indicated that use of herbicides by the forest would not cause adverse effects on wildlife or wildlife habitat. Further details about the effects of these herbicides can be found in the “Public Health” section.

Table 22. Toxicity level categories as established by the EPA

Toxicity Level	Measurement
Severely Toxic	LD50 less than 50 mg/kg
Moderately Toxic	LD50 50 to 500 mg/kg
Slightly Toxic	LD50 500 to 5,000 mg/kg
Very Slightly Toxic	LD50 5,000 to 50,000 mg/kg

2,4-D — The toxicity of 2,4-D varies by form of the chemical and organism. In fish, ester formulations tend to be more toxic, while amine salts are practically nontoxic. In birds, 2,4-D ranges from being virtually nontoxic in its butyl ester form to moderately toxic as an amine salt. Mammals are moderately sensitive to exposure. It is relatively nontoxic to bees. Most LD_{50} values for 2,4-D range from 300 to 1,000 mg/kg, though sensitivity varies greatly between animal groups and chemical form (Infoventures 1995b; Ecobichon 2001; Tu et al. 2001).

Studies in rats suggested 2,4-D was not cancer causing, though liver damage was seen at relatively low dosages. Pregnant rats showed no evidence of birth defects, though fetuses showed evidence of toxic effects. No effect on reproduction or fertility has been demonstrated in rats, and 2,4-D did not cause genetic defects in most studies (Infoventures 1995b). While an association between 2,4-D exposure and canine malignant lymphoma has been reported (Hayes et al. 1991), a causal mechanism was not identified. In a recent review of 2,4-D epidemiology and toxicology, Garabrant and Philbert (2002) concluded that evidence that 2,4-D might be carcinogenic was "scant."

2,4-D can bioaccumulate in animals. Residues have been reported in milk, eggs, and meat products. Risk to browsing wildlife, however, appears to be low. A study in Oregon after aerial spraying found concentrations on forest browse plants to be below those able to cause effects in mammals (Tu et al. 2001).

Chlorsulfuron — Chlorsulfuron has a low order of acute toxicity; with oral LD_{50} levels in the male and female rat, bobwhite quail, and mallard duck reported to be >5,000 mg/kg (Infoventures 1995g). The acute dermal LD_{50} has been reported to be >3,400 mg/kg. It is considered to be a mild irritant to the skin and a moderate eye irritant.

Chlorsulfuron is not considered to be a reproductive, mutagenic, or carcinogenic compound as (Infoventures 1995g) reports that rats fed up to 5,000 ppm per day for up to 2 years did not show evidence of carcinogenicity. Teratology studies of rats and rabbits showed no evidence of developmental effects. A 3-generation study in rats showed slight decreased fertility at the highest does of 2,500 ppm, but no decrease in fertility was observed at doses up to 500 ppm. In their mutagenic tests, Chlorsulfuron did not cause genetic damage.

Clopyralid — Clopyralid is of low toxicity to birds and mammals and nontoxic to bees. It does not bioaccumulate in animal tissue. The acute oral toxicity in rats was LD_{50} greater than 4,300 mg/kg (relatively nontoxic). In rabbits, clopyralid had a dermal LD_{50} of greater than 2,000 mg/kg (relatively nontoxic). Clopyralid caused slight skin irritation and eye irritation in rabbits. Rats showed no adverse effects after 4 hours of exposure to concentrations of 1.3 mg/L in air (Infoventures 1995a).

Clopyralid showed no evidence of oncogenicity in a 2-year feeding study in mice or rats at the highest dose tested. It showed no evidence of developmental toxicity in mice and rabbits at the highest dosage tested. No effects on reproduction were observed in study of two generations of rats at the highest dose tested. No evidence of mutagenicity was observed in a number of laboratory studies on mice and rats. Based on the results of these animal studies, clopyralid is not classified as a carcinogen, teratogen, mutagen, or reproductive inhibitor (Infoventures 1995a).

Dicamba — Dicamba is slightly toxic to mammals, nontoxic to birds, and nontoxic to bees but does not bioaccumulate. Based on results of animal studies, dicamba does not cause birth defects, cancer, or genetic damage, and has little or no effect on fertility and reproduction (Infoventures 1995c).

The manufacturing process for dicamba has the potential to result in trace amounts of 2,7-dichlorodibenzo-p-dioxin as a contaminant. It may be present in concentrations up to 50 parts per billion (ppb). The dioxin isomer, 2,3,7,8-tetra-chlorodibenzo-p-dioxin has not been found at the limit of detection (2 ppb) and is not expected as an impurity in dicamba (Pesticide Management Education Program 2001).

Glyphosate — Glyphosate itself is an acid, but it is commonly used in the isopropylamine salt form. When applied to foliage it is quickly absorbed by the leaves and rapidly moves through the plant. It acts by preventing the plant from producing an essential amino acid. Glyphosate is metabolized by some plants, while others do not break it down. Glyphosate will remain in the soil unchanged for a varying length of time depending on the soil texture and organic matter content. The half-life of glyphosate is reported to be from 3 to 130 days (Infoventures, 1995h). Soil microorganisms break down glyphosate and the surfactant used in Roundup® to carbon dioxide.

Glyphosate is reported to be nontoxic in the rat, with a reported oral LD_{50} of 5,600 mg/kg and over 10,000 mg/kg in mice, rabbits, and goats (OSU 1996a). The toxicity of the technical grade acid of glyphosate and Roundup® are nearly the same. The oral LD_{50} for the trimethylsulfonium salt is reported to be about 750 mg/kg in rats, which indicates moderate toxicity (OSU 1996a). The acute dermal LD_{50} for glyphosate and the isopropylamine salt are reported to be >5,000 mg/kg, and the dermal LD_{50} for the trimethlysulfonium salt are reported to be >2,000 mg/kg.

Studies of glyphosate lasting up to 2 years have been conducted with rats, mice, dogs, and rabbits, and with few exceptions no effects were observed (OSU 1996a; Infoventures, 1995d; USDA FS 1996c). Some tests have shown that reproductive effects may occur at high doses (over 150 mg/kg/day), but there have been little to no reports of mutagenic, developmental, or carcinogenic effects.

Imazapic — Imazapic is essentially nontoxic to terrestrial mammals, birds, amphibians, aquatic invertebrates, and insects. It does not bioaccumulate in animals, as it is rapidly excreted in urine and feces (Tu et al. 2001).

The oral LD_{50} of imazapic is greater than 5,000 mg/kg for rats and 2,150 mg/kg for bobwhite quail, indicating relative nontoxicity by ingestion. The LD_{50} for honeybees is greater than 100 mg/bee, indicating that imazapic is nontoxic to bees. Imazapic is nonirritating to eyes and skin, even in direct applications. The inhalation toxicity is very low. Chronic consumption in rats for 2 years and in mice for 18 months elicited no adverse effects at the highest doses administered. Chronic consumption by dogs for 1 year caused minimal effects (Tu et al. 2001).

Imazapic may be mixed with other herbicides such as picloram or 2,4-D. Combining imazapic with other herbicides should not increase the toxicological risk over that of either herbicide when used alone (Tu et al. 2001).

Imazapyr — Imazapyr is practically nontoxic to mammals and birds (Infoventures 1995d; USDA FS 1999d). In birds, the LD_{50} was reported to <2,150 mg/kg and in mammals between 4,800 and 5,000mg/kg (Infoventures 1995d). Imazapyr has not been found to be mutagenic and there has been no evidence to support developmental effects. EPA has classified imazapyr as a Class E compound, one having evidence of noncarcinogenicity.

Metsulfuron methyl — Metsulfuron is practically nontoxic to birds, mammals, invertebrates, and bees. Acute oral LD_{50} was greater than 5,000 mg/kg in rats and 2,000 in mallard ducks; acute dermal LD_{50} was greater than 2,000 mg/kg in rabbits (Infoventures 1995e). Based upon the results of animal studies, metsulfuron methyl is not classified as a carcinogen, mutagen, teratogen, or reproductive inhibitor (Infoventures; Pesticide Management Education Program 2001).

Picloram — Picloram is almost nontoxic to birds, relatively nontoxic to bees, and low in toxicity to mammals. Mammals excrete most picloram residues unchanged and it does not bioaccumulate in animal tissue. Formulated products are generally less toxic than picloram (Infoventures 1995i). Tu et al. (2001) and Infoventures (1995i) report an acute oral LD_{50} for rats for picloram of greater than 4,000 milligrams per kilogram (mg/kg). LD_{50}s were reported to be greater than 2,500 and 5,000 mg/kg for mallard ducks and bobwhite quail, respectively. The acute dermal LD_{50} in rabbits was reported to be greater than 2,000 mg/kg. In laboratory test with rabbits, picloram was not shown to be a skin irritant, but was a moderate eye irritant. Weight loss and liver damage in mammals has been reported following long-term exposure to high concentrations of picloram. Picloram is classified as a Class E carcinogen, a compound having evidence of noncarcinogenicity (Felsot 2001). Picloram showed no evidence of birth defects in rats or rabbits, and it was negative in two tests for mutagenicity (Infoventures 1995i).

Male mice receiving picloram at dietary doses of 1,000 to 2,000 mg/kg/day over 32 days showed no clinical signs of toxicity or changes in blood chemistry, but females did show decreased body weight and increased liver weights. Liver effects were also seen in rats at very high doses of 3,000 mg/kg/day over an exposure period of 90 days, and above 225 mg/kg/day for 90 days. Dogs, sheep, and beef cattle fed low levels of picloram for a month experienced no toxic effects. The ester and amine salt showed low toxicity in animal tests (OSU 1996b).

Based on these studies, picloram does not appear to cause genetic damage or birth defects, has little or no effect on fertility and reproduction, and is not carcinogenic (Infoventures 1995i; Felsot 2001). There have been some concerns expressed that picloram acts synergystically with 2,4-D or other ingredients to cause chronic effects on wildlife. There is some evidence that high concentrations of picloram and 2,4-D esters (note: 2,4-D proposed for use by the forest is an amine formation) have an additive, but not synergistic, effect. Picloram and 2,4-D are both rapidly excreted in an unchanged form by mammals reducing the risk of their interaction. In one study, a test group of sheep was fed a single dose of picloram (72 mg/kg) and 2,4-D (267 mg/kg) and others were fed a mixture of 7.2 mg/kg of picloram and 27 mg/kg 2,4-D for 30 days. There was no evidence of toxicity in any of these sheep (Dow 2001).

No adverse effects on endocrine activity have resulted from numerous studies conducted on mammals and birds to determine picloram toxicity values. The evidence indicates that the endocrine system in birds and mammals is not affected by exposure to picloram at expected environmental concentrations (DOW 2001).

Sulfometuron methyl — Sulfometuron methyl is a slightly toxic compound to wildlife. The oral toxicity of this compound is very low, reported to have oral LD_{50} levels in rats of >5,000 mg/kg (OSU 1996c). Acute toxicity LD_{50} values for bobwhite quail and mallard duck were reported to be <5,000 mg/kg, respectively (Infoventures 1995f). The acute dermal LD_{50} has been reported to be >2,000 mg/kg in female rabbits and >8,000 mg/kg in male rabbits. Sulfometuron methyl is considered to be a mild irritant to the skin and a moderate eye irritant.

Some immunological toxic effects have been reported with chronic exposure to sulfometuron methyl in test animals. Dogs have experienced reduced red blood cell counts and increased liver weights at exposures of 25 mg/kg/day for a year (OSU 1996c). OSU (1994) also reported reduced red blood cell counts and increased liver weights at does of 50 mg/kg/day. Other studies of the carcinogenic, reproductive, and mutagenic affinity of this compound have been negative. No reproductive related effects were noted in rats fed up to 500 mg/kg of sulfometuron methyl in their diets (OSU 1994). Infoventures (1995f) and OSU (1994, 1996c) report that sulfometuron methyl is unlikely to pose a mutagenic, carcinogenic or reproductive risk to animals and humans.

Triclopyr — Triclopyr is a moderately toxic compound. The oral LD_{50} levels in rats have been reported in the range of 630 to 729 mg/kg (OSU 1996d). Acute toxicity LD_{50} values for mammals are reported to be 310 to 713 mg/kg, and ducks were reported to have an oral LD_{50} of 1,698 mg/kg (Infoventures, 1995j). The acute dermal LD_{50} has been reported to be >2,000 mg/kg in rabbits. Triclopyr is considered to be a slight irritant to the skin and eye.

Studies summarized in OSU (1996d), Infoventures (1995j), and USDA FS (1996c) indicated that triclopyr does not pose a carcinogenic, mutagenic, reproductive, developmental risk to animals or humans at doses anticipated for this project.

Effects of Herbicides on Amphibians

Amphibians are potentially the most herbicide sensitive group of wildlife because of their permeable skin and complex life cycles. Most amphibian species require moisture or some form of water to complete their life cycle, and most are aquatic in their egg or larval stages. It is unknown if safety standards for other kinds of vertebrates are adequate for reptiles and amphibians (Hall and Henry 1992).

Carey and Bryant (1995) reviewed the numerous pathways through which amphibians could be impacted by chemicals in the environment. They suggest that adult and larval amphibians are not necessarily more sensitive to chemicals than other terrestrial or aquatic vertebrates. However, sublethal effects can manifest as increased susceptibility to disease, increased predation, altered growth rates, or disrupted development. They suggest “endocrine-disrupting toxicants can have effects at tissue levels well below detectable levels,” and that “toxicants designated as safe should not be considered to be free of endocrine-disrupting effects until proven otherwise.” Their position was substantiated by a recent study indicating that the herbicide atrazine, at concentrations below the EPA drinking water standard, can interfere with larval development in frogs (Hayes et al. 2002). Atrazine is not being considered for use by the Forest Service in this project.

Risk assessments suggest that wildlife, including amphibians, will not be affected by herbicides at the expected exposure levels. Also, there will be a buffer zone around water and wetlands where herbicides will not be applied. This mitigation will minimize the potential for amphibians to be exposed to herbicides during sensitive developmental stages. Cultural, biological and mechanical methods of weed control may have disturbance or mortality impacts on amphibians. During terrestrial stages, amphibians could be trampled or run over by a vehicle or mower, but such events would be rare.

Effects of Herbicide Application on Habitat Diversity

The short- and long-term effects of various herbicides to vegetation composition are discussed in the "Vegetation" section of the EIS. In general, effects on vegetation composition and diversity are dependent on several variables, including specific chemical used, rate of application, and seasonal timing of the application. Several studies (Bedunah and Carpenter 1989; Rice et al. 1992; Rice and Toney 1996) have documented that applications of herbicides at prescribed rates do not eliminate any native or nonnative species from the plant community. The percent composition of noxious weeds, forbs, shrubs, and grasses will change depending upon treatment used.

Effects of Weeds on Wildlife

Introduction of noxious weeds into native plant communities has had a number of negative impacts on various wildlife species. Weeds displace native forage, often reducing forage availability and use; modify habitat structure, such as replacing grasslands with forb-dominated communities; and alter ecosystem interactions, changing how species interact with each other (Duncan 1997). Losensky (1987) found that invasive weed species not only invade but can also replace native grass species. In some areas in western Montana where invasive species have been present for decades, native grass and forb communities have been completely replaced by weeds (USDA FS 2001d). Some bunchgrass dominated winter ranges on the Lolo National Forest produced 1,000 to 2,000 pounds of forage annually, but forage production declined markedly after invasion by spotted knapweed, spurge, and sulfur cinquefoil. Some of these sites were projected to produce 100 pounds of forage per acre within a few decades (USDA FS 2001d). After herbicide treatment in 1997, grass production on Mormon Ridge on the Lolo National Forest increased from 325 to 2,800 pounds per acre, and from 114 to 1,190 pounds per acre on the Sawmill site (USDA FS 2001d).

Bedunah and Carpenter (1989) found a 50 to 90 percent reduction in elk winter forage on bunchgrass sites in western Montana after invasion by spotted knapweed. Lavelle (1986) reported that less than 10 percent of the diet of a wintering elk herd was composed of weed species. Guenther (1989) found that mule deer did not use spotted knapweed, though it was common on their winter range in Montana. A study on a winter range site on the Three Mile Game Range in western Montana reported that, although elk walked through spotted knapweed infested areas, they foraged almost exclusively in an area that had been treated to remove knapweed (Thompson 1996). Elk use increased 266 percent on the site after knapweed removal. Mule deer use of favored foraging habitat on the Theodore Roosevelt National Park was reduced by 70 percent after invasion by leafy spurge (Trammel and Butler 1995).

Other wildlife species are also affected by the invasion of weed species into native habitat. Small mammal populations have been reduced as native vegetation is replaced by knapweed (Kurz

1995). Bird species composition can also change as weed species replace native plant communities (Wilson and Belcher 1989).

Effects of Noise on Wildlife

Vehicles and other ground based mechanized equipment used for weed treatment activities generate noise. Perception of noise is affected by intensity, pitch, and duration with loudness measured in decibels (dB). The sound spectrum (the plot of amplitude vs. frequency) of a sound must be weighted by the auditory function of an animal to characterize its audibility (Bowles 1995). EPA recommends the A-weighted scale to describe environmental noise because it emphasizes frequencies that humans hear best, is accurate, convenient, and used internationally (EPA 1978).

Sound attenuates (fades) as it travels from a source to a receiver. Attenuation is a function of the square of the distance, but is also dependent upon other factors such as altitude of the source, temperature, humidity, wind speed, terrain, and vegetation (Bowles 1995). Noise heard by a human or an animal is dependent on these variables and upon other factors such as ambient noise, and the auditory system and physiology of the animal.

Effects of noise on wild animals can be classified as those affecting auditory physiology and sensory perception, those affecting behavior, and those affecting populations (Bowles 1995). Physiological and sensory perception in wild animals is not likely to be affected by noise generated from weed control operations. Wild animals are free to move away from a disturbance, and negative impacts on physiology or sensory perception are generally from chronic exposure. Noise generated from weed control operations is likely to be sporadic, impulsive, and fluctuating in intensity and duration. Fluctuating noise levels may elevate heart rate, catecholamine levels, and corticosteroid levels in wild animals, but these elevated levels are generally of short duration, and animals often habituate to these disturbances over time. Short-term increases of these measures do not correlate well with stress level experienced by the animal (Bowles 1995). Noise is an environmental stressor, and with repeated exposure all vertebrate animals habituate, or adapt behaviorally as well as physiologically (Bowles 1995).

Behaviors that may be impacted by noise include habitat use, courtship and mating, predator avoidance, and migration (Bowles 1995). Ungulates typically avoid areas where noises are present and return when they are not. If noises are of brief duration and the animal has good cover, change in home range size is not detectable. If mammals are repeatedly exposed to the same noise without harassment, responses to the noise decline rapidly (Bowles 1995). Migration routes are not generally affected by noise, although short detours may increase energy expenditure (Bowles 1995). No detectable changes in population size or growth rate have been documented due to noise, as most effects of noise disturbances are relatively mild (Bowles 1995).

Forest Service Herbicide Risk Assessment

Human health and ecological risk assessments for the application of herbicides to control noxious weeds and other unwanted vegetation have been prepared for the Forest Service (1992a, 1995c, 1996c-d, 1997b, 1998e-f, 1999d-f 2000b, 2001e). These risk assessments evaluate the potential for impacts on terrestrial wildlife from exposure to herbicides. There are difficulties in assessing possible risks because toxicity testing is often performed on laboratory animals, which may not be representative of free ranging wild animals or only a few wildlife species are tested. Also,

controlled exposures in the laboratory may not resemble conditions under which wildlife might be exposed. Possible routes of exposure of terrestrial wildlife to herbicides include direct contact (spray), ingestion of contaminated food items and water, grooming, or indirect contact with contaminated vegetation or substrate. Another limitation is that testing on wildlife species generally includes fewer toxicological endpoints, and lifetime exposure studies are usually not available (Kendall et al. 2001; USDA FS 1999g).

Given these limitations, ecological risk assessments typically employ exposure estimates that yield conservative assessments of possible risk (i.e., overestimate the potential exposure) (Kendall et al. 2001; USDA FS 1992a). Available risk assessments for all considered herbicides generally conclude that under recommended application rates and conditions, the potential risks to individual wildlife are low (USDA FS 1992a, 1995c, 1996c-d, 1997b, 1998e-f, 1999d-f, 2000b, 2001e).

According to a 1992 risk assessment (USDA FS 1992a), estimated exposures exceed high risk only under extreme assumptions for one species, the long tail vole, during the use of 2,4-D, dicamba, and triclopyr (USDA FS 1992a). The wildlife risk assessment was considered to overstate potential risks from pesticide exposure because many of the assumptions used were quite conservative. For instance, no degradation of herbicides was assumed to occur and all sprayed herbicide was assumed to be biologically available. Doses were calculated based upon multiple exposure routes including oral, dermal, and through inhalation. Typical dose estimates for all herbicides and carriers/additives were below EPA low risk criterion (less than 1/5 LD_{50}) for all species. Extreme case exposure analysis resulted in moderate to high risk of toxic effects for several species from several herbicides or carriers/additives. The risk assessment concluded that the low probability of extreme exposures and rapid degradation of herbicides in the environment preclude the possibility of significant adverse effects on wildlife populations or communities.

At the highest anticipated levels of application, sulfometuron methyl may cause hemolytic anemia in herbivores, and there is a “possibility of adverse reproductive effects in potentially sensitive species” (USDA FS 1998d). Small mammals consuming vegetation contaminated with triclopyr immediately after application could suffer impaired kidney function (USDA FS 1996c). These extreme-exposure cases are unlikely, and there are no available data to determine their feasibility.

Opposing Viewpoints

A group of citizens living in the Bitterroot Valley expressed concerns that some wildlife species were exhibiting defects, potentially attributed to herbicide exposure. In 1997, they requested the Montana Department of Fish, Wildlife, and Parks (MFWP) to evaluate road killed deer to determine whether they had suffered injuries from exposure to herbicides or other environmental contaminants. According to MFWP, the deer sampled had no abnormalities outside of those normally occurring in a wild population, and had fewer abnormalities than expected (PF B-49). A subsequent review by another biologist confirmed the abnormalities (PF K-6). In an article published in the Journal of Environmental Biology, the author presented data on genital abnormalities in white tailed deer in the Bitterroot Valley. Possible causes of the genital anomalies, centering on endocrine disrupting pesticides, are discussed. The authors stated that no conclusions of cause and effect can be currently justified (Hoy 2002).

Some people have expressed concern regarding use of herbicides even though available studies and evidence suggests minimal or no potential negative impacts on wildlife or the environment. Chief concerns include: endocrine disruption, immune system disturbance, synergistic reactions, bioaccumulation, persistence in environment, low dose impact, migration through the environment, lack of data and transferability of knowledge. These concerns generally arise out of the uncertainty. The "Public Health" section of the EIS presents information and discussion on these subjects as they relate to human health. However, that discussion applies generally to wildlife, particularly since toxicity testing is carried out on laboratory animals and not on human subjects.

Field studies attempt to address exposures to organisms outside the controlled environment of a laboratory. The complexity of natural systems confounds interpretations of cause-and-effect relationships in wildlife and human health studies and is exemplified by the subject areas of carcinogenic effects of herbicides (Blair 1996; Ecobichon 2001) and endocrine disruption (Rogers and Kavlock 2001; National Academy of Sciences 1999; Carey and Bryant 1995). While some of these effects have been either associated or identified with members of the general chemical group of "pesticides," the chemicals typically implicated are fat-soluble insecticides or other chemicals unrelated to the herbicides considered for application (Blair 1996; National Academy of Sciences 1999). There is little evidence to suggest that application of the proposed herbicides at the anticipated rates of application will induce such effects (USDA FS 1992b, 1995c, 1996c-d, 1997b, 1998e-f, 1999d-f, 2000b, 2001e).

Amphibians are potentially the most sensitive to herbicides because of their complex life cycles and more permeable skin. Almost all amphibians require moisture to complete their life cycle, and most are aquatic in their egg or larval stages. Hall and Henry (1992) summarized the status of studies to assess effects of pesticides on reptiles and amphibians. They concluded that there is insufficient data to determine if safety standards for other kinds of vertebrates are adequate for reptiles and amphibians.

There is no evidence indicating that herbicides considered for application would pose risks to wildlife at the recommended application rates and expected exposure levels. It should also be noted that the forest would use an adaptive management approach for managing weeds. Information obtained from monitoring studies and new information regarding herbicides would be used to reduce effects should they become evident.

Direct and Indirect Effects Common to Alternatives 1 and 4

Manual, mechanical, herbicidal and cultural treatments would cause minimal disturbance impacts to wildlife and their habitats. These treatments are plant specific and have limited impacts on ground cover and habitat conditions. While crews are in the area working, some wildlife species may be temporarily displaced, but the disturbance would be limited in extent and duration. These short-term disturbances to wildlife would be offset by the habitat improvement of removing noxious weeds and achieving treatment objectives on the weed species found in the project area. Also, the relatively small areas proposed for treatment proportional to the entire available habitat makes these impacts immeasurable on a population level for most species. Breeding season timing restrictions and nest area buffers in the required protection measures in Appendix B would reduce the likelihood of disturbance impacts to birds during the breeding season.

Biological controls would create no disturbance to vertebrate animal species or desirable forage species. They could interact with other insects, but the controls have been extensively tested and shown not to have adverse impacts on native insect or plant species.

Implementing the required protection measures in Appendix B during chemical treatments would not be noticeably disruptive to wildlife. Because crews applying herbicides would be in the area for a limited time period, displacement of wildlife resulting from these treatments would be of short duration and within a relatively small and limited area. Also, application methods would be commensurate with existing uses and activities within the area so as not to cause additional disturbance to wildlife using the area.

The herbicide toxicity information can be applied to animals found on the three national forests covered by this proposal. For threatened, endangered species, sensitive, and management indicator species, under typical exposures, no species are at risk. Though 2,4-D, dicamba, and triclopyr may have adverse impacts on the animals listed above if directly sprayed on the animals, the likelihood of this occurring is very low. Dicamba could potentially be used on several weed species, including Malta starthistle and spotted knapweed. Triclopyr would be used almost exclusively for treatment of tree of Heaven, Russian olive, tamarisk, and Siberian elm. The method of application will be cut and daub or injections into the bark, with no broadcast spraying involved. The chances of herbicides impacting any native wildlife by this method of application are very remote.

Though we predict moderate to high use of the herbicides 2,4-D and dicamba and low utilization of triclopyr as compared to other products, we do not anticipate any adverse impacts on wildlife species from a toxicological standpoint. The maximum amount of area that might be treated with dicamba or 2,4-D is relatively minor as compared to the total project area. Triclopyr is scheduled for use on an average of less than 500 acres per year. We project that the low incidence of use and prescribed rate below what is recommended from the risk assessment would limit the risk of toxicological impacts to wildlife.

Direct and Indirect Effects of Alternative 1 (High and Low)

Most weed populations are small and scattered, so treatments that occur under this alternative would be localized. Only 0.7 percent of the land area in the national forests would be treated; of that, only 0.4 percent would be herbicide treatments. As described above, the treatments may create a short-term disturbance while people are in the area working. For weeds with large populations—like Dalmatian toadflax—only a portion of the population could practically be treated at one time, so the effects would be similar to small populations of weeds.

The most common direct effect of this alternative is the disturbance associated with treatments. Breeding season timing restrictions and nest buffers, as well as limiting treatment methods during the breeding season, would remove or reduce disturbance impacts for all species considered. See Table 23 for impacts to individual species.

The proposed application rates are typically well below the recommended amounts as disclosed in the risk assessment. These rates, combined with the low amounts of national forest to be treated in any given year, would reduce the potential for any toxicological problems to very low levels.

By implementing the breeding season timing restrictions and nest buffers in Appendix B and applying herbicides per the required protection measures and RPMPA summary table in Appendix B, toxicity impacts from herbicides have been reduced to an immeasurable level for all species being addressed.

Direct and Indirect Effects of Alternative 2

This alternative has the potential for the highest loss of wildlife habitat. Nonnative weeds would spread at the fastest rate because there is no action to contain them, which leads to the most loss of habitat. Over the next 10 years, weeds would expand from 187,000 acres to 340,645 acres. Weed spread after that time period could be exponentially greater and cause large losses in available forage for MIS ungulates such as elk, mule deer and pronghorn during the next 10-year period. Leafy spurge, Russian knapweed, cheatgrass, and thistles would also expand and invade previously uninfested grasslands, replacing palatable, nutritious feed for elk, deer, and pronghorn.

Over time, as weeds spread unchecked, tree structure along riparian areas could change from cottonwoods, willows, and other associated species to a near monoculture of tamarisk with some scattered Russian olives. This would reduce nest areas and forage for species found in this ecosystem including yellow-billed cuckoo, southwestern willow flycatcher, Lucy's warbler and Bell's vireo.

As Dalmatian toadflax and bull thistle populations expand and grow into one another, small mammal populations would diminish, resulting from losses of forage and cover. This would invariably reduce the prey base for many raptor species including northern goshawks and Mexican spotted owls.

Increased annual grass populations could increase fire frequency in desert scrub vegetation types to a point that frequent fires reduce native plant species including cliffrose and agave that are not fire adapted. This could lead to losses of local populations of butterflies, skippers and agave borers.

Direct and Indirect Effects of Alternative 3

Most weed populations are small and scattered, so treatments that occur under this alternative would be localized. As described above, the treatments may create a short-term disturbance while people are working in the area. For weeds with large populations—like Dalmatian toadflax—only a portion of the population could practically be treated at one time, so the effects would be similar to small populations of weeds.

The most common direct effect of this alternative is the disturbance associated with treatments. Breeding season timing restrictions and nest buffers, as well as limiting treatment methods during the breeding season per Appendix B, would remove or reduce disturbance impacts for all species considered.

This alternative would result in the second highest loss of wildlife habitat. Almost half of the treatment acres would be steaming. However, steaming would be used primarily on annual weeds in roadsides and heavily disturbed areas with little existing native vegetation. Burning is a short-term impact and wildlife is adapted to fires so the effects would be small and within the range of normal disturbances. Hand pulling and biological controls would have a very small disturbance impact to wildlife and would be beneficial to the habitat by maintaining native plant species. Only

13 weed species would reach contain/control objectives under this alternative. Treatments would not keep up with the rate of weed spread, and the number of acres occupied by weeds would increase by 4 percent. A greater proportion of wildlife habitat could be negatively impacted by weeds than under Alternative 1-High or 4.

Direct and Indirect Effects of Alternative 4

Most weed populations are small and scattered, so treatments that occur under this alternative would be localized. Only 0.7 percent of the land area in the national forests would be treated; of that, only 0.4 percent would be herbicide treatments. As described above, the treatments may create a short-term disturbance while people are in the area working. For weeds with large populations—like Dalmatian toadflax—only a portion of the population could practically be treated at one time, so the effects would be similar to small populations of weeds.

The most common direct effect of this alternative is the disturbance associated with treatments. Breeding season timing restrictions and nest buffers, as well as limiting treatment methods during the breeding season, would remove or reduce disturbance impacts for all species considered.

The proposed application rates are typically well below recommended amounts as disclosed in the risk assessment. These rates, combined with the small areas of national forest to be treated in any given year, would reduce the potential for any toxicological problems to very low levels.

By implementing the breeding season timing restrictions and nest buffers in Appendix B, and applying herbicides per the required protection measures and RPMPA summary table in Appendix B, toxicity impacts from herbicides have been reduced to an immeasurable level for all species being addressed.

Alternative 4 would have similar effects as those described for Alternative 1-High. This alternative could potentially reach control objectives for 22 of 24 noxious and invasive weed species. The decline in total infestations is 6,800 acres, and control is achieved on the most difficult and noxious and invasive plants.

While the treatment areas are so small as not to influence any species or population of species, preventing the uncontrolled spread of noxious or invasive weeds would prove beneficial to many species including: Mexican spotted owl, northern goshawk, Southwestern willow flycatcher, Mexican garter snake, and Wupatki Arizona pocket mouse. Considerable control of weed populations would be achieved in riparian areas which would benefit many MIS species, such as the yellow-breasted chat and Lucy's warbler. This alternative reduces noxious and invasive weeds to low levels and promotes regeneration of native woody and herbaceous plants.

Cumulative Effects of Alternatives 1, 3 and 4

The cumulative effects area includes the project area. To date, of the wildlife and fish species discussed above, amphibians seem to be most susceptible to some of the proposed chemical treatment methods.

Other activities with potential to improve overall habitat conditions for native wildlife species include: 1) current control efforts undertaken by the Arizona Department of Transportation (ADOT) which is curtailing expansion in noxious weeds in road corridors under their jurisdiction; 2) control efforts completed through various weed management areas; 3) implementation of a

tamarisk control program in Grand Canyon National Park within the Little Colorado Watershed; and 4) the proposed control efforts to curb off-road vehicle use within the project areas. All four actions will improve large areas of wildlife habitat, especially in riparian areas, and could impact overall survivability of species found in this ecosystem.

Other activities that should promote wildlife habitat are the revision of livestock grazing allotment management plans for all grazing units by 2010. Roughly 50 to 60 percent of all grazing allotments found within the project area have had NEPA completed at which time new grazing guidelines were implemented. Continually implementing grazing guidelines, completing range related work, and modifying both livestock numbers and season of use will improve the herbaceous understory, especially the cool season grass component.

Reducing the number of small diameter trees on approximately 50,000 acres in the ponderosa pine ecosystem will not only decrease the potential for wildfire but also increase forage for herbivorous native wildlife. This should increase the quantity and quality of habitat for the management indicator species like elk, turkey, and antelope as well as improve foraging opportunity for many small mammals and birds. This should increase the prey base for not only raptors but other predatory species as well.

The Forest Service has acquired instream flow rights for the Verde Wild & Scenic River from Beasley Flat downstream 40 miles to the confluence of Red Creek. Application for instream flow rights has been made on the upper Verde River for the benefit of all wildlife species though threatened, endangered, and sensitive animals are of prime importance. Instream flow assessments are also being conducted for several tributaries of the Verde River and for East Clear Creek to provide additional high quality habitat. Acquisition of instream flow rights in the project area would promote such species as the Southwestern Willow Flycatcher, bald eagle, peregrine falcon, river otter, beaver, numerous bat species, and migrating birds.

Selection of either of the alternatives using herbicides to control noxious or invasive weed populations would result in maintaining or slightly improving existing habitat for various wildlife species. Even combined with other habitat improvement projects, the relatively small habitat areas improved by treatments in Alternatives 1 and 4 in proportion to the entire project area would not be large enough to impact any species or local populations.

The list of past, present or reasonably foreseeable future projects impacting species within the project area with disturbance impacts similar to this project would most likely include ongoing highway rights-of-way maintenance projects, developed and dispersed recreation, varieties of trail uses, and uses occurring along roads. Most of these activities may produce a low level of disturbance of short duration. However, documenting known species' occurrences in the presence of these ongoing activities supports the premise that individuals of the species have habituated to the ongoing activities and associated disturbances.

By implementing required protection measures listed in Appendix B, cumulative effects from disturbance for this alternative are removed or reduced to levels that would not have any measurable impacts to any species considered.

It would be impossible to assess the impacts of herbicides from private property. However, cumulative effects from herbicides in Alternatives 1 and 4 are not expected to impact any species as the herbicide levels proposed for use are well below toxic levels for this project and other ongoing projects along highway rights-of-way.

Disturbance from motorized vehicles associated with weed treatment activities would add to existing disturbance to wildlife occurring throughout the forest and on adjacent property due to recreational use, particularly off-road motorized traffic in summer and winter, forest management activities, and increasing development of adjacent private property.

Cumulative effects common to Alternatives 1 and 4 include herbicide exposure (minimal for most or all species) combined with exposure to other weed control programs and land management actions.

Other past activities that have impacted wildlife on the forest include widespread fires in the early part of the twentieth century, followed by nearly 100 years of fire suppression, which changed the structure and distribution of vegetation on the forest; timber harvest and road building especially in the second half of the twentieth century; livestock grazing throughout much of the forest; and invasion of noxious weeds into the forest. Livestock and wildlife grazing on summer and winter ranges increases the probability of weed invasions in many areas through several avenues, including direct spread of seeds, decreasing vigor of some plants through localized overgrazing, and creating areas of bare or disturbed soil through soil trampling.

Increases in dispersed recreation—including increased OHV use—have probably increased disturbance impacts to all types of wildlife in all seasons. Without detailed studies, it is impossible to determine the extent of the effects of these activities on various species of wildlife.

Foreseeable future impacts on wildlife include increasing recreation on public land, increasing off-road vehicles such as snowmobiles and “four-wheelers,” more frequent catastrophic fire, and continued spread of noxious weeds.

Increased disturbance from motorized vehicle use associated with weed treatment in Alternatives 1, 3 and 4 would add to current levels of disturbance to wildlife throughout the forest and on adjacent land due to forest management activities and recreational use of the forest, particularly off-road motorized traffic in summer. Under all alternatives, ADOT would continue to treat weeds in areas adjacent to the forest. Wildlife would be potentially exposed to herbicides used in those areas.

Implementing Alternatives 1, 3 or 4 would reduce cumulative effects of future weed spread on wildlife inhabiting the forest and adjacent property commensurate with the number of acres treated under each alternative. Alternative 1 would have the greatest positive impact on forage production, followed by Alternatives 4 and 3, respectively. Implementation of Alternative 2 (No Action), would cumulatively add to the negative impacts on wildlife of weed infestations on the forest and adjacent properties.

Threatened, Endangered, and Sensitive Species — Due to the minimal potential for impacts to threatened, endangered, and sensitive species from implementing the action alternatives, and the environmental protection measures associated with other ongoing and reasonably foreseeable activities on the forest, no cumulative effects would result.

Cumulative Effects of Alternative 2 (No Action)

Under Alternative 2, no additional control of weeds would occur on proposed treatment areas. Negative impacts on wildlife would include those associated with continuing loss of grass and forb cover, and vegetative diversity. Positive impacts would include no additional human

disturbance from noise, vehicles, and ground personnel for short periods of time, and no exposure to herbicides.

A number of studies have documented negative effects of weed infestations on wildlife. Grass and forb production can be reduced considerably or, in some cases, eliminated on winter ranges and elsewhere. Big game, small mammals, and ground nesting birds and their predators would be negatively impacted. Shrub production can be affected over time, negatively impacting big game, birds, and their predators. Increased sedimentation from weed infestations can affect water quality, aquatic organisms, and amphibians.

If the No Action Alternative were implemented, changes in vegetation composition would be long term and negatively impact ungulates, small mammals, and birds as grasses, forbs, and shrubs would be replaced by weeds. Winter ranges for elk, mule deer, and bighorn sheep would decline in condition, decreasing carrying capacity and populations of these species on the forest.

Habitat for some small mammals, particularly those inhabiting grasslands and meadows, would be reduced as weed species reduce grass and forb cover and composition. Forest bird populations would be negatively impacted, including many neotropical migrant songbirds dependent on grasslands, meadows, and shrubs for nesting and foraging. Predators of all affected wildlife would also be impacted negatively. These predators include owls, hawks, and falcons.

The effects of increased weed populations from the No Action Alternative may be exacerbated by other ongoing activities that are also expanding or spreading weed populations. Those activities include developed and dispersed recreation, hiking, horseback riding, livestock grazing, OHV use, and other forest management activities such as timber harvest, prescribed burning, road maintenance, and brush crushing.

Threatened, Endangered, and Sensitive Species — The No Action Alternative would allow weed infestations to intensify and spread on proposed treatment sites. Loss of vegetative cover and species diversity would not directly impact most of the special status species discussed above, but could indirectly impact those species whose prey base may be reduced by an increase in weed infestations. Those species include peregrine falcon, Mexican spotted owl and northern goshawk.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Black-footed ferret (BFF)	E	X	X		Prairie dog towns. Prairie dogs rely on native vegetation for food and cover. There are no known BFF populations on NFS lands.	Negative – weeds would eliminate food of prairie dog which is ferret prey.	With no known populations, there would not be any impacts.
California condor	E		X		Condors are cliff or ledge nesters. They have been introduced in the House Rock Valley north of the Grand Canyon. They are frequently seen foraging in the Grand Canyon.	Neutral – weeds should not affect food or physical habitat.	Conservation measures include calling FWS to determine condor roosting locations or foraging sites along roads prior to treatments along roads in known condor range. Avoiding condors during treatments would alleviate disturbing the condors so treatments have no impact.
Kanab ambersnail	E		X		Kanab ambersnails are known to occur in the Grand Canyon and may have suitable habitat in Kanab Creek Wilderness. Kanab ambersnails use monkey flower and watercress for foraging and egg laying.	Negative – Tamarisk may be reducing native aquatic vegetation required by the species. Long-term potential for loss of limited riparian habitat to increased weed populations could negatively impact the species by reducing native vegetation used by Kanab ambersnails.	No treatments would occur in aquatic habitat. Required protection measures would ensure that herbicide treatments near habitat would not impact Kanab ambersnail by limiting applications to preclude any toxic impacts.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Southwestern willow flycatcher (SWFF)	E, PIF	X		X	SWWF breeds principally (at low elevations) in dense willow, cottonwood, and tamarisk thickets and woodland along streams and rivers, and (at high elevations) in pure, streamside stands of Geyer willow. Also known to use tamarisk and Russian olive for nesting. Breeding success may be heavily affected by predation and brown-headed cowbird egg parasitism. They are known to occur along the Verde River.	Neutral – have been shown to nest in tamarisk. While it is important to retain existing and potentially suitable SWWF nesting sites in tamarisk stands, there is long-term potential for loss of limited riparian habitat where tamarisk dominated sites can facilitate a periodic fire regime detrimental to riparian vegetation and ecosystems.	By implementing the required protection measures with the action alternatives, current nest stands would be maintained whether comprising native or nonnative tree species. Breeding season timing restrictions and buffers around nest patches would reduce the impact of any disturbance to nesting SWWF from treatments so as to be discountable. Treatments would occur so far from occupied nests that there would not be disturbance impacts to nesting SWWF using the patches. Planting native willows after treatments would expedite establishing future nesting stands of native tree species.
Yuma clapper rail (YCR)	E, PIF	X			Typically nests in marshy areas with cattails. Rarely occurs within the project area. Known once from Tavasci Marsh, adjacent to the project area. Potential for nesting occurrence in the project area is very low.	Negative – needs marshy vegetation. Long term potential for loss of limited riparian habitat to increased populations of nonnative weed species could preclude the opportunity for future occurrences of individuals but would not impact the species.	Breeding season timing restrictions and buffers around nesting areas would make any disturbance or toxicity impacts to YCR from weed treatments discountable.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Bald eagle	T	X	X	X	The species occupies Arizona primarily as a winter resident or migrant, with 200-250 individuals normally wintering in the state. These birds can be found statewide but mostly in the White Mountains and along the Mogollon Rim. A small resident population of approximately 40 pairs nests primarily along the Salt and Verde Rivers. On the PNF, Lynx Lake is a relatively new nesting site. On the CNF, Mormon Lake is an important winter roosting site. On the KNF, scattered individual winter roosts are known to occur near the small lakes and tanks around Williams.	Neutral – terrestrial weeds should not affect prey or physical habitat.	Implementing the conservation measure recommended by the FWS of a half-mile buffer from occupied nests would remove any impacts of disturbance or toxicity to bald eagles from any weed treatment method. Putting a buffer around winter roosts would also prevent disturbance effects to roosting bald eagles.
Chiricahua leopard frog (CLF)	T	X			The CLF occurs locally in central Arizona in rocky streams and wetlands. Although it is an opportunistic breeder, it generally breeds in the early spring at elevations below 1,800 meters and in the summer at elevations higher than 1,800 meters. CLF distribution overlaps with northern leopard frog habitat at higher elevations and	Neutral – physical habitat may be more important than vegetation.	No treatments would occur in aquatic habitat. Required protection measures limiting types and timing of herbicide applications would ensure that impacts from herbicide treatments near CLF habitat would be insignificant. Given the particular aquatic herbicides that would be used near the habitat and the limits on use tied to precipitation, any amounts of herbicides that got into

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
					lowland leopard frogs at lower elevations (600-1800 meters).		occupied waters would have insignificant impacts to CLF.
Mexican spotted owl (MSO)	T, MIS, PIF	X	X	X	The MSO is known to nest in high elevation mixed conifer, pine-oak and canyons. Critical habitat occurs on all three forests within the project area. CNF – Unknown population trend KNF – Downward population trend PNF – Not an MIS	Negative – weeds could reduce prey habitat for small mammals and passerine birds. Long-term potential for weed population increases to reduce or replace native plant species and reduce the amount of MSO prey species' habitat and subsequently negatively impact the population trends for the MSO on the CNF and KNF.	Implementing breeding season timing restrictions, nest buffers, and restricting the treatment methods to be of a similar nature as ongoing recreational uses within PACs would reduce the disturbance or toxicity impacts to MSO from treatments to be insignificant. Given the low likelihood or level of impact from treatments, this alternative would not impact the population trend for the MSO on the CNF or KNF.
Yellow-billed cuckoo (YBC)	C, S, PIF	X		X	This species is associated with mature stands of cottonwood-willow riparian deciduous forest.	Negative – weed trees could replace the dense cottonwood/willow habitats they need. Long-term potential for loss of limited riparian habitat to increased populations of noxious or invasive weeds could reduce the native plant species used for nesting and negatively impact the species.	Breeding season timing restrictions and buffers around nesting areas would make any disturbance or toxicity impacts to YBC from weed treatments unlikely to occur.
American peregrine falcon	S	X	X	X	The species nests at cliffs throughout the state, even at some distance from water. Nesting sites are known on Granite Mountain, Thumb Butte,	Neutral – weeds won't affect nesting habitat on cliffs. Peregrines eat diverse and common prey species in varied habitat.	There would be no direct effects from treatments as peregrines' nest on cliffs and no treatments would occur in those areas. No indirect effects as relatively

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
					Sycamore Canyon, Bill Williams Mtn. and Sitgreaves Mtn. Peregrines nesting in the Grand Canyon probably forage on the KNF.		small isolated areas of weed treatments would not impact peregrine foraging behavior or prey species' relative abundance.
Arizona night lizard	S	X		X	Arid and semiarid granite outcroppings and rocky areas, among fallen leaves and trunks of yuccas, agaves, and Joshua trees.	Neutral – physical habitat is more important than vegetation. Boulder habitat would not be impacted by weed expansion.	There would not be any direct effects as Arizona night lizards occur between granite rocks where treatments would not occur. There would not likely be any indirect effects as they also forage in the same boulder habitat where treatments would not occur.
Bell's vireo	S	X			Bell's vireos occupy dense riparian thickets as well as mesquite and oak thickets near water in semiarid areas. They eat insects. The decline in the Bell's vireo population is largely due to brood parasitism by the brown-headed cowbird. They occur in the lower elevations of the Coconino NF.	Negative – needs dense native riparian vegetation for nesting and foraging. Long-term potential for loss of limited riparian habitat to increased populations of noxious or invasive weeds could reduce native plant species used by Bell's vireo and subsequently negatively impact the species.	There would not be any direct effects as Bell's vireo have not been documented using tamarisk or other nonnative tree species for nesting or foraging. While treatment of nonnative tree species may disturb adjacent nesting vireos, the disturbance would likely be of short duration and intensity. Restoring native vegetation for nesting and foraging would improve habitat quality and quantity but may not offset the impacts of nest parasitism by cowbirds.

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
California floater	S	X			It depends on fish to be moved around. Diet may be comprised of detritus, animal plankton, and bacteria. Habitat is shallow areas, less than 2 meters deep, in unpolluted lakes, reservoirs and perennial streams. Adults typically live in mud or sand and juveniles live in loose sand. The elevation range is 4,000 to 8,000 feet. Clams are historically found in Arizona in the Black, Salt, Santa Cruz, Verde, Gila, and Colorado Rivers. There is a record of the species from East Clear Creek on the Blue Ridge district (AGFD 2004).	Neutral – physical habitat may be more important than vegetation.	With no treatments occurring in aquatic habitat, there would not be any direct effects. All of the herbicides proposed for use near water have a zero ecotoxicity for freshwater mollusks so there should not be any indirect effects from weed treatments.
Comstock's hairstreak	S	X			This butterfly is reported mostly from the Upper Sonoran Zone desert canyons and from transition to Canadian Zone (rarely alpine) woodland, sagebrush and chaparral in the Rockies. Favors dry, rocky areas of foothills and canyons of the Upper Sonoran plateaus from 5,000 to 6,000 feet. Their larvae feed on buckwheat. They have a single brood with adults present from March-May.	Negative – It is unlikely that noxious weeds would eliminate the host plant, buckwheat, although cheatgrass invasion has been identified as a threat (USGS 1999). Slight potential for increased fire frequency to alter vegetation composition to eliminate buckwheat that is not fire resistant. This could result in reduced habitat quantity and negatively impact local populations.	Few treatments are likely to occur within dry rocky areas or canyons. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this butterfly.

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Early elfin butterfly	S	X			Favors roadsides with flowers. Eggs are laid singly on flower buds of the host; larva feed on cliffrose buds, flowers, and young. It is locally uncommon among arid plateaus and desert mountains from 6,000 to 7,000 feet. They have a single brood with adults present from March-April.	Neutral – It is unlikely that noxious weeds would eliminate the host plant, cliffrose. However, increased cheat grass could increase the fire frequency so as to reduce native plant species including cliffrose. This could lead to losses of local populations of butterflies.	While some treatments may occur near occupied or suitable habitat, it is not likely that the butterfly would be impacted by any treatments. Herbicide applications would include direct spraying on target weed species, so there is no potential for drift impacting adjacent cliffrose plants or butterflies.
Fossil springsnail	S	X			This species is found in springs and seepages feeding Fossil Creek, including Fossil Springs in Yavapai and Gila counties, elevation 4,310 feet. Springsnails of the genus Pyrgulopsis typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.	Neutral – physical habitat may be more important than vegetation.	No treatments would occur in aquatic habitat. Required protection measures would ensure that herbicide treatments near habitat would not impact Fossil springsnail by limiting applications to preclude any toxic impacts.
Freeman's agave borer	S	X			Requires agave host (*Agave chrysantha*) but also far ranging with wider habitat use. *Agave chrysantha* is found between 2,300 and 7,000 feet in Yavapai County. Blooming from May-August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It	Neutral – uses agaves which would probably not be affected by weeds. However, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant species including agave. This could lead to losses of local populations of agave borers.	Few, if any, weed treatments are proposed in or near habitat with agave. Mechanical treatments would not impact the borer. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
					hybridizes with *A. parryi* var. *couesii* and *A. delamateri* in Yavapai County. Inhabits canyons. Adults fly from September through November.		habitat. No potential for impact to this insect.
Giant aryxna skipper	S	X			The immatures of these fall-flying large skippers burrow into the leaves and stalks of various species of agave. In southeastern Arizona, the best flights occur around the first of October. Adults do not take nectar, but are often found at puddles and other sources of moisture, and prefer steep cliff faces and road cuts. The larvae are well documented leaf borers of *Agave palmeri*. In southeast Arizona, it occurs mostly in canyons with good stands of agave. Host plants are *Agave chrysantha* and *A. deserti*. *Agave chrysantha* is found between 2,300 and 7,000 feet in Yavapai County. Blooming from May-August, it can be found on open, rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with *A. parryi* var. *couesii* and A. delamateri in Yavapai County. *Agave deserti is* not known from Coconino or Yavapai Counties.	Neutral – uses agaves which would probably not be affected by weeds. However, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant species including agave. This could lead to losses of local populations of skippers.	Few, if any, weed treatments are proposed in or near habitat with agave. Mechanical treatments would not impact the skipper. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this insect.

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Lowland leopard frog (LLF)	S	X		X	This species is generally restricted to permanent waters below elevations of 3,000 feet. It is found in small to medium streams, and occurs in small springs, stock ponds, and occasionally in large rivers. Populations typically occur in aquatic systems with surrounding desert scrub, semidesert grassland, or evergreen woodland. LLF is known to occur along Turkey Creek, Hassayampa River, and Blind Indian Creek on the PNF. May occur at stock tanks or small ponds on the KNF and CNF.	Neutral – physical habitat may be more important than vegetation.	Effects identical to Chiricahua leopard frog.
Maricopa tiger beetle	S	X		X	Habitats for this species are always sandy, riparian areas such as streambanks, edges and sand bars.	Neutral – physical habitat may be more important than vegetation.	Neutral – For those herbicides approved for use near riparian habitat, all have zero ecotoxicity for aquatic arthropods. Most treatments near or in beetle habitat would include cut and daub that would not have any direct or indirect effects to Maricopa tiger beetles.
Mexican garter snake	S	X		X	Occurs primarily in permanent marshes and streams at middle elevations in central, south-central and southeastern Arizona. This species may occur along the Verde River.	Negative – weeds could replace native cienega habitat used for cover and by prey species. Long-term potential for loss of limited riparian habitat to increased weed populations	Neutral – Treatments would not have direct effects to Mexican garter snakes as the treatments would not occur within the snake's habitat. Treatments on the periphery or adjacent to occupied

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
						could reduce native plants used as cover by the species and its prey and could negatively impact Mexican garter snake populations along the Verde River.	habitat may disturb snakes but would eventually improve Mexican garter snake habitat by restoring native plants used for cover and foraging. Treatment areas are so small as not to impact the populations or the species.
Narrow-headed garter snake	S	X		X	Occurs from central Arizona to western New Mexico and south to central and western Chihuahua and northern and western Durango, Mexico. In Arizona, known primarily from streams draining the Mogollon Rim and the White Mountains. Highly aquatic species, associated with riffle/pool complexes of cool, clear, rocky mountain streams. Known at Mormon Pocket on the Verde River and on Oak Creek.	Negative – weeds could replace native riparian habitat used by prey species. Long-term potential for loss of limited riparian habitat to increased weed populations could reduce native plants used as cover by the species and its prey and could negatively impact narrow-headed garter snake populations along the Verde River.	Neutral – Treatments would not have direct effects to narrow-headed garter snakes as treatments would not occur within the snake's habitat. Treatments on the periphery or adjacent to occupied habitat may disturb snakes but would eventually improve narrow-headed garter snake habitat by restoring native plants used for cover and foraging. Treatment areas are so small as not to impact the populations or the species.
Navajo Mexican vole	S	X			These voles occur in dry, grassy areas usually adjacent to ponderosa pine, but also adjacent to juniper, sagebrush, and spruce-fir habitat.	Negative – needs native plants in meadows, riparian, and grass for food and cover. Long-term potential for weed population increases to diminish available native plant habitat and negatively impact local populations of the species.	The design feature of limiting the use of Dicamba to outside the breeding season for terrestrial bird species would benefit Navajo Mexican voles as they would also be more mobile during this time to move away from treatment areas adjacent to occupied habitat. Long-term effects would include improved quality

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							and increased quantity of vole habitat for those small areas returned to native vegetation.
Neumogen's giant skipper	S	X			Occurs in upper Sonoran, open woodland or shrub-grassland. The larvae feed on *Agave parryi*. There are 3 varieties of this Agave species in Arizona. *Agave parryi* var. *couesii* (Coues agave) is found in Coconino and Yavapai Counties. It blooms from May to July and can be found on open slopes of grassland, chaparral, and pine-oak woodlands between 3,650 and 7,000 feet. *Agave parryi* var. *parryi* is found in Coconino County between 4,000 and 9,200 feet. Blooming between June and July, this variety is found on open slopes of grassland, chaparral and pine-oak woodland. There are confirmed records of the *A. neumoegeni* complex from Coconino and Yavapai Counties; reported from the upper Sonoran or lower Transition Zone in open woodland or shrub-grassland. Range is central Arizona to west-central New Mexico, southern New Mexico to west Texas.	Neutral – It is unlikely that noxious weeds would eliminate the host plant, agave. However, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant species including agave. This could lead to losses of local populations of skippers.	Few, if any, weed treatments are proposed in or near habitat with agave. Mechanical treatments would not impact the skipper. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this insect.

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Northern leopard frog	S	X	X		Northern leopard frog habitat is typically stock tanks and other perennial waters with rooted vegetation such as sedges, cattails, or rushes.	Neutral – physical habitat may be more important than vegetation.	Effects identical to Chiricahua leopard frog.
Obsolete viceroy butterfly	S	X			Habitat for this butterfly includes riparian areas generally below 4,500 feet where willows persist. Habitat includes subtropical to Canadian Zone watercourses. Host plants include coyote willow, and Goodding willow is a confirmed food plant for this butterfly. Red willow is a suspected food for Obsolete Viceroy Butterfly. Other host plants include cottonwood, aspen, wild cherry, and serviceberry. Apparently tied to cottonwood/willow habitat. It frequents irrigation canals, water tanks, and other areas that border humid, semidesert bottom lands. It flies 12 to 15 feet above ground. Larvae feed at night on the twigs, leaves, and other plant parts of host species in the families Salicaceae, Fagaceae, and Rosaceae. Adults are on the wing from May to August. Known from Oak Creek and the Verde River.	Negative – needs native cottonwood/willow habitat which could be replaced by nonnative weed trees. Long-term potential for loss of limited riparian habitat to increased populations of noxious or invasive weed tree species could negatively impact local populations of the butterflies.	Treatments within riparian areas would not have any drift of herbicides so there would not be any toxic impact from herbicides to butterflies in adjacent habitat. Returning small areas of riparian habitat to native plant species would not have a measurable impact on the species.

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Page springsnail	S	X			The Page springsnail is restricted to six populations in the Verde Valley, on the Coconino NF. It is found attached to firm substrates (e.g., rock, wood) in springfed areas. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.	Neutral – physical habitat may be more important than vegetation.	No treatments would occur in aquatic habitat. Required protection measures would ensure that herbicide treatments near habitat would not impact Page springsnail by limiting applications with regard to herbicides used and timing relative to precipitation to preclude any toxic impacts.
Southwestern (Arizona) toad	S	X		X	Rocky stream courses in pine-oak zone in Arizona and New Mexico. Irrigated cropland and reservoirs increasingly used.	Neutral – needs herbaceous cover and invertebrates.	Mechanical treatments adjacent to riparian zones may directly impact southwestern toads causing mortality to toads. Herbicides approved for use in riparian zones all have zero ecotoxicity to aquatic and terrestrial amphibians so there would be only disturbance impacts from herbicide treatments. Treatment areas are so small as not to impact the populations or the species.
Southwestern river otter	S	X		X	The Southwestern river otter is highly aquatic, occurring along rivers where they hunt, travel, take refuge, and frolic. Otters feed on fish, amphibians, turtles, crayfish, and other aquatic animals. They are found	Neutral – not dependant on vegetation.	There would not be any impacts to southwestern river otters or their prey from the proposed terrestrial weed treatments.

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					along the Verde River, Wet Beaver Creek, Oak Creek, and other major tributaries in the Verde Valley.		
Verde Rim springsnail	S			X	Found in the Nelson Place Spring complex in the headwaters on Sycamore Creek, Pine Mt. Wilderness area, in central Arizona. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.	Neutral – physical habitat may be more important than vegetation.	No treatments would occur in aquatic habitat. Required protection measures would ensure that herbicide treatments near habitat would not impact Verde Rim springsnail by limiting applications with regard to herbicides used and timing relative to precipitation to preclude any toxic impacts.
Wupatki Arizona pocket mouse	S	X			This subspecies is known from the Wupatki area on the Peaks Ranger District. This subspecies is not distinguishable from *P. a. ammodytes* by external or cranial characteristics but is geographically isolated from other *P. amplus* subspecies. Habitat for this pocket mouse is similar to *P. a. ammodytes*. This pocket mouse feeds almost exclusively on seeds. It is most commonly associated with Merriam's kangaroo rat.	Negative – Noxious weeds could adversely affect the food base of the pocket mouse. Weeds such as Dalmatian toadflax and knapweeds could crowd out the grasses and forbs with the seeds they depend on. In a worst-case scenario, noxious or invasive weeds could severely reduce populations of this subspecies due to habitat loss caused by replacement of native plant species by noxious weed species. Also, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant	Proposed treatments would not likely impact Wupatki Arizona pocket mice as the mice would be less likely to occur in areas dominated by nonnative weeds. Long-term benefits would include maintenance or possible increase of habitat quantity and quality.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
						species. This could lead to losses of local populations of pocket mice.	
Common black hawk	S, PIF	X		X	Lowland forest, swamps and mangroves, in both moist and arid habitats but generally near water (along rivers and streams), also foraging often on tidal flats or in open woodland. Often nests in woodlands near water; in U.S., nests in tall gallery forest trees, mostly cottonwoods supported by flowing water.	Negative – needs native cottonwood/willow gallery forests, which could be replaced by nonnative weed trees. Long-term potential for loss of limited riparian habitat could negatively impact the species.	By limiting treatment methods to be similar to existing activities within the nesting area, the only impact would be minimal disturbance during the breeding season. Long-term impacts would be maintained or improved nesting and prey habitat.
Northern goshawk (NGH)	S, MIS, PIF	X	X	X	Nests locally in coniferous forests of the mountains and high mesas in the northeastern half of Arizona. This is a MIS for late seral stage ponderosa pine vegetation type. CNF – Unknown population trend KNF – Stable population trend PNF – Unknown population trend	Negative – weeds could reduce small mammal populations, which are prey. Long-term potential for weed population increases to replace native grasses, forbs and shrubs and reduce the amount of available habitat for NGH prey species and subsequently negatively impact NGH population trends on the CNF, KNF and PNF.	Implementing breeding season timing restrictions, nest buffers, and restricting the treatment methods to be of a similar nature as ongoing recreational uses within PFAs would reduce the disturbance or toxicity impacts to NGH from treatments to be immeasurable. Given the low likelihood or level of impact from treatments, this alternative would not impact the population trend for NGH on the CNF, KNF or PNF.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Abert's squirrel	MIS	X	X	X	This is the MIS for early seral stage ponderosa pine vegetation type. CNF – Unknown population trend KNF – Stable population trend PNF – Unknown population trend	Neutral – weeds would not affect forest structure or cone production. Weed population increases would not likely impact the population trend for Abert's squirrels on the CNF, KNF or PNF.	Treatments are not likely to directly impact Abert's squirrels. There may be some disturbance to nesting squirrels but this would be of short duration and intensity. Given the small amount of area proposed for treatment relative to the existing habitat for the species, the proposed treatment would not likely impact the population trend for Abert's squirrels on the CNF, KNF or PNF.
Cinnamon teal	MIS	X	X		MIS for late seral wetlands. Ground nesting birds that prefer dense vegetative cover 12-15 inches high near water. They primarily eat aquatic vegetative seeds and also insects and snails. CNF – Unknown population trend KNF – Downward population trend PNF – Not an MIS	Negative – needs thick aquatic and emergent vegetation for nesting, hiding, and feeding. Long-term potential for loss of limited riparian habitat to increased population of noxious or invasive weeds could reduce the amount of available nesting habitat for cinnamon teals and subsequently negatively impact population trends on the CNF and KNF.	Treatments may disturb nesting teals. The extent of disturbance would be commensurate with the existing uses to which the birds are probably habituated. Given the small amount of riparian area proposed for treatment, the proposed treatment would not likely impact the population trend for this species on the CNF or KNF.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Elk	MIS	X	X		MIS for early seral stage of ponderosa pine and mixed conifer habitats. CNF – Stable population trend KNF – Upward population trend PNF – Not an MIS	Negative – weeds would reduce forage species, i.e. grasses and forbs. Long-term potential for weed population increases to reduce available forage and, therefore, causing downward elk population trends on the CNF and KNF.	Treatments would not directly impact any elk. Indirect impacts would be limited to so small an area as to not measurably impact elk habitat quantity or quality and, thus, not impact population trends for elk on the CNF or KNF.
Hairy woodpecker	MIS	X	X	X	This is the MIS for snag component in ponderosa pine vegetation type. CNF – Stable population trend KNF – Stable population trend PNF – Stable population trend	Neutral – weeds would not affect forest structure or insects. Weed population increases would not likely impact the population trend for hairy woodpeckers on the CNF, KNF or PNF.	Treatments are not likely to directly impact hairy woodpeckers. There may be some disturbance to nesting woodpeckers but this would be of short duration and intensity. Given the small amount of area proposed for treatment relative to the existing habitat for the species, the proposed treatment would not likely impact the population trend for hairy woodpeckers on the CNF, KNF or PNF.
Lincoln's sparrow	MIS	X	X		This species nests on the ground in dense brush and marshy habitats. It scratches in the leaves to eat insects and seeds. CNF – Unknown population trend KNF – Upward population trend PNF – Not an MIS	Negative – weeds reduce insects at ground level – main food, might eat thistle seeds (positive response) but overall negative. Weeds may also replace native vegetation used for nesting. Long-term potential for weed population increases to replace limited native riparian plant habitat,	Treatments are not expected to have any direct effects as Lincoln's sparrows are not expected to occur in areas with nonnative weed plant species. Treatments adjacent to occupied habitat may disturb nesting birds. Beneficial effects include maintaining and expanding suitable nesting and foraging

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
						thereby reducing nesting and foraging habitat which may have negative impacts to species population trend on the CNF and KNF.	habitat with restoration of native riparian plant species. Small area of treatment would not measurably increase available habitat so as to impact the population trend for Lincoln's sparrow on the CNF or KNF.
Macro-invertebrates	MIS	X	X	X	This is the MIS for late seral riparian and aquatic habitats. CNF – Unknown population trend KNF – Stable population trend PNF – Stable population trend	Neutral – physical habitat may be more important than vegetation. Weed population increases would not likely impact the population trend for macroinvertebrates on the CNF, KNF or PNF.	Treatments are not expected to change the aquatic habitat for macroinvertebrates. All herbicides proposed for use in riparian zones have zero ecotoxicity to aquatic invertebrates and so would not have any impact to these species. Treatments would not impact population trends for these species on the CNF, KNF or PNF.
Mule deer	MIS	X	X	X	This is the MIS for early seral stage pinyon-juniper and chaparral vegetation types. CNF – Downward population trend KNF – Downward population trend PNF – Downward population trend	Negative – weeds would reduce food supply of grass, forbs, and shrubs. Long-term potential for weed population increases to reduce available forage and negatively impact mule deer population trends on the CNF, KNF and PNF.	Treatments would not directly impact any mule deer. Indirect impacts would be limited to so small an area as to not measurably impact mule deer habitat quantity or quality and, thus, not impact population trends for mule deer on the CNF, KNF, or PNF.

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Pronghorn	MIS	X	X	X	This is the MIS for early and late seral stage grassland/desert shrub vegetation types. CNF – Downward population trend KNF – Downward population trend PNF – Various population trend	Negative – loss of forage. Long-term potential for weed population increases to reduce available native plant forage species and negatively impact pronghorn population trends. Also, certain weeds can provide predator cover within pronghorn habitat. This reduces the area that pronghorn are safe from predators and has negative impacts to fawn survival and population trends on the CNF, KNF and PNF.	Treatments would not directly impact any pronghorn. Indirect impacts would be limited to so small an area as to not measurably impact pronghorn habitat quantity or quality and, thus, not impact population trends for pronghorn on the CNF, KNF or PNF.
Pygmy nuthatch	MIS	X	X	X	This is a MIS for late seral stage ponderosa pine vegetation type. CNF – Stable population trend KNF – Stable population trend PNF – Stable population trend	Neutral – weeds would not affect forest structure or insect and spider prey. Weed population increases would not likely impact the population trend for pygmy nuthatches on the CNF, KNF or PNF.	Treatments are not likely to directly impact pygmy nuthatches. There may be some disturbance to nesting nuthatches but this would be of short duration and intensity. This project would not impact the population trend for pygmy nuthatches on the CNF, KNF or PNF.
Red squirrel	MIS	X	X		This species is found in Arizona in mixed conifer above 7,500 ft. Nests are often in cavities. Preferred mean tree diameter is 14″ dbh. Primary foods are Engelmann spruce, Douglas-fir, and white fir. Other	Neutral – weeds would not affect forest structure or cone production. Weed population increases would not likely impact the population trend for red squirrels on the CNF or KNF.	Treatments are not likely to directly impact red squirrels. There may be some disturbance to nesting squirrels but this would be of short duration and intensity. This project would not impact population trends for red squirrels due

Table 23. Treatment effects on threatened (T), endangered (E), proposed (P), candidate (C), sensitive (S), management indicator species (MIS) and partners in flight (PIF) wildlife species managed on the Coconino (CNF), Kaibab (KNF) and Prescott (PNF) National Forests by alternative.

Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
					foods include mushrooms, fungi, buds and fruits. Key habitat elements include density of cone-bearing trees, canopy cover, shading, insulation, and suitable cache sites. CNF – Unknown population trend KNF – Stable population trend PNF – Not an MIS		to the small area proposed for treatment on the CNF or KNF.
Spotted (rufous-sided) towhee	MIS			X	This is the MIS for late seral stage chaparral vegetation type. They use dense brush for nesting and foraging. Nest site is usually a cup-depression in litter under brush. They feed primarily on insects and seeds. CNF – Not an MIS KNF – Not an MIS PNF – Stable population trend	Neutral – Because of the dry site conditions and dense vegetation commonly found in chaparral sites, weeds are not as likely to eventually dominate chaparral sites. Weed population increases would not likely impact population trends for spotted towhees on the PNF.	Few treatments, if any, are expected to occur in the chaparral vegetation type. Given the extensive chaparral vegetation type in the project area, this project would not impact population trends for spotted towhees on the PNF.
Turkey	MIS	X	X	X	This is a MIS for late seral stage ponderosa pine vegetation type. However, they depend on the interspersion of habitat types CNF – Not an MIS KNF – MIS	Negative – increased weeds could reduce native plant component in meadow habitat subsequently reducing forage plant species with seed heads and native prey species habitat including that for grasshoppers, an important turkey	By limiting treatment methods to be similar to existing activities within the nesting area, the only impact would be minimal disturbance during the breeding season. Long-term impacts would be maintained or improved nesting habitat. Given the small amount

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
					PNF – Stable population trend	food item. Long-term potential for weed population increases to increase fire frequencies to reduce the amount of available habitat for turkeys and subsequently negatively impact population trends on the PNF. Frequent fires would lead to loss of large ponderosa pine for roosting. Fires during the breeding season could cause nest abandonment or poult fatality.	of area proposed for treatment relative to the existing habitat for turkeys, the proposed treatment would not likely impact population trends for turkeys on the PNF.
Yellow breasted chat	MIS	X	X		MIS for riparian habitat. Chats require dense riparian thickets of willows, vine tangles, and dense brush associated with streams, swampy ground and the borders of small ponds. Some taller trees (i.e., cottonwoods and alders) are required for song perches. They are most often found in areas in early stages of succession, as opposed to young and mature forests. CNF – Unknown population trend KNF – Upward population trend PNF – Not an MIS	Negative – nonnative weed tree species could out compete and replace native shrubs and trees used for nesting, perching, and foraging. Nonnative weeds may replace native plant species preferred by insect prey species. Long-term potential for loss of limited riparian habitat to increased noxious or invasive weed populations could reduce available habitat which would negatively impact population trends on the CNF and KNF.	Treatments may disturb nesting chats. The extent of disturbance would be commensurate with the existing uses to which the birds are probably habituated. Given the small amount of riparian area proposed for treatment, the proposed treatment would not likely impact the population trend for yellow-breasted chat on the CNF or KNF.

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
Juniper titmouse	MIS, PIF	X	X	X	This is the MIS for late seral stage pinyon-juniper vegetation type and the snag component within pinon-juniper. CNF – Unknown population trend KNF – Stable population trend PNF – Decreasing population trend	Neutral – weeds would not affect woodland structure or availability of acorns in pinyon-juniper woodlands. Weed population increases would not likely impact population trends for juniper titmice on the CNF, KNF or PNF.	Weed treatments are not likely to have any effect on this species as treatments would not be located within blocks of old growth pinyon-juniper where the species is most likely to occur. This project would not impact population trends for juniper titmice on the CNF, KNF or PNF.
Lucy's warbler	MIS, PIF	X	X	X	This is the MIS for late seral riparian habitat. It is a secondary cavity nester. This species may occur along the Verde River. CNF – Not an MIS KNF – Not an MIS PNF – Stable population trend	Negative – noxious or invasive weeds (tamarisk) replace native mesquite, willow, cottonwood breeding habitat. Tamarisk, Russian olive and Siberian elm lack the trunk diameters to provide suitable cavities. Long-term potential for loss of limited riparian habitat to increased weed populations could reduce available native plant species habitat and negatively impact population trends for Lucy's warbler on the PNF.	Weed treatments would not directly impact Lucy's warbler as they are secondary cavity nesters that would not be using tamarisk or Russian olive or Siberian elm which lack the diameters to provide suitable cavities. Given the small amount of riparian area proposed for treatment, the proposed treatment would not likely impact population trends for Lucy's warbler on the PNF.
Red-naped (yellow-bellied) sapsucker	MIS, PIF	X	X		MIS for late-seral aspen and snags in aspen. Sapsucker drills holes and consumes cambium and sap as well as variety of insects attracted to the sap. Also eats fruits and berries.	Neutral – weeds won't affect structure of aspen stands; sapsuckers have a wide diet. Weed population increases would not likely impact population trends for juniper titmice on the CNF and KNF.	Weed treatments would not impact this species. Limiting the use of Dicamba to occur outside the breeding season would remove the impact to breeding birds. Given the small amount of area proposed for treatment, the proposed

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Common Name	Status	CNF	KNF	PNF	Species Native Habitat	Expected Response to Noxious or Invasive Weeds (Alternative 2)	Expected Response to Noxious or Invasive Weed Treatments (Alternatives 1, 3 & 4)
					CNF – Stable population trend KNF – Upward population trend PNF – Not an MIS		treatment would not likely impact population trends for red-naped sapsucker on the CNF or KNF.

Public Health

Background

Potential human health risks to workers from manual and mechanical noxious weed control measures are minor and include cuts, burns, allergies and skin irritation to individuals doing the work. The direct effects on human health would be greatest to allergy and contact dermatitis sufferers who are sensitive to invasive weeds or other wild land vegetation. Skin irritations may result from reaction to the sap of various invasive weeds on contact, such as spotted knapweed and leafy spurge, or to the physical parts of the plant itself, such as stickers in thistles. Safety training and adherence to the guidelines in job hazard analyses for work with noxious or invasive weed control would greatly reduce the risk to workers. Gloves, long sleeved shirts and boots would prevent injuries or irritations and, therefore, no serious human health effects are anticipated by manual and mechanical removal of weeds.

Biological and cultural management would not impose a risk to human health of workers or the public. The health risk to herbicide applicators is primarily a function of the amount of chemical handling and length of exposure to the herbicide. The time needed in a given field season to ground apply herbicides is significant. Of the methods used to ground apply herbicides, backpack applications have the greatest potential for worker exposure. Safety training and adherence to the guidelines in job hazard analyses and Appendix B of this document, for work with noxious or invasive weed control would greatly reduce the risk to workers.

Of the weed treatment methods proposed for this project, the two with the most widespread impacts on human health are the use of herbicides and burning (Munson 2004). Smoke from burning weeds spreads over a wide area, causing problems for people with respiratory conditions such as asthma and emphysema, and for those who are reactive to chemicals in the smoke. For example, when poison oak or ivy are burned, problems are especially widespread, with 80 to 90 percent of people in the U.S. allergic to those weeds. Inhaled smoke can cause rapid swelling (like hives) in the lungs and throat (urticaria, pulmonary swelling, and anaphylactic response) and sometimes death.

The health risk to the public from herbicides is primarily a function of the amount of inadvertent exposure through contact with treated vegetation, consumption of contaminated vegetation or water, and herbicide drift. Whether a person is exposed to treated vegetation is largely a function of the probability of a person coming in contact with the treated vegetation within several hours or days of application. Ground treatment requires many small applications and the publics' chance of encountering a sprayed area is low. Additional environmental protection measures developed for the proposed ground treatment such as buffer zones from water bodies and sensitive areas, limited spray zones, public notification prior to application, and weather condition monitoring all reduce the potential for public exposure from herbicide application (see Appendix B).

Under any alternative involving herbicide use, the potential for exposure to a herbicide for the worker or general public would not exceed the daily exposure level determined to be safe by the United States Environmental Protection Agency (EPA) over a 70-year lifetime of daily exposure.

According to Munson (2004) herbicides can cause temporary or permanent damage, or can make pre-existing conditions worse. In addition to various cancers, herbicides can cause damage to the

skin, eyes, lungs, liver, kidneys, muscles, nervous system (including the brain and behavioral changes), hormone systems, immune system, and digestive system. They can also have effects on reproduction and can cause genetic damage. All synthetic herbicides, including glyphosate, have had serious effects on some people. However, when used as labeled, herbicides are normally considered safe to humans and their environment.

Because herbicides travel through air, water, and soil, they can have effects on people miles away from where they are applied. Because they persist (sometimes for over a year), they can have effects long after they are applied. Because the problems can occur remote in time and place from the application, people can be affected without knowing that herbicide is the cause.

For all of these reasons, the use of measures other than synthetic herbicides or burning is preferable whenever feasible. When synthetic herbicides or burning are used, advance notice and a means of evacuation, with a safe place to evacuate to, can help mitigate the effects for some vulnerable people.

Herbicide Risk Assessments

The following primary referenced literature was used to analyze potential human health risks associated with ground application of herbicides.

- "The Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4 and 10 and on Bonneville Power Administration Sites" (USDA FS 1992a). This analysis was developed for the Forest Service specifically to address human health issues raised by use of herbicides.
- "Assessing the Safety of Herbicides for Vegetation Management in the Missoula Valley Region – A Question and Answer Guide to Human Health Issues" (Felsot 2001).
- Risk assessments completed by the Forest Service under contract with Syracuse Environmental Research Associates for 2,4-D, picloram, clopyralid, dicamba, sulfometuron methyl, metsulfuron methyl, triclopyr, imazapic, and imazapyr. (USDA FS 1995c, 1996c-d, 1997b, 1998e-f, 1999d-f, 2000b, 2001e).
- "Bitteroot National Forest Weed Control Environmental Impact Statement" (USDA FS 2003e).

The purpose of these risk assessments is to quantify the long-term risks from an action using standards of safety that are generally accepted by the scientific and health communities. Risk assessments have three parts. The first section describes the exposure analysis that estimates the range of possible doses to workers, the general public, and aquatic organisms. A variety of scenarios and exposure pathways are examined that could result in dermal and oral exposures. The second section displays the hazard analysis where tests and data related to the toxicity of the herbicides are reviewed. Of particular interest is a value known as the "No Observed Effect Level" or NOEL. NOEL is 100 times less than the highest dose at which no adverse effects were noted in test animals.

The NOEL, in combination with various safety factors, is a partial basis for determining the safety of human doses and is useful for determining the possible noncarcinogenic effects of herbicides, such as effects on liver or kidney functions. The hazard analysis also reviews data on

the possible carcinogenicity of the chemical. The third section has the risk analysis where the dose levels calculated in the exposure analysis are compared to the NOEL levels to determine the noncarcinogenic effects of herbicides. Because NOEL levels are based on animal tests, it is assumed that the NOEL should be at least 100 times greater than the doses to establish a Margin of Safety (MOS). This risk analysis also indicates the probability of developing cancer based on a projection of the lifetime doses received from spraying.

Toxicity test data on laboratory animals are available for herbicides proposed for use in this analysis. Most tests have been conducted under EPA pesticide registration/re-registration requirements for use in the United States. EPA uses test data to determine conditions for use of herbicides in the United States.

Label restrictions on herbicides are developed to mitigate, reduce, or eliminate potential risks to humans and the environment. Label information and requirements include: personal protective equipment; user safety; first aid; environmental hazards; directions for use; storage and disposal; general information; mixing and application methods; approved uses; weeds controlled; and application rates.

Analysis of herbicide use in this FEIS assumes compliance with the product label during handling and application. Additional environmental protection measures have been developed by forest resource specialists and other technical experts to further reduce potential risks to human health and the environment during application of herbicides. These measures are detailed in Appendix B and will be implemented during analysis and application of weed control methods to further ensure worker and public safety.

Factors Affecting Hazard of Herbicide Use

Method of Application — How herbicides are applied can have a direct impact on the potential for human health effects. According to risk assessments completed on herbicide usage on forest lands, herbicide applicators are at a higher risk than the general public from herbicide use. The risk assessments compared risks to workers for all types of application, including aerial (not applicable in this project), backpack, ground mechanical, and hand applications. Lower risks were estimated for ground mechanical application as compared to other methods, even though the total amount of herbicide applied in a given day was higher. Risks associated with backpack and hand application of herbicides were estimated to be the highest, due to workers being closer to the spray nozzle and containers in which the herbicides were carried. Backpack and hand application was also reported to increase the likelihood of a worker receiving repeated exposures that may remain on the worker's skin for an extended time period.

EPA, in its re-registration of picloram (USEPA 1995), also noted that the highest risk for herbicide applicators was for those using the backpack application method, and the lowest was for aerial and ground-boom applicators.

Length of Exposure — The magnitude of a dose that is hazardous to health depends on whether a single dose is given all at once (acute exposure); multiple doses are given over longer periods (chronic exposure); or regularly repeated doses or exposures occur over periods ranging from several days to months (subchronic). EPA develops Reference Doses (RfDs), which are an estimate of a daily dose over a 70-year life span that a human can receive without an appreciable risk of deleterious effects (EPA 2003). RfDs include a "safety factor" where the No Observable Effect Level (NOEL) is divided by a factor, usually 100, to account for uncertainty and

hypersensitive individuals. The 100 value is derived by including a safety margin of 10 for extrapolating study results from mammals to humans, and an additional safety factor of 10 for variation in population response to a particular compound.

The RfD is a conservative toxicological threshold in relation to this analysis because it assumes daily exposure over a 70-year life span, and because the RfD is calculated from the NOEL, assuming humans are 100 times more sensitive than animals (uncertainty factor of 100). Actual environmental exposures for herbicide treatments in this project would typically be a few days each year for substantially less than 70 years.

Potential doses to workers or the public from application of herbicides would be transitory. Lifetime RfDs are used here as a convenient and conservative comparison for determining significance of human doses. Lifetime RfDs values are based on daily feeding studies, whereas workers and the general public would not be exposed daily over a lifetime. Maximum duration of exposure for workers on a yearly basis was estimated in the range of 10 to 40 days for commercial applicators (EPA 1995).

Route of Exposure — Substances are tested for acute toxicity and chronic toxicity by placing the chemical in the animal's stomach or food, respectively (EPA 1996a, b). Test substances are also applied to the shaved skin of an animal to estimate a dermal LD50 (EPA 1996c).

Skin acts as a protective barrier to limit and slow down movement of a chemical into the body. Studies of pesticides applied to the skin of humans indicate that for many only about 10 percent or less passes into the blood. In contrast, absorption of chemicals from the small intestine is quicker and more complete than from the skin (Feldmann and Maibach 1974; Ross et al. 2000). For this reason, dermal LD50s are usually much higher than oral LD50s. A person can tolerate greater doses of a substance without becoming sick when exposure is through skin contact rather than through ingestion (Hayes 1991).

Test organisms are also administered substances in air to estimate an inhalation LD50. The onset of illness can occur more quickly by inhalation exposure than by oral or dermal contact due to rapid entry of the substance into the bloodstream. However, studies with pesticide applicators (who receive higher exposures than the general public) indicate dermal exposures are greater than inhalation exposures (Ross et al. 2000).

Uncertainty

With the exception of accidental exposures or exposures under conservative scenarios, workers and the general public would not be exposed to an herbicide at concentrations that result in adverse health effects. This conclusion is predicated on forest employees wearing appropriate personal protection and applying herbicides in accordance with label instructions. By doing so, possible exposure by contact or through drift would result in a dose below that determined to be safe by the EPA over a lifetime of daily exposure. It is also predicated on the findings, supported by toxicological studies, that a person can be exposed to some amount of a contaminant and not have an adverse effect (i.e. the dose determines the effect).

All of the herbicides proposed for use by the forests must be registered for use by the EPA and Arizona Department of Agriculture. Registration of these herbicides and Federal regulations adopted to protect workers and the general public has required more scientific information and justification for use of herbicides. Nevertheless, there are reports in scientific literature and

various sections of this report that document associations between chemical exposures and alterations of the immune system, autoimmune disorders, and increases in the probability of carcinogenesis (MCCHB 2001; Citron 1995; Glover-Kerkvliet 1995). The literature raises concerns about additive and synergistic effects of exposure to more than one herbicide, unstudied or unknown consequences of low level chronic exposures, toxicity of inerts, byproducts or contaminants of herbicides, and uncertainties about the health effects of sensitive populations. There is also the realization that it is difficult, if not impossible, for government or any scientific agency to fully evaluate a chemical and all potential combinations to ensure there would not be an adverse effect.

Use of herbicides to control noxious weeds is not without risk. All chemical exposure results in some level of health risk, the risk primarily being a function of the dose, or amount a person or organism is exposed to over a period of time. However, the same literature that raises concern over health effects also clearly reports that effects occur at doses significantly higher than that expected through use of herbicides by the three forests. The estimated dose of each herbicide that a worker or person of the general public may be exposed to through use of the herbicide by the three forests would be below that determined to be safe by the EPA for a lifetime of daily exposure. Therefore, minimal health effects and risks to workers and the general public are anticipated by the use of herbicides by the forests.

Direct and Indirect Effects

Direct and Indirect Effects Common to Alternatives 1 and 4

The following discussion is grouped by specific herbicide with the appropriate interpretation of environmental impacts. Based on a review of risk assessments, current literature and other forest's EISs (USDA Forest Service 1992a,1995c, 1996c-d, 1997b, 1998e-f, 1999d-f, 2000b, 2001e; WHO: Damstra et al 2002; Bitteroot NF Weed Control EIS 2003e), it appears the probability of the preferred alternative causing chronic toxicity or carcinogenicity is very low. Figure 15 shows graphically the total acres of proposed herbicidal treatments scheduled for Alternatives 1 and 4.

2,4-D – This herbicide is one of the most common types prescribed and the range we anticipate goes from 7,750 to 14,970 acres recorded for the Low and High levels of Alternative 1. Alternative 4 is scheduled for 11,335 acres of 2,4-D treatments. This compound will be used to treat leafy spurge, Russian knapweed, whitetop, Mediterranean sage, musk thistle, diffuse knapweed, Scotch thistle, teasel, and bull thistle. The average soil half-life of this herbicide is 10 days with the primary mechanism to breakdown being microbial degradation. The relatively high mobility of 2,4-D makes it an extremely poor choice where high ground or surface waters occur.

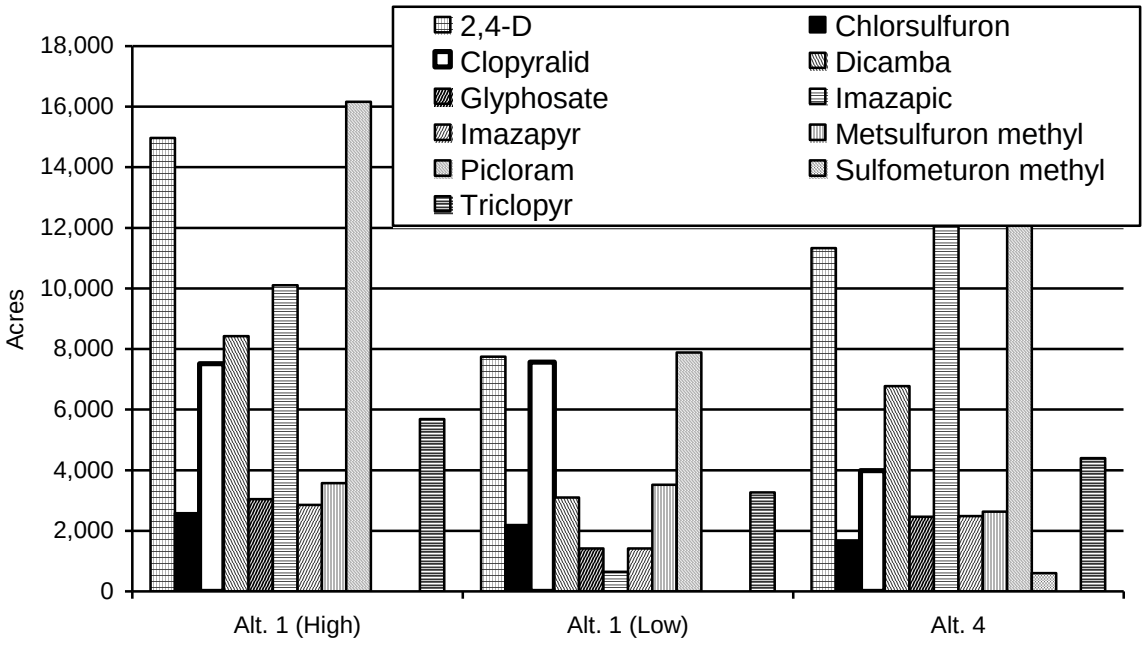


Figure 14. Total acres of proposed herbicidal treatments scheduled for Alternatives 1 and 4

Where these conditions prevail, however, an approved form of 2,4-D can be used and potential problems with ground water contamination are avoided. The anticipated rate of application ranges from less than 1 pound of active ingredient per acre to just over 2 pounds per acre as the maximum amount. At both the minimum and maximum levels, we see no potential human health impacts since we are well below the maximum application rate on the label of 4 pounds per acre. About 65 percent of all treatments using this herbicide are repeat treatments. About 90 percent of the use of this herbicide will occur in the ponderosa pine ecosystems in the Verde River and Little Colorado basins. Soils are generally 40 to 60 inches deep, fine textured and have ground water tables in excess of 3,000 feet. Contamination of either surface or ground water should not occur at these low application rates, and use of personal protective gear by the applicators as well as other BMPs will reduce the potential for any adverse toxicological problems to very low levels.

Chlorsulfuron – We predict limited use of this herbicide with a range going from just over 2,500 acres under Alternative 1-High to 1,685 acres scheduled for Alternative 4. This herbicide will be used to treat whitetop and biennial thistles. Chlorsulfuron is broken down to smaller compounds by soil microorganisms with a half-life of 1 month on acidic soils to 3 months on alkaline. Our analysis indicates that the amount needed to achieve control ranges from a minimum of .03 pound of active ingredient per acre to .07 pound per acres that is well below the maximum of 3 pounds per acre. Based on the results of animal studies, chlorsulfuron does not cause genetic damage, cancer or birth defects, and has little or no effect on fertility, reproduction, or development of offspring (USDA Forest Service 2003f). Figure 15 illustrates total pounds per acre of active ingredient for the herbicides used in Alternatives 1 and 4.

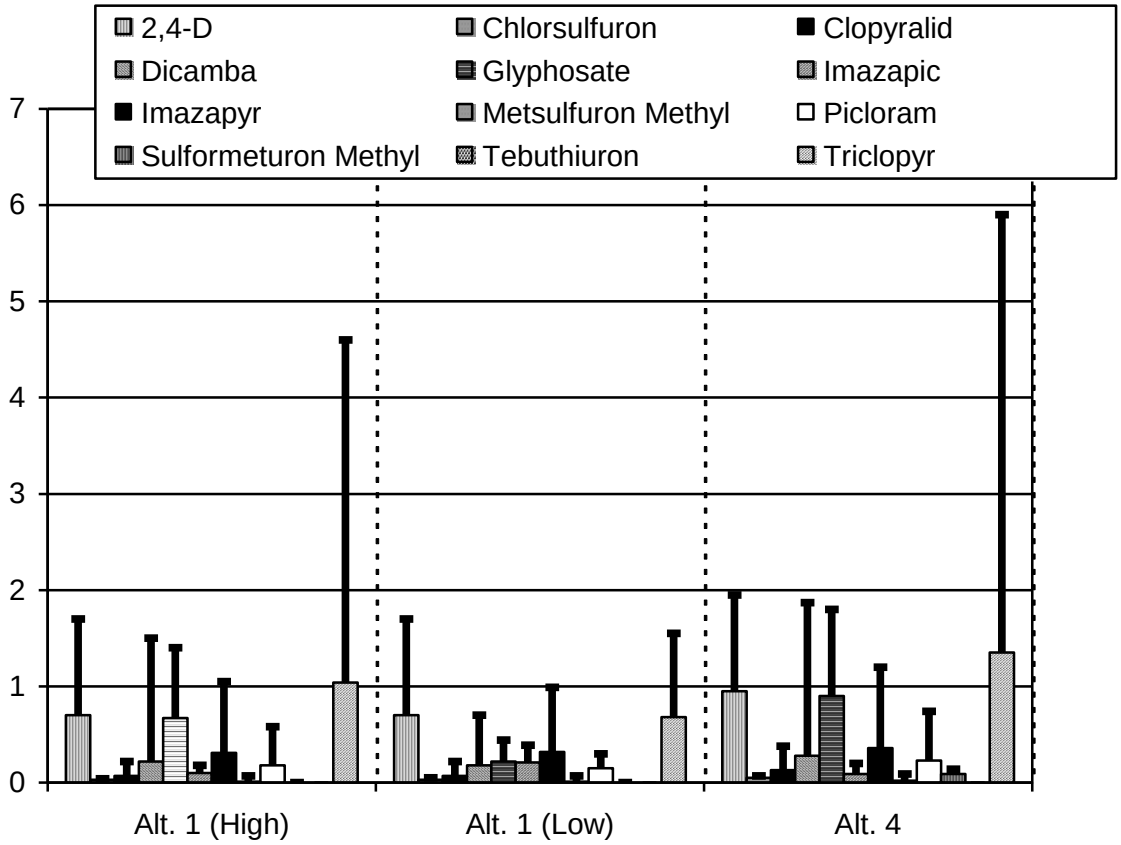


Figure 15. Total pounds per acre of active ingredient in proposed herbicidal treatments

Clopyralid — We anticipate low to moderate use of this herbicide with our predicted range going from just over 3,900 acres in Alternative 4 to about 7,500 acres scheduled for both the High and Low levels of Alternative 1. This herbicide will be used to treat annual and perennial broadleaf weeds like yellow and Malta starthistles. Clopyralid is broken down to inert substances by soil microorganisms with an average half-life of 40 days. The inability of clopyralid to bind with soils and its persistence implies that this herbicide has the potential to be highly mobile and a threat to water resources and nontarget plants, although no extensive offsite movement has been documented (The Nature Conservancy 2001). We anticipate that the amount needed to achieve control ranges from a minimum of .07 pound of active ingredient per acre to a maximum of .47 pound per acre. The Nature Conservancy (2001) noted that clopyralid is not toxic to fish, birds, mammals, and other animals though it can cause severe eye damage.

Dicamba — We anticipate low use of dicamba with Alternative 1-High and Alternative 4 targeted at 8,425 and 7,340 acres, whereas Alternative 1-Low is scheduled for 3,100 acres. This herbicide will be used to treat annual and perennial broadleaf brush and weeds (USDA Forest Service 2003g). Dicamba is moderately persistent in soil and has a half-life of 1 to 6 weeks and is broken down to inert substances by soil microorganisms (USDA Forest Service 2003g). We anticipate that the amount needed to achieve control ranges from a minimum of .18 pound of active ingredient per acre to a maximum of 1.87 pounds per acre. This range is well below the

maximum rate recommended from the risk assessment of 4 pounds per acre (USDA Forest Service and Bonneville Power Administration 1992). The USDA Forest Service (2003g) also noted that based on the results of animal studies, dicamba does not cause birth defects, cancer or genetic damage, and has little effect on fertility or reproduction. This same study also stated that there have been no reported cases of long-term health effects in humans due to dicamba exposure.

Glyphosate – We anticipate low use of glyphosate with Alternative 1-High and Alternative 4 targeted at 3,045 and 2,470 acres, whereas Alternative 1-Low is scheduled for 1,420 acres. Glyphosate is a broad-spectrum, nonselective, systemic herbicide used for control of annual and perennial plants including grasses, sedges, broad-leaved weeds, and woody plants (Extension Toxicology Network 1996). The Extension Toxicology Network (1996) also reported that glyphosate is moderately persistent in soil and has a half-life of about 50 days. They also noted that it has low potential for runoff, and microbes are the primary agent responsible for breakdown of this product. We anticipate that the amount needed to achieve control ranges from a minimum of .22 pound of active ingredient per acre to a maximum of 1.80 pounds per acre. This range is well below the maximum rate recommended from the risk assessment of 4 pounds per acre (USDA Forest Service and Bonneville Power Administration 1992). The USDA Forest Service (1997b) noted that there is little evidence to suggest that glyphosate will cause adverse effects related to human health or within the environment at the anticipated levels of exposure. Another study concluded that glyphosate is poorly absorbed by the digestive tract and is largely excreted unchanged by mammals (Extension Toxicology Network 1996).

Imazapic – We predict fairly high use of this herbicide within Alternative 1-High and Alternative 4, which are targeted at 10,105 and 12,095 acres, whereas with Alternative 1-Low the use of imazapic drops dramatically to only 645 acres. Imazapic is a selective herbicide for both the pre- and post-emergence control of some annual and perennial grasses and broad-leaved weeds (The Nature Conservancy 2001b). The Nature Conservancy (2001b) also reported that imazapic is moderately persistent in soil with a half-life of about 120 days. They also noted that it has low potential for runoff, and microbes are the primary agent responsible for its breakdown. We project that the amount needed to achieve control ranges from a minimum of .10 pound of active ingredient per acre to a maximum of .40 pound per acre. Imazapic is not considered carcinogenic and the Environmental Protection Agency has classed it as a “Group E” compound, or one that has not shown evidence of causing cancer in humans (The Nature Conservancy 2001b).

Imazapyr – We anticipate low levels of imazapyr use with Alternative 1-High and Alternative 4 targeted at 2,855 and 2,490 acres, whereas Alternative 1-Low is scheduled for 1,410 acres. Imazapyr is a broad-spectrum herbicide that can be applied pre- or post-emergence to control many annual and perennial weeds (Tu et al. 2001). The Nature Conservancy Weed Control Handbook (Tu et al. 2001) also reported that imazapyr is weakly bound to the soil and has a half-life ranging from 25 to 142 days though it has been reported to be active up to 2 years (USDA Forest Service 2003h). Imazapyr generally remains in the upper 20 inches of soil and did not run off into streams or demonstrate much lateral movement. It should not be applied were runoff water may flow onto agricultural lands or adjacent to wetlands or standing surface water (USDA Forest Service 2003h). We anticipate that the amount needed to achieve control ranges from a minimum of .31 pound of active ingredient per acre to a maximum of 1.2 pounds per acre. This range is below the maximum rate recommended from the risk assessment of 1.5 pounds per acre (USDA Forest Service 2003h and 1992). The USDA Forest Service (2003h) noted that imazapyr does not cause genetic damage or birth defects though there is not enough information available to determine whether imazapyr causes cancer or adverse effects on reproduction or fertility.

Metsulfuron methyl – We predict generally limited use of this herbicide. Within Alternative 1 (High and Low) we anticipate that about 3,500 acres will be targeted with this herbicide, and Alternative 4 is scheduled for about 2,630 acres. Metsulfuron methyl is a selective pre- and post-emergence herbicide designed to control broad-leaved weeds and some grasses. The USDA Forest Service (2003i) reported that metsulfuron methyl remains unchanged in the soil although the half-life in a silt loam soil ranged between 120 and 180 days. They also noted that metsulfuron methyl is broken down to nontoxic and nonherbicidal products by soil microorganisms and chemical hydrolysis. We anticipate that the amount needed to achieve treatment objectives ranges from a minimum of .01 pound of active ingredient per acre to a maximum of .09 pound per acre, which is well below the maximum recommended in the risk assessment of .75 pound in rangelands and 1.8 pounds associated with forested zones. Based on the results of animal studies, metsulfuron methyl is not classed as a carcinogen, mutagen, teratotgen or reproductive inhibitor (USDA Forest Service 2003i).

Picloram – We predict fairly high use of this herbicide within Alternative 1 (High and Low) as well as Alternative 4, which are targeted at 16,160 acres, 7,880 acres and 12,580 acres, respectively. Picloram is a selective herbicide and is used to prevent regrowth of woody plants, noxious weeds and brush. The USDA Forest Service (2003j) reported that picloram can stay moderately active in the soil and may exist at toxic levels in plants for more than a year after application at normal rates. This study also noted that the breakdown of this product is through microorganisms and sunlight with long-term buildup of picloram in the soil generally not a concern. Picloram cannot be used in areas with shallow water tables. We project that the amount needed to achieve control ranges from a minimum of .15 pound of active ingredient per acre for Alternative 1-Low to a maximum of .74 pound projected for Alternative 4. This is well below the maximum rate identified in the risk assessment (1992) of 2 pounds per acre of active ingredient. The USDA Forest Service (2003j) noted picloram does not cause genetic damage or birth defects, and has little or no effect on fertility or reproduction. They also stated there is not enough information available to determine whether picloram causes cancer though there have been no reported cases of long-term health problems associated with this product.

Sulfometuron methyl – We anticipate very limited use of this herbicide with only 555 acres projected and that will only occur only within Alternative 4. Sulfometuron methyl is designed to control annual and perennial grasses and will be used only to treat cheatgrass on the North Kaibab Ranger District. The USDA Forest Service (2003k) reported that sulfometuron methyl remains active in the soil with a half-life of about 1 month. They also noted that soil microorganisms and chemical hydrolysis break down to sulfometuron methyl, and after 1 year about 1 percent applied on Eastern soils remained whereas on Western soils 6 to 18 percent was still found. We anticipate that the amount needed to achieve treatment objectives ranges from a minimum of .09 pound of active ingredient per acre to a maximum of .14 pound projected for Alternative 4. This is well below the maximum recommended in the risk assessment of 9 pounds per acre targeted for rangelands. Animal studies have shown that this herbicide causes skin irritation and is a moderate eye irritant. Sulfometuron methyl is not classed as a carcinogen, mutagen, or teratotgen. Reproductive effects have been observed in rats but only at maternally toxic dose levels.

Triclopyr – We anticipate low to moderate use of this herbicide with our predicted range going from just over 3,260 acres in Alternative 1-Low to about 5,600 acres scheduled for Alternative 1-High and 4,390 acres targeted for Alternative 4. This herbicide will be used almost exclusively in treatment of woody invasive trees like tamarisk, tree of Heaven, and Russian olive. Triclopyr is broken down rapidly to inert substances by soil microorganisms with an average half-life of 45

days (USDA Forest Service 2003l). This analysis also stated that triclopyr should not be a leaching problem since it binds tightly with clay as well as organic matter, and its half-life in water is less than 24 hours. We anticipate that the amount needed to achieve control ranges from a minimum of .68 pound of active ingredient per acre to a maximum of 5.9 pounds per acre. The maximum amount recommended by the risk assessment (1992) under riparian conditions is 8 pounds per acre. Based on the results of animal studies, triclopyr does not cause birth defects or cancer, and has little or no effect on fertility or reproduction. Triclopyr is mildly fetotoxic though there is not enough information to determine if this herbicide causes genetic damage (USDA Forest Service 2003l).

We do not expect toxicological problems as it relates to the application of herbicides in either Alternative 1 (High and Low) or Alternative 4. Disclosed application rates are, at both the minimum and maximum levels, generally considerably below the rate that would fall into the scenario of routine extreme (maximum application rate prescribed from the risk assessment). The only individuals that will be exposed for any duration are the applicators of the herbicide themselves. Use of personal protective gear will reduce the probability of ever exceeding the RfD to low levels. The general public, even though they may have traveled through a recently treated zone, would not have the exposure time or levels to create potential problems related to human health. Signing and other mitigation practices would reduce this probability even lower since the general public can avoid the treatment area altogether and avoid exposure to the products.

Another important variable that ties into our anticipated effects relates to the fact that we are treating a very small portion of the project area. Even in the ponderosa pine, high elevation meadows, and riparian ecosystems in the Little Colorado and Verde River Watersheds where almost 90 percent of all treatments, including herbicides occurs, the scheduled work represents about 3 percent of the respective ecosystem. If repeat treatments are removed, then less than 1 percent of the acreage has any weed control prescribed. Most ecosystems—including shrub/grasslands, low elevation grasslands, and pinyon/juniper to mention a few—have less than one-tenth or even one-hundredth of 1 percent targeted for any control work. This will limit any exposure to herbicides to extremely low levels and virtually eliminate any problems related to human health.

A USDA Forest Service (2003l) publication noted that the herbicides prescribed have either no or, at the most, a slight influence on mutagenic or reproductive potentials. Of the 10 considered, only metsulfuron methyl and triclopyr are considered within the category of none to slight with respect to mutagenic and reproductive properties. Dicamba and 2,4-D have been classed as “evidence of noncarcinogenicity.” The general public will be exposed to little, if any, herbicides as treatments are undertaken if either Alternatives 1 or 4 are implemented. If they are, the duration of exposure will probably be on the order of minutes, and it is expected this and the low application rates are not predicted to approach the RfD. We foresee that applicators may have the potential to exceed the RfD, and that would only take place if a spill of concentrated herbicide occurred during mixing. We expect this to be reduced to a low probability if they are trained, use required protective clothing and equipment, and follow steps outlined in the safety and spill plan.

Several individuals commenting on this proposed action have indicated that the synergistic interaction of herbicides is a concern. This process is a special type of interaction in which the combined impact of two or more herbicides is greater than the impact predicted by adding their individual effects. The USDA Forest Service (2003l) defined three types of synergism that includes: (1) interaction of the active ingredients in a herbicide with its inert ingredients; (2)

interactions of these herbicides with other herbicides; and (3) the cumulative impact of not only spraying being undertaken by the Forest Service but others as well and its influence on the public.

In summary, the authorization of herbicides in Alternative 1 (High and Low) and Alternative 4 will not have any adverse impacts on human health as it relates to carcinogenicity, developmental problems, reproduction, or mutagenicity. This statement assumes that: (1) the label instructions are being followed and the appropriate herbicide is being used; (2) the applicators are using the proper personal protective gear; (3) mitigation measures are being applied; and (4) the application rate does not exceed the routine extreme, and characteristically it will approximate the routine typical or lower. At these levels, it is unlikely the RfD would be exceeded.

Although various Forest Service publications, other research, and studies have claimed virtually no adverse toxicological impacts related to use of the herbicides we have considered in this FEIS, there are differences of opinion.

The Journal of Pesticide Reform (Cox 1998a) noted that chronic toxicity was demonstrated with clopyralid use in a 2-year study with rats that found hyperplasia of the stomach lining. The also referenced a 1-year study of dogs that demonstrated an increase in liver weights and a decrease in the amount of red blood cells. Clopyralid was also tested by the Environmental Protection Agency, and their conclusions were that this herbicide caused a substantial toxicity to fetuses and birth defects. They also published a report on dicamba and referenced a study that found a 20 percent inhibition of one nervous system enzyme within pesticide applicators, as well as mutagenic problems with rats that had been injected with the herbicide (Cox 1994). Carcinogenic potentials were noted in farmers, and the conclusion was that the risk of contracting cancer and non-Hodgkin's lymphoma doubled two decades after exposure (Journal of Pesticide Reform 1994 as referenced from National Cancer Institute 1992). Glyphosate carcinogenicity was documented in one study that stated that people who were occupationally exposed to this herbicide had a threefold risk to hairy cell leukemia (Journal of Pesticide Reform 1998). They also noted potential mutagenicity problems and referenced one study that documented chromosome mutations at the lowest doses of glyphosate applied (Cox 1998b as referenced from Vigfusson and Vyse 1980).

We predict that implementation of either alternative that authorizes herbicide use, even though there is documentation that supports the opposite viewpoint, will not cause adverse human health impacts. There are several reasons why we have reached that conclusion and they are: (1) the amount of area treated represents less than 1 percent of the total associated with the forests; (2) scheduled work will be under the control of a certified pesticide applicator and personal protective gear will be worn by all workers; (3) only approved herbicides for that specific set of environmental conditions will be used; and (4) the proposed application rates are well below the typical rate as disclosed in the risk assessment (1992). This will prevent any individual from getting exposure levels where the RfD is reached and reduce the potential for long-term health effects to very low probabilities. In addition, many of the studies referenced by the Journal of Pesticide Reform were done at application rates above those that we predict will occur if either Alternative 1 or 4 is selected.

Direct and Indirect Effects Common to Alternatives 2 and 3

Alternative 2 (No Action) and Alternative 3 would not authorize the use of herbicides within Forest Service rights-of-way (e.g., Lake Mary and Perkinsville Road) or any other lands within

the project area. Since use of these products is excluded, the probability of any toxicological problems, at least on Forest Service lands, goes to zero.

Direct and Indirect Effects of Alternative 4

Even though we have already projected that no human health impacts are foreseen, except possibly for the applicators themselves under an extreme exposure situation, the establishment of limited spray zones around campgrounds, trailheads, scenic overlooks and communities will reduce an already low probability further.

An estimated 818,000 acres of limited spray zones would be established which represents about 17 percent of the project area. Except for camelthorn, leafy spurge, Russian knapweed, tamarisk, tree of Heaven, and Siberian elm all other noxious weeds will be treated by predominately other means within these areas. This includes manual, mechanical, cultural, and biological methods.

Cumulative Effects

Other Pesticide Use

Throughout the last few years, there have been several projects proposed or accomplished on the three national forests that have used pesticides. These projects include: spraying for western pine beetle infestations using carbaryl at recreation sites and overlooks on both the Kaibab and Coconino, and incidental use of insecticides and rodenticides. None of these treatments would have any impact on weed populations unless the equipment used or the operator carried seeds into the project area or moved seeds around the project area from an existing infestation. A proposal for spraying for western pine beetle infestations using carbaryl on the Prescott was cancelled recently.

There have been some herbicides applied in small quantities around administrative sites and recreation areas on all three forests; including treatment of a small leafy spurge population on the Kaibab. While these treatments reduced weed populations, there have not been any herbicidal applications in recent years.

Assessing herbicide use within and adjacent to the project area is difficult to predict since there are so many herbicides where there are no requirements for the seller or purchaser to contact the State and inform them of the product's use (Arizona Department of Agriculture, personal communication, 2003). The State noted that the only products it has control over, and requires reports, are those herbicides that are considered restricted use. The State believes that few, if any, of these products are used in either Yavapai or Coconino County since there are no custom applicators registered with the department. We believe that cumulative effects related to human health impacts from the large-scale application of restricted use herbicides on agricultural lands is not a concern in the project area, though there are 13,045 acres on which we believe herbicides are presently being used. This includes mostly pasture land, however, corn, alfalfa, landscape lawns, vegetable fields, turf (golf courses and football fields), and orchards are recorded and the use of herbicides more than likely occurs.

Statistics are, however, readily available on the kinds and amounts of herbicides used on agricultural lands in Arizona. This use is not considered a cumulative impact associated with our analysis since these applications are occurring in Yuma and Maricopa Counties, where large

irrigation districts have been formed. These districts are well outside the project area. In 2002 alone there were 28 herbicides used on 366,430 acres of agricultural lands with the total pounds applied estimated at 350,000. This value equates to about .95 pound per acre per year. If we project this out for 10 years, which was done for our analysis, there will be over 3,500,000 acres of agricultural lands treated with some form of herbicide.

Some of the most popular herbicides used for turf and landscaping include clopyralid, 2,4-D, dicamba, and glyphosate. We estimate that over the next 10 years, excluding what is being proposed under this FEIS, that about 356,970 acres of herbicide treatments will happen. The greatest majority of treatments, about 209,000 acres, will occur outside national forests on private lands. Golf courses require extensive use of pesticides for upkeep and maintenance. Extensive use of herbicides is required to maintain greens, fairways and even the roughs. Their efforts to maintain the necessary vegetation includes treatment of weed populations. Most communities within the project area have at least one golf course and some cities such as Flagstaff have six or more courses plus additional ones on the outskirts in conjunction with housing subdivisions. The quantity of pesticides used, including herbicides, in these developments is unknown.

The remaining 147,970 acres are present or reasonably foreseeable activities including: noxious weed control on sweet resinbush; activities being completed by Grand Canyon National Park on tamarisk and other noxious weeds; proposed control of aquatic and annual grass species; and vegetation management scheduled for sagebrush. If the proposed weed control project is included, the range in total herbicide treatments goes from a low of 356,970 acres recorded for Alternative 2 (No Action) and Alternative 3 (no herbicide treatments) to a maximum of 420,450 acres calculated for Alternative 1-High. Alternative 4, the preferred alternative, is scheduled for 417,945 acres. The reason this action is so close to the proposed herbicide work as disclosed in Alternative 1-High is that Alternative 4 considers road corridor spraying as a cumulative impact, whereas in Alternative 1 it is part of the scope of the alternative.

Other comparable treatments in unknown quantities occur on private lands scattered across the project area. In areas where there have been concentrations of mosquitoes, some communities have implemented insecticide spraying to reduce populations of mosquitoes to reduce the risk of West Nile Disease. These activities are concentrated in urban areas and have no effect on national forest weed populations.

Other Chemical Use. During winter, the highway departments utilize a combination of abrasives and chemicals (usually a salt compound) to reduce or minimize snow and ice accumulation on the highways, overpasses, and bridges. In mid-2004, representatives from the Arizona Department of Transportation were gathering public comments on an environmental assessment they had prepared evaluating their alternatives and taking into consideration some of the new salts and chemicals developed for this use. A final decision for this document is expected before the winter season, 2004. This decision will affect all three forests but probably the Coconino and Kaibab more than the Prescott due to the difference in severity of winters between the three forests. The chemicals used are not herbicides, but they can have a negative effect on roadside vegetation by killing or reducing the vigor of trees and plants. This effort could kill some weeds or kill competing native vegetation.

There is a proposal to renovate and enlarge the Arizona Snow Bowl skiing area on the San Francisco Peaks of the Coconino National Forest. A draft environmental impact statement was prepared and submitted to the public in February 2004. Some of the alternatives for this proposal

include use of reclaimed water from Flagstaff to be utilized for snow making purposes. The selection of this alternative could add some additional chemicals into the San Francisco Peaks area. A decision on this project should be made within the next few months.

The weed control program, if implemented, represents about 15 to 20 percent of all treatments that are occurring or will occur within the project area over the next 10 years. We do not believe our project—with the reasonably foreseeable or present actions factored in—will exceed any threshold related to herbicide concentrations in surface water, result in the contamination of ground water, or cause any long- or short-term health effects to the general public. Our conclusion is based in part on the assumption that: (1) all users read label instructions and the appropriate herbicide is used in the right setting at rates equal to or below recommended rates; (2) applicators use their personal protective gear and follow the emergency spill plan; and (3) appropriate design features and mitigation measures (Appendix B) are applied.

Impurities, Surfactants, Adjuvants, and Inert Ingredients in Herbicide Formulations

During commercial synthesis of some pesticides, byproducts can be produced and carryover into the product eventually formulated for sale. Occasionally byproducts or impurities are considered toxicologically hazardous, and their concentrations must be limited so that potential exposures do not exceed levels of concern (Felsot 2001).

Technical grade picloram and clopyralid contains hexachlorobenzene (HCB) as a byproduct of the synthesis of the active ingredients (USDA FS 1999e). HCB is also a byproduct of chlorinated solvents used extensively in industry and occasionally around the home. HCB was registered as a fungicide until banned by EPA over concerns that it may be carcinogenic. As a result, EPA has imposed a limit of 100 parts per million (ppm) HCB in Tordon®. The manufacturer of Tordon® officially maintains HCB levels in formulated picloram at 50 ppm or less (i.e. 50 milligrams per liter of formulation). Average concentrations of HCB in picloram have been estimated at 8 ppm (EPA 1995). Therefore, HCB comprises only 0.000005 percent of the Tordon® formulation, which is then further diluted by a factor of 350 when the spray solution is prepared.

Given the dilution of formulations by water in the final spray solution, estimates of HCB exposure from use of picloram or clopyralid containing products have shown that resulting residues in the environment and exposure levels to bystanders do not exceed current background levels. Longer-term dose estimates for the general public exposed to HCB in clopyralid were estimated to be below the general background exposure to HCB in the environment by factors of about 25,000 to several million (USDA FS 1999e). The central estimates of worker exposure under normal conditions to HCB were estimated to be lower than the background levels of exposure by factors of about 1,000. Thus, for commercially sold products which are more diluted than technical grade products, there appears to be no basis for asserting that the use of clopyralid or picloram in accordance with the label by the forests would result in substantial increases in the general exposure of either workers or members of the general public to HCB.

Another concern is potential presence of dioxin in formulations containing chlorinated chemicals. Dioxins are a group of chemicals involving 76 different types of related molecules called congeners, each having from 2 to 8 chlorine atoms. The toxicity of each of the types of dioxin molecules is different. Toxic potency is determined by spatial arrangement of the chlorine atoms in a molecule rather than mere presence of chlorine. Of all of the congeners, one—TCDD (2, 3, 7,

8-tetrachloro-para-dibenzodioxin)—is the most potent. All other congeners are considered 10 to 10,000 times less potent than TCDD. Congeners with the greatest number of chlorine atoms are the least potent (Van den Berg 1998).

TCDD and a few other dioxin congeners are byproducts of the synthesis of trichlorophenol. Most of the other dioxin congeners contain more chlorine than TCDD but are byproducts of the combustion of biomass (e.g., wood) and municipal waste. Dioxin congeners have always been in the environment as a result of natural fires and volcanic eruptions, and burning coal, wood, and gasoline (Alcock et al. 1998; Gribble 1994). Thus, dioxin congeners are ubiquitous but, with the exception of TCDD, their potency is quite low, they are unlikely to be absorbed through the skin, and, thus, they are not of much toxicological concern (Safe 1990).

TCDD is a byproduct of the active ingredient in 2,4,5-T. This herbicide was used as a mixture with 2,4-D to defoliate vegetation during the Vietnam War. In the past, a few imported formulations of 2,4-D were shown to contain some highly chlorinated dioxin congeners; the same congeners found in the environment and believed to be primarily the result of combustion processes. Current quality control procedures during manufacturing have essentially eliminated any dioxin congeners of concern from domestic 2,4-D formulations. Thus, use of 2,4-D products manufactured in the U.S., whether at home or in agriculture and forestry, do not contaminate the environment with the dioxin congener of greatest regulatory concern, TCDD (USEPA 2000).

The proprietary nature of herbicide formulations limits understanding of the risks posed by inerts and adjuvants in herbicide formulations. Unless the compound is classified as hazardous by the EPA, the manufacturer is not required to disclose its identity. It could be suggested that the inerts in these herbicides are not toxic, or their toxicity would be reported to the EPA. This would hold true if considerable toxicological testing of inerts has been done. That, however, has not been the case. EPA is increasing the testing requirements for inerts, but in many cases the inerts currently in use have not been tested rigorously and their toxicity is not well characterized. That being said, studies on the toxicity of technical grade formulations, which often contain the inerts, will account for toxicity of the inerts. These studies do not report human health concerns at the levels of herbicide use proposed by the forests in this project.

The literature does report considerable information on the types of inerts and adjuvants present in the herbicides proposed for use by the forests. Reports indicate that the most common impurities of technical grade 2,4-D include other phenoxyacetic acids, a variety of chlorinated phenols, and possibly low levels of nitrosamines in the amine salts (Ibrahim et al. 1991). Transline, the commercial formulation of clopyralid contains clopyralid as the monoethanolamine salt and isopropyl alcohol, an approved food additive (USDA FS 1999e). Both Tordon 22 and 22K contain the potassium salt of picloram (24.4 percent); the remaining percentage consists of polyglycol 26-2—the DOW name for polyethylene glycol—a widely used family of surfactants considered to have low toxicity and frequently used in the formulation of ointments and cosmetics (MCCHB 2001). USDA FS (1996c) reports that Garlon® formulations of triclopyr contain ethanol and kerosene. Technical formulations of imazapyr contain isopropyl alcohol and isopropanolamine salts of imazapyr (USDA FS 1999d). Glyphosate has been reported to contain small amounts of nitrosamine and N-nitroglyphosate (USDA FS 1996d).

Roundup®, a formulation of glyphosate, contains the surfactant polyoxyethyleneamine (POEA), and it contains 1,4-dioxane, classified by EPA as a probable human carcinogen. However, carcinogenic studies of Roundup® by EPA have shown the herbicide to be noncarcinogenic

(USDA FS 1996d). USDA FS (1998c) reports that the inerts in Escort®, which contains metsulfuron methyl, are confidential. They do report, however, that the inerts in Escort® are not classified by EPA as toxic.

Many herbicide formulations contain dyes. Use of dyes can be beneficial in that they can color vegetation, making it less likely for an individual to inadvertently or intentionally consume contaminated vegetation. The presence of a dye in herbicide formulations may also make it easier for workers to see when they have been contaminated and allow for prompt remedial action. Dyes may also pose risks to humans and wildlife. The most common dyes used with herbicides are Milori blue, Heliogen blue, Lithol rubine, and Sico fast orange (USDA FS 1995b). Little information is available on toxicity of the majority of dyes used in the industry. There has been considerable concern over the carcinogenic potential of less used dyes Rhodamine B and Basic Violet 3. Rhodamine B is a colorant used in some commercial herbicide dyes. Basic Violet 3 is the colorant used in Colorfast Purple. Both have been used with glyphosate. The Forest Service completed a risk assessment of Rhodamine B and Basic Violet 3. It predicted there was a cancer risk for a lifetime of occupational exposure to Rhodamine B (excess risk ranged from 8·10-6 to 8·10-8) (USDA FS 1997e). The excess cancer risk for Basic Violet 3 was estimated to be about twice that of Rhodamine B. This project does not propose to use either of these dyes.

Surfactants are also commonly used in herbicide formulations. Surfactants are added to herbicides to improve herbicide mixing and absorption or permeation of the herbicide into the plant. Like dyes and other inerts, there is limited information on the types of surfactants used and toxicity of surfactants, especially since the industry considers the surfactant to play a key role in the effectiveness of herbicide formulations. Most knowledge of surfactants is proprietary information and not disclosed. The glyphosate risk assessment (USDA FS), which attempted to assess effects of surfactant formulations on the toxicity of glyphosate, reported that toxicity of glyphosate alone was about the same as the toxicity of the glyphosate and surfactant mixer and greater than toxicity of the surfactants alone. Whether this same pattern would hold true of other herbicides having the same or different surfactants is unknown. If so, toxicological studies performed on herbicide formulations (which contain inerts and surfactants) may accurately portray the toxicity and risks posed to humans by the surfactant.

Synergistic Interactions

Concerns are occasionally raised about potential synergistic interactions of herbicides with other herbicides in the environment. Synergism is a special type of interaction in which the combined impact of two or more herbicides is greater than the impact predicted by adding their individual effects. The before mentioned risk assessments (USDA FS 1992b, 1995c, 1996c-d, 1997b, 1998e-f, 1999d-f, 2000b, 2001e) address the possibility of a variety of such interactions. These include interaction of the active ingredients in an herbicide formulation with its inert ingredients; interactions of these herbicides with other herbicides in the environment; and cumulative impacts of spraying as proposed with other herbicide spraying to which the public might be exposed.

No one can guarantee the absence of a synergistic interaction between herbicides and/or other chemicals to which workers or the public might be exposed. For example, exposure to benzene, a known carcinogen that comprises 1 to 5 percent of automobile fuel and 2.5 percent of automobile exhaust, followed by exposure to any of these herbicides could result in unexpected biochemical interactions (USDA FS 1997d). Analysis of the infinite number of materials a person may ingest or be exposed to in combination with chemicals is outside the scope of this analysis. There is

some indication, however, that coexposure to 2,4-D and picloram may induce effects not associated with exposure to 2,4-D or picloram alone (USDA FS 1998c; Cox 1998; OSU 1996b).

Endocrine Disruption

Recent studies raise suspicion regarding the potential for some herbicides to be hormonally active. However, there is no evidence indicating that herbicides considered for application would pose risks to wildlife at the recommended application rates and expected exposure levels. It should also be noted that the forests would use an adaptive management approach for managing weeds. Information obtained from monitoring studies and new information regarding herbicides would be used to reduce effects should they become evident.

The endocrine system is a complex network of glands and hormones that regulates many bodily functions in animals including growth, development, metabolism and maturation. The endocrine glands (including pituitary, thyroid, adrenal, thymus, pancreas, ovaries and testes) release measured amounts of hormones into the bloodstream that act as chemical messengers throughout the body to control many vital functions (NRDC 2004).

The Food Quality Protection Act (FQPA) requires that EPA develop tests to screen for chemicals with the potential to mimic hormones. Chemicals that do mimic or antagonize hormones and cause biochemical changes in tissues are called endocrine disrupting chemicals (Damstra et al. 2002) or hormonally active agents (HAAs). One concern over HAAs is due to the fact that the endocrine system is closely linked with the brain and immune system. All three systems communicate with one another to affect body development and functioning. Adverse effects on this network have been blamed for a variety of maladies ranging from cancer to infertility to behavioral problems (Felsot 2001).

Chemicals, other than our own hormones, can interact with components of the endocrine system. Scientists have discovered that many kinds of chemicals, including natural food biochemicals as well as industrial chemicals and some pesticides, can mimic the action of the hormones estrogen or testosterone. Concern has also been expressed about potential effects on the thyroid hormone during early development (Felsot 2001, Damstra et al. 2002).

Two general types of tests are used to screen chemicals for endocrine disrupting abilities. The most widely used tests are in vitro tests. These tests are conducted in a test tube or dish using cells and, in some cases, the actual protein receptors, enzymes, and genes involved in the biochemistry of the endocrine system. In vitro tests can be used to quickly screen large numbers of chemicals for their ability to interact with different biochemical components of the endocrine system.

Positive in vitro tests, however, do not necessarily indicate that a substance will actually disrupt hormone functioning in a whole organism. Considerable caution is necessary in extrapolating from in vitro data to in vivo (whole live animal) effects. In vitro screening tests are properly used to determine which chemicals should be subjected to a second type of test, the in vivo or “live animal” test. In vivo tests use whole animals that are fed various doses of chemical. In some cases, the chemical is injected beneath the skin or directly into the body cavity. Developmental and reproductive toxicity studies with live animals over several generations are especially useful for determining if a substance adversely affects the endocrine system.

All chemicals that have been tested in vitro (with one exception, the drug DES or diethylstilbesterol) are thousands to millions of times less potent than the natural estrogen

hormone estradiol (Felsot 2001). Also, as exhibited by estradiol, all chemicals tested in vitro, appear to show definitive threshold effects (i.e., NOELs) for estrogenic activity. No pesticides, food biochemicals, or other synthetic chemicals have definitively shown greater and/or different in vitro effects at low doses as compared to higher doses. Although our natural hormones function at very miniscule levels in the body, endocrine disrupter tests have shown that interactions of hormone receptors with natural and synthetic chemicals are still related to dose during exposure. Even chemicals capable of interacting with the endocrine system at sufficiently high doses have not been found biologically active at low doses (EPA 1997a).

In the in vivo studies to date, only a handful of chemicals—including natural food biochemicals, a few pesticides, and several industrial chemicals—show endocrine disrupting effects (Felsot 2001). In vivo experiments usually involve feeding pregnant rats or mice one or more doses of a chemical. Because the male fetus is more vulnerable to estrogen mimics than females, they are studied for any effects on prostate glands, penile malformations, and sperm production. In virtually all published cases where a series of doses are tested in vivo, endocrine effects did not occur below some threshold dose (EPA 1997a). Any effects that have been observed were in tests with doses greater than environmental or dietary concentrations, with the one exception of the drug DES. To our knowledge DES has not been identified in any of the herbicides proposed for use in this project.

Picloram - No adverse effects on endocrine activity have resulted from numerous studies conducted on mammals and birds to determine picloram toxicity values. Evidence indicates that the endocrine system in birds and mammals is not affected by exposure to picloram at expected environmental concentrations (DOW 2001). Carbon dioxide is the major end product of breakdown of picloram (Infoventures 1995i). Mammals excrete most picloram residues unchanged and it does not bioaccumulate in animal tissue. Formulated products are generally less toxic than picloram (Infoventures 1995i).

Based on these studies, picloram does not appear to cause genetic damage or birth defects, has little or no effect on fertility and reproduction, and is not carcinogenic (Infoventures 1995i; Felsot 2001).

2,4-D - Studies in rats suggested 2,4-D was not cancer causing, though liver damage was seen at relatively low dosages. Pregnant rats showed no evidence of birth defects, though fetuses showed evidence of toxic effects. No effect on reproduction or fertility has been demonstrated in rats and 2,4-D did not cause genetic defects in most studies (Infoventures 1995b). While an association between 2,4-D exposure and canine malignant lymphoma has been reported (Hayes et al. 1991), a causal mechanism was not identified. In a recent review of 2,4-D epidemiology and toxicology, Garabrant and Philbert (2002) concluded that evidence that 2,4-D might be carcinogenic was "scant."

2,4-D can bioaccumulate in animals. Residues have been reported in milk, eggs, and meat products. Risk to browsing wildlife, however, appears to be low. A study in Oregon after aerial spraying found concentrations on forest browse plants to be below those able to cause effects in mammals (Tu et al. 2001). Recently, Vincent et al. (2001) observed elevated serum testosterone and leuteinizing hormone levels in forest pesticide applicators (spraying 2,4-D) at the height of the application season. While these hormone levels were not of clinical concern and the sample size was small, results suggest that 2,4-D may have potential to interact with the endocrine system.

Glyphosate - Studies of glyphosate lasting up to 2 years have been conducted with rats, mice, dogs, and rabbits and, with few exceptions, no effects were observed (OSU 1996a; Infoventures, 1995h; USDA FS 1997b). Some tests have shown that reproductive effects may occur at high doses (over 150 mg/kg/day), but there have been little to no reports of mutagenic, developmental, or carcinogenic effects.

Glyphosate itself is an acid, but it is commonly used in the isopropylamine salt form. When applied to foliage, it is quickly absorbed by the leaves and rapidly moves through the plant. It acts by preventing the plant from producing an essential amino acid. Glyphosate is metabolized by some plants, while others do not break it down. Glyphosate will remain in the soil unchanged for a varying length of time depending on soil texture and organic matter content. The half-life of glyphosate is reported to be from 3 to 130 days (Infoventures, 1995h). Soil microorganisms break down glyphosate and the surfactant used in Roundup® to carbon dioxide.

Triazine herbicides, such as atrazine, are not being considered for use in this project because they can affect the reproductive system by interfering with androgen synthesis (Thomas and Thomas 2001). Carey and Bryant (1995) reviewed the numerous pathways through which amphibians could be impacted by chemicals in the environment. They suggest that adult and larval amphibians are not necessarily more sensitive to chemicals than other terrestrial or aquatic vertebrates. However, sublethal effects can manifest as increased susceptibility to disease, increased predation, altered growth rates, or disrupted development. They suggest "endocrine disrupting toxicants can have effects at tissue levels well below detectable levels," and that "toxicants designated as safe should not be considered to be free of endocrine disrupting effects until proven otherwise." Their position is substantiated by a recent study indicating that the herbicide atrazine, at concentrations below the EPA drinking water standard, can interfere with larval development in frogs (Hayes et al. 2002).

Social Concerns and Economic Influences

Direct and Indirect Effects on Access to Vital Services, Recreation Sites, and Plant Collection

This portion of the "Environmental Effects" section discloses the anticipated impacts of proposed herbicidal use on two significant issues. It also includes the appropriate cumulative effects analysis, if warranted. The evaluation criteria in Table 24 were developed to assess impacts of the proposed integrated weed treatments on access and plant collection.

Table 24. Direct and indirect effects on access and the collection of plants

Alternatives	Alt. 1 High	Alt. 1 Low	Alt. 2	Alt. 3	Alt. 4
Total Acres of Rights-of-Way (ROW) Treated	12,675	12,675	0	5,100	4,055
Estimated Acres of Herbicide Treatments Scheduled for ROW	11,265	11,265	0	0	2,645
Total Acres of Herbicide Treatments Scheduled	74,920	38,735	0	0	62,035*
Acres of Limited Spray Zones	0	0	0	0	818,000

* About 4,000 acres of annual grass control are accounted for in the total amound projected.

Direct and Indirect Effects Common to Alternatives 1 (High and Low) and 4

We expect to be able to identify alternate routes into campgrounds and other facilities when forest roads are identified for treatment with herbicides. In any given year we do not believe that more than 10 percent of the road network will be scheduled, and this will allow for identification of other avenues of travel.

More than half of all herbicide treatments will be completed with handheld nozzle sprayers or wick applicators. Little, if any, drift is projected with these methods. All treatments for noxious or invasive tree species are either cut and daub or straight injection into the bark of the tree. As with the use of backpack sprayers, the amount of drift is very limited and impacts on nontarget species are not anticipated. The remaining herbicide treatments will be completed using a boom sprayer either attached to a truck or all-terrain vehicles (ATV), where allowed. Though potential for drift is higher under this method, application of mitigation measures related to wind speeds would limit impacts to nontarget plants. However, losses of native plants that are collected by individuals would be limited mainly to the ponderosa pine, riparian, and high elevation grasslands of the Verde River and Little Colorado Watersheds. There will be little to no impact on collection of native plants since the total herbicide acreage treated comprise only 1.25 percent of the total 4.9 million acres on the three forests, spread out over 10 years. We anticipate that none of the plant species collected by American Indians and others will be impacted by implementation of either action.

Herbicide treatments scheduled for wilderness and other special designation areas could also potentially limit access for people with sensitivities to herbicides. These treatments will occur mainly within the Kachina Peaks and Red Rock-Secret Mountain Wilderness areas and the Verde Wild and Scenic River Corridor, although most other special designation areas have some weed species present. There are presently over 15 weeds with a combined estimate of 2,120 acres. We believe that about 60 percent will have herbicide treatments and the remaining 40 percent manual, mechanical, cultural or biological treatments. The important nature of wilderness zones and other special designation areas for promotion of wildlife habitat and watershed protection values shifts the control objective to eradication for most species. Prioritization of these areas and their relative remoteness (more difficult to return for retreatments) results in more herbicidal work forecasted compared to weed treatment strategies in other areas.

Direct and Indirect Effects Common to Alternatives 2 and 3

Alternative 2 (No Action) and Alternative 3 would not authorize use of herbicides within Forest Service rights-of-way (e.g., Lake Mary and Perkinsville Road) or other lands within the project area except National Forest System lands under jurisdiction of the Federal Highway Administration. We predict that there will be no access problems associated with Forest Service roads, campgrounds, trailheads, or any other facilities located within the project area. Collection of plants by American Indians and others for traditional or medical reasons would not be influenced by the use of herbicides from this project. Under Alternative 3, steaming of about 25,000 acres over 10 years would temporarily kill all plant species in treated areas for a period of time. However, probability is slight that the highly disturbed areas selected for steaming would contain plants desired for collection.

Direct and Indirect Effects of Alternative 1 (High and Low)

At both levels, about 11,440 acres of herbicide treatments would be authorized along main travel corridors under control of the Federal Highway Administration. This includes Interstates 17 and 40 and other roads such as State Highways 67, 89, 89A, 180, and 260. It is not anticipated that other integrated management techniques would be used to any great degree since rights-of-way corridors do not lend themselves for the use of these methods, except for possibly mechanical.

Design features for integrated weed treatment projects (see Appendix B), including communication plans, signing, and alternate routes around treated zones, are components of Alternative 1. There will also be a continuation of the present ADOT program where a phone number is available where people with sensitivities to herbicides can call and find out the routes and times, and what herbicides are proposed for use.

We predict the proposed design features will help individuals avoid traveling on roads that have been treated with herbicides, but we anticipate that people may be prevented from accessing vital services on occasion. This is especially true if they need to use Interstates 17 or 40 or some of the other heavily infested roadways like State Highways 67, 89A, 180, or 260. Many of the road systems in and around the Prescott area have not been found with high infestations of weeds. Some limited spraying will occur to prevent existing populations from spreading. As control objectives are met, additional spraying would still occur as new populations are identified but would be of such a low acreage value that we believe access to vital services would not be severely hampered.

We predict that herbicide treatments along Forest Service roads accessing campgrounds, trailheads, or scenic overlooks would be limited, this will mainly occur in the ponderosa pine, riparian, and high elevation ecosystems associated with the Verde River and Little Colorado Watersheds. On the Kaibab National Forest, only Whitehorse Lake would be affected and the potential for this will occur only during the first 5 years after implementation. On the Coconino National Forest, herbicide treatment of the high infestations along Lake Mary Road will temporarily impede access for people with sensitivities to herbicides to facilities around Upper and Lower Lake Mary, Ashurst Lake, and Mormon Lake. Within the Prescott National Forest, recreation sites including Beasley Flat, Clear Creek, Black Canyon, and Mingus Mountain will all be treated for weeds, limiting chemically sensitive individuals from accessing these sites temporarily. We foresee that most of these access limitations will occur in the first 5 years; though since these areas have some of the highest infestations, spot treatments going up to 10 years could occur.

In Alternative 1-High we predict the amount of acres treated with herbicides is 22,185 acres or about 65 percent of all treatments (34,130 acres). It is expected that the potential for individuals with MCS to experience a reaction to herbicides is the highest with this alternative. Even with the proposed mitigation, there will always be potential for an individual to travel into a recently treated zone.

At the low level, we predict the new acres treated with herbicide drops to 10,400. This represents 51 percent of the proposed acres scheduled. This drop in acres is almost all tied to the fact that Dalmatian toadflax will not be treated at the low level. It is expected that the potential for individuals with MCS to experience effects would be lower under this alternative since the amount of herbicidal work drops by 11,785 acres. However, like the high level, there will always

be potential for an individual to travel into a recently treated area and have an allergic or toxic reaction to the spraying treatment.

Direct and Indirect Effects of Alternative 3

Probability exists for MCS individuals to be hindered by smoke in their access to forest facilities. We project this will be very limited in extent if this alternative is selected. The number of acres treated over the planning horizon is about 900 acres per year, and typically the fuels are such that large volumes of smoke are not generated. In addition, these zones will be burned when mixing conditions are generally good so any production of smoke should be dissipated within a day or two after ignition. While nonchemical methods of weed control are not entirely without risk, their effects are far more limited—they are immediate in time and location (Munson 2004). Thus, they do not pose the public health risks of herbicides. Many of the risks present (mower accidents, inhalation of dust raised by mowing or cultivating, burns from flame or steam, shock from electric fencing for weed-eating goats) can be minimized with safety equipment and attention.

We also foresee that the collection of plants will not be hindered, though some nontarget plants could be lost if this action is selected. Although herbicides are excluded from use, treatments will occur along Lake Mary, Perkinsville, Snow Bowl, Townsend-Winona, and Walnut Canyon Roads. It is planned that 5,100 acres will be scheduled with most of that being steaming. Other treatments include manual pulling and reseeding with a native grass/forbs mix.

Steaming could potentially kill nontarget plants. However, we plan to use the steaming treatment method only in highly disturbed areas where no desirable plants occur, and we will reseed immediately upon completion of the retreatments, if needed.

Direct and Indirect Effects of Alternative 4

Of the total new and repeat treatments, 62,035 acres are herbicidal. This value contains the 4,000 acres scheduled for treatment of annual grasses, which was not a component of Alternative 1, the Proposed Action.

The overall reduction in herbicidal use from the high level of Alternative 1 is 12,885 acres. Species that were predominately scheduled for herbicide work in Alternative 1-High that have been shifted to other integrated weed treatment techniques in Alternative 4 include bull thistle, diffuse knapweed, Himalayan blackberry, Malta starthistle, Mediterranean sage, musk thistle, Scotch thistle, and spotted knapweed.

An estimated 818,000 acres of limited spray zones would be established which represents about 15 percent of the project area. The amount within the Verde, Little Colorado, Colorado-Grand Canyon, Gila, and Bill Williams Watersheds is calculated at 445,000 acres, 206,700 acres, 86,700 acres, 68,000 acres, and 11,700 acres, respectively. Except for camelthorn, leafy spurge, Russian knapweed, tamarisk, tree of Heaven, and Siberian elm, other weeds will be treated by manual, mechanical, cultural, and biological methods.

We anticipate that limited spray zones, with appropriate design features related to signing, public notification, and development of alternative routes around spray zones (see Appendix B), will provide adequate access to most recreational sites and other facilities. We also believe the potential for adverse health reactions will be lowest under this alternative.

According to Munson (2004), if advance notice of the event is given through a wide variety of media, some people at risk can take steps to protect themselves. Some may be able to arrange to stay indoors at home with enough food, drinking water, medicine, air filters, and supplies to wait until the smoke is gone or the herbicide is diminished, which may take several weeks. Advance notice can be of crucial help for some, although it cannot protect everyone (Munson 2004). (The need for emergency medical care or evacuation for a fire or other disaster may force some people out, or people living outside the communication network may not learn about the spraying ahead of time.) Others may need to evacuate the area. She states that it is important that some areas and routes be left herbicide-free so that a place and path of refuge exists for people to evacuate, which is what the forests are planning to do.

Cumulative Effects

Cumulatively, when other present and reasonably foreseeable actions are taken into account, selection of either Alternative 1 (High and Low) or Alternative 4 would increase the total amount of herbicides applied within the project area about 10 to 20 percent for Alternative 1, and about 15 percent for Alternative 4. Figure 16 displays the cumulative impacts of the Proposed Action and alternatives as compared to present and reasonably foreseeable actions.

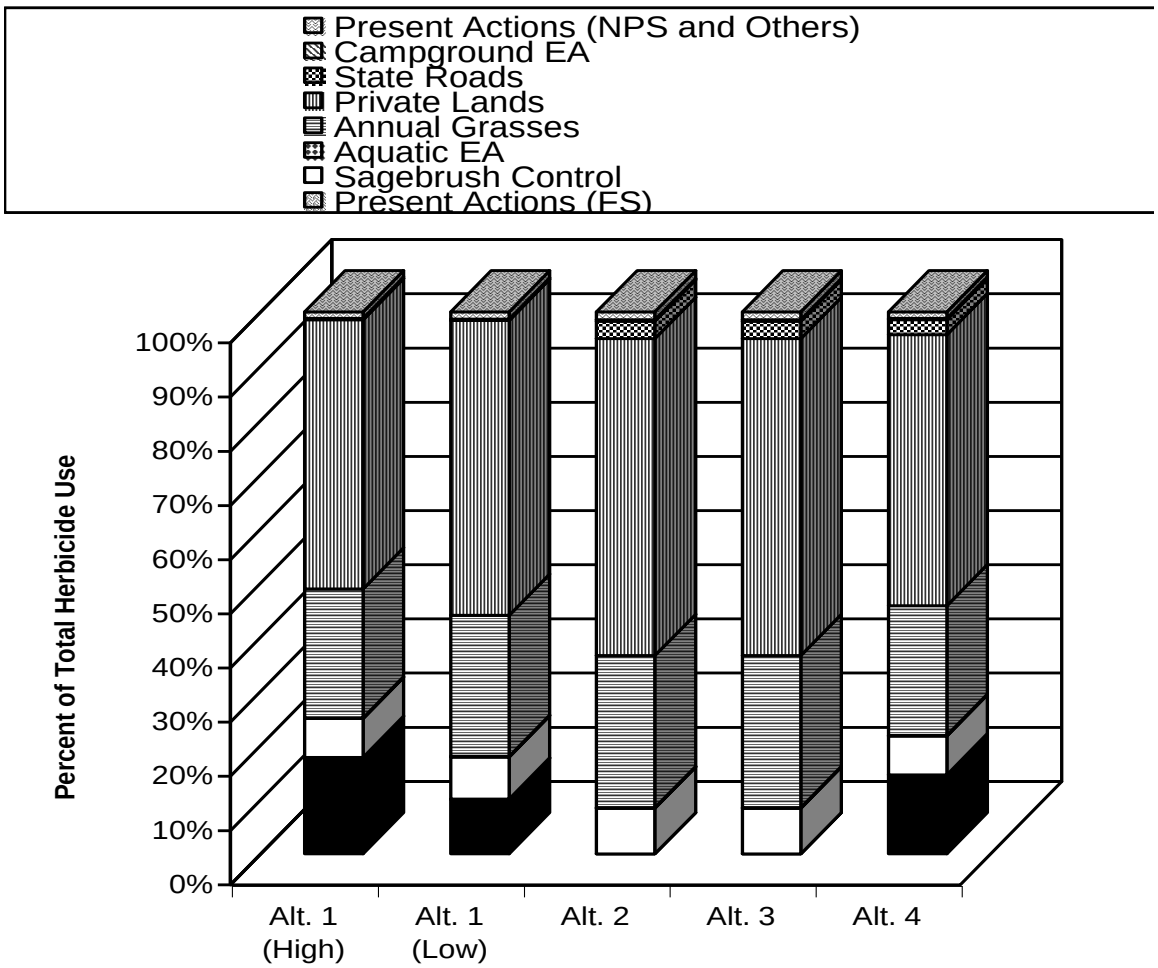


Figure 16. Cumulative impacts on access and collection of plants

By far the greatest impact from present and reasonably foreseeable actions on access will be activities associated with the use of herbicides on private lawns, golf courses, and agricultural lands. Depending on which alternative is selected, this range goes from 50 percent for Alternative 1-High to 70 percent predicted for Alternatives 2 and 3. This chart does not account for growth in Yavapai or Coconino Counties (which has averaged 5 percent per year) nor applications of insecticides and other products that influence the ability of MCS individuals to access vital services. It is conceivable that in another 10 years the amount of herbicides applied could increase by a considerable amount.

Other activities that are being undertaken at this time include spraying of sweet resinbush in the Verde Valley and control of tamarisk and several other species within Grand Canyon National Park. Several State parks are spraying to control knapweed species, and one project is being undertaken to eradicate yellow starthistle on State Trust Lands. The Bureau of Land Management is very active in the Colorado River Watershed north of the Grand Canyon and is spraying for control of biennial thistles and several other species. The combined acreage of this work over a 10-year period of time is estimated to be 5,000 acres or about 2 percent of the total work predicted.

Reasonably foreseeable activities include development of a program to contain annual grasses, campground spraying to control bark beetles, an aquatic noxious weed eradication program, and control work for big sagebrush on Kaibab National Forest. If these proposals are completed over the next several years, this could add an additional 130,500 acres over the next 10 years. The greatest amount of work would be associated with the control of annual grasses (100,000 acres) and 30,000 acres would be targeted to sagebrush control in the Little Colorado and Colorado Watersheds. This represents 20 to 25 percent of all herbicidal treatments being proposed within and adjacent to the project area.

Although highway systems under jurisdiction of the Federal Highway Administration are accounted for under direct/indirect effects for Alternative 1, they are considered a cumulative effect for Alternatives 2, 3 and 4. These FHWA treatments would contribute about 12,000 acres over the 10-year period, or less than 5 percent of the total.

Overall, when reasonably foreseeable actions are considered, the ability of MCS people to move around the project area will become more limited as additional homes are built and infrastructure demands are met. This will mean more lawns, golf courses, and athletic fields where herbicides are used in a regular fashion. Forest Service activities related to control of bark beetles, sagebrush, and annual grasses will further limit individuals who have a compromised immune system, but we believe we will be able to generally find alternate routes around the treated zones so access can be maintained to most forest facilities. The exception to this is bark beetle control that is scheduled to occur within several campgrounds within the Coconino, Kaibab and Prescott National Forests. This will limit access until the work is completed, and that is estimated to take at least 2 to 3 years.

The collection of plants by American Indians and others will be only slightly impacted, even when cumulative impacts are considered. At no time will more than 3 percent of an ecosystem be impacted by weed control and this higher level applies only to the ponderosa pine, riparian, and high elevation grasslands in the Verde River and Little Colorado Watersheds. The anticipated control work on annual grasses and big sagebrush represents less than 1 percent of their respective ecosystems. The remaining ecosystems and watersheds will have low levels of

treatments (less than 1 percent and in many cases less than one-tenth or one-hundredth of a percent), so no large losses of native plants used for medical or other purposes are foreseen.

Cultural Resources

Environmental Consequences

Intensive cultural resource surveys will be completed for individual weed treatment projects that include mechanical treatments. Before each forest authorizes an individual noxious weed treatment project that includes mechanical treatment to proceed, all historic properties will be identified and evaluated and an assessment of effect shall be completed. If significant properties are identified, they will be protected from mechanical treatment methods that have potential to adversely impact the property in consultation with the affiliated tribes and Arizona State Historic Preservation Office.

The forests shall draw from the following protection measures to ensure that effects to historic properties are avoided or minimized: (1) no mechanical treatment within site boundaries; (2) no use or staging of heavy mechanized equipment within site boundaries; and (3) allow other treatments within the boundaries of eligible or unevaluated sites if the forest and Arizona State Historic Preservation Office (SHPO) agree that the activities will have no effect or no adverse effect on historic properties. Site protection requirements shall be documented. Sites identified for protection will be monitored in accordance with Forest Service policy contained in FSM 2361.

If traditional cultural properties are identified, the forest shall consult with the affected tribes regarding inventory, evaluation, effect, and protection or treatment measures.

Previously unrecorded properties that are encountered during the course of a noxious weed control activity shall be protected in the same manner as other properties, using the protection measures stated above.

Environmental Justice

The Environmental Justice Executive Order 12898, released by the White House in 1994, places attention on adverse human health and environmental effects of agency actions that may disproportionately impact minority and low-income populations. Low-income populations are households that live below the subsistence or poverty level as defined by local, State, or Federal Government. The order simultaneously directs Federal agencies to avoid making decisions that discriminate against these communities.

Environmental justice also means that, to the greatest extent practicable and permitted by law, populations are provided the opportunity to comment before decisions are made, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment.

Scoping of the Proposed Action began in June 2001, at which time all potentially affected parties were contacted. We held meetings and received comments back from individuals, groups, and organizations regarding our proposal to treat noxious weeds. Implementing Alternative 4 will not

limit or impact low-income individuals by a disproportionate share since the majority of treatments are within Forest Service administered lands and are a considerable distance from communities and, to a large degree, private lands found within the boundaries of the project area.

Short-term Uses and Long-term Productivity

Alternatives 1 (High and Low), 3 and 4 implement some level of noxious weed control on the Coconino, Prescott, and Kaibab National Forests. Over the next 10 years, a range of treatments going from a minimum of 7,650 acres per year to a high of 21,150 acres will occur, mostly within the ponderosa pine, high elevation grasslands, and riparian zones of the Verde River and Little Colorado. We believe that maintenance of long-term productivity will be achieved only under Alternative 1-High and Alternative 4. Neither Alternative 1-Low nor Alternative 3 accomplish this since at the low level of Alternative 1, not enough area or species are treated to gain a reasonable level of control; whereas with respects to Alternative 3, exclusion of herbicide treatments virtually makes it impossible to gain control on nine species. Alternative 2 (No Action) would result in the greatest losses associated with long-term productivity since a noxious weed control strategy would not be implemented.

Unavoidable Adverse Effects

Within Alternative 1 (High and Low) and Alternative 4 we do not predict any unavoidable adverse impacts except possibly for some loss of native plants. Loss of native plants will be limited in extent and not cause loss of any threatened or endangered plant, fish, or animal species. Native plants collected by American Indians and others for medical purposes may be slightly impacted. This will occur mainly in the ponderosa pine ecosystem of the Verde River and Little Colorado basins. Some steaming is proposed under both actions, though this is very limited and mostly will occur around campgrounds and along major paved forest roads. However, for a period of years we predict these steamed areas will be virtually devoid of any effective ground cover or plants. Some access problems will happen on a limited basis as roads are treated that go into campgrounds, trailheads, wilderness areas, and scenic overlooks. We do not feel this will impact over 10 percent of the project area at any given point in time.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are not projected in Alternatives 1 (High and Low), 3, or 4 except for the financial resources necessary to implement these actions. Irretrievable commitments will occur and take the form of some loss of native plants in the ponderosa pine, riparian, and high elevation meadows associated with the Verde River and Little Colorado Watersheds. These treatment zones will also experience a decline in overall ungulate capacity on a range of acres going from a minimum of 20,395 acres (Alternative 1-Low) to a maximum of 49,605 acres associated with Alternative 3. If Alternative 2 is selected, we could experience irreversible losses in the understory habitat components in the riparian and ponderosa pine type of the Verde River and Little Colorado basins. Our projection of acres infested with noxious weeds in 10 years is just over 340,000 acres for Alternative 2, which still represents less than 10 percent of the total area. However, some of the most invasive plants including the knapweed species, camelthorn, leafy spurge, and starthistles probably will have expanded to such an extent that an eradication objective would no longer be feasible.

There would likely be no irreversible or irretrievable commitment of resources involving wildlife attributable to implementing Alternatives 1, 3 or 4. Impacts from most actions would be short term.

There would be no irreversible or irretrievable commitment of resources involving threatened, endangered, proposed, or sensitive wildlife species attributable to implementing any alternative. Impacts from actions would be short term. No long-term loss of plant species is predicted from herbicide applications, and native forb species reduced by herbicide applications are expected to recover within a few years after treatment and thrive after reduction from weed competition. Under the No Action Alternative, weed infestations would continue to intensify and spread, grass and forb cover would be reduced, and wildlife would be indirectly impacted. The longer weeds are allowed to propagate, the longer it may take to recover plant and animal communities after treatment is undertaken.

Areas with Special Designation

Environmental Consequences to the Wilderness Resource

Methods of Treatment within Wilderness

Most treatment methods within the integrated weed management described previously could be used within wilderness, wild and scenic rivers, and research natural areas with some modifications. Mechanized equipment may be used in wild and scenic and research natural areas where allowed in area plans. The methods by alternative and those modifications are described below.

- **Manual** — Hand pulling, digging, and removal of weeds will be used for many small infestations where the method is effective. (Would apply to Alternatives 1 (both High and Low), 3 and 4.)
- **Mechanical** — Most methods would not be utilized within wilderness due to potential conflicts with the resource. It may be possible to prescribe burn some infestations if it is considered and approved under the specific wilderness fire management plan. (Would apply to Alternatives 1, 3 and 4.)
- **Cultural** — There is an opportunity to utilize some grazing alternatives if wilderness is part of an existing grazing allotment. Use of fertilization and seeding of competitive native plants will be considered on a case-by-case basis. Use of weed seed-free seed mixes and mulches is and will continue to be used based upon availability of weed seed-free seed mixes and mulches. (Would apply to Alternatives 1, 3 and 4.)
- **Biological** — Approved insects and pathogens could be used in wilderness areas. (Would apply to Alternatives 1, 3 and 4.)
- **Herbicidal** — Spot treatments using injection, hand-pump backpacks, portable pressure driven sprayers, and cut and daub could be utilized within wilderness. Cutting methods would be evaluated on a case-by-case basis. (Would apply to Alternatives 1 and 4.)

Effects of Treatments to Wilderness

Treatments within designated wilderness have been evaluated for the following features: natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability/boundaries.

Natural Integrity — With the introduction of weed species to wilderness, some of the natural process may not occur. Natural integrity is generally good within wilderness as there are few, if any, human induced changes in the areas. Treatments using herbicides or hand mechanical methods would be visible in the short term. Eradication of larger infestations may not revegetate back to native species in the short term.

Apparent Naturalness — Most infestations and areas of previous infestations are not noticeable to the general public. Many noxious weeds have flowers or attractive foliage. Conversion from native species to the noxious or invasive species was gradual and not apparent to most of the general public. Conversion back to native species will be gradual and will not be apparent to most of the general public

Remoteness — Neither the infestations of weeds or the treatment of those infestations will impact the remoteness of the areas.

Solitude — Infestations of weeds will not impact the solitude of the areas. During treatment activities, there will be a temporary disturbance in and around the treatment areas and along the access route to those treatment areas.

Special Features — Infestations of weeds will generally not have any impact on the special features within wilderness. Unique plant species within a wilderness could be negatively impacted by exotic weed infestation.

Manageability/Boundaries — Infestations of weeds do not impact the Forest Service's ability to manage a wilderness. Treating infestations will require additional work, including planning, the logistics of accomplishing the work in an isolated location, conducting the work, and then monitoring the results of the work.

In addition to these criteria, it is desirable to evaluate the potential effects of treatments within these wilderness areas when they are considered as an individual's "special place – with special personal values" associated with them.

In the event that someone's "special place" receives extensive weed control treatments, potential impacts could be construed as negative in the event of a large infestation or negligible for smaller treatment areas. There are already large amounts of dead and dying vegetation in all three forests from the lingering drought and various insect attacks. It is not uncommon to see patches of dead and dying trees across the landscape.

While vegetation mortality is common, it is usually viewed in the middle ground or in the distance. It takes on an entirely different cast when it is viewed in the foreground, especially when the dying vegetation is familiar to the viewer.

If the vegetation treated consists of forbs or small plants, the negative impact would usually be a year in length or possibly 2 years. To the untrained eye, it may not be apparent that a treatment has occurred. If the treated vegetation is larger shrubs or trees, it is likely that the impacts will be

apparent for several years while the plant defoliates and stands as a snag, then several more years after the plant has fallen until it decomposes. If the plant is cut down during treatment, it will remain on the forest floor until it decomposes.

During the time from treatment until the plant decomposes there could be negative connotations for the individual so that the place either loses its "special" designation or the location is a source of anguish and animosity.

For an individual who has multiple chemical sensitivities, a "special" place may be one of their only bastions of chemical free security from a society that does not seem to understand how sensitive some people are to chemicals. To have their "special" place violated with any treatment, and in particular a chemical treatment, would have negative impacts of anguish, animosity, and quite possibly health concerns and risks.

From the resource standpoint, many of these same invasive species left untreated will change the character, usability, and ecosystem surrounding the infestation. While the visual quality of the area may be negatively impacted for 1 to 5 years, the long-term outlook for protecting and preserving the natural integrity of the wilderness resource is positive. Nontreatment of wilderness infestations could negatively change the apparent naturalness and natural integrity of the wilderness.

All Action Alternatives: Wilderness areas and other specially designated zones are considered a high priority for treatment and, as such, would be scheduled similarly for all action alternatives. The areas where substantial work is projected include Kachina Peaks, Red Rock-Secret Mountain, Kanab Creek, and West Clear Creek Wilderness areas and the Verde Wild and Scenic River Corridor. Species that would be treated include Dalmatian toadflax, diffuse knapweed, biennial thistles, tamarisk, whitetop, and Russian knapweed, and the control objectives would be reached for all these plants. This would not only maintain current wilderness values but also ensure that effective ground cover is maintained so that watershed conditions remain in satisfactory condition.

Alternative 2: Recreational and wilderness values will decline as yellow starthistle, camelthorn, and the biennial thistles (Scotch, bull, and musk) expand. The ability of people to travel through these populations will be severely restricted. Seed dispersal plus the attachment of seeds to animals, humans, and equipment will further promote the spread of these species and lead to the decline in recreational opportunities within and outside wilderness areas.

Environmental Consequences to the Grand Canyon Game Preserve

The treatment or nontreatment of weed populations within the Grand Canyon Game Preserve (GCGP) will have limited impact on game animals, nongame animals and birds in the short term. Weed infestations only occur on a few hundred acres of the approximately 656,000 acres. Over the course of time, these infestations will expand and begin to impact all animals including those game species found there. As weeds crowd out native grass and shrub species, regular feed and cover for small game, browse for mule deer, and preferred nesting and fawning vegetation will be reduced. While these negative impacts are small now and in the short term, they can and will continue to increase over time and be more difficult to arrest as time goes on. We have the best opportunity to eradicate the infestations now. Within 10 or so years eradication will not be possible; only contain or control will remain as treatment objectives.

Alternatives 1 and 4 will have similar effects and results with an integrated weed management strategy and the limited number of infestations. Manual, mechanical, cultural and biological methods of control will be used where they can control the infestation. Herbicides will be used as necessary for difficult to control species.

Alternative 2 with "no action" will have limited negative impacts in the short term but negative impacts on the GCGP and the animals found there in the long term. If some of the weeds maximize their reproductive potential, in time some animal species could be extirpated or reduced in number to the extent that only marginal viable populations remain.

Alternative 3 could control the spread of most weed infestations found in the GCGP. The tamarisk population in Kanab Creek Wilderness would not be eradicated without the use of herbicides.

Some animal species have adapted to weed species and utilize them instead of native species. The southwestern willow flycatcher now utilizes tamarisk in lieu of the native willows and cottonwood trees that tamarisk has crowded out of riparian areas. Currently, there are no known southwestern willow flycatchers in the GCGP. This topic is further discussed in the BA & E found in the project record.

Even though some species have shown their adaptability to live with weed species, the transition from native vegetation to a vegetative cover type dominated by weed species will have impacts that will not be quantifiable until they occur.

Environmental Consequences to Inventoried Roadless Areas

Methods of Treatment within Inventoried Roadless Areas

Most treatment methods within the integrated weed management described previously could be used within IRAs with some modifications. The methods by alternative and those modifications are described below.

- **Manual** — Hand pulling, digging, and removal of weeds from IRAs will be used for many small infestations where the method is effective. (Would apply to Alternatives 1 (both High and Low), 3 and 4.)
- **Mechanical** — Most methods would not be utilized within IRAs due to potential conflicts with the resource. It may be possible to prescribe burn some infestations if it is considered and approved under the specific fire management plan. Motorized methods would not be utilized. (Would apply to Alternatives 1, 3 and 4.)
- **Cultural** — There is an opportunity to utilize some grazing alternatives if the IRA is part of an existing grazing allotment. Use of fertilization and seeding of competitive native plants will be considered on a case-by-case basis. Use of weed seed-free seed mixes and mulches is and will continue to be used based upon availability of weed seed-free seed mixes and mulches. (Would apply to Alternatives 1, 3 and 4.)
- **Biological** — Approved insects and pathogens could be used in IRAs. (Would apply to Alternatives 1, 3 and 4.)

- **Herbicidal** — Spot treatments using injection, hand-pump backpacks, portable pressure driven sprayers, and cut and daub could be utilized within IRAs. Cutting methods could use both motorized and nonmotorized hand tools. (Would apply to Alternatives 1 and 4.)

Effects of Treatments to Inventoried Roadless Areas

Treatments within IRAs have been evaluated for the following features: natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability/boundaries.

Natural Integrity — With the introduction of invasive weed species to IRAs, some natural processes may not occur. Natural integrity is generally good within IRAs as there are few, if any, human induced changes in the areas. Treatments using herbicides or hand mechanical methods would be visible in the short term. Eradication of larger infestations may not revegetate back to native species in the short term.

Apparent Naturalness – Most infestations and areas of previous infestations are not noticeable to the general public. Many noxious weeds have flowers or attractive foliage. Conversion from native species to the noxious or invasive species was gradual and generally was not apparent to most of the general public. Conversion back to native species will be gradual and will not be apparent to most of the general public.

Remoteness – Neither the infestations of invasive weeds or the treatment of those infestations will impact the remoteness of the areas.

Solitude – Infestations of invasive weeds will not impact the solitude of the areas. During treatment activities, there will be a temporary disturbance in and around the treatment areas and along the access route to those treatment areas.

Special Features – Infestations of invasive weeds will generally not have any impact on the special features within wilderness. Unique plant species within an IRA could be negatively impacted by exotic weed infestation.

Manageability/Boundaries – Infestations of invasive weeds do not impact the Forest Service's ability to manage an IRA. Treating infestations will require additional work, including planning, the logistics of accomplishing the work in an isolated location, conducting the work, and then monitoring the results of the work.

Nontreatment of weed infestations such as proposed by Alternative 2 could change the natural integrity and apparent naturalness of IRAs. Depending upon the species invading the IRA, over time, the naturalness of the area could be changed to a much less desirable condition.

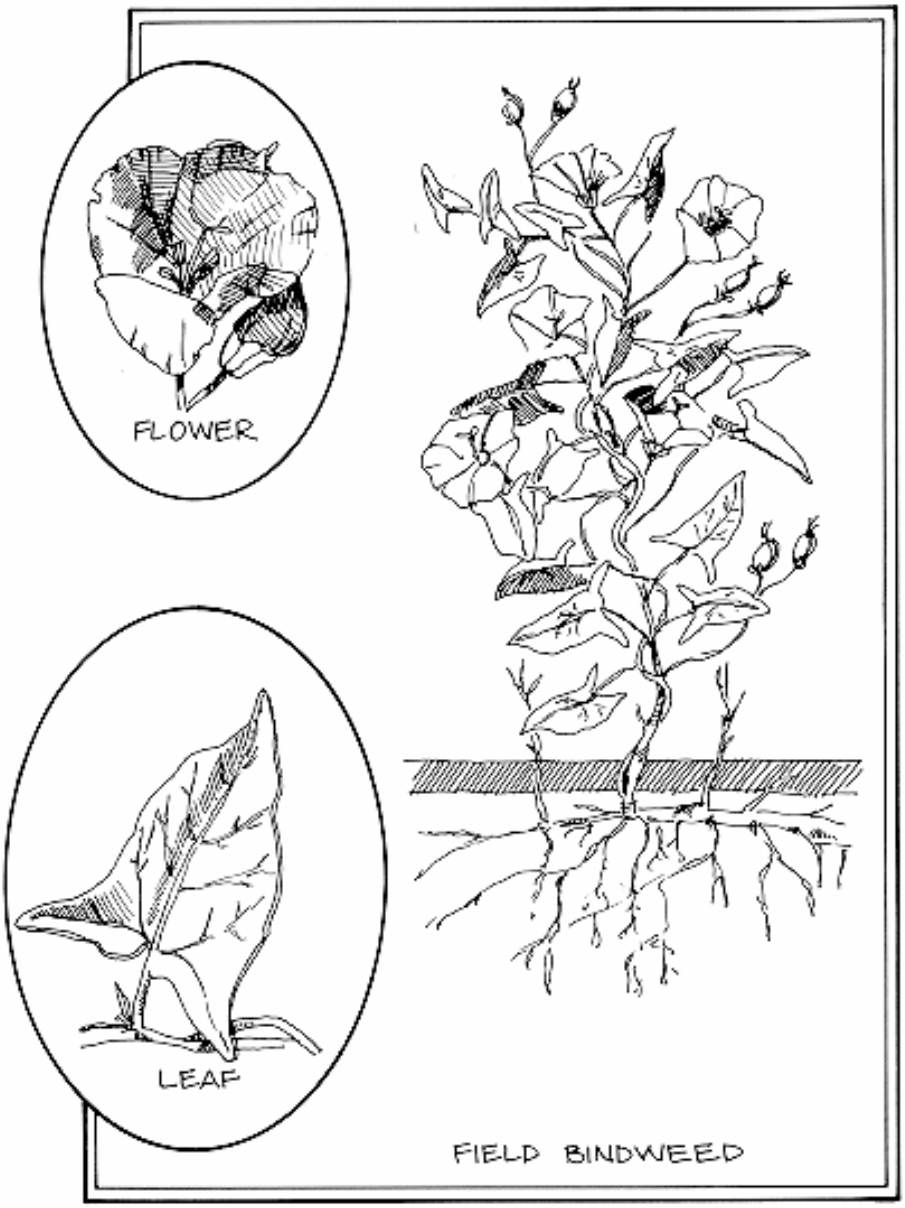
Environmental Consequences to Potential Wild and Scenic Rivers

Section 7(b) of the Wild and Scenic Rivers (W&SR) Act of 1968 provides a specific standard for review of developments near a congressionally authorized "study river." Section 7(b) specifies:

> *Developments below or above a potential wild, scenic, or recreational river may occur as long as the project "will not invade the area or diminish the scenic, recreational, and fish and wildlife values present in the potential wild, scenic, or recreational river area on the date of designation of a river for study as provided in Section 5 of this Act."*

All action alternatives proposed for this project would improve native vegetation health and watershed conditions, and would not diminish the scenic, recreational, and fish and wildlife values present in the potential wild, scenic, or recreational river areas within the project area. Evidence of dead weeds could temporarily degrade the scenic value and recreational experience of W&SRs, however, the return of native plants and increased vegetation health would soon balance this detraction.

Nontreatment of weed infestations such as proposed by Alternative 2 could change the scenic, recreational, and fish and wildlife values of the W&SR. Depending upon the species invading the W&SR, over time, the values of the area could be diminished resulting in a much less desirable area.



Chapter 5 - Consultation and Coordination

List of Preparers and Consultants

Lead Agency – Coconino, Kaibab, and Prescott National Forests

Interdisciplinary Team, Consultants, and Technical Specialty

Dave Brewer, USDA Forest Service, Kaibab National Forest, Range and Watershed

Contribution: Interdisciplinary Team Leader, Alternative Development, Environmental Impacts, Document Preparation, and NEPA Compliance

Education: B.S. – Soil Science and Zoology, University of Wisconsin at Stevens Point, 1976

Experience: Forest Service and Bureau of Indian Affairs: 27 years of experience working as a soil scientist, forest soil scientist/hydrologist, range conservationist, and planner.

Debra Crisp, USDA Forest Service, Coconino National Forest, Botanist

Contribution: Consultant to Interdisciplinary Team, Environmental Effects, and Document Preparation

Education: B.S. – Biology, Northern Arizona University, 1977
M.S. – Forestry, Northern Arizona University 2004

Experience: 22 years of experience working with the Forest Service as a forest and wildlife technician and botanist trainee with rare plants and invasive species.

Charles Ernst, USDA Forest Service, Kaibab National Forest, NEPA Specialist

Contribution: Interdisciplinary Team Leader, NEPA Compliance, and Writer/Editor

Education: B.S. – Forest Management, University of Missouri, 1976

Experience: Forest Service, Weyerhaeuser, Corporacion Forestal de Cundinamarca: 27 years of experience working as a forester and planner.

David Evans, USDA Forest Service, Prescott National Forest, Range Specialist

Contribution: Interdisciplinary Team Member, Effects Analysis, and Document Preparation.

Education: B.S. – Business, Arizona State University, 1989
M.S. – Environmental Resource Management, Arizona State University, 2001

Experience: 6 years working in vegetation management for Arizona Department of Transportation, 1.5 years experience in range management for the Prescott National Forest.

Katherine Farr, USDA Forest Service, Coconino National Forest,

Contribution: Consultant to Interdisciplinary Team, NEPA Compliance, and Writer/Editor

Education: B.S. – Forest Management, Oregon State University, 1974.

Experience: 30 years experience working as forester, forest planner, and NEPA specialist.

Noel Fletcher, USDA Forest Service, Prescott National Forest, Wildlife Biologist

Contribution: Interdisciplinary Team Member, Effects Analysis, and Preparation of Biological Assessment and Evaluation for Terrestrial Wildlife.

Education: B.S. – Wildlife Management, Habitat Option, University of Idaho, 1985

Experience: Forest Service since 1983 and a wildlife biologist from 1989 to present. Extensive NEPA experience as an ID team member, leader, writer, editor, project review and analysis. Several years experience with ESA and Forest Plan compliance.

Geneen Granger, USDA Forest Service, Southwestern Regional Office, NEPA Specialist

Contribution: Interdisciplinary Team Member, NEPA Compliance, and Writer/Editor

Education: B.A. – Cultural Anthropology, University of California, Davis, 1973
MLIS – Library and Information Science, University of California, Davis, 1987

Experience: University of California, Davis: 16 years as research/acquisitions librarian. Forest Service: 13 years as writer/editor for NEPA documents, appeals/litigation, and NEPA specialist and planner.

John Hanson, USDA Forest Service, Kaibab National Forest, Forest Archeologist

Contribution: Consultant to Interdisciplinary Team and provided information on traditional uses of native plants.

Education: B.A.– Anthropology, University of Arizona, 1967; M.A. – Anthropology, University of Arizona, 1969.; Ph.D – Archeology, University of Arizona, 1978.

Experience: 30 years experience working as an archeologist in the private sector, Bureau of Land Management, and Forest Service.

Bruce Higgins, USDA Forest Service, Kaibab National Forest, Forest Planner

Contribution: Consultant to Interdisciplinary Team, NEPA Compliance, and Writer/Editor

Education: B.S. – Forest Management, Oregon State University, 1975

Experience: 7 years as land management planning specialist and NEPA coordinator; 4 years as land management planning analyst and NEPA coordinator; 4 years as a silviculturist; 11 years as district staff in multiple resource areas.

Clare Hydock, USDA Forest Service, Prescott National Forest, Range Specialist

Contribution: Interdisciplinary Team Member, Environmental Effects, and Document Preparation

Education: A.A.S. – Hocking College, 1989; B.S. – Range Management, University of Wyoming, 1992

Experience: Forest Service: 10 years experience as a range conservationist including assignment as the noxious weed coordinator for the forest.

Lauren Johnson, USDA Forest Service, Kaibab National Forest, Ecologist

Contribution: Consultant to interdisciplinary team on weed locations and environmental effects.

Education: B.S. – Botany, University of California, Berkley, 1987; M.S. – University of Wisconsin, Madison, 1990.

Experience: 13 years experience working as a botanist and plant ecologist for the National Park Service as well as the Forest Service.

R. Michael Leonard, USDA Forest Service, Prescott National Forest, Wildlife Biologist

Contribution: Consultant to Interdisciplinary Team. Coordinated preparation of the biological assessment and evaluation.

Education: B.S. – Range Management, Texas Tech University, 1971; M.S. – Park Administration, Texas Tech University, 1974; Ph.D – Interdisciplinary Land Use Planning, Texas Tech, 1986

Experience: Bureau of Land Management, 1974 to 1978, Range and Wildlife Management; USFWS wildlife biologist 1979; Forest Service 1980 to 1993, wildlife biologist; Bat Conservation International Vice-President 1993 to 1995; and Forest Service 1995 to present, wildlife, fish and rare plant coordinator.

Tim McGann, USDA Forest Service, Kaibab National Forest, GIS Specialist

Contribution: Consultant to Interdisciplinary Team, assisted in preparation of maps found in the FEIS.

Education: B.S. – Forestry, Northern Arizona University, Flagstaff, 1975

Experience: Over 25 years of experience working as a forester and GIS specialist for three national forests.

Laura P. Moser, USDA Forest Service, Coconino National Forest, Botanist

Contribution: Interdisciplinary Team Member, Alternative Development, Environmental Effects, and Document Preparation

Education: B.S. – Plant Genetics, University of California, Davis, 1990; M.S. – Forestry, Northern Arizona University, Flagstaff, AZ, 1999

Experience: 4 years experience working as a botanist, geneticist, and invasive weed specialist for the Forest Service and other governmental organizations.

Douglas L. Parker, USDA Forest Service, Southwestern Regional Office, Integrated Vegetation Management Specialist

Contribution: Interdisciplinary Team Member, Environmental Effects, and Document Preparation

Education: B.S. – Utah State University, 1965; M.S. – Utah State University, 1969

Experience: 36 years experience with the Forest Service in integrated pest management. This includes not only the development of programs but the appropriate application use of pesticide products. Certified pesticide applicator for the Southwestern Region.

Barbara G. Phillips, USDA Forest Service, Coconino, Kaibab and Prescott National Forests, Zone Botanist

Contribution: Interdisciplinary Team Member, Alternative Development, Environmental Effects, Document and Biological Assessment and Evaluation preparation for Threatened Endangered, and Sensitive Plant Species.

Education: B.S – Botany, Cornell, 1967; M.S – Botany, University of Arizona, 1973; Ph. D. – Ecology and Evolutionary Biology, University of Arizona, 1976

Experience: 27 years experience working as a botanist and plant ecologist with rare plants and invasive weeds at the Museum of Northern Arizona, as a private consultant, and with the Forest Service.

Melissa Schroeder, USDA Forest Service, Kaibab National Forest, Assistant Forest Archeologist and Tribal Liaison.

Contribution: Consultant to ID Team and provided information on traditional uses of native plants.

Education: B.A. – Anthropology, California State University, Fullerton, 1988; M.A. – Anthropology, California State University, Fullerton, 1993.

Experience: 17 years experience working as an archeologist within the Forest Service, National Park Service, and for private cultural resource management firms.

Susan Schuhardt, USDA Forest Service, Prescott National Forest, Wildlife Biologist

Contribution: Interdisciplinary Team Member, Alternative Development, Environmental Effects, and Document Preparation

Education: B.S. – Biology, Northern Arizona University, 1987; M.S. – Forestry, Northern Arizona University, 1991

Experience: 10 years experience with the Forest Service working as a wildlife biologist, noxious weed specialist, and range conservationist

Don Smith, USDA Forest Service, Kaibab National Forest, Range Specialist

Contribution: Consultant to interdisciplinary team on weed locations and environmental effects.

Education: B.S. – Utah State University, 1969

Experience: Range conservationist for the Forest Service on four national forests for 30 years responsible for permit administration, range analysis, and noxious weed treatments.

Albert Sillas, USDA Forest Service, Prescott National Forest, Fishery Biologist

Contribution: Interdisciplinary Team Member, Alternative Development, Environmental Effects, and Document as well as Biological Assessment and Evaluation

Education: B.S. – New Mexico State University, 1986

Experience: Forest Service and Fish and Wildlife Service: 15 years working as a fishery biologist.

List of Agencies, Organizations, and Persons to Whom Copies of the DEIS and FEIS Were Sent

The following State and Federal agencies and governments were consulted during preparation of the FEIS:

Arizona Game and Fish Department

Arizona Department of Agriculture

Arizona Department of Transportation

Arizona Department of Environmental Quality

Arizona State Historic Preservation Officer

Federal Highway Administration

National Park Service

U.S. Fish and Wildlife Service

Fort McDowell Yavapai Nation

Havasupai Indian Tribe

Hopi Tribe

Hualapai Tribe

Kaibab Band of Paiute Indians

Navajo Nation

Pueblo of Zuni

San Juan Southern Paiute Tribe

Tonto Apache Nation

Yavapai-Apache Nation

Yavapai-Prescott Indian Tribe

The following organizations and individuals were sent copies of the DEIS. The mailing list for the FEIS was updated to reflect address changes and organizational changes, this is located in the project record.

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John Kennedy, AGFD
Richard Miller, AGFD

Bob Posey, AGFD
AGFD Habitat Branch
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ASU
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Kathy Jones, ASU College of Law
ASU Hayden Library
Government Document Services, ASU Libraries
Rebecca Burke, ASU Libraries
Doc Hamms, President, Audubon Society
Gary Keller, Arizona Assoc. of 4WD Clubs
Don Lane, Director, Affairs, AZ Cattle Growers
Julianne Carter, Arizona Center for Disability Law
Everett Hall, Arizona Dept of Agriculture
Michael Golightly, Arizona Game and Fish Commission
Linda Binder, Representative, Arizona House of Representatives
Representative, Arizona House of Representatives
Representative, Arizona House of Representatives
Dale Haglin, Arizona Snow Bowl
Dennis Wells, Arizona State Land Dept.
A. McVay, Arizona State Parks
Don Hood, Arizona Trail Riders
Bob & Judy Prosser, Bar T Bar Ranch
Robert Begay, BIA
Robert R McNichols, BIA
BLM
Jack Randall, Blue Ribbon Coalition
Camp Verde Community Library
Brian Segee, Center For Bio Diversity
Central Arizona Land Trust
Chino Valley Public Library
Chino Valley Review
Ursula Montano, Long-Range Planner, City of Flagstaff
Mayor Paul Daly, Attn: Mark Stevens, City of Prescott
Robert McBurnie, City of Prescott
Ken Edes, Mayor, City of Williams
Sean Evans, Cline Library
Mike Macauley, President, Coconino Cattle Growers
County Manager, Coconino County
Coconino County Coop. Ext. - Nat
Vickie Amabisca, Coconino County Public Works
Michael Anderson, Coconino County Public Works
Dead Horse Ranch State Park
Mandy Metzger, Diablo Trust
Dolph Barnhouse, DNA Legal Services
John Sproul, El Paso Gas – Env. and Safety
Lucinda Grant, Electrical Sensitivity Network
Environmental Information Center
Laura Fujii, EPA
Mail Code E3, EIS Review Coord., EPA Region 9
Leonides Payne, EPA Region 9
Regional Office, Env. Planner, Federal Highway Administration
Mr. and Mrs. Ron Wells, Sr., Fire Dept
Flagstaff Riding Club
Cameron Kern, Director, Outdoor & Env. Ed., Flagstaff Unified School
John Talberth, Forest Conservation Council
Kirsten Stade, Forest Guardians
Fredonia Public Library
Lori Makarick, Grand Canyon National Park
Grand Canyon Trust
Lincoln and Roland Manakaja, Havasupai Tribe
HDP - TCP
Bev Suderman, Natural Resources Planner, Hopi Tribe

Leigh Kuwanwisiwma, Hopi Tribe Cultural President
J. D. Hayworth, Representative, House of Representatives
Louise Benson, Hualapai Tribe
Monza Honga, Cultural Preservation Officer, Hualapai Tribe
Carmen Bradley, Chairperson, Kaibab-Paiute Tribe
William Kusner, President, Keep Sedona Beautiful
KNAU
KNAZ TV 2
KPPV Radio
Leaz Dandos, KUSK-TV
KZAM Radio Station
Little Horse Ranch
Nat White, Lowell Observatory
Manterola Sheep Co.
Marylyn Michelbach Coy, Michelbach Livestock, Inc.
Museum of Northern Arizona Library
Northern Arizona Audubon Society
Anita MacFarlane, Northern Arizona Audubon Society
Chris Fetzer, Northern Arizona Council of Governments
Byron Browning, Northern Arizona Flycasters
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Kathy Propper, NAU Dept. of Bio
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Chapter Coor., Navajo Nation, Cameron Chapter
Jack Colorado, Navajo Nation, Cameron Chapter
Anna M Frazier, Chapter President, Navajo Nation, Dilcon Chapter
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Dorothy Lee, Comm. Service Coord., Navajo Nation Gap Bodaway
Louise Walker, Comm. Service Coord., Navajo Nation Leupp Chapter
Theresa Hatathlie, Ad Asssistant, Navajo Nation, Tuba City Chapter
Jacquie Gates, Executive Director, New Horizons
Sam Henderson, Superintendent, NPS, Flagstaff Area Parks
Glen Henderson, NPS Montezuma Castle National Monument
Superintendent
Rowal Kerbo, NPS Southwest Regional Office
NRCS
Bob Adams, NRCS
William Fields, Oro Flame Mine
Page Public Library
Payson Library
Phoenix Gazette
Phoenix Library
Pine Creek Ranch
Pine-Strawberry Library
Prescott City - Yavapai County Library
Tom Fleishner, Prescott College
Prescott College Library
Jan and Mary Anderson 1, Prescott Hiking Club
Jim Powers, Prescott NF
Prescott Valley Library
John Schreiber, Red Rock State Park
Charles Ester, Salt River Project
Jeanette Cassa, San Carlos Apache Tribe
Raymond Stanley, Chairman, San Carlos Apache Tribe
Ray Wrobley, SEC Inc.
Sedona Public Library
Craig Dible, Sierra Club
Sierra Club Plateau Group
Brian Nowicki, Southwest Forest Alliance
Tempe Library
Joyce Maschinski, The Arboretum at Flagstaff
The Flagstaff Times
John A. Hall, The Nature Conservancy

Shelly Silbert, Center for Sustainable Environments, NAU
Bill Ulfelder, The Nature Conservancy
Tribune Newspapers, 120 W 1st Ave, United States Senate
Senator Robert Bennett, Attn: Chip Yost
John McCain, Senator
Larry Flatau, US Army Corps of Engineers
Honorable Trent Franks, U.S. House of Representatives
Honorable Rick Renzi, U.S. House of Representatives
Bill Austin, USFWS
Anthony Velasco, Field Supervisor, USFWS
Williams Public Library
Charles Bonnaha, Yavapai Apache Nation
Mark Alver, Yavapai Assoc. for Chem., Superintendent
Yavapai Cattle Growers
Tim Burkeen, Area Road, Yavapai County Public Works
Nancy Lee Hayden, Director of Research, Yavapai-Prescott Tribe
Leslie Glustrom
William Austin, USFWS
Clarence Spencer
Craig Dible, Sierra Club
Larry Tharp
Grace Creighton
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Gary Sabriskie, Five County Association of Governments
Brian Segee, Center for Bio Diversity
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William Fields, Oro Flame Mine
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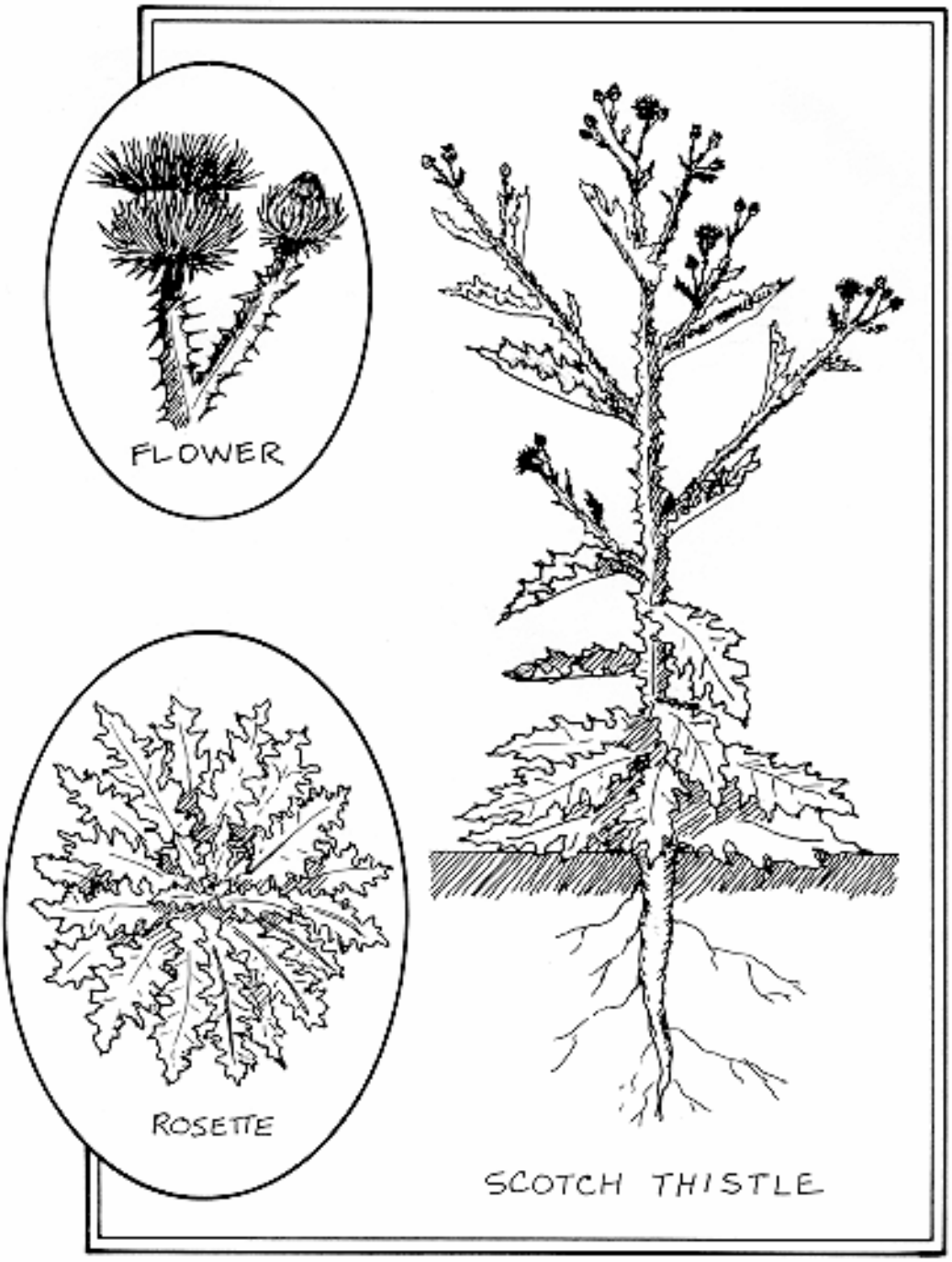
Dorothy Anderson
Justin White, ADOT Natural Resources
Manterola Sheep Company
Leroy Brady, ADOT Roadside Dev. Sec.
Bob Adams, NRCS
Marie Brown, City of Sedona
David R. Leland
Michelle James, Grand Canyon Trust
Gary Arbeiter, Red Rock State Park
Norm and Lois Smith
Amy Moore, El Paso Co Sta #3
Arizona State University
Kristine Madden
Birdsprings Chapter, Navajo Nation
Bodaway-Gap Chapter, Navajo Nation
Cameron Chapter, Navajo Nation
Dilkon Chapter, Navajo Nation
Lechee Chapter, Navajo Nation
Leupp Chapter, Navajo Nation
Tonalea Chapter, Navajo Nation
Tuba City Chapter, Navajo Nation
Leigh Kuwanwisiwma, Director Hopi Cultural Preservation Office
Bev Suderman, Natural Resources Planner, Hopi Tribe
Loretta Jackson, Tribal Preservation Officer, Hualapai Tribe
Roland Manakaja, Resource Director, Havasupai Tribe
Lincoln Manakaja, Tribal Council Member, Havasupai Tribe
Charles, Bonnaha, Yavapai Apache Nation
Nancy Lee Hayden, Director of Research, Yavapai-Prescott Indian Tribe


FLOWER
ROSETTE
SCOTCH THISTLE

Chapter 6 - Adaptive Management and Monitoring

Adaptive Management

Weed infestations constantly change. It is certain that not all infestations can and will be mapped. Even under the assumption that an inventory is 100 percent complete, by the time the inventory is finished, infestation size and number will already be changing in areas inventoried earlier in the survey. A single plant can produce more than 100,000 seeds. In our southern latitudes, some plants can produce seed three times a year. Three plants can expand to half an acre in a single growing season; half an acre can expand to 10 acres during the same period if growing conditions are favorable.

An adaptive management strategy[6] offers an avenue to describe and evaluate the consequences of changing invasive plant infestations. It addresses the question: "How can we satisfy the requirements of site specificity in NEPA compliance when we cannot specifically describe all treatment conditions, such as infestation locations and extents, species, treatment timing, and effectiveness over an effective timeframe?" By modeling the anticipated population expansion and new infestations, we have described the environmental effects we anticipate. As long as we remain within the effects we have described, then the results of this analysis remain valid. In the model we diversified our management strategies across the landscape to create a strong integrated weed management program and increase our chance of overall success by decreasing the risk of any large failures (Sheley and Petroff 1999, Borman and Kiester 2004).

New infestations and new species are usually the highest priority for treatment. Decisions that are specific to known locations and species do not allow for treatment of areas and species that were unknown at the time of the decision. The most accurate surveys will only include the species and locations found at the time of the survey. Likewise, new herbicides may become available that are better suited to an application than those approved in the decision. The time necessary to complete new and/or additional analysis can take 6 months to many years. New populations can expand during this waiting period. Treatment costs can increase and the opportunity of containing populations can be lost.

Adaptive Management Strategy

Our adaptive management strategy is based on site-specific explanations of what the Agency will do for each species under various conditions and the environmental consequences of those actions (see Chapter 4). We have an integrated weed treatment approach[7] proposed for meeting treatment objectives of each invasive plant and the priority of treatment as shown in Table 25.

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[6] Adaptive management is the process of evaluating and making adjustments in strategy if the prescribed management fails to result in desired outcome or as new circumstances arise.

[7] Integrated Weed Management (IWM) is defined as a system for the planning implementation of a program, using an interdisciplinary approach, to select a method for containing or controlling an undesirable plant species or group of species using all available methods including education; prevention; physical or mechanical methods; biological control agents; herbicide methods; cultural methods; and general land management. It is a multidisciplinary, ecological approach to managing unwanted plant species–weeds.

Table 25. Adaptive management treatment objectives and priorities.

Priority	Description	Treatment
First Priority for Treatment	New species (new to the State, county or region) and new infestations of Category A weeds. Areas of high traffic and sources of infestation – vector areas, parking lots, trailheads, horse ramps, gravel pits. Areas of special concern: rare species habitat, botanical areas, or research natural areas.	1. Hand pull isolated plants 2. Herbicide treatment 3. Steam and/or mechanical treatments in sensitive areas 4. Prevent seed set
Second Priority for Treatment	Containment of existing infestations. All Category A Weeds. Category B and C weeds in vector areas.	1. Hand pull isolated plants 2. Herbicide – roadsides, large populations and deep-rooted perennials.
Third Priority for Treatment	Reduction of existing Category A infestations. Treatment of all Category B weeds.	1. Disperse biocontrol agents on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide treatment
Fourth Priority for Treatment	Treatment of Category C. Eradication of Category A. Reduction of Category B.	1. Biocontrol on large infestations 2. Herbicide application along perimeters

Our adaptive management approach anticipates change in existing populations and establishment of new populations. It does not preclude the need for information on existing infestations and planned treatment. The most current and accurate inventories (and their expected expansion) were used to develop the Proposed Action and alternatives. A weeds summary with infested acres across the project area (by vegetation type and watershed) is included in Chapter 3.

Our approach uses existing invasive plant location data and the likely locations where species will spread, based on modeling, professional judgment, and knowledge of vectors and habitats. The effects analysis is based on the likely acres that will be treated in a single year. New weed species have been incorporated or anticipated in the analysis because it is highly likely that they will appear and spread from known vectors and pathways of invasions.

Our original treatment estimates were based on known weed populations in 2001. Survey results were extrapolated based on growth rates from current literature about each plant. We developed a model based on these growth rates and incorporated the average effectiveness of each treatment type on each species. Upon signing of the Record of Decision, this model will be used to make more up-to-date weed population estimates for incorporation into the implementation plan. These effectiveness rates were based on the more conservative accounts in current literature and best local knowledge; they will be adjusted as real results are recorded. Monitoring is essential to implementing a long-term adaptive management strategy from three perspectives: implementation, program treatment effectiveness, and environmental effects. An adaptive management strategy necessitates implementation monitoring to verify that actions are taking

place as described. The invasive plant infestation conditions will be monitored in order to track appropriate timing for each action and whether that action is effective. If a treatment were not effective, the decision maker would review the treatment strategy outlined to determine whether treatment actions need to be changed. Monitoring environmental effects will provide a basis for staying on course or modifying decisions in the future.

Addressing New Information and Changed Circumstances

Forest Service Handbook 1909.15, Section 18 addresses new information and changed circumstances. This section lays out procedures for changing documentation in environmental impact statements, environmental assessments, and categorical exclusions as well as subsequent decisions based on new information or changed circumstances. If this occurs, we propose to follow this procedure documenting changes in the annual report to facilitate keeping the project record current while implementing the decision. If it becomes necessary to supplement the environmental documents, it will be done.

Project Monitoring

Monitoring is the process of collecting information to determine the effectiveness of management actions in meeting prescribed objectives. Weed management on the Coconino, Prescott, and Kaibab National Forests focuses on density and rate of spread of invasive exotic plant species and the effects these aggressive plants have on natural resources. The forests are also interested in the effectiveness of prescribed actions on the target plant and the responses of desirable vegetation. Monitoring will help determine if our prescriptions and activities are accomplishing the goals and objectives established.

There will be three types of monitoring:

- Implementation Monitoring
  - Is the plan being implemented?
  - Are the objectives and priorities realistic and achievable?
- Treatment Effectiveness Monitoring
  - Are the treatments effective in meeting the planned objectives?
  - Are the weeds continuing to spread beyond our control actions?
- Environmental Effects Monitoring
  - Are the environmental effects outside the scope of this document?

Implementation Monitoring

Annual reports will be submitted by each forest to the Regional Office to verify that actions are taking place as described in this environmental document. Monitoring will include target species, treatment type, location, acres, timing of actions and mitigation. It will evaluate if the objectives and priorities are realistic and achievable.

Monitoring reports will be part of all contracts, and the contractors shall be required to report on such things as: method used, name and amount of herbicide used, dates sprayed, time of day sprayed, wind speed and temperature at time of herbicide application. Each forest will submit this information to the Regional Office once a year.

Treatment Effectiveness Monitoring

Monitoring of weed spread and/or suppression will be aided by analysis of an existing database and GIS layer called National Resource Information System (NRIS) Terra Invasives. Before treating any population, the perimeter of the affected area will be mapped and infested acres will be calculated by multiplying total acres by average density (percent cover). This baseline measurement will be used to compare against future acreage calculations to document the effectiveness of each type of treatment. Yearly treatment summaries will be used to assess weed spread. After 5 years inventories will be reviewed to compare with the inventory at project initiation. By tracking infested areas, we will be able to gauge if our objectives are being met by each treatment and if our predictive model is accurate. We will adjust the model based on field results, and adjust treatments following the adaptive management decision trees to ensure achievement of a species' objective.

Manual, Mechanical, Cultural, and Herbicidal Treatments

We will monitor the effectiveness of mitigation measures for notification and signing of herbicide spray zones in an effort to avoid people having allergic reactions and to provide alternative access for people with multiple chemical sensitivities and other people vulnerable to chemicals.

Forest Weeds Surveys and Sampling — Personnel will conduct visual reconnaissance and GPS surveys of treated areas to determine the presence or absence of target weed plants, and/or desirable vegetation. Sample plots will be established within selected infestations to document changes in target plant densities, species composition, and cover of desirable vegetation.

Biocontrol Agents

The Coconino, Prescott, and Kaibab National Forests will develop and implement monitoring protocols for biological control agents. Each forest will work with qualified professionals to develop specific monitoring techniques that can be effectively applied across the release zones.

Monitoring will determine insect establishment success, insect population trends, insect impact on target plants, and the effect of insect populations on weed population density and spread.

General visual reconnaissance will be completed for target organisms that have been applied toward specific weeds. Infested acres will be calculated and monitored; sub-sampling will be used for infestations greater than 10,000 acres.

Environmental Effects Monitoring

Manual, Mechanical, Cultural and Herbicidal Treatments

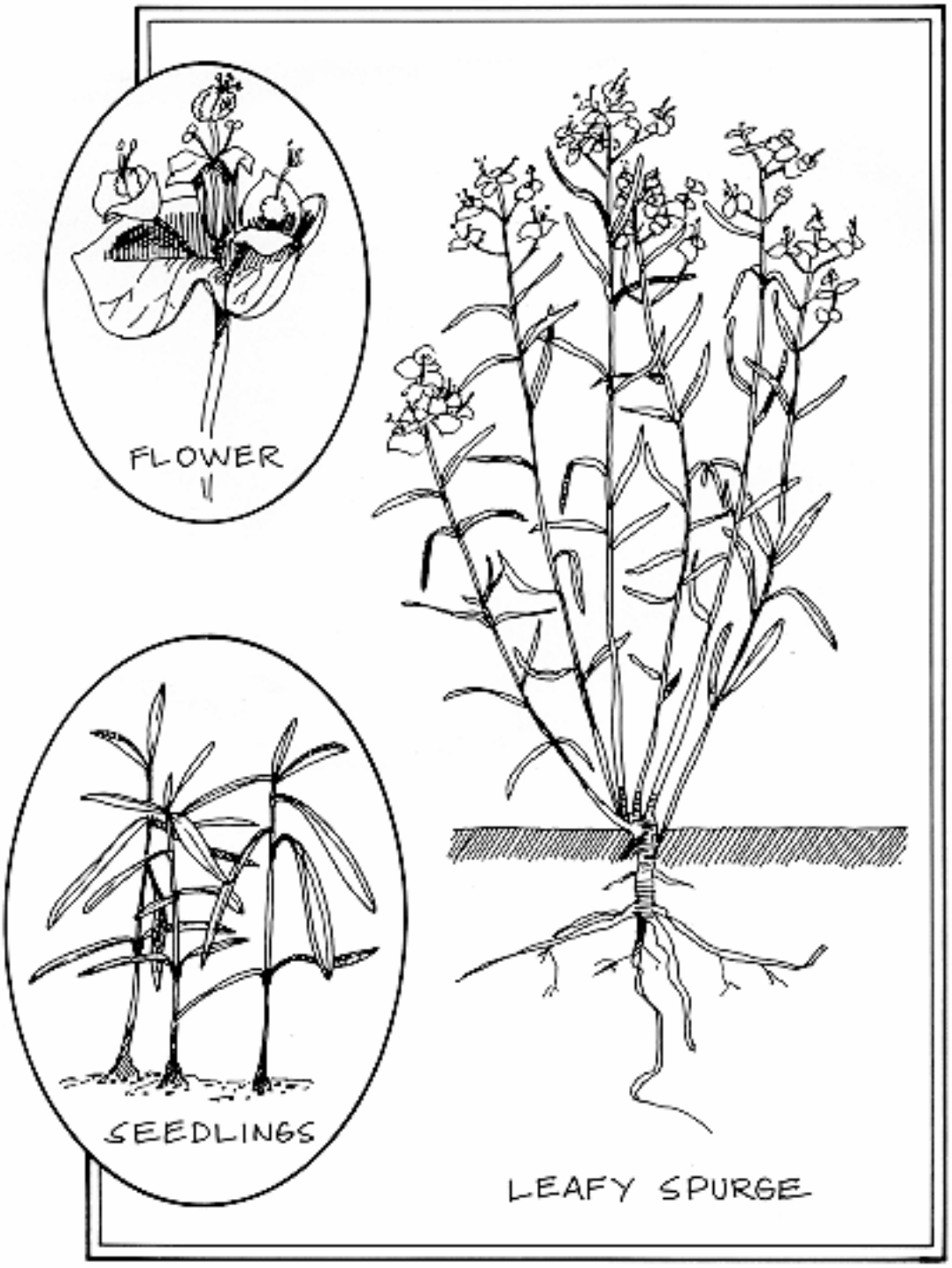
Effects on human health resulting from exposure to daily treatment operations, accidents, and long-term exposure will be monitored through documentation of project records, including worker and public health complaints. Risk to human health regarding use of herbicides has been evaluated in Chapter 4. Risk to workers is expected to be minimal if they are properly trained, follow instructions on herbicide labels, and apply mitigation practices, such as prior notification of the proposed treatment. Risks to the public are expected to be minimal if the design features, best managemet practices and mitigation measures outlined in Appendix B are followed.

Effects on public access and plant collection will be assessed to determine if design features, best management practices and mitigation measures outlined in Appendix B are working and effective.

Potential nontarget or offsite effects, such as those that may occur from a prescribed fire expanding beyond the treatment area, leaching, runoff, or aerial drift in the case of herbicide treatments, will be analyzed prior to treatment. Best management practices (Appendix B) would be applied to minimize the predicted undesirable environmental effects.

Biocontrol Agents

Monitoring will be used to determine if biocontrol agents are adversely impacting native plants and whether the biocontrol agents are able to survive and successfully reproduce under the environmental conditions of the project area.


FLOWER
SEEDLINGS
LEAFY SPURGE

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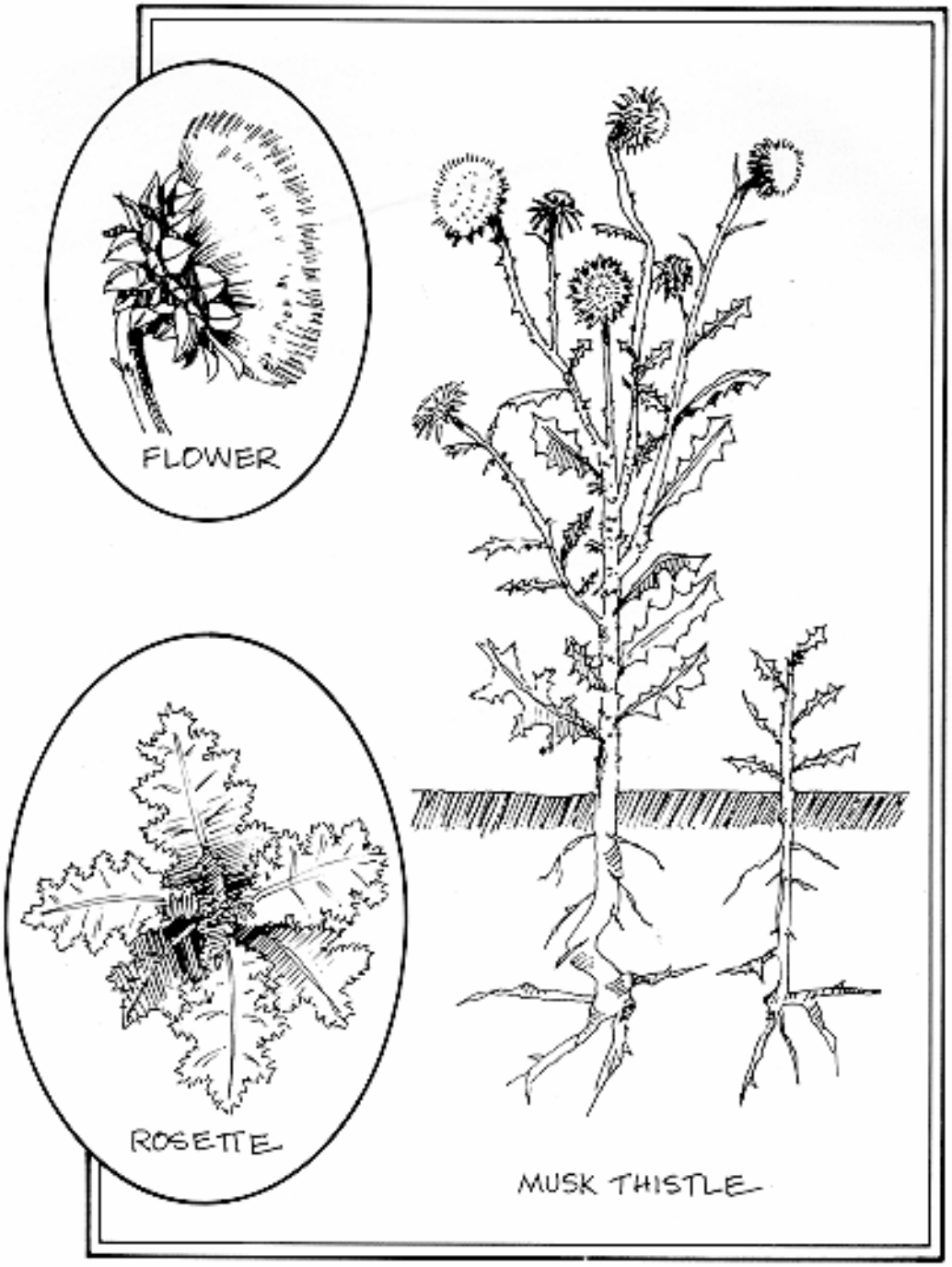

FLOWER
ROSETTE
MUSK THISTLE

Appendix A – Proposed Amendment for Noxious or Invasive Plant Management for the Coconino, Kaibab, and Prescott National Forest Plans

Goal

Prevent any new noxious or invasive weed species from becoming established, contain or control the spread of known weed species, and eradicate species that are the most invasive and pose the greatest threat to biological diversity and watershed condition.

Standard

Incorporate measures to control invasive species into project planning, implementation, and monitoring.

Guideline

Use the Appendix B "Design Features, Best Management Practices, Required Protection Measures and Mitigation Measures" in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona" (2004) for specific mitigation measures. Deviance from Appendix B does not trigger the need for a forest plan amendment, however, Required Protection Measures from Section 7 consultation (Endangered Species Act) must be followed. If as a result of environmental analysis, Best Management Practices or Mitigation Measures are modified, document the reason(s) in a NEPA decision.

Glossary

Noxious weed — Noxious weed is a legal term applied to plants regulated by Federal and State laws, such as plants designated as noxious weeds by the Secretary of Agriculture or by the responsible State official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insect or disease, and being not native or new or not common to the United States or parts thereof. (Forest Service Manual 2080.5, Federal Noxious Weed Act of 1974, PL 93-629, as amended)

Invasive species — Invasive species is defined as a species that is nonnative (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

NFMA Significance Determination

We have reviewed Forest Service Manual 1922.5 and have determined that an amendment to the land and resource management plans for all three forests should be prepared. This determination included an assessment of the changes proposed to be made and an estimation of their significance. Based upon the discussion found in Forest Service Handbook 1909.12 – Chapter 5.32, this land and resource management plan amendment has been determined to be nonsignificant.

Analysis – Forest Service Manual 1922.51

The actions proposed in this environmental impact statement do not significantly alter the multiple use goals and objectives for long-term land and resource management; in fact they complement those goals and objectives previously described and agreed upon in each of the three land and resource management plans. Not taking action to prevent further spread of the noxious or invasive weeds described in this document could alter the multiple use goals and objectives for each of the three national forests.

There were no adjustments of management area boundaries or management prescriptions for existing management areas. The treatment of noxious or invasive weeds using herbicides was incorporated into the documents.

The use of herbicides to contain, control or eradicate noxious or invasive weeds is an additional management practice that will contribute to achievement of the management prescriptions.

The three national forests have similar but distinct land and resource management plans. As a result, the adjustments to those plans varied. Here is a summary of the changes:

> The amended goal for all three national forests is to prevent any new noxious or invasive weed species from becoming established, contain or control the spread of known weed species, and eradicate species that are the most invasive and pose the greatest threat to biological diversity.
>
> The standard to incorporate measures to control invasive species in project planning, implementation, and monitoring has been added to all three national forests.
>
> New definitions for “noxious weed” and “invasive species” have been added to the Coconino and Prescott Plans and revised in the Kaibab Plan.
>
> The Kaibab Plan removed unnecessary verbiage that has been incorporated into this environmental impact statement analysis or is already required by Federal law, regulation or Executive Order. This included: using only registered pesticides following label instructions; incorporating resource management practices using integrated resource management; evaluate all applications of pesticides in terms of site response, environmental impacts, public health and safety, and monitoring and evaluation requirements; establishing nontreatment buffer areas to separate wetlands from treatment areas; incorporated a pesticide spill contingency plan; established a protocol for cleaning application apparatus and disposal of pesticide containers; and evaluated the use of pesticides only after

it has been determined that such use would not adversely affect either threatened or endangered species or their critical habitat.

The Prescott Plan adds a new goal for noxious or invasive weed control, adds the new forest-wide standards and guidelines, redefines noxious weeds, defines invasive species, and removes redundant discussions.

Analysis – Forest Service Handbook 1909.12, Chapter 5.32

These amendments to the land and resource management plans are determined nonsignificant through the following analysis. The determination of nonsignificance of this amendment is different than a determination of significance (or nonsignificance) of the environmental impact of the Proposed Action as defined by the Council on Environmental Quality Regulations found at 40 CFR 1500 to 1508.

There are four factors used to determine significance. They are: (1) timing; (2) location and size; (3) goals, objectives and outputs; and (4) management prescription.

1. Timing – The timing of this action is upon completion of the analysis process. Work to control these weeds will occur with the availability of money, time, and workers.

2. Location and Size – Currently, only a small portion of the three national forests is infested with weeds. The longer we wait to begin containing, controlling, and eradicating infestations, the more areas will become infested and the more difficult weed control will become. There is some degree of infestation on approximately 187,500 acres of the 4.9 million acres within the three forests. This is approximately 3 percent of the forest area.

3. Goals, Objectives and Outputs – Treatment objectives of this amendment will not alter the goals, objectives or level of outputs that were previously projected by the three forests' land and resource management plans.

4. Management Prescription – The amendment will not change the management prescription of any management area. It does not change the desired future condition of the land or resources, or the anticipated goods and services to be delivered.

Conclusion

We have determined that the treatment of noxious or invasive weeds using an integrated weed management system is a nonsignificant amendment to our land and resource management plans based upon the above considerations. We also find that the public was duly notified of the intent to amend the plans through the scoping efforts and distribution of the draft environmental impact statement for notice and comment.

Nora B. Rasure 11-8-04

NORA B. RASURE Date
Forest Supervisor
Coconino National Forest

11/8/04

MICHAEL R. WILLIAMS Date
Forest Supervisor
Kaibab National Forest

Michael King 11/8/04

MICHAEL R. KING Date
Forest Supervisor
Prescott National Forest

Coconino National Forest Plan Replacement Pages

Page 23 Adds a new goal concerning noxious or invasive weeds as listed above.

Page 69, 69-1 Adds a standard and a guideline concerning noxious or invasive weeds as listed above.

Page 253 Adds the definition for invasive species as listed above.

Page 257 Adds the definition of noxious weeds as listed above.

Page 272 Updates the definition of noxious weeds as listed above.

Kaibab National Forest Plan Replacement Pages

Page 20 Adds a new goal under "Forest Pest Management" as stated above.

Page 21 Modifies the standard and guidelines page schematic to reflect changes below.

Page 34-1 Adds a new forest-wide standard as stated above. Adds a forest-wide guideline as stated above.

The following changes are corrections to the forest plan:

Page 41 Remove direction that is now forest-wide and is contained in the guideline above.

"1. Inventory noxious weeds. Coordinate noxious weed control activities with other agencies and adjoining land owners" from "Guidelines for Rangeland Resource Operations and Improvements."

Page 42 Removes the following guidelines as they have been incorporated into the FEIS analysis and guideline above or are already required by Federal law, regulation or Executive Order:

"d. Apply pesticides that are registered or otherwise permitted in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act, as amended.

"e. Evaluate all applications of pesticides in terms of site response, social and environmental impacts, including public health and safety, and monitoring and evaluation requirements; determine and identify the extent, severity, and probable duration of any associated hazard.

"f. Establish nontreatment buffer areas to separate treatment areas from wetlands and riparian habitats.

"g. Incorporate pesticide spill contingency direction in resource management practices that involve the application of pesticides."

Pages 82-83 Removes the following guidelines as they have been incorporated into the FEIS analysis and guideline above or are already required by Federal law, regulation or Executive Order:

"4. Apply only pesticides that are registered with the Environmental Protection Agency or otherwise permitted in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act, as amended. Apply these materials in accordance with label direction and all applicable legal requirements.

"5. Formulate resource management practices involving the application of pesticides using integrated resource management. This formulation and review will take into account:

a. Desired management objective and future condition.

b. Soil and topography.

c. Onsite and adjacent land uses and resource conditions such as wetlands, riparian areas, wildlife habitats, dispersed recreation uses, etc.

d. Exclusion areas.

e. Weather variables.

f. Characteristics of the substance under consideration such as persistence, toxicity, mobility, bioaccumulation, and patterns and means of application.

"6. Evaluate all applications of pesticides in terms of site response, social and environmental impacts, including public health and safety, and monitoring and evaluation requirements; determine and identify the extent, severity, and probable duration of any associated hazard.

"7. Establish nontreatment buffer areas to separate treatment areas from wetlands and riparian habitats. The size, location, and other characteristics of these nontreatment areas are contingent on the specifics of the application and must be identified and evaluated in integrated resource management.

"8. Incorporate pesticide spill contingency direction in all resource management practices that involve the application of pesticides.

"9. Clean application apparatus and dispose of pesticide containers in accordance with label direction, Forest Service Handbook direction, and State and local law and regulations."

Page 93 Removes the following guidelines as they have been incorporated into the FEIS analysis and guidelines above or are already required by Federal law, regulation or Executive Order:

"Use pesticides only after it has been determined, in conjunction with other Federal and State wildlife management agencies, that such use not adversely affect either threatened, endangered species or their critical habitat."

Page 142 Adds a definition of "invasive species" to the Glossary

Page 148 Changes the definition of "noxious weed" in the Glossary.

Prescott National Forest Replacement Pages

Page 15 Add the new goal under "Vegetation Management" as stated above.

Page 52 Add the new forest-wide standard as stated above.

Page 52 Add the forest-wide guideline as stated above.

Correct the forest plan by removing the following redundant direction:

Page 35 "Control noxious weeds on rangelands to prevent significant population buildups.

"Pesticides will be applied in accordance with their respective labels, State and Federal laws, and the requirements developed in project environmental documentation.

"When using pesticides, avoid direct application to water. Do not mix or load chemicals near streams or wet areas."

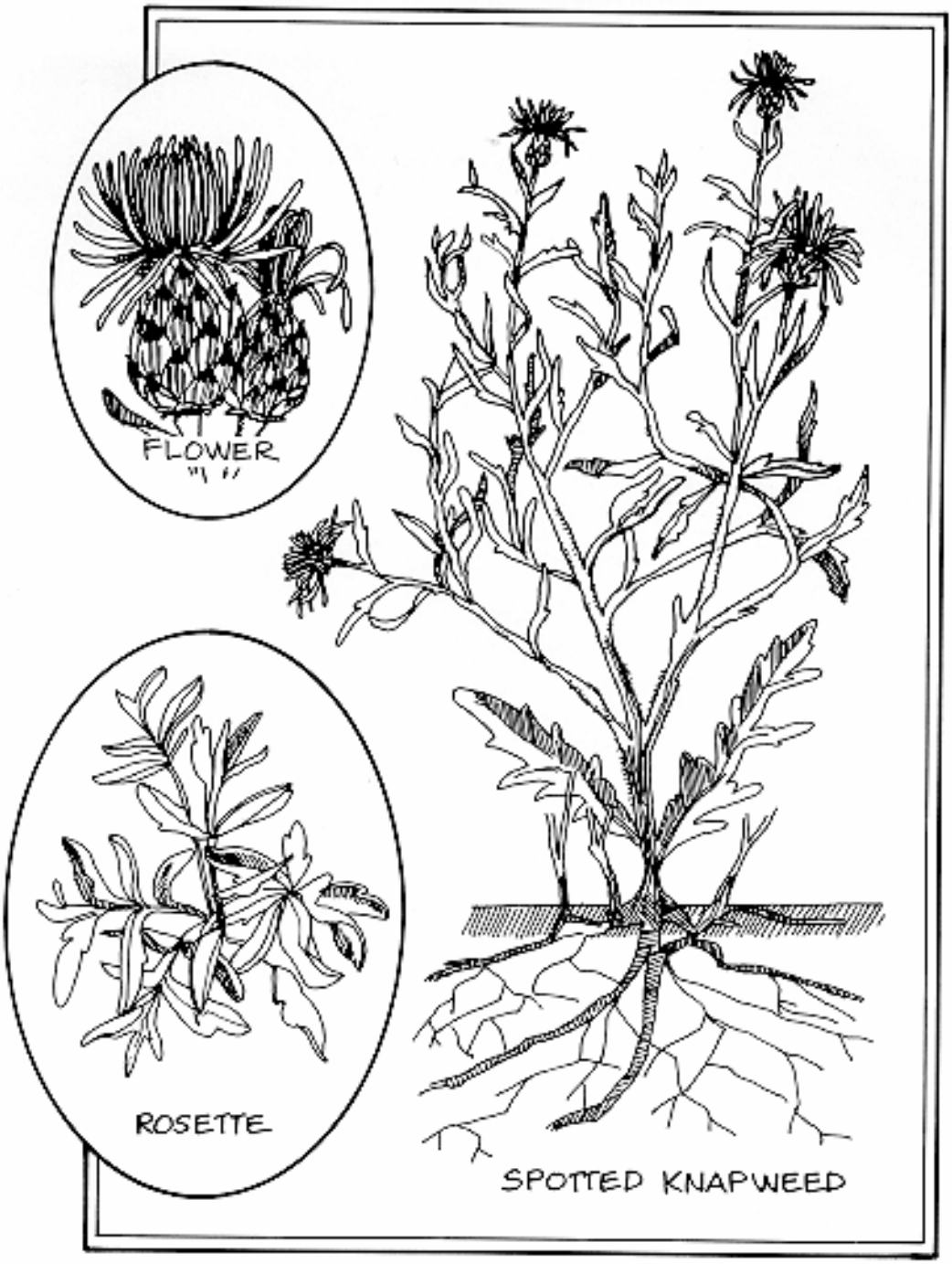
Page 39 "Applications of herbicides will be in accordance with EPA registered labels.

"Risk analyses will be completed for substances used where scientific certainty is inadequate or where inadequate data is available on human health or environmental consequences."

Correct the forest plan by adding or changing the following definitions:

Page 100 Add Glossary entry of "Invasive Species" as listed above.

Page 106 Change Glossary entry for "Noxious Weed" as listed above.


FLOWER
ROSETTE
SPOTTED KNAPWEED

Appendix B - Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures

Design Features for Integrated Weed Treatment Projects

- Establish 1-mile limited spray zones adjacent to communities, private lands, recreation sites, trailheads, and scenic overlooks identified by public meetings with the MCS community. Nonherbicidal treatment methods will be prioritized in these areas; only if these treatments are not successful will herbicides be used on deep-rooted perennial weeds.
- Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction will be coordinated, publicly posted, and completed in such a manner that alternate routes will remain accessible until the manufacturer's re-entry period is met, so individuals with multiple chemical sensitivities and other people vulnerable to chemicals can still access recreational and other facilities found within the project area.
- Public posting will include signs at trailheads leading to or near herbicide application sites and on the trail before encountering herbicide application sites adjacent to forest trails.
- Hold a yearly meeting to discuss spraying goals and locations and alternative travel areas around sprayed zones to allow chemically sensitive people freedom to travel for the year ahead and to listen to concerns from the MCS community as the project proceeds.
- No mixing, loading, and equipment cleaning will be done within the limited spray zones, nor within 300 feet of the limited spray zones or private land.
- An 800 number will be available with weekly updates of all herbicide applications on the Prescott, Kaibab or Coconino National Forests.
- Plan the timing of herbicide applications to coordinate with times of low public use (for example mid-week or during forest or area closures if timing is effective for weed species control).
- Use dye markers with herbicides to raise awareness of the physical spray location on the weeds.
- Develop "Adopt an Area" program for concerned citizens to take responsibility for weed control in locations where herbicides are not preferred as a control method.

Integrated Weed Management Practices
(Coconino, Kaibab, & Prescott National Forests Noxious and Invasive Weed Strategic Plan 1998, Amended 2002)

Introduction

Preventing the introduction and spread of noxious weeds is one objective of integrated weed management programs on National Forest System lands throughout the United States. This guide to integrated weed management practices provides a comprehensive directory for use in planning and wildland resource management activities and operations. This guide will help managers and cooperators identify weed management practices that mitigate identified risks of weed introduction and spread for a project or program.

Supporting Direction

Development of weed management prevention practices is supported by Forest Service noxious weed policy and strategy. Forest Service policy identifies prevention of the introduction and establishment of noxious weed infestations as an Agency objective. This policy directs the Forest Service to: (1) determine the factors that favor establishment and spread of noxious weeds, (2) analyze weed risks in resource management projects, and (3) design management practices to reduce these risks. The Forest Service Noxious Weed Strategy identifies development of practices for prevention and mitigation during ground-disturbing activities as a long-term emphasis item. The February 1999 Executive Order on invasive species requires Federal agencies to use relevant programs and authorities to prevent introduction of invasive species and not authorize or carry out actions that are likely to cause introduction or spread of invasive species unless the Agency has determined, and made public, documentation that shows that the benefits of such actions clearly outweigh the potential harm, and all feasible and prudent measures to minimize risk of harm will need to be taken in conjunction with the actions.

This guide uses the term "*weed*" to include the National Invasive Species Council definition of all plants exotic to the relevant ecosystem that have the potential to cause economic or ecological harm. The term "*noxious weed*" has legal definitions by Forest Service policy:

> ". . .plants designated as noxious weeds by the Secretary of Agriculture or by the responsible State official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to or not common to the United States or parts thereof." (FSM 2080.5)

The Coconino, Kaibab, and Prescott National Forests use the Arizona State-defined noxious weed list (R3-4-244 and 245) as well as the region/forest designated invasive weed lists. The listed weed species are the priority for implementing weed management in cooperation with neighbors and partners as specified in CFR 222.8.

The following table replaces Tables 3 and 5 in the 1998 "Noxious Weeds Strategic Plan Working Guidelines, Coconino, Kaibab and Prescott National Forests."

General Integrated Weed Management Practices for All Site-disturbing Projects and Maintenance Programs

Objective	Best Known Practice
1. Incorporate weed prevention and control into project layout, design, alternative evaluation, and project decisions.	1.1 – Environmental analysis for projects and maintenance programs will need to assess weed risks, analyze potential treatment of high-risk sites for weed establishment and spread, and identify prevention practices. Determine prevention and maintenance needs, including the use of herbicides if needed, at the onset of project planning. 1.2 – Coordinate with other agencies and adjacent landowners to prevent and control weeds. (CFR 222.8)
2. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	2.1 – Before ground-disturbing activities begin, **inventory** and **prioritize treatment** of invasive weeds in project operating areas and along access routes, or within reasonably expected potential invasion vicinity. Do a risk assessment accordingly; control weeds as necessary. 2.2 – After completing "Practice 2.1" above, reduce risk of spreading and creating weed infestations. Plan operating areas and access routes to avoid heavy infestation areas, plan closure of access routes at finish of project, and/or begin project operations in uninfested areas before operating in weed-infested areas. Locate and use weed-free project staging areas. Avoid or minimize all types of travel through weed-infested areas, or restrict to those periods when spread of seed or propagules are least likely. Equipment Wash Station – Centralized wash station areas will be developed in several locations throughout the CNF. They must have a filter system, for example at least 6 inches of large cinder or gravel spread over an area 10' x 30′. Filter cloth may be used for temporary stations. The area will be a perched drainage to allow excess moisture to drain after being filtered and must be at least 200 yards from a natural drainage to avoid contamination. All wash station locations must be monitored annually and all weed materials removed as soon as possible. 2.3 – Remove mud, dirt, and plant parts from project equipment before moving it into a project area. Determine the need for, and when appropriate, identify sites where equipment can be cleaned. Clean all equipment before entering National Forest System lands; a forest officer, in coordination with the unit invasive species coordinator, needs to approve use of on-forest cleaning sites in advance. This practice does not apply to service vehicles traveling frequently in and out of the project area that will remain on a clean roadway. Seeds and plant parts need to be collected when practical and incinerated. 2.4 – If operating in areas infested with weeds, clean all equipment before leaving the project site. To minimize time spent cleaning equipment, time all work in infested areas last and concurrently, designate a "contaminated" parking lot where project vehicles working in the infested area may be parked for the duration of the project. This area should be monitored in followup mitigation and should be near a "clean" vehicle/equipment lot. Identify sites where equipment and vehicles can be cleaned before leaving the site at the end of the project. Seeds and plant parts need to be collected when practical and incinerated.

Objective	Best Known Practice
	2.5 – Workers need to inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment after being trained to recognize the priority species in the area. Proper disposal means bagging the seeds and plant parts and incinerating them. 2.6 – Coordinate project activities between resources and between agencies (such as city, county, ADOT, ASLD) with any nearby weed treatments, including herbicide applications, to maximize cost effectiveness of weed treatments.
3. Prevent the introduction and spread of weeds caused by moving infested sand, gravel, borrow, and fill material in Forest Service, contractor and cooperator operations.	3.1 – Inspect material sources on site annually, and ensure that they are weed-free before use and transport. Treat weed-infested sources for eradication, and strip, stockpile, and treat contaminated material before using pit materials. 3.2 – Inspect and document the areas where materials are used (including those from treated weed-infested sources) annually for at least 3 years after project completion to ensure that any weeds transported to the site are promptly detected and controlled. 3.3 – Maintain stockpiled, uninfested material in a weed-free condition. 3.4 – Work with the responsible transportation agencies to adopt these practices for maintenance of roads that cross National Forest System lands.
4. Avoid creating soil conditions that promote weed germination and establishment.	4.1 – Minimize soil disturbance to the extent practical, consistent with project objectives. 4.2 – In those vegetation types that have relatively closed canopies as a natural condition, retain shade to the maximum extent possible to suppress weeds and prevent their establishment and growth in and around project activity.
5. Where project disturbance creates bare ground, establish vegetation to minimize favorable conditions for weeds.	5.1 – Treat disturbed soil (except surfaced projects) in a manner that optimizes native plant establishment for that specific site. Define for each project what constitutes disturbed soil and objectives for plant cover revegetation. 5.2 – Revegetation may include topsoil replacement, native seedbank promotion, planting, seeding, fertilization, and/or weed seed-free mulching as necessary. Use local native material where appropriate and feasible (or specifically identify why not used). Always use certified weed-free and weed seed-free hay or straw. Always use certified materials in areas closed by administrative order. Where practical, stockpile weed seed-free topsoil from the project area and replace it on disturbed areas (e.g. road embankments, staging areas, wash stations, or landings). 5.3 – Use local seeding guidelines to determine detailed procedures and appropriate mixes. To avoid weed contamination, a certified seed laboratory needs to test each lot against the all-State noxious weed list to Association of Seed Technologists and Analysts (AOSTA) standards, and provide documentation of the seed inspection test. Seed lots labeled as certified weed seed-free at time of sale may still contain some weed seed

Objective	Best Known Practice
	contamination. 5.4 – Monitor and document all limited term ground-disturbing operations near weed infested areas for at least five growing seasons, or the documented seed viability for the species of concern following completion of the project. For ongoing projects, continue to monitor until reasonable certainty is obtained that no weeds have occurred. Provide for followup treatments based on inspection results. 5.5 – Evaluate options, including closure, to minimize future infestations on sites where desired vegetation needs to be established.
6. Improve effectiveness of prevention practices through weed awareness and education.	6.1 – Provide information, training and appropriate weed identification materials to people potentially involved in weed introduction, establishment, and spread on National Forest System lands, including agency managers, employees, forest workers, permit holders, and recreational visitors. Educate them to an appropriate level in weed identification, biology, impacts, and effective prevention measures. Educate resource level managers to allow them to incorporate weed prevention practices in their planning of projects and daily activities. 6.2 – Provide proficient weed management expertise at each administrative unit. Expertise means that necessary skills are available and corporate knowledge is maintained. 6.3 – Develop incentive programs encouraging weed awareness, detection, reporting, and for locating new invaders.
7. Set the example; maintain weed-free administrative sites.	7.1 – Treat weeds at administrative sites and use weed prevention practices to maintain sites in a weed-free condition.

Integrated Weed Management Practices for
Fire Management Projects and Maintenance Programs

Objective	Best Known Practice
Pre-incident - Training and Planning	
FM-1. Improve effectiveness of prevention practices through weed awareness and education for incident management teams.	1.1 – Increase weed awareness, weed identification and weed prevention in all fire training. 1.2 – Include weed risk factors and weed prevention practices in resource advisor duties on all incident management teams and burn rehabilitation teams. 1.3 – Assign a local weed specialist or include in resource advisor duties to the incident management team when wildfire or control operations occur in or near an area infested with weeds. 1.4 – Resource advisors need to provide briefings that identify operational practices to reduce weed spread (for example: avoiding known weed infestation areas when locating fire lines). Include this information in shift briefings. 1.5 – Provide weed identification aids to field observers.
Wildfires, General – All wildfire weed prevention goals apply except in instances where human life or property is at risk.	
FM-2. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	2.1 – Ensure that all outside (rental, other agency or unit) equipment is free of weed seed and propagules before it is accepted by the contracting officers representative. 2.2 – Maintain a network of airports, helibases, camps, and staging areas in a weed-free condition. Coordinate with local weed specialists to locate and treat practice jump areas to make them weed free. 2.3 – Monitor and treat weeds that establish at equipment cleaning sites after fire incidents. 2.4 – If safety precautions allow, inspect and clean all fire equipment (boots, shovels, tents, rigs, tankers, water buckets, etc..) prior to moving from weed infested lands or lakes to areas that are not infested. If not possible beforehand, then power wash all equipment in a designated/mapped/monitored wash site (4-6” of cinder/gravel with controlled drainage).
FM-3. Avoid creating soil conditions that promote weed establishment.	3.1 – Use appropriate suppression tactics to reduce suppression-induced disturbances to soil and vegetation while minimizing seedbed creation due to disturbance from fire effects.

Objective	Best Known Practice
Prescribed Fire	
FM-4. Manage fire as an aid in control of weeds to prevent new weed infestations and the spread of existing weeds.	4.1 – Pre-inventory project area and evaluate weeds present with regard to the effects on the weed spread relative to the fire prescription. Remove weeds (live plants and seed sources) before project initiation. 4.2 – Plan to avoid or remove existing sources of weed seed and propagules. Avoid ignition and burning in areas at high risk for weed establishment or spread due to burn aftereffects. Treat weeds that establish or spread because of unplanned burning of weed infestations. 4.3 – Burn noninfested areas first before entering weed infested sections of the burn. Clean all equipment when project is completed. Or treat and burn all infested areas first to remove seed source then clean equipment and proceed to uninfested areas.
FM-5. Avoid creating soil conditions that promote weed germination and establishment.	5.1 – Time burns to promote native species and to hinder weed species germination. 5.2 – Consult weed species specific information and consider effects of current local conditions on species growth.
Fire Rehabilitation	
FM-6. Incorporate weed management into project layout and design.	6.1 – Evaluate weed status and risks in burned area emergency rehabilitation (BAER) plans. When appropriate, apply for burned area emergency rehabilitation and restoration funding to inventory, control, and monitor weeds. If the presence of weed seed is suspected, request BAER funds to inspect and document for spring emergence.
FM-7. Encourage vegetation establishment as appropriate to the site objectives.	7.1 – To minimize weed spread, treat weeds in burned areas as part of the burned area emergency rehabilitation plan. For adjacent known infestations that will likely spread, remove the potential contaminating seed source and encourage competitive species. 7.2 – Inspect and document weed establishment at fire access roads, cleaning sites, all disturbed staging areas, and within burned areas; control infestations to prevent spread within burned areas. 7.3 – Seed and straw mulch to be used for burn rehabilitation (for wattles, straw bales, dams, etc.) all need to be inspected and certified free of weed seed and propagules. 7.4 – Regulate human, pack animal, and livestock entry into burned areas at risk for weed invasion until desirable site vegetation has recovered sufficiently to resist weed invasion.

Integrated Weed Management Practices for Lands Stewardship Projects and Maintenance Programs

Objective	Best Known Practice
VEGETATION MANAGEMENT	
Timber Harvest Operations and Stewardship Contracting	
VM-1. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	1.1 – Treat weeds on contracted projects, emphasizing treatment of weed infestations on existing landings, skid trails, and helibases before activities commence. 1.2 – Train contract administrators to identify weeds and select lower risk sites for landings and skid trails. 1.3 – Encourage operators to maintain weed-free mill yards, equipment parking, and staging areas. 1.4 – Use standard timber sale contract clauses such as WO-C/CT 6.36 to ensure appropriate equipment cleaning.
VM-2. Retain native vegetation in and around project activity and minimize soil disturbance.	2.1 – Minimize soil disturbance to no more than needed to meet project objectives. Logging practices to reduce soil disturbance include, but are not limited to: • Over-snow logging • Skyline or helicopter logging • Reuse landings, skid trails and helibases when they are weed free 2.2 – Minimize period from end of logging to site preparation, revegetation, and contract closure.
Post Vegetation Management Operations	
VM-3. Retain native vegetation in and around project activity and minimize soil disturbance.	3.1 – Minimize soil disturbance to no more than needed to meet vegetation management objectives. Prevention practices to reduce soil disturbance include, but are not limited to: Minimizing heat transfer to soil in burning by: • Treating fuels in place (broadcast burning) instead of piling • Using small, tall steep piles • Minimizing fireline construction Minimizing soil disturbance by logging techniques: • Preference for forwarders that carry logs, rather than skidders that drag logs • Using hand fellers instead of machines • Using hand piling rather than machine piling • Avoiding decking logs in the woods • Using low PSI (impact) equipment (big tires)

Objective	Best Known Practice
VM-4. Encourage native vegetation on bare ground.	4.1 – Recognize the need for prompt growth of native vegetation, long-term restoration and weed suppression where forested vegetation management has created openings. 4.2 – Allow natural seedbank to provide vegetation if possible, next preference is for native seed grown from local collections. All seed must be certified weed seed-free for all species on the forest noxious or invasive weed list.
RANGE MANAGEMENT	
Grazing	
RM-1. Consider weed prevention and control practices in the management of grazing allotments.	1.1 – Include weed prevention practices, inspection and reporting direction, and provisions for inspection of livestock concentration areas in allotment management plans and annual operating instructions for active grazing allotments. 1.2 – For each grazing allotment containing existing weed infestations, include prevention practices focused on preventing weed spread and cooperative management of weeds in the annual operating instructions. Prevention practices may include, but are not limited to: • Maintaining healthy vegetation • Preventing weed seed transportation • Minimize potential ground disturbance - altering season of use or exclusion • Weed control methods • Revegetation • Inspection and Monitoring • Reporting • Education
RM-2. Minimize transport of weed seed into and within allotments.	2.1 – If livestock are potentially a contributing factor to seed spread, schedule units with existing weed infestations to be treated prior to seed set before allowing livestock on those units. Schedule these infested units to be the last in the rotation. 2.2 – If livestock were transported from a weed-infested area, corral livestock with weed-free feed, and annually inspect and treat allotment entry units for new weed infestations. 2.3 – Designate pastures as unsuitable range to livestock grazing when infested to the degree that livestock grazing will continue to either exacerbate the condition on site or contribute to weed seed spread.
RM-3. Maintain healthy, desirable vegetation that is resistant to weed establishment.	3.1 – Through the allotment management plan or annual operating instructions, manage the timing, intensity (utilization), duration, and frequency of livestock activities associated with harvest of forage and browse resources to maintain the vigor of desirable plant species and retain live plant cover and litter.

Objective	Best Known Practice
	3.2 – Manage livestock grazing on restoration areas to ensure that vegetation is well established. This may involve exclusion for a period of time consistent with site objectives and conditions. Consider practices to minimize wildlife grazing on the areas if needed.
RM-4. Minimize ground disturbances.	4.1 – Include weed prevention practices that reduce ground disturbance in allotment management plans and annual operating instructions. Consider for example: changes in the timing, intensity, duration, or frequency of livestock use; location and changes in salt grounds; restoration or protection of watering sites; and restoration of yarding/loafing areas, corrals, and other areas of concentrated livestock use. 4.2 – Inspect known areas of concentrated livestock use for weed invasion. Inventory and manage new infestations.
RM-5. Promote weed awareness and prevention efforts among range permittees.	5.1 – Use education programs or annual operating instructions to increase weed awareness and prevent weed spread associated with permittees' livestock management practices. 5.2 – To aid in their participation in allotment weed control programs, encourage permittees to become certified pesticide use applicators.
WATERSHED MANAGEMENT	
WM-1. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	1.1 – Inspect and document for early detection of weed establishment and spread in riparian areas and wetlands. Eradicate new infestations before they become established. 1.2 – Address weed risks in watershed restoration projects and water quality management plans. 1.3 – Pay particular attention to practices listed under "General Weed Prevention Practices for Site-disturbing Projects and Maintenance Programs" and "Aquatic Weed Management Practices."
WILDLIFE AND FISHERIES	
WM-2. Avoid creating soil conditions that promote weed germination and establishment.	1.1 – Periodically inspect for weeds and document those areas where wildlife concentrate in the winter and spring resulting in overuse or soil scarification. 1.2 – Use weed-free materials at big game baiting stations. 1.3 – For wildlife openings and habitat improvement projects, follow the practices outlined in "General Weed Prevention Practices" and "Vegetation Management."

Integrated Weed Management Practices for Engineering/Roads/Minerals Projects and Maintenance Programs

Objective	Best Known Practice
ENGINEERING/ ROADS/ MINERALS	
Project Planning	
ERM-1. Incorporate weed prevention into project layout, design, alternative evaluation, and decisions.	1.1 – Include weed surveys at the project planning stage as outlined in "General Weed Management Practices" 1.2 – For timber sale purchaser road maintenance and decommissioning, use standard timber sale contract clauses such as WO-C/CT 6.36 to ensure appropriate equipment cleaning. 1.3 – For new and reconstruction of roads conducted as part of public works (construction) contracts and service contracts include contract language for equipment cleaning such as is in WO-C/CT 6.36. 1.4 – Include weed prevention measures—including project inspection and documentation—in minerals operation and reclamation plans.
Project Implementation	
ERM-2. Prevent conditions favoring weed establishment, minimize bare soil conditions and promote vegetation on bare ground.	2.1 – Ensure that all outside (rental, other agency or unit) equipment brought onto the forest is free of weed seed and propagules before it is accepted by the contracting officers representative. 2.2 – Schedule and coordinate all earth-moving or soil-disturbing activities (such as pulling of invasive weed-infested roadsides or ditches) in consultation with the local weed specialist. Do not blade or pull roadsides and ditches that are infested with weeds unless doing so is required for public safety or protection of the roadway. If the ditch must be pulled, ensure the weeds remain onsite. Blade from least infested to most infested areas. When it is necessary to blade weed-infested roadsides or ditches, schedule the activity when seeds or propagules are least likely to be viable and spread. Minimize soil surface disturbance and contain bladed material on the infested site.
Decommissioning and Maintenance	
ERM-3. Minimize roadside sources of weed seed that could be transported to other areas.	3.1 – Retain bonds until reclamation requirements are completed, including weed treatments, based on inspection and documentation. Require followup monitoring based on seed viability in soil of known and potential weed species. 3.2 – Periodically inspect system roads and rights-of-way for invasion of weeds. Train road maintenance staff to recognize weeds and report locations to the local weed specialist. Inventory weed infestations and schedule them for treatment. 3.3 – Avoid acquiring water for dust abatement from weed-infested areas. 3.4 – For timber sale purchaser road maintenance and decommissioning, use contract clauses for equipment cleaning such as in WO-C/CT 6.36.

Objective	Best Known Practice
	3.5 – For road maintenance and decommissioning conducted as part of public works (construction) contracts and service contracts include contract language for equipment cleaning such as in WO-C/CT 6.36. 3.6 – Treat weeds in road decommissioning and reclamation projects before roads are made impassable. Re-inspect and plan followup monitoring and treatment based on initial inspection and documentation.

Integrated Weed Management Practices for Public Services and Aquatic Projects

Objective	Best Known Practice
Recreation, Wilderness, and Special Management Areas	
PS-1. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	1.1 – On designated public lands, issue closure orders that specify the use of weed free or weed seed-free feed, hay, straw, and mulch. Refer to 36 CFR 251.50. Cooperate with State, county, tribal governments, and other agencies to develop and support publicly available weed-free materials. 1.2 – Where they exist, post and enforce weed-free feed orders. (FSM 2081.03) 1.3 – Encourage backcountry pack and saddle stock users to feed stock only weed-free feed for several days before travel on National Forest System lands. 1.4 – Inspect, brush, and clean animals—especially hooves and legs—before entering public land. Inspect and clean tack and equipment. 1.5 – Tie or hold stock in ways that minimize soil disturbance and avoid loss of desirable native vegetation. 1.6 – Annually inspect all campgrounds, trailheads, and recreation areas that are open to public vehicle use for weeds; document and treat new infestations. 1.7 – Maintain trailheads, boat launches, outfitter and public camps, picnic areas, airstrips, roads leading to trailheads, and other areas of concentrated public use in a weed-free condition. Consider high use recreation areas as high priority for weed eradication. 1.8 – Consider seasonal or full-time closure of campgrounds, picnic areas, and other recreation use areas until weeds are reduced to levels that minimize potential for spread. 1.9 – In areas susceptible to weed infestation, limit vehicles to designated maintained travel routes. Inspect and document inspections on travel ways for weeds and treat as necessary.
PS-2. Promote weed prevention practices through public awareness and education.	2.1 – Educate public land users to identify common invasive weeds and to avoid recreating in infested areas. If weeds are encountered, the public should inspect and clean motorized and mechanized trail vehicles of weeds and their seeds. 2.2 – Post weed awareness messages and prevention practices at strategic locations such as trailheads, roads, boat launches, and forest portals. 2.3 – In weed-infested areas, post weed awareness messages and prevention practices at roadsides.
Lands and Special Uses	
PS-3. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	3.1 – Consider weed status of lands when making land acquisition or disposal decisions. 3.2 – Conduct weed inventories of all lands considered for acquisition. 3.3 – Land acquisition decisions may require weed control as a condition of sale or exchange. 3.4 – Include a weed prevention and control provision in all special use permits,

Objective	Best Known Practice
	authorizations, or other grants involving ground-disturbing activities. Include this provision in existing ground-disturbing authorizations that are being amended for other reasons; consider including this provision by amending existing ground-disturbing authorizations as necessary. 3.5 – Require weed prevention and control in operating and maintenance plans when authorized activities present a high risk for weed infestation or the location of the activity is vulnerable to weed introduction or spread.
Aquatic Management for Forest Projects and Special Use Permits.	
AM-1. To prevent new weed infestations and the spread of existing weeds, avoid or remove sources of weed seed and propagules.	1.1 – Provide outreach to Arizona Game and Fish Department, counties, and other agencies concerning the unique prevention measures and control practices associated with aquatic weeds. 1.2 – Rinse and inspect boats (including rafts), trailers, and other boating equipment and remove any visible plants, animals, or mud before leaving any waters or boat launching facilities. Drain water from motor, live well, bilge, and transom wells while on land before leaving the vicinity. Wash and dry boats, tackle, downriggers, anchors, nets, floors of boats, props, axles, trailers, and other boating equipment to kill weeds not visible at the boat launch. Clean with high pressure or hot (90 degrees) water, or dry boat and equipment for at least 5 days. 1.3 – Maintain a 100-foot buffer of aquatic weed-free clearance around boat launches and docks. 1.4 – Promptly post sites if aquatic invasives are found. Confine infestation. Where prevention is infeasible or ineffective, close facility until infestation is contained. 1.5 – Wash and dry tackle, downriggers, float tubes, waders, and other equipment to remove or kill harmful species not visible at the boat launch. 1.6 – Avoid moving weed plants from one body of water to another. 1.7 – Avoid running personal watercraft through aquatic plants near boat access locations. Instead, push or winch watercraft onto the trailer without running the engine. After the watercraft is out of the water, start the engine for 5-10 seconds to blow out any excess water and vegetation. After engine has stopped, pull weeds out of the steering nozzle. Inspect trailer and any other sporting equipment for weed fragments and remove them before leaving the access area. Wash or dry watercraft before transporting to another body of water. 1.8 – Waterfowl hunters may use elliptical, bulb-shaped, or strap anchors on decoys, because these types of anchors avoid collecting submersed and floating aquatic plants. Inspect waders and hip boots, removing any aquatic plants and, where possible, rinse mud from them before leaving the water. Remove aquatic plants, animals, and mud attached to decoy lines and anchors. 1.9 – Construct new boat launches and ramps at deepwater sites. Restrict motorized boats in lakes near areas that are infested with weeds. Move sediment to upland or quarantine areas when cleaning around culverts, canals, or irrigation sites. Clean equipment before moving to new sites. Inspect and clean equipment before moving from one project area to another.

Soil, Water and Air Best Management Practices

The Soil and Water Conservation Practices Handbook (FSH 2509.22) was developed in concert between the USDA Forest Service, Southwestern Region and both Departments of Environmental Quality from Arizona and New Mexico. It is a formalized agreement with the specific purpose to respond to the objectives defined by Congress in the Federal Water Pollution Control Act, as amended. The main objective of this law is to restore and maintain the chemical, physical, and biological integrity of the Nation's water.

Basically, the Forest Service has agreed to ensure that all project work contains site-specific best management practices (BMPs) developed through the National Environmental Policy Act process. The Forest Service has also agreed to implement a BMP monitoring strategy that includes implementation monitoring to ensure application of BMPs as specified in the project, as well as effectiveness monitoring to determine if the BMP met stated objectives.

A best management practice is defined as a practice or combination of practices, that is determined by the State after problem assessment, to be the most effective and practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to the level compatible with water quality goals (FSH 2509.22).

The following lists of BMPs have been developed for this project and are designed to minimize any potential water quality problems with approval of herbicide use on the forests. All BMPs are considered standard procedure and do not constitute deviation from normal planning or implementation processes. BMPs identified for this project are also listed in the Soil and Water Conservation Handbook (2509.22). Application of the BMPs will ensure compliance with the requirements of the Federal Water Pollution Control Act.

- 21.11: Pesticide Application According to Label Directions and Applicable Legal Requirements — All approved herbicides will be applied according to label instructions to avoid water contamination. Directions found on the label of each herbicide are detailed and specific and include legal requirements for use. These constraints will be incorporated into individual project plans and contracts. Responsibility for inservice projects rests with the Forest Service's project supervisor who shall be a certified applicator. For contracted projects, it is the responsibility of the contracting officer or the contracting officer's representative to ensure that label instructions and other applicable legal requirements are followed.
- 21.12: Pesticide Application Monitoring and Evaluation — The objective of this BMP is to determine whether pesticides were applied safely, restricted to intended target areas, and deposited at the right rates. It is also designed to evaluate if nontarget species were impacted. Another component is also to provide early warning of possible hazardous conditions and determine the extent, severity, and duration of any potential hazard that might exist. Monitoring methods include spray cards, dye tracing, and direct measurements of herbicides on plants or near water. Monitoring of existing herbicide concentrations will be conducted prior to any treatments in riparian corridors where perennial water is found.
- 22.13: Pesticide Spill Contingency Plan — The objective of this BMP is to eliminate contamination of water or the soil resource that may occur from accidental spills.
    - 24.14: Cleaning and Disposal of Herbicide Containers — This BMP is designed to prevent water contamination from cleaning or disposal of herbicide containers. The cleaning and

disposal of these items will be done in accordance with Federal, State, and local laws. The forest or district pesticide use coordinator will approve proper rinsing procedures in accordance with State and local laws and regulations, and arrange disposal of containers when inservice personnel apply the product. When a contractor applies the herbicide, the contractor is responsible for proper container disposal in accordance with label instructions.

- 21.16: Controlling Pesticide Drift During Spray Application — The objective of this BMP is to minimize risk of pesticides falling directly into water or nontarget areas. The spray application of herbicides is accomplished according to a prescription which accounts for terrain and that specifies the following: spray exclusion areas, buffer zones, and factors such as formulation, equipment, droplet size, spray height, application pattern, flow rate, and the limiting factors of wind speed and direction, temperature, and relative humidity. On inservice projects, the Forest Service project manager supervisor is responsible for ensuring the prescription is followed, whereas if contracted, the contracting officer is delegated the responsibility.

Weed Control Pesticide Safety and Spill Plan

Information and Equipment

The forest pesticide coordinators for the Coconino, Kaibab, and Prescott National Forests will fulfill the role as the certified pesticide applicator for the project. The regional pesticide coordinator will initially serve as the technical staff and advisor until forest personnel are trained and certified.

All participants will receive training on safety and application procedures prior to any spraying.

The certified applicator will supervise spraying operations as required.

A copy of the labels and material safety data sheets (MSDS) for all herbicides will be available at all times during project operations. Employees will be completely familiar with the information in these documents in case it is needed in the event of a spill or incident.

Required personal protective equipment (PPE) will be worn at all times when herbicides are being mixed and applied. Label requirements for specific herbicides will be followed. Applicators and handlers must wear long-sleeved shirt and long pants, waterproof and chemical-resistant gloves, and boots and socks.

An emergency spill kit, with directions for use, will be present when herbicides are being mixed, transported, and applied. Employees will be trained in the use of the spill kit prior to initiation of operations.

The spill kit will contain the following equipment:

- Shovel
- Broom
- Ten pounds of absorbent material
- Box of large plastic bags
- Nitrile gloves

Mitigations for Herbicide Use

- Application personnel will be trained by, and all application will be under direct supervision of, a Forest Service certified pesticide applicator (Region 3 Supplement 2100-98-1). All applicators must wear protective clothing as described on the label.
- All herbicide applications will follow EPA label requirements, USDA policy, and Forest Service direction (e.g., FSM 2150 Pesticide Use Management and Coordination; FSH 2109.11 Pesticide Project Handbook; FSH 2109.12 Pesticide Storage, Transportation, Spills, and Disposal Handbook; and FSH 2109.13 Pesticide Project Personnel Handbook).
- Only herbicides labeled for use adjacent to water will be used within riparian zones and areas with shallow ground water.
- Suspension of broadcast herbicidal applications will occur when the following conditions exist. During these weather patterns, herbicide application methods will be limited to hand-held spot spraying or wick application:
    - Wind velocity exceeds 6 miles per hour for liquids or 15 miles per hour for granular herbicides, unless a lower maximum wind speed is specified on the label.

  - Snow or ice covers the target plant.
  - Precipitation is occurring or is imminent.
  - Fog significantly reduces visibility.
  - Air turbulence, such as thermal updrafts, is sufficient to affect the normal herbicide distribution pattern.
- Herbicides will be transported daily to the project site under the following conditions: (a) transport only the quantity needed for that day's work, and (b) transport concentrate only in containers in a manner that will prevent tipping or spilling, and in a compartment that is isolated from food, clothing, and safety equipment.
- Mixing, loading, and equipment cleaning must be done onsite and at least 300 feet from the edge of a "Limited Spray Zone" or from private land (unless the owner is cooperating in the project), open water, known wellheads, or sensitive areas. Mixing and cleaning water must be transported to the site in labeled containers that are separate from water used for other purposes.
- Nonherbicidal methods, except grazing, will be the preferred choice for 100 feet around wellheads. If herbicides must be used, treatments will be timed with the driest periods to prevent leaching of any herbicides directly into the wellhead and still have effective control.
- Safety and spill plans will be written for each project.
- All herbicide containers will be disposed of in accordance with label, State, and Federal requirements.
- Broadcast spray sites will be posted at all access points 2 weeks before, during, and 2 weeks following herbicide application.

Procedures for Herbicide Spill Containment

Notify the supervisor's office and relevant district office of an incident or spill. Identify the nature of the incident and extent of the spill. Include the following information:

Product Name:	Tordon 22K	Reclaim
Chemical Name:	Picloram	Clopyralid
EPA Registration Number:	62719-6	62719-83

Remove any injured or contaminated person to a safe area. Remove contaminated clothing and follow instructions on the MSDSs. Do not leave an injured person alone. Obtain medical help for any injured employee.

Contain the spilled herbicide as much as possible on the site. Prevent the herbicide from entering ditches, gullies, wells, or water systems.

Small Spills (Less than 1 gallon of herbicide formulation or less than 10 gallons of herbicide mixture)

- Qualified employees will be present to confine a spill.
- Follow MSDS guidelines for emergency first aid procedures in the event of an accidental exposure.
- Restrict entry to the spill area by roping off and flagging.
- Contain spread of spill with earthen dikes.
- Cover spill with absorbent material.

- Place contaminated materials into leakproof containers and label them.
- Dispose of contaminated materials according to label instructions and State requirements.

Large Spills (More than 1 gallon of herbicide formulations or more than 10 gallons of herbicide mixture)

- Keep people away from the spill.
- Flag and rope off the spill area.
- Follow MSDS guidelines for emergency first aid procedures in the event of an accidental exposure.
- Contact Dow AgroSciences at 1-800-992-5994.
- Call Chemical Transportation Emergency Center (Chemtrec) at 1-800-424-9300 if DowAgroSciences cannot be reached.
- Notify the highway patrol or sheriff if the spill occurs on a highway.
- Contain spread of the spill with earthen dikes.
- Cover the spill with absorbent material.
- Spread the absorbent material around the perimeter of the spill and sweep toward the center.
- Call the direct supervisor or safety coordinator and the forest hazardous material coordinator for further instruction or action.

Notification List of Key Personnel

(To be updated for individual districts/projects)

Forest Supervisor (numbers for each SO):_____

District Offices (numbers):_____

Regional Pesticide Coordinator: Doug Parker at (505) 842-3280

National Forest Safety Officers: Name & number_____

National Forest Hazardous Materials Coordinator: Alan Anderson (928) 527-3590

Local hospital and number:_____

Chemtrec: 1-800-424-9300

Required Protection Measures for Weed Treatments in Identified Species Habitats

Integrated Treatment for Noxious or Invasive Weeds on Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties

Endangered Species Act Section 7 Consultation #2-21-01-I-0335

Species Conservation Measures (Project Design Features)

RPMPA refers to the Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service (summarized in Tables 26 and 27) authored by J. Allen White, July 2004.

General Project BMPs

1. Implement integrated weed best management practices.
2. Survey T&E species' habitats to determine and prioritize the occupied and potential habitats that would be most vulnerable to encroachment of invasive and noxious weeds.
3. Use native species for seeding and planting during revegetating. An exception is the use of sterile hybrid grasses after careful analysis to provide immediate ground cover after wildfires.
4. FS will review "weed-free" certifications for seed and mulch to ensure they are "free" of the weed species to be controlled in the action area.
5. Treatments that are not within these design features would require additional analysis and may require additional coordination with the FWS (U.S. Fish and Wildlife Service).
6. Work cooperatively with adjacent landowners to manage noxious or invasive weeds to prevent their spread into NFS (National Forest System) lands.

All Species

1. Where specified, species breeding season timing restrictions and buffers are applicable to all treatment methods that are not commensurate with the designated uses.
2. Where two or more species' habitats occur, the more restrictive measures will take priority.
3. Noxious or invasive weed treatment methods during the breeding seasons for birds would be commensurate with designated uses (nonmotorized, motorized, livestock, etc.) in the treatment areas.
4. Adjuvants including surfactants and cleaners would be used or applied according to the adjuvant Table 27.
5. Forest Service would submit to the FWS an annual report of herbicide treatments occurring within T&E species' habitat.

Arizona cliffrose (*Purshia subintegra*)

1. Survey forest Arizona cliffrose habitat for noxious or invasive weeds.

2. Survey Arizona cliffrose habitat to determine and prioritize the occupied and potential seedling sites that would be most vulnerable to encroachment of invasive and noxious weeds.

3. Treatment crew members will be experienced in identifying Arizona cliffrose and FS sensitive species and will be supervised by a botanist.

4. Prior to initiation of weed treatments, survey each forest Arizona cliffrose treatment site for presence of seedlings of Arizona cliffrose.

5. Establish a buffer zone with a minimum radius equal to the height of the seedling when using manual/mechanical treatments where seedlings occur.

6. If application of herbicides is deemed necessary, conduct test treatments of the herbicide on ex situ Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones to avoid adverse effects.

7. Only those herbicides reviewed and approved by the FS botanist may be used in or near Arizona cliffrose habitat.

8. Timing of herbicide treatments is critical: when effective for controlling weeds, treatments should be done in fall when Arizona cliffrose plants are not actively growing or not under water stress.

9. Do not use torching of noxious or invasive weeds in Arizona cliffrose habitat. Treatments with herbicide will be done without prior torching.

**Apache trout, Gila chub, Gila topminnow,
Little Colorado spinedace in Small Riparian Habitats**

1. After a survey has been conducted, no restrictions on pesticide applications if USFWS concur that habitat is unoccupied by the species (RPMPA, pg. 73).

2. When streamflows are 100 cfs or greater, herbicides would be applied per guidelines for large aquatic habitats in RPMPA, pg. 76 (see Table 26 in RPMPA).

3. When streamflows are less than 100 cfs, herbicides would be applied per guidelines in RPMPA pg. 73 with the following modifications (see Table 26 in RPMPA).

   - Approved herbicides (aquatic formulations only): Glyphosate, Imazapic, and Imazapyr may be used within the riparian zone adjacent to but not in the aquatic habitat.
   - Spot applications to individual plants are permitted within the buffer zone.
   - For pool habitats, no pesticide applications may occur near pools when there is no surface flow of water in and out of the pool(s). Per the RPMPA, a 30-foot buffer would apply when there is no surface flow of water.

4. When streamflows exceed 100 cfs (cubic feet per second), may apply guidelines for large riparian habitats (see Table 26 in RPMPA).

Colorado pike minnow, loach minnow, razorback sucker, spikedace and roundtail chub in large riparian habitats

1. After a survey has been conducted, no restrictions on pesticide applications if USFWS concur that habitat is unoccupied by the species (RPMPA, pg. 76).

2. When streamflows are 100 cfs or greater, herbicides would be applied per guidelines for large aquatic habitats in RPMPA, pg. 76 (see Table 26 in RPMPA).

3. When streamflows are less than 100 cfs, herbicides would be applied per guidelines in RPMPA, pg. 73 with the following modifications (see Table 26 in RPMPA):

   - Approved herbicides (aquatic formulations only): Glyphosate, Imazapic, and Imazapyr may be used within the riparian zone adjacent to but not in the aquatic habitat.
   - Spot applications to individual plants are permitted within the buffer zone.
   - For pool habitats, no pesticide applications may occur near pools when there is no surface flow of water in and out of the pool(s). Per the RPMPA, a 30-foot buffer would apply when there is no surface flow of water.

Southwestern willow flycatcher

1. No biological control of tamarisk anywhere on the three forests ("SWWF Recovery Plan," pg. 121) until further NEPA analysis and ESA Section 7 compliance is documented.

2. Treatment within patches will comply with the southwestern willow flycatcher recovery plan.

3. FS biologist will determine patch size for nesting areas per the "SWWF Recovery Plan" and identify sites on the ground prior to treatments.

4. FS biologist would confirm occupancy during the breeding season (April through August, "SWWF Recovery Plan," pg. 21).

5. For occupied breeding patches, treatments adjacent to breeding patches would occur 100 meters from the edge of the patch ("SWWF Recovery Plan," pg. H-21).

6. Herbicides would be applied per guidelines in RPMPA, pg. 64 (see Table 26 in RPMPA).

Yellow-billed cuckoo

1. Herbicides would be applied per guidelines in RPMPA, pg. 64 (see Table 26 in RPMPA).

2. FS biologist would determine patch size for nesting areas and identify sites on the ground prior to treatments.

3. FS biologist would confirm occupancy during the breeding season (May through August).

4. In occupied breeding areas, treatments adjacent to breeding areas would occur outside the time of occupancy.

Bald Eagle

1. Breeding season is December 1 through June 30 (BECAS, pg. 32).
2. Nest occupancy confirmed by FS biologist.
3. No treatments may occur within one-half mile of occupied bald eagle nests (FWS per consultation) from the beginning of breeding season through occupancy for each breeding season as confirmed by FS biologist.
4. Specified herbicides may be applied along road rights-of-way within breeding areas during the breeding season (see Table 26 in RPMPA).
5. No treatments within 100 feet of occupied winter roosts (roosting season October 1 through March 30).

California Condor

1. Forest Service will contact FWS immediately prior to herbicide applications in condor habitat to determine if any roosting or nesting condors are in the proposed application area. If condors are present, no herbicides will be used within 0.2 km (0.125 mi) for spot applications using hand-operated equipment, or within 0.4 km (0.25 mi) for mechanized ground applications of roost or nest sites to protect California condors from disturbance.

Mexican spotted owl

1. Breeding season is March 1 through August 30.
2. No treatments may occur within occupied "No Activity Centers." "No Activity Center" is the nest area from the MSO Recovery Plan, page 86. FS biologist to determine occupancy. If no surveys are done, MSO territories are assumed occupied until surveys are done to determine otherwise.
3. Specified herbicides may be applied along road rights-of-way in MSO PACs during the breeding season (see Table 26 in RPMPA).
4. Only specified herbicides may be applied within MSO PACs (see Table 26 in RPMPA).
5. Specified herbicides may be applied from FS system trails during the breeding season commensurate with the designated trail use (nonmotorized, motorized, livestock). Crews of two people may enter the PAC up to six times per breeding season for treatment purposes.
6. Specified herbicides may be applied during the breeding season to the remainder of the MSO PAC outside of the "No Activity Center" by nonmotorized methods.

Chiricahua, Northern, and Lowland leopard frogs

1. Herbicides would be applied per guidelines in RPMPA, pg. 136 (see Table 26 in RPMPA).
2. If there is a high probability (80 percent chance) of local, moderate rain (0.25 inch or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least 4 hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inch) is predicted locally within 48 hours, applications will be discontinued

until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Yuma clapper rail

1. Herbicides would be applied per guidelines in RPMPA, pg. 64 (see Table 26 in RPMPA).
2. FS biologist will determine nesting areas and identify the site on the ground prior to treatment.
3. FS biologist would confirm occupancy during the breeding season (March through July).
4. In occupied breeding areas, treatments adjacent to breeding areas would occur outside the time of occupancy.

Black-footed ferret, brown pelican, Mexican gray wolf

1. No herbicide limitations for this project per the RPMPA (pages 41, 28, and 109, respectively).

Kanab ambersnail, Page springsnail, Verde Rim springsnail

1. Herbicides would be applied per guidelines in RPMPA, pg. 69 (see Table 26 in RPMPA).
2. If there is a high probability (80 percent chance) of local, moderate rain (0.25 inch or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least 4 hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inch) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Northern goshawk

1. Breeding season is March 1 through September 30.
2. No treatments may occur within occupied “nest stands.” FS biologist to determine occupancy.
3. Specified herbicides may be applied along road rights-of-way in goshawk PFAs during the breeding season (same as MSO).
4. Only specified herbicides may be applied within goshawk PFAs (same as MSO).
5. Specified herbicides may be applied from FS system trails during the breeding season commensurate with the designated trail use (nonmotorized, motorized, livestock).
6. Specified herbicides may be applied during the breeding season to the remainder of the goshawk PFA outside of the “nest stand” by nonmotorized methods.

Migratory Birds Including Sensitive, MIS, and PIF Species

1. Class 0 or 1 avian toxicity herbicides may be applied during nesting season (March through August).
2. Treatment and application methods would be commensurate with the designated uses within the treatment area.

3. Avoid using avian toxicity Class 2 or 3 (Dicamba) during the breeding season. For all habitats, these herbicides may be used September through February.

Table 26. Required protection measures for pesticide applications in identified species habitats.

Species	Herbicides					
	2,4-D (acid formulations)	2,4-D (aquatic amine salt formulations)	2,4-D (nonaquatic amine salt formulations)	2,4-D (aquatic ester formulations)	2,4-D (nonaquatic ester formulations)	Chlorsulfuron
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace (Flows <100cfs)	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid- 30-foot buffer from edge of water body or habitat.	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 feet downstream. Liquid – 50-foot buffer				Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid – 30-foot buffer from edge of water body or habitat*
Arizona cliffrose	May not be used in habitat.			May not be used in or near habitat.		
Bald eagle	A half-mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during breeding season.			Buffer applies for 1 mile up and downstream from nest's location when applied at edge of water of occupied nest. Spot - 10 ft. from water edge. Mechanized - 80 ft. from water edge. A ½-buffer	Buffer applies for 1 mile up and downstream from nest's location when applied at edge of water of occupied nest. Spot - 10 ft. from water edge. Mechanized - 80 ft. from water edge. A ½-buffer from currently	A ½-mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during breeding season.

Table 26. Required protection measures for pesticide applications in identified species habitats.

Species	Herbicides					
	2,4-D (acid formulations)	2,4-D (aquatic amine salt formulations)	2,4-D (nonaquatic amine salt formulations)	2,4-D (aquatic ester formulations)	2,4-D (nonaquatic ester formulations)	Chlorsulfuron
				from currently occupied nests.	occupied nests.	
California condor	May be applied along road ROW. A ¼-mile buffer from nests, roosts, and release sites					
Chiricahua leopard frog, Northern leopard frog, Lowland leopard frog	Spot applications on land above high water line of species habitat, one-half mile upstream (including tributaries), 300 feet downstream. Liquid – 30-foot buffer					May be applied on land below or above the high water line of species habitat.
Colorado pikeminnow, loach minnow, razorback sucker, spikedace and roundtail chub (Flows >100cfs)	No buffer			Spot applications in the following areas: one-half mile upstream (including tributaries), all species habitat, and 300 feet downstream. Liquid – 20-foot buffer		No buffer
Kanab ambersnail, Page springsnail, Verde Rim springsnail	Spot applications around habitat: Liquid – no buffer ULV – 80-foot buffer	Spot applications around habitat: Liquid – 10-foot buffer ULV – 150-foot buffer				Spot applications around habitat: Liquid – no buffer ULV – 80-foot buffer
Mexican gray wolf, black-footed ferret, brown pelican	No limitations					
Mexican	May be sprayed along road ROW during			May be sprayed within the		May be sprayed

Table 26. Required protection measures for pesticide applications in identified species habitats.

Species	Herbicides					
	2,4-D (acid formulations)	2,4-D (aquatic amine salt formulations)	2,4-D (nonaquatic amine salt formulations)	2,4-D (aquatic ester formulations)	2,4-D (nonaquatic ester formulations)	Chlorsulfuron
spotted owl	breeding season. May be applied in rest of PAC outside the breeding season.			PAC outside of No Activity center during the breeding season.		along road ROW during BS. May be applied in rest of PAC outside the BS.
Migratory birds including sensitive & PIF species	May be applied during the breeding season.					
Northern goshawk	May be sprayed along road ROW during the breeding season. May be applied in rest of PFA outside the breeding season.			May be sprayed within PFA outside of nest stand during the breeding season.		May be sprayed along road ROW during the BS. May be applied in rest of PFA outside the BS.
Southwestern willow flycatcher	Spot – no buffer Mechanized – 30-foot buffer Breeding season timing restriction – April through August			No buffer. Breeding season timing restriction – April through August		Spot – no buffer Mechanized – 30-foot buffer BS TR – April-August
Yellow-billed cuckoo	Spot – no buffer Mechanized – 30-foot buffer Breeding season timing restriction – May through August			No buffer Breeding season timing restriction – May through August		Spot – no buffer Mechanized – 30-foot buffer BS TR – May-August
Yuma clapper rail	Spot applications within species habitat, ½ mile upstream (including tributaries) and 300 feet downstream: Liquid – 10-foot buffer ULV – 150-foot buffer Breeding season timing restriction – March through July			No buffer. Breeding season timing restriction – March through July		Spot applications within species habitat, ½ mile upstream (including tributaries), and 300 feet downstream: Liquid – 10-foot

Table 26. Required protection measures for pesticide applications in identified species habitats.

Species	Herbicides					
	2,4-D (acid formulations)	2,4-D (aquatic amine salt formulations)	2,4-D (nonaquatic amine salt formulations)	2,4-D (aquatic ester formulations)	2,4-D (nonaquatic ester formulations)	Chlorsulfuron
						buffer ULV – 150-foot buffer BS TR – March - July

Table 26. Required protection measures for pesticide applications in identified species habitats.

	Herbicides						
Federal Species	**Clopyralid**	**Dicamba**	**Glyphosate (aquatic)**	**Glyphosate (nonaquatic)**	**Imazapic**	**Imazapyr (technical formulation)**	**Imazapyr (aquatic)**
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace (Flows <100cfs)	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 ft. downstream: Liquid – 30-foot buffer from edge of water body or habitat*		Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 ft. downstream: Liquid-No buffer w/spot applications per the conservation measures	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 ft. downstream: Liquid- 30-foot buffer from edge of water body or habitat*	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 ft. downstream: Liquid-No buffer w/spot applications per the conservation measures	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid- 30-foot buffer from edge of water body or habitat* *10-foot buffer if FWS approved & spot applied	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 ft. downstream: Liquid-No buffer w/spot applications per the conservation measures
Arizona cliffrose	Conduct test treatments of the herbicide on ex situ Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones; treatments should be	May not be used in or near habitat.			Conduct test treatments of the herbicide on ex situ Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones; treatments should be	May not be used in or near habitat	

Table 26. Required protection measures for pesticide applications in identified species habitats.

	Herbicides						
Federal Species	**Clopyralid**	**Dicamba**	**Glyphosate (aquatic)**	**Glyphosate (nonaquatic)**	**Imazapic**	**Imazapyr (technical formulation)**	**Imazapyr (aquatic)**
	done in fall.				done in fall		
Bald eagle	A ½-mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during breeding season	Buffer applies for 1 mile up & down stream from nest's location when applied at edge of water of occupied nest. Spot-10 feet from water edge Mechanized-80 feet from water edge. Half-mile buffer from currently occupied nests.	A ½-mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during breeding season.				
California condor	May be applied along road ROW- a ¼-mile buffer from nests, roosts, and release sites	A ¼ mile from occupied nests, roosts, release sites	May be applied along road ROW. A ¼-mile buffer from nests, roosts, and release sites.				

Table 26. Required protection measures for pesticide applications in identified species habitats.

	Herbicides						
Federal Species	**Clopyralid**	**Dicamba**	**Glyphosate (aquatic)**	**Glyphosate (nonaquatic)**	**Imazapic**	**Imazapyr (technical formulation)**	**Imazapyr (aquatic)**
Chiricahua leopard frog, Northern leopard frog, Lowland leopard frog	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, ½ mile upstream (including tributaries), 300 feet downstream: Liquid – 30-foot buffer	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, ½ mile upstream (including tributaries), 300 feet downstream. Liquid – 30-foot buffer	May be applied on land below or above the high water line of species habitat.		
Colorado pikeminnow, loach minnow, razorback sucker, spikedace and roundtail chub (Flows >100cfs)	No buffer	Spot applications in the following areas: ½ mile upstream (including tributaries), all species habitat, and 300 ft downstream: Liquid – 10-foot buffer	No buffer	Spot applications in the following areas :½ mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid – 10-ft. buffer	No buffer		
Kanab ambersnail, Page springsnail, Verde Rim springsnail	Spot applications around habitat: Liquid – no buffer ULV – 80-foot buffer						

Table 26. Required protection measures for pesticide applications in identified species habitats.

	Herbicides						
Federal Species	**Clopyralid**	**Dicamba**	**Glyphosate (aquatic)**	**Glyphosate (nonaquatic)**	**Imazapic**	**Imazapyr (technical formulation)**	**Imazapyr (aquatic)**
Mexican gray wolf, black-footed ferret, brown pelican	No limitations						
Mexican spotted owl	May be sprayed along road ROW during BS. May be applied in rest of PAC outside the BS.	May not be sprayed in MSO PACS Spot-300 ft outside PACs & unsurveyed habitat Mechanized-¼ mile outside PACs & unsurveyed habitat.	May be sprayed within PAC outside of No Activity center during the BS.	May be sprayed along road ROW during BS. May be applied in rest of PAC outside BS.	May be sprayed within PAC outside of No Activity center during the BS.	May be sprayed along road ROW during BS. May be applied in rest of PAC outside BS.	May be sprayed within PAC outside of No Activity center during the BS.
Migratory birds including sensitive & PIF species	May be applied during the BS.	May be applied Sept.-February	May be applied during the breeding season.				
Northern goshawk	May be sprayed along road ROW during BS. May be applied in rest of PFA outside BS.	May be sprayed within PFA outside of nest stand during the BS.		May be sprayed along road ROW during BS. May be applied in rest of PFA outside BS.	May be sprayed within PFA outside of nest stand during the BS.	May be sprayed along road ROW during BS. May be applied in rest of PFA outside BS.	May be sprayed within PFA outside of nest stand during the BS.

Table 26. Required protection measures for pesticide applications in identified species habitats.

	Herbicides						
Federal Species	**Clopyralid**	**Dicamba**	**Glyphosate (aquatic)**	**Glyphosate (nonaquatic)**	**Imazapic**	**Imazapyr (technical formulation)**	**Imazapyr (aquatic)**
Southwestern willow flycatcher	Spot - no buffer Mechanized - 30 ft BS TR - April-August	Spot - 10 ft Mechanized - 60 ft BS TR - April-August	No buffer. BS TR - April-August	Spot - no buffer Mechanized - 30 ft BS TR - April-August	No buffer. BS TR - April-August	Spot - no buffer Mechanized - 30 ft BS TR - April-August	No buffer. BS TR - April-August
Yellow-billed cuckoo	Spot - no buffer Mechanized - 30 ft BS TR – May - August	Spot - 10 ft Mechanized - 60 ft BS TR - May - August	No buffer. BS TR - May-August	Spot - no buffer Mechanized - 30 ft. BS TR - May-August	No buffer. BS TR - May-August	Spot - no buffer Mechanized - 30 ft buffer BS TR - May-August	No buffer. BS TR - May-August
Yuma clapper rail	Spot applications within species habitat, ½ mile upstream (including tributaries), and 300 ft. downstream: Liquid - 10 ft buffer ULV - 150 ft buffer BS TR - March - July	Spot applications within species habitat, ½ mile upstream (including tributaries), and 300 ft. downstream: Liquid - 20 ft buffer ULV - 200 ft buffer BS TR - March - July	No buffer. BS TR - March - July	Spot applications within species habitat, ½ mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer BS TR - March - July	No buffer. breeding BS TR- March - July	Spot applications within species habitat, ½ mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer BS TR - March - July	No buffer. BS TR - March - July

Table 26. Required protection measures for pesticide applications in identified species habitats.

Federal Species	Herbicides					
	Imazapyr (nonaquatic)	Metsulfuron--Methyl (see note below)	Picloram (see note below)	Sulfometuron--Methyl	Triclopyr (amine salt formulations)	(ester formulations)
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace (Flows <100cfs)	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid - No buffer w/spot applications per the conservation measures	Spot applications in the following areas: 1 mile upstream (including tributaries), all species habitat, and 300 ft downstream: Liquid – 30-foot buffer from edge of water body or habitat*				Spot applications in the following areas 1 mile upstream (including tributaries), all species habitat, and 300 feet downstream Liquid – 50-foot buffer
Arizona cliffrose	May not be used in or near habitat					
Bald eagle	A ½-mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during the breeding season.					Buffer applies for 1 mile up & downstream from nest's location when applied at edge of water of occupied nest. Spot - 10 ft. from water edge Mechanized-80 ft. from water edge ½ mile buffer from currently occupied nests.

Federal Species	Herbicides					
	Imazapyr (nonaquatic)	Metsulfuron--Methyl (see note below)	Picloram (see note below)	Sulfometuron--Methyl	Triclopyr (amine salt formulations)	(ester formulations)
California condor	May be applied along road ROW 1/4 mile buffer from nests, roosts, and release sites.					
Chiricahua leopard frog, Northern leopard frog, Lowland leopard frog	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, ½ mile upstream (including tributaries), 300 feet downstream: Liquid – 30-foot buffer			May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, ½ mile upstream (including tributaries), 300 feet downstream: Liquid – 50-foot buffer
Colorado pikeminnow, loach minnow, razorback sucker, spikedace and roundtail chub (Flows >100cfs)	No buffer	Spot applications in the following areas: ½ mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid – 10-foot buffer			No buffer	Spot applications in the following areas: ½ mile upstream (including tributaries), all species habitat, and 300 feet downstream: Liquid - 20-foot buffer
Kanab ambersnail, Page springsnail, Verde Rim springsnail	Spot applications around habitat: Liquid - no buffer; ULV – 80-foot buffer.					
Mexican gray wolf, black-footed ferret, brown pelican	No limitations					

Federal Species	Herbicides					
	Imazapyr (nonaquatic)	Metsulfuron--Methyl (see note below)	Picloram (see note below)	Sulfometuron--Methyl	Triclopyr (amine salt formulations)	(ester formulations)
Mexican spotted owl	May be sprayed within PAC outside of No Activity center during the BS.	May be sprayed along road ROW during breeding season. May be applied in rest of PAC outside the breeding season.		May be sprayed within PAC outside of No Activity center during the BS.	May be sprayed along road ROW during BS. May be applied in rest of PAC outside BS.	May be sprayed within PAC outside of No Activity center during the BS.
Migratory birds including sensitive & PIF species	May be applied during the breeding season.					
Northern goshawk	May be sprayed within PFA outside of nest stand during the BS.	May be sprayed along road ROW during the breeding season. May be applied in rest of PFA outside the breeding season.		May be sprayed within PFA outside of nest stand during the BS.	May be sprayed along road ROW during BS. May be applied in rest of PFA outside BS.	May be sprayed within PFA outside of nest stand during the breeding season.
Southwestern willow flycatcher	No buffer - BS TR - April-August	Spot - no buffer. Mechanized - 30 ft. BS TR - April-August	No buffer. BS TR - April-August	No buffer. BS TR - April-August	Spot - no buffer. Mechanized - 30 ft. BS TR - April-August	No buffer. BS TR - April-August
Yellow-billed cuckoo	No buffer - BS TR - May-August	Spot - no buffer. Mechanized - 30 ft. BS TR - May-August	No buffer. BS TR - May-August	No buffer. BS TR - May-August	Spot - no buffer. Mechanized - 30 ft. BS TR - May-August	No buffer. BS TR - May-August
Yuma clapper rail	No buffer. BS TR - March - July	Spot applications within species habitat, ½ mile upstream	No buffer. BS TR- March – July.		Spot applications within species habitat, ½ mile upstream	No buffer. BS TR - March - July

Federal Species	Herbicides					
	Imazapyr (nonaquatic)	Metsulfuron--Methyl (see note below)	Picloram (see note below)	Sulfometuron--Methyl	Triclopyr (amine salt formulations)	(ester formulations)
		(including tributaries), and 300 feet downstream: Liquid - 10 ft. buffer ULV - 150 ft. buffer BS TR - March - July			(including tributaries), and 300 feet downstream: Liquid - 10 ft. buffer ULV - 150 ft. buffer BS TR - March - July	

Notes:

RPMPA - Resource Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service. J. Allen White, U.S. Fish and Wildlife Service, 10711 Burnett Road, Suite No. 200, Austin, Texas 78758, July 2004.
These RPMPAs are to be implemented in concert with the required protection measures detailed in Appendix B of the FEIS for the tri-forest noxious or invasive weed treatments.

Metsulfuron = metsulfuron is rated as Class 1 in toxicity groups for fish and amphibians due to reported mortality incidents not indicated by toxicity data.

Picloram = picloram is used mostly for broad-leaved plants but can harm some grasses and other monocots.

A **buffer zone** is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 and 10 miles per hour, and no rainfall for 24 hours) should be followed in implementing recommended buffer zones.

Spot applications include pesticide applications by hand-operated equipment or a spray gun that discharges pesticide in liquid streams from a spray tank.

Low aerial applications (nozzle or spreader height less than 12 feet) and high aerial applications (nozzle or spreader height greater than 12 feet) are relative to the plant canopy or a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.

Liquid formulations include any type of liquid-based formulation other than ULV formulations.

ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

Abbreviation Key: BS - Breeding Season; ROW - Right of way; PAC - Protected Activity Center; PFA – Post-fledging family area; MSO - Mexican spotted owl; TR - Timing restriction.

Table 27. Adjuvant summary table and required protection measures

Species	ACTIVATOR 90, SILWET L-77, CHOICE, LI 700, ACIDI pHACTANT, ALL CLEAR, Tank and Equipment Cleaner Mineral oil**	Methylated Seed Oil**, AMIGO**, Marker dye WSP, CHEM-TROL, NU FILM P, FIGHTER F, FOAM FIGHTER
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace Colorado pikeminnow, loach minnow, razorback sucker, spikedace, roundtail chub, Chiricahua leopard frog, northern leopard frog, lowland leopard frog, southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, bald eagle, brown pelican, Kanab ambersnail, Page springsnail, Verde Rim springsnail, riparian migratory birds	Shall not be used in riparian habitat*.	Approved for use in riparian habitat.
Arizona cliffrose, Mexican spotted owl, California condor, black-footed ferret, Mexican gray wolf, Northern goshawk, terrestrial migratory birds,	Approved for use in habitat.	Approved for use in habitat.

***Riparian habitat –** Overstory trees include alders, conifers, cottonwood, maple, sycamore, and willows. Understory species include hackberry, New Mexico locust, and soapberry. Herbaceous plants include sedges, spikerush, bull rush, little bluestem, blue grama, Canadian wildrye, sand bluestem, squirreltail, smartweed, and curlydock (EIS vegetation affected environment).

****Carriers –** Three types of oils used to ensure even distribution of small amounts of herbicides during application.

Appendix C - Maps

Appendix D - Susceptibility of TE&S Plant Species to Proposed Herbicides

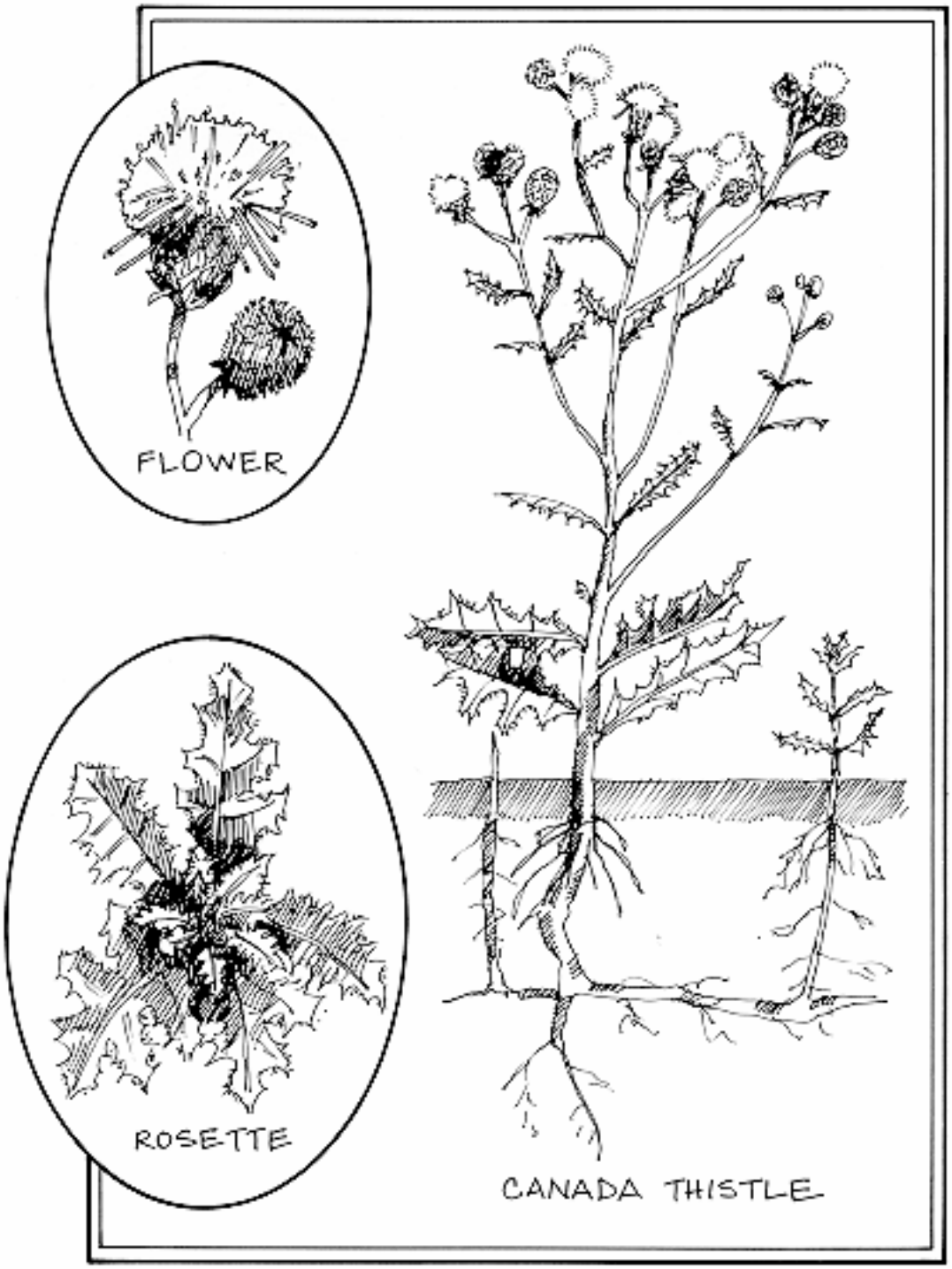


Table of Susceptibility of TECS Plant Species to Proposed Herbicides

Plant Names	Family	Invasive Species	**Proposed Herbicides:** Chemical Common Names										
			2,4-D	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron Methyl	Triclopyr	Chlorsul-furon
			Susceptibility of TE&S Plant Species to Proposed Herbicides										
Asclepias welshii **Welsh's milkweed**	Asclepiadaceae	cheatgrass	High	Moderate	Moderate /High	High	Low	Moderate	Moderate /High	Moderate	Low	Moderate	High
Astragalus cremnophylax var. *cremnophylax* **Sentry milkvetch**	Fabaceae	cheatgrass	High	High	High	High	Low*	High	High	High	High	High	High
Cycladenia humilis var. *jonesii* **Jones' cycladenia**	Apocynaceae		High	High	Moderate /High	High	Low	Moderate	High	Moderate	Low?	Moderate	High
Pediocactus bradyi **Brady pincushion cactus**	Cactaceae	cheatgrass	High	Low*	High	Low	Low	?	?	High	?	?	High
Pediocactus sileri **Siler pincushion cactus**	Cactaceae	cheatgrass, Scotch thistle	High	Low*	High	Low	Low	?	?	High	?	?	High
Purshia subintegra **Arizona cliffrose**	Rosaceae	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes	High?	Low	High	High	Low	Moderate	High	High	High	High	High
Senecio franscisanus **San Francisco Peaks groundsel**	Asteraceae	Dalmatian toadflax	Moderate	High	High	High	Low**	High	High	High	High	High	High
Spiranthes romanzoffiana var. *diluvialis* **Ute ladies tresses**	Orchidaceae	unknown	High	Low	Low	Low	Low	Low	Low	Moderate /High	Moderate	Moderate	High
Agave delamateri **Tonto Basin agave**	Agavaceae	annual bromes										High	High
Arenaria aberrans **Mt. Dellenbaugh sandwort**	Caryophyllaceae	cheatgrass, horehound	High	Low	High	High	Low	High	High	High	High	High	High
Astragalus ampullarius **Coppermine milkvetch**	Fabaceae		High	High	High	High	Low*	High	High	High	High	High	High
Astragalus cremnophylax var. *hevronii* **Marble Canyon milkvetch**	Fabaceae	cheatgrass	High	High	High	High	Low*	High	High	High	High	High	High

Table of Susceptibility of TECS Plant Species to Proposed Herbicides

Plant Names	Family	Invasive Species	**Proposed Herbicides:** Chemical Common Names										
			2,4-D	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron Methyl	Triclopyr	Chlorsul-furon
			Susceptibility of TE&S Plant Species to Proposed Herbicides										
Astragalus cremnophylax var. *myriorraphis* **Cliff milkvetch**	Fabaceae		High	High	High	High	Low*	High	High	High	High	High	High
Astragalus rusbyi **Rusby milkvetch**	Fabaceae	Dalmatian toadflax, bull thistle	High	High	High	High	Low*	High	High	High	High	High	High
Botrychium crenulatum **Crenulate moonwort**	Ophioglossaceae	Dalmatian toadflax	?	High	?	?	?	?	?	?	?	?	High
Carex ultra **Cochise sedge**	Cyperaceae	unknown											
Castilleja kaibabensis **Kaibab paintbrush**	Scrophulariaceae	unknown	High	Low	High	High	High	High	High	High	High	Moderate	High
Chrysothamnus molestus **Disturbed rabbitbrush**	Asteraceae	bull thistle	High	High	High	High	Low**	High	High	High	High	High	High
Cimicifuga arizonica **Arizona bugbane**	Ranunculaceae	bull thistle, Dalmatian toadflax, Himalayan Blackberry	High	Moderate	High	High	Low	High	High	Moderate /High	Moderate /High	Moderate	High
Cirsium parryi ssp. *mogollonicum* **Mogollon thistle**	Asteraceae	bull thistle	High	High	High	High	Low**	High	High	High	High	High	High
Desmodium metcalfei **Metcalfe's ticktrefoil**	Fabaceae	unknown	High	High	High	High	Low*	High	High	High	High	High	High
Eremocrinum albomarginatum **Utah solitaire lily**	Liliaceae	unknown	High	Low	Low?	Low?	Low	Moderate	Moderate /High	Low	Moderate /High	Low	High
Erigeron saxatalis **Cliff fleabane**	Asteraceae	cheatgrass	High	High	High	High	Low**	High	High	High	High	High	High
Eriogonum ericifolium var. *ericifolium* **Heathleaf wild buckwheat**	Polygonaceae	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes	High	High	High	High	High	Moderate /High	Moderate /High	Moderate	High	Moderate	High

Table of Susceptibility of TECS Plant Species to Proposed Herbicides

Plant Names	Family	Invasive Species	**Proposed Herbicides:** Chemical Common Names										
			2,4-D	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron Methyl	Triclopyr	Chlorsul-furon
			Susceptibility of TE&S Plant Species to Proposed Herbicides										
Eriogonum mortonianum **Morton wild buckwheat**	Polygonaceae	cheatgrass, halogeton	High	High	High	High	High	Moderate /High	Moderate /High	Moderate	High	Moderate	High
Eriogonum ripleyi **Ripley's wild buckwheat**	Polygonaceae	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes	High	High	High	High	High	Moderate /High	Moderate /High	Moderate	High	Moderate	High
Eriogonum thompsonae var. *atwoodii* **Atwood wild buckwheat**	Polygonaceae	cheatgrass, halogeton	High	High	High	High	High	Moderate /High	Moderate /High	Moderate	High	Moderate	High
Gentiana barbellata **Bearded gentian**	Gentianaceae	Dalmatian toadflax	High	Moderate ?	High	High	Low	Moderate /High	Moderate /High	Moderate	High	Moderate	High
Hedeoma diffusum **Flagstaff pennyroyal**	Lamiaceae	Dalmatian toadflax, Mediterranean sage, musk thistle, diffuse knapweed, Scotch thistle	High	Moderate /High	High	High	Low	Moderate /High	Moderate /High	Moderate	High	Moderate	High
Helenium arizonicum **Arizona sneezeweed**	Asteraceae	leafy spurge, spotted knapweed	High	High	High	High	Low**	High	High	High	High	High	High
Heuchera eastwoodiae **Eastwood alumroot**	Saxifragaceae	bull thistle	High	Low		High	Low	Moderate	Moderate	Moderate	Moderate	Moderate	High
Lesquerella kaibabensis **Kaibab bladderpod**	Brassicaceae	unknown	High	High	High	High	Low	Moderate	Moderate	High	High	Moderate	High
Lupinus latifolius ssp. *leucanthus* **Giant lupine**	Fabaceae	Dalmatian toadflax, tamarisk	High	High	High	High	Low*	High	High	High	High	High	High
Pediocactus paradinei **Kaibab plains cactus**	Cactaceae	cheatgrass	High	Low*	High	Low	Low	?	?	High	?	?	High
Pediocactus peeblesianus var. *fickeiseniae* **Fickeisen pincushion cactus**	Cactaceae	cheatgrass	High	Low*	High	Low	Low	?	?	High	?	?	High

Table of Susceptibility of TECS Plant Species to Proposed Herbicides

Plant Names	Family	Invasive Species	**Proposed Herbicides:** Chemical Common Names										
			2,4-D	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron	Picloram	Sulfometuron Methyl	Triclopyr	Chlorsul-furon
			Susceptibility of TE&S Plant Species to Proposed Herbicides										
Penstemon clutei **Sunset Crater beardtongue**	Scrophulariaceae	diffuse knapweed, cheatgrass, yellow starthistle, camelthorn	High	Moderate	High	High	High***	High	High	High	High	Moderate	High
Penstemon distans **Mt. Trumbull beardtongue**	Scrophulariaceae	unknown	High	Moderate	High	High	High***	High	High	High	High	Moderate	High
Penstemon nudiflorus **Flagstaff beardtongue**	Scrophulariaceae	diffuse knapweed, Dalmatian toadflax, Mediterranean sage	High	Moderate	High	High	High***	High	High	High	High	Moderate	High
Phlox amabilis **Arizona phlox**	Polemoniaceae		High	Moderate	Moderate /High	High	Low	Moderate	Moderate /High	Moderate	High	Moderate	High
Polygala rusbyi **Hualapai milkwort**	Polygalaceae	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes	High	Moderate	Moderate /High	High	Low	Moderate	Moderate /High	High	Moderate	Moderate	High
Rosa stellata ssp. *Abyssa* **Grand Canyon rose**	Rosaceae	cheatgrass	High	Moderate	High	High	Low	High	High	High	High	High	High
Salvia dorrii ssp. *Mearnsii* **Mearns sage**	Lamiaceae	Russian knapweed, yellow starthistle, Malta starthistle, annual bromes	High	Moderate	Moderate /High	High	Low	Moderate	Moderate /High	Moderate	High	High	High

Herbicide effects to TE&S plant species based on effects to members of the same plant family or genus if available from Fay et al. 1996 and current herbicide product labels.

Herbicides are assumed applied at prescribed rates. Application at higher than prescribed rates is likely to have a higher impact on nontarget vegetation.

* Imazapic has low impact on legumes when applied at 4 oz. per acre post emergence with more than three leaves present.

** Imazapic has low impact on these species when applied at 4 oz. per acre. Imazapic acts as more of a sterilant when applied at rates high enough to kill leafy spurge, although some species are tolerant.

*** Imazapic has been advertised to control Dalmatian toadflax and is, therefore, assumed to be a threat to other members of the Scrophulariaceae.

No information could be found for those boxes left blank, and it must be assumed that the TE&S plant species is susceptible to that herbicide. Members of the Saxifrage family are not typically weedy and do not show up on herbicide labels.

Table of Proposed Treatment of TE&S Plant Species (if herbicide is necessary in the plant's habitat)

			Proposed Treatment (if herbicide is necessary in the plant's habitat)	
Scientific Name	**Family**	**Invasive Species**	**Common Name 1**	**Common Name 2**
Asclepias welshii **Welsh's milkweed**	Asclepiadaceae	cheatgrass	Imazapic	2,4-D
Astragalus cremnophylax var. *cremnophylax* **Sentry milkvetch**	Fabaceae	cheatgrass	Imazapic	
Cycladenia humilis var. jonesii **Jone's cycladeni**	Apocynaceae	no	Imazapic	Sulfometuron Methyl
Pediocactus bradyi **Brady pincushion cactus**	Cactaceae	cheatgrass	Imazapic	Clopyralid
Pediocactus sileri **Siler pincushion cactus**	Cactaceae	cheatgrass	Imazapic	
		Scotch thistle	Imazapic	
Purshia subintegra **Arizona cliffrose**	Rosaceae	Russian knapweed	Imazapic	
		yellow starthistle	Clopyralid	
		Malta starthistle	Clopyralid	
		annual bromes	Imazapic	
Senecio franscisanus **San Francisco Peaks groundsel**	Asteraceae	Dalmatian toadflax	Imazapic	
Agave delmateri **Tonto Basin agave**	Agavaceae	annual bromes	Imazapic	Clopyralid
Arenaria aberrans **Mt. Dellenbaugh sandwort**	Caryophyllaceae	cheatgrass	Imazapic	
Astragalus ampullarius **Coppermine milkvetch**	Fabaceae	unknown	Imazapic	
Astragalus cremnophylax var. *hevronii* **Marble Canyon milkvetch**	Fabaceae	cheatgrass	Imazapic	
Astragalus cremnophylax var. *myriorraphis* **Cliff milkvetch**	Fabaceae	unknown	Imazapic	
Astragalus rusbyi	Fabaceae	Dalmatian toadflax	Imazapic	

Table of Proposed Treatment of TE&S Plant Species (if herbicide is necessary in the plant's habitat)

Rusby milkvetch		bull thistle	Imazapic	
Botrychium crenulatum **Crenulate moonwort**	Olphioglosiaceae?	unknown		
Castilleja kaibabensis **Kaibab paintbrush**	Scrophulariaceae	unknown	Clopyralid	
Chrysothamnus molestus **Tusayan rabbitbrush**	Asteraceae	bull thistle	Imazapic	
		cheatgrass	Imazapic	
Cimicifuga arizonica **Arizona bugbane**	Ranunculaceae	bull thistle	Imazapic	
		Dalmatian toadflax	Imazapic	
		Himalayan blackberry	Garlon	(with mitigation)
Cirsium parryi ssp. *mogollonicum* **Mogollon thistle**	Asteraceae	bull thistle	HAND PULL	HAND PULL
Eremocrinum albomarginatum **Utah solitaire lily**	Liliaceae	no	Clopyralid	Imazapic
Erigeron saxatalis **Cliff fleabane**	Asteraceae	cheatgrass	Imazapic	2,4-D
Eriogonum ericifolium var. *ericifolium* **Heathleaf wild buckwheat**	Polygonaceae	Russian knapweed	Picloram	
		yellow starthistle	Metsulfuron?	
		Malta starthistle	Metsulfuron?	
		annual bromes	Metsulfuron?	
Eriogonum mortonianum **Morton wild buckwheat**	Polygonaceae	cheatgrass	Metsulfuron?	
		halogeton	Metsulfuron?	
Eriogonum ripleyii **Ripley's wild buckwheat**	Polygonaceae	Russian knapweed	Picloram	
		yellow starthistle	Metsulfuron?	
		Malta starthistle	Metsulfuron?	
		annual bromes	Metsulfuron?	
Eriogonum thompsonae var. *atwoodii* **Atwood wild buckwheat**	Polygonaceae	cheatgrass	Metsulfuron?	
		halogeton	Metsulfuron?	
Gentiana barbellata **bearded gentian**	Gentianaceae	Dalmatian toadflax	Imazapic	Triclopyr

Table of Proposed Treatment of TE&S Plant Species (if herbicide is necessary in the plant's habitat)

Hedeoma diffusum **Flagstaff pennyroyal**	Labiatae	Dalmatian toadflax	Imazapic	
		Mediterranean sage	Clopyralid	
		musk thistle	Imazapic	
		diffuse knapweed	Clopyralid	Picloram
		Scotch thistle	Imazapic	
Helenium arizonicum **Arizona sneezeweed**	Asteraceae	leafy spurge	Imazapic	
		Dalmatian toadflax	Imazapic	
		spotted knapweed	Imazapic	2,4-D
Heuchera eastwoodiae **Eastwood alumroot**	Saxifragaceae	unknown	Clopyralid	Imazapic
Lesquerella kaibabensis **Kaibab bladderpod**	Cruciferae	unknown	Clopyralid	Imazapic
Lupinus latifolius ssp. *Leucanthus* **giant lupine**	Fabaceae	Dalmatian toadflax	Clopyralid	
		tamarisk	Garlon	(with mitigation)
Pediocactus paradinei **Kaibab plains cactus**	Cactaceae	cheatgrass	Imazapyr?	
Pediocactus peeblesianus var. *fickeiseniae* **Fickeisen pincushion cactus**	Cactaceae	cheatgrass	Imazapyr?	
Penstemon clutei **Sunset Crater beardtongue**	Scrophulariaceae	diffuse knapweed	Clopyralid	
		cheatgrass	Clopyralid	
		yellow starthistle	Clopyralid	
		camelthorn	Picloram	(with mitigation)
Penstemon distans **Mt. Trumbull beardtongue**	Scrophulariaceae	no	Clopyralid	
Penstemon nudiflorus **Flagstaff beardtongue**	Scrophulariaceae	diffuse knapweed	Clopyralid	
		Dalmatian toadflax	HAND PULL	
		Mediterranean sage	Clopyralid	

Table of Proposed Treatment of TE&S Plant Species (if herbicide is necessary in the plant's habitat)

Phlox amabilis **Arizona phlox**	Polemoniaceae	unknown	Imazapyr?	(with mitigation)
Polygala rusbyi **Hualapai milkwort**	Polygalaceae	Russian knapweed	??	(with mitigation)
		yellow starthistle	Clopyralid	
		Malta starthistle	Clopyralid	
		annual bromes	Clopyralid	
Rosa stellata ssp. *abyssa* **Grand Canyon rose**	Rosaceae	cheatgrass	Imazapic	(with mitigation)
Salvia dorrii ssp. *Mearnsii* **Mearns sage**	Labiatae	Russian knapweed	Imazapic	
		yellow starthistle	Clopyralid	
		Malta starthistle	Clopyralid	
		annual bromes	Imazapic	
Spiranthes romanzoffiana var. *diluvialis* **Ute ladies tresses**	Orchidaceae	unknown	Clopyralid	Imazapic

Appendix E - Cumulative Impacts Project List

Forest Service Activities

Almost all activities that have occurred, are occurring, or will occur on the three national forests have or could potentially impact populations of invasive weeds either by introducing seeds or portions of weeds into noninfested areas, creating conditions favorable for the germination or spread, or by reducing native plants that serve to compete with weeds. This is a best attempt effort at describing the types of projects that have either occurred, are occurring, or will likely occur in the reasonable future and describes how the project could impact weed populations in the vicinity of the project.

In addition, a list of projects that are currently being planned on the three forests is included to serve as a representative sample for a typical schedule of proposed actions for the three forests. If there are two sets of parenthesis behind the project's name, the first set includes the forest(s) where the project is occurring. In the event that there is only one set of parenthesis behind the projects name, the number references the discussion that best describes the project and the potential impact the project will have on weed populations.

1. Roads and Rights-of-Way Management

This category includes road construction, reconstruction and road maintenance. The work is usually accomplished with heavy equipment including bulldozers, road maintainers, tractors, and crawler equipment. With annual mowing and maintenance of ditches and culverts, the work involves activity on both sides of roadways for many miles. Generally, roadside mowing does not include extensive ground disturbance. Ditch reshaping and culvert replacement does create some disturbed ground in the vicinity of the project. All of these projects could bring weed seed onto the forests, or transport seed from existing infestations to noninfested areas. Where the soil is disturbed, such as during reconstruction or construction activities, the relocated or existing weed seeds have an excellent seedbed. Germination conditions within the ditches and along the roadways are generally good to excellent with adequate light and moisture provided. Current contract clauses for road management direct operators to clean their equipment before they leave one forest's jobsite to go to another forest's jobsite, although work around the same forest has a high potential to distribute weed seeds from an infested area to a noninfested area.

Other rights-of-way such as utility lines, pipelines, telephone lines, and along the railroad tracks are developed and maintained including receiving various types of treatments to control weeds and other vegetation. While most national forest sections receive mechanical treatments, unknown quantities of herbicides are being utilized on some private sections of the rights-of-way. Construction of these rights-of-way could introduce weeds due to the heavy equipment used and creation of good germination sites for deposited seeds.

2. Vegetation Management

This category includes both green tree and salvage sales scattered around the forests, including within the wildland-urban interface to the far reaches of the forests. A salvage sale occurs where a catastrophic event such as a wildfire or an expanse of trees have been killed by insects, disease or another phenomenon. A green tree sale is where forest managers have determined that there are excess trees and that some of these excess trees can be removed. The trees to be removed have commercial value and have been sold to an interested party. Harvest and removal of the trees generally involves the use of heavy equipment such as yarders, tractors, skidders, loaders, and logging trucks. The trees are felled, then moved either singly or in groups to a landing where they

are loaded onto a truck to be removed from the forest. Timber sales generally necessitate a developed and maintained road system whose impacts have been previously discussed. The logging operation provides a vector of infestation by either bringing weed seed into the logging unit, or distributing the seeds around the logging unit. With heavy equipment movement, ground disturbance occurs and provides a good seedbed for weed seed germination. With the harvest of trees, reduced competition for light and water exists for newly germinated weeds or the newly deposited weed seeds. With less competition and adequate nutrients and moisture, logging areas frequently have infestations of weeds.

The harvest of firewood and Christmas trees are smaller versions of a timber sale. While these situations have less impact than a larger timber sale, the potential for an individual to transport weed seeds from further away and deposit them on the forests is greater, since there are fewer mitigation measures in place that require cleaning of the vehicles prior to entering the forest.

Areas where salvage sales occur generally have reduced local vegetative competition for weeds. In the case of a wildfire, additional nutrients and reduced seed sources for native vegetation exist. With mineral soils exposed over a large area, wildfire areas have historically had large infestations of weeds. While part of this is due to excellent seedbed preparation, how wildfires have traditionally been fought on the national forests creates an ideal vector of infestation for weed seed. This issue is further discussed under “Fire Management.”

Contract clauses for larger timber sales typically require contractors to bring clean equipment onto the forest and timber sale administrators usually inspect the equipment to insure that compliance with this clause is obtained. With smaller sales such as for Christmas trees or firewood, there is less opportunity for inspection of vehicles before they go to the forest.

Noncommercial or Precommercial Thinning – These activities include work to improve a resource area, such as a wildlife habitat improvement project or a timber stand by noncommercial or precommercial thinning operations. While some of the work is done with handtools, some heavy equipment may also be utilized. Potential impacts from cultural treatment activities are similar to timber sales and from road maintenance. If the work is accomplished using handtools, the impacts are comparable to firewood or Christmas tree sales. There is some additional possibility for contract administration to monitor and limit weed seed introduction, especially if the project is in a noninfested area and the contractor is known to be from an area infested with a specific weed. Due to the contractor covering essentially 100 percent of a project area, the chances that they will come in contact with existing weed populations and spread portions of those plants to noninfested areas does exist. In addition, when the contractor moves from one project area to another within the same forest, there is only a limited chance that the contractor’s equipment will receive a spray wash unless the contract administrator is aware that the equipment is contaminated with weed seed and the area to be worked next is not infested. Whether or not the contractor stays on the site during the work activity or camps at another location conveniently located could impact the potential for weed seed dispersal either around the project site from the camping area or depositing weed seeds collected at the worksite in and around the camping area.

3. Range Management

Cattle and other livestock have the potential to pick up and transport weed seeds around the forest and to carry seeds onto the forest. Many grass and weed species’ seeds germinate better after they have traveled through the digestive system of an animal. Some seeds get stuck in animal’s coats,

and in their hooves, tails, or manes. In moving animals from pasture to pasture, the animals can distribute weed seeds from an infested area to a noninfested area. In the event that supplemental feed is provided for animals, unless it is certified as "weed free," it can bring in new weeds to the forest. To combat this potential vector of infestation, livestock are sometimes quarantined for a few days after they have been moved to clear their systems of weed seeds.

Range permittees frequently drive through pastures looking at their livestock and have the potential to pick up weed and distribute them in noninfested areas. Fortunately, most permittees are familiar with the various species of weeds and take care to avoid driving through infested areas. Range improvement projects such as fencing, water tank development, or maintenance can create suitable seedbeds for seeds or disperse seeds.

Control efforts on 35 acres of sweet resinbush and the reasonably foreseeable action on aquatic species found in the Verde River will further reduce the influence of weeds in the project area. Though the total amounts of treatments within the Verde River are not determined, it appears that 15 to 20 acres of Eurasian watermilfoil and water primrose may be treated over the next 10 years, predominately using aquatically labeled herbicides.

4. Fire Management

Wildfires – Typically, firefighters from within the region drive to ongoing wildfires. They bring their equipment and tools and any collected weed seed with them. While most incident management teams coordinate high pressure washing of equipment before fire crews leave to return home, it is difficult if not impossible for all fire equipment to be spray washed and cleaned before it goes to the fire line.

In addition to agency equipment and personnel, most fires have a plethora of contracted equipment including engines, dozers, tractors and chippers. While most of this equipment gets a pre-inspection prior to going to the fire line, this seldom includes a spray wash to rid the equipment of any weed seed it might have picked up on its last job. At least some weeds are introduced to fire areas by this vector of infestation.

Fire—whether it is a wildfire or a prescribed fire—creates conditions that are conducive to weed spread and maximizing their germination. Fires create an optimum seedbed, removing some competing vegetation and providing useable nutrients. This occurs during all stages of the fire through the rehabilitation process where fire lines are waterbarred, seeded and fertilized. In at least one case, weed infestations have been created by the use of contaminated seed mixtures.

Prescribed Fire – Prescribed fire has many similarities to wildfire in the creation of optimum conditions for weed seed germination and making nutrients available for the growth and development of weed species. Usually prescribed fires do not eliminate the overstory vegetation from the burn area. Generally, prescribed fire operations do not bring in as many resources to the fire area as do wildfires. Using local resources who are familiar with local conditions and what portions of the forest or ranger district are weed infested by which species and which are noninfested minimizes the potential for new infestations of new species to occur.

Firefighters and personnel conducting prescribed burns can be vectors of infestation if they have contacted weed infestations during their project work. They can spread seeds around the project area, bring seed to the project area from their home districts, or they can gather seed at the fire

location and take seeds back home with them. The seeds can be in their clothing or on the equipment that they bring to a fire.

5. Recreation Management and Activities

5a – Thousands of people come to the national forests each year to recreate and enjoy the natural resources found in them. Public use of the Arizona forests is probably slightly higher than the national average due to the climate. The mild northern Arizona climate makes the Coconino, Kaibab, and Prescott National Forests desirable destinations 12 months of the year. With Grand Canyon National Park so close, many people visit the forests on their way to or from the Grand Canyon. While the local population visits the forests, there is a continuous stream of out-of-state and out-of-country visitors, too. All forms of recreation have the potential to either introduce weed species to the forests, or for forest visitors to collect weed seeds on the forest and introduce them back at their homes or where they visit next. While these forests are destinations for vacations, many more people pass through the area on their way to or from another destination.

Campers, hikers, motorcyclists, hunters, and others all have the potential to either introduce weeds into this area from where they have been with seeds being transported here in their equipment, or to take seeds from here and infest other areas. Some forms of recreation use have greater potential than others.

Equestrian use of the national forests is increasing. Horses are used for recreational riding, equestrian events, hunting, and during range management and other resource management activities. For people traveling cross county with horses, the national forests provide a location where they can allow their horses to relax after an extended trip, stretch their legs, exercise and graze outside the confines of a horse trailer. Combining camping and horse riding over large expanses of the forests is popular. Viewing the forests from the back of a horse and being able to get further away from the crowds with their pet is appealing to many equestrians. Groups of equestrians frequently ride together to visit historically used areas and explore new ones. Hunters frequently use horses to get to the back country in pursuit of game species and to bring the game that they have taken back to vehicular accessed locations. Many outfitter-guide operations use horses and other animals such as llamas to ride and carry equipment into the back country. The Forest Service and other land agencies frequently use horses to check grazing improvements such as fences or water improvements. Other types of resource management activities use horses where they provide the most convenient or desirable transportation mode.

Horses, llamas and other livestock all have the potential to bring weed seeds into the forest or to transport weed seeds to a noninfested area. The seed transportation can occur as part of the animal's feed and digestive process or can be carried on their exterior on their coats, manes, tails, or hooves. With events such as equestrian trail rides, endurance races or just gathering of acquaintances that occur on all three forests, it is common to see horse trailers, trucks, horses and enthusiasts from multiple states camped in the forests for multiple days. In these situations, it is quite possible to transfer weed seed from several states away into the Arizona forests and then onto other states. While a period of quarantine would reduce the potential of spreading weed seed, there is not currently any policy requiring it in Arizona. Hay and straw for feed and bedding also can contain weed seed. While there is direction toward implementing a policy of using weed-free certified hay, it has not been established as of this writing.

There are numerous activities involving the management or development of recreation facilities that have potential impacts to weed infestations. Construction of buildings and facilities is discussed below in "7. Lands and Mineral Resources, Administrative or Special Use Area Development."

Trail construction and maintenance activities involve work using handtools and sometimes bigger equipment. Ground disturbances created by this equipment can create sites conducive for weed seed germination and development. Movement of this equipment from an infested area to a noninfested area can disperse weed seeds and expand the area of infestation.

5b, Off-Highway Vehicles (OHVs) – Off-highway vehicles, including jeeps, trucks, dune buggies, all terrain vehicles (ATVs), and trail motorcycles, are used extensively along roads and trails in all three forests. Some cross-country travel occurs with all vehicles, but ATVs and trail motorcycles make up most of this impact. Some specific uses of these vehicles are separated out of this discussion where the potential impacts to noxious weeds vary. These vehicles provide the public with a less strenuous and, in many cases, a faster way to see the back country. People can explore canyons and mountainsides, with the push of an accelerator pedal or thumb switch. Places where only the hardiest hikers could reach after several days of strenuous hiking can now be reached in a few hours of riding. The use of OHVs on the national forests has increased over the last 10 years and is likely to continue increasing in future years. New ATVs are bigger, more powerful, and going places that few imagined possible in the past. Other OHVs are following the same route as ATVs, but at a slightly slower rate although there are areas where concentrated OHV use and enthusiasts equal or exceed ATV use.

OHVs serve as vectors of infestation in that they carry weed seeds from infestations to areas of noninfestation. There currently are no requirements for operators to keep their vehicles clean of mud, dirt, and weed seed. While vanity and owner pride of showing off a shiny and technologically enhanced vehicle keep some vehicles free of mud and weed seed, an equal number of operators use their dirt (and possibly weed seed) covered vehicles as proof that they have, "been there and done that." OHVs can also disturb sufficient soil to prepare seedbeds for weed seeds. In areas of concentrated use, vegetation and ground cover is either heavily disturbed or eliminated.

In 2003 Forest Service Chief Dale Bosworth acknowledged OHVs as one of the four main management issues facing the Forest Service. By the year 2000, there were almost 36 million OHVs in the United States. In July 2004, the Forest Service drafted a National OHV policy that proposed a national framework to guide local designation of roads, trails, and areas for OHV use and prohibit cross-country travel. While this policy does not limit the number of OHVs on the forests, it will limit where they can travel in the future. This policy will serve to reduce the areas that are infested from this vector to along road and trail borders.

In March 2001, the Forest Service published a Notice of Intent for an environmental impact statement (EIS) to develop an OHV policy on the Coconino, Kaibab, Prescott, Tonto, and Apache-Sitgreaves National Forests. A draft environmental impact statement was released during the summer of 2003, work continues on that document with a projected completion date in 2005. The purpose and need of that document are to stop the impacts of travel between roads and trails by OHVs on areas currently open to their use. Forest land and resource management plan amendments for the five national forests would be developed in conjunction with the EIS. The

decision for this document, when signed and implemented, will further reduce the potential for OHVs to be vectors of infestation of weed species both on national forest and private land.

OHVs and, in particular, ATVs are used extensively during the big game hunting season on the forests. ATVs facilitate scouting efforts and transport hunters around the forests with less wear and tear on their bigger OHVs. During the season, hunters can get to the back country quicker, quieter and generally with less effort. If they are successful, they can get their harvested animals back out. Moving several hundred pounds of elk quarters with an ATV or easing a 4 x 4 truck near the site of an animal harvested is much easier than hauling those same elk quarters out of the back country in a backpack, one at a time. While there are roads and trails that hunters use, there is also a lot of cross-country travel that can cause or expand weed infestations by spreading weed seeds or parts of weed plants into noninfested areas. While some of the cross-country OHV travel will be reduced in conjunction with the National and the five forest environmental impact statements discussed above, at least some of the use described here will continue.

The demand for elk and deer antlers has created an additional potential impact of OHVs and, in particular, ATVs on the forests. Enthusiasts collect the antlers in the spring after they are shed. The value of shed antlers depends on the quality, size, and shape that they are in. A large matched pair of antlers can be worth several thousand dollars, so the competition of finding antlers faster and quicker exists. Antlers can fall off at any time and place in the spring, so covering large expanses of the forests where elk and deer frequent, numerous times over the course of several weeks gives the antler hunter the best chance of finding antlers. Antler hunters frequently cover parts of the forests on ATVs using a grid pattern. This effort occurs through much of the elk range on almost all of the three national forests. If an elk and an ATV can get to a location, it is probable that an antler hunter has traveled there looking for antlers. With the grid pattern utilized and the extensive areas covered, this activity probably contributes more to spreading weed infestations than does the use of ATVs during general trail riding or hunting activities. Using ATVS or OHVs cross country will be prohibited when the five forest OHV regulations come into effect.

5c, Hiking – Hikers probably carry a few weed seeds into noninfested areas in their clothing and equipment. It is doubtful that they are responsible for many new infestations, although it is likely that they expand some infestations by picking up weed seeds in their boots or clothing and depositing them into noninfested areas.

5d, Mountain Biking – Mountain bikes are an alternative nonmotorized method of seeing the back country. While many bikers are looking for established trails or old roads, some are content rolling along a game trail or going cross country. Mountain bikes are used by some recreationists to get further away from the crowds. In comparison to OHVs and hikers, mountain bikes probably distribute less weed seeds than ATVs or OHVs, but slightly more than hikers. This assumption is based upon the differences in the average distances traveled in a day's time.

5e, Outfitter Guide Operations – These operations vary in type and nature, but in general are trips into the forests that the public pays to participate in. Guides provide a variety of services including, but not limited to, transportation, meals, drinks, and equipment such as rafts, tents, horses, ATVs, and OHVs. The guides generally know the forest area that they are presenting to the public, but not always. Generally, outfitter guide groups can disperse weeds and weed seeds into noninfested areas with their activities. The amount and degree of this would be comparable to the discussion presented above for comparable types of transportation being used. It is likely

that some guides recognize some of the weed species and know to avoid them. This would have a net reduction of impact from this vector.

Some outfitter guides provide tours of the forest along main roads or scenic routes. While these may get off the paved highways, it is doubtful that they contribute much to weed seed dispersal. It is likely that at an overlook or parking lot some weed seeds could be picked up and then dropped off at another stop.

Some outfitter guides may provide a camping opportunity to the public. In these situations, the group travels through the forest to a designated camping area. They may travel in 4 x 4 vehicles, ATVs, horses, bikes or hike through the forest to the designated camping area. These camping areas are generally large enough to support larger groups. Over time, the numbers of people using these locations increase above and beyond the outfitters and their clients to include private parties that find the area desirable for camping purposes. Through the increased use, native vegetation is reduced and the area becomes conducive for germination of weed seeds. These seeds can be brought in on equipment, with horses either on tack, in feed, or in their digestive systems, or on other modes of travel. Since the area is being used on a somewhat regular basis, the potential exists for more seeds or parts of the weed plants to be picked up again and transported to another noninfested area.

5f, Developed Recreation – Established recreation areas have more concentrated public usage than do dispersed recreation sites and, as a result, they have greater potential for having weeds introduced, harboring weeds and serving as a source for weed seeds. There is a greater potential that weeds from more distant places are introduced at developed sites as people from across the country use the areas on their way to and from distant destinations. It is not uncommon for cross-country travelers to leisurely travel 300 or more miles in a day and still have time to stop and see local sites and attractions. Frequent stops and camping early provides the necessary timing for either picking up weed seeds or depositing them in the campground.

When using developed recreation areas, the public uses a variety of equipment from self-contained, fully powered recreation vehicles (RVs) to lightweight, back-packing equipment. During periods of nonuse, RVs are frequently parked in a location where weed populations exist. Over time, the weeds may grow into or become attached to the RV. When the RV is mobilized for a trip, these weeds may or may not be cleaned from the RV before departure. If the weed seeds are picked up at the recreation site, they are carried home and likely deposited where the RV is stored, perpetuating this cycle.

Tents and smaller pieces of camping equipment can and do serve as a vector for transporting weed seeds. There is more discussion about this above.

5g, Special Use Permitted Events – Throughout the year, there are numerous events of various types that can serve to further spread the seeds or parts of weed plants. These generally are more organized and attract people from further away. Examples include, but are not limited to: American Cancer Society Walk for a Cure, sporting events such as muzzle loader or archery competitions, marathons, trail rides, mountain man rendezvous, organized group events, organized auto and motorcycle tours, and family reunions. These events are frequently combined with using RVs, and camping, and can either spread weeds onto the forests or take weeds back to noninfested private lands. These events have similar potentials for weed dispersal as their principle mode of transportation described above has. In the event that a group brings multiple

types of recreational equipment such as OHVs and horses, the event may serve to both distribute weed seeds on the forest and collect other species of weed seeds and distribute them in a noninfested area.

6. Stewardship Resources

While many human-caused types of weed seed dispersal have been discussed, another source of weed spread is wildlife. Some weed seeds are edible by wildlife and are carried from an area of infestation to an area where they are deposited. Wildlife can also carry weed seeds in their coats, feathers or on their hooves.

7. Lands and Mineral Resources

Administrative or Special Use Area Development – Throughout the forests, there are periodic projects to build new facilities or repair and renovate old ones. This work generally removes vegetation, disturbs the soils, and creates areas more conducive to seed germination. The movement of heavy equipment from off-forest can introduce new weed species or seeds. Projects that fall into this category include construction projects in existing or new sites, ranging from building a communications tower to a new district office. Within many existing recreation sites the renovation of existing facilities or the addition of new ones is occurring. These activities can create suitable germination areas for weed seeds and can also serve as a vector to move seeds from infested areas to noninfested areas.

Rock Quarry Management – All three forests have various mineral operations occurring. There are active rock quarries where flagstone is removed on both the Kaibab and Prescott National Forests. Additional operations on the Prescott include prospecting and placer mining for the removal of gold or other precious or semiprecious metals. All three forests have active pits where volcanic cinders are being removed. The operations of these pits and quarries involve some use of heavy equipment. The disturbance creates sites conducive for seed germination. Movement of equipment from one site to another can serve as a vector for weed seeds or plants.

Off-Forest Activities

8. Rights-of Way Development and Treatments

Each year highway departments at the local, county, State and Federal levels do some roadside herbicidal treatment of weeds. While the majority of this occurs on private inholdings within the forests, some Federal easements on the three national forests are also treated. In May 2004, Forest Supervisor Karl P. Siderits signed a decision authorizing herbicidal treatments along approximately 2,700 miles of interstate highways, U.S. highways, and State routes within the boundaries of six national forests including the Coconino, Kaibab, and Prescott. This effort would treat approximately 1,500 acres per year on the Coconino, 500 acres on the Kaibab, and 1,000 acres on the Prescott annually. This work will be completed on Interstates 17 and 40, State Highways 89, 89A, 260, and others as well.

There are some herbicides applied to the roadsides by local counties and city governments, the exact amount and types applied is unknown. Rights-of-way such as utility lines, pipelines, telephone lines, and along the railroad tracks are developed and maintained including receiving various types of treatments to control weeds and other vegetation. Unknown quantities of

herbicides are being utilized on some private sections of the rights-of-ways. Construction of these rights-of-ways could introduce weeds due to the heavy equipment used and creation of good germination sites for deposited seeds.

During winter, the highway departments utilize a combination of abrasives and chemicals (usually a salt compound) to reduce or minimize snow and ice accumulation on the highways, overpasses, and bridges. In mid-2004, representatives from the Arizona Department of Transportation were gathering public comments on an environmental assessment they had prepared evaluating their alternatives and taking into consideration some of the new salts and chemicals developed for this use. A final decision for this document is expected before the winter season, 2004. This decision will affect all three forests but probably the Coconino and Kaibab more than the Prescott due to the difference in the severity of winters between the three forests. The chemicals used are not herbicides, but they can have a negative effect on roadside vegetation by killing or reducing the vigor of trees and plants. This effort could kill some weeds or kill competing native vegetation.

9. Other Pesticide Use

Throughout the last few years, there have been other projects proposed or accomplished that have used pesticides. These projects include spraying for western pine beetle infestations using carbaryl at recreation sites and overlooks, and incidental use of insecticides and rodenticides. None of these treatments would have any impact on weed populations unless the equipment used or the operator carried seeds into the project area or moved seeds around the project area from an existing infestation.

Historically there have been some herbicides applied around administrative sites and recreation areas on private lands scattered across the project area. In areas where there have been concentrations of mosquitoes, some communities have implemented insecticide spraying to reduce populations of mosquitoes to reduce the risk of West Nile Disease. These activities occur in urban areas away from the forests and have no effect on national forest weed populations.

Additional efforts to control the spread of weeds occur when weed management areas are established. Regions within the project area that now have (or are developing) weed management areas (WMAs) include the Arizona Strip, Flagstaff, Prescott, Camp Verde, Tusayan and Williams communities. Though weed management areas focus more on information gathering and educational aspects, they often complete small ground treatments. Typically, the integrated weed treatment methods used are manual and cultural, although WMA partners use herbicides on nonforest lands.

The State Land Department is also treating several species using predominately herbicides. Their major effort is to control Scotch thistle and yellow starthistle within the Rio de Flag. About 25 to 35 acres are being treated annually to control this plant, and control will continue for 2 to 10 years to deplete the seed bank of the invasive species and treat new populations found downstream.

Assessing herbicide use within and adjacent to the project area is difficult to predict since there are so many herbicides where there are no requirements for the seller or purchaser to contact the State and inform them of the product's use (Arizona Department of Agriculture, personal communication, 2003). The State noted that the only products it has control over, and requires reports, are those herbicides that are considered restricted use. The State believes that few, if any,

of these products are used in either Yavapai or Coconino County since there are no custom applicators registered with the department.

Statistics are, however, readily available on the kinds and amounts of herbicides used on agricultural lands in Arizona. Most of this use is not considered a cumulative impact associated with our analysis since these applications are occurring in Yuma and Maricopa Counties, where large irrigation districts have been formed. These districts are well outside the project area. There are 13,045 acres on which we believe herbicides are presently being used. This includes mostly pasture land, however, corn, alfalfa, landscape lawns, vegetable fields, turf (golf courses and football fields), and orchards are recorded and the use of herbicides more than likely occurs.

Some of the most popular herbicides used for turf and landscaping include clopyralid, 2,4-D, dicamba, and glyphosate. We estimate that over the next 10 years, excluding what is being proposed under this FEIS, that about 356,970 acres of herbicide treatments will happen. The greatest majority of treatments, about 209,000 acres, will occur outside national forests on private lands. Golf courses require extensive use of pesticides for upkeep and maintenance. Extensive use of herbicides is required to maintain greens, fairways and even the roughs. Their efforts to maintain the necessary vegetation includes treatment of weed populations. Most communities within the project area have at least one golf course and some cities such as Flagstaff have six or more courses plus additional ones on the outskirts in conjunction with housing subdivisions. The quantity of pesticides used, including herbicides, in these developments is unknown.

Activities are being completed by Grand Canyon National Park on tamarisk and other invasive weeds.

Current Project List

Multiple Forest Projects

APS Sycamore 69KV Powerline Permit Reissuance (Prescott and Tonto NFs) (8)

Cross-Country Use of Motorized Vehicles in Five Arizona Forests (Coconino, Kaibab, Prescott, Apache-Sitgreaves, and Tonto NFs) (5b)

Gray Wolf Land Exchange (Kaibab, Prescott, Apache-Sitgreaves, Coronado NFs)

Management of Noxious Weeds on State Highways on National Forest Lands in Arizona (Coconino, Kaibab, Prescott, Coronado, Apache-Stigreaves NFs) (8)

Sinaqua Circle Trail, Trailhead, and Interpretive Facility Development (Coconino, Prescott NFs) (5a)

New Verde Valley Ranger District Office (Coconino and Prescott NFs) (7)

Tonto Apache Land Exchange (Coconino, Prescott, Tonto NFs)

Treatment of Noxious Weeds –Three Forests (Coconino, Kaibab, Prescott NFs) (This is the project)

Verde Wild and Scenic River Comprehensive River Management Plan (Coconino, Prescott, Tonto NFs)

Draft Supplement to the Final Environmental Impact Statement for Amendment of Forest Plans (All forests in Region 3 including the Coconino, Kaibab, Prescott NFs)

Fossil Creek Area Planning (Coconino, Tonto NFs)

Coconino National Forest Projects (10-01-04 thru 12-31-04)

Bar T and Anderson Springs Range Allotment Management (3)
Windmill Range Allotment Management (3)
APS 69 KV Powerline Construction (8)
APS Flagstaff 69KV Feeders Upgrade (8)
APS Substation Development at Winona (7)
Angell Range Allotment Plan (3)
Arizona Snow Bowl Facilities Improvement (7, 8)
Bellemont Manufactured Home Park Access (1)
Burlington Northern/Santa Fe Communications Tower (7)
Campbell Crater Aggregate Mine Access (1)
Glaspie Easement (1)
MCS Stables Easement (1)
Pine Canyon Fuels Reduction (4)
Rain Valley Homeowners Road Agreement (1)
Summit Fire District Townsite Act
2005 Road Closure and Decommissioning (1)
Coyote Basin Access and Utilities ROW (1, 8)
Deep Lake Range Allotment Management Plan (3)
Deep Lake Exclosures (3)
Elliot Springs Grassland Improvement Project (2)
Fort Tuthill to Kachina Village Trail Connection (5a)
Hoxworth Spring Prescribed Burn (4)
KAFF Tower Proposal (7)
Lake Mary Meadows Two Fuel Reduction Project (4)
Lee Butte Cabin Upgrades (7)
Little Boot Lake Tank Removal (3)
Mormon Lake Basin Fuels Reduction (4)
Mountainaire Fuels Reduction (4)
Munds Parks Trails Management (5a)
Pickett Lake and Padre Canyon Allotments Management (3)
Pickett, Padre, Walnut, Deep PJ Wildlife Habitat Improvements (2)
Prime Fisher/Fry Exclosures (2)
Skunk Fuel Reduction/Prescribed Burning (4)
Walnut Canyon Range Allotment Management (3)
APS Dry Creek Buried Line (8)
Camp Verde Townsite Act (19)
Clear Creek Mineral Withdrawal (7)
Herkenham Trail Management (5a)

Lime Kiln Historic Trail Management (5a)
Lower Oak Creek Restoration Project (2, 1, 5a)
Mail Historic Trail (5a)
Natural Gas Pipeline SR 179 (8)
Oak Creek Canyon Shower/Toilets (7)
Oak Creek Fuel Reduction (4)
Oak Creek Sediment Project 2)
Oak Creek Vista Climbing (5a)
Olive Lane Improvements (1)
Red Rock Outfitter and Guide Use (5e)
Sedona Administrative Site Sale
Sedona Trail Connections (5a)
Verde Administrative Site Sale
Verde Valley School and House Mountain Trail System (5a)
Walker Basin Allotment Boundary Fence (3)
Zalesky Trail Management (5a)
APS Blue Ridge 69KV Transmission Line (8)
Bald Mesa Fuels Reduction Project (4)
Buck Butte Pit (7)
Coconino County Road Repair (1)
East Clear Creek Watershed Health Improvement (2)
Knoll Lake Campground Improvement (1, 7, 5a)
Lowell Observatory Telescope (7)
Maple Draw Restoration Project (2)
Upper Beaver Creek Watershed Fuels Reduction (4)
Victorine 10 K Area Analysis

Kaibab National Forest Projects (10-1-04 thru 12-31-04)

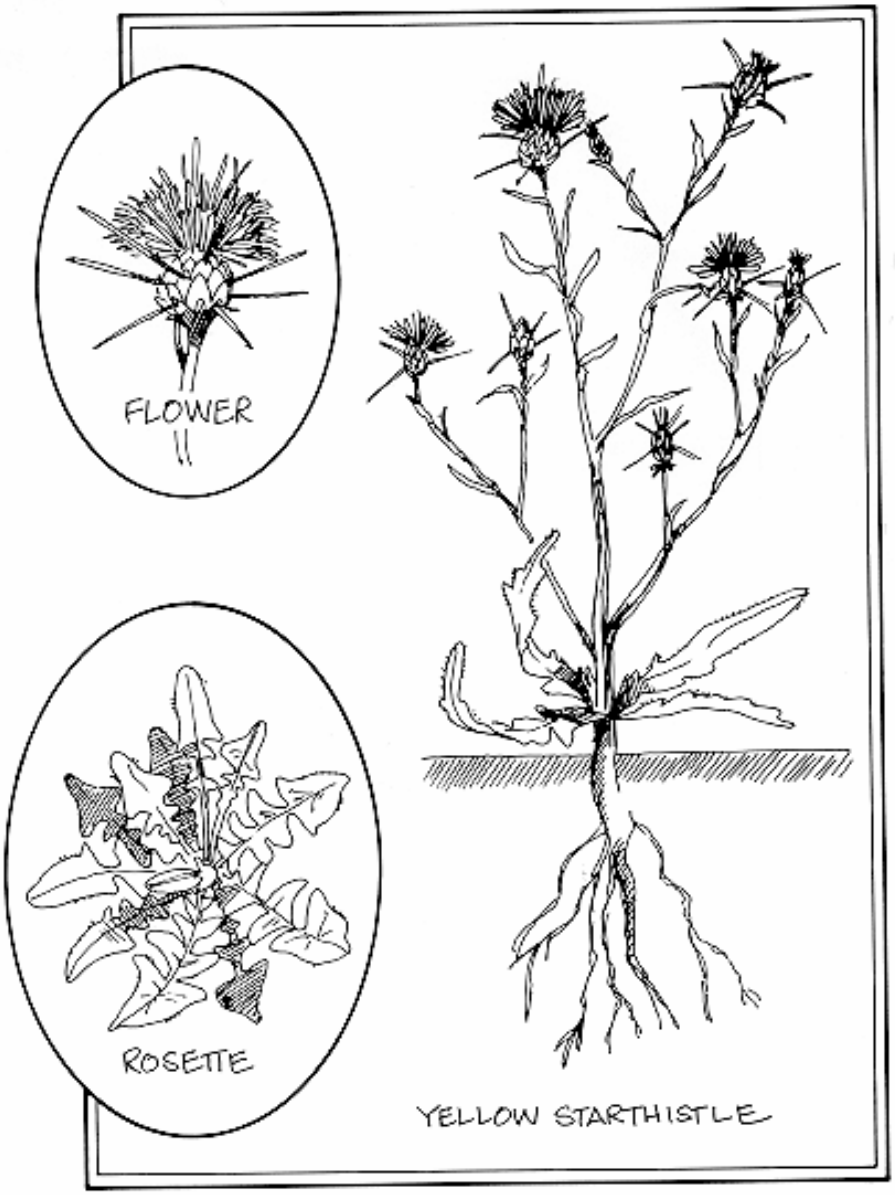
Campground Bark Beetle Project (9)
Campground Bark Beetle Control Project (9)
City Project (2, 4)
Community Tank Grassland Restoration Project (2)
Dogtown Fuels Reduction (4)
Government Mountain Aspen Restoration (2)
Homestead-Davenport Range Allotment Management (3)
Pineaire Fuels Reduction (4)
South Williams Prescribed Burn (4)
Southzone Recreation Desired Future Condition
Spitz Hill/Sitgreaves Range Allotment Management (3)

Twin Prescribed Burn (4)
Williams Followup Mistletoe Treatment (2)
Antelope Vendors Association
Big Saddle, Little Mountain, and West lake PCT (2)
Demotte Campground Reconstruction (7)
Highway 67 Fuels Reduction (4)
House Rock Valley Sagebrush Treatment (2)
House Rock Valley PJ/Cliffrose Browse Release (2)
Jacob-Ryan Vegetation Management (1, 2, 4)
Kaibab Camper Village Special Use (7)
Ryan 1 Wildlife Habitat Improvement (2)
Telephone Hill Vegetation Management (1, 2, 4)
XP Rides (5a, 5e)
Anita/Cameron/Moqui Range Allotment Management (3)
Long Jim Fuels Reduction (4)
Navajo Transmission Project (8)

Prescott National Forest Projects (10-1-04 thru 12-31-04)

Preventative Insecticide Spraying in Recreation Areas (9) This project has been cancelled.
Forest Plan Amendment for Fire Use, Firewood and Forest Plan Monitoring (19)
Camp Wood Prescribed Fire (4)
Drake Cement Limestone Quarry (7)
Horseshoe Grazing Permit (3)
Walnut Creek-Hyde Mountain Lookout Cabin (7)
Yavapai Flood Control District Alert Repeater
Yolo Ranch Road Easement (1)
AZ-DPS Towers Mountain Electronic Site Reconstruction (7)
Camp Wamatochick Buildings (7)
Central Yavapai Fire District Station
Communications Site Hazardous Fuel Reduction (4)
Freeland’s Goldie 4 and 7 (7)
Gold Basin Placer Mining Operation (7)
Heck’s Flour Gold 1 (7)
King Pin/Paystreak Mines (7)
Lynx Lake Fish Habitat Improvement (2)
Prater Placer Mine (7)
Roadrunners Patriot Claims (7)
Seideman’s Monkey River Mineral Exploration (7)
Trailhead for Trails 3 and 100 (5a)

Walker Charcoal Kiln Access Road (1)
Young Water Line and Tanks
AZ-DPS and Sedona Fire Department Squaw Peak Electronic Site (7)
Copper Canyon Trailhead Development (5a)
Monroe Road Easement (1)
N & S Mingus Electronic Site (1)
Schlosberg Road Easement Permit Reissuance (1)
Top Rock 1 (7)
Verde Rim Range Allotment Management (3)



Appendix F. Biological Assessments and USFWS Consultation

United States Department of Agriculture **Forest Service** **Prescott National Forest**

344 South Cortez
Prescott, AZ 86303
Phone: (928) 443-8000
Fax: (928) 443-8008
TTY: (928) 443-8001

File Code: 1950-3/2670
Date: OCT 15 2004

Mr. Steve Spangle
Field Supervisor
U.S. Fish and Wildlife Service
2321 W. Royal Palm Road
Phoenix, AZ 85021

Dear Steve,

We have received your letter of concurrence on the determination of the findings for the Biological Assessment for Threatened, Endangered and Proposed Species addressed in the *Environmental Impact Statement for the Integrated Treatment of Noxious and Invasive Weeds (Coconino, Kaibab, and Prescott National Forests, Coconino, Mojave, and Yavapai Counties, Arizona, 2004)* we sent you September 2, 2004. We are most appreciative of your very timely response and the cooperation provided by your staff members who were closely involved in this project. Brenda Smith and John Nystedt were instrumental in helping us complete the consultation in a timely manner.

Enclosed are the final documents that comprise this Biological Assessment.

If you have any questions regarding this BA, please contact Mike Leonard, Wildlife, Fish and Rare Plants Team Leader at (928) 777-2210.

Sincerely,

Joyce N. Chadwick
MICHAEL R. KING
for Forest Supervisor Prescott National Forest

cc: Brenda Smith, USFWS Flagstaff, Michael R Williams, Nora Rasure

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In Reply Refer to:

AESO/SE
02-21-01-I-0335

September 30, 2004

Mr. Michael R. King, Forest Supervisor
Prescott National Forest
344 South Cortez
Prescott, Arizona 86303

Dear Mr. King:

Thank you for your correspondence of September 2, 2004, regarding the Integrated Treatment of Noxious and Invasive Weeds on the Coconino, Kaibab and Prescott National Forests, Coconino, Mojave and Yavapai counties, Arizona. You requested our concurrence on the determination that the proposed action may affect, but is not likely to adversely affect, 13 species listed as threatened, endangered or proposed under the Endangered Species Act, as amended (16 U.S.C. 1531 et seq.) (Act), identified in Table 1. Your correspondence included three draft biological assessments (BAs), all dated August 31, 2004, that covered fishes, terrestrial species, and the Arizona cliff rose (*Purshia subintegra*). Subsequently, we received three final BAs, all dated September 22, 2004, via email on September 23, 2004.

Table 1. Listed species and/or designated critical habitat that occurs in the action area.

Common Name	Scientific Name	Status	Critical Habitat	Forest(s)
Apache trout	*Oncorhynchus apache*	Threatened	No	Kaibab
Arizona cliffrose	*Purshia subintegra*	Endangered	No	Coconino
Chiricahua leopard frog	*Rana chiricahuensis*	Threatened	No	Coconino
Colorado pikeminnow	*Ptychocheilus lucius*	Experimental nonessential	Not in action area	Coconino, Prescott
Gila chub	*Gila intermedia*	Proposed endangered	Proposed	Coconino, Prescott
Gila topminnow	*Poeciliopsis occidentalis*	Endangered	No	Prescott
Little Colorado spinedace	*Lepidomeda vittata*	Threatened	Yes	Coconino
Loach minnow	*Tiaroga cobitis*	Threatened	No[1]	Coconino, Prescott

Common Name	Scientific Name	Status	Critical Habitat	Forest(s)
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Yes	Coconino, Kaibab, Prescott
Razorback sucker	*Xyrauchen texanus*	Endangered	Yes	Coconino, Prescott
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	No	Coconino, Prescott
Spikedace	*Meda fulgida*	Threatened	No[1]	Coconino, Prescott
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	No	Coconino, Prescott

[1] On June 1, 2004, the U. S. District Court for the District of New Mexico vacated critical habitat for loach minnow and spikedace. The final judgement was issued August 31, 2004.

Because critical habitat for the loach minnow has been vacated and the species is considered extirpated from the Prescott and Coconino National Forests, it will not be given further consideration in this concurrence letter. Similarly, because critical habitat for the spikedace has been vacated, critical habitat for this species will not be given further consideration in this letter.

Description of the Proposed Action

The Forest Service proposes using an integrated combination of methods for the treatment of up to 28 weed species over a ten-year period on the Coconino, Kaibab and Prescott National Forests. The goals are to prevent any new weeds from becoming established within the three forests; contain or control the spread of 14 known species; and eradicate nine that are the most invasive, pose the greatest threat to biological diversity, and represent about one percent of infested acres within the forests (from Table 1 of the Forest Service Draft Environmental Impact Statement (DEIS) for Integrated Treatment of Noxious and Invasive Weeds, dated February 2004).

About 187,500 acres, or three percent, of the 4.9 million acres in these three forests have been identified as being impacted by noxious and invasive weeds. Infested sites range in size from less than an acre with single plants to a population of one species covering several thousand acres.

Treatment methods used would vary depending on specific conditions. Methods include manual (digging and hand-pulling), mechanical (clipping, mowing, tilling, steaming and burning), cultural (livestock grazing), biological, and use of herbicides. Containment/control and especially eradication is often a step-by-step process requiring a variety of methods over time. Treatments may be applied multiple times per year or over the course of multiple years. Non-herbicidal methods would be emphasized first unless proven or known to be ineffective. Typically, non-herbicidal treatment methods are not effective for deep-rooted perennial weeds, such as camelthorn, Russian knapweed, leafy spurge, tamarisk and tree of heaven. Methods will be combined where appropriate. Combining herbicides with other control methods can reduce

the amount of herbicide needed and increase the efficiency of treatment compared to use of either treatment alone. Control objectives can be reached without the use of herbicides for five weed species.

About 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally, 16,000 acres biologically, and 57,000 acres with herbicides. The majority of treatments will occur within the ponderosa pine type in the Verde and Little Colorado watersheds as well as along major travel corridors (e.g., railroads and Maintenance Level 3 and 4 roads[1]).

Herbicides will be applied with low pressure vehicle-mounted systems, backpack sprayers or other hand-held devices. There will be no aquatic or aerial applications. The eleven herbicides proposed for use are: 2,4-D, chlorsulfuron, clopyralid, dicamba, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron-methyl and triclopyr.

Biological control agents will be used on a relatively limited basis due to the lack of large, dense, and continuous infestations in the action area (except possibly for leafy spurge), and the limited effectiveness of biocontrol agents in eliminating infestations. Use of biocontrol agents is most appropriate to control the expansion of large populations that are beyond the practical use of other methods, followed by treatments with other methods for containment or eradication. There was at least one successful release of biocontrol agents in the action area. In 1994 two agents (also included in this proposal) were released in the A-1 Mountain Allotment of the Coconino National Forest to control Dalmatian toadflax. All biocontrol agents for the proposed action have been permitted for release by the Animal and Plant Health Inspection Service (APHIS), a process that includes rigorous scientific testing, permit recommendations by an interagency technical advisory group, and compliance with the National Environmental Policy Act and the Act. In addition, prior to release of any biocontrol agent in the forests, the Forest Service will obtain a permit from the APHIS (EIS page 94). Based on a prior consultation between APHIS and the U.S. Fish and Wildlife Service on permitting the Chinese leaf beetle (*Diorhabda elongata*), which targets tamarisk, this biocontrol agent was removed from the proposed action based on possible effects to southwestern willow flycatcher habitat.

Grazing, a form of cultural treatment, has previously been used within the action area and has met with some success in controlling the spread of noxious weeds. Grazing treatments of noxious weeds would occur within the context of other actions (e.g., in accordance with allotment management plans).

Because of the aggressiveness and adaptability of noxious and invasive weeds and the uncertainty of success associated with proposed treatment methods, adaptive management will be employed to increase the effectiveness of treatments. Infested areas will be regularly mapped and monitored after treatment to determine which control methods are the most effective, and to prioritize areas for treatment. Priority will be given to preventing the spread of weeds into

[1] Interstate, Federal and state highways in the action area are covered under the Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System lands in Arizona, which was the subject of NEPA analysis, and consultation under the Act.

wilderness and habitat for threatened and endangered species. Treatment methods will be adjusted to maximize effectiveness. Alternative treatments that are not within the project design or covered by conservation measures will require additional analysis and may require additional coordination with us.

Conservation Measures

The proposed action includes several general conservation measures, as well as a number of specific conservation measures designed for each of the listed species that occurs in the action area. The specific conservation measures are based primarily on the July 2004 *Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U. S. Fish and Wildlife Service* (RPMPA) and appropriate adjustments that are the result of extensive discussions between the Forest Service and us. All of the general conservation measures and specific conservation measures are part of the proposed action and are incorporated herein by reference from the three BAs dated September 22, 2004.

Specific conservation measures consist primarily of buffer zones that will separate areas where herbicides will be applied from areas where listed species and/or their habitat occur. Each species addressed by the RPMPA has one or more buffer zones that will be applied according to various herbicide formulations, toxicity levels, application methods, and other factors. The buffer zones were developed primarily to protect the listed species or its habitat from the potential toxicity of the herbicides, but were also designed to prevent disturbance where needed (e.g., during the breeding season) based on the type of application. For the purpose of this consultation, these buffer zones may also apply to other analogous treatment methods when appropriate. For example, the manual treatment method (i.e., pulling weeds) would have the same buffer zone as the manual herbicide application method (hand spraying).

We concur with the Forest Service's determination that the proposed action may affect, but is not likely to adversely affect, the species or proposed or critical habitat listed in Table 1. We base this conclusion on the project design, and the general and specific conservation measures that are part of the proposed action. Specific rationale for each species is as follows:

Apache trout
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. Currently, weeds have not been documented in the vicinity of Apache trout habitat. In the event treatments are necessary, conservation measures will be implemented. Application of buffer zones to treatment areas and use of direct herbicide application methods will minimize the potential for chemical contamination of occupied waters and minimize any impairment of water quality from erosion and run-off from treatments near streams.

Arizona cliffrose
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, BA for Arizona cliffrose. Currently, weeds are not known to occur in Arizona cliffrose habitat. In the event treatments are necessary, conservation measures will be implemented. For

mechanical/manual treatments, loss of seedlings or disturbance to older plants will be avoided by conducting a pre-treatment inventory of seedlings, establishing buffer zones, and using an experienced crew supervised by a botanist. Application of herbicides will be preceded by test treatments of the herbicide on *ex situ* cliffrose to determine buffer zones needed to avoid adverse effects. Herbicides treatments will be conducted outside of the active growing season, if appropriate for weed control. Torching of weeds will not be conducted in Arizona cliffrose habitat.

Chiricahua leopard frog
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, BA for Terrestrial Species. Conservation measures apply for habitat that is occupied, unsurveyed or inconclusively surveyed. Application of buffer zones to treatment areas and use of direct application methods will minimize the potential for chemical contamination of occupied waters and minimize any impairment of water quality from erosion and run-off from treatments. Restricting herbicide application when precipitation is likely will minimize the potential for contaminated run-off to reach leopard frog habitat.

Colorado pikeminnow
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. The potential for chemical contamination of occupied waters and impairment of water quality from erosion and run-off from treatments will be minimized by avoiding the application of herbicides to aquatic habitat and the use of direct application methods to minimize drift. In addition, the use of buffer zones around treatment areas will be implemented or expanded when stream flows fall below 100 cubic feet per second.

Gila chub
A description of this species, habitat, proposed critical habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. Application of buffer zones to treatment areas and use of direct herbicide application methods will minimize the potential for chemical contamination of occupied waters and minimize any impairment of water quality from erosion and run-off. Treatments within areas proposed as critical habitat on the floodplain will be limited in extent and will avoid or minimize effects to primary constituent elements. Treatments will avoid aquatic primary constituent elements.

Gila topminnow
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. Application of buffer zones to treatment areas and use of direct herbicide application methods will minimize the potential for chemical contamination of occupied waters and minimize any impairment of water quality from erosion and run-off.

Little Colorado spinedace
A description of this species, habitat, designated critical habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. Application of buffer zones and use of direct herbicide application methods near occupied and critical habitat will minimize the potential for

chemical contamination of water, and minimize any impairment of water quality from erosion and run-off.

Mexican spotted owl
A description of this species, habitat, designated critical habitat, and distribution in the action area is in the September 22, 2004, BA for Terrestrial Species. The application of buffer zones, use of low toxicity herbicide formulations, and the timing of treatments will minimize exposure of owls or their prey to herbicides. Restricting treatments of weeds within Protected Activity Centers to crews of two that will work primarily along roads and established trails will minimize disturbance to breeding owls. Treatments within areas designated as critical habitat, that contain one of more of the primary constituent elements, will be limited in extent and effects to primary constituent elements will be minimal.

Razorback sucker
A description of this species, habitat, designated critical habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. The potential for chemical contamination of occupied waters and impairment of water quality from erosion and run-off from treatments will be minimized by avoiding the application of herbicides to aquatic habitat and the use of direct application methods to minimize drift. In addition, the use of buffer zones around treatment areas will be implemented or expanded when stream flows fall below 100 cubic feet per second. Treatments within areas designated as critical habitat on the floodplain will be limited in extent and will avoid or minimize effects to primary constituent elements. Treatments will avoid aquatic primary constituent elements.

Southwestern willow flycatcher
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, BA for Terrestrial Species. Treatments within flycatcher habitat will be designed in accordance with the Southwestern Willow Flycatcher Recovery Plan to avoid adverse effects. Occupied sites will be protected by buffer zones. Treatments will be restricted in size (e.g., 5% of the exotic-dominated area per year) and will be monitored for successful restoration of native vegetation.

Spikedace
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, T&E Fish BA. The potential for chemical contamination of occupied waters and impairment of water quality from erosion and run-off from treatments will be minimized by avoiding the application of herbicides to aquatic habitat and the use of direct application methods to minimize drift. In addition, the use of buffer zones around treatment areas will be implemented or expanded when stream flows fall below 100 cubic feet per second.

Yuma clapper rail
A description of this species, habitat, and distribution in the action area is in the September 22, 2004, BA for Terrestrial Species. Avoiding weed treatments adjacent to occupied or unsurveyed habitat during the breeding season will protect birds from potential disturbance. Use of buffer

Mr. Michael R. King, Forest Supervisor 7

zones for herbicide treatments will protect Yuma clapper rails from herbicide exposure and protect its aquatic habitat from contamination.

If the proposed action changes or if additional information becomes available that indicates the action may affect any listed or proposed species in a manner or extent not considered in this consultation, your determination may need to be reconsidered. For additional communication regarding this project please refer to consultation number 02-21-01-I-0335.

We appreciate your cooperative efforts during this consultation to minimize effects to listed and proposed species and their habitats. Should you require further assistance or if you have any questions, please contact John Nystedt of our Flagstaff Suboffice at (928) 226-0614 (x104) or Brenda Smith (x101). Thank you for your continued efforts to conserve endangered species.

Sincerely,

For

Steven L. Spangle
Field Supervisor

cc: Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Assistant Field Supervisor, Fish and Wildlife Service, Flagstaff, AZ
Forest Supervisor, Coconino National Forest, Flagstaff, AZ
Forest Supervisor, Kaibab National Forest, Williams, AZ

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Biological Assessment

for
Federally Listed Terrestrial Species Not Affected by Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests in Coconino, Gila, Mojave and Yavapai Counties, Arizona

Prepared by:

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September 22, 2004

Description of Project

Location: The project location includes all reserved public lands, wilderness, and non-wilderness, within the three national forests: Coconino, Kaibab and Prescott. Of the 4.9 million acres, about 187,500 acres (or 3 percent of the land area) have been identified as being impacted with noxious weeds. Five watersheds have been inventoried within the project area and include the Verde River (2,139,405 acres), Little Colorado (1,089,255 acres), Colorado/Grand Canyon (1,011,660 acres), Middle Gila (480,835 acres), and Bill Williams (186,635 acres). Numerous private parcels are found within or adjacent to the three national forests. This project excludes ADOT highway rights-of-way.

Purpose: The purpose of this project is to eradicate, contain, control or prevent weeds within the three national forests. The desired goal is to prevent any new weeds from becoming established, contain or control the spread of 14 known invasive species, and eradicate 8 species which are the most invasive and pose the greatest threat to the biological diversity within the project area. The control of these plants would promote the ecosystem health of forested and rangeland habitats by maintaining or improving native forbs and grass species, increasing the regeneration of cottonwood and willow trees in riparian corridors, and ultimately preventing the loss of wildlife habitat.

Project objectives: The 3 national forests propose to authorize annual treatments of weed infestations scattered throughout the forests. There are currently 25 species of noxious and invasive weeds found within the project area and 4 new species that have been found adjacent to the national forests. Sites range in size from single plants to a population of one species covering several thousand acres. The various methods analyzed under the integrated weed management approach include: manual; mechanical (clipping, mowing, tilling, steaming and burning); cultural (grazing by livestock, fertilization, seeding of competitive plants, and the use of weed seed-free seed mixes and mulches); biological; and herbicidal.

The annual combination of methods to be used would vary depending on specific conditions. Riparian invasive weeds could be treated up to water's edge using methods approved for this type of application. Over the planning horizon of 10 years, it is estimated that 2 to 3 percent of the total national forest lands would be treated. Repeated treatments or re-treatments would be necessary for most weed species because seeds in the soil can be viable for 10 or more years. Therefore, recurring actions would be authorized until the desired control objective is reached.

Selected Alternative – Alternative 4

This alternative was also established to address the three significant issues; this action includes the option of herbicide use. Interstates, U.S. highways, and State highways will be covered under the Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona (2004).

This alternative would treat 31,047 weed infested acres on the ground with repeated visits over next ten years. This would require 124,050 acres of total treatments (or approximately 4 revisits per site); about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally (including re-vegetation), 16,000 biologically, and 57,000 acres with herbicides. Adaptive management principles apply.

Limited spray zones would be established adjacent to and within 1 mile of communities, recreation sites, trailheads, and scenic overlooks. Sites where non-herbicidal treatment methods will be effective due to species, population size, or site factors will be targeted for all integrated weed treatment methods except herbicides. Herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds where treatment objectives cannot be met using manual techniques. Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met.

Communication systems will be established to notify individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled for use. Proposed treatment plans will be posted on the World Wide Web and updated regularly to show time periods during which certain areas could be treated. This information will also be available on a 1-800 phone number. Specific actions will also be included and identification of alternative routes around the treated zones, if available.

Integrated Weed Management Strategies

Alternative 4, the selected alternative, is a combination of Alternatives 1 and 3 in that it uses all treatment methods but is designed to minimize herbicide use in the limited spray zones. For a detailed description of the alternatives, see Chapter 2 of the FEIS.

An integrated combination of methods will be needed to control such aggressive and adaptable noxious and invasive weeds. Our adaptive management strategy will include extensive mapping and consistent monitoring following treatments and re-vegetation to determine which control methods continue to be most effective.

For more details see the Wildlife Specialist Report.

SPECIES CONSERVATION MEASURES (Project Design Features)

RPMPA refers to the Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service authored by J. Allen White, July 2004. For this project, the RPMPAs were the starting point for the conservation measures. The table below summarizes how the conservation measures deviate from the RPMPAs and the rationale for that deviation.

See Appendix 1 for summary of RPMPA and adjustments. See Appendix 2 for a summary of where the adjuvants may be used.

Table 1. Conservation Measures Deviations From RPMPA

Species	Deviation From RPMPA	Reasoning
California condor	Added requirement from Roads BA to call FWS prior to treatments	Removes potential for disturbance to condors roosting along roads on road kills
Bald eagle	Required ½ mile buffer for all activities during the breeding season.	Removes all impacts from treatments to bald eagles during nesting and fledging period.

Table 1. Conservation Measures Deviations From RPMPA

Species	Deviation From RPMPA	Reasoning
Kanab ambersnail	Added protection measure limiting applications based on precipitation forecast.	Remove toxicity impacts from possibility of precipitation washing herbicide in to confined habitat after application.

Species Conservation Measures (Project Design Features):

General Project BMPs:

1. Implement Integrated Weed Best Management Practices.
2. Survey T&E species' habitats to determine and prioritize the occupied and potential habitats that would be most vulnerable to encroachment of invasive and noxious weeds.
3. Use native species for seeding and planting during revegetating. An exception is the use of sterile hybrid grasses after careful analysis to provide immediate ground cover after wildfires.
4. FS will review "weed-free" certifications for seed and mulch to ensure they are "free" of the weed species to be controlled in the action area.
5. Treatments that are not within these design features would require additional analysis and may require additional coordination with the FWS (U.S. Fish and Wildlife Service).
6. Work cooperatively with adjacent landowners to manage noxious or invasive weeds to prevent their spread into NFS (National Forest System) lands.

All species:

1. Where specified, species breeding season timing restrictions and buffers are applicable to all treatment methods that are not commensurate with the designated uses.
2. Where two or more species' habitats occur, the more restrictive measures will take priority.
3. Noxious or invasive weed treatment methods during the breeding seasons for birds would be commensurate with designated uses (non-motorized, motorized, livestock, etc.) in the treatment areas.
4. Adjuvants including surfactants and cleaners would be used or applied according to the adjuvant summary table.
5. Forest Service would submit to the FWS an annual report of herbicide treatments occurring within T&E species' habitat.

Bald Eagle:

1. Breeding season is December 1- June 30 (AGFD undated).
2. Nest occupancy confirmed by FS biologist.
3. No treatments may occur within ½ mile of occupied bald eagle nests (FWS per consultation) from the beginning of breeding season through occupancy for each breeding season as confirmed by FS biologist.
4. Specified herbicides may be applied along road right of ways within breeding areas during the breeding season (See summary table).
5. No treatments within 100 ft of occupied winter roosts (Roosting season Oct 1-Mar 30).

California condor:

1. Forest Service will contact FWS immediately prior to herbicide applications in condor habitat to determine if any roosting or nesting condors are in the proposed application area. If condors are present, no herbicides will be used within 0.2 km (0.125 mi) for spot applications using hand operated equipment, or within 0.4 km (0.25 mi) for mechanized ground applications of roost or nest sites to protect California condors from disturbance.

Black-footed ferret, brown pelican, Mexican gray wolf:

1. No herbicide limitations for this project per the RPMPA (pgs 41, 28, & 109, respectively).
2. Kanab ambersnail, Page springsnail, Verde Rim springsnail:
3. Herbicides would be applied per guidelines in RPMPA pg. 69. (See summary table)
4. If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Kanab ambersnail:

1. Herbicides would be applied per guidelines in RPMPA pg. 69. (See summary table)
2. If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Species considered and evaluated:

This biological assessment displays the effects of this project (i.e. all aspects of treatments in the selected alternative) on the six species that are listed or proposed under the Endangered Species Act of 1973, as amended (Table 2), for which there are no effects.

This program of noxious or invasive weed treatments with its proposed conservation measures will have no effect on the following endangered, threatened, or proposed species; designated or proposed critical habitat areas; or, nonessential experimental populations.

Table 2. Species with Federal Endangered Species Act status and proposed or designated critical habitat areas that may occur in treatment areas within the project area.

Common Name	*Scientific Name*	Status	Forest of Occurrence
Mammals			
Mexican gray wolf	*Canis lupus baileyi*	Experimental	Potentially Coconino, Kaibab, Prescott
Black-footed ferret	*Mustela nigripes*	Endangered	Coconino (potential)
Birds			
Brown pelican	*Pelicanus occidentalis*	Threatened	Coconino (accidental)
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Coconino, Kaibab, Prescott
California condor	*Gymnogyps californianus*	Nonessential Experimental Population	Kaibab, Coconino
Invertebrates			
Kanab ambersnail	*Oxyloma haydeni kanabensis*	Endangered	Kaibab

CONSULTATION AND COORDINATION

Informal section 7 consultation on this proposed program began with a National Environmental Policy Act (NEPA) scoping request dated August 31, 1998. The U.S. Fish and Wildlife Service (FWS), Arizona Ecological Services Field Office responded to this request with a letter and species list dated October 5, 1998 (PR DOC #197) (Cons. # 2-21-01-I-0335).

Information on endangered and threatened species and critical habitats was collected from the three Arizona national forests (Coconino, Kaibab, and Prescott). The forests were asked to identify endangered, threatened, and proposed species, and designated and proposed critical habitat areas that occur within their Forests. For aquatics species, they were asked to identify any occupied habitat or proposed or designated critical habitat areas. They were requested to identify both occupied and suitable habitat.

The Forest Service and FWS began intensive and detailed informal consultation in April 2004 just after the release of the March 2004 DRAFT "Recommended Protection Measures for Pesticide Applications in the

Southwest Region of the U.S. Fish and Wildlife Service". Many meetings, e-mails, phones calls and discussions took place over the next several months. The RPMPA were finalized in July 2004 (White 2004). The conservation measures developed during those communications have been incorporated into this project. Those conservation measures are listed below.

In general, mechanized/mechanical treatments are addressed through the timing and buffers for disturbance concerns as the areas impacted by these possible treatment methods are of such small scale to be inconsequential with regard to habitat effects. Herbicides were addressed for their potential toxic effects as well as the disturbance impacts from applications. Biological controls were considered for the full extent of their effects and their compliance with various recovery plans. Cultural treatments were addressed by saying that any grazing would occur within the parameters of the project specific NEPA and ESA analyses.

The following species were suggested for consideration by the Fish & Wildlife Service but are not being considered for the given reasons:

Desert Tortoise is not found on any of the Forests. The Prescott National Forest has surveyed for Desert tortoise and not found any.

Hualapai Mexican vole is not considered a listed species for the Coconino, Kaibab, and Prescott NFs by the FWS (USDI 1998). Per the May 29, 1998 USDI FWS memo, the Service will carry out Section 7 consultations on the Hualapai vole only in the Hualapai Mountains, which is outside of the project area.

Brown Pelican is only accidental (does not nest) on the Coconino and Kaibab National Forests. It is not found on the Prescott National Forest.

See the Wildlife Specialist report for the full wildlife herbicide risk assessment.

Species Status and Effects Findings:

Black-footed ferret (Mustela nigripes)

Endangered Species Act Status: Endangered, 1967

Forest Occurrence in Arizona: None

Recovery Plan: Final, 1988; currently in revision

Critical Habitat: None designated

Effects Finding: No Affect

Natural History

The black-footed ferret is a member of the weasel family. It depends almost exclusively on prairie dog colonies for food, shelter, and denning. The range of the black-footed ferret coincided with the range of three species of prairie dogs (black-tailed, white-tailed, and Gunnison's), and ferrets with young have only been observed in the vicinity of active prairie dog colonies.

Distribution

The historical distribution of the black-footed ferret was similar to the range of black-tailed, white-tailed, and Gunnison's prairie dogs. This range included 12 western states (Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota,

Texas, Utah, and Wyoming) as well as part of Canada. In Arizona, the Apache-Sitgreaves, Coconino, and Kaibab NFs are within the historical range of the black-footed ferret.

Status (Range-wide)

The decline in the distribution and abundance of the black-footed ferret was largely due to the reduction or elimination of prairie dog colonies. This reduction was due to both intentional control efforts in the early 20th century, as well as the conversion of grassland to cropland and urban development. In addition, outbreaks of sylvatic plague and canine distemper accelerated the decline in both prairie dog and ferret populations, since these species have no natural immunity to these pathogens.

The black-footed ferret was considered extinct until the discovery of a small population in Wyoming in 1981. Due to an outbreak of disease in this population, the remaining individuals were removed from the wild in 1986-87 to serve as founders for a captive breeding program. Since 1991, black-footed ferrets have been reintroduced to the wild as non-essential experimental populations at seven sites in the United States and one in Mexico. An eighth reintroduction in the United States was proposed in South Dakota in 2002.

Although reintroduced to areas throughout its range, the black-footed ferret has failed to become re-established in the wild with the possible exception of one site in South Dakota. Reintroduction sites require large prairie dog complexes capable of supporting a population of ferrets. Ideal sites are prairie dog complexes exceed 4,000 ha (10,000 acres) in size, although complexes greater than 2,000 ha (5,000 acres) may be considered for ferret reintroduction.

Status (Within the Action Area)

No black-footed ferrets occur on National Forest System lands in Arizona. The last survey for black-footed ferrets on national forests was conducted by Ruffner in 1980. No ferrets were found, but Ruffner did locate 29 Gunnison's prairie dog colonies and measured the area of 22 of these colonies (Table 3). These data show that in 1980 there were no sites on Arizona national forests capable of supporting ferret reintroduction. No recent quantitative estimates for Gunnison's prairie dog colonies are available, but the largest towns surveyed by Ruffner were on the Gila NF (6 colonies totaling 762 ha or 1,884 ac). These towns have increased in size since 1983, although populations do fluctuate from year to year.

Table 3. Gunnison's prairie dog colonies on national forest lands in Arizona and New Mexico (Ruffner 1980).

Forest	# Active	# abandoned or status unknown	# active colonies measured for area	Area (ha) of active colonies	Area (ac) of active colonies	Average colony size (ac)
Apache-Sitgreaves	3	2	3	30	73	24
Cibola	1	6	1	116	287	287
Coconino	8	10	7	269	664	95
Gila	6	4	6	762	1,884	314
Kaibab	11	9	5	268	661	132
Total	29	31	22	1,445	3,569	853

No ferret reintroductions have occurred on National Forest System lands in Arizona, although ferrets were released in 1996 in the Aubrey Valley, Arizona, near the Kaibab National Forest. This area is about 32 km (20 mi) west of the Kaibab NF. Populations of prairie dogs appear to be increasing on National Forest System lands, but the presence and high incidence of plague makes these populations unstable and currently unsuitable for ferret reintroduction.

Gunnison's prairie dog colonies occur on the Coconino NF and some extend into highway right-of-way. None of these colonies are presently large enough to support ferret reintroductions.

Effects Analysis (Black-footed Ferret)

No black-footed ferrets occur on national forests in Arizona so herbicide use on right-of-ways will have no direct affect on ferrets. The only possible indirect effect would be through effects on ferret habitat (i.e. prairie dog colonies). Presently, no prairie dog colonies are large enough to support ferrets, but perhaps they could expand to suitable size in the future. Herbicide use on right-of-ways at the levels proposed should not inhibit the growth of prairie dog colonies because application will be infrequent, the risk from application is low, and only a small part of any colony would be treated. Treatment for noxious weeds or hazardous vegetation could benefit prairie dog habitat by helping to maintain the open conditions prairie dogs prefer. This would not impact the black-footed ferret.

Effects Finding (Black-footed Ferret)

The preferred alternative for noxious and invasive weed treatments with the conservation measures would have no affect on the black-footed ferret.

Mexican gray wolf (*Canis lupus baileyi*)

Endangered Species Act Status: Endangered, all subspecies, 1976; Relisted, 1978; Non-essential Experimental Population, 1998

Forest Occurrence: Apache-Sitgreaves (outside of project area)

Recovery Plan: Final, 1982

Critical Habitat: None designated

Effects Finding (Exp. Population): No Affect

Natural History

Mexican gray wolves were extirpated from the wild before their natural history and ecological role could be described and studied. The natural history of the Mexican gray wolf is assumed to be similar to that of other gray wolves.

Wolf groups (or packs) usually have a set of parents (alpha pair), their offspring from the current and previous years, and possibly unrelated wolves that have been accepted into a pack. Wolves begin mating when they are 2-3 years old and are typically monogamous unless a mate dies. Wolves usually rear their pups in subterranean dens for the first 6 weeks. Wolves may also use some other type of shelter for dens such as a cave. The same wolves can use a den site year after year. On average, five pups are born in early spring and the entire pack may care for them. Pups

depend on their mother's milk for the first month of their life and then are gradually weaned as the adults feed them regurgitated meat. Pups begin traveling with the adults at 7-8 months of age. A young wolf will leave its natal pack (disperse) at 1-2 years of age looking for a mate to form its own pack. Lone dispersing wolves have traveled as far as 800 km (500 mi) in search of a new home and wolves may travel as far as 50 km (30 mi) in a day.

Wolf packs usually live within a specific territory that they defend to the exclusion of other wolves and often conspecifics such as coyotes. Territory size ranges from 85 km² (50 mi²) to greater than 1,600 km² (1,000 mi²) depending on the availability and seasonal movements of prey. Wolves are habitat generalists and typically only require adequate prey to survive. For the Mexican gray wolf this has historically been the Madrean evergreen forests and woodlands, including pine, oak woodlands, pinyon-juniper woodlands, riparian areas, and grasslands at elevations above 1,370 m (4,500 ft) (Brown 1983).

Distribution

Mexican gray wolves are the southernmost, rarest, and most genetically distinct gray wolf in North America. They historically occurred in the mountainous regions of the Southwest from throughout portions of southern Arizona, New Mexico, and Texas into central Mexico. Aggressive predator control programs extirpated Mexican gray wolves from the U.S. Field research has not confirmed that Mexican gray wolves continue to occur in Mexico. Currently a reintroduced non-essential experimental population occurs in the Apache-Sitgreaves and Gila NFs.

Status (Rangewide)

On January 12, 1998, the U.S. Fish and Wildlife Service published an Endangered Species Act (ESA) section 10(j) rule on the Mexican gray wolf that provided for the designation of specific populations in the United States “as experimental” (50 CFR 17.84(k)). Under 10(j), a population of a listed species re-established outside its current range but within its probable historical range may be designated as an experimental population. Non-essential experimental populations located outside of national wildlife refuges or national parks are treated as if they are proposed for listing. This means that under section 7 of the ESA, Federal agencies must conference with the U.S. Fish and Wildlife Service on their proposed actions that are likely to jeopardize the continued existence of the species. Section 10(j) rules provide for management flexibility of experimental populations to address the concerns of local residents.

Current estimates suggest that about 37 animals are alive in the wild. Eight wolf packs are expected to have litters in 2003. Since the reintroduction began 11 of the released wolves have been shot and 4 have been hit by cars on highways. Human-caused mortalities continue to be the primary cause of death for released Mexican wolves. In 2003, four family groups are scheduled for release, two in New Mexico, and two in Arizona, one of which will be on White Mountain Apache tribal lands.

Wolves will likely cross highways occasionally as they move within their territories, but they are unlikely to remain long in these open areas where they would be vulnerable.

Effects Analysis (Mexican Gray Wolf Non-essential Experimental Population)

No Mexican gray wolves currently occur within the three forests. The likelihood of their expansion to the three forests in ten years is low. Given these circumstances, it is highly unlikely that any Mexican gray wolves will come in contact with the herbicides used in this program. Even if exposed to herbicides, the risk assessment indicates the possibility of harm is low.

Effects Finding (Mexican Gray Wolf Non-essential Experimental Population)

The preferred alternative for noxious and invasive weed treatments with the conservation measures would have no affect on the non-essential experimental population of the Mexican gray wolf.

Bald Eagle (Haliaeetus leucocephalus)

Endangered Species Act Status: Threatened, 1995
Forest Occurrence: Coconino, Kaibab, Prescott
Recovery Plan: Final, 1982 for SW Recovery Region
Critical Habitat: None designated
Effects Finding: No Affect

Natural History

The bald eagle is the only species of sea eagle native to North America. It frequents estuaries, large lakes, reservoirs, major rivers, and some seacoast habitats. Fish are the major component of its diet, but waterfowl, seagulls, and carrion are also eaten.

Bald eagles usually nest in trees near water, but are known to nest on cliffs. Adults tend to use the same breeding areas year after year, and often the same nest, though a breeding area may include one or more alternative nests. Bald eagle pairs begin courtship about a month before egg-laying. The nesting season lasts about 6 months. After an incubation period of 35 days the nestlings hatch; fledging takes place at 11-12 weeks of age. Parental care may extend 4-11 weeks after fledging (U.S. Fish and Wildlife Service 1999).

Bald eagles found in the Arizona and New Mexico, specifically those found in Arizona, demonstrate some unique behavioral characteristics in contrast to bald eagles in the remaining lower 48 states. Eagles in the Southwest frequently construct nests on cliffs as opposed to trees and establish their breeding territories earlier, typically in November and December (U.S. Fish and Wildlife Service 1982). Eggs are laid in January or February. The early onset of breeding is believed to be a behavioral adaptation allowing chicks to avoid the extreme desert heat of midsummer and allowing adults to take advantage of food resources for the rearing of eaglets (U.S. Fish and Wildlife Service 2002).

In Arizona, the diet consists mostly of fish, but they will also eat birds, amphibians, reptiles, small mammals, and carrion.

Distribution

The bald eagle historically ranged and nested throughout North America except extreme northern Alaska, northern Canada, and central and southern Mexico. Due, in part, to reintroduction efforts in many states, the species present nesting distribution is close to its historical distribution (U.S. Fish and Wildlife Service 1999). Within Arizona, bald eagles are found nesting in the Tonto, Coconino, Apache-Sitgreaves, and Prescott NFs, and they winter throughout all six national forests in Arizona.

Bald eagle breeding areas in Arizona are predominantly located in the upper and lower Sonoran life zones with the exception of the Luna Lake breeding area on the Apache Sitgreaves NF, the the Rock Creek and DuPont breeding areas on the Tonto NF, and the Lynx Lake breeding area on the Prescott NF which are found in coniferous forests. Most breeding areas in Arizona are close to a variety of aquatic habitats including reservoirs, regulated river systems, and free-flowing rivers and creeks. The alteration of natural river systems through the construction of dams and other water developments has had both beneficial and detrimental effects on the bald eagle.

Status of the Species (Rangewide and Within the Action Area)

In 1978, the FWS classified the bald eagle as endangered in 43 states and threatened in 5 others. It was not listed as endangered or threatened in Alaska and is not found in Hawaii. In 1995, the species was reclassified to threatened (U.S. Fish and Wildlife Service 1995). The bald eagle was proposed for delisting on July 6, 1999 (U.S. Fish and Wildlife Service 1999). If the proposal is finalized, the bald eagle would be removed from protections under the ESA. However, once it is delisted under the ESA, the bald eagle will still be protected by the Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, and other Federal laws. No critical habitat has been designated for this species.

Since its original listing in 1967, bald eagles have increased in number and expanded in range due to the banning of DDT, habitat protection, and additional recovery efforts. Surveys conducted between 1963 and 1998 show that occupied breeding areas in the lower 48 states have grown from 417 to over 5,748 (U.S. Fish and Wildlife Service 1995, 1999). In addition, the average number of young produced per nest has increased from 0.59 in 1963 to 1.16 in 1994 over the range of the species (U.S. Fish and Wildlife Service 1995).

In the 1999 proposal to delist the species, the U.S. Fish and Wildlife Service stated that the number of breeding pairs in the Southwestern Recovery Unit, which includes Arizona, has more than doubled in the last 15 years (U.S. Fish and Wildlife Service 1999). However, research by the Arizona Department of Fish and Game indicates that Arizona's breeding population is not supported by immigration from other states or regions, therefore, continued attention to the survivorship of bald eagles in Arizona is important.

In the 20 years from 1970 to 1990, 226 eaglets fledged in Arizona (Hunt et al. 1992). In the 4 years from 1999 to 2002, 118 eaglets fledged (Driscoll and Kolosza 2001, 2002; U.S. Fish and Wildlife Service 2002). About 60% (28) of the breeding areas in Arizona are on national forests. There are 20 on the Tonto, 4 on the Coconino, and 2 each on the Prescott and Apache-Sitgreaves.

In addition to breeding eagles, Arizona provides habitat for wintering eagles. Of the 300-400 birds typically seen during statewide winter counts, most occur on the Coconino NF near lakes, west along the Mogollon Rim, and east throughout the White Mountains (Apache-Sitgreaves

NF); however, the Salt River can have about 30 birds and the Verde River about 40 (J. Driscoll, Arizona Game and Fish Department, Phoenix, pers. comm. 2003). A handful of eagles (approximately 6-10) are known to roost at the lakes around Prescott.

Bald eagles may roost on trees or cliffs adjacent to water and they may sometimes feed on road-kill carrion. Most bald eagles nest along streams or lakes.

Special Conservation Measures for the Bald Eagle

In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

1. Breeding season is December 1- June 30 (AGFD undated).
2. Nest occupancy confirmed by FS biologist.
3. No treatments may occur within ½ mile of occupied bald eagle nests from the beginning of breeding season through occupancy for each breeding season as confirmed by FS biologist.
4. Specified herbicides may be applied along road right of ways within breeding areas during the breeding season (See summary table).
5. No treatments within 100 ft of occupied winter roosts (Roosting season Oct 1-Mar 30).

Effects Analysis (Bald Eagle)

Herbicides will be used almost exclusively in the summer so there will be little overlap between program activities and the presence of migratory bald eagles that winter in Arizona. Nevertheless, a 100 ft buffer zone will be applied around known winter roost sites for all treatments that may be implemented from October to April. The bioaccumulation of pesticide residues in the body tissues of this upper food chain predator was formerly a major threat to bald eagles. None of the herbicides being used will bioaccumulate in body tissues. There is virtually no chance that bald eagles will come in contact with herbicides through direct application or through brushing against freshly sprayed vegetation. It is unlikely that bald eagles will ingest herbicides that are on prey because fish make up most of the bald eagle's diet and there are buffer zones around aquatic habitats. In the rare instance that some herbicides were consumed, the risk analysis indicates a low risk from this amount of ingestion. The general mitigations and BMPs for this program will protect food sources in aquatic environments. As further protection of aquatic food sources, pendamethalin, 2,4-D (ester formulations), and triclopyr (ester formulation) will not be applied within 3 m (10 ft) for spot applications and 25 m (80 ft) for mechanized ground applications of shorelines (e.g., of streams, rivers and lakes) that are within 1.6 km (1 mi) of eagle nests.

Protection from direct disturbance to bald eagles will be provided by prohibiting treatments by any method within 0.50 mi of any known bald eagle nest from October 1 to July 1, or until juveniles have left the nest. Limiting treatments to more than ½ mile from the nest during the period of occupancy to would alleviate any toxicity impacts or disruptions in the foraging behavior of nesting and breeding eagles.

Effects Finding (Bald Eagle)

The preferred alternative for noxious and invasive weed treatments with the conservation measures would have no affect on the bald eagle.

California condor (Gymnogyps californianus)

Endangered Species Act Status: Endangered, 1967; Non-essential Experimental Population, 1996

Forest Occurrence: Coconino, Kaibab

Recovery Plan: Final, 1996

Critical Habitat: Yes, 1976

Effects Finding (Exp. Population): No Affect

Effects Finding (Critical Habitat): No Affect

Natural History

The California condor is the largest North American vulture. It is a strict scavenger and historically fed on the carcasses of deer, elk, antelope, and, in coastal areas, beached whales. Condors spend much of their time roosting on cliffs or tall conifers. They nest on rock crevices, overhung ledges, or rarely in cavities in sequoia trees. They generally breed once very other year, laying a single egg. Incubation times are long (56 days average), as are rearing times (young fledge at 6 months), requiring extensive parental care.

Distribution

The historical distribution of the California condor was along the Pacific coast from British Columbia, Canada, to Baja California Norte, Mexico. By 1987, the range of the condor had been reduced to six counties north of Los Angeles, California. At that time, all existing condors were removed from the wild for captive breeding. In 1992, captive condors were released into the wild in California on the Los Padres NF. A second captive-bred release program was initiated at the Vermillion Cliffs area in northern Arizona in 1996.

Reasons for the decline of the California condor are varied, including loss of habitat and eggshell thinning due to DDT. However, the largest factor in the condor's decline has been adult mortality through ingestion of lead shot and shooting. As scavengers, condors are very susceptible to lead poisoning from ingestion of shot in animals hunters wound or kill. Collisions with power lines have been an injury and mortality factor in birds released since 1992.

Status (Rangewide and Within the Action Area)

Currently there are two California condor release areas in the United States, one in California and the second in Arizona. Condors were released at the Vermillion Cliffs site in Arizona in 1996. These released birds are part of a non-essential experimental population. As of 2002, the total number of free-flying California condors in Arizona was 31 birds.

Although the release site is not on National Forest System lands, the non-essential experimental population area includes portions of the Kaibab and Coconino NFs. Condors may use these areas for foraging or roosting. It is possible that condors could scavenge for road-kill along highways,

but this is expected to be infrequent. Nesting has only been attempted in Grand Canyon National Park.

Special Conservation Measures for the California condor

In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- ADOT will contact FWS immediately prior to herbicide applications in condor habitat to determine if any roosting or nesting condors are in the proposed application area. If condors are present, no herbicides will be used within 0.2 km (0.125 mi) for spot applications using hand operated equipment, or within 0.4 km (0.25 mi) for mechanized ground applications of roost or nest sites to protect California condors from disturbance.

Effects Analysis (California condor Non-essential Experimental Population)

The bioaccumulation of pesticide residues in body tissues was formerly a major threat to California condors. None of the herbicides being used will bioaccumulate in body tissues. With herbicides only being applied once a year in any given area and this mostly limited to the highway clear zone, there is virtually no chance that California condors will come in contact with herbicides through direct application or through brushing against freshly sprayed vegetation. It is equally unlikely that California condors will ingest herbicides that are on road-killed animals because these animals also have a low likelihood of exposure. In the extremely unlikely instance that some herbicides were consumed, the risk analysis indicates a low risk from this amount of ingestion. The potential for direct disturbance to roosting or nesting California condors will be eliminated by prohibiting herbicide application by any method within 0.2 km (0.125 mi) (by spot applications using hand operated equipment) or 0.4 km (0.25 mi) (by mechanized ground applications) of roosting California condors or their occupied nest sites. The combination of low herbicide toxicity, low potential for herbicide exposure, and protection from disturbance makes the possibility of adverse affects to the California condor insignificant and discountable.

Effects Finding (California condor Non-essential Experimental Population)

The preferred alternative for noxious and invasive weed treatments with the conservation measures would have no affect on the non-essential experimental population of the California condor.

Critical Habitat

Critical habitat for the California condor has been designated in nine areas in Kern, Los Angeles, San Luis Obispo, Santa Barbara, Tulare, and Ventura counties California.

Effects Finding (California condor Critical Habitat)

The preferred alternative for noxious and invasive weed treatments with the conservation measures would have no affect on the critical habitat for the California condor.

Yuma clapper rail (*Rallus longirostris yumanensis*)

Endangered Species Act Status: Endangered, 1967
Forest Occurrence: Coconino, Tonto
Recovery Plan: Final, 1983
Critical Habitat: None designated
Effects Finding: No effect

Natural History

The Yuma clapper rail is one of seven subspecies of *Rallus longirostris*. The Yuma clapper rail breeds in shallow water near shore of fresh water or brackish marshes with cattail and bullrush stands. Densities of rails are highest in light cattail stands, followed in descending order by light bullrush stands, dense bullrush stands, and dense cattail stands. Stands dissected with narrow channels of flowing water have higher densities of birds.

Clapper rails feed on crayfish, small fish, clams, isopods, and insects. They begin nesting in February, with egg-laying occurring from March to July. Clutch size is typically 6-8 eggs, and young are precocial.

Distribution

There is reason to believe that the Yuma clapper rail expanded its range northward along the Colorado and Gila rivers due to the creation of marsh habitat from diversion dams. Historically, the Yuma clapper rail occurred in the southern part of the Colorado River from Yuma, Arizona, southward. Construction of dams along the Colorado and other rivers caused the formation of large silt deposits, which in turn developed into cattail marshes. Depending on sediment load and dam height, clapper rail habitat takes from 10-15 years to develop after the construction of an impoundment. The increased habitat availability let the clapper rail expand its range northward as the habitat developed.

Currently, the Yuma clapper rail breeds in marshes along the Colorado River from the Nevada-California border south to the Colorado River delta in Mexico. Smaller breeding populations are also found around the Salton Sea and the Gila River basin in Arizona. Within national forests, vagrant birds occur at Roosevelt Lake on the Salt River, and wintering birds have been observed adjacent to the Coconino NF at Tavasci Marsh near Flagstaff.

Status (Rangewide and Within the Action Area)

From about 1970 through 1983, an estimated 1,700 breeding Yuma clapper rails occurred from the Colorado River delta to Arizona, including the birds around the Salton Sea in California. More recent data estimates 500-1,100 birds in the lower Colorado River Basin, including the 9-55 birds on the Gila River near Phoenix, Arizona.

Within National Forest System lands in Arizona, the Yuma clapper rail occurs on the Tonto NF at Roosevelt Lake, and on lands adjacent to the Coconino NF. Adjacent to the Coconino NF, several Yuma clapper rails were observed wintering in Tavasci Marsh in 2003 (Agyagos 2004). No breeding Yuma clapper rails have been documented, although suitable habitat exists on the Coconino NF.

Highways that pass through National Forest System lands near where Yuma clapper rails have been observed include State Highways 88, 188, and 288 in the vicinity of Roosevelt Lake, and Interstates 17 and 40, and State Highway 89 in the vicinity of Tavasci Marsh near Flagstaff.

Limiting factors for the Yuma clapper rail are availability of marsh habitat and food. Threats to the Yuma clapper rail are the loss of marsh habitat due to river management activities, including fluctuating reservoir levels. However, the impoundments along the lower Colorado River and its tributaries have created habitat for the rail.

Special Conservation Measures for the Yuma Clapper Rail

In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- No herbicides will be applied within occupied or unsurveyed Yuma clapper rail habitat during the breeding season to protect birds from potential disturbance.
- Chlorsulfuron, clopyralid, 2,4-D (acid, aquatic amine salt, nonaquatic amine salt, and butyric acid formulations), glyphosate (Roundup), imazapyr (technical formulation), isoxaben, metsulfuron methyl, pendimethalin, and triclopyr (amine salt formulation) will not be used within 3 m (10 ft) for spot applications and 25 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size) of the edge of Yuma clapper rail habitat. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- Dicamba (rated as Class 2 in the Waterfowl Avian Toxicity Group) will have a buffer zone for all liquid formulations of 6 m (20 ft) for spot applications using hand-operated equipment and 30 m (100 ft) for mechanized ground applications from the edge of Yuma clapper rail habitat. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Yuma Clapper Rail)

Yuma clapper rails are water birds that will stay near their marsh habitats. They feed on crayfish, small fish, clams, isopods, and insects and would not be expected to forage near highways. The mitigations, BMPs, and special conservation measures described above will protect Yuma clapper rails from any herbicide exposure and will protect the rail's aquatic environment from any herbicide contamination. These conservation measures make the possibility of effects to the Yuma clapper rail from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Yuma Clapper Rail)

The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures will have no effect on the Yuma clapper rail.

Summary of Determinations of Effects:

Mexican gray wolf: With no occurrences of the species within the project area and no limitations for pesticide applications, this project will have no affect on the Mexican gray wolf.

Black-footed ferret: With no occurrences of the species within the project area, this project will have no affect on the black-footed ferret.

Bald eagle: With the ½ mile buffer required around occupied nests, all impacts from treatments would be removed from bald eagles. No toxicity impacts would occur from using the specified herbicides around water. This project would have no affect to bald eagles.

California condor: With the requirement to call FWS prior to treatments in order to avoid disturbing any roosting condors, all disturbance impacts from treatments would be removed. No toxicity impacts would occur from using the selected herbicides. This project would have no affect to California condors.

Kanab ambersnail: With no aquatic treatments occurring within its habitat, and appropriate buffers and weather related restrictions on terrestrial applications, all potential for impacts have been removed through project design. This project will have no affect to the Kanab ambersnail.

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Appendix 1

Required Protection Measures for Pesticide Applications

Species/ Herbicides	2, 4-D (acid formulations)	2, 4-D (aquatic amine salt formulations)	2, 4-D (nonaquatic amine salt formulations)	2, 4-D (aquatic ester formulations)	2, 4-D (nonaquatic ester formulations)	CHLORSULFURON
Bald eagle	1/2 mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests. May be applied along existing road ROW (paved or gravel-base roadways only) during BS	Buffer applies for 1 mile up & down stream from nest's location when applied at edge of water of occupied nest.Spot-10 ft from water edgeMechanized-80 ft from water edge 1/2 mile buffer from currently occupied nests.	Buffer applies for 1 mile up & down stream from nest's location when applied at edge of water of occupied nest.Spot-10 ft from water edgeMechanized-80 ft from water edge 1/2 mile buffer from currently occupied nests.	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS
California condor	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites

Species/ Herbicides	2, 4-D (acid formulations)	2, 4-D (aquatic amine salt formulations)	2, 4-D (nonaquatic amine salt formulations)	2, 4-D (aquatic ester formulations)	2, 4-D (nonaquatic ester formulations)	CHLORSULFURON
Kanab ambersnail	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer
Mexican gray wolf, black-footed ferret, brown pelican	No limitations	No limitations	No limitations	No limitations	No limitations	No limitations

Federal species/ Herbicides	CLOPYRALID	DICAMBA	GLYPHOSATE (aquatic)	GLYPHOSATE (nonaquatic)	IMAZAPIC	IMAZAPYR (technical formulation)	IMAZAPYR (aquatic)
Bald eagle	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during	Buffer applies for 1 mile up & down stream from nest's location when applied at edge of water of occupied nest.Spot-10 ft from water edgeMechanized-80 ft from water	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS

Federal species/ Herbicides	CLOPYRALID	DICAMBA	GLYPHOSATE (aquatic)	GLYPHOSATE (nonaquatic)	IMAZAPIC	IMAZAPYR (technical formulation)	IMAZAPYR (aquatic)
	BS	edge 1/2 mile buffer from currently occupied nests.				BS	
California condor	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	1/4 mile from occupied nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites
Kanab ambersnail	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer
Mexican gray wolf, black-footed ferret, brown pelican	No limitations	No limitations	No limitations	No limitations	No limitations	No limitations	No limitations

Federal species/ Herbicides	IMAZAPYR (nonaquatic)	METSULFURON-METHYL (see note below)	PICLORAM (see note below)	SULFOMETURON-METHYL	TRICLOPYR (amine salt formulations)	TRICLOPYR (ester formulations)
Bald eagle	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	1/2 mile buffer from currently occupied nests.May be applied along existing road ROW (paved or gravel-base roadways only) during BS	Buffer applies for 1 mile up & down stream from nest's location when applied at edge of water of occupied nest. Spot-10 ft from water edgeMechanized-80 ft from water edge 1/2 mile buffer from currently occupied nests.
California condor	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites	May be applied along road ROW 1/4 mile buffer from nests, roosts, release sites
Kanab ambersnail	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer
Mexican gray wolf, black-footed ferret, brown pelican	No limitations	No limitations	No limitations	No limitations	No limitations	No limitations

Notes:

RPMPA - Resource Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service. J. Allen White, U.S. Fish and Wildlife Service, 10711 Burnett Road, Suite No. 200, Austin, Texas 78758, July 2004.

These RPMPAs are to be implemented in concert with the Design Features detailed in Appendix E of the FEIS for the Tri-Forest Noxious and Invasive Weed Treatments

Metsulfuron = metsulfuron is rated as Class 1 in toxicity groups for fish and amphibians due to reported mortality incidents not indicated by toxicity data

Picloram = picloram is used mostly for broad-leaved plants but can harm some grasses and other monocots

1 - A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between three to ten miles per hour, and no rainfall for 24 hours) should be followed in implementing recommended buffer zones.

2 - Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.

3 - Low aerial applications (nozzle or spreader height less than 12 feet) and high aerial applications (nozzle or spreader height greater than 12 feet) are relative to the plant canopy or a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40% grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40% grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

4 - Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.

5 - Liquid formulations include any type of liquid-based formulation other than ULV formulations.

6 - ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre

BS - Breeding Season
ROW - Right of way
TR - Timing restriction

Appendix 2

Adjuvant Summary Table and Design Features

Species	ACTIVATOR 90, SILWET L-77, CHOICE, LI 700, ACIDI pHACTANT, ALL CLEAR, Tank and Equipment Cleaner	MSO, AMIGO, Marker dye WSP, CHEM-TROL, NU FILM P, FIGHTER F, FOAM FIGHTER
Bald eagle, brown pelican, Kanab ambersnail	Shall not be used in riparian habitat*.	Approved for use in riparian habitat.
California condor, black-footed ferret, Mexican gray wolf	Approved for use in habitat.	Approved for use in habitat.

***Riparian habitat** - Overstory trees include alders, conifers, cottonwood, maple, sycamore, and willows. Understory species include hackberry, New Mexico locust, and soapberry. Herbaceous plants include sedges, spikerush, bull rush, little bluestem, blue grama, Canadian wildrye, sand bluestem, squirreltail, smartweed, and curlydock (EIS vegetation affected environment).

Cons. # 2-21-01-I-0335

Biological Assessment for Terrestrial Species that May be Affected by Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab and Prescott National Forests in Coconino, Gila, Mojave, and Yavapai Counties, Arizona

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Description of Project

Location: The project location includes all reserved public lands, wilderness, and non-wilderness, within the three national forests: Coconino, Kaibab and Prescott. Of the 4.9 million acres, about 187,500 acres (or 3 percent of the land area) have been identified as being impacted with noxious weeds. Five watersheds have been inventoried within the project area and include the Verde River (2,139,405 acres), Little Colorado (1,089,255 acres), Colorado/Grand Canyon (1,011,660 acres), Middle Gila (480,835 acres), and Bill Williams (186,635 acres). Numerous private parcels are found within or adjacent to the three national forests. This project excludes ADOT highway rights-of-way.

Purpose: The purpose of this project is to eradicate, contain, control or prevent weeds within the three national forests. The desired goal is to prevent any new weeds from becoming established, contain or control the spread of 14 known invasive species, and eradicate 8 species which are the most invasive and pose the greatest threat to the biological diversity within the project area. The control of these plants would promote the ecosystem health of forested and rangeland habitats by maintaining or improving native forbs and grass species, increasing the regeneration of cottonwood and willow trees in riparian corridors, and ultimately preventing the loss of wildlife habitat.

Project objectives: The 3 national forests propose to authorize annual treatments of weed infestations scattered throughout the forests. There are currently 25 species of noxious and invasive weeds found within the project area and 4 new species that have been found adjacent to the national forests. Sites range in size from single plants to a population of one species covering several thousand acres. The various methods analyzed under the integrated weed management approach include: manual; mechanical (clipping, mowing, tilling, steaming and burning); cultural (grazing by livestock, fertilization, seeding of competitive plants, and the use of weed seed-free seed mixes and mulches); biological; and herbicidal.

The annual combination of methods to be used would vary depending on specific conditions. Riparian invasive weeds could be treated up to water's edge using methods approved for this type of application. Over the planning horizon of 10 years, it is estimated that 2 to 3 percent of the total national forest lands would be treated. Repeated treatments or re-treatments would be necessary for most weed species because seeds in the soil can be viable for 10 or more years. Therefore, recurring actions would be authorized until the desired control objective is reached.

Preferred Alternative: This alternative was also established to address the three significant issues; however, this action maintains the option of herbicide use. This alternative was designed by combining the most effective treatment regimes from integrated weed management without herbicides with some treatment regimes from integrated weed management with herbicides to reduce overall costs and increase effectiveness. For example, herbicides will not be used for the 5 species that can reach control objectives w/o pesticides. This alternative emphasizes using non-herbicidal weed treatment methods first until proven ineffective, or in combination with herbicides to use the least amount of chemical required for an effective treatment.

Under this action about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally (including re-vegetation), 16,000 biologically, and 57,000 acres with herbicides. Limited spray zones would be established adjacent to and within 1 mile of

communities, recreation sites, trailheads, and scenic overlooks. Adaptive management principles apply and if the selected integrated weed management method does not work, then other methods, including herbicides, could be used. In addition, herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds that cannot reach treatment objectives using manual techniques (such as camelthorn, Russian knapweed, leafy spurge, tamarisk, and tree of Heaven). Sites where other treatment methods will be effective due to species, population size or site factors will be targeted for all integrated weed management methods except herbicides. Plant species in this category include yellow and Malta starthistle, Mediterranean sage, musk thistle, Scotch thistle, and bull thistle. Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met, so multiple chemical sensitive individuals could still access recreational and other facilities found within the project area.

Limited spray zones do not include rights-of-way under the jurisdiction of the Federal Highway Administration or other public entities (State and county roads). Therefore, even if a limited spray zone is established around a community, a road under Federal Highway Administration, State, or county jurisdiction that traverses the area is not considered part of the zone. Interstates, U.S. highways, and state highways will be covered under the Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona. However, if ADOT does not treat a priority infestation in one of these roadway easements, the Forest Service would undertake this work. Under situations where the limited spray zones do fall under the jurisdiction of the Forest Service, the preferred methods will be mechanical, manual, cultural, or biological.

This action includes a nonsignificant forest plan amendment for the Coconino, Kaibab, and Prescott National Forests.

Mitigation for Alternative 4

Communication systems will be established to notify individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled for use. Proposed treatment plans will be posted on the World Wide Web and updated regularly to show time periods during which certain areas could be treated. This information will also be available on a 1-800 phone number. Specific actions will also be included and identification of alternative routes around the treated zones, if available.

Integrated Weed Management Strategies

An integrated combination of methods will be needed to control such aggressive and adaptable noxious and invasive weeds. Our adaptive management strategy will include extensive mapping and consistent monitoring following treatments and re-vegetation to determine which control methods continue to be most effective.

Prevention is the most effective and least expensive method of control (these practices are detailed in Appndix E of the FEIS and the Noxious Weed Strategic Plan and Working Guidelines 1998). Maintenance of a vigorous, competitive plant community will reduce invasive weed seedling establishment. Cleaning tires, boots and hooves when leaving infested areas will prevent the creation of new infestations. Extensive disturbances often give invasive weed species another

advantage over native plants. Re-vegetation of large disturbed sites with vigorous, hardy native grass and perennial plants will also prevent establishment of new invasive weed populations. Using only certified weed-free seed, straw, mulch and hay products on the three forests will also reduce new introductions of invasive weeds.

No single control method, nor any one-year treatment program will ever achieve effective control of an area infested with invasive weeds. The fast growth, extensive root system and high reproductive capacity of these plants requires long-term cooperative integrated management programs and planning to contain and reduce invasive weed populations in Northern Arizona.

Scattered plants and spot infestations around the perimeter of the infestation need to be treated first to contain spread of the infestation. To limit seed dispersal, treatment of infestations along roads and trails should be done at the same time as treatment around the infestation perimeter. Treatments should then move inward toward the core of the infestation. Treatments will need to be repeated until the seed bank is depleted. For yellow starthistle, fire can be used to stimulate germination of a high proportion of the seedbank allowing the manager to use another technique to come in and remove these seedlings; using this technique the invasive weed seedbank can be depleted in 3-5 years instead of the 10-20 years of its full potential (DiTomaso 1999).

Combining the use of herbicides with other control techniques can reduce the amount of herbicide needed and increase the efficiency of a treatment (Tu et al 2001). Mechanical control followed by an herbicide treatment can be more effective than either treatment alone. Herbicide treatment followed by seeding with competitive grasses has been successful in many parts of the western U.S. Prior to seed set hand pulling or grubbing is effective for small infestations, and also following a mechanical or an herbicide treatment to insure no plants set seed that year. Appropriate timing of a weed control technique is the most important factor to improve/ensure effectiveness. Most annual and biennial plants should be treated early in the season before the plants bolt and flowering occurs. In contrast many perennials are most effectively treated with systemic herbicides in fall when the plant is actively transporting nutrients into its root system (Beck, personal communication 2003).

Insects alone will not eliminate an infestation; however they will enhance control and reduce the rate of expansion of large existing infestations. Biological control is most appropriate in populations large enough to be beyond control by any other means. The use of herbicides in combination with insect control is successful on large populations of several weed species. One example of this technique would be to release the insects near the center of the infestation, and then spray the edges to reduce or prevent the spread of the infestation.

Biological control agents include APHIS (Agricultural Plant Health Inspection Service) approved insects and pathogens that undergo a rigorous testing procedure prior to being available for release. Initial testing occurs in quarantined laboratories abroad and in the United States. The agents are tested for their effectiveness in controlling the target organism and for their host specificity. Testing includes potential effects on economic crops, rare plants, and similar species found in North America. An agent can be released only after is has been determined that it is unlikely that the agent will feed or cause injury to any native or agronomic species. It generally takes between ten and fifteen years for an agent to be cleared for release. Prior to the release of a new agent an environmental analysis is prepared by APHIS. The analysis assumes that agents will spread throughout North America, to wherever the target species exists. It is intended that the APHIS analysis will satisfy the intent of NEPA for the release and distribution of the agent in

the United States. The only action the Forest Service is taking by releasing an agent is changing the location and influencing the rate of spread of the agent. There would be no biological control of tamarisk.

Table 1. Rangeland Weeds and Proposed Biological Control Agents

Target Weed Common Name	Species Rank for Treatment	Proposed Agent	Type
Leafy Spurge	1	*Brachypterolus pulicariusl* *Calophasia lunula* *Eteobalea intermediella* *Eteobalea serratella* *Gymnetron antirrhini* *Gymnetron linariae* *Gymnetron netum* *Mecinus janthinus*	Ovary-feeding beetle Defoliating moth Root-boring moth Moth Seed-capsule feeding weevil Seed-capsule feeding weevil Seed-capsule feeding weevil Stem-mining weevil
Yellow and Malta Starthistle	2 and 3	*Bangasternus orientalis* *Larinus curtus* *Eustenopus villosus* *Urophora sirunaseva* *Chaetorellis australis* *Chaetorellis australis*	Seed-head weevil Flower weevil Hairy weevil Seed-head weevil Peacock fly False-peacock fly
Russian Knapweed	5	*Subanguina picridis*	Nematode
Spotted and Diffuse Knapweed	9 and 10	*Urophora affinis* *Urophora quadrifasciata* *Larinus minutus* *Metzneria paucipunctella* *Agapeta zoegana* *Sphenoptera jugoslavica* *Cyphocleonus achates*	Seed-head fly Seed-head fly Flower weevil Seed-head moth Root moth Root-gall beetle Root weevil
Dalmatian Toadflax	18	*Brachypterolus pulicarius* *Calophasia lunula* *Eteobalea intermediella* *Eteobalea serratella* *Gymnetron antirrhini* *Gymnetron linariae* *Gymnetron netum* *Mecinus janthinus*	Ovary-feeding beetle Defoliating moth Root-boring moth Moth Seed-capsule feeding weevil Seed-capsule feeding weevil Seed-capsule feeding weevil Stem-mining weevil
Bull Thistle	20	*Urophora stylata*	Bull thistle gall fly

Cultural treatments include grazing by livestock, fertilization, and the seeding of competitive native plants. Except for grazing by livestock the other methods do not appear to have been used to control the spread of noxious weeds within the project area. Phillips (personnel communication, 2003) stated that the grazing of sheep on leafy spurge has made a noted drop in the spread of the plant though the area encompassed by this weed has remained fairly constant since treatments began. It appears this technique has reduced the ability of the plant to produce seeds and spread out from the core population though it has not killed the plants. Livestock grazing for treatment of noxious and invasive weeds would occur within the parameters of the NEPA for the specific project (e.g. allotment AMP, Leafy spurge control, etc.).

Introductions of new exotic plants are expected to occur within the next 10 years. In fact, some species may already be present on the three national forests, but they have not been found. The key to dealing with new exotic weeds involves early detection and rapid response. Information and education programs to show people how to recognize species of concern are helpful in detecting infestations when they are still small. Repeated surveys also will be needed to locate new infestations. After detection, selection of the treatment method will depend on the growth characteristic of each species, size of the infestation, and efficacy of the methods. An eradication strategy is a step-by-step procedure to stop spread, prevent reproduction, and deplete viable seeds or plant parts in the soil (Sheley and Petroff 1999). It is hoped that new infestations will be detected when they are less than 1 acre in size. Early detection and rapid response to exotic weed infestations in wilderness areas and rare plant and animal habitats will be the top priority for treatment in all alternatives.

Mitigations for Herbicide Use

All herbicide application will be done according to all relevant labels, under supervison of a certified pesticide applicator. Suspension of broadcast herbicidal applications will occur when the following conditions exist:

- Wind velocity exceeds 6 miles per hour for liquids or 15 miles per hour for granular herbicides, unless a lower maximum wind speed is specified on the label.
- Snow or ice covers the target plant.
- Precipitation is occurring or is imminent.
- Fog significantly reduces visibility.
- Air turbulence, such as thermal updrafts, is sufficient to affect the normal herbicide distribution pattern.

During these weather patterns herbicide application methods will be limited to hand-held spot spraying or wick application. No broadcast spraying will be used in riparian ecosystems:

1. Application personnel will be trained by, and all application will be under direct supervision of, a Forest Service certified pesticide applicator (Region 3 Supplement 2100-98-1).
2. All herbicide applications will follow EPA label requirements, USDA policy, and Forest Service direction (e.g., FSM 2150 Pesticide-Use Management and Coordination; FSH 2109.11 Pesticide Project Handbook; FSH 2109.12 Pesticide Storage, Transportation, Spills, and Disposal Handbook; and FSH 2109.13 Pesticide Project Personnel Handbook).
3. Only herbicides labeled for use adjacent to water will be used within riparian zones and areas with shallow ground water.
4. All applicators must wear protective clothing as described on the label.
5. Herbicides will be transported daily to the project site under the following conditions: (a) transport only the quantity needed for that day's work, and (b) transport concentrate only in containers in a manner that will prevent tipping or spilling, and in a compartment that is isolated from food, clothing, and safety equipment.
6. Mixing, loading, and equipment cleaning must be done onsite and at least 300 feet from the edge of a "Limited Spray Zone" or from private land (unless the owner is cooperating in the project), open water, or sensitive areas. Mixing and cleaning water must be

transported to the site in labeled containers that are separate from water used for other purposes. Safety and spill plans will be written for each project.

7. All herbicide containers will be disposed of in accordance with label, State, and Federal requirements.
8. Broadcast spray sites will be posted at all access points 2 weeks before, during, and 2 weeks following herbicide application.

Mitigation practices for all action alternatives are found in Appendix E of the FEIS.

The table below summarizes those weeds being treated and the likely herbicide active ingredients for treatment.

Table 2. Noxious and invasive weeds and herbicide active ingredients.

	Herbicide Active Ingredients										
Invasive Plant by Priority	**2,4 D**	**chlorsulfuron**	**clopyralid**	**dicamba**	**glyphosate**	**imazapic**	**imazapyr**	**metsulfuron methyl**	**picloram**	**sulfometuron methyl**	**triclopyr**
leafy spurge	X				X	X	X		X		
yellow starthistle	X		X	X	X				X		
Malta starthistle	X		X	X	X				X		
camelthorn	X			X			X	X	X		X
Russian knapweed	X		X	X		X	X		X		
whitetop	X							X			
Mediterranean sage	X		X	X					X		
muskthistle	X	X	X		X			X	X		
spotted knapweed	X		X	X					X		
diffuse knapweed	X		X	X	X				X		X
Scotch thistle	X	X	X	X				X	X		
Russian olive	X						X				X
Siberian elm	X						X				X
tamarisk	X						X				X
Himalayan blackberry	X				X						X
giant reed					X						
sulfur cinquefoil	X								X		
Dalmatian toadflax	X			X	X	X	X		X		X
tree of Heaven	X						X				X
bull thistle	X	X	X	X				X	X		
cheatgrass						X				X	
wild oats					X	X					
jointed goatgrass					X	X				X	

Species considered and evaluated:

All terrestrial species on the three forests' Threatened, Endangered, and Proposed Species lists were considered.

This Biological Assessment (BA) determines the effects of this program (*i.e.* all aspects of treatments in the preferred alternative) on 4 animals that are listed or proposed under the Endangered Species Act of 1973, as amended (Table 1). This program of noxious and invasive weed treatments with its proposed conservation measures **is not likely to adversely affect** the following endangered, threatened, or proposed species or any designated or critical habitat areas.

Table 3. Species with Federal Endangered Species Act status and/or designated critical habitat areas that may occur in treatment areas within the project area.

Common Name	Scientific Name	Status	Forest of Occurrence
Birds			
Mexican spotted owl	*Strix occidentalis lucida*	Threatened, Critical Habitat	Coconino, Kaibab, Prescott
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Coconino, Prescott
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Coconino, Prescott
Amphibians			
Chiricahua leopard frog	*Rana chiricahuensis*	Threatened	Coconino

CONSULTATION AND COORDINATION

Informal section 7 consultation on this proposed program began with a National Environmental Policy Act (NEPA) scoping request dated August 31, 1998. The U.S. Fish and Wildlife Service (FWS), Arizona Ecological Services Field Office responded to this request with a letter and species list dated October 5, 1998 (PR DOC #197) (Cons. # 2-21-01-I-0335).

Information on endangered and threatened species and critical habitats was collected from the three Arizona national forests (Coconino, Kaibab, and Prescott). The forests were asked to identify endangered, threatened, and proposed species, and designated and proposed critical habitat areas that occur within their Forests. For aquatics species, they were asked to identify any occupied habitat or proposed or designated critical habitat areas. They were requested to identify both occupied and suitable habitat.

The Forest Service and FWS began intensive and detailed informal consultation in April 2004 just after the release of the March 2004 DRAFT "Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U.S. Fish and Wildlife Service" (U.S. Fish and Wildlife Service, March 2004). Many meetings, e-mails, phones calls and discussions took place over the next several months. The RPMPA were finalized in July 2004. The conservation measures developed during those communications have been incorporated into this project. Those conservation measures are listed below.

In general, mechanized/mechanical treatments are addressed through the timing and buffers for disturbance concerns as the areas impacted by these possible treatment methods are of such small scale to be inconsequential with regard to habitat effects. Herbicides were addressed for their potential toxic effects as well as the disturbance impacts from applications. Biological controls were considered for the full extent of their effects and their compliance with various recovery plans. Cultural treatments were addressed by saying that any grazing would occur within the parameters of the project specific NEPA and ESA analyses.

SPECIES CONSERVATION MEASURES (Project Design Features)

RPMPA refers to the Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service authored by J. Allen White, July 2004. For this project, the RPMPAs were the starting point for the conservation measures. The table below summarizes how the conservation measures deviate from the RPMPAs and the rationale for that deviation. See Appendix 1 for summary of RPMPA and adjustments. See Appendix 2 for a summary of where the adjuvants may be used.

Table 4. Conservation Measures Deviations From RPMPA

Species	Deviation From RPMPA	Reasoning
Chiricahua leopard frog	Application limitations tied to weather precipitation forecast	Prevent herbicides from washing into small contained habitats
Mexican spotted owl	During the breeding season, predatory avian zero toxicity herbicides may be applied by hand from a backpack sprayer within the PAC outside of the "No Activity Center" or nest area. Transportation within the PAC would be commensurate with the designated trail uses (hike, ATV, livestock, etc.)	Any disturbance from application methods would become part of impacts of the ongoing uses (hiking, ATV, horseback riding, etc.) that are occurring within the PACs and would not be an additive impact.
Southwestern willow flycatcher	Added species specific breeding season timing restrictions and Recovery Plan requirements.	To make sure adverse effects would not occur inside species' habitat (RPMPA pg 65)
Yuma clapper rail	Added species specific breeding season timing restrictions	To make sure adverse effects would not occur inside species' habitat (RPMPA pg 65)

Species Conservation Measures (Project Design Features):

RPMPA refers to the Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service authored by J. Allen White, July 2004.

General Project BMPs:

1. Implement Integrated Weed Best Management Practices.
2. Survey T&E species' habitats to determine and prioritize the occupied and potential habitats that would be most vulnerable to encroachment of invasive and noxious weeds.

3. Use native species for seeding and planting during revegetating. An exception is the use of sterile hybrid grasses after careful analysis to provide immediate ground cover after wildfires.
4. FS will review "weed-free" certifications for seed and mulch to ensure they are "free" of the weed species to be controlled in the action area.
5. Treatments that are not within these design features would require additional analysis and may require additional coordination with the FWS (U.S. Fish and Wildlife Service).
6. Work cooperatively with adjacent landowners to manage noxious and invasive weeds to prevent their spread into NFS (National Forest System) lands.

All species:

1. Where specified, species breeding season timing restrictions and buffers are applicable to all treatment methods that are not commensurate with the designated uses.
2. Where two or more species' habitats occur, the more restrictive measures will take priority.
3. Noxious and invasive weed treatment methods during the breeding seasons for birds would be commensurate with designated uses (non-motorized, motorized, livestock, etc.) in the treatment areas.
4. Adjuvants including surfactants and cleaners would be used or applied according to the adjuvant summary table (Appendix 2).
5. Forest Service would submit to the FWS an annual report of herbicide treatments occurring within T&E species' habitat.

Southwestern willow flycatcher:

1. No biological control of tamarisk anywhere on the three forests (SWWF Recovery Plan, pg. 121) until further NEPA analysis and ESA Section 7 compliance is documented.
2. Treatment within patches will comply with the southwestern willow flycatcher Recovery Plan.
3. FS biologist will determine patch size for nesting areas per the SWWF Recovery Plan and identify sites on the ground prior to treatments.
4. FS biologist would confirm occupancy during the breeding season (April through August, SWWF RP pg.21).
5. For occupied breeding patches, treatments adjacent to breeding patches would occur 100 meters from the edge of the patch (SWWF RP, pg H-21).
6. Herbicides would be applied per guidelines in RPMPA pg. 64. (See summary table (Appendix 1))

Mexican spotted owl:

1. Breeding season is March 1-August 30.
2. No treatments may occur within occupied "No Activity Centers". "No Activity Center" is the nest area from the MSO Recovery Plan page 86. FS Biologist to determine

occupancy. If no surveys are done, MSO territories are assumed occupied until surveys are done to determine otherwise.

3. Specified herbicides may be applied along road right of ways in MSO PACs during the breeding season (See summary table – Appendix 1).
4. Only specified herbicides may be applied within MSO PACs (See summary table – Appendix 1).
5. Specified herbicides may be applied from FS system trails during the breeding season commensurate with the designated trail use (non-motorized, motorized, livestock). Crews of 2 people may enter the PAC up to 6 times per breeding season for treatment purposes.
6. Specified herbicides may be applied during the breeding season to the remainder of the MSO PAC outside of the "No Activity Center" by non-motorized methods.

Chiricahua leopard frog:

1. Herbicides would be applied per guidelines in RPMPA pg. 136. (See summary table – Appendix 1)
2. If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Yuma clapper rail:

1. Herbicides would be applied per guidelines in RPMPA pg. 64. (See summary table – Appendix 1)
2. FS biologist will determine nesting areas and identify the site on the ground prior to treatment.
3. FS biologist would confirm occupancy during the breeding season (March through July).
4. In occupied breeding areas, treatments adjacent to breeding areas would occur outside the time of occupancy.

Herbicide Risk Assessment:

The herbicides proposed for use include chlorsulfuron, clopyralid, 2,4-D, dicamba, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sufometuron methyl, and triclopyr. These herbicides are marketed under a variety of trade names. The U.S. Environmental Protection Agency (EPA) has registered all of these herbicides and the various product labels include requirements and restrictions.

None of the herbicides proposed for use bioaccumulate and, therefore, none pose a risk to upper food chain consumers.

Animals and plants have different metabolic pathways so a compound that is toxic to plants can be relatively non-toxic to animals. The EPA classifies all of the herbicides proposed for use, except for 2,4-D, as slightly toxic (Category III) to almost non-toxic (Category IV) to humans. The rating for 2,4-D is moderately toxic (Category II) (Chapter 2, USDA Forest Service 2003).

The risk assessment is a common method for analyzing potential effects of various chemicals on humans and non-target species. It uses generally accepted standards of safety to quantify the long-term risks from an action. The USDA Forest Service, Southwestern Region has analyzed the risk of the use of 21 herbicides and 4 carriers (USDA Forest Service1992). In addition, specific risk assessments are available for all of the herbicides being considered (*http://www.fs.fed.us/foresthealth/pesticide/risk_assessments*). A comparison of the 1992 risk assessment and the updated risk assessments indicate the conclusions remain the same.

The risk assessment for the Southwestern Region (USDA Forest Service 1992) displays estimated risks to non-target species of mammals, fish, birds, reptiles, amphibians, and invertebrates. These estimates are based on a comparison of laboratory toxicity studies with estimated exposures of representative species. The assessments display risks from "routine typical" and "routine extreme" cases. Routine typical cases represent risks to workers, the public, and other organisms that may occur as a result of routine operations. The routine extreme approach is used to estimate doses that would occur under conditions of maximum use and maximum exposure (Appendix A, USDA Forest Service 2003).

The herbicides proposed for use all have low aquatic toxicity under typical case water concentrations (Table III-H-6. page III-H-13. 1992 risk assessment). The only exception is triclopyr not labeled for aquatic application, which may present a high risk for trout in streams and a moderate risk for trout in lakes. All herbicides would be used in accordance with label directions so triclopyr would not be used where it might enter water. Picloram, dicamba, and 2,4-D not labeled for aquatic applications may present a moderate risk under extreme water concentration, but this case seems highly unlikely under the conditions of proposed application. Nevertheless, these herbicides would not be used where they might enter water. Clopyralid, dicamba, and glyphosate are roughly 1/5 to 1/50 as toxic to various aquatic organisms, so under conditions of proposed application they are highly unlikely to pose a risk to aquatic organisams (Appendix A, USDA Forest Service 2003).

For threatened, endangered, or sensitive aquatic organisms, triclopyr products not labeled for aquatic use may present an unacceptable risk to cold-water fish under the typical case scenario. Likewise, 2,4-D not labeled for aquatic use may present an unacceptable risk to aquatic invertebrates. However, in accordance with label directions, these products would not be used in aquatic applications. It must be noted that the assessment was made using aerial application as the treatment approach realizing that aerial application poses the potential risk of inadvertent application to water. The herbicide applications near water would be hand backpack applications by spot application to single plant or plant clusters using hand-operated equipment and a back pack tank, and this would result in minimal risk of contamination to surface water. Leaching of herbicides through soil is not a significant process. Herbicides do have the potential for overland flow during heavy rainstorms, but the likelihood of such movement on infiltration-dominated sites makes water contamination unlikely. Mitigation measures and BMPs would reduce the potential for possible adverse effects to aquatic organisms.

The 1992 risk assessment addresses possible effects on representative terrestrial animals. These animals represent different types, sizes, and feeding habits that serve as surrogates for threatened, endangered, and sensitive animals. Again, aerial application was used in the analysis because it was assumed ground application would result in much lower herbicide exposures. Under the typical case, all species are in the low risk category given the materials proposed for use.

Species Status and Effects Findings:

Mexican spotted owl (Strix occidentalis lucida)

Endangered Species Act Status:Threatened, 1993
Forest Occurrence:Coconino, Kaibab, Prescott,
Recovery Plan:Final, 1995
Critical Habitat:Yes, Final Rule: August 31, 2004
Effects Finding (Species):Not Likely to Adversely Affect
Effects Finding (Critical Habitat):Not Likely to Adversely Affect, beneficial effect

Natural History

Mexican spotted owls are nocturnal predators that feed primarily on small mammals. They are "perch and pounce" predators that locate prey from an elevated perch by sight or sound, then pounce on the prey and capture it with their talons. They consume a variety of prey throughout their range, but commonly eat small and medium-sized rodents such as woodrats, peromyscid mice, and microtine voles. They also eat bats, birds, reptiles, and arthropods. Spotted owls in mountain ranges with forest-meadow interfaces take relatively more voles than in other areas (U.S. Fish and Wildlife Service 1995).

Home range is defined as the area an animal uses during its normal activities. The home-range size for Mexican spotted owls was determined by monitoring movements of radiotagged owls. Across the owl's range in the southwestern U.S., home ranges varied from 261-1,487 ha (645-3,672 ac) for individuals and from 381-1,551 ha (941-3,831 ac) for pairs (U.S. Fish and Wildlife Service 1995).

Mexican spotted owls live in forested habitats with uneven stand structure. They form monogamous pairs and do not attempt nesting every year. If they attempt nesting, they generally lay their eggs in late March or early April. The female incubates the eggs while the male forages for food and feeds the female. After the eggs hatch, the male feeds both the female and the young until the young leave the nest. The nest is typically in a cavity, a platform, or occasionally a cave. Fledging of young occurs in July and August (U.S. Fish and Wildlife Service 1995).

Distribution

The historical and current ranges of the Mexican spotted owl include the states of Utah, Colorado, Arizona, New Mexico, and extreme western Texas. It also occurs in Mexico. The owl's distribution within this range was never continuous; instead, the owl occurred in patches of suitable habitat. The present and historical ranges are similar, except the owl no longer occurs in lower elevation riparian areas (U.S. Fish and Wildlife Service 1995).

The U.S. Fish and Wildlife Service (1995) has organized the distribution of the Mexican spotted owl into six recovery units (RUs) in the U.S. These are the Colorado Plateau (southern Utah, northern Arizona, northwestern New Mexico, and southwestern Colorado), the Southern Rocky Mountains in Colorado (all of Colorado except the eastern plains and the northwestern and southwestern corners), the Southern Rocky Mountains in New Mexico (north-central New Mexico), the Upper Gila Mountains (The Mogollon uplift from Flagstaff to the New Mexico border and the Gila Mountains in west-central New Mexico), the Basin and Range-West (southern Arizona south of the Mogollon uplift and extreme southwestern New Mexico), and Basin and Range-East (central and southern New Mexico from roughly the southern end of the Sangre de Cristo Mountains to the Texas and Mexico borders). National forests in Arizona are in the Colorado Plateau, Upper Gila Mountains, and Basin and Range-West RUs (Table 2).

Table 5. Mexican spotted owl recovery units for Arizona national forests.

Forest	Recovery Unit		
	Basin-Range, West	Upper Gila Mtns.	Colorado Plateau
Apache-Sitgreaves	X	X	
Coconino		X	
Coronado	X		
Kaibab		X	X
Prescott	X		
Tonto	X	X	

Status (Range-wide)

Relatively little was known about the abundance of Mexican spotted owls prior to the U.S. Fish and Wildlife Service being petitioned to list it under the ESA in 1989. Reports of owls go back many years and multiple records may exist from the same site over time, so it is impossible to determine historical owl totals. Beginning in 1990, the Forest Service and others began more systematic surveys to determine the number and location of owls (Table 3) (U.S. Fish and Wildlife Service 1995). The Upper Gila Mountains RU in western New Mexico and east-central Arizona contains about 58% (424 out of 758) of the Mexican spotted owls in the U.S. NFS lands account for most of the land management responsibility in these RUs.

Table 6. Number of Mexican spotted owl sites by recovery unit prior to 1990 and from 1990-1993 (U.S. Fish and Wildlife Service 1995).

Recovery Unit	No. sites prior to 1990	No. sites, 1990-1993
Colorado Plateau	87	62
S. Rocky Mtns-CO	20	14
S. Rocky Mtns-NM	41	34
U. Gila Mtns	253	424
Basin/Range-W	169	103
Basin/Range-E	30	121
Totals	600	758

The Forest Service has determined the amount of suitable habitat for Mexican spotted owls on NFS lands in Arizona. This corresponds to all lands that are in mixed conifer forest, pine-oak forest, or riparian cover types and totals about 1.1 million ha (2.8 million ac) (Table 7). The Forest Service has also designated Mexican spotted owl Protected Activity Centers (PACs) around all nesting and roosting spotted owls, as well as territorial owls detected at night for which daytime locations were not recorded. The number of PACs does not necessarily represent the number of owl pairs, since all PACs may not be occupied in any given year. PACs are about 600 ac in size and irregular in shape. They are estimates made by forest biologists of the best habitat around a particular owl occurrence. There are about 517 Mexican spotted owl PACs on Arizona national forests (Table 7). This number changes slightly from year to year as new owls are discovered and habitat is lost from such things as forest fire and disease.

Table 7. Mexican spotted owl PACs and suitable habitat on Arizona national forests (Source: unpublished Forest Service maps compiled for the regional Land and Resource Management Plan programmatic consultation 2003).

National Forest	Spotted Owl PACs	Acres of Suitable Habitat
Apache-Sitgreaves	136	874,530
Coconino	181	728,050
Coronado	107	238,610
Kaibab	6	163,940
Prescott	15	153,350
Tonto	72	542,120
Totals	517	2,800,600

Status (Within the Action Area)

All of the suitable MSO habitat on the Prescott NF has been surveyed and inventoried. The MSO PACs on the PNF are monitored regularly for occupancy and reproductive status. On the Kaibab NF, all of the suitable habitat was inventoried in the early 1990's. The MSO PACs are monitored as funding allows and project planning requires. For the Coconino, over 90% of the suitable MSO habitat has been surveyed. Any unsurveyed habitat probably occurs in remote wilderness areas or in marginal potential habitat. Surveys were done to protocol; however, some are becoming fairly old. There is a low likelihood of noxious or invasive weeds treatments occurring in unsurveyed habitat for any of the three forests.

Suitable Mexican spotted owl habitat (*i.e.* mixed conifer forest, pine-oak forest, or riparian cover types) contains numerous roads, trails, and drainages that may require treatment of noxious and invasive weeds. PACs may contain paved roads, dirt roads, hiking trails, livestock trails, or even motorized trails. These PACs were often established with the current level of human activity occurring within the territory.

Special Conservation Measures for the Mexican spotted owl

In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures would be adopted.

1. Breeding season is March 1-August 30.

2. No treatments may occur within occupied "No Activity Centers". "No Activity Center" is the nest area from the MSO Recovery Plan page 86. FS Biologist to determine occupancy. If no surveys are done, MSO territories are assumed occupied until surveys are done to determine otherwise.
3. Specified herbicides may be applied along road right of ways in MSO PACs during the breeding season (See summary table).
4. Only specified herbicides may be applied within MSO PACs (See summary table).
5. Specified herbicides may be applied from FS system trails during the breeding season commensurate with the designated trail use (non-motorized, motorized, livestock). Crews of 2 people may enter the PAC up to 6 times per breeding season for treatment purposes.
6. Specified herbicides may be applied during the breeding season to the remainder of the MSO PAC outside of the "No Activity Center" by non-motorized methods.

Effects Analysis (Mexican spotted owl)

Roads and trails in the action area pass through suitable Mexican spotted owl habitat and owls, as PAC designations indicate, can occupy habitats directly adjacent to these travelways. These travelways are typically the routes by which noxious and invasive plants enter the PAC habitat whether on a hiker's boot, a dog's fur, and ATV tire tread, or a horse's hoof or coat. Most weed treatments would be concentrated along these travel ways where the undesirable plants occur. However, there is virtually no chance that Mexican spotted owls would come in contact with herbicides either from direct application or from brushing against freshly sprayed vegetation because owls are nocturnal and spraying would be done in the daytime. Also, restricting treatments to occur outside of occupied nest area or "NO Activity Center" during the breeding season reduces the potential for any MSO to come in contact with freshly sprayed herbicides or to be disturbed by treatment activities. Likewise, the prey of owls, mostly rodents, tends to be nocturnal and they also are unlikely be directly sprayed. Therefore, owls would probably not ingest herbicides that are on prey they capture in right-of ways. Some areas may have herbicide treatments up to six times a year if a variety of weeds occur within the same area. The herbicides risk analysis indicates a low risk to either the owl or its prey from this amount of herbicide exposure. Owls in or near treatment areas are likely habituated to noise from passing vehicles, hikers, livestock, or ATV's (all terrain vehicles) and would not likely be disturbed from the brief presence of people with spray equipment.

The herbicides chosen for use within MSO PACs are those with low (Class 0 or 1) ecotoxicity rating and those with no eye irritation to predatory avian. Approximately less than 30% of the MSO PACs in the project area have the potential to be treated for weeds. The combination of low herbicide toxicity, low potential for herbicide exposure, and low likelihood of direct disturbance makes the possibility of adverse affects to the Mexican spotted owl insignificant and discountable.

Noxious and invasive weed treatments reduce existing weed populations and allow for native plant species populations to develop that would be favorable for prey species habitat. Therefore, the proposed action may improve Mexican spotted owl foraging habitat.

Effects Finding (Mexican Spotted Owl)

The preferred alternative for noxious and invasive weed treatments with the conservation measures is not likely to adversely affect the Mexican spotted owl.

Critical Habitat

Critical habitat for the Mexican spotted owl was designated on February 1, 2001 (66 FR 8530). No critical habitat areas were designated on national forests in Arizona (U.S. Fish and Wildlife Service 2001). However, under an October 10, 2003, court decision, the FWS reopened comments on the July 21, 2000, proposal (65 FR 45336) upon which the February 1, 2001 designation was based (U.S. Fish and Wildlife Service 2003). The proposal contained 1,330,339 ha (3,287,339 ac) of National Forest System lands in Arizona. Within that area, actual critical habitat is limited to areas that met the definition of protected and restricted habitat in the Mexican Spotted Owl Recovery Plan. Some of the critical habitat areas are within the action area for this program (U.S. Fish and Wildlife Service 2000). The final rule for MSO critical habitat designation is printed today in the Federal Register on August 31, 2004 (69 FR 53182).

In determining which areas to propose as critical habitat, the FWS is required to consider those physical and biological features (primary constitute elements) that are essential to conservation of the species and that may require special management considerations or protection. The FWS determined the primary constituent elements for Mexican spotted owl from studies of their habitat requirements and the information provided in the Mexican Spotted Owl Recovery Plan (U.S. Fish and Wildlife Service 1995 and references therein). Since owl habitat can include both canyon and forested areas, the FWS identified primary constituent elements in both areas. The primary constituent elements for MSO include (69 FR 53232):

A. Primary constituent elements related to forest structure:

1. A range of tree species, including mixed conifer, pine-aok, and riparian forest types, composed of different trees sizes reflecting different ages of trees, 30 to 45 percent of which are large trees with a trunk diameter of 12 inches (0.3 meters) or more when measured at 4.5 feet (1.4 meters) from the ground.
2. A shade canopy created by the tree branches covering 40 percent or more of the ground; and
3. Large dead trees (snags) with a trunk diameter of at least 12 inches (0.3 meters) when measures 4.5 feet (1.4 meters) from the ground.

B. Primary constituent elements related to maintenance of adequate prey species:

1. High volume of fallen trees and other woody debris;
2. A wide range of tree and plant species, including hardwoods; and
3. Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.

C. Primary constituent elements related to canyon habitat include one or more of the following:

1. Presence of water (often providing cooler and often higher humidity than surrounding areas);

2. Clumps or stringers of mixed-conifer, pine-aok, pinyon-juniper, and/or riparian vegetation;
3. Canyon wall containing crevices, ledges, or caves; and
4. High percent of ground litter and woody debris.

Effects Analysis (Mexican Spotted Owl Critical Habitat)

Surveys would be done to determine the extent of noxious weeds infestations in and treatments would be limited to the areas needed to control these infestations. These spot applications would be done with low pressure vehicle-mounted systems, backpack sprayers, and other hand-held devices that would keep herbicide effects within the target area. All of the targeted noxious weeds are annuals or herbaceous perennials. These plants generally grow in open disturbed habitats and not in the areas of 40% canopy cover that characterize Mexican spotted owl primary constituent elements. However, noxious weeds may occur in herbaceous communities that provide for the needs of some Mexican spotted owl prey species. Here, noxious weeds reduce species diversity and habitat quality for prey species. The removal of noxious weeds would benefit habitat for prey species and therefore have a beneficial effect on the primary constituent element of adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration. Treatments are not expected to have any impact on the primary constituent elements of canyon habitat.

Effects Finding (Mexican Spotted Owl Critical Habitat)

The preferred alternative for noxious and invasive weed treatments with the conservation measures is not likely to adversely affect Mexican spotted owl critical habitat and is likely to have long term beneficial effects.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Endangered Species Act Status:Endangered, 1995
Forest Occurrence:Apache-Sitgreaves, Tonto, Coconino, Prescott
Recovery Plan:Final, 2002
Critical Habitat:None Designated
Effects Finding:Not Likely to Adversely Affect

Natural History

The SWWF (southwestern willow flycatcher) is one of five subspecies of the willow flycatcher. It is a neotropical migrant that breeds in the southwestern United States and winters in Mexico, Central America, and extreme northern South America. SWWF arrive on breeding grounds in Arizona and New Mexico in late April and early May. Nesting begins in late May and early June. Average clutch size is three to four eggs. The time from egg laying to fledging is short (28 days). Renesting is uncommon if the first nesting attempt is successful, but is regularly attempted if the first clutch is lost or abandoned (U.S. Fish and Wildlife Service 2002).

SWWF nest in lowland riparian communities typically where there are dense patches of willow, buttonbush, boxelder, and *Baccharis* spp., sometimes with a scattered overstory of cottonwood. Nest sites typically have a dense canopy. SWWF have been known to successfully nest in stands of tamarisk and other nonnative species (U.S. Forest Service 2000). In almost all cases, water that is still or slowly moving or saturated soils are present at or near the breeding site (U.S. Fish and Wildlife Service 2002). Nests are open cup structures typically placed in the fork of a branch from 2-7 m (6.5-23 ft) above ground (U.S. Fish and Wildlife Service 2002).

SWWF feed on small to medium-sized insects. They use "sit-and-wait" foraging with long periods of perching interspersed with foraging bouts (U.S. Fish and Wildlife Service 2002).

Distribution

Historically, the SWWF bred in lowland riparian areas in California, Arizona, New Mexico, Texas, and Utah, with possible breeding in Nevada and Colorado. In California, the historical range of the SWWF included all lowland riparian areas in the southern third of the state. In Arizona, the SWWF nested in portions of all major watersheds (the Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro rivers). In New Mexico, the SWWF occurred in the Rio Grande, Chama, Zuni, San Francisco, and Gila drainages, with records from the Pecos River and Penasco Creek. In Texas, the SWWF occurred in the Rio Grande, Guadalupe Mountains, and Davis Mountains. In southern Utah, the SWWF was a locally common breeding resident along the Colorado River and its tributaries (U.S. Fish and Wildlife Service 1995).

Currently, SWWF no longer breed in Texas, but still breed in the other states where they were found historically. However, there have been declines in all of the states in the number of breeding territories and nesting locations (U.S. Fish and Wildlife Service 2002).

SWWF habitat surveys were conducted along the Verde River in post-flood conditions of 1994. At that time, no suitable nesting habitat was identified, and it appeared unlikely that potential habitat occurred. However, more recent evaluations suggest some areas could be suitable. Due to recovery from floods and grazing, at least three areas are currently expressing small (< 1 acre), dense patches of cottonwood regeneration. Although SWWF have not been observed to nest in cottonwood trees, these stands may be suitable based on vegetation density. Two of these sites are below the Clarkdale gauging station at the confluence of Sycamore Creek and the Verde River, and the third is near Alvarez Ranch.

The suitable breeding habitat is at the Tuzigoot/Tavasci habitat complex near Clarkdale. These habitats were last occupied by SWWF in 1996. Changes in vegetation structure might explain why these areas are no longer occupied.

Status (Range-wide)

The SWWF recovery plan (U.S. Fish and Wildlife Service 2002) divides the range of the SWWF into six Recovery Units (RU). These recovery units represent major river drainages. Each recovery unit is further subdivided into smaller Management Units (MU) (Table 5). The breeding territory is the measure of abundance used for each MU and for the RU as a whole. There are 816 breeding territories range-wide.

Table 8. Current status of the SWWF by recovery unit and management unit (Survey data from M. Sogge, e-mail pers. comm. with C. Woods, 24 June 2003).

Recovery Unit	Management Unit	Number of Territories (avg. of last 3 surveys)
Basin and Mojave	Amargosa	5
	Kern	24
	Mojave	8
	Owen's	20
	Salton	3
Coastal California	San Diego	80
	Santa Ana	30
	Santa Clara	5
	Santa Ynez	17
Upper Colorado	Powell	no data
	San Juan	2
Lower Colorado	Virgin	26
	Middle Colorado	12
	Little Colorado	7
	Pahranagat	24
	Hoover-Parker	16
	Bill Williams	33
	Parker-Southerly International Boundary	3
Gila	Lower Gila	no data
	Hassayampa-Aqua Fria	1
	Verde	5
	Roosevelt	110
	San Francisco	2
	Upper Gila	204
	Middle Gila-San Pedro	124
	Santa Cruz	0
Rio Grande	San Luis Valley	34
	Upper Rio Grande	18
	Middle Rio Grande	36
	Lower Rio Grande	5
	Texas	no data
	Pecos	no data

SWWF are known to breed in four MUs (Roosevelt, San Francisco, Verde, and Little Colorado) on national forests in Arizona. The Roosevelt and Verde MUs are on the Tonto and Prescott NFs and the San Francisco and Little Colorado MUs are on the Apache-Sitgreaves NF. Table 6 shows the territories in these MUs from 1993-2001. There was a 3-year average of 115 breeding territories on Arizona national forests as of 2001. Surveys in 2002 located 146 territories in the Roosevelt MU, 13 territories in the Verde MU, 1 territory in the San Francisco MU, and 1 territory in the Little Colorado MU (Smith *et al*. 2002). In addition, there are old records of SWWF on the Verde River in the vicinity of Cottonwood and Camp Verde on or near the

Coconino and Prescott NFs. While records show this area being occupied from 1993-2000 (Paradzik and Woodward, 2003), surveys in these areas in 2002 detected no SWWF (Smith *et al*. 2002).

Table 9. Known SWWF territories on national forests in Arizona, 1993-2001 (Survey data from M. Sogge, e-mail pers. comm. with C. Woods, 24 June 2003).

Year	Gila RU			Lower Colorado RU
	Roosevelt MU	Verde MU	San Francisco MU	Little Colorado MU
1993	5	1	5	5
1994	33		5	5
1995	21		4	9
1996	39		3	11
1997	39	2	2	7
1998	48	0	3	7
1999	76	0	3	5
2000	115	0	2	3
2001	140	0	1	2
3-year avg.	110	0	2	3

Riparian habitat loss and modification are the main reasons for the SWWF's decline and lack of recovery. Riparian habitat loss and modification occur due to dams and reservoirs, which alter natural stream flow patterns; groundwater pumping, which may lower water tables and reduce riparian potential; stream channelization and bank stabilization, which separate the stream from its floodplain; removal of riparian vegetation; livestock grazing; recreation; fire; agricultural development and urban development (U.S. Fish and Wildlife Service 2002).

Secondary threats to the SWWF are exotic plant species (especially tamarisk) and brood parasitism from brown-headed cowbirds (U.S. Fish and Wildlife Service 2002). Because of the small population size, and the degree of fragmentation between breeding populations, SWWF are susceptible to demographic stochasticity and reduced genetic variation (U.S. Fish and Wildlife Service 2002).

Status (Within the Action Area)

Nesting vegetation for the SWWF varies from a saltcedar (*Tamarix* spp.) dominated understory with patchy Fremont cottonwood (*Populus fremontii*) and/or Goodding's willow (*Salix gooddingii*) overstory to pure stands of saltcedar.

Special Conservation Measures for the Southwestern Willow Flycatcher

The following conservation measures would be implemented for SWWF.

1. No biological control of tamarisk anywhere on the three forests (SWWF Recovery Plan, pg. 121) until further NEPA analysis and ESA Section 7 compliance is documented.

2. Treatment within patches would comply with the southwestern willow flycatcher Recovery Plan.
3. FS biologist would determine patch size for nesting areas per the SWWF Recovery Plan and identify sites on the ground prior to treatments.
4. FS biologist would confirm occupancy during the breeding season (April through August, SWWF RP pg.21).
5. For occupied breeding patches, applications adjacent to breeding patches would occur 100 meters from the edge of the patch (SWWF RP, pg H-21).
6. Herbicides would be applied per guidelines in RPMPA pg. 64. (See summary table)

Effects Analysis (Southwestern Willow Flycatcher)

There are no SWWF nesting in the project area. The project area may provide some suitable habitat for SWWF near and just beyond treatment areas, but these areas would be left in natural vegetation. Saltcedar, which can provide SWWF habitat, is an undesirable plant and it is targeted for removal as a noxious weed in this project. Implementing the Conservation Measures would minimize any impacts from treatments that might either disturb SWWF or damage their habitat. These measures include timing restrictions to avoid disturbance and/or the use of selective herbicides or hand application of herbicides to remove only noxious weeds and leave desirable vegetation.

Flycatchers prefer to forage over riparian or marshy areas where prey insects are abundant. There is virtually no chance that southwestern willow flycatchers would come in contact with herbicides through direct application or through brushing against freshly sprayed vegetation as applications near known SWWF habitat would occur outside of the breeding season. It is unlikely SWWF would ingest herbicides that are on insect prey because herbicide applications would be very infrequent outside the breeding season. In the rare instance that some herbicides were consumed, the risk analysis indicates a low risk from this amount of ingestion.

The possibility of effects to SWWF or their habitat from herbicide use is further reduced by the special conservation measures of not be applying herbicides within known/occupied southwestern willow flycatcher habitat and not applying chlorsulfuron, chlopyralid, 2,4-D (any formulation), glyphosate (nonaquatic Roundup), imazapyr (technical formulation), metsulfuron methyl, and triclopyr (amine salt formulation) within 15 m (50 ft) (by spot applications using hand operated equipment) or 30 m (100 ft) (by mechanized ground applications) of the edge of known SWWF habitat. The combination of low herbicide toxicity, low potential for herbicide exposure, and application of the special conservation measures makes the possibility of effects to the SWWF from the proposed program of noxious and invasive weed treatments insignificant and discountable.

The conservation measures for the SWWF listed above would protect insect prey in aquatic environments.

The practice of not using Chlorsulfuron, chlopyralid, 2,4-D (any formulation), glyphosate (nonaquatic Roundup), imazapyr (technical formulation), metsulfuron methyl, and triclopyr (amine salt formulation) within 15 m (50 ft) (by spot applications using hand operated equipment) or 30 m (100 ft) (by mechanized ground applications) of the edge of southwestern willow flycatcher habitat to protect woody vegetation would also apply to stream reaches that have been

identified in the Southwestern Willow Flycatcher Recovery Plan (U.S. Fish and Wildlife Service 2002) as suitable for occupation by expanding flycatcher populations.

Effects Finding (Southwestern Willow Flycatcher)

The preferred alternative for noxious and invasive weed treatments with the conservation measures is not likely to adversely affect the southwestern willow flycatcher.

Yuma clapper rail (Rallus longirostris yumanensis)

Endangered Species Act Status:Endangered, 1967
Forest Occurrence:Coconino, Tonto
Recovery Plan:Final, 1983
Critical Habitat:None designated
Effects Finding:May affect, not likely to adversely affect

Natural History

The Yuma clapper rail is one of seven subspecies of *Rallus longirostris*. The Yuma clapper rail breeds in shallow water near shore of fresh water or brackish marshes with cattail and bullrush stands. Densities of rails are highest in light cattail stands, followed in descending order by light bullrush stands, dense bullrush stands, and dense cattail stands. Stands dissected with narrow channels of flowing water have higher densities of birds (U.S. Fish and Wildlife Service 1983).

Clapper rails feed on crayfish, small fish, clams, isopods, and insects (U.S. Fish and Wildlife Service 1983). They begin nesting in February, with egg-laying occurring from March to July (Salt River Project 2002). Clutch size is typically 6-8 eggs, and young are precocial (Salt River Project 2002).

Distribution

There is reason to believe that the Yuma clapper rail expanded its range northward along the Colorado and Gila rivers due to the creation of marsh habitat from diversion dams (U.S. Fish and Wildlife Service 1983). Historically, the Yuma clapper rail occurred in the southern part of the Colorado River from Yuma, Arizona, southward. Construction of dams along the Colorado and other rivers caused the formation of large silt deposits, which in turn developed into cattail marshes (U.S. Fish and Wildlife Service 1983). Depending on sediment load and dam height, clapper rail habitat takes from 10-15 years to develop after the construction of an impoundment (U.S. Fish and Wildlife Service 1983). The increased habitat availability let the clapper rail expand its range northward as the habitat developed.

Currently, the Yuma clapper rail breeds in marshes along the Colorado River from the Nevada-California border south to the Colorado River delta in Mexico. Smaller breeding populations are also found around the Salton Sea and the Gila River basin in Arizona (U.S. Fish and Wildlife Service 1983). Within national forests, vagrant birds occur at Roosevelt Lake on the Salt River

(Tonto NF), and wintering birds have been observed adjacent to the Coconino NF at Tavasci Marsh near Flagstaff.

Status (Rangewide and Within the Action Area)

From about 1970 through 1983, an estimated 1,700 breeding Yuma clapper rails occurred from the Colorado River delta to Arizona, including the birds around the Salton Sea in California (U.S. Fish and Wildlife Service 1983). More recent data (Salt River Project 2002) estimates 500-1,100 birds in the lower Colorado River Basin, including the 9-55 birds on the Gila River near Phoenix, Arizona.

Within National Forest System lands in Arizona, the Yuma clapper rail occurs on the Tonto NF at Roosevelt Lake (Salt River Project 2002), and on lands adjacent to the Coconino NF (C. Overby, pers. comm. 19 June 2003). A single bird was observed on the Tonto NF in 2002. This bird was most likely a vagrant (B. Burger, pers. comm., e-mail dated 11 June 2003). Adjacent to the Coconino NF, several Yuma clapper rails were observed wintering in Tavasci Marsh in 2003 (C. Overby, pers. comm. 19 June 2003). No breeding Yuma clapper rails have been documented, although suitable habitat exists on both the Tonto and Coconino NFs.

Limiting factors for the Yuma clapper rail are availability of marsh habitat and food (U.S. Fish and Wildlife Service 1983). Threats to the Yuma clapper rail are the loss of marsh habitat due to river management activities, including fluctuating reservoir levels (Salt River Project 2002). However, the impoundments along the lower Colorado River and its tributaries have created habitat for the rail.

Special Conservation Measures for the Yuma Clapper Rail

In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures would be adopted.

1. Herbicides would be applied per guidelines in RPMPA pg. 64. (See summary table)
2. FS biologist will determine nesting areas and identify the site on the ground prior to treatment.
3. FS biologist would confirm occupancy during the breeding season (March through July).
4. In occupied breeding areas, applications adjacent to breeding areas would occur outside the time of occupancy.

Effects Analysis (Yuma Clapper Rail)

Yuma clapper rails are water birds that would stay near their marsh habitats. They feed on crayfish, small fish, clams, isopods, and insects. The mitigations, BMPs, and special conservation measures described above would protect Yuma clapper rails from any herbicide exposure and would protect the rail’s aquatic environment from any herbicide contamination. These conservation measures make the possibility of effects to the Yuma clapper rail from the proposed program of noxious and invasive weed treatments insignificant and discountable.

Effects Finding (Yuma Clapper Rail)

The preferred alternative for noxious and invasive weed treatments with the conservation measures is not likely to adversely affect the Yuma clapper rail.

Chiricahua leopard frog (*Rana chiricahuensis*)

Status:Threatened, 2002
Forest Occurrence:Coconino
Recovery Plan:No
Critical Habitat:None Designated
Effects Determination:Not likely to adversely affect

Natural History

Leopard frogs, as a group, are habitat generalists that can adapt to a variety of wetland situations. Suitable Chiricahua leopard frog habitat includes lakes, rivers, streams, springs, ponds, and man-made structures such as reservoirs, stock tanks, and acequias (Sredl and Jennings, in press). This frog is found at elevations of 1,000-2,710 m (3,200-8,900 ft) (Platz and Mecham 1979, Sredl *et al.* 1997). It is occasionally found in livestock drinkers, irrigation sloughs and acequias, wells, abandoned swimming pools, backyard ponds, and mine adits (Sredl and Jennings, in press). The frog uses permanent or nearly permanent pools and ponds for breeding. Most sites that support populations of this frog would hold surface water yearlong in most years. Time from hatching to metamorphosis is shorter in warm water than in cold water; water permanency is probably more important at higher elevations and in the northern portion of the species' range.

Likely to be occupied habitats include: 1) currently suitable habitat where the frog has been documented within the last 10 years, but is apparently now absent, or 2) suitable habitat that is (a) within 1.6 km (1 mi) overland of occupied habitat, (b) within 4.8 km (3 mi) along an ephemeral or intermittent drainage from occupied habitat, or (c) within 8 km (5 mi) along a perennial stream from occupied habitat. Most of the Forests have been surveyed extensively for ranid frogs within the last 10 years.

Understanding Chiricahua leopard frog dispersal abilities is crucial to determining the likelihood that a frog population would colonize nearby suitable habitats. In August 1996, Rosen and Schwalbe (1998) found up to 25 young adult and subadult Chiricahua leopard frogs at a roadside puddle in San Bernardino Valley, Arizona. They believed the only possible origin of these frogs was a stock tank located 5.5 km (3.4 mi) away. Rosen *et al.* (1996) found small numbers of Chiricahua leopard frogs at two locations in Arizona that supported large nonnative predator populations. They suggested these frogs must have come from elsewhere because predation would have precluded successful reproduction. They believed populations 2-7 km (1.2-4.3 mi) away were the likely source of these frogs. In the Dragoon Mountains of Arizona, Chiricahua leopard frogs breed at Halfmoon Tank, but frogs occasionally turn up at Cochise Spring, which is 1.3 km (0.8 mi) down the canyon in an ephemeral drainage, and in Stronghold Canyon, which is 1.7 km (1.1 mi) down the canyon. No breeding habitat exists for Chiricahua leopard frogs at Cochise Spring or Stronghold Canyon, thus it appears frogs at these sites are immigrants from Halfmoon Tank. In the Chiricahua Mountains, a population of Chiricahua leopard frogs

disappeared from the Silver Creek stock tank after the tank dried up, but frogs then began to appear in Cave Creek, which is about 1.0 km (0.6 mi) away, again suggesting immigration. Movements away from water appear to be nonrandom. Streams are important dispersal corridors for young northern leopard frogs (Seburn *et al.* 1997). Displaced northern leopard frogs would "home" and apparently use olfactory, auditory, and possibly celestial orientation as guides (Dole 1968, 1972). Rainfall or increased ambient humidity may be an important factor in dispersal because odors carry well in moist air making it easier for frogs to find other wetland sites (Sinsch 1991).

Distribution

The Chiricahua leopard frog is found in central and southeastern Arizona and in west-central and southwestern New Mexico. In Mexico, the species is found in northern Sonora, the Sierra Madre Occidental of Chihuahua, and northern Durango. In Arizona, the species was historically widely distributed on the Coronado, Tonto, and Apache-Sitgreaves NFs. The most extant localities are on the Coronado NF. The distribution of the species in Mexico is unclear due to limited survey work and the presence of closely related taxa (especially *Rana montezumae*) in the southern part of the range of the Chiricahua leopard frog.

In Arizona, slightly more than half of historical localities were natural lotic systems, a little less than half were stock tanks, and the rest were lakes and reservoirs. Currently in Arizona, 63% of extant populations are in stock tanks. In New Mexico, of the sites Chiricahua leopard frogs occupied from 1994-1999, 67% were creeks or rivers, 17% were springs or spring runs, and 12% were stock tanks.

Status (Range-wide and Within the Action Area)

Threats to this species include predation by nonnative bullfrogs, fishes, and crayfish; disease; drought; floods; degradation and destruction of habitat; water diversions and groundwater pumping; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; fire regimes altered due to livestock grazing and fire suppression; and environmental contamination. Chytridiomycosis is a disease affecting amphibian populations globally and has been found in Chiricahua leopard frogs in Arizona and New Mexico.

The species is rarely found where nonnative fish, bullfrogs, or crayfish inhabit aquatic sites. Chiricahua leopard frogs may occur in the presence of low densities of nonnative predators in complex systems or large aquatic sites.

Aquatic habitats may become unsuitable for Chiricahua leopard frogs due to increased amounts of sediments, longer or more frequent periods of intermittency, reduced flows, dewatering of ponds or bank chiseling. In certain situations, altering livestock grazing practices may help restore aquatic habitats.

In Arizona, 63% of the extant Chiricahua leopard frog localities are stock tanks, versus only 35% of the extirpated localities (Sredl and Saylor 1998), suggesting Arizona populations of this species have fared better in stock tanks than in natural habitats. Stock tanks provide small patches of habitat that are often dynamic and subject to drying and elimination of frog populations. However, Sredl and Saylor (1998) also found that non-native predators (with the exception of bullfrogs) occupy stock tanks less frequently than natural sites.

The majority of Chiricahua leopard frog occurrences on National Forest System lands in Arizona are on the Coronado NF. There are few Chiricahua leopard frog occurrences on the Coconino NF. East of Camp Verde in the vicinity of the West Clear Creek and Fossil Springs wilderness areas is near several leopard frog occurrences. Three of these occurrences are directly adjacent to the roadway either within the right-of-way or within 60 m (200 ft) of the right of way. At least 6 occurrences are less than 3.2 km (2 mi) downstream from the highway.

Special Conservation Measures for the Chiricahua Leopard Frog

In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures would be adopted for Chiricahua leopard frog habitat that is occupied, unsurveyed, or inconclusively surveyed.

1. Herbicides would be applied per guidelines in RPMPA pg. 136. (See summary table)

2. If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Effects Analysis (Chiricahua Leopard Frog)

The special conservation measures for Chiricahua leopard frog listed above would protect Chiricahua leopard frogs and their environments. By only applying aquatic approved herbicides and limiting the timing of application based on the possibility of precipitation, the likelihood of any Chiricahua leopard frogs being impacted by any herbicide applications is discountable. The impacts of such an application would be insignificant with the protection measures in place. These conservation measures make the possibility of effects to the Chiricahua leopard frog from the proposed program of noxious and invasive weed treatments insignificant and discountable.

Effects Finding (Chiricahua Leopard Frog)

The preferred alternative for noxious and invasive weed treatments with the conservation measures is not likely to adversely affect the Chiricahua leopard frog.

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Appendix 1

RPMPA Herbicide Application Summary Table for terrestrial species in consultation with the FWS

Federal Species/ Herbicides	Arizona cliffrose	Chiricahua leopard frog	MSO	Southwestern willow flycatcher	Yuma clapper rail
2, 4-D (acid formulations)	May not be used in habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April – August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July
2, 4-D (aquatic amine salt formulations)	May not be used in habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April – August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July
2, 4-D (nonaquatic amine salt formulations)	May not be used in habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April – August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July

Federal Species/ Herbicides	Arizona cliffrose	Chiricahua leopard frog	MSO	Southwestern willow flycatcher	Yuma clapper rail
2, 4-D (aquatic ester formulations)	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
2, 4-D (nonaquatic ester formulations)	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
CHLORSULFURON	May not be used in or near habitat	May be applied on land below or above the high water line of species habitat.	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April-August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July
CLOPYRALID	Conduct test treatments of the herbicide on ex situ Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones Treatments should be done in fall	May be applied on land below or above the high water line of species habitat.	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April-August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July

Federal Species/ Herbicides	Arizona cliffrose	Chiricahua leopard frog	MSO	Southwestern willow flycatcher	Yuma clapper rail
	Apply herbicide on the starthistle rosettes when the soil is dry and Arizona cliffrose is not as actively growing, such as late fall and winter				
DICAMBA	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May not be sprayed in MSO PACS Spot-300 ft outside PACs & unsurveyed habitat Mechanized-1/4 mile outside PACs & unsurveyed habitat	Spot - 10 ft Mechanized - 60 ft Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 20 ft buffer ULV - 200 ft buffer Breeding season timing restriction - March - July
GLYPHOSATE (aquatic)	May not be used in or near habitat	May be applied on land below or above the high water line of species habitat.	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
GLYPHOSATE (nonaquatic)	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April-August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July

Federal Species/ Herbicides	Arizona cliffrose	Chiricahua leopard frog	MSO	Southwestern willow flycatcher	Yuma clapper rail
IMAZAPIC	Conduct test treatments of the herbicide on ex situ Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones Treatments should be done in fall Apply herbicide on the starthistle rosettes when the soil is dry and Arizona cliffrose is not as actively growing, such as late fall and winter	May be applied on land below or above the high water line of species habitat.	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
IMAZAPYR (technical formulation)	May not be used in or near habitat	May be applied on land below or above the high water line of species habitat.	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April-August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July
IMAZAPYR (aquatic)	May not be used in or near habitat	May be applied on land below or above the high water line of species habitat.	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July

Federal Species/ Herbicides	Arizona cliffrose	Chiricahua leopard frog	MSO	Southwestern willow flycatcher	Yuma clapper rail
IMAZAPYR (nonaquatic)	May not be used in or near habitat	May be applied on land below or above the high water line of species habitat.	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
METSULFURON-METHYL (see note below)	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	Spot - no buffer Mechanized - 30 ft Breeding season TR - April-August Breeding Season buffer - 100 meters from edge of patch	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July
PICLORAM (see note below)	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed along road ROW during BS May be applied in rest of PAC outside breeding season	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
SULFOMETURON-METHYL	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July
TRICLOPYR (amine salt formulations)	May not be used in or near habitat	May be applied on land below or above the high water line of species habitat.	May be sprayed along road ROW during BS May be applied in	Spot - no buffer Mechanized - 30 ft Breeding season TR - April-August	Spot applications within species habitat, 1/2 mile upstream (including tributaries), and 300 ft

Federal Species/ Herbicides	Arizona cliffrose	Chiricahua leopard frog	MSO	Southwestern willow flycatcher	Yuma clapper rail
			rest of PAC outside breeding season	Breeding Season buffer - 100 meters from edge of patch	downstream: Liquid - 10 ft buffer ULV - 150 ft buffer Breeding season timing restriction - March - July
TRICLOPYR (ester formulations)	May not be used in or near habitat	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 50 ft buffer	May be sprayed within PAC outside of No Activity center during the BS	No buffer - Breeding season timing restriction - April-August Breeding Season buffer - 100 meters from edge of patch	No buffer – Breeding season timing restriction - March - July

Notes:

RPMPA - Resource Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service. J. Allen White, U.S. Fish and Wildlife Service, 10711 Burnett Road, Suite No. 200, Austin, Texas 78758, July 2004.

These RPMPAs are to be implemented in concert with the Design Features detailed in Appendix E of the FEIS for the Tri-Forest Noxious and Invasive Weed Treatments

Metsulfuron = metsulfuron is rated as Class 1 in toxicity groups for fish and amphibians due to reported mortality incidents not indicated by toxicity data

Picloram = picloram is used mostly for broad-leaved plants but can harm some grasses and other monocots

1 - A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between three to ten miles per hour, and no rainfall for 24 hours) should be followed in implementing recommended buffer zones.

2 - Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.

3 - Low aerial applications (nozzle or spreader height less than 12 feet) and high aerial applications (nozzle or spreader height greater than 12 feet) are relative to the plant canopy or a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40% grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40% grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

4 - Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.

5 - Liquid formulations include any type of liquid-based formulation other than ULV formulations.

6 - ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre

BS - Breeding Season
ROW - Right of way
PAC - Protected Activity Center
MSO - Mexican spotted owl
TR - Timing restriction

Appendix 2

Adjuvant Summary Table and Design Features

Federal Species	ACTIVATOR 90, SILWET L-77, CHOICE, LI 700, ACIDI pHACTANT, ALL CLEAR, Tank and Equipment Cleaner	MSO, AMIGO, Marker dye WSP, CHEM-TROL, NU FILM P, FIGHTER F, FOAM FIGHTER
Chiricahua leopard frog, Southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail	Shall not be used in riparian habitat*.	Approved for use in riparian habitat.
Arizona cliffrose, Mexican spotted owl	Approved for use in habitat.	Approved for use in habitat.

***Riparian habitat** - Overstory trees include alders, conifers, cottonwood, maple, sycamore, and willows. Understory species include hackberry, New Mexico locust, and soapberry. Herbaceous plants include sedges, spikerush, bull rush, little bluestem, blue grama, Canadian wildrye, sand bluestem, squirreltail, smartweed, and curlydock (EIS vegetation affected environment).

Biological Evaluation for Sensitive Terrestrial Species Within or Potentially Affected by Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests in Coconino, Gila, Mojave, and Yavapai Counties, Arizona

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November 18, 2004

Description of Project:

Location: The project location includes all reserved public lands, wilderness, and non-wilderness, within the three national forests: Coconino, Kaibab and Prescott. Of the 4.9 million acres, about 187,500 acres (or 3 percent of the land area) have been identified as being impacted with noxious weeds. Five watersheds have been inventoried within the project area and include the Verde River (2,139,405 acres), Little Colorado (1,089,255 acres), Colorado/Grand Canyon (1,011,660 acres), Middle Gila (480,835 acres), and Bill Williams (186,635 acres). Numerous private parcels are found within or adjacent to the three national forests. This project excludes ADOT highway rights-of-way.

Purpose: The purpose of this project is to eradicate, contain, control or prevent weeds within the three national forests. The desired goal is to prevent any new weeds from becoming established, contain or control the spread of 14 known invasive species, and eradicate 8 species which are the most invasive and pose the greatest threat to the biological diversity within the project area. The control of these plants would promote the ecosystem health of forested and rangeland habitats by maintaining or improving native forbs and grass species, increasing the regeneration of cottonwood and willow trees in riparian corridors, and ultimately preventing the loss of wildlife habitat.

Project objectives: The 3 national forests propose to authorize annual treatments of weed infestations scattered throughout the forests. There are currently 25 species of noxious and invasive weeds found within the project area and 4 new species that have been found adjacent to the national forests. Sites range in size from single plants to a population of one species covering several thousand acres. The various methods analyzed under the integrated weed management approach include: manual; mechanical (clipping, mowing, tilling, steaming and burning); cultural (grazing by livestock, fertilization, seeding of competitive plants, and the use of weed seed-free seed mixes and mulches); biological; and herbicidal.

The annual combination of methods to be used would vary depending on specific conditions. Riparian invasive weeds could be treated up to water's edge using methods approved for this type of application. Over the planning horizon of 10 years, it is estimated that 2 to 3 percent of the total national forest lands would be treated. Repeated treatments or re-treatments would be necessary for most weed species because seeds in the soil can be viable for 10 or more years. Therefore, recurring actions would be authorized until the desired control objective is reached.

Selected Alternative – Alternative 4

This alternative was also established to address the three significant issues; this action includes the option of herbicide use. Interstates, U.S. highways, and State highways will be covered under the Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona (2004).

This alternative would treat 31,047 weed infested acres on the ground with repeated visits over next ten years. This would require 124,050 acres of total treatments (or approximately 4 revisits per site); about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally (including re-vegetation), 16,000 biologically, and 57,000 acres with herbicides. Adaptive management principles apply.

Limited spray zones would be established adjacent to and within 1 mile of communities, recreation sites, trailheads, and scenic overlooks. Sites where non-herbicidal treatment methods will be effective due to species, population size, or site factors will be targeted for all integrated weed treatment methods except herbicides. Herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds where treatment objectives cannot be met using manual techniques. Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met.

Communication systems will be established to notify individuals and groups who are collecting plants or traveling through zones where herbicides are scheduled for use. Proposed treatment plans will be posted on the World Wide Web and updated regularly to show time periods during which certain areas could be treated. This information will also be available on a 1-800 phone number. Specific actions will also be included and identification of alternative routes around the treated zones, if available.

Integrated Weed Management Strategies

Alternative 4, the selected alternative, is a combination of Alternatives 1 and 3 in that it uses all treatment methods but is designed to minimize herbicide use in the limited spray zones. For a detailed description of the alternatives, see Chapter 2 of the FEIS.

An integrated combination of methods will be needed to control such aggressive and adaptable noxious and invasive weeds. Our adaptive management strategy will include extensive mapping and consistent monitoring following treatments and re-vegetation to determine which control methods continue to be most effective.

For more details see the Wildlife Specialist Report.

Required Protection Measures (Project Design Features):

RPMPA refers to the Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service authored by J. Allen White, July 2004. For this project, the RPMPAs were the starting point for the conservation measures. The table below summarizes how the conservation measures deviate from the RPMPAs and the rationale for that deviation.

See Appendix 1 for summary of RPMPA and adjustments. See Appendix 2 for a summary of where the adjuvants may be used.

General Project BMPs:

1. Implement Integrated Weed Best Management Practices.
2. Survey T&E species' habitats to determine and prioritize the occupied and potential habitats that would be most vulnerable to encroachment of invasive and noxious weeds.
3. Use native species for seeding and planting during revegetating. An exception is the use of sterile hybrid grasses after careful analysis to provide immediate ground cover after wildfires.

4. FS will review "weed-free" certifications for seed and mulch to ensure they are "free" of the weed species to be controlled in the action area.
5. Treatments that are not within these design features would require additional analysis and may require additional coordination with the FWS (U.S. Fish and Wildlife Service).
6. Work cooperatively with adjacent landowners to manage noxious or invasive weeds to prevent their spread into NFS (National Forest System) lands.

All species:

1. Where specified, species breeding season timing restrictions and buffers are applicable to all treatment methods that are not commensurate with the designated uses.
2. Where two or more species' habitats occur, the more restrictive measures will take priority.
3. Noxious or invasive weed treatment methods during the breeding seasons for birds would be commensurate with designated uses (non-motorized, motorized, livestock, etc.) in the treatment areas.
4. Adjuvants including surfactants and cleaners would be used or applied according to the adjuvant summary table.
5. Forest Service would submit to the FWS an annual report of herbicide treatments occurring within T&E species' habitat.

Yellow-billed cuckoo:

1. Herbicides would be applied per guidelines in RPMPA pg. 64. (See summary table)
2. FS biologist would determine patch size for nesting areas and identify sites on the ground prior to treatments.
3. FS biologist would confirm occupancy during the breeding season (May through August).
4. In occupied breeding areas, treatments adjacent to breeding areas would occur outside the time of occupancy.

Northern, and Lowland leopard frogs:

1. Herbicides would be applied per guidelines in RPMPA pg. 136. (See summary table)
2. If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Northern goshawk:

1. Breeding season is March 1-September 30.

2. No treatments may occur within occupied "Nest stands". FS Biologist to determine occupancy.
3. Specified herbicides may be applied along road right of ways in goshawk PFAs during the breeding season (Same as MSO).
4. Only specified herbicides may be applied within goshawk PFAs (Same as MSO).
5. Specified herbicides may be applied from FS system trails during the breeding season commensurate with the designated trail use (non-motorized, motorized, livestock).
6. Specified herbicides may be applied during the breeding season to the remainder of the goshawk PFA outside of the "Nest stand" by non-motorized methods.

Species considered and evaluated:

Terrestrial and Aquatic Wildlife Species –Sensitive

There are 23 species are classed as sensitive and are currently found on the USDA Forest Service Region 3 list for terrestrial and aquatic wildlife.

Table 4. Sensitive Animal Species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat (Yes, No, Unknown)	Invasive Species in Habitat
Coccyzus americanus occidentalis	Yellow-billed cuckoo	C	Verde river, tributaries, and small creeks in Agua Fria drainage	Low elevation Riparian	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Pyrgulopsis morrisoni	Page springsnail	C	Page Springs	Riparian	Yes	Himalayan blackberry
Anodonta californiensis	California floater	S	East Clear Creek	Riparian	Unknown	Unknown
Pyrgulopsis simplex	Fossil Springsnail	S	Fossil Creek	Riparian	Yes	Himalayan blackberry
Pyrgulopsis glandulosa	Verde Rim Springsnail	S	Sycamore Creek (Pine Mtn.)	Riparian	Unknown	Unknown
Cicindela oregona maricopa	Maricopa Tiger Beetle	S	Verde river, Prescott area, Agua Fria drainage, Hassayampa cr.	Low elevation Riparian	Yes	Tamarisk
Agathymus aryxna	Giant Aryxna Skipper	S	Coconino NF	Shrubland, woodland-chaparral, pinyon-juniper	Unknown	Unknown

Table 4. Sensitive Animal Species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat (Yes, No, Unknown)	Invasive Species in Habitat
Agathymus baueri freemani	Freeman's Agave Borer	S	Coconino NF	Shrubland, woodland-chaparral, pinyon-juniper	Unknown	Unknown
Agathymus neumoegeni	Neumogen's Giant Skipper	S	Coconino NF	Shrubland, low elevation grassland, woodland-chaparral	Unknown	Unknown
Callophrys comstocki	Comstreak's hairstreak	S	Coconino NF	Shrubland, ponderosa-oak, mixed conifer, woodland-chaparral	Unknown	Unknown
Incisalia fotis	Early Elfin	S	Coconino NF	Woodland-chaparral	Yes	Dalmatian toadflax
Limenitis archippus obsolete	Obsolete Viceroy Butterfly	S	Oak Creek and Verde river	Low elevation Riparian	Unknown	Unknown
Bufo microscaphus microscaphus	Southwestern (Arizona) toad	S	Coconino, Kaibab and Prescott NF	Low elevation Riparian	Yes	water primrose
Rana pipiens	Northern Leopard Frog	S	Coconino and Kaibab NF	High elevation Riparian	Yes	tamarisk
Rana yavapaiensis	Lowland Leopard Frog	S	Verde river and Agua Fria drainages	Low elevation Riparian	Yes	tamarisk
Thamnophis eques megalops	Mexican garter snake	S	Verde River, Oak Creek	Low elevation Riparian	Yes	water primrose, Eurasian water milfoil, Himalayan blackberry, giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Thamnophis rufipunctatus	Narrow-headed garter snake	S	Coconino and Prescott NF	Riparian	Unknown	Unknown
Xantusia vigilis arizonae	Arizona Night Lizard	S	Coconino NF	Woodland-chaparral	Unknown	Unknown

Table 4. Sensitive Animal Species for the Coconino, Kaibab, and Prescott National Forests

Scientific Name	Common Name	Status*	Location	Vegetation Type	Weeds in Habitat (Yes, No, Unknown)	Invasive Species in Habitat
Accipiter gentilis	Northern goshawk	S	Coconino, Kaibab and Prescott NF	Ponderosa-oak, mixed conifer	Yes	leafy spurge, knapweed species, Dalmatian toadflax, biennial thistles
Buteogallus anthracinus	Common Black Hawk	S	Coconino and Prescott NF	Low elevation Riparian	Yes	giant reed, tamarisk, tree of Heaven, Russian olive, Siberian elm, Russian knapweed, whitetop
Falco peregrinus anatum	American Peregrine Falcon	S	Coconino, Kaibab, and Prescott NF	Cliffs	Yes	bull thistle
Vireo bellii	Bells' vireo	S	Coconino NF	Low elevation Riparian	Unknown	Unknown
Lutra canadensis sonora	Southwestern river otter	S	Verde river	Riparian	Yes	giant reed, tree of Heaven, Russian knapweed, whitetop, Russian olive, tamarisk, Siberian elm
Microtus mexicanus navaho	Navajo Mexican vole	S	Coconino and Kaibab NF	Riparian, high elevation grassland, ponderosa-oak	Yes	Dalmatian toadflax, bull thistle
Perognathus amplus cineris	Wupatki Arizona Pocket Mouse	S	Coconino NF	High elevation grasslands, pinyon-juniper	Unknown	Unknown

* T = Threatened, E = Endangered, C = Candidate species as classified by the U.S.Fish and Wildlife Service according to the Endangered Species Act. S = Sensitive species according to the Forest Service Region 3 Regional Forester's list.

The above-listed species are described below.

Western yellow-billed cuckoo is a late migrant and summer resident requiring large tracts of undisturbed riparian deciduous forests where willow, cottonwood, sycamore, or alder occur. Yellow-billed cuckoos in higher elevations can be found in mesquite and tamarisk. They prefer dense vegetation, which creates a humid environment. Nests are loose twig structures built on a horizontal limb of trees, shrubs, and sometimes vines. Nests are in thick undergrowth or in trees, typically 4 to 8 feet above ground. The yellow-billed cuckoo feeds on cicadas, katydids,

caterpillars, and other large prey. The breeding season for this bird begins around June 15. They have been found along the Verde River and low elevation small streams.

Page springsnail is restricted to six extant populations in the Verde Valley, on the Coconino N.F., and possibly a few more populations on state or other lands, such as the Page Springs Fish hatchery. The snail is found attached to firm substrates (e.g., rock, wood) in spring fed areas. Springsnails of the genus Pyrgulopsis typically occur on rock or aquatic macrophytes in moderate water currents. Springsnail species are usually limited to a small geographic area.

California floater is a freshwater clam with an extremely thin, large shell, about 80 mm in length, with no teeth. It is a bivalve with larval, parasitic, juvenile, and adult stages. It depends on fish to be moved around. Diet may be comprised of detritus, animal plankton, and bacteria. Habitat is shallow areas, less than 2 meters deep, in unpolluted lakes, reservoirs, and perennial streams. Adults typically live in mud or sand and juveniles live in loose sand. The elevation range is 4,000 to 8,000 feet. Clams are historically found in Arizona in the Black, Salt, Santa Cruz, Verde, Gila, and Colorado rivers. There is a record of the species from East Clear Creek, on the Mogollon Rim Ranger District (AGFD 2004). Alteration and destruction of riverine habitats, including channelization, dredging, impoundment, erosion, siltation, water diversion, groundwater pumping, pollution, and watershed modifications are threats to the species. Status may also be tied to a specific fish or group of fishes that serve as hosts for the larval stage. Many of the native fishes within the range of the floater have been depleted by habitat alteration, competition, and predation by non-native fishes.

Fossil springsnail is found in springs and seepages feeding Fossil Creek, including Fossil Springs in Yavapai and Gila counties, elevation 4,310 feet. Springsnails of the genus Pyrgulopsis typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area. The shell is 2 to 2.5 mm tall.

Verde Rim springsnail is found in the Nelson Place Spring complex in the headwaters on Sycamore Creek, Pine Mt. Wilderness, in central Arizona. Springsnails of the genus Pyrgulopsis typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.

Maricopa Tiger Beetle occurs in open sand or mud flats and stone terraces along permanent or intermittent streams and near temporary and permanent ponds, open soil such as dirt roads and parking lots near water to some distance from water. They have been reported near leaky faucets and pipes, cattle tanks and ponds. They are generally not found on sand or mud bars with dense low-growing vegetation or on streams where cobblestone predominates. The main vegetative association at collection sites in riparian corridors is ash, sycamore, cottonwood, and willow. Vegetation outside the immediate riparian corridor varies from juniper-chaparral to grassland and Upper Sonoran desert scrub. The elevation at collection sites ranges from 1,092 to 6,880 feet. Beetles are generally active from March to mid-June and September to mid-November. The diet is mainly other insects. Threats to this species include drought, trampling, and soil compaction.

Giant Aryxna skipper are fall-flying large skippers, and the immature burrow into the leaves and stalks of various species of agave. In southeastern Arizona, the best flights occur around the first of October. Adults do not take nectar, but are often found at puddles and other sources of moisture, and prefer steep cliff faces and road cuts. The larvae are well-documented leaf borers of Agave palmeri. In southeast AZ, it occurs mostly in canyons with good stands of agave. Host

plants are Agave chrysantha and A. deserti. Agave chrysantha is found between 2300 to 7000 feet in Yavapai County. Blooming from May-August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with A. parryi var. couesii and A. delamateri in Yavapai County. Agave deserti is not known from Coconino or Yavapai Counties. Found within arid but well vegetated desert canyons or canyons with periodic water and open grassy woodlands in the Sonoran zone.

Freeman's agave borer requires an agave host, but is also far ranging with wider habitat use. Its' host, Agave chrysantha is found between 2300 to 7000 feet in Yavapai County. Blooming from May to August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with A. parryi var. couesii and A. delamateri in Yavapai County. Inhabits canyons. Adults fly from September through November.

Neumogen's giant skipper occurs in upper Sonoran, open woodland or shrub-grassland. The larvae feed on Agave parryi. There are 3 varieties of this Agave species in Arizona. Agave parryi var. couesii (Coues agave) is found in Coconino and Yavapai counties. It blooms from May to July and can be found on open slopes of grassland, chaparral, and pine-oak woodlands between 3650 to -7000 feet. Agave parryi var. parryi is found in Coconino County between 4000 to 9200 feet. Blooming between June and July, this variety is found on open slopes of grassland, chaparral and pine-oak woodland. There are confirmed records of the A. neumoegeni complex from Coconino and Yavapai Counties; reported from the upper Sonoran or lower Transition Zone in open woodland or shrub-grassland. Range is central Arizona to west-central New Mexico, southern New Mexico to west Texas.

Comstock's hairstreak butterfly is reported mostly from the Upper Sonoran Zone desert canyons and from transition to Canadian Zone (rarely alpine) woodland, sagebrush and chaparral in the Rockies. Favors dry, rocky areas of foothills and canyons of the Upper Sonoran plateaus from 5000 to 6000 feet. Their larvae feed on buckwheat. They have a single brood with adults present from March to May.

Early elfin favors roadsides with flowering cliffrose. Eggs are laid singly on flower buds of the host; larva feed on cliffrose buds, flowers, and young fruits. It is locally uncommon among arid plateaus and desert mountains from 6000 to 7000 feet. They have a single brood with adults present from March-April.

Obsolete viceroy butterfly habitat includes riparian areas generally below 4,500 feet where willows persist. Habitat includes subtropical to Canadian Zone watercourses. Host plants include: coyote willow and Goodding willow is a confirmed food plant for this butterfly. Red willow is a suspected food for Obsolete Viceroy Butterfly. Habitat for this butterfly includes riparian areas generally below 4,500 feet where willows persist. Other host plants include cottonwood, aspen, wild cherry, and serviceberry. Apparently tied to cottonwood/willow habitat. It frequents irrigation canals, water tanks, and other areas that border humid, semi-desert bottomlands. It flies 12 to 15 feet above ground. Larvae feed at night on the twigs, leaves, and other plant parts of host species in the families Salicaceae, Fagaceae, and Rosaceae. Adults are on the wing from May to August. Known from Oak Creek and the Verde River.

Southwestern toad occurs in rocky streams, canyons, and floodplains, usually with dense riparian vegetation. Found in the upland desert and pine/oak communities south of the Mogollon Rim between 2,000 and 6,000 feet in elevation. They are known in East Clear Creek, and

portions of all four counties within the project area (AGFD, 2004a). They use loose, gravelly areas of streams and arroyos or the sandy banks of quiet water. They breed in gently flowing waters, generally with well-developed riparian vegetation, from February through July. They may be abroad until September. This toad feeds on insects, arthropods, and snails. Generally, they occupy habitat similar to that of leopard frogs.

Northern leopard frog occurs in the northeastern quarter of Arizona, usually in montane streams and wetlands that have aquatic vegetation and in wet meadows at higher elevations. This frog is generally restricted to permanent waters. It is an opportunistic breeder, with most breeding occurring in late spring. The Northern leopard frog is known from all ranger districts of the Coconino except Redrock, and from the Kaibab N.F.

Lowland leopard frog prefers permanent stream pools, springs, stock tanks, and side channels of major rivers within desert scrub, grassland, and oak and pine/oak woodland habitats. It is found from sea level to 4,800 feet in elevation but more commonly less than 3,300 feet. It is seldom found in association with bullfrogs. The lowland leopard frog is an opportunistic breeder, but generally breeds from February through April. Its habitat includes open areas with high herbaceous vegetation along the margins for cover. The diet is mainly small invertebrates. The lowland leopard frog historically inhabited Redrock Ranger District, and is found on the Prescott N.F in Walnut Creek, Government Springs, Indian Creek, Cienega Creek, Turkey Creek, Hassayampa River, Blind Indian Creek and Dry Creek. There is also one historic sighting of lowland leopard frog at Perkinsville along the Verde River.

Mexican garter snake is usually found in or near streams, ponds, and cienegas in the highland canyons (up to 6,200 feet in elevation) with pine/oak or pinyon/juniper woodland, but may follow streams into lower desert grasslands. It is most closely linked to shallow slow-moving or impounded waters, although it also occurs in other aquatic environments. The Mexican garter snake's diet consists of leopard frogs, toads, tadpoles, small mammals, and various native fishes. Large adults can take lizards and small rodents during occasional terrestrial forays. The Mexican garter snake is known to be associated with leopard frogs, which are a major prey species. Bullfrogs are a significant predator. It is known from the Agua Fria River, Oak Creek, Verde River, and Sycamore Creek Wilderness. Threats to this species include lowered water tables, habitat degradation and destruction, and predation by bullfrogs and introduced fishes.

Narrow-Headed garter snake is the most aquatic of the garter snakes. It is found near cool, well lit, quiet, rocky pools. It is usually within a meter of water. Preferred habitat is along large streams and rivers in pinyon/juniper and oak woodlands and ponderosa pine forests. Important habitat components are bank vegetation including shrub-sized and sapling Arizona alder (the most conspicuous species), velvet ash, willows, and canyon grape. Food items include fish, frogs, tadpoles, and salamanders. The range is the mountains of central and eastern Arizona and west-central New Mexico in the Mogollon Rim area, from 5,000 to 6,000 feet in elevation. There are disjunctive populations in Mexico. Good populations can be found in Oak Creek Canyon and the East Verde River. Threats to the species are lowered water tables, habitat modification, and increased recreational use in riparian areas.

Arizona night lizard is a secretive lizard found in arid and semiarid lands in the chaparral-oak belt in central Arizona. This lizard occupies the spaces beneath fallen branches, logs, and dead clumps of agave, dead brush, cow dung, and in rock crevices. It is a Sensitive species on the

lower-elevation districts of the Coconino N.F and may occur at the lower elevations of the Prescott NF.

Northern goshawk occupies ponderosa pine, mixed species, and spruce-fir forest types in the Southwest. The goshawk is a forest habitat generalist that uses a wide variety of forest seral stages. It prefers stands of intermediate canopy cover for nesting, while more open areas are used for foraging. All forested (ponderosa pine and mixed conifer) habitat above the Mogollon Rim is considered to be goshawk habitat, as well as any associated pine or mixed conifer stringers that may extend below the Rim. Mature conifers and cottonwoods are primary nest trees in Arizona. The northern goshawk eats birds up to the size of a grouse, and mammals up to and including jackrabbit size. There is a concern that populations and reproduction of the goshawk are declining in the western United States, although, after reviewing several petitions requesting listing, the U.S. Fish and Wildlife Service has determined that listing is not warranted at this time. These declines may be associated with forest changes caused by timber harvesting, but fire suppression, livestock grazing, drought, and toxic chemicals may also be involved (Reynolds et. al 1992). "Management Recommendations for the Northern Goshawk in the Southwestern United States" (RM-217) was published in 1992. Many of the recommendations were incorporated into all Forest Plans in the Southwestern Region with the 1996 Forest Plan revisions. The northern goshawk occurs on all three forests within the project area. The highest densities occur on the North Kaibab Ranger District.

Common black-hawk occurs in the southwestern United States as a summer resident. It nests along the Verde River and its tributaries in low elevation cottonwood/sycamore riparian areas, and in Sycamore Creek (Pine Mtn.), Indian Creek, Little Sycamore Creek. It is dependent upon a mature, relatively undisturbed habitat supported by a permanent flowing stream. Groves of tall trees (75 to 100 feet) must be present along the streamcourse for nesting. They hunt from tree and cliff perches. In addition, they often wade into water and chase after prey on foot. Shallow streams of low to moderate gradient provide ideal hunting conditions. Food items include crayfish, frogs, tadpoles, reptiles, birds, small mammals, and fish.

Peregrine falcons are found in Arizona wherever sufficient prey is found near cliffs. Optimum peregrine habitat is generally considered to be steep, sheer cliffs overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance. Prey is mainly doves and pigeons, and incidentally shorebirds, waterfowl, and songbirds. Peregrines may forage up to 20 km from the nest site, but normally stay within 12 km. Peregrines are frequently associated with large rivers or waterfowl refuges during the winter. Nest sites average 200 to 300 feet high on a cliff. They are found in 5 locations on the Prescott, also on the Coconino and North Kaibab. The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (USDI 1999) and continues to be a Forest Service Sensitive species.

Bell's vireo occupies dense riparian thickets as well as mesquite and oak thickets near water in semiarid areas. They eat insects. The decline in the Bell's vireo population is largely due to brood parasitism by the brown-headed cowbird. They are a Sensitive species on the lower elevations of the Coconino NF and may also occur on the Prescott NF.

Southwestern river otter is highly aquatic, occurring along rivers where they hunt, travel, take refuge, and frolic. Otters feed on fish, amphibians, turtles, crayfish, and other aquatic animals. The Southwestern river otter is historic to the Verde River, Wet Beaver Creek, Oak Creek, and other major tributaries in the Verde Valley. Evidence suggests that a few populations persisted at

least into the 1960's and likely to the present. In 1981 and 1982, Arizona Game and Fish Department introduced a Louisiana subspecies into Fossil Creek and the Verde River near the Fossil Creek and East Verde confluences. This introduced species is successfully reproducing and may eventually cause genetic swamping of the native form, if any still exist.

Navajo Mountain Mexican vole has range from Navajo Mountain southward to the western part of the Mogollon Plateau from near Mormon Lake westward to the vicinity of Williams. Locations have been reported from 3800 to 9700 feet in elevation with a number of locations around the San Francisco Mountains from Williams to Mormon Lake (Hoffmeister 1986). Voles occupy meadows and riparian areas above the Mogollon Rim. They also occur within the forested areas where tree densities are low. They rely on grasses and other herbaceous vegetation for food and cover.

Wupatki Arizona pocket mouse is a subspecies known from the Wupatki area on the Peaks Ranger District. This subspecies is not distinguishable from P. a. ammodytes by external or cranial characteristics but is geographically isolated from other P. amplus subspecies. Habitat for this pocket mouse is similar to P. a. ammodytes. This pocket mouse feeds almost exclusively on seeds. It is most commonly associated with Merriam's kangaroo rat.

Predicted Response of Sensitive Species to Noxious Weed Invasion

Each species of concern was evaluated as to its response to the effect of noxious weeds on components of its habitat, such as cover, prey base, food, and structure. Those with a positive or neutral response will be dropped from further analysis.

Table 6. Predicted response of candidate and sensitive animal species to weeds

Common Name	Status (C, S, PIF)	C	K	P	Predicted Response to Noxious Weed Invasion
Amphibians					
Southwestern (Arizona) toad	S	X		X	Neutral - needs herbaceous cover and invertebrates
Chiricahua leopard frog	S	X			Neutral – physical habitat may be more important than vegetation.
Northern leopard frog	S	X	X		Neutral - physical habitat may be more important than vegetation.
Lowland leopard frog	S	X		X	Neutral - physical habitat may be more important than vegetation.
Reptiles					
Mexican garter snake	S	X		X	Negative - weeds could replace cienega habitat
Narrow-headed garter snake	S	X		X	Negative - weeds could replace riparian habitat
Arizona night lizard	S	X			Neutral - physical habitat is more important than vegetation
Birds					
Yellow-billed cuckoo	C, PIF	X		X	Negative - weed trees could replace the dense cottonwood/willow forests they need

Table 6. Predicted response of candidate and sensitive animal species to weeds

Common Name	Status (C, S, PIF)	C	K	P	Predicted Response to Noxious Weed Invasion
Northern goshawk	S, MIS, PIF	X	X	X	Negative - weeds could reduce small mammal populations, which are prey
Common black hawk	S, PIF	X		X	Negative - needs cottonwood/willow gallery forests, which could be replaced by weed trees
American peregrine falcon	S	X	X	X	Neutral - weeds won't affect cliff habitat, and it eats diverse and common prey
Bell's vireo	S	X			Negative - needs dense riparian vegetation
Mammals					
Southwestern river otter	S	X			Neutral – not dependant on vegetation
Navajo Mexican vole	S	X			Negative - needs meadows, riparian, and grass for food and cover
Wupatki Arizona pocket mouse	S	X			Negative – weeds may replace native vegetation found in limited habitat.
Insects					
Giant aryxna skipper	S	X			Neutral – uses agaves, which may not be affected by weeds
Freeman's agave borer	S	X			Neutral – uses agaves, which may not be affected by weeds
Neumogen's giant skipper	S	X			Neutral – uses agaves, which may not be affected by weeds
Comstock's hairstreak	S	X			Negative – uses native plants for food
Maricopa tiger beetle	S	X		X	Neutral - physical habitat may be more important than vegetation
Early elfin	S	X			Neutral – It is unlikely that noxious weeds would eliminate the host plant, cliffrose.
Obsolete viceroy butterfly	S	X			Negative - needs cottonwood/willow habitat which could be replaced by weed trees
Invertebrates					
California floater	S	X			Neutral – physical habitat may be more important than vegetation
Page springsnail	S	X			Neutral – physical habitat may be more important than vegetation
Fossil springsnail	S	X			Neutral – physical habitat may be more important than vegetation
Verde Rim springsnail	S			X	Neutral – physical habitat may be more important than vegetation

C – Coconino National Forest K – Kaibab National Forest P – Prescott National Forest

* Status Definitions: C - Candidate Taxon, Ready for Proposal; S - Sensitive: Those species listed on the Regional Forester's Sensitive Species list for the Southwestern Region of the Forest Service (Appendix B); PIF - Partners in Flight priority bird species (Latta, 1999)

For a detailed analysis of the effects of the preferred Alternative on wildlife resources, see the Wildlife Specialist Report.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
Yellow-billed cuckoo (YBC)	C, S, PIF	X		X	This species is associated with mature stands of cottonwood-willow riparian deciduous forest.	Negative - weed trees could replace the dense cottonwood/willow habitats they need. Long term potential for loss of limited riparian habitat to increased populations of noxious or invasive weeds could reduce the native plant species used for nesting and negatively impact the species.	Breeding season timing restrictions and buffers around nesting areas would make any disturbance or toxicity impacts to YBC from weed treatments unlikely to occur.
American peregrine falcon	S	X	X	X	The species nests at cliffs throughout the state, even at some distance from water. Nesting sites are known on Granite Mountain, Thumb Butte, Sycamore Canyon, Bill Williams Mtn, and Sitgreaves Mtn. Peregrines nesting in the Grand Canyon probably forage on the KNF.	Neutral - weeds won't affect nesting habitat on cliffs. Peregrines eat diverse and common prey species in varied habitat.	There would be no direct effects from treatments as peregrines' nest on cliffs and no treatments would occur in those areas. No indirect effects as relatively small isolated areas of weed treatments would not impact peregrine foraging behavior or prey species' relative abundance.
Arizona night lizard	S	X		X	Arid and semiarid granite outcroppings and rocky areas, among fallen leaves and trunks of yuccas, agaves, Joshua trees	Neutral - physical habitat is more important than vegetation. Boulder habitat would not be impacted by weed expansion.	There would not be any direct effects as Arizona night lizards occur between granite rocks where treatments would not occur. There would not likely be any indirect effects as they also forage in the same boulder habitat where treatments would not occur.
Bell's vireo	S	X		X	Bell's Vireos occupy dense riparian thickets as well as mesquite and oak thickets near water in semiarid areas. They eat insects. The decline in the Bell's vireo population is largely due to brood parasitism by the brown-headed cowbird. They occur in the lower	Negative - needs dense native riparian vegetation for nesting and foraging. Long term potential for loss of limited riparian habitat to increased populations of noxious or invasive weeds could reduce native plant species used by Bell's vireo and subsequently negatively impact the	There would not be any direct effects as Bell's vireo have not been documented using tamarisk or other nonnative trees species for nesting or foraging. While treatments of nonnative tree species may disturb adjacent nesting vireos, the disturbance would likely be of short

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
					elevations of the Coconino N.F.	species.	duration and intensity. Restoring native vegetation for nesting and foraging would improve habitat quality and quantity but may not offset the impacts of nest parasitism by cowbirds.
California floater	S	X			It depends on fish to be moved around. Diet may be comprised of detritus, animal plankton, and bacteria. Habitat is shallow areas, less than 2 meters deep, in unpolluted lakes, reservoirs and perennial streams. Adults typically live in mud or sand and juveniles live in loose sand. The elevation range is 4,000 – 8,000 feet. Clams are historically found in Arizona in the Black, Salt, Santa Cruz, Verde, Gila, and Colorado rivers. There is a record of the species from East Clear Creek, on the Blue Ridge district (AGFD 2004).	Neutral – physical habitat may be more important than vegetation.	With no treatments occurring in aquatic habitat there would not be any direct effects. All of the herbicides proposed for use near water have a zero ecotoxicity for freshwater mollusks so there should not be any indirect effects from weed treatments.
Comstock's hairstreak	S	X			This butterfly is reported mostly from the Upper Sonoran Zone desert canyons and from transition to Canadian Zone (rarely alpine) woodland, sagebrush and chaparral in the Rockies. Favors dry, rocky areas of foothills and canyons of the Upper Sonoran plateaus from 5000-6000'. Their larvae feed on buckwheat. They have a single brood with adults present from March-May.	Negative – It is unlikely that noxious weeds would eliminate the host plant, buckwheat, although cheatgrass invasion has been identified as a threat. Slight potential for increased fire frequency to alter vegetation composition to eliminate buckwheat that is not fire resistant. This could result in reduced habitat quantity and negatively impact local populations.	While some treatments may occur within the species' habitat, the majority of the species' wide ranging habitat would not be treated. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this butterfly.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
Early elfin butterfly	S	X			Favors roadsides with flowers. Eggs are laid singly on flower buds of the host; larva feed on cliffrose buds, flowers, and young fruits. It is locally uncommon among arid plateaus and desert mountains from 6000-7000'. They have a single brood with adults present from March-April.	Neutral – It is unlikely that noxious weeds would eliminate the host plant, cliffrose. However, increased cheat grass could increase the fire frequency so as to reduce native plant species including cliffrose. This could lead to losses of local populations of butterflies.	While some treatments may occur near occupied or suitable habitat, it is not likely that the butterfly would be impacted by any treatments. Herbicide applications would include direct spraying on target weed species, so there is no potential for drift impacting adjacent cliffrose plants or butterflies.
Fossil springsnail	S	X			This species is found in springs and seepages feeding Fossil Creek, including Fossil Springs in Yavapai and Gila counties, elevation 4,310'. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.	Neutral – physical habitat may be more important than vegetation.	No treatments would occur in aquatic habitat. Conservation Measures would ensure that herbicide treatments near habitat would not impact Fossil springsnail by limiting applications to preclude any toxic impacts.
Freeman's agave borer	S	X			Requires agave host (*Agave chrysantha*) but also far ranging with wider habitat use. *Agave chrysantha* is found between 2300-7000 feet in Yavapai County. Blooming from May-August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with *A. parryi* var. *couesii* and *A. delamateri* in Yavapai County. Inhabits canyons. Adults fly from September through November.	Neutral – uses agaves, which would probably not be affected by weeds. However, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant species including agave. This could lead to losses of local populations of agave borers.	Few if any weed treatments are proposed in or near habitat with agave. Mechanical treatments would not impact the borer. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this insect.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
Giant aryxna skipper	S	X			The immatures of these fall-flying large skippers burrow into the leaves and stalks of various species of agave. In southeastern Arizona, the best flights occur around the first of October. Adults do not take nectar, but are often found at puddles and other sources of moisture, and prefer steep cliff faces and road cuts. The larvae are well-documented leaf borers of *Agave palmeri*. In southeast AZ, it occurs mostly in canyons with good stands of agave. Host plants are *Agave chrysantha* and *A. deserti*. *Agave chrysantha* is found between 2300-7000 feet in Yavapai County. Blooming from May-August, it can be found on open rocky slopes in high desert scrub, chaparral and juniper grassland. It hybridizes with *A. parryi* var. *couesii* and *A. delamateri* in Yavapai County. *Agave deserti* is not known from Coconino or Yavapai Counties. Found within arid but well vegetated desert canyons or canyons with periodic water and open grassy woodlands in the Sonoran zone.	Neutral – uses agaves, which would probably not be affected by weeds. However, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant species including agave. This could lead to losses of local populations of skippers.	Few if any weed treatments are proposed in or near habitat with agave. Mechanical treatments would not impact the skipper. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this insect.
Lowland leopard frog (LLF)	S	X		X	This species is generally restricted to permanent waters below elevations of 3,000 feet. It is found	Neutral - physical habitat may be more important than vegetation.	Effects identical to Chiricahua leopard frog

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
					in small to medium streams, and occurs in small springs, stock ponds, and occasionally in large rivers. Populations typically occur in aquatic systems with surrounding desert scrub, semi-desert grassland, or evergreen woodland. LLF known to occur along Turkey Creek, Hassayampa River, Blind Indian Creek on the PNF. May occur at stock tanks or small ponds on the KNF and CNF.		
Maricopa tiger beetle	S	X		X	Habitats for this species are always sandy, riparian areas such as stream banks, edges and sand bars.	Neutral - physical habitat may be more important than vegetation	Neutral – For those herbicides approved for use near riparian habitat, all have zero ecotoxicity for aquatic arthropods. Most treatments near or in beetle habitat would include cut and daub that would not have any direct or indirect effects to Maricopa tiger beetles.
Mexican garter snake	S	X		X	Occurs primarily in permanent marshes and streams at middle elevations in central, south-central and southeastern Arizona. This species may occur along the Verde River.	Negative - weeds could replace native cienega habitat used for cover and by prey species. Long term potential for loss of limited riparian habitat to increased weed populations could reduce native plants used as cover by the species and its prey and could negatively impact the Mexican garter snake populations along the Verde River.	Neutral – Treatments would not have direct effects to Mexican garter snakes as the treatments would not occur within the snake's habitat. Treatments on the periphery or adjacent to occupied habitat may disturb snakes but would eventually improve Mexican garter snake habitat by restoring native plants used for cover and foraging. Treatment areas are so small as not to impact the populations or the species.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
Narrow-headed garter snake	S	X		X	Occurs from central Arizona to western New Mexico and south to central and western Chihuahua and northern and western Durango, Mexico. In Arizona, known primarily from streams draining the Mogollon Rim and the White Mountains. Highly aquatic species, associated with riffle/pool complexes of cool, clear, rocky mountain streams. Known at Mormon Pocket on the Verde River and on Oak Creek.	Negative - weeds could replace native riparian habitat used by prey species Long term potential for loss of limited riparian habitat to increased weed populations could reduce native plants used as cover by the species and its prey and could negatively impact the narrow-headed garter snake populations along the Verde River.	Neutral – Treatments would not have direct effects to narrow-headed garter snakes as treatments would not occur within the snake's habitat. Treatments on the periphery or adjacent to occupied habitat may disturb snakes but would eventually improve narrow-headed garter snake habitat by restoring native plants used for cover and foraging. Treatment areas are so small as not to impact the populations or the species.
Navajo Mexican vole	S	X			These voles occur in dry grassy areas, usually adjacent to ponderosa pine, but also adjacent to juniper, sagebrush, and spruce-fir habitat.	Negative - needs native plants in meadows, riparian, and grass for food and cover. Long term potential for weed population increases to diminish available native plant habitat and negatively impact local populations of the species.	Limiting the use of Dicamba to occur outside the breeding season for terrestrial bird species would benefit Navajo Mexican voles as they would also be more mobile to move away from treatment areas adjacent to occupied habitat. Long term effects would include improved quality and increased quantity of vole habitat for those small areas returned to native vegetation.
Neumogen's giant skipper	S	X			Occurs in upper Sonoran, open woodland or shrub-grassland. The larvae feed on *Agave parryi*. There are 3 varieties of this Agave species in Arizona. *Agave parryi* var. *couesii* (Coues agave) is found in Coconino and Yavapai counties. It blooms from May – July and can be found on open slopes of grassland, chaparral, and pine-oak	Neutral – It is unlikely that noxious weeds would eliminate the host plant, agave. However, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native plant species including agave. This could lead to losses of local populations of skippers.	Few if any weed treatments are proposed in or near habitat with agave. Mechanical treatments would not impact the skipper. Only 2,4-D has high to very high toxicity for terrestrial arthropods. Most herbicide treatments would be targeted at weed species and would not likely drift to adjacent habitat. No potential for impact to this insect.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
					woodlands between 3650-7000 feet. *Agave parryi* var. *parryi* is found in Coconino County between 4000-9200 feet. Blooming between June and July, this variety is found on open slopes of grassland, chaparral and pine-oak woodland. There are confirmed records of the *A. neumoegeni* complex from Coconino and Yavapai Counties; reported from the upper Sonoran or lower Transition Zone in open woodland or shrub-grassland. Range is central Arizona to west-central New Mexico, southern New Mexico to west Texas.		
Northern leopard frog	S	X	X		Northern leopard frog habitat is typically stock tanks and other perennial waters with rooted vegetation such as sedges, cattails, or rushes.	Neutral - physical habitat may be more important than vegetation.	Effects identical to Chiricahua leopard frog
Obsolete viceroy butterfly	S	X			Habitat for this butterfly includes riparian areas generally below 4,500 feet where willows persist. Habitat includes subtropical to Canadian Zone watercourses. Host plants include: coyote willow and Goodding willow is a confirmed food plant for this butterfly. Red willow is a suspected food for Obsolete Viceroy Butterfly. Other host plants include cottonwood, aspen, wild cherry, and	Negative - needs native cottonwood/willow habitat which could be replaced by nonnative weed trees. Long term potential for loss of limited riparian habitat to increased populations of noxious or invasive weed tree species could negatively impact local populations of the butterflies.	Treatments within riparian areas would not have any drift of herbicides so there would not be any toxic impact from herbicides to butterflies in adjacent habitat. Returning small areas of riparian habitat to native plant species would not have a measurable impact on the species.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
					serviceberry. Apparently tied to cottonwood/willow habitat. It frequents irrigation canals, water tanks, and other areas that border humid, semi-desert bottom lands. It flies 12 to 15 feet above ground. Larvae feed at night on the twigs, leaves, and other plant parts of host species in the families Salicaceae, Fagaceae, and Rosaceae . Adults are on the wing from May to August. Known from Oak Creek and the Verde River.		
Page springsnail	S	X			The Page springsnail is restricted to six populations in the Verde Valley, on the Coconino N.F. It is found attached to firm substrates (e.g., rock, wood) in springfed areas. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.	Neutral – physical habitat may be more important than vegetation	No treatments would occur in aquatic habitat. Conservation Measures would ensure that herbicide treatments near habitat would not impact Page springsnail by limiting applications with regard to herbicides used and timing relative to precipitation to preclude any toxic impacts.
Southwestern (Arizona) toad	S	X		X	Rocky stream courses in pine-oak zone in Arizona and New Mexico. Irrigated cropland and reservoirs increasingly used. Known to occur in portions of all four counties within the project area (AGFD 2004a).	Neutral - needs herbaceous cover and invertebrates.	Mechanical treatments adjacent to riparian zones may directly impact southwestern toads causing mortality to toads. Herbicides approved for use in riparian zones all have zero ecotoxicity to aquatic and terrestrial amphibians so there would be only disturbance impacts from herbicide treatments. Treatment areas are so small as not to impact the populations or the species.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
Southwestern river otter	S	X		X	The Southwestern river otter is highly aquatic, occurring along rivers where they hunt, travel, take refuge, and frolic. Otters feed on fish, amphibians, turtles, crayfish, and other aquatic animals. They are found along the Verde River, Wet Beaver Creek, Oak Creek, and other major tributaries in the Verde Valley.	Neutral – not dependant on vegetation.	There would not be any impacts to SW river otters or their prey from the proposed terrestrial weed treatments.
Verde Rim springsnail	S			X	Found in the Nelson Place Spring complex in the headwaters on Sycamore Creek, Pine Mt. Wilderness area, in central Arizona. Springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current. Springsnail species are usually limited to a small geographic area.	Neutral – physical habitat may be more important than vegetation.	No treatments would occur in aquatic habitat. Conservation Measures would ensure that herbicide treatments near habitat would not impact Verde Rim springsnail by limiting applications with regard to herbicides used and timing relative to precipitation to preclude any toxic impacts.
Wupatki Arizona pocket mouse	S	X			This subspecies is known from the Wupatki area on the Peaks Ranger District. This subspecies is not distinguishable from *P. a. ammodytes* by external or cranial characteristics but is geographically isolated from other *P. amplus* subspecies. Habitat for this pocket mouse is similar to *P. a. ammodytes*. This pocket mouse feeds almost exclusively on seeds. It is most commonly associated with Merriam's kangaroo rat.	Negative - Noxious weeds could adversely affect the food base of the pocket mouse - weeds such as Dalmatian toadflax and knapweeds could crowd out the grasses and forbs with the seeds they depend on. In a worst case scenario, noxious or invasive weeds could severely reduce populations of this subspecies due to habitat loss caused by replacement of native plant species by noxious weed species. Also, increased cheat grass or annual bromes could increase the fire frequency so as to reduce native	Proposed treatments would not likely impact Wupatki Arizona pocket mice as the mice would be less likely occur in areas dominated by nonnative weeds. Long term benefits would include maintenance or possible increase of habitat quantity and quality.

Table 8. Treatment effects to Candidate (C) and sensitive (S) wildlife species managed on the Coconino (C), Kaibab (K) and Prescott (P) National Forests (NF) for the Selected alternative.

Common Name	Status (C,S)	C	K	P	Species native habitat	Expected Response to noxious or invasive weeds (Alternative 2)	Expected response to noxious or invasive weed treatments (Alternative 4)
						plant species. This could lead to losses of local populations of pocket mice.	
Common black hawk	S, PIF	X		X	Lowland forest, swamps and mangroves, in both moist and arid habitats but generally near water (along rivers and streams), also foraging often on tidal flats or in open woodland. Often nests in woodlands near water; in U.S., nests in tall gallery forest trees, mostly cottonwoods supported by flowing water.	Negative - needs native cottonwood/willow gallery forests, which could be replaced by nonnative weed trees. Long term potential for loss of limited riparian habitat could negatively impact the species.	By limiting treatment methods to be similar to existing activities within the nesting area, the only impact would be minimal disturbance during the breeding season. Long term impacts would be maintained or improved nesting and prey habitat.
Northern goshawk	S, MIS, PIF	X	X	X	Nests locally in coniferous forests of the mountains and high mesas in the northeastern half of Arizona. This is a MIS for late seral stage ponderosa pine vegetation type. CNF - Unknown population trend KNF – Stable population trend PNF- Unknown population trend	Negative - weeds could reduce small mammal populations, which are prey. Long term potential for weed population increases to replace native grasses, forbs and shrubs and reduce the amount of available habitat for NGH prey species and subsequently negatively impact the NGH population trends on the CNF, KNF and PNF.	Implementing breeding season timing restrictions, nest buffers, and restricting the treatment methods to be of a similar nature as the ongoing recreational uses within PFAs would reduce the disturbance or toxicity impacts to NGH from treatments to be immeasurable. Given the low likelihood or level of impact from treatments, this alternative would not impact the population trend for the NGH on the CNF, KNF or PNF.

Determinations:

The analyses above show that the selected alternative is not likely to trend toward listing any candidate or sensitive terrestrial species.

SIGNATURES:

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Appendix 1

Required Protection Measures for Pesticide Applications

Species/ Herbicides	2, 4-D (acid formulations)	2, 4-D (aquatic amine salt formulations)	2, 4-D (nonaquatic amine salt formulations)	2, 4-D (aquatic ester formulations)	2, 4-D (nonaquatic ester formulations)	CHLORSULFURON
Northern leopard frog, Lowland leopard frog	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be applied on land below or above the high water line of species habitat.
Page springsnail, Verde Rim springsnail	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - 10 ft buffer ULV - 150 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer
Migratory birds including sensitive & PIF species	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS

Species/ Herbicides	2, 4-D (acid formulations)	2, 4-D (aquatic amine salt formulations)	2, 4-D (nonaquatic amine salt formulations)	2, 4-D (aquatic ester formulations)	2, 4-D (nonaquatic ester formulations)	CHLORSULFURON
Northern goshawk	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed within PFA outside of nest stand during the BS	May be sprayed within PFA outside of nest stand during the BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS
Yellow-billed cuckoo	Spot - no bufferMechanized - 30 ftBreeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	No buffer - Breeding season TR - May-August	No buffer - Breeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August

Federal species/ Herbicides	CLOPYRALID	DICAMBA	GLYPHOSATE (aquatic)	GLYPHOSATE (nonaquatic)	IMAZAPIC	IMAZAPYR (technical formulation)	IMAZAPYR (aquatic)
Northern leopard frog, Lowland leopard frog	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries),	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300	May be applied on land below or above the high water line of species habitat.	May be applied on land below or above the high water line of species habitat.	May be applied on land below or above the high water line of species habitat.

Federal species/ Herbicides	CLOPYRALID	DICAMBA	GLYPHOSATE (aquatic)	GLYPHOSATE (nonaquatic)	IMAZAPIC	IMAZAPYR (technical formulation)	IMAZAPYR (aquatic)
		300 ft downstream: Liquid - 30 ft buffer		ft downstream: Liquid - 30 ft buffer			
Page springsnail, Verde Rim springsnail	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer
Migratory birds including sensitive & PIF species	May be applied during the BS	May be applied September-February	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS
Northern goshawk	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS		May be sprayed within PFA outside of nest stand during the BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed within PFA outside of nest stand during the BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed within PFA outside of nest stand during the BS
Yellow-billed cuckoo	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	Spot - 10 ft Mechanized - 60 ft Breeding season TR - May - August	No buffer - Breeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	No buffer - Breeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	No buffer - Breeding season TR - May-August

Federal species/ Herbicides	IMAZAPYR (nonaquatic)	METSULFURON-METHYL (see note below)	PICLORAM (see note below)	SULFOMETURON-METHYL	TRICLOPYR (amine salt formulations)	TRICLOPYR (ester formulations)
Northern leopard frog, Lowland leopard frog	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 30 ft buffer	May be applied on land below or above the high water line of species habitat.	Spot applications on land above high water line of species habitat, 1/2 mile upstream (including tributaries), 300 ft downstream: Liquid - 50 ft buffer
Page springsnail, Verde Rim springsnail	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer	Spot applications around habitat: Liquid - no buffer ULV - 80 ft buffer
Migratory birds including sensitive & PIF species	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS	May be applied during the BS

Federal species/ Herbicides	IMAZAPYR (nonaquatic)	METSULFURON-METHYL (see note below)	PICLORAM (see note below)	SULFOMETURON-METHYL	TRICLOPYR (amine salt formulations)	TRICLOPYR (ester formulations)
Northern goshawk	May be sprayed within PFA outside of nest stand during the BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed within PFA outside of nest stand during the BS	May be sprayed along road ROW during BS May be applied in rest of PFA outside BS	May be sprayed within PFA outside of nest stand during the BS
Yellow-billed cuckoo	No buffer - Breeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	No buffer - Breeding season TR - May-August	No buffer - Breeding season TR - May-August	Spot - no buffer Mechanized - 30 ft Breeding season TR - May-August	No buffer - Breeding season TR - May-August

Notes: RPMPA - Resource Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service. J. Allen White, U.S. Fish and Wildlife Service, 10711 Burnett Road, Suite No. 200, Austin, Texas 78758, July 2004.

These RPMPAs are to be implemented in concert with the Design Features detailed in Appendix E of the FEIS for the Tri-Forest Noxious and Invasive Weed Treatments

Metsulfuron = metsulfuron is rated as Class 1 in toxicity groups for fish and amphibians due to reported mortality incidents not indicated by toxicity data

Picloram = picloram is used mostly for broad-leaved plants but can harm some grasses and other monocots.

1 - A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between three to ten miles per hour, and no rainfall for 24 hours) should be followed in implementing recommended buffer zones.

2 - Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.

- 3 - Low aerial applications (nozzle or spreader height less than 12 feet) and high aerial applications (nozzle or spreader height greater than 12 feet) are relative to the plant canopy or a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40% grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40% grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 - Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 - Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 - ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre
- BS - Breeding Season
  ROW - Right of way
  PAC - Protected Activity Center
  PFA – Post-fledging family area

  MSO - Mexican spotted owl
  TR - Timing restriction

Appendix 2

Adjuvant Summary Table and Design Features

Species	ACTIVATOR 90, SILWET L-77, CHOICE, LI 700, ACIDI pHACTANT, ALL CLEAR, Tank and Equipment Cleaner	MSO, AMIGO, Marker dye WSP, CHEM-TROL, NU FILM P, FIGHTER F, FOAM FIGHTER
Northern leopard frog, lowland leopard frog, yellow-billed cuckoo, Page springsnail, Verde Rim springsnail, riparian migratory birds	Shall not be used in riparian habitat*.	Approved for use in riparian habitat.
Northern goshawk, terrestrial migratory birds,	Approved for use in habitat.	Approved for use in habitat.

***Riparian habitat** - Overstory trees include alders, conifers, cottonwood, maple, sycamore, and willows. Understory species include hackberry, New Mexico locust, and soapberry. Herbaceous plants include sedges, spikerush, bull rush, little bluestem, blue grama, Canadian wildrye, sand bluestem, squirreltail, smartweed, and curlydock (EIS vegetation affected environment).

Biological Assessment of Arizona Cliffrose (Purshia subintegra) for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona

A: Description of Project:

Location: The project location includes all reserved public lands, wilderness, and non-wilderness, within the three national forests: Coconino, Kaibab and Prescott. Of the 4.9 million acres, about 187,500 acres (or 3 percent of the land area) have been identified as being impacted with noxious weeds. Five watersheds have been inventoried within the project area and include the Verde River (2,139,405 acres), Little Colorado (1,089,255 acres), Colorado/Grand Canyon (1,011,660 acres), Middle Gila (480,835 acres), and Bill Williams (186,635 acres). Numerous private parcels are found within or adjacent to the three national forests.

Purpose: The purpose of this project is to eradicate, contain, control or prevent weeds within the three national forests. The desired goal is to prevent any new weeds from becoming established, contain or control the spread of 14 known invasive species, and eradicate 8 species which are the most invasive and pose the greatest threat to the biological diversity within the project area. The control of these plants will promote the ecosystem health of forested and rangeland habitats by maintaining or improving native forbs and grass species, increasing the regeneration of cottonwood and willow trees in riparian corridors, and ultimately preventing the loss of wildlife habitat.

Project objectives: The 3 national forests propose to authorize annual treatments of weed infestations scattered throughout the forests. There are currently 25 species of noxious and invasive weeds found within the project area and 4 new species that have been found adjacent to the national forests. Sites range in size from single plants to a population of one species covering several thousand acres. The various methods analyzed under the integrated weed management approach include: manual; mechanical (clipping, mowing, tilling, steaming and burning); cultural (grazing by livestock, fertilization, seeding of competitive plants, and the use of weed seed-free seed mixes and mulches); biological; and herbicidal.

The annual combination of methods to be used would vary depending on specific conditions. Riparian invasive weeds could be treated up to water's edge using methods approved for this type of application. Over the planning horizon of 10 years, it is estimated that 2 to 3 percent of the total national forest lands would be treated. Repeated treatments or re-treatments would be necessary for most weed species because seeds in the soil can be viable for 10 or more years. Therefore, recurring actions would be authorized until the desired control objective is reached.

The Preferred Alternative: This alternative was established to address **the three significant issues** and maintain the option of herbicide use. Under this action about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally, 16,000 biologically, and 57,000 acres with herbicides. Limited spray zones would be established adjacent to and within 1 mile of communities, recreation sites, trailheads, and scenic overlooks. Sites where non-herbicidal treatment methods will be effective due to species, population size or site factors will be targeted for all integrated weed management methods except herbicides. Plant species in this category include yellow and Malta starthistle, Mediterranean sage, musk thistle, Scotch thistle, and bull thistle. Adaptive management principles apply and if the selected integrated weed management method does not work, then other methods, including herbicides, could be used. In addition, herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds that cannot reach treatment objectives using manual techniques (such as camelthorn, Russian knapweed, leafy spurge, tamarisk, and tree of Heaven). Any

proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met, so multiple chemical sensitive individuals could still access recreational and other facilities found within the project area.

Limited spray zones do not include rights-of-way under the jurisdiction of the Federal Highway Administration or other public entities (State and county roads). Interstates, U.S. highways, and state highways will be covered under the Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona. However, if ADOT does not treat a priority infestation in one of these roadway easements, the Forest Service would undertake this work.

Under the Preferred Alternative, 22 weed species will be authorized for some level of treatment. Eleven species (98 percent of the infested acres) have been assigned a contain/control objective; an additional 10 species (representing 1 percent of the infested acres) are targeted for complete eradication; and 1 species (also representing about 1 percent of the infested acres) is assigned an eradicate/control objective. The remaining four species, which are currently not inventoried within the national forest boundaries, have been assigned a prevent/eradicate objective.

A total of 21 herbicides and 4 additives (adjudvants and surfactants) that have been approved and documented in the Risk Assessment for Herbicide Use for Forest Service Regions 1, 2, 3, 4, and 10 (1995) and on Bonneville Power Administrative Sites (1992) will be considered for use. If approved, treatments would begin in 2004 and would continue for up to 10 years. An implementation plan will be developed based on the predictive models created for the final environmental impact statement (FEIS). These models calculate the effect of different treatment regimes proposed for a species within an alternative. Since little has been published about weed treatments within the project area, annual results will be evaluated and used to validate the predictive model. The forests will review their program of projects to evaluate any changes in the effects described in the FEIS predictions and will review new information about invasive plants and treatment effectiveness. Annual treatment programs will be coordinated with other Federal and State agencies and private individuals doing similar or adjacent projects.

Adaptive management is part of the action and includes the following:

- Treatments of infestations of noxious weeds that may become established but which are not currently identified on the species list or known to occur on the forests;
- The use of approved herbicides, adjuvants, and surfactants that may not be specifically listed in the proposed action, and;
- If prescribed management fails to result in desired outcome, alternative strategies will be developed, and management will be adapted until the desired conditions are achieved. New alternative strategies will be reviewed on a site-specific and case-by-case basis. If it is demonstrated through analysis that the environmental impacts of a new approach falls outside the impacts as disclosed in this document, then additional environmental analysis will be undertaken under NEPA.

B. Species considered and evaluated. All plant species on the three forests' Threatened, Endangered, and Candidate Plant Species lists were considered. Arizona cliffrose is the only listed species with effects. For the other listed plant species there are no effects due to lack of

habitat or lack of direct, indirect or cumulative effects. Rationale for their exclusion are provided in the Botany Specialists' Report (Phillips and Crisp 2004).

Arizona Cliffrose (*Purshia subintegra*)

Endangered Species Act Status:	Endangered, 1984
National Forest Occurrence:	Coconino, Tonto
Recovery Plan:	Final, 1995
Critical Habitat:	None designated
Determination of Effect:	May affect species, not likely to adversely affect species or its habitat

Natural History

Arizona cliffrose is a long-lived shrub. Mature plants are capable of producing many seeds per year. Plants begin blooming in late March and continue through early May. Normally, hundreds of flowers are produced on each mature plant. Native bees and introduced honeybees are the main pollinators. The flowers are primarily cross-pollinated, but are partially self-compatible. Cross-pollinated flowers produce significantly more seeds than self-pollinated flowers. Most fruits develop during April and are dispersed during the summer when rains dislodge the seeds. The timing of seed germination and seedling establishment is unknown (U.S. Fish and Wildlife Service 1995).

Distribution

The Arizona cliffrose is endemic to white Tertiary (Miocene and Pliocene) limestone lakebed deposits that are high in lithium, nitrates, and magnesium (Anderson 1986, Arizona Game and Fish Department 2001). Elevations are 650-1,100 m (2,100-3,600 ft) (U.S. Fish and Wildlife Service 1995).

Arizona cliffrose occurs in four disjunctive populations spread across 320 km (200 mi) in central Arizona. The Burro Creek population in Mohave and Yavapai counties is the largest population. It has three subpopulations the largest of which is in T. 14 N., R. 11 W., and Secs. 1, 2, 11, and 12. Two small outlier subpopulations are in T. 14 N., R. 11 W., and Secs. 20, 21, 28, and 29, and in T. 14 N., R. 11 W., Secs. 31 and 32. The Cottonwood population in Yavapai County is the second largest population. It is in T. 16 N., R. 3 E., and Secs. 22-27, 35, and 36, and in T. 15 N., R. 3 E., Sec. 1. The Horseshoe Lake population in Maricopa and Yavapai counties has three subpopulations. These are in T. 7 N., R. 6 E., and Secs. 3 and 4, in T. 8 N., R. 6 E., Secs. 22 and 23, and in T. 8 N., R. 6 E., Secs. 9, 10, 15, and 16. The Bylas population in Graham County is in T. 2 S., R. 20 E., Secs. 23-26. The full extent of this population is unknown due to limited surveys (U.S. Fish and Wildlife Service 1995).

Status of the Species (Range-wide)

Multiple agencies have management responsibility for Arizona cliffrose. The Burro Creek population is on Federal lands managed by the BLM, Kingman Resource Area. The Cottonwood population is on Federal, Arizona State, Yavapai County and private lands. The Federal lands are part of Coconino NF and the State lands are managed as Dead Horse Ranch State Park. The Horseshoe Lake population is on Federal land with management of lake operations under the

Bureau of Reclamation and surface management under Tonto NF. The Bylas population is on the San Carlos Apache Indian Reservation (U.S. Fish and Wildlife Service 1995).

Arizona cliffrose appears to be long-lived and capable of large reproductive output. Plants with this life history strategy tend to have low recruitment rates and few seedlings and juveniles in each population. However, a viable population should have plants of differing ages and sizes. We do not yet know what recruitment rates are necessary to maintain viable Arizona cliffrose populations. The recruitment rates appear to vary among populations. There are areas in the Cottonwood population that support a relatively large number of established seedlings. In contrast, the other three Arizona cliffrose populations appear to have insufficient recruitment. Although seedlings have been seen in the Burro Creek population, age/size class distribution appears heavily weighted towards large older plants.

More than 20 years ago, several observers noted that reproduction at Burro Creek appeared to be insufficient to maintain the population. Several observers noted that reproduction at Bylas appeared insufficient to maintain the population, while other observers found all age classes represented, including seedlings and senescent plants (U.S. Fish and Wildlife Service 1995).

Major impacts to Arizona cliffrose include urbanization, recreation, road and utility line construction, minerals exploration and mining, and livestock and wildlife browsing. The Cottonwood population is in a developing urban/suburban area. The most serious impacts from land development, road construction, and recreation are occurring here. The soils supporting Arizona cliffrose populations contain high quality bentonite, a type of clay with numerous commercial uses. Most mining and exploration has been in the Burro Creek and Horseshoe Lake populations. Livestock and/or wildlife browse all Arizona cliffrose populations. The greatest use occurs when both livestock and wildlife are present and when livestock are grazed yearlong (U.S. Fish and Wildlife Service 1995).

Status of the Species (Within in the Project Area)

The Cottonwood population occurs mostly on the Coconino NF. Jenkins (1991), Lutz (1994,1995), Hanneman (1995), and Baker and Wright (1996) conducted surveys in the vicinity of Cottonwood in the Verde Valley and elsewhere and confirmed the distribution of the previously known population, but did not extend the known range (Phillips et al. 1995). Warrick (1986), Lutz (1994, 1995), Baker and Wright (1993, 1994, 1995, and 1996) and Envirosystems Management, Inc. (2003) have done surveys on the Prescott NF, but have not located any populations of Arizona cliffrose there. Some potential habitat remains to be surveyed on both the Coconino and Prescott NFs.

Yellow starthistle, Malta starthistle, Russian knapweed and annual bromes are noxious and invasive weeds that may grow in the habitat of Arizona cliffrose. Malta starthistle and Russian knapweed occur in Dead Horse Ranch State Park immediately adjacent to populations of Arizona cliffrose on the Forest. One site of Russian knapweed is both on Deadhorse Ranch State Park and Forest lands, although the site is not in Arizona cliffrose habitat and is approximately 0.2 miles from known Arizona cliffrose plants (B. Phillips, personal observation July 6, 2004).

Region 3 Sensitive taxa share habitat with Arizona cliffrose. Heathleaf buckwheat (*Eriogonum ericifolium* var. *ericifolium*) and Ripley buckwheat *(Eriogonum ripleyi*) are limited to Tertiary limestone lakebed deposits. Three other Region 3 taxa, Hualapai milkwort (Polygala rusbyi),

Mearn's sage (*Salvia dorrii* ssp. *Mearnsii*) and Arizona phlox (*Phlox amabilis*) can be found in the desert scrub community but are not entirely limited to lakebed deposit soils.

Effects Analysis

Arizona cliffrose occurs on the Coconino NF in Management Areas (MAs) 11 and 17 in the Project Area. Emphasis for MA 11 is watershed condition, rangeland management, wildlife habitat for upland game birds, and dispersed recreation. Management Area 17 includes the Verde Valley Botanical Area, which was created to manage Arizona cliffrose and several other sensitive and rare plants. Emphasis for MA 17 is to maintain as nearly as possible existing conditions and natural processes for public enjoyment, demonstration, and study.

The Coconino Forest Plan (CFP) (USDA Forest Service 1987) has several Forest-wide Standards and Guidelines for endangered species management. Those appropriate for this integrated treatment of noxious and invasive weeds project are: Habitat management for federally listed species will take precedence over unlisted species. Inventory, evaluate, and prepare recovery schedules for threatened or endangered species. Monitor implementation of approved schedules, reproductive success, and effects of management activities at occupied threatened or endangered species sites. Use Biological Assessments to evaluate project impacts on threatened or endangered species and conduct appropriate Fish and Wildlife Service consultation when necessary. Provide appropriate protection or enhancement.

Standards and guidelines for MA 11 applicable to Arizona cliffrose include: The Verde Valley outside the wild and scenic section and lower Oak Creek is managed for dispersed recreation. Coordinate with Dead Horse State Park for connecting trails and access roads adjacent to the park.

Standards and guidelines for MA 17 applicable to Arizona cliffrose for this Project include: Prohibit off-road driving. Research Natural Areas and botanical area are managed to protect and maintain their uniqueness and ecological condition. Do not allow special use authorizations that would or could adversely affect or change the character of the areas. Manage roads adjacent to botanical areas … to prevent vehicular intrusion. Block and obliterate existing roads entering the areas in the first decade.

Surveys to identify locations of Arizona cliffrose plants in relation to noxious and invasive weed plants will be conducted in potential habitat before treatments occur. The best way to avoid infestation of the Arizona cliffrose habitat by any noxious and invasive weeds is by controlling or containing infestations in surrounding areas before they spread into the Forest. The Three-forest Noxious Weed Strategy (Phillips et al. 1998) and Integrated Weed Best Management Practices will be followed to ensure that all appropriate actions are taken to prevent spread of noxious and invasive weeds from off-forest sites onto the national forest lands occupied by Arizona cliffrose.

However, if noxious and invasive weeds do enter the forest in Arizona cliffrose habitat, it would be very important to control and eradicate the weeds immediately because the effects of non-treatment would be much more detrimental to Arizona cliffrose and its habitat than the potential adverse effects of treatments. Without treatment, yellow starthistle, Malta starthistle, and Russian knapweeds could grow unimpeded. It is likely that these noxious and invasive weeds would then directly out-compete seedlings of the Arizona cliffrose and kill some of the associated species that provide protective niches for Arizona cliffrose seedlings. Since Russian knapweed and yellow starthistle can form monocultures, virtually eliminating any other species in an area by their

allelopathic chemicals, they could also kill adult plants of Arizona cliffrose. The effects discussed below are therefore addressing the scenarios of treatments within Arizona cliffrose habitat on national forest lands in the case of such eventuality.

Since torching the noxious and invasive weeds growing in close proximity could kill seedling or adult Arizona cliffrose plants, treatment of noxious and invasive weeds in the Arizona cliffrose habitat with herbicide will be done without prior torching. Fire is a non-specific treatment. Any plant, regardless of status, can be damaged or destroyed during fire. This is a deviation from the usual treatment that will be applied under the Preferred Alternative, which proposes that yellow starthistle and Russian knapweed will be treated by burning to remove dead plants, and then treated with herbicide.

Some acres of yellow starthistle would be treated manually**.** Yellow starthistle and Malta starthistle could be hand pulled immediately adjacent to adult Arizona cliffrose plants but pulling where seedlings of the Arizona cliffrose are present could kill the seedlings by dislodging their roots. Design features include using trained field crews supervised by a botanist to avoid damage to Arizona cliffrose plants. Proper identification, combined with careful implementation, will prevent damage to Arizona cliffrose plants during manual or mechanical control of weeds. A buffer zone with a minimum radius equal to the height of the seedling will be established when using manual/mechanical treatments where seedlings occur.

Buffer zones for herbicides will be established around existing Arizona cliffrose plants. . If application of herbicides is deemed necessary, test treatments of the herbicide will be conducted on *ex situ* Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones to avoid adverse effects. Timing of herbicide treatments is critical: when effective for controlling weeds, treatments should be done in fall when shrubs are not actively growing and are not under water stress.

Specific herbicides have been selected for use in or near populations of TECS plants to have the least impacts to the plant of concern. Decisions were based on the known effects of the herbicides and based on the species they are known to control. The herbicides were selected based on the taxonomic relationship between the weed species and the plant. For example, if the weed species to be controlled and the plant are in the same taxonomic family or a closely related family, the assumption is that herbicides that would affect one would also affect the other. Herbicides were selected to have minimum or moderate impacts to the Threatened, Endangered, Candidate and Sensitive plants. The herbicides considered and those selected for each species are shown in Appendix D of the Final Environmental Impact Statement (FEIS). Only those herbicides reviewed and approved by the FS botanist will be used in or near Arizona cliffrose habitat.

The only major difficulty encountered was in the selection of herbicides to treat weeds in the habitat of the Arizona cliffrose. Two Sensitive plants, Heathleaf wild buckwheat and Ripley's wild buckwheats are found in the same habitat. Herbicides that will control weeds near the Arizona cliffrose might have adverse effects on the wild buckwheats. The herbicides selected would have the least effect on Arizona cliffrose and impacts to the wild buckwheats would need to be mitigated.

The herbicide imazapic is effective on Russian knapweed. Mature Russian knapweed plants would require herbicide treatment to kill them because of their deep taproots. Imazapic probably would have low toxicity to Arizona cliffrose when directed below the foliage, not on the foliage.

According to the labels for PLATEAU® (BASF 2000, 2002) (whose active ingredient is imazapic), brush and trees species tolerant to application directed below the foliage include species in the rose family (of which Arizona cliffrose is a member) such as serviceberry (*Amelanchier alnifolia*), hawthorn (*Crataegus* spp.), and cultivated apples, peaches, and plums. However, the label does suggest that the herbicide "be tried on a limited basis to determine tolerance in your area." Also, "application to tree and brush species that are under stress due to drought, disease, insect damage or other factors may be more susceptible to injury from PLATEAU® herbicide and may result in severe injury or death. Some species may exhibit tip chlorosis and minor necrosis. Foliar contact may increase injury to include defoliation and terminal death. Application methods that minimize foliar contact with desirable tree and brush species can improve tolerance. When making fall applications of PLATEAU® herbicide, potential injury to tree and brush species from foliar contact may be minimized by making the application after the leaves have begun to senesce…or after leaf drop. ….PLATEAU® herbicide applications in and around tree and brush species should be made at the recommended timing for the target weed species." Fall applications would be appropriate for treatment of Russian knapweed so it would be possible to follow this guideline.

The herbicide clopylarid is effective against the starthistles and probably would have low toxicity to Arizona cliffrose. According to labels for Transline™, Stinger™ and Curtail™ Reclaim™ (whose active ingredient is clopyralid), these herbicides are used for annual and perennial broadleaf and legume weeds control. Species in the rose family are not listed (Dow AgroSciences 1998, 2001a, 2001b, 2003). The supplemental labeling for Stinger™ directs that it can be used for broadleaf control around stone fruits such as apricot, plum, peach and cherry, which are in the Rose family (Dow AgroSciences 2002). The inability of clopyralid to bind with soils and its persistence implies that it has the potential to be highly mobile and affect water resources and non-target plants, although no extensive offsite movement has been documented (The Nature Conservancy 2001). A design feature would be to apply the herbicide on the starthistle rosettes when the soil is dry and Arizona cliffrose is not as actively growing, such as late fall and winter. Therefore, under this alternative there is a low probability that some Arizona cliffrose plants might be killed from herbicide use but it is unlikely to occur if care is taken to avoid direct spray on the Arizona cliffrose.

Annual bromes in the Verde Valley would not be treated under the Preferred Alternative. The annual bromes would continue to increase, resulting in increased threat to the Arizona cliffrose due to potential for increased frequency of wildfires. Based on observations of the effects of wildfires on other desert scrub ecosystems, Arizona cliffrose and the desert scrub community probably are not well adapted to wildfires. Associated plant species could be killed and the soils modified, leading to deterioration of the habitat of Arizona cliffrose following wildfire.

Cumulative Effects

The Coconino Forest Plan (USDA Forest Service 1987) designated the 470 ha (1,140 acres) Verde Valley Botanical Area for the protection of the unique plant community, which includes Arizona cliffrose. The Forest Service has considered Arizona cliffrose and its habitat, including the botanical area, in its actions since 1987 and has implemented many favorable actions.

In 1991, areas known to contain an important part of the Cottonwood population were withdrawn from the Bar-T-Bar land exchange. In 1991, additional surveys documented the presence of Arizona cliffrose and several FS sensitive species in the land exchange area (Jenkins 1991).

These lands were withdrawn from the exchange. The Coconino NF has indicated that no lands containing endangered species will be exchanged out of Federal ownership (U.S. Fish and Wildlife Service 1995).

The Coconino National Forest revised the Windmill Allotment Management Plan in 1992 to better accommodate Arizona cliffrose recovery needs, excluding livestock from some pastures and monitoring use in others (Ward personal communication 1996). The forest is currently working on the environmental documentation for a revised Windmill Allotment Management Plan. Managing livestock in the Windmill Allotment using the CFP S&Gs is providing increased protection for plants and habitat through use of fences, monitoring, and grazing regimes (M. Hannemann, Coconino NF email personal communication with B. Phillips 2003)**.**

Red Rock Ranger District initiated several actions since 1996 including trail re-routing and rock placement to protect Arizona cliffrose along several trails in the area of Dead Horse Ranch State Park, photo monitoring along trails, and maintenance of fences to exclude cattle and OHVs from the Verde Valley Botanical Area. Other beneficial actions included maintenance and enhancement of vehicle closures along Rocking Chair Road and emergency consultation on illegally placed signs. District biologists initiated the emergency consultation, then coordinated placement of the signs to eliminate damage to Arizona cliffrose (B. Phillips, Coconino NF, e-mail personal communication with C. McDonald 5 September 2003). The Forest Service closed and rehabilitated an unofficial target shooting range.

Numerous meetings have been held since June 1995, regarding the impacts from existing and proposed trails, types of recreation uses, and proposed development in the vicinity of Dead Horse Ranch State Park. These meetings have included the participation of personnel from the FS, State Park, FWS, and others. Surveys have been conducted for Arizona cliffrose, other sensitive plant species, and archeological and historical resources. There has been on-going informal consultation with FWS on this issue.

The Forest Service is working with State and local planners and other entities such as Dead Horse Ranch State Park, Arizona Department of Transportation, and private landowners to develop more comprehensive and ecosystem-based plans for the Verde Valley. A draft management plan for the Verde Valley Botanical Area has been prepared for the Forest Service (The Arboretum at Flagstaff, 2002). Modifications to the development plans of Dead Horse Ranch State Park Phase 3 Roadway Improvements resulted in increased protection for Arizona cliffrose and its habitat, both within the botanical area and adjacent to it (Phillips 1993).

In 1996 a 5-year research program on *Purshia subintegra* funded by ADOT as mitigation for the Hwy. 89A expansion project and the Mingus Avenue Bypass project in the Verde Valley was begun and conducted by the Arboretum at Flagstaff research facility. As mitigation for these road expansions, the Arboretum at Flagstaff cultivated Arizona cliffrose plants for return to sites along the roadway. However, several sites were unsuitable due to steep road cuts. The Arboretum at Flagstaff and the FS found suitable locations for some of these plants on CNF lands adjacent to Dead Horse State Park in Cottonwood. In April 2003 personnel from the Arboretum, Forest Service and numerous volunteers planted Arizona cliffrose plants and some associated Region 3 sensitive plant species on a Forest Service parcel as well as adjacent County land. These plants will be cared for and irrigated through a cooperative effort with the Arboretum, U.S. Forest Service, Dead Horse Ranch State Park, and volunteers (B. Phillips, Coconino NF, e-mail personal. communication. with C. McDonald 5 September 2003)..

The Arboretum at Flagstaff established 30 demographic plots at four sites in the Verde Valley in 1996 and monitored them yearly until 2001. Results of these plots and other studies on *Purshia subintegra* can be found in the yearly reports prepared by the Arboretum that are on file at the Coconino NF(Baggs 1996, 1997, 1998, 2000, Baggs and Maschinski 2000, 2001). Some of these studies include genetics, cultivation requirements, and perceived threats.

Other management agencies have also considered Arizona cliffrose in their projects and implemented positive actions as well. Therefore, the positive results anticipated from implementation of the Preferred Alternative will be additive to the positive actions the forest has taken to date, and will counter stresses such as OHV activity and environmental conditions such as prolonged drought and, potentially, increased frequency of wildfires due to non-treatment of exotic annual grasses that would have deleterious effects on Arizona cliffrose and its habitat.

Cumulatively, when other reasonably foreseeable actions are considered, weed populations should decline within and adjacent to the project area over the next 5 to 10 years. Other land managers are involved in actions to control or eradicate noxious and invasive weeds. (USDA Forest Service 2004).

Project Design Features:

1. Implement Integrated Weed Best Management Practices.
2. Work cooperatively with adjacent landowners to manage noxious and invasive weeds to prevent their spread into NFS Arizona cliffrose habitat.
3. Survey Forest Arizona cliffrose habitat for noxious and invasive weeds.
4. Survey Arizona cliffrose habitat to determine and prioritize the occupied and potential seedling sites that would be most vulnerable to encroachment of invasive and noxious weeds.
5. Treatment crew members will be experienced in identifying Arizona cliffrose and FS Sensitive species and will be supervised by a botanist.
6. Prior to initiation of weed treatments, survey each Forest Arizona cliffrose treatment site for presence of seedlings of Arizona cliffrose.
7. Establish a buffer zone with a minimum radius equal to the height of the seedling when using manual/mechanical treatments where seedlings occur.
8. If application of herbicides is deemed necessary, conduct test treatments of the herbicide on ex situ Arizona cliffrose with varying distances for buffers to determine appropriate buffer zones to avoid adverse effects.
9. Only those herbicides reviewed and approved by the FS botanist may be used in or near Arizona cliffrose habitat.
10. Timing of herbicide treatments is critical: when effective for controlling weeds, treatments should be done in fall when shrubs are not actively growing and are not under water stress.

11. Do not use torching of noxious and invasive weeds in Arizona cliffrose habitat. Treatments with herbicide will be done without prior torching.

Determination of Effects

There are many beneficial positive effects of the Preferred Alternative in regard to the prevention and control of noxious and invasive weeds in the habitat of Arizona cliffrose. The incorporation of the above project design features would make the probability very unlikely that yellow starthistle, Malta starthistle, and Russian knapweed might grow into the Forest habitat of Arizona cliffrose so the negative effects of noxious and invasive weeds on both seedling and adult Arizona cliffrose plants and associated species and habitat would be prevented. There is a remote possibility of killing a seedling of Arizona cliffrose while uprooting a weed and there could be minor killing of some foliage on adult Arizona cliffrose plants. However, there should be no interference with Arizona cliffrose reproduction, and I expect only very minor effects to the habitat due to soil disturbance from pulling noxious and invasive weeds and foot traffic. I determine that these effects will be insignificant or discountable.

I conclude, therefore, that the implementation of the project, "*Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona,"* **May Affect but is Not Likely to Adversely Affect the Species or its Habitat.**

Prepared by: /s/ Barbara G. Phillips Date: September 2, 2004

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Coconino, Kaibab, and Prescott National Forests Integrated Treatment for Noxious or Invasive Weeds Project

T&E Fish Biological Assessment

Cons. # 2-21-01-I-0335

Prepared by:

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September 22, 2004

Introduction

This Biological Assessment (BA) documents the effects on federally listed fish species from the implementation of the selected Alternative 4 of the integrated weed management (IWM) program for the Coconino, Kaibab, and Prescott National Forests.

The following table summarizes the determination of effects for federally listed or proposed fish species found within or impacted by the selected Alternative 4 for treatment of noxious and invasive weeds within the Coconino, Kaibab, and Prescott National Forests.

Table 1. Summary of ESA Effect Determinations for Federally Listed or Proposed Fish Species and designated Critical Habitat.

Common Name	ESA Species Affect Calls	ESA Critical Habitat Affect Calls
Gila topminnow	MANLAA	None
Razorback sucker	MANLAA	MANLAA
Colorado pikeminnow	NLJ	None
Spikedace	MANLAA	MANLAA
Loach minnow	MANLAA	MANLAA
Apache trout	MANLAA	None
Little Colorado spinedace	MANLAA	MANLAA
Gila chub	MANLAA	MANLAA

MANLAA = may affect, not likely to adversely affect

NLJ = not likely to jeopardize

CONSULTATION AND COORDINATION

Informal section 7 consultation on this proposed program began with a National Environmental Policy Act (NEPA) scoping request dated August 31, 1998. The U.S. Fish and Wildlife Service (FWS), Arizona Ecological Services Field Office responded to this request with a letter and species list dated October 5, 1998 (PR DOC #197) (Cons. # 2-21-01-I-0335).

Information on endangered and threatened species and critical habitats was collected from the three Arizona national forests (Coconino, Kaibab, and Prescott). The forests were asked to identify endangered, threatened, and proposed species, and designated and proposed critical habitat areas that occur within their Forests. For aquatics species, they were asked to identify any occupied habitat or proposed or designated critical habitat areas. They were requested to identify both occupied and suitable habitat.

The Forest Service and FWS began intensive and detailed informal consultation in April 2004 just after the release of the March 2004 DRAFT "Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U.S. Fish and Wildlife Service" (U.S. Fish and Wildlife Service, March 2004). Many meetings, e-mails, phones calls and discussions took place over the next several months. The RPMPA were finalized in July 2004. The conservation measures developed during those communications have been incorporated into this project. Those conservation measures are listed below.

PROJECT LOCATION

The Coconino, Kaibab, and Prescott National Forests, administered by the United States Department of Agriculture, are located in central and north central Arizona and encompass about 4.9 million acres. Major communities within or adjacent to the forests include Flagstaff, Williams, Ashfork, Chino Valley, Prescott, Prescott Valley, Camp Verde, Cottonwood, Rimrock, and Sedona. The project location includes all reserved public lands, wilderness, and non-wilderness, within the three national forests.

Of the 4.9 million acres, about 187,500 acres (or 3 percent of the land area) have been identified as being impacted with noxious weeds. There are currently 25 species of noxious weeds found within the project area and 4 new species that have been found adjacent to the national forests (Table 1). Sites range in size from single plants to a population of one species covering several thousand acres. The highest concentrations of weeds are found within the Little Colorado and Verde River Watersheds. Of the estimated 187,500 acres infested with weeds, roughly 182,335 acres, or 97 percent, occur within these two basins. Two species, bull thistle and Dalmatian toadflax, represent 177,085 acres of the area impacted.

DESCRIPTION OF ACTIONS UNDER THE SELECTED ALTERNATIVE

Under this action about 14,000 acres would be treated manually, 18,000 acres mechanically, 14,000 acres culturally, 16,000 biologically, and 57,000 acres with herbicides. Limited spray zones would be established adjacent to and within 1 mile of communities, recreation sites, trailheads, and scenic overlooks. Adaptive management principles apply and if the selected integrated weed management method does not work, then other methods, including herbicides, could be used. In addition, herbicides will be authorized in limited spray zones if the inventoried species include deep-rooted perennial weeds that cannot reach treatment objectives using manual techniques (such as camelthorn, Russian knapweed, leafy spurge, tamarisk, and tree of Heaven)

Sites where other treatment methods will be effective due to species, population size or site factors will be targeted for all integrated weed management methods except herbicides. Plant species in this category include yellow and Malta starthistle, Mediterranean sage, musk thistle, Scotch thistle, and bull thistle. Any proposed use of herbicides in right-of-way corridors under national forest jurisdiction would be coordinated, publicly posted, and completed in such a manner that alternate routes would remain accessible until the manufacturer's re-entry period is met, so multiple chemical sensitive individuals could still access recreational and other facilities found within the project area.

Limited spray zones do not include rights-of-way under the jurisdiction of the Federal Highway Administration or other public entities (State and county roads). Therefore, even if a limited spray zone is established around a community, a road under Federal Highway Administration, State, or county jurisdiction that traverses the area is not considered part of the zone. Interstates, U.S. highways, and state highways will be covered under the Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona. However, if ADOT does not treat a priority infestation in one of these roadway easements, the Forest Service would undertake this work. Under situations where the limited spray zones do fall under the jurisdiction of the Forest Service, the preferred methods will be mechanical, manual, cultural, or biological.

The table below summarizes those weeds being treated and the likely herbicide active ingredients for treatment.

Table 2. Noxious and invasive weeds and herbicide active ingredients.

	Herbicide Active Ingredients										
Invasive Plant by Priority	**2,4 D**	**chlorsulfuron**	**clopyralid**	**dicamba**	**glyphosate**	**imazapic**	**imazapyr**	**metsulfuron methyl**	**picloram**	**sulfometuron methyl**	**triclopyr**
leafy spurge	X				X	X	X		X		
yellow starthistle	X		X	X	X				X		
Malta starthistle	X		X	X	X				X		
camelthorn	X			X			X	X	X		X
Russian knapweed	X		X	X		X	X		X		
whitetop	X							X			
Mediterranean sage	X		X	X					X		
muskthistle	X	X	X		X			X	X		
spotted knapweed	X		X	X					X		
diffuse knapweed	X		X	X	X				X		X
Scotch thistle	X	X	X	X				X	X		
Russian olive	X						X				X
Siberian elm	X						X				X
tamarisk	X						X				X
Himalayan blackberry	X				X						X
giant reed					X						
sulfur cinquefoil	X								X		
Dalmatian toadflax	X			X	X	X	X		X		X
tree of Heaven	X						X				X
bull thistle	X	X	X	X				X	X		
cheatgrass						X				X	
wild oats					X	X					
jointed goatgrass					X	X				X	

SPECIES CONSERVATION MEASURES (Project Design Features)

RPMPA refers to the Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service authored by J. Allen White, July 2004. For this project, the RPMPAs were the starting point for the conservation measures. The table below summarizes how the conservation measures deviate from the RPMPAs and the rationale for that deviation. See Appendix 1 for summary of RPMPA and adjustments. See Appendix 2 for a summary of where the adjuvants may be used.

Table 3. Conservation Measures Deviations From RPMPA

Species	Deviation From RPMPA	Rationale
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace	May apply RPM's for large aquatic systems when flows >100cfs	Volume of water would provide dilution factor to remove impacts to species from herbicides.
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace	Spot applications (hand operated equipment with back pack sprayer) with no buffer from water's edge for glyphosate, imazapic, imazapyr application to individual plants	Closely controlled application of warm water fish zero toxicity herbicides would not have an adverse effect on any fishes as the herbicides would not likely get into the water and their toxicity is zero
Colorado pikeminnow, loach minnow, razorback sucker, spikedace	Apply modified RPM's for small aquatic systems when flows <100cfs	Low flow of water would not be able to provide dilution factor for herbicide applications

General Project BMPs:

1. Implement Integrated Weed Best Management Practices.
2. Use native species for seeding and planting during revegetating. An exception is the use of sterile hybrid grasses after careful analysis to provide immediate ground cover after wildfires.
3. FS will review "weed-free" certifications for seed and mulch to ensure they are "free" of the weed species to be controlled in the action area.
4. Treatments that are not within these design features would require additional analysis and may require additional coordination with the FWS (U.S. Fish and Wildlife Service).
5. Work cooperatively with adjacent landowners to manage noxious and invasive weeds to prevent their spread into NFS (National Forest System) lands.

All species:

1. Where specified, species breeding season timing restrictions are applicable to all treatment methods that are not commensurate with the designated uses.
2. Where two or more species' habitats occur, the more restrictive measures will take priority.
3. Noxious and invasive weed treatment methods during the breeding seasons for birds would be commensurate with designated uses (non-motorized, motorized, livestock, etc.) in the treatment areas.
4. Adjuvants including surfactants and cleaners would be used or applied according to the adjuvant summary table.

Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace in SMALL riparian habitats:

1. After a survey has been conducted, no restrictions on pesticide applications if USFWS concur that habitat is unoccupied by the species (RPMPA, pg. 73).

2. When stream flows are **100 cfs or greater**, herbicides would be applied per guidelines for large aquatic habitats in RPMPA pg. 76. (See summary table)
3. When stream flows are **less than 100 cfs**, herbicides would be applied per guidelines in RPMPA pg. 73 with the following modifications (See summary table):
   a. Approved Herbicides (Aquatic formulations only): Glyphosate, Imazapic, Imazapyr may be used within the riparian zone adjacent to but not in the aquatic habitat.
   b. Spot applications to individual plants are permitted within the buffer zone.
   c. For pool habitats, no pesticide applications may occur near pools when there is no surface flow of water in and out of pool or pools. Per the RPMPA, a 30 ft buffer would apply when there is no surface flow of water.
   d. When stream flows exceed 100 cfs (cubic feet per second), may apply guidelines for large riparian habitats (See Summary table).

Colorado pikeminnow, loach minnow, razorback sucker, spikedace in LARGE riparian habitats:

1. After a survey has been conducted, no restrictions on pesticide applications if USFWS concur that habitat is unoccupied by the species (RPMPA, pg76).
2. When stream flows are 100 cfs or greater, herbicides would be applied per guidelines for large aquatic habitats in RPMPA pg. 76. (See summary table)
3. When stream flows are less than 100 cfs, herbicides would be applied per guidelines in RPMPA pg. 73 with the following modifications (See summary table):
   a. Approved Herbicides (Aquatic formulations only): Glyphosate, Imazapic, Imazapyr may be used within the riparian zone adjacent to but not in the aquatic habitat.
   b. Spot applications to individual plants are permitted within the buffer zone.
   c. For pool habitats, no pesticide applications may occur near pools when there is no surface flow of water in and out of pool or pools. Per the RPMPA, a 30 ft buffer would apply when there is no surface flow of water.

STATUS OF LISTED SPECIES/CRITICAL HABITAT

Gila topminnow

Endangered Species Act Status:	Endangered, 1967
National Forest Occurrence:	None; proposed for Coconino, Prescott
Recovery Plan:	Final, 1995; revised draft 1999
Critical Habitat:	None designated

Determination of Effect: May affect, not likely to adversely affect species or its habitat

Habitat. Habitat requirements of Gila topminnow are broad; it prefers shallow, warm, and quiet waters, but can adjust to a wide range of conditions, living in quiet to moderate currents, depths to 3 ft, and water temperatures from a constant 80º F springs to streams that naturally fluctuating from 43-99º F. Topminnows can live in a wide variety of waters such as springs, cienegas, marshes, permanent or interrupted streams, and along the edges of large rivers. Preferred habitat contains dense mats of algae and debris, usually along stream margins or below riffles, with sandy substrates sometimes covered with organic mud and debris. Topminnows can withstand a wide range of water chemistries, with recorded pHs of 6.6-8.9 in existing habitats, dissolved oxygen readings of 2.2-11 ppm, and salinities that range from tap water to seawater.

Affected Habitat Description. There is no occupied habitat in the project area. Several sites on the PNF (Prescott National Forest) and CNF (Coconino National Forest) are recommended for restocking (U.S. Fish and Wildlife Service 1999). Currently, only Fossil Creek has been through NEPA (National Environmental Policy Act) analysis for reintroduction of topminnow (U.S. Department of Interior 2003). Other identified sites would be reintroduced with topminnow contingent on NEPA and could occur within the 10-year timeframe of the Plan. Potential sites include but are not limited to: Dry Creek, Indian Creek, Reimer Spring, Government Spring, Lower Mine Spring, Johnson Wash, and Sycamore Creek (near Dugas) on the PNF; and Fossil Creek on the CNF (Voeltz and Bettaso 2003). All of these sites are located within either the Verde River Watershed or Middle Gila Watershed. The majority of sites are small, spring systems with < ¼ mile of potential/suitable habitat. Many of the spring sites have been fenced to exclude livestock grazing and other uses are minimal. Fossil Creek and Sycamore Creek are larger systems with several miles of potential /suitable habitat. The presence of noxious weeds at the reintroduction sites is unknown.

Analysis of Effects. There would be no direct effects to Gila topminnow because there would be no treatments within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in upland and riparian areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's (Best Management Practices) would minimize runoff and soil erosion off of treatment areas so that any sediment moving into topminnow habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Cumulative Effects. The majority of Gila topminnow reintroduction sites would have no cumulative effects because the sites are within Forest System lands. Fossil Creek has a private inholding that encompasses a short segment of the stream south of Irving. Sycamore Creek has one parcel of private land above the proposed reintroduction site. Human impact along this reach of stream is low because of accessibility and rough terrain.

Determination of Effects. Effects to Gila topminnow and their habitat would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect Gila topminnow or its habitat.**

Razorback sucker

Endangered Species Act Status:	Endangered, 1991
National Forest Occurrence:	Coconino, Prescott
Recovery Plan:	Final, 1998; amended 2002
Critical Habitat:	Yes, 1994
Determination of Effect:	May affect, not likely to adversely affect species or its designated critical habitat

Habitat. Habitats required by adults in rivers include deep runs, eddies, backwaters, and flooded off-channel environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter (U.S. Fish and Wildlife Service 1998). Spring migrations of adult razorback sucker were associated with spawning in historic accounts, and a variety of local and long-distance movements and habitat-use patterns have been documented. Spawning in rivers occurs over bars of cobble, gravel, and sand substrates during spring runoff (January – April) at widely ranging flows and water temperatures (typically greater than 14° C). Razorback sucker are broadcast spawners that scatter adhesive eggs over cobble substrate. Eggs incubate in interstitial spaces (small, narrow spaces between rocks or other substrates). Young require nursery environments with quiet, warm, shallow water such as tributary mouths, backwaters, or inundated floodplain habitats in rivers, and coves or shorelines in reservoirs.

Affected Habitat Description. Razorback sucker reintroductions into the UVR (upper Verde River), made from 1981 to 1992, failed to establish any self-sustaining populations (Hendrickson 1993). A total of 19,363 large razorback suckers have been stocked into the lower Verde Verde from 1994 to 2003 (Jahrke and Clark 1999; F. Agyagos 2003). A small population occurs in the lower Verde River from stockings of hatchery-raised fish. There has been a steady increase in the number of razorback sucker recaptured in annual monitoring and survival over several years has been documented (Jahrke and Clark 1999; Weedman 2001, 2002). Some fish have been found in spawning condition but no evidence of reproduction or recruitment has been documented. The annual goal of the reintroduction program is to stock 2000 large (>300 millimeter) individuals into the Verde River system (Jahrke and Clark 1999). Threats to the species in the Verde River include potential habitat loss from urban development and water withdrawals in the watershed, and competition and predation by nonnative fish species.

CH (Critical habitat) in or adjacent to the project area includes 85 miles of the Verde River and its 100-year floodplain from Perkinsville (T18N R2E section 31) downstream to Fossil Creek(U.S. Fish and Wildlife Service 1994). The majority of the upper Verde River from Perkinsville to Clarkdale (19-miles) is in Forest Service ownership. The majority of the lands along the river in the Verde Valley from Clarkdale to below Camp Verde (45-miles) is in private ownership. The river is in Forest Service ownership again below Camp Verde to the confluence with Fossil Creek (21-miles). All primary constituent elements of CH are considered to be present within the Verde

River, except for presence of nonnative species that are at levels that are negatively impacting this species.

Table 4. Razorback sucker – Primary constituent elements of Critical habitat

Primary constituent elements
Water: This includes a quantity of water of sufficient quality (i.e. temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular live stage for this species.
Physical Habitat: This includes areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding, and rearing habitats, or access to these habitats.
Biological Environment: Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function on nutrient availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced nonnative fish species in many areas.

There is an estimated 98,000 acres impacted by noxious weeds within the Verde Watershed on the CNF and PNF. Most of these acres are associated with Dalmatian toadflax and bull thistle within the ponderosa pine vegetation type. There is an estimated 1,345 infested acres within the riparian zone of the Verde River and its tributaries. Noxious weeds species include Tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven, and Russian knapweed.

Livestock grazing occurs throughout the Verde Watershed on federal, state, and private lands. The upper Verde River on Forest System lands has been excluded from livestock grazing since 1998. The majority of the lower Verde River from Beasley Flat to Fossil Creek is excluded from livestock grazing. Livestock grazing does occur along portions of the river from about the confluence of Cottonwood Basin downstream to the confluence with Coldwater Creek on the PNF. This reach is proposed for fencing to restrict livestock grazing on the river under direction of the Verde Wild and Scenic River Comprehensive Plan (USDA Forest Service 2004). There are a few, small private land inholdings within the PNF in the upper and lower Verde River. The majority of the middle Verde River from Clarkdale downstream to below Camp Verde is within private ownership. Private land activities that could affect razorback sucker and CH along the Verde River include residential development, livestock grazing, agriculture, groundwater pumping from private wells, water diversions, and recreational activities. Impacts include direct and indirect effects to water quantity and quality.

Analysis of Effects. *Species:* There would be no direct effects to razorback sucker because no treatments would occur within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of

herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into razorback sucker habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Critical Habitat: Treatments would occur within and adjacent to designated CH of the Verde River. Use of manual, mechanical, cultural, or herbicidal treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and/or soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into CH would be such small immeasurable amounts as to have an insignificant effect to CH. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to water quality of CH. These treatments would have insignificant short-term impacts to the CH primary constituent elements of spawning, nursery, feeding, and rearing habitats, or access to these habitats when inundated. Long-term benefits to CH floodplain and its riparian vegetation include improved function due to return to native riparian vegetation.

Cumulative Effects. Community growth and development in the Prescott area and Verde Valley would continue to have impacts to the Verde River system as well as increase the amount of individuals using the project area. Potential effects include reduction in streamflow from increased water usage, reduced water quality from increased runoff and sediment input from alterations in the watershed, and impacts to riparian/aquatic areas from increased recreational activities. The Noxious Weed Plan would have long-term beneficial effect to retaining native vegetation in the watershed and riparian areas and help to offset impacts from community growth and development.

Determination of Effects. Effects to razorback sucker and designated critical habitat would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect razorback sucker or its designated critical habitat.**

Colorado pikeminnow

Endangered Species Act Status:	Endangered, 1967; Experimental nonessential 1985
National Forest Occurrence:	Coconino, Prescott
Recovery Plan:	Final, 1978; revised 1990; amended 2002
Critical Habitat:	Yes, 1994
Determination of Effect:	Not likely to jeopardize species or its habitat

Habitat. Adults require pools, deep runs, and eddy habitats maintained by high spring flows (U.S. Fish and Wildlife Service 1991a, 2002b). These high spring flows maintain channel and

habitat diversity, flush sediments from spawning areas, rejuvenate food production, form gravel and cobble deposits used for spawning, and rejuvenate backwater nursery habitats. Spawning occurs after spring runoff at water temperatures typically between 18 and 23°C. After hatching and emerging from spawning substrate, larvae drift downstream to nursery backwaters that are restructured by high spring flows and maintained by relatively stable base flows. Strong year classes of Colorado pikeminnow have been linked to years immediately following wet hydrologic conditions resulting in high spring-runoff flows.

Affected Habitat Description. Populations within the Verde River are considered "Experimental non-essential" under Section 10J of the Endangered Species Act (U.S. Fish and Wildllife Service 1985). There is no critical habitat designated in the Verde River.

Colorado pikeminnow reintroductions into the UVR (upper Verde River), made from 1985 to 1992, failed to establish any self-sustaining populations (Hendrickson 1993). A total of 10,852 large Colorado pikeminnow have been stocked in the lower Verde River from 1994 to 2003 (Jahrke and Clark 1999; F. Agyagos 2003). A small population occurs in the lower Verde River from stockings of hatchery-raised fish. There has been a steady increase in the number of Colorado pikeminnow recaptured in annual monitoring (Jahrke and Clark 1999; Weedman 2001, 2002). No evidence of reproduction or recruitment has been documented. The annual goal of the reintroduction program is to stock 2000 large (>300 millimeter) individuals into the Verde River system (Jahrke and Clark 1999). Threats to the species include potential habitat loss from urban development and water withdrawals in the watershed above occupied habitat, and competition and predation by nonnative fish species.

There is an estimated 98,000 acres impacted by noxious weeds within the Verde Watershed on the CNF and PNF. Most of these acres are associated with Dalmatian toadflax and bull thistle within the ponderosa pine vegetation type. There is an estimated 1,345 infested acres within the riparian zone of the Verde River and its tributaries. Noxious weeds species include Tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven, and Russian knapweed.

Livestock grazing occurs throughout the Verde Watershed on federal, state, and private lands. The upper Verde River on Forest System lands has been excluded from livestock grazing since 1998. The majority of the lower Verde River from Beasley Flat to Fossil Creek is excluded from livestock grazing. Livestock grazing does occur along portions of the river from about the confluence of Cottonwood Basin downstream to the confluence with Coldwater Creek on the PNF. This reach is proposed for fencing to restrict livestock grazing on the river under direction of the Verde Wild and Scenic River Comprehensive Plan (USDA Forest Service 2004). There are a few, small private land inholdings within the PNF in the upper and lower Verde River. The majority of the middle Verde River from Clarkdale downstream to below Camp Verde is within private ownership. Private land activities that could affect razorback sucker and CH along the Verde River include residential development, livestock grazing, agriculture, groundwater pumping from private wells, water diversions, and recreational activities. Impacts include direct and indirect effects to water quantity and quality.

Analysis of Effects. There would be no direct effects to Colorado pikeminnow because no treatments would occur within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are

restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into pikeminnow habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Cumulative Effects. Community growth and development in the Prescott area and Verde Valley would continue to have impacts to the Verde River system as well as increase the amount of individuals using the project area. Potential effects include reduction in streamflow from increased water usage, reduced water quality from increased runoff and sediment input from alterations in the watershed, and impacts to riparian/aquatic areas from increased recreational activities. The Noxious Weed Plan would have long-term beneficial effect to retaining native vegetation in the watershed and riparian areas and help to offset impacts from community growth and development.

Determination of Effects. Effects to Colorado pikeminnow and their habitat would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan **Is not likely to jeopardize the continued existence of the Colorado pikeminnow or its habitat.**

Spikedace

Endangered Species Act Status:	Threatened, 1986
National Forest Occurrence:	Coconino (proposed), Prescott
Recovery Plan:	Final, 1991
Critical Habitat:	Yes, 2000
Determination of Effect:	May affect, not likely to adversely affect species or its designated critical habitat

Habitat. Spikedace occupy mid-water habitats usually less than 1 m deep, with slow to moderate water velocities over sand, gravel, or cobble substrates (Propst *et al*. 1986, Rinne and Kroeger 1988). Adults often aggregate in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars (Propst *et al*. 1986). The preferred habitat of the spikedace varies seasonally and with maturation (Propst *et al*. 1986). In winter, the species congregates along stream margins with cobble substrates. The erratic flow patterns of southwestern streams that include periodic spates and recurrent flooding are essential to the feeding and reproduction of the spikedace by scouring the sands and keeping gravels clean (Propst *et al.* 1986). Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but will also occupy backwater habitats. The young typically occupy stream margin habitats, where the water velocity is less than 0.16 ft/sec (5 cm/sec) and the depth is less than 1.96 in (5 cm).

Affected Habitat Description. Recently spikedace are only known in the UVR (upper Verde River) and do not occupy the lower Verde River (below Peck's Lake diversion dam) or any of its tributaries. Spikedace are proposed for reintroduction into Fossil Creek under the Native Fish Restoration Environmental Assessment (U.S. Department of Interior 2003).

Spikedace have been most recently collected throughout the UVR from near the confluence with Granite Creek downstream to the confluence with Sycamore Creek. Spikedace are considered very rare in the UVR based on extensive surveys (Girmendock and Young 1997; AFGD 2000a, 2000b, 2001a, 2001b, 2003; Rinne and Stefferud 1998; RMRS 2004). This population has become recently rare due to various factors, most notably predation and competition by nonnative fish and lack of flooding (Rinne 1999). Longitudinal surveys for spikedace throughout the entire upper Verde River by RMRS recorded 140 spikedace in 1995, 15 in 1997, and 0 in 1998 (Rinne and Stefferud 1998). One spikedace was recorded by AGFD between the Burnt Ranch and FR 638 sites in 1999 in similar surveys from Granite Creek downstream to Perkinsville (M. Brouder 2002). No spikedace have since been found. Threats to the species in the upper Verde River include potential habitat loss from urban development and water withdrawals in the watershed, and competition and predation by nonnative fish species.

CH in or near the project area includes the following stream reaches and their 100-year floodplains:

Verde River – 106 miles of river extending from the confluence with Fossil Creek upstream to Sullivan Dam. The majority of the upper Verde River from Sullivan Dam to Clarkdale (40-miles) is in Forest Service ownership with the upper most reach being in state ownership. There are a three private land parcels within this reach. The majority of the lands along the river in the Verde Valley from Clarkdale to below Camp Verde (45-miles) is in private ownership. The river is in Forest Service ownership again below Camp Verde to the confluence with Fossil Creek (21-miles).

Fossil Creek – 5 miles of creek extending from the confluence with the Verde River upstream to the confluence with an unnamed tributary. All of this reach is within Forest Service ownership.

West Clear Creek – 7 miles of creek extending from the confluence with the Verde River upstream to the confluence with Black Mountain Canyon. The lower half of this reach is within private lands and the upper half within Forest Service lands.

Beaver/Wet Beaver Creek – 21 miles of creek extending from the confluence with the Verde River upstream to the confluence with Casner Canyon. This reach is within mixed ownership with the majority being private with the remainder being in Forest Service and National Park lands.

Oak Creek – 34 miles of creek extending from the confluence with the Verde River upstream to the confluence with an unnamed tributary (near the Yavapai/Coconino County boundary). This reach is within mixed ownership with the majority being private and the rest being Forest Service lands.

Granite Creek – 1.4 miles of creek extending from the confluence with the Verde River upstream to a spring. All of this reach is within state ownership.

Table 5. Spikedace – Primary Constituent Elements of Critical Habitat

Primary Constituent Elements
1. Permanent, flowing, unpolluted water.
2.Living areas for adult spikedace with slow to swift flow velocities in shallow water with shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at downstream riffle edges.
3. Living areas for juvenile spikedace with slow to moderate flow velocities in shallow water with moderate amounts of instream cover.
4. Living areas for larval spikedace with slow to moderate flow velocities in shallow water with abundant instream cover.
5. Sand, gravel, and cobble substrates with low to moderate amounts of fine sediment and substrate embeddedness.
6. Pool, riffle, run, and backwater components present in the aquatic habitat.
7. Low to moderate stream gradient.
8. Water temperatures in the approximate range of 1-30°C (35-85°F) with natural diurnal and seasonal variation.
9. Abundant aquatic insect food base.
10. Periodic natural flooding.
11. A natural, unregulated hydrograph or, if the flows are modified or regulated, then a hydrograph that demonstrates an ability to support a native fish community.
12. Habitat devoid of nonnative aquatic species detrimental to spikedace, or habitat in which detrimental nonnative species are at levels, which allow persistence of spikedace.

There is an estimated 98,000 acres impacted by noxious weeds within the Verde Watershed on the CNF and PNF. Most of these acres are associated with Dalmatian toadflax and bull thistle within the ponderosa pine vegetation type. There is an estimated 1,345 infested acres within the riparian zone of the Verde River and its tributaries. Noxious weeds species include Tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven, and Russian knapweed.

Livestock grazing occurs throughout the Verde Watershed on federal, state, and private lands. The upper Verde River on Forest System lands has been excluded from livestock grazing since 1998. The majority of the Verde River and its tributaries on Forest System lands have been excluded from livestock grazing in recent years. Livestock grazing does occur along portions of the Verde River from about the confluence of Cottonwood Basin downstream to the confluence with Coldwater Creek on the PNF. This reach is proposed for fencing to restrict livestock grazing on the river under direction of the Verde Wild and Scenic River Comprehensive Plan (USDA Forest Service 2004).

There are several communities and private land inholdings within the Verde River system in the project area. The majority of the middle Verde River from Clarkdale downstream to below Camp Verde is within private ownership. Private land activities that could affect spikedace and CH along the Verde River include residential development, livestock grazing, agriculture,

groundwater pumping from private wells, water diversions, and recreational activities. Impacts include direct and indirect effects to water quantity and quality.

Analysis of Effects. *Species:* There would be no direct effects to spikedace because no treatments would occur within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into spikedace habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Critical Habitat: Treatments would occur within and adjacent to designated CH of the Verde River and its tributaries. Use of manual, mechanical, cultural, or herbicidal treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and/or soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into CH would be such small immeasurable amounts as to have an insignificant effect to CH. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to water quality of CH. These treatments would have insignificant short-term impacts to the CH primary constituent elements of spawning, nursery, feeding, and rearing habitats, or access to these habitats when inundated. Long-term benefits to CH floodplain and its riparian vegetation include improved function due to return to native riparian vegetation.

Cumulative Effects. Community growth and development in the Prescott area and Verde Valley would continue to have impacts to the Verde River system as well as increase the amount of individuals using the project area. Potential effects include reduction in streamflow from increased water usage, reduced water quality from increased runoff and sediment input from alterations in the watershed, and impacts to riparian/aquatic areas from increased recreational activities. The Noxious Weed Plan would have long-term beneficial effect to retaining native vegetation in the watershed and riparian areas and help to offset impacts from community growth and development.

Determination of Effects. Effects to spikedace and designated critical habitat would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect spikedace or its critical habitat.**

Loach Minnow

Endangered Species Act Status:	Threatened, 1986
National Forest Occurrence:	None; Coconino (proposed)
Recovery Plan:	Final, 1991
Critical Habitat:	Yes, 2000
Determination of Effect:	May affect, not likely to adversely affect species or its designated critical habitat

Habitat. The loach minnow is found in small to large perennial streams, and uses shallow, turbulent riffles with primarily cobble substrate and swift currents (U.S. Fish and Wildlife Service 1991b). The loach minnow uses the spaces between, and in the lee of (sheltered side), larger substrate for resting and spawning. It is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Recurrent flooding and a natural hydrograph are very important in maintaining the habitat of loach minnow and in helping the species maintain a competitive edge over invading nonnative aquatic species.

Affected Habitat Description. The loach minnow is considered extirpated from the Verde River Basin (U.S. Fish and Wildlife Service 2000). Fish surveys of Verde River tributaries in 2001 found no loach minnows (U.S. Fish and Wildlife Service 2001). Loach minnow are proposed for reintroduction into Fossil Creek under the Native Fish Restoration Environmental Assessment (U.S. Department of Interior 2003).

CH for the loach minnow occurs in the project area. CH for the loach minnow overlaps with that given for the spikedace. The affected environment is the same as for spikedace.

Table 6. Loach minnow Primary Constituent Elements of Critical Habitat

Primary Constituent Elements
1. Permanent, flowing, unpolluted water
2. Living areas for adult loach minnow with moderate to swift flow velocities in shallow water with gravel, cobble, and rubble substrates
3. Living areas for juvenile loach minnow with moderate to swift flow velocities in shallow water with sand, gravel, cobble, and rubble substrates
4. Living areas for larval loach minnow with slow to moderate flow velocities in shallow water with sand, gravel, and cobble substrates and abundant instream cover
5. Spawning areas for loach minnow with slow to swift flow velocities in shallow water with uncemented cobble and rubble substrate
6. Low amounts of fine sediment and substrate embeddedness
7. Pool, riffle, run, and backwater components present in the aquatic habitat
8. Low to moderate stream gradient
9. Water temperatures in the approximate range of 1-30°C (35-85°F) with natural diurnal and seasonal variation
10. Abundant aquatic insect food base

Primary Constituent Elements
11. Periodic natural flooding
12. A natural, unregulated hydrograph or, if the flows are modified or regulated, then a hydrograph that demonstrates an ability to support a native fish community
13. Habitat devoid of nonnative aquatic species detrimental to loach minnow, or habitat in which detrimental nonnative species are at levels, which allow persistence of loach minnow

Analysis of Effects. *Species:* There would be no direct effects to loach minnow because no treatments would occur within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into loach minnow habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Critical Habitat: Treatments would occur within and adjacent to designated CH of the Verde River and its tributaries. Use of manual, mechanical, cultural, or herbicidal treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and/or soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into CH would be such small immeasurable amounts as to have an insignificant effect to CH. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to water quality of CH. These treatments would have insignificant short-term impacts to the CH primary constituent elements of spawning, nursery, feeding, and rearing habitats, or access to these habitats when inundated. Long-term benefits to CH floodplain and its riparian vegetation include improved function due to return to native riparian vegetation.

Cumulative Effects. Community growth and development in the Prescott area and Verde Valley would continue to have impacts to the Verde River system as well as increase the amount of individuals using the project area. Potential effects include reduction in streamflow from increased water usage, reduced water quality from increased runoff and sediment input from alterations in the watershed, and impacts to riparian/aquatic areas from increased recreational activities. The Noxious Weed Plan would have long-term beneficial effect to retaining native vegetation in the watershed and riparian areas and help to offset impacts from community growth and development.

Determination of Effects. Effects to loach minnow and designated critical habitat would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect loach minnow or its designated critical habitat.**

Apache trout

Endangered Species Act Status:	Threatened, 1975
National Forest Occurrence:	Kaibab
Recovery Plan:	Final 1979; revised 1983
Critical Habitat:	None designated
Determination of Effect:	May affect, not likely to adversely affect species or its habitat

Habitat. Apache trout prefer cool, clear, high-elevation streams and rivers, although they may have historically ranged down into larger streams. Large individual trout live in pools, while smaller ones prefer cover and structure such as overhanging trees or brush in runs and riffles.

Affected Habitat Description. An Ord Creek strain of Apache trout was introduced into North Canyon Creek, North Kaibab Ranger District, Kaibab National Forest, in 1963. Genetic testing of fish in 1979 determined that the trout population were pure Ord Creek strain. In 1996 and 1998, a total of 558 fish were removed from the creek for reintroduction into Ord Creek in New Mexico. Fish surveys of North Canyon Creek conducted in 2000 and 2001 found a stable population (Arizona Game and Fish Department 2001).

North Canyon Creek is a small, perennial system located within the Saddle Mountain Wilderness. Forest Service trail #4 parallels the creek and crosses multiple times. Human impact at the bottom of the canyon and along the narrow stream is low. Fishing pressure is not known but is considered to be light. Livestock grazing occurs in the watershed but no evidence of livestock grazing impacts have been noted along the creek (Arizona Game and Fish Department 2001). Threats to the species and their habitat include wildfire within the North Canyon drainage.

Analysis of Effects. There would be no direct effects to Apache trout because there would be no treatments within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in upland and riparian areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into Apache trout habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Cumulative Effects. There are no cumulative effects because all the lands within the North Canyon drainage with occupied habitat are within Forest System lands.

Determination of Effects. Effects to Apache trout and their habitat would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect Apache trout or its habitat.**

Little Colorado spinedace

Endangered Species Act Status:	Threatened, 1987
National Forest Occurrence:	Coconino
Recovery Plan:	Final, 1997
Critical Habitat:	Yes, 1987
Determination of Effect:	May affect, not likely to adversely affect species or its designated critical habitat

Habitat. Spinedace are found in water 0.5-4.3 ft deep, but appear most abundant in depths of about 1.9 ft. Spinedace are most common in slow-to-moderate water currents that flow over fine gravel bottoms. They avoid deep, heavily shaded pools and shallow, open areas, preferring unshaded pools with rocks or undercut banks for cover. Temperatures where populations exist generally range from 58-79° F. Young of the year are most abundant on uniformly turbulent riffles 3.9-9.8 in. deep. Spinedace appear quite capable of tolerating relatively harsh environments that undergo dramatic fluctuations in pH, dissolved gases, and water temperatures. Their populations are believed to be declining due to alteration of habitat through reduced streamflow and predation and/or competition with non-native fishes. Predation occurs mainly from rainbow trout and green sunfish.

Affected Habitat Description. Little Colorado spinedace populations occur in the East Clear Creek drainage on the CNF. The entirety of the East Clear Creek drainage is considered occupied spinedace habitat (USDA Forest Service 1999). Populations fluctuate seasonally and annually. They have been recently recorded in Poverty Draw, Coldwater Springs, Cienega Draw, Jones Crossing, and Miller Canyon above the Blue Ridge Reservoir; and 95 Crossing, Barbershop Canyon, Kinder Crossing/Horse Crossing, Hamilton Crossing, Leonard Canyon, West Leonard Canyon, Willow Creek, and Bear Canyon below Blue Ridge Reservoir. Threats to the species include predation by nonnative species such as trout and crayfish.

CH in the project area includes 31 mi of East Clear Creek (Coconino County, Arizona) from its confluence with Leonard Canyon upstream to Blue Ridge Reservoir, and from the upper end of Blue Ridge Reservoir to Potato Lake (U.S. Fish and Wildlife Service 1997). CH designation includes only the stream course. The primary constituent elements of critical habitat include clean, permanent flowing water with pools and a fine gravel or silt-mud substrate.

There is an estimated 84,000 acres impacted by noxious weeds within the Little Colorado Watershed on the CNF. Most of these acres are associated with Dalmatian toadflax and bull thistle within the ponderosa pine vegetation type. Livestock grazing occurs throughout the watershed. The majority of East Clear Creek and many of its tributaries have been excluded from livestock grazing. There are several private land inholdings along East Clear Creek and Leonard Canyon within the CNF. Activities on these inholdings can include livestock grazing, recreation, water diversions, and agriculture. Stocking of trout into Blue Ridge Reservoir and Knoll Lake

occur as a put-and-take fisheries. Migitation and monitoring is in place to reduce the possibility of fish migration downstream into occupied spinedace habitat.

Analysis of Effects. *Species:* There would be no direct effects to Little Colorado spinedace because no treatments would occur within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into spinedace habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Critical Habitat: Treatments would occur adjacent to designated CH of East Clear Creek. Use of manual, mechanical, cultural, or herbicidal treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and/or soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into CH would be such small immeasurable amounts as to have an insignificant effect to CH. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to water quality of CH. These treatments would have insignificant short-term impacts to the CH primary constituent elements of spawning, nursery, feeding, and rearing habitats, or access to these habitats when inundated. Long-term benefits to CH floodplain and its riparian vegetation include improved function due to return to native riparian vegetation.

Cumulative Effects. The majority of the East Clear Creek drainage within the project area would have no cumulative effects because the sites are within Forest System lands. There are some parcels of private land inholdings within Forest System lands that would continue to have unquantified impacts to the species and its habitat.

Determination of Effects. Effects to Little Colorado spinedace and CH would be insignificant and discountable. It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect Little Colorado spinedace or its designated critical habitat.**

Gila chub

Endangered Species Act Status:	Proposed Endangered, 2002
National Forest Occurrence:	Coconino, Prescott
Recovery Plan:	None
Critical Habitat:	Yes, proposed 2002

Determination of Effect: May affect, not likely to adversely affect species or its designated critical habitat

Habitat. Gila chub commonly inhabit pools in smaller streams, springs, and cienegas (a desert wetland), and can survive in small artificial impoundments (Miller 1946; Minckley 1973; Rinne 1975). Gila chub are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover including terrestrial vegetation, boulders, and fallen logs (Rinne and Minckley 1991).

Affected Habitat Description. The gila chub is currently known in six locations in the project area. Site locations and status of Gila chub populations are taken from Weedman et. al. (1996) and also from USDA Forest Service (2003) and include:

Sycamore Creek (Middle Gila Watershed): Occupied habitat occurs along 3-miles of perennial-interrupted creek from Double T Waterfall downstream to Rock Bottom Box on PNF lands. Recent surveys show healthy populations with mulitple age classes (USDA Forest Service 2003). Natural and manmade barriers restrict movement of gila chub to upstream reaches of creek and also upstream migration of nonnative fish from lower reaches of the creek. Rainbow trout occur in upstream reaches and migrate downstream in gila chub habitat during high flows. No other fish species occur in the 3-mile reach though nonnative crayfish are present. Livestock grazing impacts occur at the lower end of this reach. There is minimal impact in the upper reach because of rough terrain limiting accessibility. There is minimal human impacts along this reach.

Little Sycamore Creek (Middle Gila Watershed): Occupied habitat occurs along 0.25-miles of creek above the Horner Mountain Ranch. Recent surveys show healthy populations with mulitple age classes (USDA Forest Service 2003). Co-occuring aquatic species include desert sucker, longfin dace, lowland leopard frog, mosquitofish, and crayfish. There is a water diversion pump in the lower end of occupied habitat to supply water to the ranch. This lower pool also has some human impacts from recreational activities.

Indian Creek (Middle Gila Watershed): Occupied habitat occurs along 0.25-miles of creek at Upper Water and Middle Water springs on PNF lands. Recent surveys show healthy populations with mulitple age classes (USDA Forest Service 2003). Both sites were fenced to exclude livestock grazing in 2003. Water diversions occur at both sites to pipe water to troughs outside the exclosures for livestock use. Co-occuring aquatic species include desert sucker, longfin dace, and lowland leopard frog. There is minimal human use of these sites.

Red Tank Draw (Verde Watershed): The status of gila chub populations in this creek is unknown. Green sunfish and crayfish are abundant in this system. Livestock grazing on CNF lands also occurs along the creek.

Spring Creek (Verde Watershed): Occupied habitat occurs from just above FS Road 796 downstream to the confluence with Oak Creek. Co-occuring fish species include desert sucker, Sonora sucker, speckled dace, and longfin dace. Smallmouth bass and fathead minnows have been collected and along with other nonnatives pose a threat to gila chub. Most land along the perennial reach of Spring Creek is privately owned, and possible impacts from development or land uses are unknown. Camping and recreation are ongoing activities at the FR 796 crossing of the creek.

Walker Creek (Verde Watershed): Occupied habitat occurs above the FS Road 618. The creek is fenced to exclude livestock grazing on CNF lands. There is a water diversion to private land below the exclosure. Co-occuring aquatic species include desert sucker and speckled dace. The ephemeral nature of the lower end of Walker Creek appears to be limiting invasion of nonnatives from Wet Beaver Creek.

Proposed CH in or near the project area includes the following stream reaches and a 300-foot width from each streambank:

Walker Creek – 4.2 miles of creek extending from Forest Road 618 crossing upstream to T 14 ½ N, R 6 E, Section 1 SESE. The lower 1-mile of this reach is within private lands with the remainder being Forest Service lands.

Red Tank Draw – 6.7 miles of creek extending from the eastern edge of the Montezuma Castle National Monument upstream to the confluence with Rarick Canyon. The lower 1.5-mile is primarily in private lands with the remainder being Forest Service lands.

Spring Creek – 3.6 miles of creek extending from T 16 N, R 4 E, Section 27 SE ¼ upstream to the crossing of Arizona Highway 89A. This reach is in mixed ownership with the majority being in private or state lands with two short reaches of Forest Service lands.

Williamson Valley Wash – 4.2 miles of creek extending from the gaging station upstream to the crossing of Williamson Valley Road. All of this reach is within private ownership.

Little Sycamore Creek – 0.75 miles of creek extending from the confluence with Sycamore Creek upstream to Horner Mountain Ranch. This reach is in mixed private and Forest Service ownership.

Sycamore Creek – 11.5 miles of creek extending from the Rock Bottom Box upstream to the Nelson Place Spring. The majority of this reach is in Forest Service ownership with 5 parcels of private lands interspersed along the reach.

Indian Creek – 3.3 miles extending from 2-miles southwest of the PNF boundary upstream about 1 mile within the PNF. The majority of this reach is in Bureau of Land Management or Forest Service ownership with one parcel of private lands.

Table 7. Gila Chub – Primary constituent elements of proposed Critical habitat.

Primary Constituent Elements
1. Perennial pools, areas of higher velocity between pool areas, and areas of shallow water among plants or eddies all found in small segments of headwaters, springs, or cienegas of smaller tributaries.
2. Water temperatures for spawning ranging from 20 to 26.5^{O}C (68 to 79.7 ^{O}F) with sufficient dissolved oxygen, nutrients, and nay other water related characteristics needed.

Primary Constituent Elements
3. Water quality with reduced levels of contaminants or any other water quality characteristics, including excessive levels of sediments, adverse to Gila chub health.
4. Food base consisting of invertebrates, filamentous (threadlike) algae, and insects.
5. Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs.
6. Habitat devoid of nonnative aquatic species detrimental to Gila chub or habitat in which detrimental nonnative are kept at a level which allow Gila chub to continue to survive and reproduce.
7. Streams that maintain a natural unregulated flow pattern including periodic natural flooding. If flows are modified, then the stream should retain a natural flow pattern that demonstrates an ability to support Gila chub.

There is an estimated 98,000 acres impacted by noxious weeds within the Verde Watershed on the CNF and PNF. Most of these acres are associated with Dalmatian toadflax and bull thistle within the ponderosa pine vegetation type. There is an estimated 1,345 infested acres within the riparian zone of the Verde River and its tributaries. Noxious weeds species include Tamarisk, giant reed, Russian olive, Himalayan blackberry, tree of Heaven, and Russian knapweed. Current weed infestations within the Middle Gila Watershed are estimated at 1,875 acres. There are a few, small private land inholdings along occupied CH. Private land activities that could affect Gila chub and CH include residential development, livestock grazing, agriculture, groundwater pumping from private wells, water diversions, and recreational activities. Impacts include direct and indirect effects to water quantity and quality.

Analysis of Effects. *Species:* There would be no direct effects to Gila chub because no treatments would occur within the aquatic habitat. Noxious weed treatments could occur up to the waters edge of aquatic habitat. Application of herbicides near occupied habitat would follow RPMPA guidelines. These guidelines restrict use of herbicides and adjuvants to those that have been determined to be practically nontoxic to fish species. In addition, application methods are restricted to spot applications of liquid formulations to minimize spray drift and/or surface runoff of herbicides. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to the species or its habitat. Use of manual, mechanical, or cultural treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into Gila chub habitat would be such small immeasurable amounts as to have an insignificant effect to the species or its habitat.

Critical Habitat: Treatments would occur within and adjacent to designated CH. Use of manual, mechanical, cultural, or herbicidal treatments in riparian and upland areas would result in short-term, localized impacts to vegetation and/or soil. Implementing BMP's would minimize runoff and soil erosion off of treatment areas so that any sediment moving into CH would be such small immeasurable amounts as to have an insignificant effect to CH. Implementing RPMPA guidelines would minimize the toxicity and exposure of herbicides to such small immeasurable levels as to have an insignificant effect to water quality of CH. These treatments would have insignificant short-term impacts to the CH primary constituent elements of spawning, nursery, feeding, and

rearing habitats, or access to these habitats when inundated. Long-term benefits to CH floodplain and its riparian vegetation include improved function due to return to native riparian vegetation.

Cumulative Effects. Community growth and development in the project area would continue to have impacts to the stream systems as well as increase the amount of individuals using the project area. Potential effects include reduction in streamflow from increased water usage, reduced water quality from increased runoff and sediment input from alterations in the watershed, and impacts to riparian/aquatic areas from increased recreational activities. The Noxious Weed Plan would have long-term beneficial effect to retaining native vegetation in the watershed and riparian areas and help to offset impacts from community growth and development.

Determination of Effects. Effects to proposed Gila chub and their proposed CH would be insignificant and discountable. It is expected that the Gila chub and CH will be listed in the near future. Based on this listing, It is my determination that implementation of the Noxious Weed Plan would **May affect, but is not likely to adversely affect Gila chub or its designated critical habitat.**

SIGNATURES:

Prepared by:

Albert Sillas 09/22/04

Albert Sillas — Date
District Fish and Wildlife Biologist
Verde Ranger District
Prescott NF

Approved by:

R. Michael Leonard 10/15/04

R. Michael Leonard — Date
WFRP Team Leader
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Appendix 1

RPMPA Herbicide Application Summary Table for fish species in consultation with the FWS

Federal Species/ Herbicides	2, 4-D (acid formulations)	2, 4-D (aquatic amine salt formulations)	2, 4-D (nonaquatic amine salt formulations)	2, 4-D (aquatic ester formulations)	2, 4-D (nonaquatic ester formulations)	CHLORSULFURON	CLOPYRALID	DICAMBA	GLYPHOSATE (aquatic)	GLYPHOSATE (nonaquatic)
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace (Less than 100 cfs)	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 50 ft buffer	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 50 ft buffer	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 50 ft buffer	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 50 ft buffer	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- No buffer w/ spot applications per the conservation measures	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*

Colorado pikeminnow, loach minnow, razorback sucker, spikedace (Greater than 100 cfs)	No buffer	No buffer	No buffer	Spot applications in the following areas :1/2 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid-20 ft buffer	Spot applications in the following areas :1/2 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid-20 ft buffer	No buffer	No buffer	Spot applications in the following areas :1/2 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid-10 ft buffer	No buffer	Spot applications in the following areas :1/2 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid-10 ft buffer

Federal Species/ Herbicides	IMAZAPIC	IMAZAPYR (technical formulation)	IMAZAPYR (aquatic)	IMAZAPYR (nonaquatic)	METSULFURON-METHYL (see note below)	PICLORAM (see note below)	SULFOMETURON-METHYL	TRICLOPYR (amine salt formulations)	TRICLOPYR (ester formulations)
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- No buffer w/ spot applications per the conservation measures	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat* *10 ft buffer if Spot applied	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- No buffer w/ spot applications per the conservation measures	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- No buffer w/ spot applications per the conservation measures	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 30 ft buffer from edge of water body or habitat*	Spot applications in the following areas :1 mile upstream (including tributaries), all species habitat, & 300 ft downstream: Liquid- 50 ft buffer
Colorado pikeminnow, loach minnow, razorback sucker, spikedace	No buffer	No buffer	No buffer	No buffer	Spot applications in the following areas :1/2 mile upstream (including	Spot applications in the following areas :1/2 mile upstream (including	Spot applications in the following areas :1/2 mile upstream (including	No buffer	Spot applications in the following areas :1/2 mile upstream (including

					tributaries), all species habitat, & 300 ft downstream: Liquid-10 ft buffer	tributaries), all species habitat, & 300 ft downstream: Liquid-10 ft buffer	tributaries), all species habitat, & 300 ft downstream: Liquid-10 ft buffer		tributaries), all species habitat, & 300 ft downstream: Liquid-20 ft buffer

Notes:

RPMPA - Resource Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service. J. Allen White, U.S. Fish and Wildlife Service, 10711 Burnett Road, Suite No. 200, Austin, Texas 78758, July 2004.

These RPMPAs are to be implemented in concert with the Design Features detailed in Appendix E of the FEIS for the Tri-Forest Noxious and Invasive Weed Treatments

Metsulfuron = metsulfuron is rated as Class 1 in toxicity groups for fish and amphibians due to reported mortality incidents not indicated by toxicity data

Picloram = picloram is used mostly for broad-leaved plants but can harm some grasses and other monocots

1 - A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between three to ten miles per hour, and no rainfall for 24 hours) should be followed in implementing recommended buffer zones.

2 - Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.

3 - Low aerial applications (nozzle or spreader height less than 12 feet) and high aerial applications (nozzle or spreader height greater than 12 feet) are relative to the plant canopy or a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40% grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40% grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

4 - Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.

5 - Liquid formulations include any type of liquid-based formulation other than ULV formulations.

6 - ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre

BS - Breeding Season
ROW - Right of way
PAC - Protected Activity Center
MSO - Mexican spotted owl
TR - Timing restriction

Appendix 2

Adjuvant Summary Table and Design Features

Federal Species	ACTIVATOR 90, SILWET L-77, CHOICE, LI 700, ACIDI pHACTANT, ALL CLEAR, Tank and Equipment Cleaner	MSO, AMIGO, Marker dye WSP, CHEM-TROL, NU FILM P, FIGHTER F, FOAM FIGHTER
Apache trout, Gila chub, Gila topminnow, Little Colorado spinedace, Colorado pikeminnow, loach minnow, razorback sucker, spikedace	Shall not be used in riparian habitat*.	Approved for use in riparian habitat.

***Riparian habitat** - Overstory trees include alders, conifers, cottonwood, maple, sycamore, and willows. Understory species include hackberry, New Mexico locust, and soapberry. Herbaceous plants include sedges, spikerush, bull rush, little bluestem, blue grama, Canadian wildrye, sand bluestem, squirreltail, smartweed, and curlydock (EIS vegetation affected environment).

Appendix G. Response to Comments and Government/Agency Letters

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1451	1	"The following facts are of concern to me: Very little is known about long term low level effects of herbicides on animals and humans, recent reports on frogs raise a red flag."	Yes	We agree that there is little known regarding long-term, low-level effects. For example, the use of Atrazine or any of the Triazines were not proposed in this FEIS due to their correlation with negative effects to frogs.
1451	2	"Chemical interactions are relatively common and can have negative effects considerably stronger than separate chemicals (little study has been done)."	Yes	Agree; there is little known regarding herbicide synergism. More analysis of synergistic effects is included in the document under "Public Health," Ch. 4.
1451	3	"Evaporation of the herbicides contributes to air pollution and the polar regions are already in toxic overload from the migration of air pollutants (many animals as well as humans exceed EPA limits stored in their fat cells)."	Yes	Evaporation was considered and herbicide labels provide direction to minimize nontarget effects.
1451	4	"There is a high probability that the ground water will be contaminated and once a herbicide enters the ground water it is not readily broken down (cleanup and health costs)."	Yes	Mitigation measures appear in Appendix B to minimize contamination of ground water. See "Safe Drinking Water" in Ch. 4.
1451	5	"Considering these factors, I feel that the costs estimated for the herbicide plans are vastly underestimated. Is there a copy of the costs analysis of the plans?"	Yes	The cost analysis is available in the project record. These costs are based on 1999-2001 data and provide relative costs between alternatives.
1451	6	"Are there any riparian areas, springs, that have been benchmarked for chemical contamination? If not, will there be studies in the areas of concern?"	Yes	Riparian areas that have been identified for treatment using herbicides have recommended protection measures in place to minimize this potential. See wildlife specialist report (WSR) and project biological assessment and evaluation (BA&E).

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1458	1	"I suggest that somewhere you discuss the interaction of the noxious weed program with the program to reduce potential forest fires by aggressive forest thinning. In some cases these two programs may assist each other and in other cases create conflict."	Yes	Good idea. See "Cumulative Effects," Ch. 4.
1464	1	"Please read the following site on reaction to proposed application of herbicides."	Yes	Thank you for the information; we printed the article and have reviewed this document. The FEIS plans to use buffer zones to prevent contamination of our lakes and we are not treating aquatic weeds.
1466	1	"What exactly is a noxious or invasive weed. You present some general definitions (p 4-5) but I couldn't find a specific definition as why spp X is on your hit list. Nor could I find any differentiation of your list for noxious or invasive. Are all the spp noxious and invasive?"	Yes	Noxious weed is explained in the section "Noxious Weed Defined" in Chapter 1. We have added a clearer explanation of invasive weed and why these species are invasive in the project area.
1466	2	"A serious problem I have is your proposed attack on these plants. By your own estimates only ~3% of the NF's are "infested" (p 42-43). Why spend an estimate ~$10 million to $12 million? In these days of tight budgets can you really justify this kind of expenditure? Seems to me that if you invested $10-$12 million in good, on the ground, sound resource management efforts, you'd be far better off (and probably control your weed problems)."	Yes	Yes, this expenditure is justified because of the negative impacts weeds have on our environment. You have stated the point precisely: weed management is a good, sound, on-the-ground resource effort.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1470	1	"Mechanical measures, as defined in your draft document, have the potential to result in the deposition of dredged or fill material within waters of the United States, and may require a Department of the Army permit issued under Section 404 of the Clean Water Act. A Section 404 permit is required for the discharge of dredged or fill material into the waters of the United States, including adjacent wetlands."	NA	Thank you for providing useful information.
1474	1	"Recently I read in our local newspaper The Daily Courier, the astronomical cost of implementing this program. I was shocked to think that the U.S. government is spending that amount of money when many people in our country don't have enough to eat or adequate medical care."	Yes	Justification of this project is in Ch. 1, "Purpose and Need."
1475	1	"Real Good Job"		Thank you.
1475	2	"Mistletoe and horehound are all over Diamond Valley, has tried burning, spraying, cutting it out and can't kill horehound."	Yes	Thank you for the information but this is outside the scope of this project.
1475	3	"Doesn't like herbicides; would volunteer to assist."	Yes	Thank you. If preferred alternative is approved, other methods will be utilized to reduce total amounts of herbicide use.
1478A	1	"Good exhibit, hope you get a good turnout of citizens to view it."	No	Thank you.
1478B	1	"Informative exhibit and a worthwhile project"	No	Thank you.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1479	1	"I am very concerned with the use of toxic chemicals in the forest. I am chemically sensitive and I need places to be free of chemicals to stay alive…. When you use biological agents it gets into the ground water, soil, and air and eventually effects human health."	Yes	We are assuming from context that the biological agents you are referring to are pesticides. We have considered this in the "Safe Drinking Water Act" discussion and the "Environmental Consequences" section for "Soil, Water and Air," Ch. 4.
1479	2	"I feel pulling, mowing, grazing, plowing and tilling would be your best options and also native plant growth."	Yes	These techniques are part of all the action alternatives.
1479	3	"One application of pesticides can last up to 30 years in the environment."	Yes	We have considered the longevity of the proposed herbicides (see risk assessments in the project record) and have addressed this in project mitigations (see Appendix B).
1479	4	"Pesticides travel hundreds of miles from application."	Yes	We have considered translocation (solubility, drift and leaching) of the proposed herbicides (see risk assessments in the project record) and have addressed this in project mitigations (see Appendix B).
1480	1	"The proposed new projects if implemented as planned, are exempt from the requirements of the Farmland Protection Policy Act (FPPA) as revised in 1994, that excludes land which is already in or is committed to urban development, currently used as water storage, or land that is not prime or unique farmland."	NA	Thank you for the information.
1481	1	"Thank-you, so very much. Yes, I am very interested, but not quite this much."	No	Thank you.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1485	1	"Primarily my concern about the application of herbicide/pesticide in the South Lake Mary Road area reflects a belief that any chemicals deposited in that area will find their way into our water supply. The four families at North Ranch are jointly supplied by a well on the property. "	Yes	We have considered this in the Safe Drinking Water Act discussion and the "Environmental Consequences" section for "Soil, Water and Air" and have addressed this in project mitigations.
1485	2	"We also maintain a trout pond from the run-off which travels directly from the proposed application area under Lake Mary Road and onto the property."	Yes	The fish specialist report (FSR) and BA&E for this project addresses effects to fish.
1485	3	"I can't fathom a justification for contaminating our water supply and diminishing the value of our property based solely in the elimination of plants that someone might consider unsightly."	No	Although some of these weed species are unsightly, this is not the purpose and need of this project, chapter.1.
1485	4	"It was easy enough for me to gather information on the risks of picloram usage to the water supply. For example, the report which follows was developed by the USFS of Sheridan County, Wyoming and directly addresses the issue: http://water.usgs.gov/pubs/fs/fs12301/">Click here: Pesticides in Ground Water-Sheridan County, Wyoming, 1999-2000</A> The results of this study indicate that of the several chemicals for which tests were run in that area, picloram or Tordon was found in the second highest concentration in the ground water."	Yes	Thank you for this information. We have reviewed this document and incorporated it into the "Environmental Consequences" section for "Soil, Water and Air," Ch. 4, and have addressed this in project mitigations (Appendix B).
1486	1	"This is in full support of your invasive weeds management plan. We need to stop these invasive weeds before they take over completely. Move ahead as quickly as you can!"	No	Thank you.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1487	1	Phone conversation note: she is in favor of Option 4 but would change it from restricted spraying in the buffer zones to no spraying in the buffer zones.	Yes	We agree to a point. We will utilize other effective methods of treatment identified in this project before introducing herbicides into limited spray zones.
1488	1	"First, your team is to be complemented for the extensive work in preparing this detailed program to rid the area of noxious and invasive weds. We fully endorse your planned action and hope you are given the funding and power to implement the program ASAP."	No	Thank you.
1489	1	"Herbicides are bad for many reasons: they kill beneficial plants and insects and animals."	Yes	We have proposed design features and mitigation measures in Appendix B that will minimize effects to nontarget organisms. See the botany specialists' report (BSR), FSR, WSR, and project BA&E.
1489	2	"Herbicides eventually get into the water supply and poison our water and air."	Yes	See "Safe Drinking Water Act" discussion in Ch. 4.
1489	3	"They [herbicides] drift and there is no controlling where they go. So even if only designated areas are sprayed, this stuff can drift and persist in the environment for weeks, months or even years."	Yes	We have considered translocation (solubility, drift and leaching) of the proposed herbicides (see risk assessments in the project record) and have addressed this in project design features and mitigations (see Appendix B).

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1491	1	"My concerns include the lack of firm limits on the number of acres to be treated with herbicides and on the percentage of total treatments apportioned to herbicide use. Current wording in the statement allows for no limits on the number of acres to be chemically treated nor on the amount of herbicides to be used. For example, p. vii states '…alternative strategies will be developed to address this problem-…' And p. 19 states '…method does not work then other methods, including herbicides, could be used.'"	Yes	Limits are defined within the "Adaptive Management" section in Ch. 6.
1491	2	"The role of monitoring the inevitable increase in pesticide residue in the 350 wells monitored is left to the Arizona Dept. of Environmental Quality (ADEQ). There is so much latitude in the wording in the statement that Water Quality in future years can be completely ignored by the Forest Service unless EPA allowed levels of chemical residues are exceeded, at which time it will be too late to protect the drinking water of future generations of Arizona residents."	Yes	Public drinking water systems and wells are monitored by ADEQ and they follow EPA maximum contaminant level recommendations. See "Safe Drinking Water" in Ch. 4.
1492	1	Sent letter, document number 1503, from EPA.	No	Responses to this phone call are included in responses to 1503, the respondent's letter.
1493	1	Chemically intolerant because of an accident from fire as an engineer. It is irresponsible for the Forest Service to put toxic chemicals within a mile of the city. Affects the water, earth and animals.	No	Additional discussion on MCS effects is included in "Public Health and Social Concerns" and "Economic Influences" in Chapters 3 and 4.
1493	2	Who is saying that these chemicals are harmless? Has no confidence in EPA or their testing. Does not trust chemical companies or the use of chemicals.	No	A variety of sources of information were utilized in preparing this document. See the project record.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1493	3	Suggests that we use black plastic to cover the weeds to rob them of sun and air. Wants notification if herbicide spraying will happen within 1 mile of house.	Yes	Black plastic is a temporary method and effective on small scale projects. Seed viability for many species exceeds 10 years in the soil. This method also kills nontarget organisms which we tried to minimize by our techniques.
1493	4	Is smoke and chemical sensitive. 1 mile away from people is not nearly enough.	Yes	We considered a 3-mile limited spray zone, but it was infeasible in order to have effective weed control.
1493	5	Using chemicals is a very irresponsible thing to do. Chemical use is not good for the environment. Independent research has not shown that the use of chemicals is safe.	Yes	A variety of sources of information were utilized in preparing this document. See the project record.
1493	6	Also concerned about impacts to wildlife.	Yes	We have proposed design features and mitigation measures in Appendix B that will minimize effects to nontarget organisms. See the WSR and project BA&E.
1493	7	Believes there has got to be a better method. If chemicals are used she would have to be notified and would have to close up her house for several days. Even by doing this she will still be extremely ill. There are a lot of chemically sensitive people in this area and they will have a lot of problems if chemicals are used.	Yes	Additional discussion on MCS effects is included in “Public Health and Social Concerns” and “Economic Influences” in Chapters 3 and 4.
1494	1	Repeat submission of project record 1493, comments 1-7.	Yes	See response to project record 1493, comments 1-7.
1495	1	“Our constituents still support biological methods only.”	Yes	This is one tool in our integrated weed management program and alone would not meet control objectives for this project.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1495	2	"At the onset of this process several years ago we collected thousands of signatures supporting biological treatment of noxious weeds-NO PESTICIDES UNDER ANY CIRCUMSTANCES!"	No	The petition pertains to treatment along highways and state roads which is outside the scope of this document. See response to project record 1495, comment 1.
1495	3	"We stand firm to keep our environment risk free from chemical poisoning for treatment of noxious weeds."	No	We have proposed design features and mitigation measures in Appendix B that will minimize effects to nontarget organisms. See the WSR and project BA&E.
1496	1	"The risk assessment is based on out-dated analysis (12 years old)."	Yes	We used updated risk assessments and added references to them in the FEIS.
1496	2	"Research by Professor Dodson, University of Wisconsin, has shown that much lower amount [sub-leathal (sic!)] of chemicals have a detrimental effect on wildlife."	Yes	New risk assessments and U.S. Fish and Wildlife Service (FWS) recommendations are being followed. We found only Dodson's research relating to water nymphs (not relevant to this EIS).
1496	3	"The issue of Multiple Chemical Sensitivity is critical to evaluate in the forest – the only safe place these folk have. It appears it is mentioned in the DEIS only to be ignored."	Yes	The analysis of effects to MCS people was further developed. See response to project record 1493 and Appendix B, where design features for communication and access are addressed.
1496	4	"The use of compounds shown to be endocrine disrupters in developmental stages of animal life is irresponsible. Again research has shown toxicity at sub-leathal (sic!) quantities."	Yes	Endocrine disruptors discussion was added to "Public Health" in Ch. 4.
1496	5	"There is no discussion of how you will prevent weeds from being re-introduced by livestock, recreational hikers, and those pesky ORV drivers. Do you plan to address this?"	Yes	This EIS is a treatment plan. See "Integrated Weed Management Practices" in Appendix B.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1496	6	"In California there have been good results with goats grazing out weeds instead of sheep."	Yes	The use of cultural methods (grazing by livestock) is included in Alternatives 1, 3 and 4.
1496	7	"The amount of acreage designated for herbicide treatment is small. It can easily be treated in more humane, safe, and appropriate ways."	Yes	Use of herbicides is part of the IWM program, used only where they have to be. See Alternative 4 discussion.
1496	8	"It is claimed that glyphosate has low potential for runoff. And just how active are the microbes that make it down in a drought!"	Yes	See the risk assessment for Gyphosate. "Gyphosate is readily metabolized by soil bacteria and many species of soil microorganisms can use gyphosate as sole carbon source." Since soil microbes are native, they should be quite well adapted to climatic variations.
1497	1	Against use of herbicides; son had neurological symptoms when exposed to herbicides. There are safer alternatives, Concerned about potential danger to elderly and youth.	Yes	Additional discussion on MCS effects is included in "Public Health" and "Social Concerns and Economic Influences" in Chapters 3 and 4.
1499	1	"PLEASE DO NOT SPRAY PESTICIDES IN THE NATIONAL FOREST!!!" Has medical condition caused by exposure to toxic chemicals.	No	See response to project record 1497.
1500	1	"I am totally against using chemical weed control in the National Forest."	No	The use of herbicides is part of the integrated weed management approach. As such, the use of herbicides is minimized using this approach.
1500	2	…"studies have tied Lymph Cancer to weed killers."	Yes	See the risk assessments and environmental consequences under "Public Health," Ch. 4.
1501	1	Thanks you for the well prepared "DEIS…." I support Alt. 4 to achieve maximum effectiveness, having little to no adverse effects on the affected environment.	No	Thank you.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1501	2	"Tamarisk treatment suggests cutting + painting of stump vs spraying. This treatment should be considered for some riparian areas (Rio Verde?)."	Yes	The cut and daub, and hack and squirt methods are the primary methods proposed to treat tamarisk.
1502	1	"Picloram is toxic."	Yes	New risk assessments for picloram are included in the project record. We agree with point; however, the herbicide can be used safely.
1502	2	"If roundup is used it's (sic!) toxicity is hazardous."	Yes	New risk assessment for Roundup is included in the project record. We agree with point; however, the herbicide can be used safely.
1502	3	"Consider the costs to endangered species of plants."	Yes	See discussion of effects to plants in Ch. 4 and BSR and BA for endangered species of plants.
1502	4	"Hand sprayed droplets can get into the air thereby contaminating the air of humans, those with asthma, children, and those with multiple chemical sensitivities and others who would experience detrimental health challenges by the spraying."	Yes	Adjuvants minimize vaporization of herbicides (see Chapters 2 and 4). Low pressures and large droplets reduced vaporization of herbicides. See "Environmental Consequences" for "Air Quality," Ch. 4. Sensitive individuals can avoid areas where herbicides are being used due to notification under "Design Features" outlined in Appendix B.
1502	5	"Also, endangered are our waterways as the chemicals seep into the ground."	Yes	See "Environmental Consequences" for "Watersheds and Soils," Ch. 4.
1503	1	"The EPA has environmental concerns because the DEIS does not identify or evaluate impacts to drinking water sources that may be affected by herbicide applications."	Yes	See "Safe Drinking Water Act" discussion, Ch. 4 and coordination with ADEQ for wellhead and aquifer protection, and the "Weed Control Pesticide Safety and Spill Plan" in Appendix B.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1503	2	"The Safe drinking water Act and 40 CFR 141 provides a mechanism to protect public health from contaminants in water provided by public water systems. EPA has health-based standards called Maximum Contaminant Levels (MCLs), for many water contaminants, including synthetic organic contaminants such as herbicides."	N/A	See discussion under project record 1503, comment 1.
1503	3	Provided information on picloram, glyphosate, and 2,4-D that should be included in the FEIS. Referenced the EPA technical facts (in record).	N/A	See discussion under project record 1503, comment 1.
1503	4	"The FEIS should evaluate the feasibility for mitigation of drinking water impacts."	N/A	See discussion under project record 1503, comment 1.
1504	1	"Please take more time to reconsider not spraying poisonous herbicides in the National Forests around here. The heavy metals and chemicals in herbicides are biologically active for many years to come."	Yes	See the risk assessments for herbicides in the project record and "Public Health" in Ch. 4.
1505	1	If alternative 3 would work, why are we considering other alternatives?	Yes	Alternative 3 works for some but not all weed species. We are required to consider a range of alternatives under NEPA.
1505	2	Requests 3 mile buffer of herbicide applications and equipment cleaning from properties.	Yes	We considered a 3-mile limited spray zone, but it was infeasible in order to have effective weed control.
1505	3	1 mile limited spray zones inadequate; "Several doctors responded and addressed this issue. Have you also discarded and/or discounted their advise that for those mentioned above [MCS] must have a 5 (five) mile distance of protection for ground spray and a 25 (twenty-five) mile protective barrier for aerial spray."	Yes	See limited spray zones discussion in "Social Concerns and Economic Influences," Ch. 4. No aerial spraying is planned.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1505	4	"Granuals should not be applied to the ground without trenching a depth of a few plus inches, applying the granuals into the trenchs (sic!), cover with dirt, then water. Direct application to the ground will cause the granuals to travel with the winds, get picked up and carried by persons and animals. Granuals must be watered on a daily basis to become effective and penetrate the soil….Therefore, granual usage may be risky to persons and wildlife."	Yes	Thank you for the information. It is unlikely that we will use granuals for these reasons; however, we do not want to preclude use entirely from the project area if they can be used in a site-specific situation.
1505	5	"If you would allow those that know they have health concerns to register their names, addresses, and phone numbers with a formal registry you set up, then perhaps you could consider a wider safety zone for those individuals that are willing to come for and identify themselves….I would appreciate your thoughts regarding this particular matter."	Yes	In talking with various members of the MCS community, concerns were raised about providing this type of information. We believe that the approach we have outlined in Appendix B, "Design Features for Integrated Weed Treatment Projects," will provide appropriate notification procedures.
1505	6	Develop 800 number and a contact person that can be reached during business hours.	Yes	We are going to do this before any herbicide application occurs. See "Mitigations Common to Alternatives 1 and 4" and "Design Features for Integrated Weed Treatment Projects" in Appendix B.
1505	7	"Cleaning equipment, etc. on site at least 300 feet from private land is NOT ACCEPTABLE. This carries the dangers of toxic spills, as well on dumping the cleaning chemicals with this area."	Yes	Equipment will not be cleaned within the limited spray zones, which will provide a 1-mile buffer around private lands. See "Design Features for Integrated Weed Treatment Projects" developed for this issue, Appendix B, and Record of Decision.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1505	8	"I would like a written guarantee that this [cleaning of equipment] cannot and will not happen near any of my properties."	No	While we can't provide a written guarantee, see response to project record 1505, comment 6.
1505	9	"I don't believe that you can make a blanket statement that the usage of chemicals will not effect the health of individuals."	No	We agree. We have expanded the discussion to include uncertainty, effects of impurities, surfactants, adjuvants and inert ingredients, synergistic effects, and endocrine disruption under the section "Environmental Consequences" to "Public Health," and "Social Concerns and Economic Influences," Ch. 4.
1505	10	"I believe the 'right approach' is to use the least amount of chemical. I believe you should honor the wishes of private landowners, and/or the chemically injured to protect their property and health from the possibility of chemical drift contamination even if you believe that they may not be harmed."	Yes	We agree that we want to use the least amount of chemical that is effective. Spray drift is considered in the development of limited spray zones and methods of application: we will use low pressure and large droplets.
1505	11	Expresses concerns about effects to Porphyria patients.	Yes	See additional writeup on endocrine disruptors under "Public Health" in Ch. 4.
1506	1	"I am opposed to the use of herbicides & pesticides in our forests and elsewhere due to the health risks & damage it causes persons with MCS, vital organ damage & or death."	Yes	See "Environmental Consequences to "Public Health" and "Social Concerns and Economic Influences," Ch. 4.
1506	2	Opposed to use of pesticides in our forests.	No	The use of an integrated weed treatment approach minimizes the use of herbicides in the forest.
1506	3	Concerned about health risks and damage herbicides and pesticides cause persons with MCS: vital organ damage or death. Also to persons with other health issues such as lung and heart diseases, and the general public.	Yes	See responses to project record 1505, comment 9 and project record 1506, comment 1.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1506	4	"Your assessment skimmed over the health effects involved and in particular how the use of herbicides, pesticides, biocides will effect persons with MCS!"	Yes	See responses to project record 1505, comment 9 and project record 1506, comment 1.
1506	5	"Furthermore, the one mile no spray zone is not enough. It is too close to residential areas & will cause further illness & vital organ damage to those with MCS, other illnesses to those with other health issues and the general public."	Yes	We considered a 3-mile limited spray zone, but it was infeasible in order to have effective weed control.
1506	6	Implores FS to use alternative methods	No	Alternative methods will be used as long as they are effective.
1506	7	1 mile Limited Spray Zone is inadequate for persons with MCS. Recommends 5-25 mile no spray zone, as did several doctors. Distance for cleaning of machinery should be 5-25 miles.	Yes	See response to project record 1506, comment 5.
1507	1	Writes to voice strong opposition to use of herbicides in the NFs.	No	Thank you for your input. The use of an integrated weed treatment approach will minimize the use of herbicides.
1507	2	"Even if spraying is away from towns, communities, trails and camps, it will affect animals & birds, and get into the soil & into run off during rainstorms, and be carried by the wind."	Yes	See discussion of direct, indirect and cumulative effects, "Wildlife and Fish" in Ch. 4, WSR, FSR, and BA & E. See effects to "Soil, Water and Air" in Ch. 4.
1507	3	"Also, it is very hazardous for the workers doing the spraying."	Yes	The risk assessments for the various herbicides take into consideration the effects to persons applying the herbicides. See "Public Health," Ch. 4, and Appendix B.
1507	4	"We need to find healthier ways of providing stewardship of the land, there are already far too many chemicals in our environment."	No	The integrated weed management approach uses nonherbicidal methods, too.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1508	1	Does not want herbicides used in forest.	No	Thank you for your input. The use of an integrated weed management system will minimize the use of herbicides.
1508	2	Health effects to people with asthma.	Yes	See "Environmental Consequences" of "Public Health" and "Social Concerns and Economic Influences," Ch. 4.
1508	3	…"there are gaps in the health data, and for every expert who says that they are safe, there is another who says that they are not."	Yes	We have provided more discussion of the literature available on the relevant topics. See also the uncertainty discussion under "Public Health," Ch. 4.
1508	4	"A chemical war on weeds is going to be expensive in terms of money and human health, and we will lose in the end, anyway."	Yes	Costs of treatment are less now than they will be in the future and the overall cost of nontreatment is unacceptable.
1509	1	Didn't get info out to the Navajo Chapter bordering Kaibab NF during the comment period.	No	We have discussed this project with the tribes during annual project consultation since 1999 and sent the DEIS directly to the tribes (see "Public Involvement," Ch. 1).
1509	2	Requested map of proposed herbicide treatment areas.	No	Team leader talked with commenter and pointed out maps in the DEIS.
1509	3	"A large number of folks depend on native plants from the forest."	Yes	See Issue 3 of "Proposed Action/Public Involvement." Also, public notification information will facilitate the notification of individuals who collect plants (see Appendix B).

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1510	1	"The Department (Arizona Game and Fish) recognizes that the spread of noxious weeds is a serious threat to wildlife habitats, and we support efforts to control noxious and invasive weed species in order to restore native vegetation."	No	Thanks for your support.
1510	2	"We recommend that the DEIS better address impacts associated with treatments in riparian zones."	Yes	See additional discussion on riparian zones in FEIS under "Watersheds and Soils" and "Weeds" in Ch. 4.
1510	3	"We recommend that the statement concerning Hualapai Mexican vole be stated as, 'this species does not occur in the project area, although it is part of its historic range.'"	Yes	Hualapai Mexican vole does not occur in the project area, although it is part of its historic range. See WSR.
1510	4	Clarification of the treatment objectives is needed with regards to the potential direct or indirect negative impacts, such as the consequences of releasing biological agent in the area.	Yes	See "Biological Control" under "Integrated Weed Treatment Strategy" in Ch. 2.
1510	5	"Conditions following treatment could result in the presence of lower quality vegetation (Anderson 1998). The removal of tamarisk vegetation without successful restoration of native species has the potential for short and long-term impacts on wildlife resources."	Yes	The treatment of tamarisk as it relates to the wildlife resource has been evaluated in Ch. 4, the WSR and BA&E. Restoration of native vegetation after removal of tamarisk will be evaluated on a case-by-case basis.
1510	6	Need to examine the root causes of colonization and propagation of noxious weeds in riparian areas when choosing the most effective control measure. (Example is saltcedar)	Yes	The most effective control measure at each site will be selected by considering the species, location of the infestation, and coordination with other resources found in the vicinity of the infestation.
1510	7	"..suggest that all tamarisk removal follow the guidelines set forth in the SWFRP (Appendix H)."	Yes	Agree. This is the protocol that the removal of tamarisk will follow. See the WSR, BA&E and Appendix B.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1510	8	The infestation of tamarisk and other invasive species as causing the decline in quality of wildlife habitat should be researched in further detail.	No	This research is outside the scope of this project.
1510	9	"Clarification of the treatment objectives is needed with regards to the potential direct and indirect negative impacts, such as the consequences of releasing biological agents in an area."	Yes	It is not practical to consider the complete eradication of tamarisk. The treatment objective is to contain/control. Use of biological agents for tamarisk will not occur due to coordination needs with the Southwestern Willow Flycatcher Recovery Plan.
1510	10	"The current hydro-geomorphic conditions of the river system may no longer support the regeneration of native plant species."	No	We disagree; however, this is outside the scope of this project.
1510	11	…"further analysis is needed regarding the removal of exotic species from riparian areas."	No	Treatment of tamarisk and other riparian weeds has been evaluated in Ch. 4, specialists' reports and BA&E. Restoration of native vegetation will be evaluated on a case-by-case basis. See also Appendix B.
1510	12	"From a wildlife habitat standpoint, over 90% of the Southwestern willow flycatcher nests are being utilized in tamarisks sites, many within the Verde River System."	Yes	Tamarisk removal and its impacts to the Southwestern willow flycatcher are considered in Ch. 4, the WSR, BA and Appendix B.
1510	13	"The removal of tamarisk vegetation without successful restoration of native species has the potential for short and long term impacts on wildlife resources."	Yes	Restoration of native vegetation is planned in conjunction with this project. See effects under "Wildlife" in Ch. 4.
1510	14	"We further suggest that all tamarisk removal or riparian restoration projects follow the guidelines set forth in the Southwestern Willow Flycatcher Recovery Plan."	Yes	We agree. This is the protocol that the removal of tamarisk will follow. See the WSR, BA and Appendix B.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1511	1	"I don't believe that the four choices we have been given even slightly address the issue of remediation of the problem of weeds. We have been forced to choose one over the other when none of them is acceptable."	No	In addition to the 4 alternatives that were considered in detail, two additional alternatives were considered then eliminated from further consideration. See discussion in Chapter 2.
1511	2	Has been permanently damaged by the chemicals being considered for use.	No	Concerns about health issues have been considered in "Public Health" and "Social Concerns and Economic Influences," Ch. 4 and by risk assessments for the various herbicides.
1511	3	"The use of herbicide in the national forests is just not acceptable."	No	The use of an integrated weed treatment approach minimizes the use of herbicides in the forest.
1511	4	"My choice is to use completely nontoxic control….Then after five to seven years if the goal has not been obtained, the use of some herbicide in combination with nontoxic control can be considered."	Yes	We have been using nonherbicidal control techniques since 1995. Waiting 5 to 7 additional years for treatment of many infestations would have detrimental impacts on the ecosystems.
1512	1	Supports use of non-chemical methods.	No	Thank you for your comments.
1512	2	"The four options presented do not give a comprehensive way to do this."	No	We disagree. Nonchemical treatments are part of integrated weed treatment strategies in all action alternatives. Alternative 3 was developed to provide a nonherbicide approach.
1512	3	"The ten year plan should incorporate any and all avenues of research and consultation to implement a program that will benefit the ecosystem, plants, animals, and humans without the use of herbicides and pesticides."	Yes	The adaptive management that is built into this decision allows for this. See Chapter 6.
1512	4	"Choosing to use chemicals without knowing the long term impact on the area and ecosystem does not make sense."	Yes	The "Environmental Consequences" section (Ch. 4) discusses the impacts on the area and the resources.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1512	5	…"once you start using herbicides, it changes the soil, so that you will have to continue using them….	No	The soils resource is discussed in "Environmental Consequences" in Ch. 4.
1512	6	"Choosing non-toxic methods of weed control is NOT a preference, it is a necessity for those of us whose lives have been destroyed and those lives that will be destroyed if these chemicals are used on the Arizona National Forest."	Yes	The use of an integrated weed treatment strategy is preferred and considered necessary to accomplish the treatment objectives for weeds. Nonchemical methods are an integral part of this strategy. See environmental consequences under "Public Health" and "Social Concerns and Economic Influences," Ch. 4.
1513	1	"PNFF believes that the Interdisciplinary Team failed to effectively develop Issue #2 (see Page viii) through the NEPA (National environmental Policy Act) Integrated Resource Management process as noted: 'The use of herbicides for noxious weed control may cause health problems for people who come in contact with the herbicides and/or treated areas.'"	Yes	See discussion on "Public Health" and "Social Concerns and Economic Influences" in Chapters 3 and 4.
1513	2	Too much of the draft EIS analysis is spent on the control and eradication of noxious and evasive weeds, but fails to provide adequate analyses on Public Health effects."	Yes	See project record 1513, comment 1.
1513	3	"The PNFF wishes to ask the Interdisciplinary Team: Which is of greater importance, the control of weeds OR the health of a community?"	Yes	Controlling weeds is important to the health of the whole community.
1513	4	The length of exposure, route of exposure, and toxicity are discussed, but only to the extent that it related to the individuals applying the herbicides. "The Interdisciplinary Team failed to fully develop any NEPA analysis of the length, route, and degree of toxicity as it relates to the Multiple Chemically Sensitive (MCS) Community."	Yes	Each MCS individual is unique so there is no one "safe level." It will vary by person, chemical, rate and method of application. We will establish buffers (restricted spray zones) around areas used by the MCS community that the FS manages to address this (see Appendix

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
				B). Notification procedures are outlined to allow sensitive community members the ability to avoid specific areas being treated at any point in time.
1513	5	"The EIS references Figures 15 and 16 which were developed to help disclose the impacts on public health. Total acres and total pounds do not address public health…The EIS stops short by not evaluating the environmental cumulative effects of each given chemical on the health (sic!) the community. …However, half-life in terms of human health and exposure has no value. Therefore, and because of this, the PNFF finds the EIS inadequate in analyzing the cumulative effects on human health in and around the communities being considered for noxious/invasive weed treatment.… One question not addressed in the EIS in terms of half-life is the question: what is the least amount of herbicides in terms of half-life that is considered safe for the MCS?"	Yes	No Observable Effects Level (NOEL) numbers for each chemical were used in toxicity analysis. Half-life numbers are used to evaluate persistence in the environment. We expanded the discussion of effect of herbicides relating to people in the "Public Health" section of Ch. 4 and the cumulative effects discussion throughout Ch. 4. See also Figure 16 and Appendix E.
1513	6	"..the EIS fails to evaluate and consider "Areas Used by Chemically Sensitive Citizens," a handwritten document provided to the Interdisciplinary Team showing the general locations of many MCS individuals. These locations were not a consideration in the EIS."	Yes	Yes, we did consider these locations in the DEIS. The document to which you refer is project record 851. We used this document to develop the 1-mile buffer of limited spray zones around private lands and recreation sites. The Federal and State highways listed in project record 851 are covered in a separate environmental analysis entitled, "Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona." A decision was made on May 27, 2004 by the

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
				forest supervisor of the Tonto NF, Karl P. Siderits, as delegated responsibility from the Regional Forester.
1513	7	"A review of the Literature Cited section failed to find any reference to studies regarding human health effects. There was no indication that the Interdisciplinary Team seriously considered the effects of herbicide application on human health other than the workers."	Yes	We added the references used for analysis to the "Literature Cited" section in the FEIS. Interdisciplinary team logic was that the proposed chemicals at the highest concentrations specified for treatment (often below maximum label rate) demonstrate no to very few negative effects on human health in applicators. We will buffer the communities, notify, and post signs so the public will not be exposed if they are concerned about effects. If they are exposed, it will be to a lesser level than the applicators (workers). We recognize MCS people are more sensitive than the general public so we developed design features to be used during project implementation (Appendix B).
1513	8	"The EIS fails to evaluate the carcinogenic effect of the chemicals referenced in this EIS in terms of 'evidence' of effect on the human health of the associated communities."	Yes	See the risk assessments and discussion of environmental consequences under "Public Health," Ch. 4.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1513	9	"In a study by the National Center for Environmental Health at the Centers for Disease Control and Prevention it reads: 'While the human health effects associated with chronic, low-level herbicide exposures are not well understood, a growing body of scientific evidence suggests that environmental exposures to different herbicide classes can have varying health effects.' (http://web.health.gov/environment/mcs/index.htm)"	Yes	Yes, agreed. This is why we considered access and human health to be significant issues and we developed 2 alternatives to address these issues. The Web site is for a report by the Interagency Workgroup on Multiple Chemical Sensitivity, which was consulted in writing the EIS.
1513	10	"Based on the limited review of 'differences of opinion' (two paragraphs), the PNFF believes that the Interdisciplinary Team fails to fully develop this section in order to meet the NEPA requirements for presentation of differences of opinion."	Yes	Good point; we expanded this discussion in more detail under the "Public Health" and "Wildlife" sections in Ch. 4.
1513	11	"Area is not a reasonable analysis factor when you consider toxicity, duration, and transportability by weather elements from 1 percent of the three forests as it relates to human health."	Yes	Area is a factor of exposure and exposure determines toxicity. Over 99 percent of the 3 forests will not be treated by any integrated weed treatment technique. Of the 0.6 percent treated, fewer than half the acres will be by herbicides. There will be a lot of forest land available to people with MCS.
1513	12	"What is the projection of people using the forests of having chemical sensitivity?"	Yes	See documents cited in project record 1522.
1513	13	"What does the fact that the person doing the application is 'certified' mean in terms of human health impact?"	Yes	As part of the Forest Service and State certification process an applicator learns to apply chemicals according to the manufacturer's label specifications, techniques to minimize the exposure to humans, to minimize the likelihood of spills, and to minimize the possibility of

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
				chemicals moving offsite. The applicator also learns to use the least amount of chemical required for an effective treatment and the most effective application procedures that have the least effect on nontarget species.
1513	14	"The Interdisciplinary Team fails to understand even 'approved herbicides' can cause human health impacts, especially to the MCS community." "The Interdisciplinary Team fails to understand and consider that regardless of how far below the typical rate and amount no matter how small or insignificant is of serious consequence to many members of the MCS community. This fact is not considered as part of the environmental analyses."	Yes	We do understand that "approved herbicides" may cause human health impacts. Additional discussion on MCS effects is included in Chapters 3 and 4. We also developed the design features for MCS in Appendix B in coordination with the MCS community.
1513	15	"The EIS analysis is centered on the workers applying the herbicides without regard to the MCS community who visits the forests or is in an area of a community adjacent to a spray location."	Yes	See response to project record 1513, comment 7.
1513	16	"Because of the above, the EIS contains false and misleading information for the conduct of environmental analysis."	Yes	The document uses a variety of sources of information. See Ch. 4 and the project record.
1513	17	"The Best Management Practices (BMP) as detailed in Appendix E [of the DEIS] are out of compliance, especially with the Prescott Forest Plan….There was a Regional withdrawal of Guide (FSH 2209.22, R3 Supplement).	Yes	The citation of FSH 2209.22, R3 Supplement, was an error in the DEIS. The citation should have been FSH 2509.22, R3 Supplement, which still exists. This citation has been corrected in the FEIS. All three national forests will have a forest land management plan amendment that will be incorporated by reference in Appendix B as a guideline.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1513	18	"A review of the EIS fails to find any analyses by the Interdisciplinary Team that are adaptable to the conditions and circumstances of noxious and invasive weeds as they relate to Best Management Practices."	Yes	This FEIS is to evaluate effects of integrated weed treatment techniques, and does not present a full integrated weed management plan. The forests have been using integrated weed management practices (IWMPs) for several years under the "Three-Forest Noxious Weeds Strategy Working Guidelines." We added the IWMPs in Appendix B to address prevention and spread of weeds. Appendix B has been relabeled for clarity.
1514 A	1	Not MCS, but very sensitive to chemicals, has allergic reactions, prefers non-chemical treatments.	No	Thank you for your interest.
1514 A	A-2	Reports current spraying in Sedona Area, campgrounds and visitor sites.	Yes	Carbaryl spraying for bark beetles is covered in "Cumulative Effects," Ch. 4.
1514 B	B-1	Concerned about the use of herbicides, recommends manual treatment, doesn't trust herbicides, hard to know final death toll to species, best to look at alternative methods.	Yes	The proposal to utilize an integrated weed management system is discussed previously in project record 1493.
1514 B	B-2	Manual labor would increase job opportunities. Complimented FS for listening and responding to call.	Yes	Thank you. See project record 1493 and project record 1515, comment 1.
1514 C	C-1	Doesn't like weeds. Has concerns about impacts to wildlife (toxicology) for both wild and domestic animals. Concerned about dermal contact of animals to the fresh spray.	Yes	See Ch. 4, "Wildlife" and the WSR, BA&E, and also risk assessments for discussion.
1514 D	D-1	National Map of Aquifers Groundwater database for AZ kept by ADWR	NA	Provided useful information to be used in the document.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1514 E	E-1	Very sensitive to sprays – MCS. Reports' spraying in Sedona recently; has been miserable last few days because of spraying. Wants non-chemical treatments due to chemicals are toxic to humans. Has lived there 14 years.	Yes	See response for project record 1514 A, comment 2. The project will utilize an integrated weed management approach with multiple methods of treatment.
1514 F	F-1	Likes limited spray zones with no herbicide treatments in them.	No	Thank you for your concern and point of view.
1514 F	F-2	Equipment cleaning should be further than 300' away in No spray areas. Recommend 1 mile NSZ.	Yes	Good point; we have included this in the mitigations measures developed for this issue.
1514 G	G-1	Against spraying for human health reasons, she has collapsed heart valve, don't jeopardize her health	Yes	Additional discussion on MCS effects is included in Chapters 3 and 4. We also developed design features for MCS in Appendix B in coordination with the MCS community.
1514 H	H-1	Human health risks/toxicity	Yes	See response to project record 1514 G, comment G-1.
1514 H	H-2	Limit re-introduction of invasive species. Reintroduction of desirable plants to crowd out weeds, in particular long term.	Yes	We agree with this statement. We have considered the reintroduction of native species as part of "Integrated Weed Management Practices," Appendix B.
1514 H	H-3	Limited alternative, need to expand. Recommends using the lesser impact treatments and delaying herbicide treatments until the lesser are proven ineffective. Doing nothing isn't an option, having a mixture of treatments with minimal herbicides.	Yes	Agree—an integrated weed treatment approach to treat most effectively is proposed.
1514 H	H-4	Some herbicides change soil composition and leave residues in soil.	Yes	See environmental consequences and effects, "Watersheds and Soils," Ch. 4.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1514 I	I-1	MCS - Needs prompt notification. Concerned about the Toxicology. Concerned about potential impacts to water supplies.	Yes	See response to project record 1514-G, comment G-1. "Design Features for Integrated Weed Treatment Projects" in Appendix B has a communications plan with the public.
1514 J	J-1	Prefers Option 3 to 4 since 9 of the species can be controlled w/o pesticides. Don't spray the 9 species in limited spray zones.	Yes	Alternative 4 (Preferred) utilizes the same nonherbicidal integrated weed treatments as Alternative 3 for those weeds that can be controlled without herbicides. Use of herbicides greatly reduces the cost of treatments compared to manual-mechanical (which require many more retreatments) and Alternative 4 achieves greater control/eradication for many weeds. See also response to project record 1522, comment 1.
1514 J	J-2	Prefers more adaptive management with non-pesticide treatments tried before pesticides (See Barbara Rubin comment). Try to license vinegar or acetic acid for use instead of pesticides.	Yes	Good idea; we may experiment with this on a limited basis to determine the effects.
1514 K	K-1	Reduce herbicide use for 5 of the species of 9 in Alt 4 that can have control objective achieved w/o pesticides, consider vinegar spraying, Thanks for all the hard work, She is MCS.	Yes	See response to project record 1514 J, comments J-1 and J-2.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1515	1	New Alternative: "I wish to reformulate the choices presented in light of the fact that a ten year program is to be generated which leaves room for a period of consultative and experimental efforts early in the program."	Yes	This decision allows for an adaptive management approach based on improved technology or information. For the past several years many species have been treated with nonherbicidal methods; under the preferred alternative, nonherbicidal methods will be used for those weeds that can be controlled without herbicides.
1515	2	"Some herbicides change soil composition and leave residues in soil. Use of chemicals which alter soil, harm non-targeted forms of plant growth as well as animals and humans for miles around application sites, is indefensible as a means of weed control prior to exhausting all other possibilities."	Yes	The effects to all resources are discussed under "Environmental Consequences," Ch. 4 and the BSR, FSR, WSR, and BA&E. Also see the plant and animal species design features in Appendix B.
1515	3	"If zero tolerance for weeds is altered to envision control of growth rather than eradication, more options are available for consideration."	Yes	Agree; hence the contain and control objectives for some priority invasive weed species.
1515	4	A ten year program should consider the following: "1. Vector control, 2. Consultative planning, 3. Control areas (given budget constraints and the size of the lands to be covered, ignore some areas early in the program to act as controls to measure what might happen without intervention in a true experimental model), 4. A postponement of usage of toxic chemical formulations should be made pending assessment of the program's attainments."	Yes	1. See response to project record 1513, comment 9. 2. Consultation with experts in alternative techniques has been ongoing (see response to project record 1515, comment 1). 3. Good idea. Using nontreated populations as controls and following over time would provide comparison for treatments. 4. See response to project record 1515, comment 1.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1516	1	"All (alternatives) seem to have too much dependence on herbicide use and too little attention to mitigation of the effects of trampling, etc. in order to accomplish the treatments."	Yes	A full range of alternatives including a no herbicide use alternative have been considered in the document.
1516	2	"What about timing?… I think you can expect an enormous uproar from the public if you spray ineffectively and out of season."	Yes	Timing of the treatments will be choreographed to achieve the best possible results.
1516	3	"Who is responsible for eradication weed infestations along easements such as the one I mentioned above?" (Doney Park Water Company utility road)	Yes	Responsibility depends on wording in the special use permit. All new/renewed permits should include weed prevention and control language. Infested land administered by the Forest Service adjacent to ROWs would be the responsibility of the Forest Service.
1516	4	"If there are closures this spring and summer, perhaps you can move some of the scheduled treatments up in order to take advantage of the absence of visitors to reduce exposure."	Yes	We will strive to minimize the impacts on forest users, especially exposure. There are certainly opportunities to utilize this strategy in and around many of the developed recreation areas.
1516	5	"What seems to be missing is any re-vegetation treatment following eradication. It seems to me that leaving that ground essentially bare is an invitation to cheatgrass invasions and whatever else lurks, waiting to find a spot to take over."	Yes	No. Revegetation is definitely part of the process. Cultural treatment acres include revegetation efforts. Also see Appendix B.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1516	6	"What do you really intend in the case of Dalmation toadflax? If I read correctly, you expect to treat parts of the 155,800 acres every year for 10 years and end up with 155,800 acres of Dalmation toadflax PLUS all the unintended effects of killing native plants and species of special interest, both plants and animals, to say nothing of exposing the public to 10 years of residues of toxic chemicals. You also will have trampled over a significant acreage in the effort to accomplish the treatments."	Yes	Dalmatian toadflax spreads at an approximate rate of 14 percent per year. The strategy for containment of Dalmatian toadflax includes reducing this spread on the fringes of the populations by treating isolated pockets of infestations and using biocontrol within the core of the infestation.
1516	7	"What is steaming and how do you do it?"	Yes	See "Integrated Weed Treatment Strategy" discussion of control methods in Ch. 2.
1516	8	"What comprises an infestation: one plant or 1,000,000 plants per acre?"	No	It is the presence of an invasive weed that defines an infestation.
1516	9	"How many declarations of "Oops!" do you expect per acre when you set our to spray herbicides on infestations around Pediocactus that are fairly sensitive to chemicals"	No	No herbicide spraying is proposed in the immediate vicinity of *Pediocactus* without buffer zones. The species was displayed in the table to show its sensitivity to herbicides and demonstrate the need to use buffers and other methods near *Pediocactus*. See the BSR in the project record and BA&E.
1516	10	"Where are your BMPs for preventing spread of populations by boot soles, vehicle tires, etc.?	Yes	This was left out of the DEIS; it is now included in Appendix B. There is additional information in the "Cumulative Impacts Project List," Appendix E, too.
1516	11	"You don't attempt to justify the cost per acre (I noticed figures of $108-$115). It seems to me to be very low unless most of what you plan to do is broadcast herbicides from a quad."	Yes	Costs were estimated based upon 1999-2001 costs of treatment. See response to project record 1451, comment 5. These costs could easily be low in today's market.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1517	1	The Draft EIS adequately addresses the issues related to herbicide use on public land and Alternative 4 has the most flexibility in choosing the correct combination of noxious weed treatment strategies that will minimize negative effects on people, non-target organisms, and the environment. The adaptive management approach of Alternative 4 is also in concurrence with current research."	Yes	Thank you.
1518	1	"I'm writing to express my dismay about Forest Service plans to spend 12 million dollars applying herbicides in 3 national forests."	Yes	While this cost seems high, the potential cost of doing nothing until the problem is worse is even higher. Some aspects of adaptive management may prove less expensive during the implementation process.
1518	2	"Given the choice between noxious weeds and noxious chemicals, I will gladly take the weeds."	No	Thank you for your input.
1518	3	"One of the reasons many of us choose to live here is that historically, the use of chemicals has been very low."	Yes	True, historically the use of chemicals has been low throughout central Arizona and the world.
1518	4	"I'm horrified to learn that the Forest Service is planning to experiment with 12 different chemicals on 74,000 acres."	Yes	Experimentation was completed prior to registration. The FS is planning to apply them following label instructions.
1518	5	"A project this size is unwieldy—it will be hard to monitor, and its long-range effects difficult to quantify."	Yes	The potential long range impacts have been quantified in spreadsheet models. Each forest has a designated noxious weed coordinator who will be responsible for the monitoring that will occur on the three national forests simultaneously.
1518	6	"I understand that noxious weeds are a serious problem, but I feel that there are better ways to deal with them. Therefore, I'll give my support to Alternative 3."	Yes	An integrated weed management strategy is planned to adequately manage the situation.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1518	7	"I realize that the chances for 'eradication' are limited with this option, but I feel that it offers the best balance of safety and effectiveness."	No	Thank you for your input.
1518	8	"It seems to me that the chances of eradication are limited anyway when the weeds are also present and multiplying on private land."	No	Several weed management areas have been developed within the project area with partners who treat weeds on private lands as well as those lands managed by other agencies.
1518	9	"Having lived in the Mormon Lake area for a number of years, and suffered health effects from controlled burns, I have to say that enough is enough."	No	Thank you for your input.
1518	10	"Living in a community surrounded by forest service land should not force a person to constantly check schedules and consult signs."	No	Many people want to be informed about what is going on. Checking schedules and consulting signs is optional.
1518	11	"I read about this plan in the Arizona Daily Sun on April 10th—ten days before the period for pubic comment ended. I don't feel that this issue got enough exposure, and I suspect that many members of potentially impacted communities remain uninformed."	No	This project has been ongoing with extensive public input since 1998. Public meetings were held with persons with MCS, Native American tribes, and other interested publics, and announcements have occurred in local newspapers, at meetings, and in the Federal Register.
1518	12	"A project of this size deserves serious debate. It should not be snuck in while most of us were focused on the proposed Snow Bowl expansion."	No	See response to project record 1518, comment 11.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1518	13	"Finally, I'd like to suggest that we limit the amount of "disturbance" taking place on our public lands."	No	We agree. The forests have been implementing integrated weed best management practices as part of the "Three-Forest Noxious Weeds Strategic Plan Working Guidelines" for over 6 years. Many of these practices relate to ways to minimize disturbance to reduce the potential spread of invasive plants.
1518	14	"It's my understanding that noxious weeds thrive in areas where the soil has been disturbed. OHVs are the prime offenders. Keeping them on designated roadways would help your efforts to contain the spread of noxious weeds."	No	Coordination with the "Five Forest Cross-country Travel EIS" (in preparation) is ongoing. There are national and state efforts underway. See cumulative effects discussions, including Appendix E.
1519	1	"I worked on 'Timber Stand Improvement' in the 1970's and saw how toxic Tordon can be."	Yes	See environmental effects discussion under "Public Health," Ch. 4 and new risk assessments in the project record.
1519	2	"Maybe more money should be spent on prevention, and less on remediation. Weeds occur where the soil is unnaturally disturbed."	Yes	We agree. See "Background" in Ch. 1 about the establishment of weed management areas and education efforts. Appendix B details prevention measures that are being used.
1519	3	"By preventing overgrazing, unchecked off road vehicle use, and unnatural disturbances of the land we may be able to slow the spread of noxious weeds."	Yes	Over grazing is outside the scope of this document. See cumulative effects for OHV use and other disturbances.
1519	4	"Cultural factors – since the Native American people are opposed to the application of chemicals, we should take their viewpoint into consideration."	Yes	Close coordination with American Indians has occurred throughout this project.
1519	5	"I prefer Alternative 2, No Action. Let's not be too hasty with the application of chemicals."	No	Thank you for your input.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1520	1	"As a horticulturist and a member of the MCS community, …I applaud your efforts at researching a broad range of possible solutions. I am very pleased to see the degree to which the concerns of the MCS community have been considered in your decision making process."	No	Thank you.
1520	2	"I would like to state my opinion that only numbers 3 & 4 should be considered further." "Alternative 3 is the only plan that fully addresses the three significant issues presented on page viii of the DEIS as well as the issue of wildlife safety discussed on later pages."	No	Thank you for your input.
1520	3	"Using only 'EPA approved' products will not be enough to protect application workers, nor the general human and wildlife populations. 'EPA approved' products have only been proven effective, not necessarily tested for safety. A large percentage of pesticides on the market today have only been tested by their manufacturers. History has shown that the EPA frequently allows products to enter and stay on the market for a number of years before independent research finds them unacceptable."	Yes	See environmental effects discussion under "Public Health" and "Wildlife" in Ch. 4, and risk assessments and product labels for more information. Safety design features are contained in "Soil, Water and Air Best Management Practices," "Mitigations for Herbicide Use," and "Weed Control Pesticide Safety and Spill Plan" in Appendix B.
1520	4	"I consider the use of herbicides and insecticides in our society to be a major threat to the health of humans, domesticated animals and wildlife. The most obvious cases, like mine, where exposures bring on immediate, acute reactions are just the tip of an iceberg. All living organisms are detrimentally effected (sic!) by oxidative stress, with each individual being further propelled toward predisposed conditions or illness by each exposure, no matter how small. Any study that tries to set a safe level of exposure for a given substance is overly simplistic, often arbitrarily focusing on a	Yes	We have added discussion of synergistic interactions and endocrine disruption under "Public Health," Ch. 4. See also "Social Concerns and Economic Influences" in Chapters 3 and 4. We recognize that some people are more sensitive to chemicals than others and this is why we designed Alternative 4 and the design features in Appendix B. See also response to project record 1505, comment 9.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
		single possible negative effect, such as cancer, while ignoring the possibility of insidious degradation of health (harder to measure, but probably more common than cancer). Such studies also ignore the phenomenon of mixed ingredients, and the effects of multiple exposures, such as pesticides plus petrochemicals or pesticides plus aromatic hydrocarbons. Furthermore, studies have yet to be done investigating the possible link between pesticides and the growing rates of many chronic illnesses, such as asthma and ADD, not to mention the recent lowering of life expectancy for Americans."		
1520	5	"In particular, if alternative 4 is selected the proper notification of sensitive individuals as to the exact location and dates of planned herbicide applications would be critical. A toll free information line in addition to notification calls would be helpful."	Yes	See Appendix B for design features and communication plan.
1521	1	"We are attaching petitions with 1,140 signatures."	No	The petition references treatments along public highways and state roads and is outside the scope of this EIS.
1521	2	"We ask that you use one of the numerous alternatives to herbicidal spraying that are available and already being used by other states, counties and cities throughout the United States."	Yes	Alternative 4, if approved, provides for alternative methods as part of the integrated weed management strategy.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1522	1	"I would first like to express the appreciation of the chemically sensitive community for the careful analysis you have given in the report to non-herbicidal approaches to killing weeds, and for the incorporation into the report of efforts of mitigation such as the limited spray zones and plans to notify the public when spraying does take place."	No	Thank you.
1522	2	"Dave Brewer and his team have been great to work with over the last few years, and have exhibited compassion and sensitivity to the issues of the chemically sensitive community."	No	Thank you very much.
1522	3	"…spraying of the 9 species which the plan allows to be herbicided within the limited spray zones should be done with extreme caution to any public exposure or neighboring residential areas. Spraying within the limited spray zones should be avoided as much as possible."	Yes	This is certainly our intent. Currently we know of very few infestations of these 9 species in the 1-mile limited spray zones and by implementing integrated weed management practices (Appendix B), we intend to prevent future encroachment. See our proposal to "Adopt a Weed Area." This could be a topic at the annual meeting – see Appendix B.
1522	4	"I am including 2 documents that express my concerns about herbicide safety. The first document, 'Are home use pesticides safe?' by Consumers Union, a respected authority, goes into great detail in summarizing how inadequately pesticides actually are tested for safety, and notes that herbicides are tested less thoroughly than insecticides or fungicides. The fact that the EPA approves an herbicide does NOT mean it has been thoroughly tested for a variety of health impacts."	Yes	Thank you. Most herbicides work on chemical pathways that are present only in plants, not animals. We recognize that there are different levels of sensitivity to chemicals so we incorporated design features (see Appendix B) to accommodate the needs of the MCS community if Alternative 4 is chosen.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1522	5	"The [second] document is entitled 'Non Agricultural pesticides – risks and regulation.'….One point to note is that pesticides are studied with just the active ingredient, not as a product that includes toxic 'inert ingredients' in combination with the 'active ingredient.' The half-lives of pesticides are based on studies of that active ingredient, not how long toxic 'inerts' last in the environment. Many pesticide 'inerts' are in fact extremely toxic in themselves."	Yes	We included more documentation in the project record and have revised the text to be clearer.
1522	6	"I have also referenced two studies (Meggs, et al. and Kreutzer, et al.) addressing the fact that the frequency of MCS in the general population is greater than most people realize...."	Yes	We believe we have created adequate safeguards to reduce human exposure to chemicals and to inform people in a timely manner of the small scale spraying that we intend to do. Please see design features to be used during implementation (see Appendix B).
1522	7	"Kreutzer, et al found that rates of chemical sensitivity were twice as high for American Indians. The higher risk of chemical sensitivity in American Indians has implications for the extreme caution that should be used (such as limited spray zones and signage) in areas where American Indians may be gathering plants they use as a part of their culture. Consumption of plants with herbicide residues could be extremely harmful, as could inadvertent contact with a recently-sprayed area."	Yes	We addressed this in the EIS. We recognize that there are different levels of sensitivity to chemicals so we incorporated "Design Features" in Appendix B to accommodate the needs of the Native American community.
1522	8	"On page 21, item #6 states: mixing, loading, and equipment cleaning must be done onsite and at least 300 feet from private land (unless the owner is cooperating in the project), open water, or sensitive areas. These actions would violate the intent of the limited-spray zones, which intend to keep all herbicides no closer than one mile from sensitive areas	Yes	Thank you. We have revised the text to be clearer and incorporated the idea in design features to be used during implementation (see Appendix B).

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
		(residential areas, campgrounds, trailheads, etc). Some alternative plan needs to be created so no cleaning or mixing is done within a limited-spray zone."		
1522	9	"On page xiii, you mention your intent to have alternative travel areas around sprayed zones. This is extremely important to allow sensitive people freedom to travel. This should be a goal in the final EIS Statement."	Yes	We agree and this could be a discussion item at the annual meeting.
1522	10	"Careful attention should be given to avoid contaminating surface and ground water. The ADEQ should carefully monitor any increase in pesticide contamination in their wells."	Yes	We have considered this in the "Safe Drinking Water Act" discussion and the environmental consequences section for "Soil, Water and Air."
1522	11	"I feel an 800 number should be developed that records all herbicide and insecticide applications in the Prescott, Kaibab or Coconino National Forests (or, if necessary, an 800 number for each forest, but one would be better). This 800 number could be modeled on the ADOT 800 number…."	Yes	Thank you. We have revised the text to be clearer and incorporated the idea in design features to be used during implementation (Appendix B).
1522	12	"At the meeting on 4/14/04 between the MCS community and members of the Forest Service, a suggestion was made by the Forest Service that a yearly meeting be held to discuss spraying goals and locations for the year ahead and to listen to concerns from the MCS community as the project proceeds. I believe this is an excellent idea."	Yes	Thanks for the idea. We agree and it has been put in design features to be used during implementation (Appendix B).
1523	1	"We strongly support the Forest Service's initiative in attempting to control noxious and invasive weeds. The proposed program will promote ecosystem health and prevent losses in the capacity of the land to support productive wildlife habitat. Proper control methods can result in the long-term improvement of habitat for plants, fish and wildlife, and	NA	Thanks for the support.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
		specifically, for species listed as threatened and endangered (listed species) under section 4 of the Endangered Species Act (ESA)."		
1523	2	"We must also point out the need for an accurate analysis of effects on listed species to ensure compliance with the ESA and to promote conservation of these species."	NA	The consultation for the BA&E provided the additional analysis.
1523	3	"To minimize effects to listed species, alternative treatments, such as hand-pulling or other mechanical methods, may be more appropriate than using herbicides in some areas."	NA	We agree and have incorporated alternative methods of treatment into the integrated weed treatment strategy.
1523	4	"…the potential effects on listed threatened or endangered species or their critical habitat should also influence selection of the appropriate method(s)."	NA	We agree. These effects were analyzed during the consultation.
1523	5	"In general, we recommend that treatments in areas where listed species or critical habitat occur be tailored to result in the least possible effects to those species or critical habitat while allowing you to accomplish your objectives. To aid in achieving this goal, we recommend use of our draft "Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U.S. Fish and Wildlife Service" (RPMPA)."	NA	We agree. The RPMPA was utilized during the consultation. Both the final and draft copies were utilized and are included in the project record.
1523	6	"We have concerns regarding the use of biological control agents due to potential impacts to endangered species' habitat. Improper or inappropriate use of biological control agents could result in significant impacts not only to listed species, but also to the composition, structure, and functioning of the ecosystem surrounding the treatment site. Even when approved agents are used in the manner intended, there could be unintended adverse effects on listed species. For example	NA	OK. We have eliminated the use of biological control on tamarisk in Alternative 4 to comply with the Southwestern Willow Flycatcher Recovery Plan.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
		the Chinese leaf beetle (*Diorhaba elongata*) is the proposed biological control agent for tamarisk. In many areas and situations, tamarisk provides important habitat for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*). Loss of tamarisk on a large, or possibly even a small, scale could significantly impact this species. In this case, control of tamarisk should include an evaluation of the root causes for its occurrence, a determination of effect for the flycatcher and other sensitive riparian species, and development of appropriate avoidance and mitigation measures."		
1523	7	"The endangered Arizona cliffrose (*Purshia subintegra*) is vulnerable to extinction due to localized habitat and a limited number of populations…..Under the proposed program, roadways are one of the major areas of treatment, and the treatment objective for two of the weed species associated with Arizona cliffrose is stated as "eradication"….Based on the high number of weeds associated with Arizona cliffrose (see Page 54) and depending on the treatment method used, the likelihood of proposed treatment adversely affecting individuals of this species could be substantial. Impacts at the species level may also be significant due to this species' distribution and the focus of the weed management program. Your biological evaluation of this project should be revised to include a thorough effects analysis for this species."	NA	Table 9 refers to the presence or not of weeds in the habitat of Arizona cliffrose. The table and specialists' report has been revised to state that these weeds may grow in the habitat (surveys to date have found the weeds only on land adjacent to the forest). The biological assessment has been written to clarify what actions would take place should weeds be found in Arizona cliffrose habitat on the forest and species conservation measures were designed during the consultation process with FWS specifically to address concerns.
1523	8	"Because dicamba is highly toxic the Service is concerned that full effects of this herbicide have not been evaluated with regard to those that may occur to the endangered Mexican spotted owl (*Strix occidentalis Lucinda*). The Service	NA	Thank you, we reduced the total amount of dicamba and the locations where we would use it. We also incorporated some of the RPMPA buffers.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
		recommends potential adverse effects for these species be addressed through application of buffers zones as given in the RPMPA and use of other management tools (e.g., Recovery Plan for the Mexican Spotted Owl).		
1523	9	"Although we fully anticipate the use of risk assessments, we caution against relying too heavily on this source of information in effects analysis contained in this DEIS. The non-target hazard analysis for the 1992 risk assessment summarized primarily laboratory studies on a limited number of species representative of those typically found in rangeland, forestland or riparian areas in the West."	NA	Additional, updated risk assessments have been used, in addition to various other sources of information. Please see the project record for a listing.
1523	9	"If section 7 consultation is conducted on the implementation of the Proposed Alternative, we recommend the consultation include all actions considered possible through adaptive management."	NA	Informal consultation on the Preferred Alternative 4 did consider all actions.
1523	10	"We recommend the Forest Service take other factors into account during evaluation of impacts, including the differences in response between a surrogate species in the lab and the non-target listed species in the field; the complex formulations of constituents that comprise pesticides and their possible individual and interactive toxicities; and the effects that pesticides constituents may have as they degrade; and possibly recombine, in the environment. Because of these uncertainties, we recommend that you reevaluate the potential for effects and consider buffer zones as recommended in the RPMPA to minimize adverse effects."	NA	We agree and utilized the limited spray zones and the RPMPA to minimize adverse effects. See also species design features that were designed during the consultation process with FWS specifically to minimize adverse effects.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	11	"There are numerous plants listed on a label for a particular pesticide for which another pesticide would provide better control. We recommend additional consideration of this in the herbicide selection process."	NA	We used multiple sources of literature to develop herbicide control methods. The FS is also limited to using those herbicides for which risk assessments have been completed.
1523	12	"In addition, the DEIS (Page 46) states that application rates will be 'below the routine typical scenario.' Application rates used should be based on levels, which are effective on each species of invasive plant. As a rule, applications must achieve a 95 percent to 98 percent kill of many invasive plants to achieve a turnaround and actually reduce populations, particularly in plants having high seed production volume." "In addition, there is evidence that failure to control at optimal levels can result in a shift of species, with increases in those invasive plants that are resistant to the particular herbicide being used (e.g., Roundup). If the statement on Page 46 means that rates proposed are not based on defined application rates, application may not be effective in bringing populations of species under control and may, in fact, have further adverse effects to the invasive species control program."	NA	The 95 percent is not a general rule; however, it is an objective for which to strive after multiple treatments. The location in the draft from which the comment arose is incorrectly listed.
1523	13	"We recommend manual control be followed by other treatments (herbicide application) to ensure best results."	NA	We have revised text to be clearer in Ch. 2, "Integrated Weed Treatment Strategy."
1523	14	"Effective control and eradication plans should address the original cause and means of how noxious and invasive weeds arrived and were established."	NA	See the additional writeup on cumulative effects and vectors of infestation.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	15	"Simultaneous or subsequent restoration of desired ecosystem components (e.g. native plants that have been displaced by invaders) is another factor that should be considered in your program."	NA	Re-establishing the native species is incorporated into the document.
1523	16	"The Plant Protection Act (PPA) passed a couple of years ago, invalidated all but two sections of the Federal Noxious Weed Act. Therefore, reference to the Federal Noxious Weed Act should be verified to ensure they are still in effect and were not affected by the PPA."	NA	We have referenced the PPA in addition to the FNWA. See "Weed Definitions and Regulations" for noxious weed definition in Chapter 1.
1523	17	"…U.S. Fish and Wildlife Service has also been consulting with the Forest Service on the proposed 'Management of Noxious Weed and Hazardous Vegetation on Public Roads on National Forest Lands in Arizona.' Please revise the DEIS to explain how the two consultations are coordinated."	NA	Please see Proposed Action and cumulative effects discussions where the other project is discussed.
1523	18	"The DEIS states that: only approved herbicides will be used in riparian corridors." It should state, "only herbicides approved for use in or near water will be used in riparian corridors."	NA	Thanks; have updated.
1523	19	"The statement that herbicides will be used at levels below the recommended rate should be revised to reflect the need for application rates at levels which are effective on each particular invasive plant species."	NA	Thanks; have updated.
1523	20	"The text reading: 'low application rates and total area where treatments will occur is not going to exceed the reference dose.' To clarify that the reference dose refers to the amount of active ingredient which will actually end up on the ground; and it is based on the NOEL with a 100-fold protection factor built in to account for possible unintended impacts."	NA	See risk assessment summary section where NOEL is defined and discussed.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	21	"The DEIS indicates riparian invasive species could be treated up to the water's edge, leading to concerns regarding effects to aquatic species. The service recommends potential adverse effects for these species be addressed through applications of buffer zones as given in the RPMPA."	NA	This topic was discussed and agreed upon in the consultation proceedings.
1523	22	"Purpose and Need for Action, Page 6; The DEIS states here and in various other portions of the DEIS that aquatic weeds will be addressed in a separate EA, yet later in the document you imply you will be controlling them. Please clarify the intent of the Forest Service with regard to Aquatic weeds."	NA	No aquatic vegetation in water will be treated in conjunction with this project.
1523	23	"Siberian elm must also be treated with herbicides, as well as Russian knapweed, leafy spurge, tamarisk, and tree of heaven. In addition, camelthorn should be added as another deep-rooted perennial."	NA	While herbicides are a preferred method of treatment, there may be situations where some of the alternative methods are used to better coordinate with other resources.
1523	24	"Chapter 3 Affected Environment. Introduction: We recommend that this section provide information, perhaps in a table format, about flows in each of the watersheds and indications of reached that are ephemeral to assist in full evaluation of impacts."	NA	Additional discussion about this was provided during the consultation process.
1523	25	"We recommend clarifying use of the name: "white top", since it applies equally to *Cardaria* and *Lapidium* {sic!} species. We believe it is better to use the name: "hoary cress" for *Cardaria* and "perennial pepperweed" for *Lapidium* spp."	NA	We have adjusted the text.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	26	"In addition, under Alternative 3 we do not expect the project to reach to objectives for Arundo and teasel without the use of herbicides. Arundo is a very difficult plant to control due to its propensity to grow from any tiny root fragment. Without herbicides, we question whether the treatment objectives for this plant would be met."	NA	We will consider your comments for the implementation of treatments.
1523	27	"Latex in leafy spurge not only can affect livestock, it can also affect people. It is irritating to skin, and it can cause temporary blindness if gotten in the eyes (from hands touching eyes). It is particularly potentially harmful to those with sensitive skin, such as children."	NA	Thank you for the information. This information is being included in the decision rational for the Record of Decision.
1523	28	"Yellow starthistle can produce up to 150,000 seeds per plant and seed viability has been suspected to be as long as 30 years (Sheley and Petroff)."	NA	Thank you for the information. Yellow Starthistle will be a difficult weed to eradicate due to these characteristics.
1523	29	"Russian olive is also spread by birds."	NA	Thank you for the information. We are adding bird dispersal of seed into the cumulative effects portion.
1523	30	"Tamarisk can produce as many as 500,000 seeds per plant, although seeds are short-lived (2-3 months)."	NA	Thank you for the information.
1523	31	"Integrated Weed Management Strategies: We recommend use of the method recently developed by the California Exotic Pest Plant council (CalEPPC), the Nature Conservancy, and several university professionals for California, Nevada, and Arizona be used in identifying priority plants."	NA	We are participating in that process in Arizona and thus are familiar with it. Our project prioritization was done prior to initiation of the process in Arizona. Also we take into account urgency to treat weeds on the forests and the size and distribution of the populations.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	31	"In addition, the goal stated on this page should be eradication for the 20 acres of Siberian elm to be consistent with comments later in the DEIS that Siberian elm will be eradicated."	NA	Thank you for the information; we have adjusted the text.
1523	32	"Skeleton weed is not mentioned in the table, although it is mentioned on page 53 of the DEIS. Please revise the DEIS to resolve this inconsistency."	NA	Thank you for the information; we have adjusted the text.
1523	33	"Setting an arbitrary 'limited spray zone within one mile of communities, recreation sites, trailheads, and scenic overlooks' (table 13) could prove detrimental to the program, as these are the areas where invasive plants are most likely to become established."	NA	Establishing limited spray zones is necessary to provide chemical free zones for sensitive people. See also response to project record 1523, comment 4.
1523	34	"Management planning activities should work to schedule both treatments and restrictions in access in a manner that both avoids health impacts to MCS persons and accomplishes goals of the noxious and invasive weed program."	NA	We agree and have strived to develop a document that makes this possible.
1523	35	"Of the adjuvants mentioned in the DEIS, those composed of petroleum derivatives and limonone may have greater toxicity than that of the herbicides being proposed. We recommend the types of adjuvants considered be based on those preferred for specific herbicides proposed and the DEIS include discussions of the adjuvant toxicity as well as the herbicide itself."	NA	We agree and dropped the petroleum based adjuvants and limonone.
1523	36	"We also recommend the DEIS consider other choices of adjuvants for treatments, for example a vegetable oil (like JLB oil), could hold less risk as a choice for stump treatments than other more toxic adjuvants."	NA	We agree and added several other adjuvants.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	37	"Please provide justification and supporting documentation for effective biological control agents for camelthorn."	NA	We are not planning any biological control for camelthorn. Effective agents are not yet developed.
1523	38	"The DEIS indicates that the listed herbicides have 'relatively low aquatic toxicity under typical concentrations.' We recommend that the paragraph define 'relatively low' toxicity, and describe concentrations in the study area basins and how they compare to whatever USDA (1988) describes as 'typical.'"	NA	See the risk assessments for discussion of the toxicity.
1523	39	"Integrated Weed Management Strategies: There is need throughout this document, particularly this section, to distinguish between ester and amine formulations (e.g., triclopyr and glyphosate)."	NA	This has been adjusted.
1523	40	"Picloram is also effective as a basal spray to small trees, and extremely small amount need be used. With its inherent low toxicity (>10,000 mg/kg) and small amounts used, it is an excellent herbicide for control in areas where groundwater is not shallow."	NA	Thank you for the information.
1523	41	"In addition, imazapic is being used in prairie restoration because it does not heavily impact native grass species."	NA	Thank you for the information.
1523	42	"The percentages in Table 18 do not appear to be based upon the best control method for each species in many cases. Please provide justification and supporting documentation for these percentages."	NA	The information in Table 18 is derived from the analysis of the infestations and best estimate of herbicide to be used.
1523	43	"We recommend control be done prior to seeding and in some case, before flower production. (Musk thistle, for example, can complete seed production just using the residual moisture in cut stems.)"	NA	We agree; timing of herbicide treatments will be such that they are most effective.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	44	"Please clarify the justification for applying a 14% rate of spread to all species. With some as low as 5%, others as high as 20%, it would seem more appropriate to address the potential spread rate of each species, and evaluate the influence of rainfall quantity and timing on seed production and how these factors can influence the speed of spread of infestations."	NA	Weed populations expand in response to the growing conditions they encounter, moisture, competition, and climate. With infestations found on various parts of 4.9 million acres at various elevations and under varying conditions, the team believed that the use of 14 percent was best for many species. We used different rates for some species, as documented in the project record.
1523	45	"Please modify the statement 'Imazapic would be useful in or near stands of ponderosa pines to avoid tree mortality, adjacent to surface waters, and when ground water is below 18 inches of the soil surface.' Imazapic is a comparatively volatile sulfonylurea herbicide; it would seem to be potentially harmful to ponderosa pines, particularly young ones."	NA	Thank you for the information; we have adjusted the statement.
1523	46	"In general, 2,4-D is proposed for use far more than necessary. Considering there are less toxic alternatives for control of some of these species, 2,4-D should not be used unless it is the most effective herbicide in bringing a species under control, and/or other herbicides are not likely to be successful in doing so."	NA	Thank you for the information. There will be opportunities to adjust which herbicides are used as implementation efforts begin. At this time, 2,4-D is very effective on many of the weeds with minimal impact on many of the other resources that are being coordinated.
1523	47	"Specifically, 2,4-D is not appropriate to use on tamarisk, Siberian elm, Russian olive, or tree of heaven. For these species, triclopyr is recommended."	NA	Thank you for the information.
1523	48	"Small diameter tamarisk in areas where desirable plants are found can be brought under control with basal applications of Garlon 4, although there is a limit of 1 ½ quarts per acre of the latter."	NA	Thank you for the information.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	49	"For Russian knapweed, basal applications of picloram can be very effective where shallow groundwater is not a concern."	NA	Thank you for the information.
1523	50	"The objective of eradication of yellow starthistle, with seed viability of up to 30 years, and seed production at 150,000 seeds per plant, most likely will not be achieved in a 10 year program. However significant control is possible."	NA	Thank you for the information.
1523	51	"Clarification is needed for the estimation for the expected cost for manual control."	NA	See response to project record 1452, comment 5. Costs were based upon labor rates during the calendar year 2000. It is understood that current costs would be higher.
1523	52	"Please provide support for the Forest Service assertion that steaming will work for controlling invasive species."	NA	Additional information has been included in the discussion describing the various methods of treatment.
1523	53	"It should be stated that sheep can spread seeds from infested to uninfested areas, resulting in the need to quarantine and clean sheep before moving to/from grazing areas."	NA	We agree; use of cultural methods will require additional measures to reduce the chances of spreading weed seeds.
1523	54	"We feel it would be more appropriate to calculate reduction of infestations by density for any deep-rooted perennial. Elimination of satellite infestations is a realistic goal, along with reduction of density of large infestations within the 10 year time frame."	NA	Thank you for the information.
1523	55	"Contaminated seed mixes were the source of a major infestation of yellow star thistle on one National Forest after a fire."	NA	We agree; the use of weed seed-free seed mixtures and weed-free hay are important to reduce these potential vectors of infestation.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	56	"The USDI recommends control for giant reed be revised to include cutting the stems and immediately (within 30 seconds) treating the stump with Rodeo (or equivalent glyphosate product)."	NA	Thank you for the information.
1523	57	"Research has shown that manual control was only about 40% effective on spotted knapweed. Every plant missed could completely re-infest an area."	NA	Thank you for the information.
1523	58	"Due to the depth of roots, manual control of camelthorn and Russian knapweed would be ineffective."	NA	Camelthorn and Russian knapweed will have combination treatments, using both herbicides and manual treatments. Herbicides will be used on the larger plants; manual controls will be used on the new seedlings before they develop their extensive root systems.
1523	59	"Musk thistle will bloom and seed after mechanical control, if it has reached the bud stage. Mowing will likely result in musk thistle plants that bloom and seed below the level of the mower. Grubbing should be done 6 inches down to discourage re-growth."	NA	Thank you for the information.
1523	60	"We are concerned about the effectiveness of utilizing manual control of diffuse knapweed on 483 acres. Pulling must be done 3 times a year to provide any significant control, in spring, late June, and just before seed dispersal (timing may vary with altitude and latitude)."	NA	We agree and have projected the multiple treatments per year for the control objectives.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	61	"Yellow starthistle and, possibly malta starthistle, may have seed viability longer than 10 years. Complete eradication may not occur with that time period, and follow-up monitoring will be necessary to catch any remaining plants, for perhaps as long as another 10 years or more. Likewise, burning and seeding are not likely to achieve control with manual removal."	NA	Thank you for the information.
1523	62	"Whitetop (a. k. a., hoary cress) is a deep-rooted plant. Mechanical and cultural control may not be effective in controlling it. The USDI recommends success in eradication be increased with use of a herbicide in addition to mechanical and cultural control."	NA	Thank you for the information.
1523	63	"If application of Garlon 3A to cut stumps of Siberian elm is done at the right time of the year (particularly late summer and fall) and all trees capable of producing seed are removed, re-treatment should not be done except to prevent re-infestation from outside sources."	NA	Thank you for the information.
1523	64	"We feel it is important to evaluate and mitigate the spread of invasives by grazing activities, in addition to stream bank destabilization by livestock."	NA	Grazing is discussed as a vector of infestation and as a cumulative effect.
1523	65	"It appears to be unrealistic to propose effective treatment of 49,605 acres without the use of herbicides."	NA	The total infested forestland under treatment for Alterative 3 is 23,410 acres over 10 years. While this may be unrealistic, it isn't impossible. Many of the people involved with this project would prefer that an alternative without the use of herbicides be selected. As such, we had to evaluate it and the results that would be obtained if no herbicides were used.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	66	"Dalmation toadflax is a deep rooted perennial that can reproduce by root buds. We feel mechanical treatments are likely to cause an increase in density, whether by "steaming," or by physical removal."	NA	Manual, herbicidal, and biological methods will be used on this species to achieve a contain/control objective.
1523	67	"The USDI is concerned that the cost associated with manual control of invasives has been underestimated."	NA	See project record 1523, comment 51 for discussion.
1523	68	"While cheatgrass control is very important, we feel the list of invasive grass plants is not inclusive enough."	NA	We revised the FEIS to include treatment of the more generic "annual nonnative grasses." During forest monitoring, we will be vigilant for other noxious or invasive species. In the event that other annual nonnative grasses or weeds need treatment, the adaptive process may be used to treat them.
1523	69	"It was stated previously in the DEIS that aquatic invasives were not to be addressed in this document. However, it is stated here the intent to control Eurasian water milfoil and water primrose."	NA	See response to project record 1523, comment 22. No aquatic vegetation will be treated with this project. This discussion had been included in an earlier version of the document, it was removed from the DEIS.
1523	70	"The sentence, 'We believe that this action would have the highest potential to cause sedimentation into stream courses since we are undertaking the highest amount of mechanical treatments that generally have the most potential to create bare soil,' is incomplete, because it does not consider other important factors that affect sedimentation into streams."	NA	Thank you for your input.
1523	71	"Please provide supportive evidence for the assertion that clopyralid would have little impact on Flagstaff pennyroyal."	NA	Documentation of this determination is in the botany specialists' report and botany biological evaluation. Mediterranean sage and diffuse knapweed would be treated with clopyralid in

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
				and around Flagstaff Pennyroyal populations because it is the least toxic to Flagstaff Pennyroyal. Manual and biological control would also be included in the treatment protocol.
1523	72	"It should be stated that stump treatment for tamarisk with Garlon 3A (50% with water) should present virtually no risk to giant lupine unless the herbicide were accidentally spilled, or the plant trampled during stump applications."	NA	Thank you for your input.
1523	73	"Mitigation should include coordination with other agencies."	NA	Coordination with other agencies was initiated during development of the DEIS. That coordination continued through consultation with the Fish and Wildlife Service during development of the BA, with the EPA for safe drinking water coordination, with the Arizona Department of Environmental Quality for safe drinking water, and with the Arizona Department of Transportation for coordination during their herbicide application efforts. Public involvement and coordination has been and will continue to be extensive.
1523	74	"Further delineation of what and when vital services will be limited, and to whom, needs to be provided."	NA	Thank you for your input.

Forest Service Response to Comments

Project Record No.	Comment Number	Comment	Substantive? (Yes/No)	Response
1523	75	Chapter 6. "The section describes monitoring, but not the response to be taken if the monitoring gives results indicating an increase in concentrations of pesticides."	NA	If the monitoring indicates that treatment methods are inadequate, use of other more effective methods will be undertaken. These could include an increase in concentrations of herbicides as long as label instructions were being followed.
1523	76	"The USDI strongly supports the Forest Service's initiative to promote ecosystem health and prevent losses in the capacity of the land to support productive wildlife habitat by establishing a program to control noxious and invasive weeds."	NA	Thank you for your support.
1523	77	"Proper control methods can result in the long-term improvement of habitat for plants, fish and wildlife, and specifically, for species listed as threatened and endangered (listed species) under section 4 of the Endangered Species Act."	NA	Thank you for your support.
1523	78	"We do, however recommend further evaluation of impacts to species listed as threatened and endangered under the Endangered Species Act (ESA) (listed species), impacts possible during the use of herbicides, and the effectiveness of the proposed action."	NA	During the intensive consultation process with the Fish and Wildlife Service during preparation of the BA, this item was resolved.
1524	1	Notes possible burdock infestations in various locations on the North Kaibab.	Yes	We will continue to monitor all portions of all three forests in search of infestations of new weeds. It may become necessary to treat these infestations of burdock, although at this time, they are not considered a threat.

Government and Agency Comment Letters

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
ARIZONA-NEVADA AREA OFFICE
3636 NORTH CENTRAL AVENUE, SUITE 900
PHOENIX, ARIZONA 85012-1939

Noxious Weeds EIS
Vol. 30 Doc. IV 76 Pg. 1

March 17, 2004

REPLY TO

Office of the Chief
Regulatory Branch

Michael R. Williams
Forest Supervisor
Kaibab National Forest
USDA, Forest Service
800 South Sixth Street
Williams, Arizona 86046

File Number: 2004-00849-DE

Dear Mr. Williams:

The U.S. Army Corps of Engineers (Corps) received a copy of the *Draft Environmental Impact Statement for Integrated Treatment of Noxious and Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests in Coconino, Mojave, and Yavapai Counties, Arizona,* dated February 2004. This office has reviewed the document, and comments are provided below.

Alternatives 1, 3, and 4 discussed the use of mechanical means to eradicate, prevent, contain or control noxious and invasive weeds. Mechanical measures, as defined in your draft document, have the potential to result in the deposition of dredged or fill material within waters of the United States, and may require a Department of the Army permit issued under Section 404 of the Clean Water Act. A Section 404 permit is required for the discharge of dredged or fill material into the waters of the United States, including adjacent wetlands. Examples of activities requiring a permit are those that substantially disturb vegetative root systems, involve mechanized pushing, dragging, or other similar activities that redeposit excavated soil material; placing bank protection; temporary or permanent stock-piling of excavated material; grading roads; grading (including vegetative clearing operations) that involves the filling of low areas or leveling the land; constructing weirs or diversion dikes; constructing approach fills; and discharging dredged or fill material as part of any other activity.

Noxious Weeds EIS
Vol. 30 Doc. 1470 Pg. 3

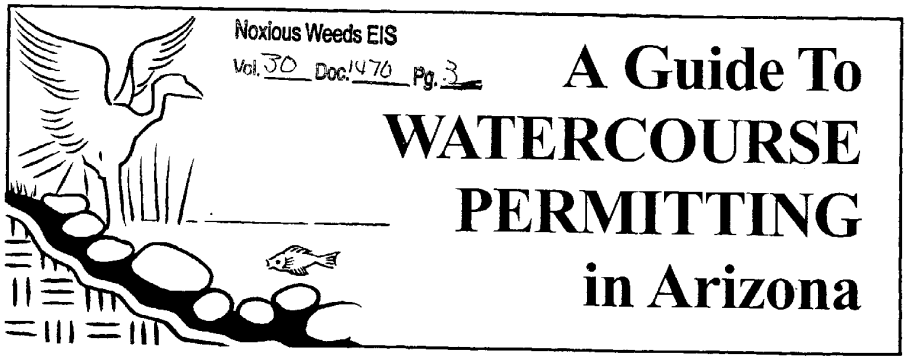
Enclosed you will find a permit application form and a pamphlet that describes our regulatory program. Thank you for the opportunity to review and comment. If you have questions, please contact Daisy Eldridge at (602) 640-5385 x 268. Please refer to file number 2004-00849-DE in your reply.

Sincerely,

Cindy Lester

Cindy Lester P.E.
Chief, Arizona Section
Regulatory Branch

Enclosures



GUIDE TO APPLICABLE PERMITS

ACRONYMS AND DEFINITIONS

A. FLOODPLAIN USE PERMITS

B. NPDES PERMIT (POINT SOURCES OF POLLUTION)

C. NPDES STORM WATER GENERAL PERMIT (CONSTRUCTION)

D. NPDES STORM WATER GENERAL PERMIT (INDUSTRIAL)

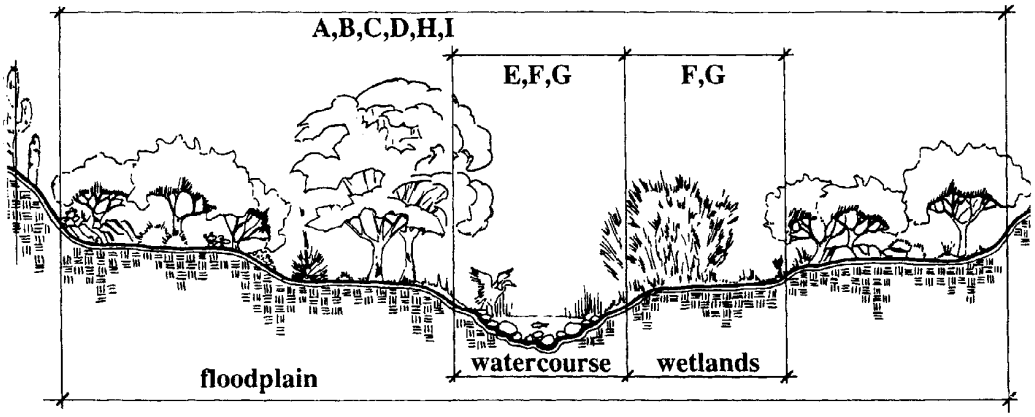
E. SECTION 10 PERMIT (RIVER AND HARBOR ACT)

F. SECTION 404 PERMIT (CLEAN WATER ACT)

G. STATE WATER QUALITY CERTIFICATION (SECTION 401)

H. OTHER STATE AND LOCAL PERMITS THAT MAY APPLY

I. OTHER PERMITS, CONTINUED



Noxious Weeds EIS
Vol. 30 Doc. 1470 Pg. 4

GUIDE TO APPLICABLE PERMITS

Using the diagram above, determine where your project will take place: floodplain, watercourse, or wetlands. The letters in the diagram refer to the permits listed below and described on the following pages.

A. Floodplain Use Permits
B. NPDES Permit (Point Sources of Pollution)
C. NPDES Storm Water General Permit (Construction Activities)
D. NPDES Storm Water General Permit (Industrial Activities)
E. Section 10 Permit (River and Harbor Act)
F. Section 404 Permit (Clean Water Act)
G. State Water Quality Certification (Section 401)
H. Other state and local permits that may apply, depending upon location and activity
I. Other permits, continued

GUIDE TO APPLICABLE PERMITS

ACRONYMS AND DEFINITIONS

A. FLOODPLAIN USE PERMITS

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D. NPDES STORM WATER GENERAL PERMIT (INDUSTRIAL)

E. SECTION 10 PERMIT (RIVER AND HARBOR ACT)

F. SECTION 404 PERMIT (CLEAN WATER ACT)

G. STATE WATER QUALITY CERTIFICATION (SECTION 401)

H. OTHER STATE AND LOCAL PERMITS THAT MAY APPLY

I. OTHER PERMITS, CONTINUED

Noxious Weeds EIS
Vol. 3C Doc. 1080 Pg. 1

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
3003 N. Central Avenue, Suite 800
Phoenix, Arizona 85012-2946
(602) 280-8801
FAX (602) 280-8809

Michael Williams, Forest Supervisor
800 S. 6th Street
Williams, Arizona 86046-2899

Dear Mr. Williams:

This response is in regard to your letter dated February 25, 2004, regarding the proposed Integrated Treatment of Noxious and Invasive Weeds in the Coconino, Kaibab, and Prescott National Forests within Coconino, Mojave, and Yavapai Counties, Arizona.

The Natural Resources Conservation Service (NRCS) has general responsibility, nationwide, for implementing the Farmland Protection Policy Act (FPPA) and to review projects that may affect prime farmland and/or wetlands associated with agriculture. After reviewing the information provided, the following is noted:

1- The proposed new projects if implemented as planned, are exempt from the requirements of the FPPA, as revised in 1994, that excludes land which is already in or is committed to urban development, currently used as water storage, or land that is not prime or unique farmland.

2- We do not see any immediate concerns or impacts that would directly affect wetland areas associated with agriculture.

We recommend that any future development projects receive a prime farmland determination prior to any construction activities. Should you have questions, please feel free contact Jeff Schmidt, Community Assistance Coordinator at 602.280.8818. Thank you again for the chance to review the proposed project.

Sincerely,

JAMES A. BRIGGS
Assistant State Conservationist (T)

cc:
Andree Duvarney, National Env. Coord. ECS, Washington, DC (NRCS ED #2879)
Jeff Schmidt, Community Assistance Coordinator, NRCS, Phoenix, Arizona

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

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Noxious Weeds EIS
Vol. 3 C Doc. 1-543 Pg. 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

April 15, 2004

Charles Ernst
Kaibab National Forest
U.S. Forest Service
800 South 6th Street
Williams, AZ 86046

Subject: Draft Environmental Impact Statement, Integrated Treatment of Noxious and Invasive Weeds; Coconino, Kaibab and Prescott National Forests; Coconino, Mohave and Yavapai Counties, Arizona (CEQ #040095)

Dear Mr. Ernst:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the above-referenced project. Our detailed comments (enclosed) are provided under the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

The Coconino, Kaibab and Prescott National Forests propose to implement a program to control noxious and invasive weeds. The DEIS evaluates three action alternatives and No Action. We rate the DEIS and Proposed Action as EC-2, Environmental Concerns - Insufficient Information. Please see the enclosed "Summary of Rating Definitions" for a detailed explanation of EPA's rating system.

EPA has environmental concerns because the DEIS does not identify or evaluate impacts to drinking water sources that may be affected by herbicide applications. Nor does the DEIS evaluate mitigation to avoid or reduce potentially adverse effects on drinking water sources such as limited spray zones similar to the zones proposed for communities, recreation sites, trailheads, and scenic overlooks.

Noxious Weeds EIS
Vol. 3C Doc. 1503 Pg. 3

We appreciate the opportunity to comment. Please send one copy of the Final EIS (FEIS) to the letterhead address (mailcode: CMD-2) when available. If you have any questions, please contact my staff reviewer, David Tomsovic, at 415-972-3858 or < tomsovic.david@epa.gov >.

Sincerely,

Laura Fujii for

Lisa B. Hanf, Manager
Federal Activities Office

Enclosures: 2
"Summary of EPA Rating Definitions"
EPA's Detailed Comments on DEIS

SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

Noxious Weeds EIS
Vol. 30 Doc. 1503 Pg. 3

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

Noxious Weeds EIS
Vol. 30 Doc. 1563 Pg. 4

U.S. EPA DETAILED COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR INTEGRATED TREATMENT OF NOXIOUS AND INVASIVE WEEDS; COCONINO, KAIBAB, AND PRESCOTT NATIONAL FORESTS, ARIZONA, APRIL 15, 2004

Drinking Water

1. EPA's review identified potential impacts to sources of drinking water (human consumption). The DEIS does not:

- Identify sources of drinking water (public or non-public) within, or in immediate proximity to, areas proposed for herbicide applications, or subject to runoff from areas receiving herbicide applications.
- Provide a map of sources of drinking water within, or in immediate proximity to, areas proposed for herbicide applications, including public water systems.
- Evaluate if herbicide applications may adversely affect public water systems or non-public (private) drinking water sources such as private wells.

Recommendations: The Final Environmental Impact Statement (FEIS) should identify existing or potential drinking water sources within, or in immediate proximity to, areas proposed for herbicide applications, or potentially subject to runoff from areas receiving herbicide applications. The FEIS should provide a map depicting drinking water sources in relation to areas proposed for applications. The FEIS should evaluate if proposed applications may adversely affect public water systems or private drinking water sources.

2. The Safe Drinking Water Act (SDWA) and 40 CFR Part 141 provide a mechanism to protect public health from contaminants in water provided by public water systems. EPA has health-based standards, called "maximum contaminant levels" (MCLs), for many water contaminants, including synthetic organic contaminants such as herbicides. A "public water system" is one that provides drinking water to the public via pipes or constructed conveyances, and has at least 15 service connections, or regularly serves a daily average of at least 25 individuals for a minimum 60 days a year (SDWA Section 1401).

The DEIS evaluates the project's water quality effects only in relationship to the Clean Water Act (e.g., p. 35 on water quality standards, and pp. 37-38 on monitoring wells for pesticides). There is no discussion of the SDWA, the SDWA's requirements or drinking water sources. Although the DEIS (especially pp. 165-172) addresses human health effects of herbicides, it does not address health effects associated with exposure via a drinking water pathway.

Recommendations: The FEIS should address potential human health effects of herbicide applications within the framework of the SDWA and 40 CFR Part 141. Below is information on picloram, glyphosate, and 2,4-D that should be included in the FEIS. The potential health effects of other herbicides proposed for application should be in the FEIS as well.

Noxious Weeds EIS
Vol. 3 / Doc. 1503 Pg. 5

Picloram. Picloram potentially causes damage to the central nervous system, weakness, diarrhea and weight loss in persons exposed to levels exceeding the MCL. Drinking water levels considered "safe"for short-term exposures are, for a 10-kilogram (22 pound) child consuming one liter of water per day, a one- to 10-day exposure to 20 mg/L or up to a 7-year exposure to 0.7 mg/L. EPA's MCL for picloram is 0.5 parts per *million* (ppm). If picloram is released to soil it will not be expected to adsorb to the soil and may leach to ground water, a conclusion supported by detection of picloram in ground water samples.

Glyphosate. Glyphosate potentially causes lung congestion and increased breathing rate at levels exceeding the MCL. Drinking water levels considered "safe" for short-term exposures are, for a 10-kilogram child consuming one liter of water per day, up to a ten-day exposure to 20 mg/L or up to a 7-year exposure to one mg/L. EPA's MCL for glyphosate is 0.7 ppm. After glyphosate is applied to land, it strongly adsorbs to soil, remains in upper soil layers, and exhibits a low propensity for leaching. Glyphosate may enter aquatic ecosystems and drinking water sources via surface runoff.

2,4-D. 2,4-D potentially causes nervous system damage from short-term exposures at levels above the MCL. Drinking water levels of 2,4-D considered "safe" for short-term exposures are, for a 10-kilogram (22 pound) child consuming one liter of water per day, a one-day exposure of 1 mg/L, or a 10-day exposure to 0.3 mg/L. EPA's MCL for 2,4-D is 70 parts per *billion* (ppb). See EPA's Technical Fact Sheets on picloram, glyphosate, 2,4-D and other synthetic organic contaminants at < http://www.epa.gov/safewater/dwh/t-soc.html >.

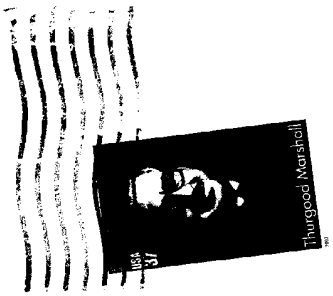
3. No aerial or aquatic herbicide use would occur under the Proposed Action (p. ix). Limited spray zones are proposed adjacent to, and within a mile of, communities, recreation sites, trailheads, and scenic overlooks. There is no evaluation of limited spray zones around drinking water sources or public water systems. Mitigation to avoid or reduce adverse effects may include (1) limited spray zones around drinking water sources and public water systems, and (2) coordination on herbicide applications with facilities such as camps. A monitoring program is presented (pp. 189-191) including monitoring environmental effects. It does not include monitoring drinking water sources for possible contamination by herbicides proposed for use by this project.

As discussed on April 13, 2004 (Mr. Ernst, USFS; and Mr. Tomsovic, EPA), several factors are pertinent when evaluating impacts to drinking water sources. Factors include the herbicides' short- and long-term "environmental fate;" hydrologic conditions; groundwater depth; distance between applications and drinking water sources; and whether a drinking water source is used all year or only seasonally.

> Recommendations: The FEIS should evaluate the feasibility of mitigation for drinking water impacts. If drinking water mitigation is reasonable, the Record of Decision should include commitments for implementation. If monitoring of drinking water sources is recommended, appropriate commitments should be in the Record of Decision.

2

Noxious Weeds EIS
Vol. 30 Doc. 1503 Pg. 6



Received
APR 19 2004
OFEG

Mr. Charles Ernst
U.S. Forest Service
Kaibab National Forest
800 South 6th Street

CMDL FAC
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ENVIRONMENTAL PROTECTION AGENCY
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2004

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THE STATE OF ARIZONA
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(602) 942-3000 • AZGFD.COM

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DEPUTY DIRECTOR
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April 16, 2004

Noxious Weeds EIS
Vol. 3D Doc. 1570 Pg. 1

Mr. Dave Brewer
Kaibab National Forest
800 South 6th Street
Williams, Arizona 86046

Re: Environmental Impact Statement for the Integrated Treatment of Noxious and Invasive Weeds

Dear Mr. Brewer:

The Arizona Game and Fish Department (Department) reviewed the Draft Environmental Impact Statement (DEIS) for the Integrated Treatment of Noxious and Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests (Forest). The Department recognizes that the spread of noxious weeds is a serious threat to wildlife habitats, and we support efforts to control noxious and invasive weed species in order to restore native vegetation. We understand existing conditions within the project area indicate that noxious and invasive weed species have expanded to over 3 percent of the land area and that the control of these plants would promote ecosystem health, prevent losses in the productive capacity of the land, and avoid declines in riparian habitat values.

To this effect, the Department supports the preferred Alternative. However, we recommend that the DEIS better address impacts associated with treatments in riparian areas. In addition, we encourage the Forest to examine the root causes of colonization and propagation of noxious weeds in riparian areas when choosing the most effective control measure. An example may be the presence of saltcedar, which is generally the result of changes in the hydrology of the stream and a reduction in competing native vegetation.

The Department's specific comments are listed as an attachment to this letter. Again, we appreciate the opportunity to review the DEIS and look forward to working with the Forests during the development of site-specific projects. Please contact me at (602) 789-3605 if you have any questions regarding this letter.

Sincerely,

Bob Broscheid
Habitat Branch Chief

Note: Letter Faxed & received 4-19-04
Followed up by hand-off 4-20-04

APR-19-2004 17:52 P.02/04

Noxious Weeds EIS
Vol. 30 Doc. 570 Pg. 2

Mr. Dave Brewer
April 16, 2004
2

BB:kh

Attachment

cc: Richard Miller, Habitat Program Manager, Region II
Kevin Morgan, Habitat Program Manager, Region III

APR-19-2004 17:53 P.03/04

TOTAL P.04

Noxious Weeds EIS
Vol. 30 Doc. 1510 Pg. 3

Attachment

Arizona Game and Fish Department Comments on the DEIS for Integrated Treatment of Noxious and Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests

April 16, 2004

General Comments

Page 76
We recommend that the statement concerning Hualapai Mexican vole be stated as, "this species does not occur in the project area, although it is part of its historic range". According to Hoffmeister, this species has never occurred in this area of the state and technically, it has nothing to do with genetic studies, but with the historic occurrences. We can only rely on the accepted data that Prescott has the same species as the Kaibab and Coconino, *Microtus mexicanus navaho.*

Purpose and Need for Action

Page 3
The infestation of tamarisk and other invasive species as causing the decline in quality of wildlife habitat should be researched in further detail. The current hydro-geomorphic conditions of the river systems may no longer support the regeneration of native plant species. Also, further analysis is needed regarding the removal of exotic species from riparian areas. From a wildlife habitat standpoint, over 90% of the Southwestern willow flycatcher nests are being utilized in tamarisk sites, many within the Verde River system (AGFD, unpublished data, Paradzick and Woodward 2003). The root causes of degradation need to be considered when considering the use of herbicides and biocontrol insects. Conditions following treatment could result in the presence of lower quality vegetation (Anderson 1998).

Risk Assessment Summary - Biological Control

Page 93
The removal of tamarisk vegetation without successful restoration of native species has the potential for short and long-term impacts on wildlife resources. The Department recommends considering more research regarding the ecological mechanisms related to the exotic species identified. We also recommend evaluating the underlying issues associated with invasive species degradation and restoration in riparian areas. We further suggest that all tamarisk removal or riparian restoration projects follow the guidelines set forth in the Southwestern Willow Flycatcher Recovery Plan (Appendix H, Exotic Plant Species in Riparian Ecosystems of the U.S. Southwest, and K, Habitat Restoration).

Direct and Indirect Effects of Alternative 4

Page 151
Clarification of the treatment objectives is needed with regards to the potential direct or indirect negative impacts, such as the consequences of releasing of biological agents in an area.

APR-19-2004 17:53 P.04/04

Noxious Weeds EIS
Vol. 3D Doc. 570 Pg. 4

FAX TRANSMISSION FORM

PHONE (602) 789-3600
FAX (602) 789-3928

TO: Dave Brewer 928-635-8208
Michael Williams

FROM: THE HABITAT BRANCH
ARIZONA GAME & FISH DEPARTMENT
Kelly Hickins

DATE: 4-19-04

SUBJECT: DEIS Integrated Treatment of Noxious and Invasive Weeds

COMMENTS: A signed hard copy of our comments is in route, but we wanted to make sure you received them by the closing day.

NUMBER OF PAGES TO FOLLOW: 3

The Arizona Game & Fish Department is responsible for managing Arizona's fish and wildlife resources as an enduring public trust. In addition, the Department is charged with promoting safe and responsible use of watercraft and off-highway vehicles. Funding is provided from the sale of licenses and permits; watercraft registration fees; federal excise taxes on firearms, fishing equipment, boats, and other sporting goods; State lottery revenues; donations on State income tax forms; and various contracts and grants. Department policy is set by the Arizona Game & Fish Commission, whose five members are appointed by the Governor.

APR-19-2004 17:52 P.01/04

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
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(602) 942-3000 • AZGFD.COM

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April 16, 2004

Noxious Weeds EIS
Vol. 30 Doc. 1510 Pg. 5

Mr. Dave Brewer
Kaibab National Forest
800 South 6th Street
Williams, Arizona 86046

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Sincerely,

Bob Broscheid
Habitat Branch Chief

AN EQUAL OPPORTUNITY REASONABLE ACCOMMODATIONS AGENCY

Mr. Dave Brewer
April 16, 2004
2

Noxious Weeds EIS
Vol. 3 Doc. 1570 Pg. 6

BB:kh

Attachment

cc: Richard Miller, Habitat Program Manager, Region II
Kevin Morgan, Habitat Program Manager, Region III

Noxious Weeds EIS
Vol. 3D Doc 570 Pg. 7

Attachment

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April 16, 2004

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Attachment DEIS Comments
April 16, 2004
2

Noxious Weeds EIS
Vol. 30 Doc. 1570 Pg. 8

Literature Cited

Anderson, B. 1998. The case for salt cedar. Restoration and Management note 16:130-134.

Paradzick, Charles E. and April A. Woodward. 2003. Distribution, Abundance, and Habitat Characteristics of Southwestern Willow Flycatchers (Empidonax traillii extimus) in Arizona, 1993-2000. Ecology and Conservation of the Willow Flycatcher. Studies in Avian Biology No. 26:22-29, 2003. Cooper Ornithological Society. Allen Press Inc., Kansas.

U.S. Fish and Wildlife Service. 2002. Southwestern Willow Flycatcher (Empidonax traillii extimus) Final Recovery Plan. Appendices H and K.

Noxious Weeds EIS
Vol. 3D Doc! 523 Pg!

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1111 Jackson Street, Suite 520
Oakland, CA 94607

TAKE PRIDE IN AMERICA

ER 04/0185

Mr. Charles Ernst
Interdisciplinary Team Leader
Kaibab National Forest
U. S. Department of Agriculture
800 South Sixth Street
Williams, Arizona 86046-2899

Dear Mr. Ernst:

The U. S. Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement for the Integrated Treatment of Noxious and Invasive Weeds, Coconino, Kaibab, and Prescott National Forests, Coconino, Mojave, and Yavapai Counties, Arizona.

The Preferred Alternative described in the document proposes to treat noxious and invasive weeds on a series of infestations totaling 119,030 acres. The Forest Service proposes using integrated weed management approaches including manual, mechanical, cultural, biological, and herbicidal methods.

Herbicide treatments account for 47 percent of all scheduled work, and there will be no aerial or aquatic applications of herbicides. The majority of treatments will be along major travel corridors and within the ponderosa pine vegetation type in the Verde and Little Colorado watersheds. The desired condition is to prevent any new plants from becoming established within the forests, contain or control the spread of 14 species, and eradicate eight species.

Adaptive management is a component of this alternative. After approval, treatments under this program will continue for up to 10 years.

We offer the following comments to assist the Forest Service in its efforts.

General Comments:

We strongly support the Forest Service's initiative in attempting to control noxious and invasive weeds. The proposed program will promote ecosystem health and prevent losses in the capacity of the land to support productive wildlife habitat. Proper control methods can result in the long-term improvement of habitat for plants, fish and wildlife, and specifically, for species listed as threatened and endangered (listed species) under section 4 of the Endangered Species Act (ESA).

1

Noxious Weeds EIS
Vol. 30/30 Doc. 1523 Pg. 2

In general, the Department's comments relate to evaluation of impacts to species listed as threatened and endangered under the Endangered Species Act (ESA) (listed species), regarding the use of herbicides, and the effectiveness of the proposed action.

Vol. 3A Doc. 1523 Pg. 3

Effects of Proposed Actions on Federally Listed Species

The discussion of impacts in the DEIS emphasizes the overall benefits of noxious and invasive weed management. While we strongly support the Forest Service's effort and acknowledge the long-term benefits such a program can have, we must also point out the need for an accurate analysis of effects on listed species to ensure compliance with the ESA and to promote conservation of these species.

The discussion of impacts in the DEIS emphasizes herbicides. This is appropriate given that herbicides make up about half of the proposed treatments, and that herbicide formulations, which often contain many constituents, can contribute to a complex effects analysis. To minimize effects to listed species, alternative treatments, such as hand-pulling or other mechanical methods, may be more appropriate than using herbicides in some areas. Following is an example of factors that should be considered in an effects analysis.

We understand that each target weed species is likely to be most effectively addressed by one or more specific methods, which may or may not include herbicides. However, the potential effects on listed threatened or endangered species or their critical habitat should also influence selection of the appropriate method(s). In general, we recommend that treatments in areas where listed species or critical habitat occur be tailored to result in the least possible effects to those species or critical habitat while allowing you to accomplish your objectives.

To aid in achieving this goal, we recommend use of our draft "Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U. S. Fish and Wildlife Service" (RPMPA). The RPMPA is primarily intended to serve as a screening-level assessment for pesticide protection measures that can be used to protect Federally listed species, species proposed for listing, and critical habitat.

Recommended protection measures may be modified on a case-by-case basis based on additional information and analysis. We recommend using the RPMPA as a guide for your effects analysis and as a model to develop protection for listed species and critical habitat that may be affected.

The Southwestern Willow Flycatcher Recovery Plan, Appendix H (USFWS 2002), provides a discussion on the control of exotic plants in riparian ecosystems, the likelihood of reestablishment of native vegetation after treatment, and recommended approaches to address the overall problem. We recommend that the approaches outlined in recovery plan be applied to exotic plant management in areas where flycatcher habitat is involved. The approaches may be useful to consider for other situations and for other species, as well.

We have concerns regarding the use of biological control agents due to potential impacts to endangered species' habitat. Improper or inappropriate use of biological control agents could result in significant impacts not only to listed species, but also to the composition, structure, and functioning of the ecosystem surrounding the treatment site. Even when approved agents are used in the manner intended, there could be unintended adverse effects on listed species. For example, the Chinese leaf beetle (*Diorhabda elongata*) is the proposed biological control

Noxious Weeds EIS
Vol. 30 Doc. 523 Pg. 4

agent for tamarisk. In many areas and situations, tamarisk provides important habitat for the endangered southwestern willow flycatcher (*Empidonax traillii extimus).*

Loss of tamarisk on a large, or possibly even a small, scale could significantly impact this species. In this case, Control of tamarisk should include an evaluation of the root causes for its occurrence, a determination of effect for the flycatcher and other sensitive riparian species, and development of appropriate avoidance and mitigation measures.

The endangered Arizona cliffrose (*Purshia subintegra*) is vulnerable to extinction due to localized habitat and a limited number of populations. Herbicides were identified as a threat in both the Recovery Plan (USFWS 1995) and in the Final Rule listing the Arizona cliffrose (49 Federal Register 22326). Paved roads pass through half of all known cliffrose populations on these national forests (two of four). Under the proposed program, roadways are one of the major areas of treatment, and the treatment objective for two of the weed species associated with Arizona cliffrose is stated as "eradication."

In addition, the DEIS (Table 20) states that the treatment effects on Arizona cliffrose are that plants might be killed and that seedlings could be pulled out accidentally. The Preferred Alternative states there is "low likelihood" of killing plants if direct spray with clopyralid is avoided. Alternative 3, which relies on non-herbicide methods of control, indicates cliffrose plants "might be set on fire or killed by heat effects." Taking the comments found in the DEIS into consideration, there is little rationale given for the stated low likelihood of plants being killed.

In fact, based on the high number of weeds associated with Arizona cliffrose (see Page 54) and depending on the treatment method used, the likelihood of proposed treatment adversely affecting individuals of this species could be substantial. Impacts at the species level may also be significant due to this species' distribution and the focus of the weed management program. Your biological evaluation of this project should be revised to include a thorough effects analysis for this species.

The Service's RPMPA indicates the herbicide dicamba has a pesticide ecotoxicity rating of class 2 for large avian/predatory avian species. Because dicamba is highly toxic the Service is concerned that full effects of this herbicide have not been evaluated with regard to those that may occur to the endangered Mexican spotted owl (*Strix occidentalis Lucinda).* The Service recommends potential adverse effects for these species be addressed through application of buffers zones as given in the RPMPA and use of other management tools (e.g., Recovery Plan for the Mexican Spotted Owl).

The discussion of impacts to animals is based on a comparison to a risk assessment prepared by the Forest Service and the Bonneville Power Administration in 1992. Although we fully anticipate the use of risk assessments, we caution against relying too heavily on this source of information in effects analysis contained in this DEIS. The non-target hazard analysis for the 1992 risk assessment summarized primarily laboratory studies on a limited number of species representative of those typically found in rangeland, forestland or riparian areas in the West.

Noxious Weeds EIS
30 Doc. 1523 Pg. 5

Three herbicides proposed for use in the 1992 assessment were identified as moderately toxic (2,4-D; dicamba; and triclopyr). However, the same risk analysis concluded that under typical exposures, all of the herbicides and carriers present a low risk to individual terrestrial animals. The DEIS applies this information to animals found on the three national forests and determines that for listed species under typical exposures, no species are at risk. This determination is based on the assumptions that exposures will be "typical," direct spraying on animals will not occur (or is of a very low likelihood), and the area to be treated is relatively minor to the total project area.

The proposed action includes an adaptive management component that allows flexibility in the treatment of noxious and invasive weeds. For example, if a selected treatment method does not work, then other methods, including herbicides, may be used. If section 7 consultation is conducted on the implementation of the Proposed Alternative, we recommend the consultation include all actions considered possible through adaptive management.

Use of Herbicides in Control of Noxious and Invasive Species

The discussion of risk assessments in the DEIS (Page 92) states, "No one can predict a safe exposure to any substance, natural or synthetic, unless the specific situation or context of exposure and dose are known." Given the variability of circumstances under which herbicides may be applied in the field and the known toxicity of at least three of the proposed herbicides, it is reasonable to assume that there may be adverse effects.

We recommend the Forest Service take other factors into account during evaluation of impacts, including the differences in response between a surrogate species in the lab and the non-target listed species in the field; the complex formulations of constituents that comprise pesticides and their possible individual and interactive toxicities; and the effects that pesticides constituents may have as they degrade, and possibly recombine, in the environment. Because of these uncertainties, we recommend that you reevaluate the potential for effects and consider buffer zones as recommended in the RPMPA to minimize adverse effects.

While the DEIS attempts to reflect statements from the Risk Assessment done by the Forest Service, it states potential impacts of the active ingredients in pesticides as if the Forest Service were proposing to apply them full strength (those strengths upon which determinations of potential or possible carcinogenic effects, impacts on reproduction, etc., were based). Because the toxicity of a herbicide at the diluted application rate is so much lower than the toxicity of the inherent active ingredient, we recommend this assumption be reconsidered.

It appears that at least some herbicide control methods proposed in the DEIS appear to be based on what is listed on the label, not on research specific to a particular plant species. There are numerous plants listed on a label for a particular pesticide for which another pesticide would provide better control. We recommend additional consideration of this in the herbicide selection process.

While it is generally a good idea to have herbicide alternatives that operate with different modes of action, for the comparatively short term of this DEIS and the apparent density of

Noxious Weeds EIS
Vol. 30 Doc. 1523 Pg. 6

most of the populations, it appears that there is a proposal to use more kinds of herbicides than would be necessary to control the invasive species. We recommend the list of herbicides proposed be reconsidered and those that are duplicative in action be evaluated to determine which is least likely to have adverse effects and only those herbicides be retained on the list.

In addition, the DEIS (Page 46) states that application rates will be "below the routine typical scenario." Application rates used should be based on levels, which are effective on each species of invasive plant. As a rule, applications must achieve a 95 percent to 98 percent kill of many invasive plants to achieve a turnaround and actually reduce populations, particularly in plants having high seed production volume.

In addition, there is evidence that failure to control at optimal levels can result in a shift of species, with increases in those invasive plants that are resistant to the particular herbicide being used (e.g., Roundup). If the statement on Page 46 means that rates proposed are not based on defined application rates, application may not be effective in bringing populations of species under control and may, in fact, have further adverse effects to the invasive species control program.

Effectiveness of Proposed Action

Because there are many factors, which influence success of treatments, the ability to predict the effectiveness of the proposed management actions on invasive plants is limited, with a high degree of associated uncertainty. As a rule, kill rates of many invasives that fall below 95 percent in a given year are not considered capable of reducing a population (particularly those with high seed production) within a reasonable period of time.

Manual control of any of the invasive species is extremely labor intensive and particularly ineffective for deep-rooted species. Most manual control research done to date indicates only an approximate success rate of 40 percent, far below that which can bring a population of most species under control. For this particular project, the large area and density of invasive species would be expected to reduce the success rate even further. We recommend manual control be followed by other treatments (herbicide application) to ensure best results.

Certain management practices (e.g., livestock grazing) may be responsible for the occurrence of weeds in some areas. Effective control and eradication plans should address the original cause and means of how noxious and invasive weeds arrived and were established.

To help prevent the re-establishment of noxious and invasive weeds in treated areas or the establishment of weeds in new areas, on-going management practices that contribute to or facilitate the establishment or spread of noxious and invasive weeds should be evaluated and modified, as appropriate.

For example, some forests have developed extensive general and specific guidelines to address the ways various projects (e.g., prescribed fire, forest restoration) can be managed to help prevent the establishment or re-establishment of noxious weeds. We fully support such guidelines and recommend they be evaluated and ultimately incorporated into management

6

Noxious Weeds EIS
Vol. 30 Doc. 1523 Pg. 7

actions and projects.

Simultaneous or subsequent restoration of desired ecosystem components (e.g., native plants that have been displaced by invaders) is another factor that should be considered in your program. If those components are not re-established after treatments are conducted, then reinvasion by the same or other noxious weeds may occur.

The Plant Protection Act (PPA) passed a couple of years ago, invalidated all but two sections of the Federal Noxious Weed Act. Therefore, references to the Federal Noxious Weed Act should be verified to ensure they are still in effect and were not affected by the PPA. In addition, the
U. S. Fish and Wildlife Service has also been consulting with the Forest Service on the proposed "Management of Noxious Weed and Hazardous Vegetation on Public Roads on National Forest Lands in Arizona." Please revise the DEIS to explain how the two consultations are coordinated.

The Department provides the following specific comments to assist the Forest Service in revision of the DEIS to reflect the above general comments.

Specific Comments:

Summary of Potential Environmental Impacts, Threatened and Endangered Species, Page xvii: The DEIS states that "only approved herbicides will be used in riparian corridors." It should state, "Only herbicides approved for use in or near water will be used in riparian corridors." The statement that herbicides will be used at levels below the recommended rate should be revised to reflect the need for application rates at levels which are effective on each particular invasive plant species.

Summary, Access to Vital Services, Forest Service Recreation Sites, Collection of Plants by Native Americans, and Public Health: The text reading: "low application rates and total area where treatments will occur is not going to exceed the reference dose." To clarify that the reference dose refers to the amount of active ingredient which will actually end up on the ground; and it is based on the NOEL with a 100-fold protection factor built in to account for possible unintended impacts.

Chapter 2, Alternatives Including the Proposed Action

Proposed Action: The DEIS indicates riparian invasive species could be treated up to the water's edge, leading to concerns regarding effects to aquatic species. The Service recommends potential adverse effects for these species be addressed through application of buffers zones as given in the RPMPA.

Purpose and Need for Action, Page 6: The DEIS states here and in various other portions of the DEIS that aquatic weeds will be addressed in a separate EA, yet later in the document you imply you will be controlling them. Please clarify the intent of the Forest Service with regard to aquatic weeds.

Noxious Weeds EIS
Vol. 30 Doc. 1523 Pg. 8

Alternatives, Preferred Alternative, Alternative 4: Siberian elm must also be treated with herbicides, as well as Russian knapweed, leafy spurge, tamarisk, and tree of heaven. In addition, camelthorn should be added as another deep-rooted perennial.

Chapter 3 Affected Environment

Introduction: We recommend that this section provide information, perhaps in a table format, about flows in each of the watersheds and indications of reaches that are ephemeral to assist in full evaluation of impacts.

Noxious and Invasive Weeds: The DEIS states that the forests "have experienced an expansion of noxious and invasive weeds from a few isolated populations along roads to over 185,000 acres today." To fully provide the public with an understanding of the very real issue related to the expansion of these species, we recommend the Forest Service include the time period in which this expansion occurred (e.g., 10, 20, or 50 years).

Species Descriptions: We recommend clarifying use of the name "white top," since it applies equally to *Cardaria* and *Lapidium* species. We believe it is better to use the name "hoary cress" for *Cardaria* and "perennial pepperweed" for *Lapidium spp.* In addition, under Alternative 3 we do not expect the project to reach to objectives for Arundo and teasel without the use of herbicides

Arundo is a very difficult plant to control due to its propensity to grow from any tiny root fragment. Without herbicides, we question whether the treatment objectives for this plant would be met.

Latex in leafy spurge not only can affect livestock, it can also affect people. It is irritating to skin, and it can cause temporary blindness if gotten in the eyes (from hands touching eyes). It is particularly potentially harmful to those with sensitive skin, such as children.

Yellow starthistle can produce up to 150,000 seeds per plant and seed viability has been suspected to be as long as 30 years (Sheley and Petroff). The DEIS should use this information to support management of this species over the life of the program.

Russian olive is also spread by birds. Tamarisk can produce as many as 500,000 seeds per plant, although seeds are short-lived (2 to 3 months).

Integrated Weed Management Strategies: We recommend use of the method recently developed by the California Exotic Pest Plant Council (CalEPPC), the Nature Conservancy, and several university professionals for California, Nevada, and Arizona be used in identifying priority plants. In addition, the goal stated on this page should be eradication for the 20 acres of Siberian elm to be consistent with comments later in the DEIS that Siberian elm will be eradicated.

Skeleton weed is not mentioned in the table, although it is mentioned on Page 53 of the DEIS.

Noxious Weeds EIS
Vol. 30 Doc. 1523 Pg. 2

Please revise the DEIS to resolve this inconsistency. In addition, please clarify whether yellow toadflax is found within the subject forests as it is abundant near Durango, Colorado.

Social Concerns: The measures used to disclose the effects of herbicide use and "potential human health effects" need clarification. Parameters need to be established (both temporal and spatial) allowing for the development of appropriate exposure mitigating procedures.

Access to Vital Services and Recreation Sites: Setting an arbitrary "limited spray zone within one mile of communities, recreation sites, trailheads, and scenic overlooks" (Table 13) could prove to be detrimental to the program, as those are the areas where invasive plants are most likely to become established. The DEIS comments that access by Multiple Contaminant Sensitive (MCS) persons to the forest would be "severely" restricted; however, if only 1 to 3 percent of the forest is currently infested with invasive plants, then no more than 1 to 3 percent of the forest would be unavailable to MCS persons over the life of the program.

Management planning activities should work to schedule both treatments and restrictions in access in a manner that both avoids health impacts to MCS persons and accomplishes goals of the noxious and invasive weed program (e.g., treat heavily traveled roads during periods of expected low public use). Further clarification and specific descriptions of limitations and mitigation plans should be provided in the text.

Overview - Herbicides Use and Toxicity (Table 14): Of the adjuvants mentioned in the DEIS, those composed of petroleum derivatives and limonene may have greater toxicity than that of the herbicides being proposed. We recommend the types of adjuvants considered be based on those preferred for specific herbicides proposed and the DEIS include discussions of the adjuvant toxicity as well as the herbicide itself. We also recommend the DEIS consider other choices of adjuvants for treatments, for example a vegetable oil (like JLB oil), could hold less risk as a choice for stump treatments than other more toxic adjuvants.

Risk Assessment Summary: Please provide justification and supporting documentation for effective biological control agents for camelthorn.

Chapter 4, Environmental Consequences

Noxious and Invasive Weed Populations: The DEIS indicates that the listed herbicides have "relatively low aquatic toxicity under typical concentrations." We recommend that the paragraph define "relatively low" toxicity, and describe concentrations in the study area basins and how they compare to whatever U. S. Department of Agriculture (USDA)(1988) describes as "typical."

Integrated Weed Management Strategies: There is need throughout this document, particularly this section, to distinguish between ester and amine formulations (e.g., triclopyr and glyphosate). There are significant differences between where amine and ester formulations should be allowed. Currently the DEIS does not make this distinction. Picloram is also effective as a basal spray to small trees, and extremely small amounts need be used. With its inherent low toxicity (>10,000 mg/kg) and small amounts used, it is an excellent herbicide for

Noxious Weed EIS
Vol. 30 Doc. 1523 Pg. 10

control in areas where groundwater is not shallow. In addition, imazapic is being used in prairie restoration because it does not heavily impact native grass species.

The percentages in Table 18 do not appear to be based on the best control method for each species in many cases. Please provide justification and supporting documentation for these percentages.

We recommend control be done prior to seeding, and in some cases, before flower production. (Musk thistle, for example, can complete seed production just using the residual moisture in cut stems.) Please clarify the justification for applying a 14 percent rate of spread to all species. With some as low as 5 percent, others as high as 20 percent, it would seem more appropriate to address the potential spread rate of each species, and evaluate the influence of rainfall quantity and timing on seed production and how these factors can influence the speed of spread of infestations.

Please modify the DEIS statement to read: "Imazapic would be useful in or near stands of ponderosa pines to avoid tree mortality, adjacent to surface waters, *and* when ground water is below 18 inches of the soil surface." Imazapic is a comparatively volatile sulfonylurea herbicide; it would seem to be potentially harmful to ponderosa pines, particularly young ones. Please verify that use of this herbicide will not impact ponderosa pine populations.

In general 2,4-D is proposed for use far more than necessary. Considering there are less toxic alternatives for control of some of these species, 2,4-D should not be used unless it is the most effective herbicide in bringing a species under control, and/or other herbicides are not likely to be successful in doing so. Specifically, 2,4-D is not appropriate to use on tamarisk, Siberian elm, Russian olive, or tree of heaven. For these species, triclopyr is recommended; and for tamarisk, imazapyr in most areas, as a 1 percent foliar spray, is suggested. Small diameter tamarisk in areas where desirable plants are found can be brought under control with basal applications of Garlon 4, although there is a limit of 1½ quarts per acre of the latter.

For Russian knapweed, basal applications of picloram can be very effective where shallow groundwater is not a concern. When other herbicides must be used due to ground being saturated, planting competitive grasses can assist in preventing reinfestation. In addition, some success in controlling Russian knapweed along a roadside has even been achieved during an extreme drought year with applications of glyphosate.

Alternative 1 – Proposed Action (High) Strategies: The objective of eradication of yellow starthistle, with seed viability of up to 30 years, and seed production at 150,000 seeds per plant, most likely will not be achieved in a 10-year program. However, significant control is possible.

Direct and Indirect Effects of Alternative 1: Proposed Action: Clarification is needed for the estimation for the expected cost for manual control. Please provide support for the Forest Service assertion that steaming will work for controlling invasive species. Suggest that it be utilized only in areas where total elimination of vegetation is desired, as a pilot test. It should

Noxious Weeds EIS
Vol. 31 Doc. 1523 Pg. 11

be stated that sheep can spread seeds from infested to uninfested areas, resulting in the need to quarantine and clean sheep before moving to/from grazing areas.

We feel it would be more appropriate to calculate reduction of infestations by density for any deep-rooted perennial. Elimination of satellite infestations is a realistic goal, along with reduction of density of large infestations within the 10-year time frame.

Please provide documentation for the methods to be utilized to ensure prevention of introduction of invasives in seed mixes. Contaminated seed mixes were the source of a major infestation of yellow starthistle on one National Forest after a fire.

The Department recommends control for giant reed be revised to include cutting the stems and immediately (within 30 seconds) treating the stump with Rodeo (or equivalent glyphosate product).

Please provide evidence documenting the effectiveness of steaming. In addition, the safety issues associated with this method need to be discussed in more detail.

Research has shown that manual control was only about 40 percent effective on spotted knapweed. Every plant missed could completely re-infest an area. Due to the depth of roots, manual control of camelthorn and Russian knapweed would be ineffective.

Musk thistle will bloom and seed after mechanical control, if it has reached the bud stage. Mowing will likely result in musk thistle plants that bloom and seed below the level of the mower. Grubbing should be done 6 inches down to discourage re-growth.

We are concerned about the effectiveness of utilizing manual control of diffuse knapweed on 483 acres. Pulling must be done 3 times a year to provide any significant control (Shelley and Petroff), in spring, late June, and just before seed dispersal (timing may vary with altitude and latitude).

Yellow starthistle and, possibly malta starthistle, may have seed viability longer than 10 years. Complete eradication may not occur within that time period, and follow-up monitoring will be necessary to catch any remaining plants, for perhaps as long as another 10 years or more.

Whitetop (a.k.a., hoary cress) is a deep-rooted plant. Mechanical and cultural control may not be effective in controlling it. The Department recommends success in eradication be increased with use of an herbicide in addition to mechanical and cultural control.

Burning and seeding are not likely to achieve control with manual removal on 483 acres for diffuse knapweed.

If application of Garlon 3A to cut stumps of Siberian elm is done at the right time of year (particularly late summer and fall) and all trees capable of producing seed are removed, re-treatment should not be done except to prevent re-infestation from outside sources.

Noxious Weeds EIS
Vol. 30 Doc. 523 Pg. 12

We feel it is important to evaluate and mitigate the spread of invasives by grazing activities, in addition to stream bank destabilization by livestock.

Direct and Indirect Effects of Alternative 3: It appears to be unrealistic to propose effective treatment of 49,605 infested acres without the use of herbicides.

Dalmation toadflax is a deep rooted perennial that can reproduce by root buds. We feel mechanical treatments are likely to cause an increase in density, whether by "steaming," or by physical removal.

The Department is concerned that the cost associated with manual control of invasives has been underestimated. We have much experience related to costs associated with several methods of manual methods of control, and would be happy to work with the Forest Service to cost future activities.

While cheatgrass control is very important, we feel the list of invasive grass plants is not inclusive enough. Further clarification is requested.

It was stated previously in the DEIS that aquatic invasives were not to be addressed in this document. However, it is stated here the intent to control Eurasian water milfoil and water primrose. Please clarify this discrepancy.

The sentence, "We believe that this action would have the highest potential to cause sedimentation into stream courses since we are undertaking the highest amount of mechanical treatments that generally have the most potential to create bare soil," is incomplete, because it does not consider other important factors that affect sedimentation into streams. For example, information about land slope and distance of projected bare soil areas from the nearest surface-water bodies is also a component that contributes to sediment loading. This information should be provided in the document to validate the statement.

Please provide supportive evidence for the assertion that clopyralid would have little impact on Flagstaff pennyroyal.

It should be stated that stump treatment for tamarisk with Garlon 3A (50 percent with water) should present virtually no risk to giant lupine unless the herbicide were accidentally spilled, or the plant trampled during stump applications.

The sentence indicated herbicides will be applied "in low doses" should be changed to "at low application rates."

Please clarify whether all treatments to be done with triclopyr. We recommend Arsenal (1 percent foliar applications) be considered for some tamarisk control.

Chapter 7, Consultation and Coordination: Mitigation should include coordination with other agencies. Further delineation of what and when vital services will be limited, and to whom, needs to be provided.

12

Noxious Weeds EIS
Vol. 30 Doc. 523 Pg. 13

Chapter 6 Adaptive Management and Monitoring, Environmental Effects Monitoring, Background Herbicide Levels: The section describes monitoring, but not the response to be taken if the monitoring gives results indicating an increase in concentrations of pesticides. We recommend that the section include action levels and response actions planned in the event of exceedance of these action levels.

Summary Comments:

In summary, the Department strongly supports the Forest Service's initiative to promote ecosystem health and prevent losses in the capacity of the land to support productive wildlife habitat by establishing a program to control noxious and invasive weeds. Proper control methods can result in the long-term improvement of habitat for plants, fish and wildlife, and specifically, for species listed as threatened and endangered (listed species) under section 4 of the Endangered Species Act (ESA).

We do, however, recommend further evaluation of impacts to species listed as threatened and endangered under the Endangered Species Act (ESA) (listed species), impacts possible during the use of herbicides, and the effectiveness of the proposed action.

Thank you for the opportunity to comment on the proposed action, and for your continued efforts to conserve listed species and their habitat.

Should you require further assistance, or if you have any questions, please contact Stephen Robertson, Environmental NEPA Coordinator, U. S. Fish and Wildlife Service, Region 2, at 505-248-6669.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc: Willie Taylor, Director OEPC HQ
Regional Director, U. S. Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
(Attn: Stephen Robertson)
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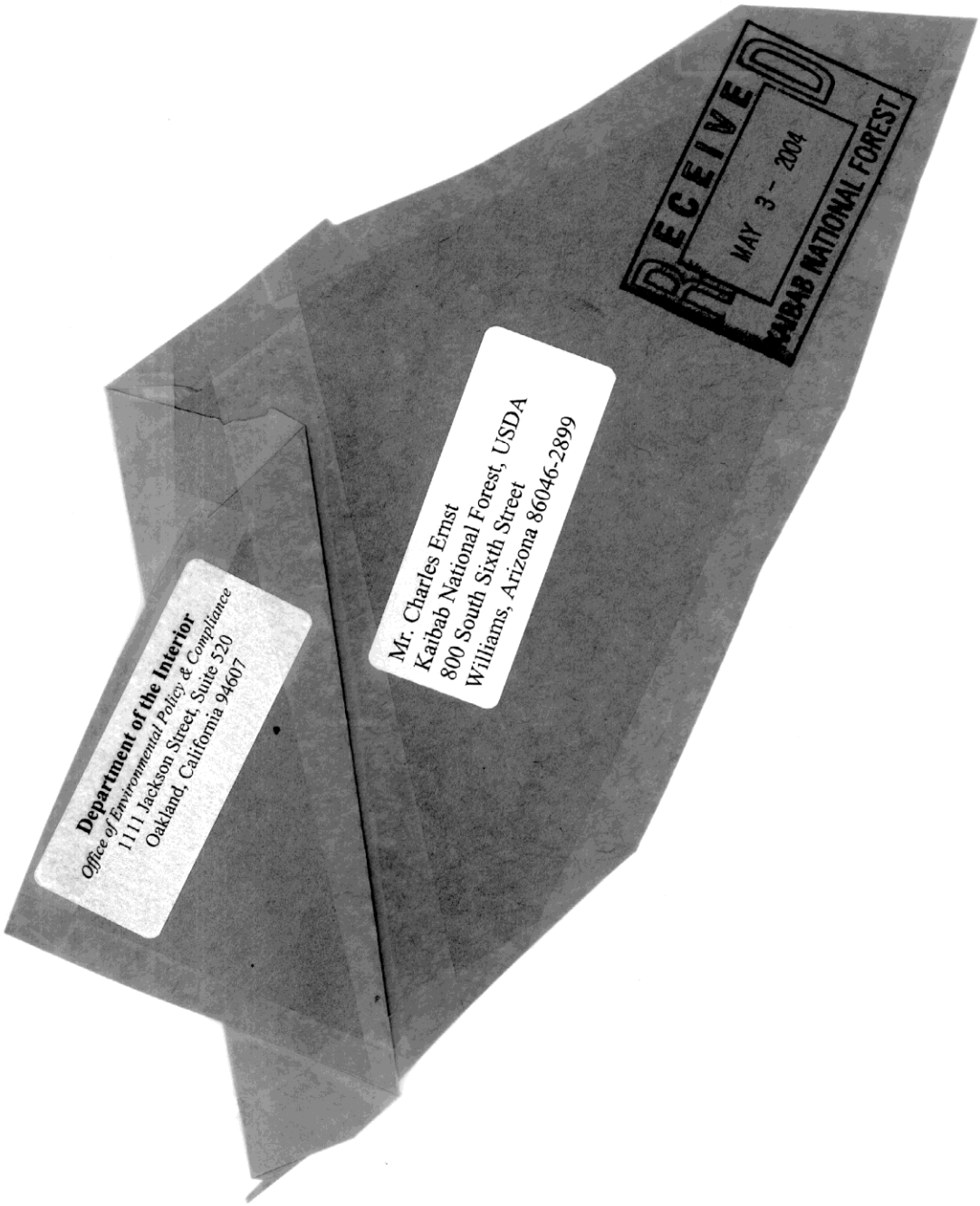
13

Noxious Weeds EIS
Vol. 30 Doc. 523 Pg. 14



Index

Access 3, 4, 23, 26, 27, 43, 66, 78, 98, 115, 147, 148, 156, 213, 214, 215, 216, 218, 220, 240, 241, 290, 383, 387, 469
Adaptive Management 9, 237, 238
American Indians .3, 8, 24, 44, 100, 101, 115, 214, 218, 220
Best Management Practices 22, 136, 152
Bill Williams 14, 49, 51, 52, 53, 54, 59, 61, 73, 120, 121, 127, 149, 150, 216, 249
Biodiversity 120, 126, 131
Campgrounds 8, 23, 29, 59, 100, 206, 214, 215, 218, 220
Carcinogenicity 197, 199, 204, 205
Colorado/Grand Canyon 14, 49, 53, 54, 59, 127
Consultation and Coordination.....9, 227
Critical Habitat.....152, 155, 157, 261
Cumulative Impacts 217, 218
Easements.....27, 135, 155, 383, 469
Environmental Impacts 9, 18, 199
Grazing...14, 31, 51, 60, 62, 64, 88, 136, 148, 149, 151, 156, 169, 238, 385, 431
Herbicidal ... iii, 1, 2, 3, 4, 15, 21, 25, 26, 28, 42, 134, 135, 155, 199, 213, 214, 215, 216, 218, 290, 386
Human Health 247
Limited Spray Zones 4, 8, 23, 27, 43, 44, 206, 216, 357, 383, 423, 469
Little Colorado 1, 4, 5, 11, 14, 15, 44, 49, 50, 52, 54, 59, 60, 61, 71, 76, 78, 79, 119, 120, 121, 127, 128, 129, 135, 153, 154, 156, 200, 204, 214, 215, 216, 218, 220, 261, 469
Management Indicator Species 90, 93, 166
Mexican Spotted Owl (MSO) 93
Middle Gila 14, 49, 50, 51, 52, 60, 61, 79
Multiple Chemical Sensitivity (MCS) 21, 22, 244
NOEL 8, 196, 197
Northern Arizona Weed Council (NAWC) 10
Northern Goshawk..... 88, 93, 254, 431
Plan Amendment 149
Plant Collection 213, 241
Preferred Alternative..... 4, 8, 38, 40, 356, 422
Proposed Action.....iii, 1, 3, 9, 14, 25, 27, 40, 118, 127, 138, 148, 259
Public Health 7, 195
Purpose and Need for Action..... 9
Record of Decision 21
Risk Assessment 17, 166, 168, 196, 202, 203, 204, 205, 257
Scenic Overlooks 4, 23, 27, 43, 100, 206, 215, 220, 357, 383, 423, 469
Sensitive Species 12, 79, 146, 151, 253
Soils ... 33, 34, 35, 51, 59, 62, 70, 71, 72, 73, 74, 75, 76, 116, 200, 201, 203
T&E 253
Toxicity..... 153, 158, 196, 199, 205
Trailheads 4, 8, 23, 27, 43, 100, 206, 214, 215, 220, 238, 357, 383, 423, 469
Unique Waters 50
Verde.... 1, 4, 5, 11, 12, 14, 15, 42, 44, 49, 52, 53, 54, 59, 60, 61, 62, 63, 64, 65, 71, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 87, 88, 89, 101, 104, 105, 116, 119, 120, 121, 127, 128, 129, 135, 136, 146, 147, 151, 153, 154, 155, 156, 169, 200, 204, 214, 215, 216, 218, 220, 223, 243, 244, 246, 248, 250, 254, 258, 335, 425, 426, 427, 428, 429, 430, 431, 469
Verde Valley.... 11, 63, 64, 65, 75, 76, 83, 85, 89, 146, 147, 151, 218, 243, 244, 246, 428, 431
Water Quality..... 49, 52, 94, 243, 287
Watersheds... 5, 14, 15, 44, 49, 52, 54, 59, 61, 116, 119, 120, 121, 127, 128, 129, 135, 153, 154, 156, 204, 218, 220, 258, 469
Weed Management Areas..... 11, 135, 341