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Wildlife Specialist Report & Biological Evaluation

Forest Plan Revision FEIS

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Introduction

This report evaluates and discloses the potential environmental consequences on the wildlife resource that may result with the adoption of a revised land management plan. It examines, in detail, four different alternatives for revising the 1988 Kaibab National Forest land management plan.

Relevant Laws, Regulations, and Policy that Apply

National Forest Management Act (NFMA) regulations, adopted in 1982, require that habitat be managed to support viable populations of native and desirable non-native vertebrates within the planning area. USDA regulation 9500-004, adopted in 1983, reinforces the NFMA viability regulation by requiring that habitats on national forests be managed to support viable populations of native and desired non-native plants, fish, and wildlife. For planning purposes, a viable population shall be regarded as one that has the estimated numbers and distribution of reproductive individuals to ensure its continued existence is well distributed in the planning area. Also, the 1982 planning provisions require that "Forest planning shall provide for diversity of plant and animal communities and tree species consistent with the over-all multiple-use objectives of the planning area".

The Forest Service Manual 2600 –Wildlife, Fish and Sensitive Plant habitat Management, Chapter 2670 – threatened, Endangered and Sensitive Plants and Animals provides directions on conducting a biological evaluation and what type of information should be provided within this document. The objections of biological evaluations is 1) to ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or contribute to animal species or trends toward Federal listing of any species; 2) to comply with the requirements of the Endangered Species Act that actions of Federal agencies not jeopardize or adversely modify critical habitat of Federally listed species; and 3) to provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decisionmaking process (2672.41). This document serves as the biological evaluation for the revised forest plan EIS. A separate biological assessment was developed for consultation with US Fish and Wildlife Service.

There is a requirement for the forest to use best available science during analysis to inform the planning process. Wildlife biologists consulted with a variety of resources during the Kaibab National Forest Plan Revision process. Appendix A describes in detail the use of best available science used for the development of the revised forest plan and for the wildlife analysis. In summary, the wildlife biologists did a review for current relevant literature, reviewed national databases and data management systems, worked in collaboration with local researchers and scientist to develop contemporary modeling tools and approaches, and attended scientific conferences, workshops and collaborative meetings.

The Fish and Wildlife Service has new regulations (Federal Register 74:46835-46879; 11 September 2009) that allow permits to take eagles under the Bald and Golden Eagle Protection Act (Eagle Act) (50 CFR 22.26). The regulations provide for individual and programmatic permits that are consistent with the goal of stable or increasing eagle breeding populations.

To comply with the Migratory Bird Treaty Act (1918), the forest has used the Executive Order 13186 (2001) and the MOU with FWS signed in 2009 in pursuant to the Executive Order 13186.

The regulatory language concerning Management Indicator Species (MIS) is found in several sections of the 1982 NFMA forest planning provisions:

> Each alternative [in the LRMP EIS] shall establish objectives for the maintenance and improvement of habitat for MIS selected under paragraph (a)(1) of this section, to the degree consistent with overall multiple use objectives of the alternative.
>
> In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as MIS and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities. In the selection of MIS, the following categories shall be represented where appropriate: Endangered and threatened plant and animal species identified on State and Federal lists for the planning area; species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished, or trapped; non-game species of special interest; and additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality. On the basis of available scientific information, the interdisciplinary team shall estimate the effects of changes in vegetation type, timber age classes, community composition, rotation age, and year-long suitability of habitat related to mobility of MIS. Where appropriate, measures to mitigate adverse effects shall be prescribed.
>
> Planning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and of animal population trends of the MIS.
>
> Population trends of the MIS will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with State fish and wildlife agencies, to the extent practicable.
>
> In forest planning, the suitability and potential capability of National Forest System lands for producing forage for grazing animals and for providing habitat for MIS shall be determined as provided in paragraphs (a) and (b) of this section. Lands so identified shall be managed in accordance with direction established in forest plans.

Methodology and Analysis Process

This viability evaluation focuses on information relevant to the Kaibab National Forest. Our goal for this evaluation is to use a clearly defined, transparent process to identify species for which there are substantive risks to maintenance of viable populations, and to ensure consideration of appropriate habitat management strategies to reduce those risks to acceptable levels where feasible.

A species is considered viable if the following conditions are met:

- Habitat is well distributed, compared to reference condition within the planning unit;
- The species occupies a substantial portion of its habitat on the planning unit;
- Management will not result in a substantial decline in the amount of or quality of habitat.

Because NFMA regulations require providing habitat for species viability within the planning area, focus of this evaluation is on habitat provided on national forest land. Surrounding private lands may contribute to, or hinder, maintenance of species viability on national forest land, but are not relied upon to meet regulation requirements. For this reason, habitat abundance was assessed based on conditions found on national forest land. Habitat distribution, however, was assessed considering the condition of intermixed ownerships and conditions, which may affect the interactions of species among suitable habitat patches on national forest lands.

Evaluation of bats and migratory birds focused on breeding populations only, unless otherwise indicated. This focus does not mean that foraging, wintering and migrating populations were not considered during planning, but that viability evaluation makes most sense when viewed in terms of the relative stability of breeding populations.

Part I

A comprehensive list of species with potential viability concerns was compiled by the Kaibab National Forest and was used to help revise the forest plan by determining species viability issues. Appropriate desired conditions, standards and guidelines were developed for the proposed plan by referencing the habitat needs of the species on this list, further helping to ensure viability for all these species. Forest planning species were identified only for forest plan revision purposes, and they hold no special regulatory status beyond existing state and federal status. The identified forest planning species were closely considered in the plan revision process, to determine if particular direction needed to be written into the revised forest plan and to provide for special habitat needs or other management requirements.

This “forest planning species” list was developed collaboratively by the Kaibab National Forest, local stakeholders and species area experts and by consulting with scientific databases such as NatureServe and BISON-M, The Arizona State Wildlife Action Plan (AZGFD 2012). The Regional Forester’s Sensitive Species List, The U.S. Fish and Wildlife Service (FWS) threatened, endangered and sensitive species list, and The Museum of Northern Arizona.

Explicit criteria were used to identify species considered to be of concern or interest in the plan area. The list is comprised of 148 plant and animal species (out of >1800 species initially considered) and includes those species found, or potentially found, on the National Forest from the following categories:

- Species listed as proposed, threatened, or endangered under the federal Endangered Species Act.
- Species list on the Regional Forester’s Sensitive Species list.
- Species identified as locally rare on the National Forest by Forest Service biologists, local species experts, Arizona Department of Game and Fish biologists, and FWS biologists.
- Birds of conservation concern as identified by FWS and Arizona Partner in Flight
- Species of high public interest including species of high socio-economic concern.

Species included on the list needed to occur within the planning area (i.e. the Forest), have a known quantity and/or distribution, and could be responsive to forest management. Invasive species were not included on this list, but are addressed in the plan as threats that affect ecosystem and species diversity.

While developing the forest planning species list, a coarse filter/ fine filter process was used to ensure the needs of all wildlife species were addressed and to determine the need for plan direction. The process considered habitat, habitat components, and species specific traits. Species were grouped first by habitat association, represented by water or the broadly defined vegetation types historically present in the

planning area (i.e., 'PNVT'). "Potential natural vegetation types (PNVTs) represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail" (Schussman et al. 2006). Further, PNVTs combine potential vegetation and historic fire regime to form ecosystem classes useful for landscape assessment.

Species were secondarily grouped by habitat components (e.g. snags, downed woody debris, understory vegetation) not specifically addressed by broad habitat associations. Species specific plan direction was only developed where needed and only for those threats which the Forest Service could impact through management and for which the Forest Service has jurisdictional control. A full description of these methods and associated criteria as well as a summary of results can be found in the Kaibab National Forest Species Diversity Report version 1.2.5 (KNF 2008a).

In 2011, the 148 planning species underwent further analysis utilizing a viability approach. Prior to conducting this assessment for the abbreviated list of planning species, the Nature Serve rankings for the original 1,835 species were reassessed to determine if any had changed since the original screening. A few NatureServe rankings had changed, however, these changes were not sufficient to warrant removing or adding a species to or from the planning list. Included in this reassessment were an additional 47 species found within the Arizona Game and Fish State Wildlife Action Plan (AZGFD 2012). Upon completion of this phase, the shorter list of planning species was re-analyzed based upon the three conditions of viability listed above. This was done by accessing all previous research conducted during the drafting of the Species Diversity Report in 2008 and the methods detailed below. Analysis of species using the additional viability criteria did not add or remove any species from the original planning list however; updates were made to the KNF species diversity database. This provides useful information for future actions including monitoring and project implementation as well as a consistent template from which species may be analyzed in the future should new information become available.

The course to fine filter approach aided in plan development by helping to identify desired conditions for all wildlife species as part of a two-step process. That is, broad direction was first developed to include those landscapes and ecological processes necessary to protect and maintain at a minimum, wildlife species. Desired conditions were then developed for each PNVT or habitat type. In some cases however, such as for species with limited distributions, or specific life requirements, a second fine filter was applied. That is, more detailed attention was given to the adequacy of the conditions identified in the course filter PNVT desired conditions. Additional plan components were then added as necessary.

Many of the species on the list do have limited distributions or specific life history requirements that needed additional plan direction. Appendix C lists the forest planning species and shows how each species or species group is provided for (i.e. habitat provided with other plan direction; needs provided for with species specific plan direction; or under existing law, regulation, or policy).

Part II

The initial species diversity analysis (for the 148 species) and subsequent report combined plants and wildlife into the same report. The focus of the analysis in this report is for the 65 non-plant species on the forest planning list, as well as the addition of the 3 federally listed and sensitive species not included in the forest planning list for a total of 68 species analyzed.

Forest Service biologists and local species specialists developed Forest Ranks or "F Ranks" for the list of 68 forest planning species. The ranking process generally follows the conventions used by NatureServe and others in defining State and Global Ranks (Table 1). The F Ranks were used in the viability risk assessment as a categorical variable representing a species' current abundance.

Table 1. Forest (F) ranking for Forest Planning Species

F ranking	Description
F?	Present on the forest, but abundance information is insufficient to develop risk
F1	Extremely rare on the national forest
F2	Very rare on the national forest
F3	Rare and uncommon on the forest
F4	Widespread abundant on the forest
F5	Demonstrably secure on the forest
FP	Possibly could occur on the forest, but documented occurrences not known
FN	Occurs on the forest, but no breeding population is documented on the forest
FO	Occurs off the forest

Those species that are both confirmed present and rare or of unknown abundance (F1 through F3, and F?) on the Kaibab National Forest were assessed for viability risk. Species ranked as F? were treated as F1 species to provide a conservative approach to those species for which abundance information is not available. For federally listed species and Forest Service sensitive species, even species rated as no known breeding pairs on the Forest, or with the potential for downstream effects, were analyzed and treated as F3 species. Species that are currently abundant on the forest (F4, F5) are assumed to be at low risk of losing viability within the next 50 years, and therefore, were not further evaluated for viability risk. This low risk to the F4 and F5 species is also based on the fact that they were used as forest planning species and all the action alternatives were developed to provide for these species in the long-term. Appendices B and C show how viability will be provided for.

Habitat elements (Table 2) are used to determine the effects of forest management on species habitats and do not include all activities that could impact species such as disturbance during the breeding season or activities that are outside the control of the Forest Service. Other impacts will be discussed under the alternatives indirect effects sections or cumulative effects.

Table 2 Habitat elements used to plan for, and assess risk to, viability of terrestrial species during forest plan revision, Kaibab National Forest.

Habitat Element	Element Description
Pinyon-juniper communities (general).	A shifting mosaic of continuous canopy is interspersed with openings across the landscape. Tree basal area is variable, but has at least 10% canopy cover.
Pinyon-juniper grasslands	Open woodlands with a grassy understory – deeper soils, fire return interval (FRI) of 0-35 years.
Pinyon-juniper shrublands	Mosaic of different age-class patches, with FRI of 35 to >200 years, includes sagebrush and may have coarse-textured, gravelly, or lithic soil characteristics.
Pinyon-Juniper woodlands persistent	Mosaic of patches of woodlands within PJ matrix; poorer soils. Infrequent fire.
Ponderosa Pine -bunchgrass	Mid- and late-successional ponderosa pine forests with various-sized patches of younger regenerating trees. A frequent low FRI in the system (0-35 years) is desired.
Ponderosa Pine – Gambel oak	Mid- and late-successional pine-oak forests with various-sized patches of younger regenerating trees. A frequent low FRI (0-35 years).
Ponderosa Pine - uneven aged forest with vertical	Older forest with multilayered canopy

heterogeneity	
Ponderosa Pine - uneven aged forest with horizontal heterogeneity	Mosaic of grassy openings interspersed with groups of trees of varying size classes (groups and clumps).
Frequent fire mixed conifer	Mid- and late-successional mixed-conifer forests with frequent fire in the system
Mesic mixed conifer/spruce fir	Mid- and late-successional mixed-conifer/spruce fir stands have more closed conditions due to infrequent disturbances.
Aspen-general	Exist in smaller stands within a larger forest matrix dominated by ponderosa pine or mixed conifer vegetation. Maintained by historic fire intervals.
Aspen-within ponderosa pine and frequent fire mixed conifer	In ponderosa pine and frequent fire mixed conifer vegetation types, the size, age and spatial extent of aspen stands reflect its historical distribution. Coniferous species comprise less than 10% of the overstory.
Aspen-within mesic mixed conifer and spruce fir	Aspen occurs as a shifting mosaic across its range with new aspen clones establishing over time.
Sagebrush shrublands	Dominated by mature grasses and sagebrush. The majority of sagebrush is in mid-seral or mature states.
Montane/subalpine meadows and grasslands	Small to large mature openings within forested stands; circular or long and liner. In general found above 8,000 feet elevation
Grasslands (general)	Grass/forb/shrub canopy cover is typically above 25%, with less than one quarter of any grassland below this range. Tree canopy cover ranges from 0% to 9%, depending upon specific site conditions. In general found below 8,000 feet elevation
Colorado Plateau/Great Basin grassland	Grasses and forbs with minimal tree canopy. Vegetation height and canopy cover are sufficient to support fire on a 10 to 30 year return interval.
Semi-desert grassland	Grasses with shrub density <10 percent, FRI 10-30.
Desert communities	Desert grasses, desert shrubs, succulent species and some herbaceous cover
Woodlands and savanna	Open woodlands and savannas characterized by low canopy cover and rich grass-dominated understories with periodic fire within the system. <10% historic tree cover
Gambel oak shrublands	Dominated by native hardwood trees and tall shrubs, with coniferous trees widely scattered and frequently mature or old. Young Gambel oak thickets and sometimes other species comprise a patchy shrub layer. An understory of grass and forbs is present. Low intensity fire occurs over periods of < 25 years.
Rocky outcrops, cliffs, and canyons	Rocky outcrops and cliffs characterized by exposed rock, shallow soils and sparse vegetation
Wetland/Cienega,	Perennial and/or ephemeral springs or headwater streams with pools of standing water. For wetlands, hydrophytic plants are present.
Riparian forest	Structurally diverse forest with deciduous riparian vegetation that includes mature and younger trees, grasses and shrubs.
Cottonwood-willow riparian forest	Structurally diverse forest characterized by mid-age to mature cottonwood and willow trees with interspersed areas of young trees, grass and shrubs and permanent water (streamside veg).
Snags	Forest containing an abundance of snags; meets historic range of density This includes large snags, partial snags and trees with broken tops, sloughing bark, wide lightning scars (>4” in wide) or those capable of supporting large stick nests or nesting cavities.
Downed wood	Forest contains an abundance of down wood; meets historic range of density
Natural waters	High water quality in natural perennial waters ; spring, seeps and streams

Constructed waters	High water quality in constructed waters
Caves and mines	Caves and mines with microclimates capable of supporting associated biota
Connectivity or "connectedness"	Contiguous blocks of habitat provide movement corridors for breeding, foraging and migrating

Effects to these habitat elements are analyzed in specialist reports for other sections. Based on these analyses, each habitat element was assigned categorical values by alternative to indicate future abundance (Table 3) and distribution (Table 4), general likelihood that the habitat element would limit viability of associated species (Tables 5 and 6), and overall effect of nation forest management on the habitat element (Table 8). Knowledge of Forest Service specialists were used to assign abundance and distribution values, based on interpretations of historical conditions supported by conservation literature, current conditions, and magnitude and direction of effects expected under each alternative. The rankings were done in an interdisciplinary team setting with all the planning team members providing input on the rankings for both abundance and distribution.

The future abundance variable (Table 3) is defined as the abundance of the associated habitat element in 50 years if the alternative were selected and implemented over that 50-year period. (See the Assumption section below for more detail on why a 50-year time line.)

Definitions of abundance categories are stated in quantifiable terms in order to be objective as possible; however, in many cases quantifiable estimates of future abundance are not available. In these cases, knowledge of Forest Service specialists was used to assign abundance values based on current conditions and the magnitude and direction of effects expected under each alternative.

Table 3. Values used to categorize projected abundance of each habitat element after 50 years of implementing each forest plan revision alternative.

Habitat Abundance Value	Description
Rare	The habitat element is rare, with generally less than 100 occurrences, or patches of the element generally covering less than 1 percent of the national forest planning area
Occasional	The habitat element is encountered occasionally, and generally is found in 1 to 10 percent of the national forest planning area.
Common	The habitat element is abundant and frequently encountered, and generally is found on more than 10 percent of the national forest planning area.

Similar to the future abundance variable, the future distribution variable (Table 4) is defined as the distribution of the associated habitat element in 50 years if the alternative were selected and implemented over that 50-year period. In contrast to the abundance variable, it includes consideration of intermixed ownership patterns and conditions, and their general effects on movements and interactions of individuals among the suitable habitat patches found on national forest lands.

This approach relies on the assumption that a habitat distribution similar to that which supported associated species during recent evolutionary history will likely contribute to their maintenance in the future, and that the further a habitat departs from that historical distribution, the greater the risk to

viability of associated species. This approach has its own set of difficulties, as evidence of presettlement conditions relevant to the planning area is often anecdotal and scarce. Nevertheless, the precision required to assign the categorical values for this variable is not high, and may be supported by general positions described in mainstream conservation literature. Knowledge of Forest Service specialists were used to assign distribution values, based on interpretations of historical conditions supported by conservation literature, current conditions, and magnitude and direction of effects expected under each alternative.

For the broad habitat classifications called PNVTs, the term "reference conditions" refers to the ecological characteristics that existed prior to European settlement. The period is defined for this assessment as between 1000 and 1880 AD. Additional information on reference conditions can be found in the Vegetation and Fire Ecological Need for Change Report, version 1.01 (KNF 2008b)

Quality of habitat is based on the desired condition of the different vegetation types. These desired conditions are reflected in the description of the habitat elements in Table 2. A basic assumption of this analysis is that by meeting the distribution of the habitat element in its desired condition, this would provide the habitat quality of species dependent on this habitat type. This also ties back to the assumption that reference condition is the historic condition that these species evolved with and that it would adequately provide for their habitat needs.

Table 4. Values used to categorize projected distribution of each habitat element after 50 years of implementing each forest plan revision alternative.

Habitat Distribution Value	Description
Poor	The habitat element is poorly distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and /or their evenness in distribution across the landscape is greatly reduced.
Fair	The habitat element is fairly well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is somewhat reduced.
Good	The habitat element is well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and /or their evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions.

Habitat element abundance and distribution variables were combined to create one variable to indicate the general likelihood that the habitat element would be limiting to populations of associated species (Table 5).

Everything else being equal, quality habitat elements that are rare and poorly distributed are those most likely to cause risk to viability of associated species; those that are common and well distributed are least likely to cause risk to viability of associated species.

Table 5. Likelihood of habitat limitation to associated species as derived from habitat abundance and distribution values.

Habitat abundance	Habitat Distribution		
	Poor	Fair	Good
Rare	High	High	Moderate
Occasional	High	Moderate	Low
Common	Moderate	Low	Low

In this general context, habitat limitation refers to a habitat factor, quantity, distribution, or quality, that results in risk to continued existence of the species within the planning area. Table 6 defines the definitions used for likelihood of habitat limitation.

Table 6. Definition for habitat limitations to species viability

Habitat Limitation	Description
High	High probability that habitat will be a limiting factor for species viability
Moderate	Habitat has a likelihood of having some limiting factor for species viability
Low	Habitat will likely not be a factor in limiting species viability

Providing for species viability requires providing abundant and well-distributed habitat in ways that allow existing populations to persist or expand. The ability of existing populations to respond to available habitat depends in part on their current robustness, which is generally a function of population size. In general, for a given habitat condition, small populations will be at greater risk than large populations. To reflect this fact, the likelihood of habitat limitation variable (Table 5) was combined with a species' F Rank (Table 1) for each species/habitat element interaction to generate a viability risk rating (Table 7).

Associations of very rare species with habitat elements that are likely to be most limiting were identified as those most at risk; associations of more common species with habitats less likely to be limiting received lower risk ratings. Ratings include three levels of "high" risk (Table 7) to ensure results err on the side of caution.

Table 7. Viability risk rating for species/habitat interactions as a function of specie' F Rank and likelihood of habitat element limitation variables.

Likelihood of Habitat Element Limitations	Species F Rank		
	F? or F1	F2	F3 or FN
High	Very High	High	Moderate-High
Moderate	High	Moderate - High	Moderate
Low	Moderate-High	Moderate	Low

Once viability risk ratings were developed for each species/habitat relationship, habitat elements most commonly associated with risks to species viability were identified by counting the number of very high, high, and moderately high rating associated with each. To assess the role of national forest management in minimizing viability risk associated with each habitat element, a management effects variable was

assigned to each habitat element by alternative. The management effects variable (Table 8) categorized the goal of management for the habitat element, the expected resulting trend, and any additional opportunity for minimizing viability risk. Numbers of very high, high and moderately-high risk ratings were summarized (Table 13) by management effects variable by each alternative to assess how well alternatives addressed viability-related habitat needs.

Table 8. Values used to categorize the effect of nation forest management in minimizing or contributing to species viability risk associated with each habitat element by forest plan revision alternative.

Management Effect Value	Description
1	Abundance and distribution of the habitat element is maintained or improved by providing optimal protection, maintenance, and restoration to all occurrences (with limited exceptions in some cases). Little additional opportunity exists to decrease risk to viability of associated species because management is at or near optimal.
2	Abundance and distribution of the habitat element is improved through purposeful restoration, either through active management or passively by providing for successional progression. Opportunity for decreasing risk to associated species is primarily through increasing rates of restoration, where possible
3	The habitat element is maintained at approximately current distribution and abundance, though location of elements may shift over time as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to increase abundance and distribution of the habitat element.
4	Regardless of management efforts, the habitat element is expected to decrease in distribution and abundance as a result of factors substantially outside of Forest Service control (e.g., invasive pests, climate change, other Federal laws). Opportunity to reduce risk to viability of associated species is primarily through cooperative ventures with other agencies and organizations.
5	The habitat element is expected to decrease in distribution and abundance as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to maintain or increase this habitat element.

Distribution of viability risk was also summarized by species status, i.e. federally listed under the Endangered Species Act, listed as Regional Forester's sensitive species, or identified as locally rare or of other concern. The species status summary highlights the relative role of other provisions included in law and policy that result in additional consideration of at-risk species during planning.

Part III

The current planning rule requires that species shall be selected as MIS to estimate the effects of the planning alternatives on wildlife populations. Management Indicator Species are selected because their population changes are believed to indicate the effects of management. They are used to evaluate

alternatives by displaying the effects of the alternatives in terms of amount and quality of habitat and corresponding population trends. For this planning cycle four species were selected; Grace's warbler, western bluebird, ruby-crowned kinglet, and American pronghorn. The pronghorn is the only species that was also a MIS for the previous planning cycle. The Forest used current forest-wide population and habitat trend information (KNF 2010) as a foundation to help determine potential affects between the alternatives. For the three new species selected as MIS for the three action alternatives, occupancy modeling is also used to help determine population and habitat trends. The models will help show changes of habitat over time with 2010 data used as a baseline.

Population changes are usually assessed by estimating how density or abundance changed over time or in response to management actions. A variety of techniques have been developed to reduce bias in density and abundance estimates that results when species are detected imperfectly or infrequently, as is often the case with songbirds. Many of these techniques, however, require moderate-to-large sample sizes to generate estimates with the necessary precision to detect trends or habitat relationships (Dickson et al. 2011). Further it may take many years before adequate sample sizes can be attained to estimate density and make inferences about habitat changes. These previous methods are valuable for collecting long-term trend data; however they may be of limited utility in an adaptive management framework where ideally, management has the ability to act quickly as new information on emerging trends becomes available. Recent advances in occupancy estimation techniques allow habitat covariates to be incorporated into estimates of occupancy, colonization, and local extinction while accounting for detection probability resulting in estimates that are less biased than naïve estimates (i.e., those that assume perfect detectability) (MacKenzie et al. 2003), directly relating species presence to habitat change. These novel approaches allow meaningful trend data to be collected and analyzed for smaller sample sizes, within relatively shorter periods of time. Subsequently these methods provide managers with the ability to respond more quickly to emerging management needs.

Site occupancy can be used in a monitoring context to reflect the current state of the population and, through multiseason extensions, provide information on population trends. Estimating occupancy often requires less detection than other density estimation techniques allowing for more precise estimates of rare or infrequently detected species (MacKenzie et al. 2003; MacKenzie et al. 2005). Furthermore, efforts to relate occupancy to habitat-relevant covariates allow estimation and prediction of changes in population state due to coarser-scale changes in land-use and climate. Habitat-occupancy relationships can be derived using high-resolution satellite imagery, which provides the opportunity to identify the impacts of more localized changes (e.g., forest restoration treatments) across larger spatial scales (Dickson et al. 2011).

The Forest collaborated with Northern Arizona University to develop occupancy models for the three bird species. The following summarizes the methods used to determine occupancy under current conditions. For more detail see Dickson et al. (2011). These models integrated habitat information with songbird monitoring data that has been collected on the Forest since 2005. For the three species of songbird, the models predict occupancy dynamics (e.g., probabilities of detection, occupancy, colonization and local extinction), provide new information on temporal trends in occupancy, and generate spatially explicit, probabilistic surfaces within a GIS that permit the identification of areas with relatively high and low occupancy under current conditions. In addition, these models can be used in conjunction with a suite of tools designed to rapidly derive forest structural attributes from subsequent Landsat imagery, as well as on the ground rapid vegetation plots, to identify changes in occupancy due to forest management activities.

Assumptions

In the analysis for this resource, the following assumptions have been made:

- The land management plan provides a programmatic framework for future site-specific actions.
- Land management plans do not have direct effects. They do not authorize or mandate any site-specific projects or activities (including ground-disturbing actions).
- Land management plans may have implications, or environmental consequences, of managing the forests under a programmatic framework.
- The Plan decisions (desired conditions, objectives, standards, guidelines, management areas, monitoring) will be followed when planning or implementing site-specific projects and activities.
- Law, policy, and regulations will be followed when planning or implementing site-specific projects and activities.
- Monitoring identified in the Monitoring Chapter will occur and the land management plan will be amended, as needed.
- The Forest will be funded similar to past budget levels (past 5 years).
- The planning timeframe is 15 years; other timeframes may be analyzed depending on the resource (usually a discussion of anticipated trends into the future).
- The kinds of resource-management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives. However, the specific location, design, and extent of such activities are generally not known at the time. The decisions are made on a site-specific (project-by-project) basis. Therefore, the discussions should refer to the potential for the effect to occur and are usually only estimates. The effects analyses are to be useful for comparing and evaluating alternatives on a forest-wide basis. It is not intended to be applied directly to specific locations on the Forest.
- The point in time for which the most progress is expected to be made toward achieving desired conditions in fire adapted ecosystems which is still relevant to this analysis is considered to be 50 years. That is, the greatest percentage of the landscape (which is considered temporally relevant to this analysis) would be in the desired state at that time mark. This is also a reasonable scale at which the positive effects to most wildlife populations might be realized. While the life of the forest plan is considered to be 15 years, it should set a trajectory for continued habitat improvement into the feasible future. Additional information on desired conditions in fire adapted ecosystems and detailed information on predicted outcomes for the proposed action and alternatives can be found in the Vegetation and Fire Specialist Report (KNF 2013a).
- That a habitat distribution similar to that which supported associated species during reference conditions will likely contribute to their maintenance in the future, and that the further a habitat departs from that historical distribution, the greater the risk to viability of associated species.

Revision Topics Addressed in this Analysis

The Comprehensive Evaluation Report (CER) (KNF 2009) was prepared in April of 2009 to evaluate the "needs for change", in light of how management under the current Kaibab Forest Plan is affecting the current conditions and trends related to sustainability. This CER is based upon the Ecological Sustainability Report (KNF 2008c), and the Social and Economic Evaluation Report (KNF 2008d) which describe the social, economic, and ecological conditions and trends across the Forest.

An internal Management Review of this CER was conducted in December of 2008 to determine which needs for change issues would be carried forward into plan revision. The Forest Leadership Team identified four priority topics that focus the scope of the Kaibab's Plan revision. These topics reflect the priority needs and potential changes in program direction that are emphasized in the development of the Revised Forest Plan components. They are:

- Modify stand structure and density towards reference conditions and restore historic fire regimes.
- Protect and regenerate aspen.
- Protect seeps, springs, ephemeral wetlands, and North Canyon Creek.
- Restore grasslands; reduce tree encroachment in grasslands and meadows.

Resiliency and adaptation to climate change

In a recent review, Periman (2008), found that most current models of climate change are broad and still evolving, making it difficult to assess associated impacts at the forest level scale. This distinction is important if locally implemented management strategies are to be effective.

In general, most climate modelers agree that the Southwest is trending toward prolonged drought. Future potential ecological effects in the Southwest may include an increase in more intense disturbance events such as wildfires, monsoons, and wind. Changing ecological conditions could provide opportunities for invasion by non-native species with potential subsequent negative impacts on various taxa. General trends toward decreased precipitation could limit overall forest productivity. General changes in vegetation patterns could affect overall distribution and range of flora as well as fauna. Cumulatively these factors would likely impact biodiversity, however to what extent is currently uncertain. (See Periman 2008 and references therein).

There has been some recent debate in the literature on whether restoration to reference conditions is an effective strategy in light of climate change. Fulé (2008) notes

> "Reference conditions encompass not only the recent past but also evolutionary history, reflecting the role of fire as a selective force over millennia. Taking a long-term functional view of historical reference conditions as the result of evolutionary processes can provide insights into past forest adaptations and migrations under various climates".

In 2004, the Wildlife Society (Inkley et al. 2004) came out with a set of recommendations or actions to assist wildlife biologists in coping with the challenges of global climate changes to help ensure a future for wildlife. They had 11 recommendations that would apply to management of national forest lands. These include:

- ✓ Recognize global climate change as a factor in wildlife conservation.
- ✓ Manage for diverse conditions.
- ✓ Do not rely solely on historical weather and species data for future projections without taking into account climate change. Example, may need to change bird surveys if migratory birds start appearing earlier in the breeding season.
- ✓ Reduce nonclimate stressors on ecosystems.
- ✓ Maintain healthy, connected, genetically diverse populations.
- ✓ Reduce the risk of uncharacteristic high intensity fires.

- ✓ Reduce likelihood of catastrophic events affecting populations. Maintaining widely dispersed and viable populations of individual species reduce the potential for localized catastrophic events causing a significant negative effect.
- ✓ Prevent and control invasive species.
- ✓ Conduct medium- and long-range planning.
- ✓ Ensure ecosystem processes.
- ✓ Employ monitoring and adaptive management.

Summary of Alternatives

Four alternatives are evaluated in this analysis:

Alternative A – No Action (current Forest Plan)

Under the No Action alternative, the current management plan would continue to guide management on the Kaibab National Forest. The current plan emphasizes producing timber products, providing recreation opportunities to meet demand, range management, and improvement of soil and riparian resources. The current plan has no desired conditions for grasslands, wetlands, springs, traditional cultural use, or air quality. There are very few desired conditions for other resources; however, in some cases, there are standards and guidelines that in some cases imply desired conditions.

Under the existing forest plan, the Forest is currently implementing approximately 2,000 acres per year of mechanical thinning and roughly 13,000 acres of burning within ponderosa pine type, with small amounts of treatments in the mixed conifer. In addition, the Kaibab is currently implementing roughly 200 acres per year of grassland restoration projects. Aspen restoration has been occurring, but at a low and variable rate. Protection of ephemeral wetlands has been occurring, but spring protection and restoration has been minimal.

Alternative B - The proposed plan/preferred alternative was developed focusing on the 4 priority needs for change below:

1. Modify stand structure and density of forested ecosystems towards reference conditions and restore historic fire regimes. The multiple ecological, social, and economic benefits of reducing the risk of uncharacteristic fires made this a primary area of focus. The proposed forest plan defines desired characteristics of forested ecosystems including: species composition; structural characteristics such as spacing tree groups and tree density; and disturbance patterns such as frequency, severity, intensity, and size of fire.

It also describes the strategies in the form of objectives or guidelines that define “when” and “how” the desired conditions would be achieved. Objectives in the proposed plan would increase the amount and rate of mechanical thinning and managed fire treatments to reduce the risk of uncharacteristic fire and to improve forest resiliency in the face of climate change. Reducing the risk of uncharacteristic wildfire would also provide increased protection from uncharacteristic wildfire for communities, infrastructure, and watersheds, including a 26,000-acre watershed that provides water for the city of Williams.

2. Promote aspen regeneration and establishment. Aspen has been in serious decline in the lower elevations on the forest. Aspen supports high levels of plant and animal diversity and also has important

recreation and scenery values. The proposed forest plan defines desired conditions for aspen including regeneration, recruitment, structural composition, understory plants, and disturbance processes.

Strategies for achieving desired conditions focus on removing encroaching conifers, protecting aspen from browse, restoring forest structure and understory across the landscape which should help to disperse elk, and reintroducing fire. The plan objectives reflect the differences in how aspen occurs between the North Kaibab, Tusayan, and Williams Ranger Districts and addresses the primary needs.

3. Protect natural waters. The Kaibab NF has little natural water. With less than 2 miles of perennial stream, it is one of the driest forests in the Nation. Most of the natural waters are springs and wetlands that occur as isolated features in the arid landscape. Waters are important centers of biological diversity, have traditional cultural significance, and are popular recreation destinations. Actions to protect springs and wetlands are relatively inexpensive and would provide important ecological and social benefits. The proposed forest plan provides desired conditions and includes objectives and strategies for restoring and protecting springs, wetlands, and natural waters.

4. Restore grasslands by reducing tree encroachment in grasslands and meadows. Tree encroachment into grasslands over the past 100 years has occurred due to the absence of fire. This has reduced the quantity and quality of available habitat for grassland associated species. The montane/subalpine meadows on the North Kaibab Ranger District are at a higher risk of loss because they are linear and encroachment occurs more quickly. The proposed forest plan contains desired conditions and objectives to restore the natural patterns of abundance, composition, and connectivity of grasslands. Objectives focus on removing conifers from areas where they have encroached, restoring fire to the ecosystem, and modifying fences that would improve habitat connectivity for pronghorn antelope.

Others key items addressed:

In addition to the priority needs for change topics above, the proposed Forest Plan provides consistent, efficient, and scientifically-based plan components to provide direction for: 1) a range of high quality scenery and recreation opportunities, with an emphasis on dispersed recreation opportunities within limits of the administrative and resource capacity.; 2) objectives and guidelines provide a consistent and efficient management response after large uncharacteristic wildfires.; 3) guidance for mineral exploration and development, special-use management, and forest products collection; 4) continued opportunities to graze livestock consistent with other desired conditions; 5) continued availability and access to resources for traditional cultural use and guidance for managing traditional cultural properties and 6) the proposed plan identifies 11 areas totaling about 6,238 to be recommended for wilderness designation..

Alternative C – is similar to the proposed action, with the following differences.

1. In response to the issue that “the proposed plan does not adequately protect existing and provide for future old growth,” alternative C would replace the proposed vegetation management guideline “Projects should retain…large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs (e.g., Thomson’s age class 4 (Thomson 1940), Dunning’s tree class 5 (Dunning 1928) and/or Keen’s tree class 4 (A and B) (Keen 1943)” (see appendix K), with “Projects should retain trees with physical characteristics typical of those that were established prior to 1890 (i.e., generally larger than 16 inches diameter at breast height, with yellowing platy bark).”

In response to the issue that “lands of high conservation value such as the Kaibab Squirrel Area National Natural Landmark should not be managed for timber or biomass production because regular mechanical

disturbance can have adverse effects to soils and other resources," this alternative would establish a new management area (MA) on the North Kaibab Ranger District. The MA, called the "North Kaibab Wildlife Habitat Complex" would be approximately 260,000 acres and include most of the Kaibab Squirrel National Natural Landmark, and eight linked ephemeral riparian valleys and canyons. In this MA, there would be a desired condition that the wildlife habitat complex provides effective wildlife linkages and core areas for wide ranging species, and a guideline that states "Mechanical thinning would be used initially to restore the desired forest structure. Thereafter, the desired conditions should primarily be maintained with fire and other natural disturbances." Because this area would not be managed for timber or biomass production, it would be removed from the suitable timber base.

2. In response to the issue that "Areas should not be excluded from wilderness consideration just because they have evidences of past human activity, provided they are substantially unnoticeable, or could be rendered as such through restoration," additional wilderness would be recommended.

In addition to the recommended wilderness in the proposed action, alternative C would propose five new wilderness areas (totaling about 36,900 acres): Burro Canyon, Coconino Rim, Seegmiller, South Canyon Point, and Willis Canyon. This alternative also proposes an area in Government Canyon (approximately 1,000 acres) contiguous to a potential wilderness identified by the Prescott NF. Due to its small size, Government Canyon would only be recommended if the adjacent area on the Prescott NF was recommended for wilderness designation. All recommended wilderness' would be managed to protect their wilderness values until Congress acts on the recommendation

Alternative D – Alternative D was developed in response to the issue that "the negative effects associated with regular mechanical disturbance outweigh the benefits. Restoring the natural fire regime to forested landscapes provides greater overall benefit to ecosystems, communities, and economies." Alternative D would contain the following forestwide guideline: "Mechanical thinning would be used initially to restore the desired forest structure. Thereafter, the desired conditions should primarily be maintained with fire and other natural disturbances." Because no areas on the forest would be managed for timber or biomass production, there would be no lands identified as suitable for timber production. Alternative D also contains the same presettlement tree guideline and recommended wilderness as alternative C.

Description of Affected Environment

Existing Condition

Three major vegetation types dominate the landscape. Pinyon-juniper woodlands cover 40 percent of the Forest, and are found at lower elevations. As elevation increases, pinyon juniper transitions to ponderosa pine forests which cover 35 percent of the Forest. At higher elevations, mixed conifer forest predominates on the crest of the Kaibab Plateau on the North Kaibab Ranger District, and the tops of Kendrick, Sitgreaves, and Bill Williams peaks on the Williams Ranger District. Mixed conifer forests cover 8 percent of the KNF. Due to the range of elevation and soil types on the Forest, there is a wide diversity of other vegetation types including spruce-fir, grasslands, sagebrush shrublands, Gambel oak shrublands, and desert communities. Riparian and wetland vegetation is present in small but important areas.

Most of the vegetation on the Forest is adapted to the recurrent wildland fires started by lightning from spring and summer thunderstorms. Frequent, low-intensity fire plays a vital a role in maintaining ecosystem health. In the 1800's, intensive grazing by domestic livestock removed the grasses that

previously carried low intensity surface fires. Early settlers suppressed fires to protect their livelihood and homes. As a result, the condition and structure of most of northern Arizona's forests, woodlands, shrublands, and grasslands has changed. Fuels continued to build up because when fires were started, they were usually extinguished quickly.

With a significantly reduced understory and no fire, conifer seedlings survived at unprecedented rates. Ponderosa pine, spruce, fir, juniper and pinyon seedlings invaded forest openings, grasslands and savannahs. Many large, old trees were harvested for lumber. Today the Kaibab National Forest contains uncharacteristically dense forests with many more young trees than were present historically. The forest and woodlands are deficient in grasses, forbs, and shrubs due to tree competition, and are at high risk for uncharacteristic wildfires due to the accumulated buildup of live and dead woody material, increased crown bulk density, and increased canopy continuity.

The probability and occurrence of large uncharacteristic, stand-replacing fires continues to increase. These fires burn with more intensity, have higher tree mortality, degrade watersheds, sterilize soils, and threaten homes and communities. While the average number of fire starts has been stable over the past 30 years, there has been a dramatic increase in the total number of acres burned by uncharacteristic wildfire across the Kaibab National Forest, particularly since 1995.

SPECIES VIABILITY - Species Considered and Evaluated

Species viability is based mainly on the list of species that were used as forest planning species for the plan revision development. The initial species diversity analysis and subsequent report combined plants and wildlife. The focus of this analysis is on the non-plant species on the forest planning list. Since the original list was developed in 2008, there have been a few changes. The bald eagle and Sonoran Desert bald eagle population have been lumped together. It has been determined that the Sonoran population is not a separate population and ESA protection was removed in 2010. This analysis is based on the 65 forest plan species, as well as the addition of 4 federally listed or region sensitive species not included in the original forest planning list, for a total of 69 species. The Kaibab fairy shrimp was added after the DEIS due a new regional sensitive species signed on September 18, 2013 adding this species as sensitive on the forest.

The following is the key to the variable used in Table 9:

F Rank: F? (Information insufficient to develop rank);

F1 (Extremely rare on the forest);

F2 (Very rare on the forest);

F3 (Rare and uncommon on the forest)

F4 (Widespread abundant on the forest)

F5 (Demonstrably secure on the forest)

FP (Possibly on the forest, documented occurrences not known to occur)

FN (non-breeding population)

FO (off forest)

PNVT Association: **CWRF**: Cottonwood-Willow Riparian Forest; **DC**: Desert Communities; **DMC:** Dry Mixed Conifer; **GBG:** Great Basin Grassland; **GOS:** Gambel Oak Shrubland; **MCA:** Mixed Conifer with Aspen; **MSG:** Montane Subalpine Grassland; **PJW:** Pinyon Juniper woodland; **PPF:** Ponderosa Pine

Forest; **SbS:** Sagebrush Shrubland; **SdG:** Semi-desert Grassland; **SFF:** Spruce Fir Forest; **W/C:** Wetland / Cienega; **W:** Water; **Multi:** Multi-PNVT

Table 9. Forest Planning Species list, Forest ranking and Associated PNVT

Scientific Name	Common name	FRank	PNVT Association
Accipiter gentilis	Northern goshawk	F3*	PPF, DMC
Amphispiza belli	Sage sparrow	FN	SbS
Aquila chrysaetos	Golden eagle	F2	SbS, MSG, GBG, SdG
Athene cunicularia hypugaea	Western burrowing owl	FN	MSG, GBG, SdG
Baeolophus ridgwayi	Juniper titmouse	F4	PJW
Buteo regalis	Ferruginous hawk	FN	SbS, GBG, SdG
Cardellina rubrifrons	Red-faced warbler	F4	DMC, MCA
Coccothraustes vespertinus	Evening grosbeak	F3	DMC, MCA
Contopus cooperi	Olive-sided flycatcher	F3	PPF, DMC, MCA, SF
Dendragapus obscures	Dusky (blue) grouse	F3	MCA, SF
Dendroica graciae	Grace's warbler	F5	PPF
Dendroica nigrescens	Black-throated gray warbler	F5	PJW
Falco peregrines anatum	American peregrine falcon	F2	Multi
Gynmogyps californianus	California condor	F2	Multi
Gymnorhinus cyanocephalus	Pinyon jay	F5	PJW
Haliaeetus leucocephalus	Bald eagle	F2	PPF, W/C, W
Melanerpes lewis	Lewis' woodpecker	F3	PPF
Oporornis tolmiei	MacGillivray's warbler	F2	PPF, DMC, MCA
Oreoscoptes montanus	Sage thrasher	FP	SbS
Passerculus sandwichensis	Savannah sparrow	FP	MSG, GBG
Pipilo chlorurus	Green-tailed towhee	F4	PPF, DMC, SbS, GOS
Progne subis arboricola	Purple martin (western spp.)	F3	PJW
Regulus satrapa	Golden-crowned kinglet	F3	MCA, SF
Sphyrapicus nuchalis	Red-naped sapsucker	F3	MCA
Spizella breweri	Brewer's sparrow	F4	PJW, SbS
Strix occidentalis lucida	Mexican spotted owl	F2	PPF, DMC, MCA
Vermivora celata	Orange-crowned warbler	F3	DMC, MCA
Vireo vicinior	Gray vireo	F3	PJW
Meda fulgia	Spikedace	FO	Upland terrestrial
Oncorhynchus apache	Apache (Arizona) trout	F1	W
Tiaroga cobitis	Loach minnow	FO	Upland terrestrial
Bufo microscaphus	Arizona toad	FP	W/C, CWRF, W
Crotalus cerberus	Arizona black rattlesnake	F4	PJW, PP, GBG, DC
Eumeces skiltonianus	Western skink	F3	PJW, PPF

Hyla wrightorum	Arizona (mountain) treefrog	F3	PPF, W/C, W
Lampropeltis pyromelana infralabialis	Utah Mountain kingsnake	F4	PJW, PP, SdG, GOS
Lampropeltis triangulum	Milksnake	F3	GBG, SdG
Rana pipiens	Northern leopard frog	F1	W/C, W
Spea intermontana	Great basin spadefoot	F3	PJW, SbS, GBG, SdG, W/C, W
Branchinecta kaibabensis	Kaibab Fairy Shrimp	F3	W/C, W
Acrolophitus nevadensis	Nevada point-headed grasshopper	FP	PPF, W/C, W
Aeshna persephone	Persephone's darner	FP	PJW, SbS
Callophrys sheridanii comstocki	Desert green hairstreak	F?	PJW, SbS
Cicindela terricola kaibabensis	Kaibab variable tiger beetle	F?	MSG
Libellula nodisticta	Hoary skimmer	F?	W/C
Papilio indra kaibabensis	Kaibab Indra swallowtail	FP	PJW, DMC, GBG
Piruna polingii	Four-spotted skippering	FP	MSG, W/C
Speyeria nokomis	Nokomis fritillary	F?	PPF, DMC, MCA
Speyeria nokomis nokomis	Nokomis fritillary ssp. nokomis	FP	PPF, DMC, MCA, W/C
Antilocapra americana	Pronghorn	F4	SbS, MSG, GBG, SdG
Corynorthinus townsendii pallescens	Pale Townsend's big-eared bat	F3	Multi
Cynomys gunnisoni	Gunnison's prairie dog	F3	GBG, SdG
Dipodomys microps leucotis	House Rock Valley chisel-toothed kangaroo rat	F2	SdG
Euderma maculatum	Spotted bat	F3	SbS, MSG, GBG, SdG
Eumops perotis californicus	Greater western mastiff bat	FN	MSG
Idionycteris phyllotis	Allen's lappet-browed bat	F3	PPF, DMC
Microtus longicaudus	Long-tailed vole	F3	MSG
Lasiurus blossevillii	Western red bat	FP	Riparian habitat
Microtus mogollonensis navaho	Navajo Mogollon vole	F3	MSG, GBG
Myotis auriculus	Southwestern myotis	F4	PPF, DMC, MCA
Neotamias minimus consobrinus	Kaibab least chipmunk	F3	MCA, SFF
Nyctinomops macrotis	Big free-tailed bat	FN	PJW, SbS, MSG, DC
Ovis canadensis nelsoni	Desert bighorn sheep	F3	DC
Sciurus aberti	Abert's squirrel	F4	PPF
Sciurus aberti kaibabensis	Kaibab tree squirrel	F4	PPF
Sorex merriami	Merriam's shrew	F3	PPF, DMC
Sorex nanus	Dwarf shrew	F3	MSG
Tamiasciurus hudsonicus	Red squirrel	F4	MCA, SF

Thomomys talpoides kaibabensis	Kaibab northern pocket gopher	F3	MCA, MSG, SFF

*****The F3 ranking for the northern goshawk is a conservative measure for the goshawk population due to difficulties in conducting population surveys across the Forest. Project level surveys and monitoring indicate the goshawk is actually widespread across the Forest. Local research on the NKRD suggests territories are saturated and breeding pairs are relatively stable across years (Reynolds and Joy 2006).

HABITAT ELEMENTS

Habitat elements are the habitat components or features that are required to support wildlife species. The Species Diversity Report shows by forest planning species the threats to habitat features in addition to risk to ecosystem diversity characteristics. Table 2 is based on the habitat elements shown to be threatened or to be important habitat elements for the species with viability issues. Habitat elements are used to determine the effects of forest management on species habitats and do not include all activities that could impact species such as disturbance during the breeding season or activities that are outside the control of the Forest Service. Other impacts will be discussed under the alternatives effects sections or cumulative effects.

Potential Natural Vegetation Type

The current condition of many of the habitat elements are based on the Kaibab National Forest Ecological Sustainability Report (Version 1.01, December 19, 2008; KNF 2008c). The following PNVT descriptions are a summary of this document and the report is incorporated by reference.

> The pinyon-juniper woodland PNVT covers about 638,000 acres and occurs on all three ranger districts. Currently, the woodlands exhibit greater canopy closure and less structural diversity than during the reference period. A variety of structural stages are under-represented, including early development stages with grass and tree seedlings, mid-development stage with grass or shrubs and low (<20%) tree cover, and old woodland (>180 yrs) with grass or shrubs and high (>45%) tree cover. Other stages are over-represented including mid- and late-development stages with moderate (20-45%) tree cover. In general, pinyon-juniper woodlands are moderately departed from reference conditions. Increased tree density, canopy cover, and the associated loss of understory plant cover and diversity are the primary characteristics that are departed, especially in the pinyon-juniper grasslands.
>
> The ponderosa pine forest PNVT covers about 541,000 acres, and occurs on all three ranger districts. Aspen occurs in patches within this PNVT on the Williams Ranger District (WRD) and is a common over- and understory component on the North Kaibab Ranger District (NKRD). The ponderosa pine forest are much denser than historic conditions, with 79% of the stands in a "closed" state (>32% canopy cover). Historically there were spaces between clumps of trees that are now either smaller or nonexistent. Only 19% of the PNVT is currently in historic condition, which is defined as a mature to old forest with various-sized patches of young regenerating trees. The remaining portions are younger and denser stands. The ponderosa pine forests are highly departed from reference conditions.
>
> Mixed conifer forest (frequent fire and mesic) occur on approximately 128,000 acres on the WRD and NKRD. Aspen occurs in patches on the WRD and as a near co-dominant species in some places on the NKRD. Trees in this PNVT are younger and denser than during the reference period. About 5% of the area exists in a mature uneven-age state and only 23% of the area is comprised of uneven aged groups. The mixed conifer forests are highly departed from reference condition.

Spruce-fir forest PNVT occurs on approximately 29,100 acres primarily on the NKRD. A few acres exist on the WRD. Current tree density and canopy cover are substantially greater than during the reference period. Average stand age is also younger, due to the number of young trees that have persisted in the absence of characteristic disturbances. Spruce-fir forests are highly departed from reference conditions.

The sagebrush shrubland PNVT covers about 88,700 acres on the NKRD and Tusayan Ranger District (TRD). A few areas in this PNVT have received mowing treatments to increase forage production and some areas have undergone type-conversions to grasslands on both districts. A type-conversion to crested wheatgrass has occurred across about 13% of the sagebrush shrublands on the Forest. In the rest of the PNVT, it is more mature and closed than during the reference period. Approximately 7% of the area is a late-seral mix of herbaceous and shrub vegetation with encroaching pinyon and juniper. The sagebrush shrublands are moderately departed from reference conditions.

Montane/subalpine grasslands PNVT cover approximately 40,900 acres and occur on all three districts. Montane and subalpine grasslands are being invaded by conifers on at least 8% of this PNVT. Many narrower meadows surrounded by ponderosa pine have a high number of invading pine seedlings within them. Larger grasslands can have young conifer encroachment that extends at least one-quarter mile within them. This PNVT is moderately departed from reference conditions.

The Colorado Plateau/Great Basin grassland PNTV occurs on about 44,300 acres on the TRD and WRD. Tree encroachment and an increase in the shrub component are present on parts of this PNVT. In general, this PNVT are moderately departed from reference conditions.

The semi-desert grasslands PNVT cover about 25,000 acres on the NKRD. Establishment of pinyon, juniper and sagebrush within these grasslands is occurring. This PNVT is minimally departed from reference conditions.

Desert communities PNVT consists of about 13,800 on the NKRD. The area has seen increase in closed shrub overstory as compare to reference condition. The desert communities are moderately departed from reference conditions.

Gambel oak shrublands occurs in patches totaling approximately 5,400 acres on the NKRD and WRD. The PNVT currently consists entirely of older plants with a high dead woody component. In areas with thick shrubs, there is little grass cover. Gambel oak shrublands are highly departed from reference conditions.

Wetland/cienega PNVT cover approximately 1,500 acres split between NKRD and WRD. Wet meadows are being invaded by conifer species. Several narrower meadows surrounded by forest have many tree seedlings and are rapidly departing from historic conditions. In general, wetlands and cienega are minimally departed from reference conditions.

Cottonwood-willows riparian forest covers about 1,200 acres and only occurs on NKRD in Kanab Creek Wilderness. Upstream impoundments and diversions in Kanab Creek has reduced flooding disturbance and the steam is now highly intermittent. A majority of the PNVT is in an uncharacteristic state due to the absence of large old trees and the invasion of tamarisk and Russian olive. There are only 5 to 10 large cottonwoods per mile of stream and willows mostly only occur in side drainages. There is little to no herbaceous cover. This PNVT is highly departed from reference conditions.

Other Habitat Elements

Many species are also associated with fine-scale habitat features not necessarily captured by course PNVT descriptions.

Snags in coniferous forest have had several studies done on or near the forest. Miller and Benedict (1994) found an average of 0.6 ponderosa pine snags (12 inches DBH or greater) per acre. Ganey (1999) found a median of two snags per acre on the Kaibab and Coconino National Forests. The Forest Inventory Assessment found 0.6 ponderosa pine snags per acre that were 19 inches DBH and larger across Arizona forests in 1995 (O'Brien 2002). For that same assessment, there was an average of 2.9 snags per acre greater than 11 inches DBH on the forest, chiefly comprised of Utah juniper and two needle pinyon. By comparison, repeat FIA surveys completed in 2007 found 6.8 snags per acre across the forest. In general the FIA surveys completed in 1995 and 2007 show an overall increase in ponderosa pine and mixed-conifer forest snag density across the forest.

The Forest does not have any standardized data to determine current downed wood levels on the forest. In addition, there is an inherent spatial variability in downed wood across the landscape. Ganey and Vojta (2010) did look at coarse woody debris (CWD) in Northern Arizona mixed-conifer and ponderosa pine forest. Part of this study occurred on the Williams Ranger District and is the best information available at this time for these two habitat types. The study found CWD was well distributed across the landscape in both forest types. They suspect that disruption of surface fires in the study area has resulted in a more continuous distribution of forest fuels than occurred under historical conditions. Most mixed-conifer plots met or exceeded Forest Service guidelines within the current Forest Management Plan for retention of large logs with regard to wildlife. In contrast, large logs were sparse and patchily distributed in ponderosa pine forest. This is believed to be because the data representing a wide range of successional stages and large trees had been removed, so there were not as many present in the stand to produce large logs.

Natural waters include perennial streams, seeps and springs. The only known historic perennial streams on the KNF are North Canyon Creek and Kanab Creek. In the perennial reach of North Canyon Creek, the historic flow ranged from one to six miles, depending on precipitation, before becoming subsurface flow. This stream channel is currently classified in good condition and is not diverted. Historically, Kanab Creek was a perennial stream within the Forest, but with current upstream water use and diversion this stream no longer exhibits perennial flow within the KNF boundaries. Flooding disturbance is therefore greatly reduced. Historic livestock grazing has adversely impacted the Kanab Creek area, but livestock have been excluded from grazing since 1996. The Forest contains 167 springs and seeps. Ninety-two of these springs occur on the North Kaibab Ranger District, 74 occur on the Williams Ranger District, and one has been identified on the Tusayan Ranger District. The historic extent and flow of springs and seeps are generally unknown, but are presumed to be approximately equal to the current extent and flow. Developed springs remove water from the site and reduce riparian vegetation extent. Several springs have been observed and documented to be at risk or are nonfunctional riparian areas due to ungulate grazing, spring infrastructure maintenance, or recreational activity.

Most of the constructed waters on the Forest are in the form of stock tanks, created for livestock and wildlife starting in the 1930s. There are approximately 490 reservoirs and stock tanks on the Forest. The construction of these waters has increased the amount of the open water on the forest from the reference condition.

Compared to reference conditions, the distribution and abundance of caves on the forest have not changed. Mines have increased in abundance and distribution across all three districts from the reference time period.

Connectivity is important for both terrestrial and aquatic species. It connects adjacent habitat and promotes healthy movement of animals between foraging and wintering grounds, as well as genetic flow between populations. Connectivity can occur at different spatial scales and among similar and different habitat patches. It is reduced by habitat fragmentation which can be caused by natural (e.g. wildfire) or unnatural processes (e.g. human development). An animal's ability to move between optimal habitats is important in evaluating how well it responds to such disturbances over time. Prior to 1890, there were no real barriers to animal movement in Northern Arizona. Since that time, the State has experienced phenomenal population growth. The inter-related development of structures including roads, railroads, fences, canals, and more recently development from wind and solar energy has likely had an impact on Arizona's wildlife populations; changes which have affected movement corridors and dispersal potential for many species, particularly wide ranging animals. Connectivity has also been affected by changes in vegetation; this includes encroachment of trees in grassland areas, or loss of movement corridors entirely as a result of uncharacteristic wildfire.

Critical Habitat for listed Species

The Forest has designated Critical Habitat for one federally listed wildlife species, the Mexican spotted owl. Critical Habitat Units (CHU) are found on North Kaibab and Williams Rangers Districts. There is one unit in Colorado Plateau (CP-10) and three units in Upper Gila Mountain (UGM-13, UGM-15, and UGM-17). Table 10 describes the CHU acreage and how much of each unit is located on the forest. The table displays all the area within the units and the amount of critical habitat on the forest within the units. Within the CHUs boundaries, only areas that fit the definition of restricted or protected habitat in the 1995 Recovery Plan for the MSO (USFWS 1995) are considered as critical habitat. It is estimated there is approximately 127,630 acres of critical habitat within the units. Figure 1 shows the locations of the CHUs.

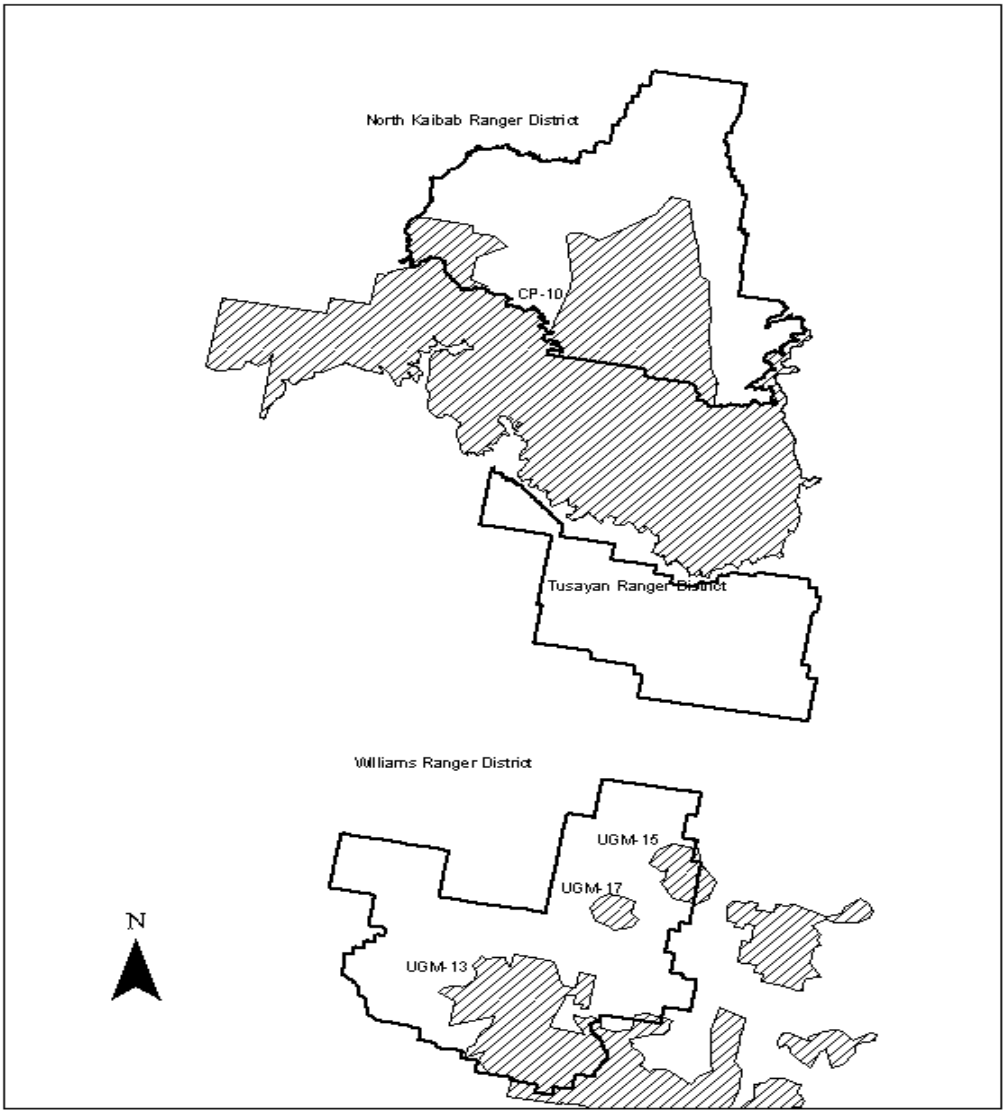


Figure 1. Map of Critical Habitat Units on the Kaibab National Forest

Table 10. MSO Critical Habitat Units on the Kaibab National Forest

CHU Name	District	CH acreage on the KNF	Total CHU acreage	Acreage on KNF	% of CHU on Forest
CP-10	North Kaibab	70,350	918,847	230,710	25
UGM-13	Williams	52,060	253,341	127,050	50
UGM-15	Williams	2,390	22,531	17,810	79
UGM-17	Williams	2,830	10,914	10,914	100
	Total acres	**127,630**	**1,205,633**	**386,484**	**32**

All of the CHUs have experienced some level of wildfire that has removed or altered primary constituent elements for the Mexican spotted owl. Primary constituent elements for the MSO are those that provide nesting, roosting and foraging habitat for the owl.

The forest has potential to impact critical habitat for the loach minnow and spikedace which is located off-forest. Their critical habitat is located approximately 12 miles from the forest boundary on the Verde River in Unit 1 (USFWS 2012c). The forest occupies approximately 9% of the Verde River Watershed.

Amount of Occupied Habitat and Unoccupied Habitat for Listed and Sensitive Species

The California condor has three basic habitat needs; feeding habitat with adequate food, roosting sites, and adequate nesting sites. The condor requires fairly open grassland habitat for feeding. Condors spend much of their time roosting on cliffs or tall conifers. A typical roost site has rock cliffs, dead conifer snags or both, and is located in an isolated or at least semi-secluded area. Condors nest in various types of caves, crevices, and potholes. In 2010 there was a failed nesting attempt on the Forest. The only successful nesting attempt for condors on the Forest occurred during the 2011 nesting season, which produced one chick. The Forest is used primarily for foraging. While the condor could forage over all the Kaibab, they have primarily been found on North Kaibab Ranger District and occasionally seen on the Tusayan Ranger District. These two districts have approximately 37,632 acres of grassland PNVTs on them. At this time the Forest does not have data on the amount of cliff habitat on the Forest. Most of this habitat is located in either canyons or on mountains.

The Williams and North Kaibab Ranger Districts are the only two districts that contain MSO habitat. There are seven Mexican spotted owl Protected Activity Centers (PACs) on the Forest for a total of 5,112 acres of occupied habitat (also called protected habitat in the Revised Recovery Plan (USFWS 2012a)). All of the PACs are located on the Williams Ranger District. Unoccupied habitat for the MSO is defined as recovery habitat using the habitat definition in the Revised Recovery Plan (USFWS 2012a). It is estimated there are 135,964 acres of recovery habitat on the forest. The Vegetation Dynamics Development Tool (VDDT) model (see the Vegetation and Fire Specialist Report (KNF 2013a) for a detailed explanation of VDDT analyses) was used to determine the estimated amount of nesting and roosting habitat available on the Forest. The VDDT states K, L, & M were used to determine the amount of habitat (see appendix B for more detail on states used). Based on VDDT modeling, it is estimated that there are approximately 13,294 acres of ponderosa pine/Gambel oak habitat on the Williams Ranger District and 35,123 acres of mixed conifer habitat, for a total of 48,417 acres of nesting and roosting habitat currently available.

The Apache trout is only found in North Canyon Creek on the North Kaibab Ranger District. While the 2010 5-year review notes that there are five miles of habitat, the Apache trout is located currently within a two mile stretch of the creek.

Neither the loach minnow nor spikedace occur on the Kaibab National Forest. However, critical habitat, while not occurring on the Forest, could be affected by Forest management in the form of downstream effects. Consequently, there is no direct effect to these species only indirect effects since all effects would be off-forest.

For sensitive species on the Forest, the level of knowledge varies as to how much habitat is actually occupied. Table 11 shows districts where each species is located, the amount of habitat potentially available by PNVT, and the amount of known occupied habitat for species the Forest has occupancy information for. Occupied habitat is a subset of the total acres shown in the PNVT acres. Those species not tied to a PNVT are discussed separately. Not all acres of the associated PNVT can support habitat

components for all species. The acreage is likely an overestimate of the amount of habitat that is available for different species. For the water PNVT, the number of springs, seeps, reservoirs or tanks is shown.

To determine PNVT acreage, the CER (KNF 2009) was used for most species. Where possible, the VDDT models for ponderosa pine and mixed conifer were used to help estimate the amount of potential habitat available for certain species. The species whose acreage was determined by VDDT are the goshawk, bald eagle, Allen's lappet-browed bat, Kaibab least chipmunk, Kaibab tree squirrel and Kaibab northern pocket gopher. For the goshawk, the acreage shown is for nesting, roosting and post-fledging family areas since these are the most limiting features for the goshawk. For the Kaibab tree squirrel we show both general habitat use as well as optimum nesting habitat for the squirrel. (see appendix B for more details on use of VDDT model)

Table 11. Sensitive species and Acres of Associated PNVT Acres

Species	District	PNVT	Acres in PNVT or number of water features	Acres of Occupied Habitat
Northern goshawk	All	Ponderosa Pine Forest Dry Mixed Conifer	186,007 29,960 215,967 total	134,390
Western burrowing owl	All	Montane Subalpine Grassland Great Basin Grassland Semi-desert Grassland	48,584 44,181 25,115 117,880 total	No known occupied habitat on forest
Bald eagle	All	Ponderosa Pine Forest Wetland / Cienega Water	410,857 1,479 412,336 total 129 seeps/springs 492 reservoirs/tanks	1 nest site on forest, mainly used in the winter
Northern leopard frog	All	Wetland / Cienega Water	1,479 129 seeps/springs 492 reservoirs/tanks	1 pond
Kaibab fairy shrimp	North Kaibab	Wetland/Cienega Water	Unknown number of wetland/cienage or water on district	Belk (2000) found to be common in numerous melt-water pools and small lakes on the Kaibab Plateau
Four-spotted skippering	Williams	Montane Subalpine Grassland Wetland / Cienega	39,828 871 40,699 total	No known occupied habitat on forest
House Rock Valley chisel-	North	Semi-desert Grassland	25,115	12,300

toothed kangaroo rat	Kaibab			
Spotted bat	All	Sagebrush Shrubland Montane Subalpine Grassland Great Basin Grassland Semi-desert Grassland	89,450 48,584 44,181 25,115 207,330 total	unknown
Allen's lappet-browed bat	All	Ponderosa Pine Forest Dry Mixed Conifer	410,857 70,770 481,627 total	2 known maternity roost sites
Long-tailed vole	North Kaibab	Montane Subalpine Grassland	6,545	unknown
Navajo Mogollon vole	Williams Tusayan	Montane Subalpine Grassland Great Basin Grassland	42,039 44,180 86,219 total	40,500
Kaibab least chipmunk	North Kaibab	Mixed Conifer with Aspen Spruce Fir Forest	19,848 2,828 22,676 total	unknown
Desert bighorn sheep	North Kaibab	Desert Communities	13,777	13,777
Kaibab tree squirrel	North Kaibab	Ponderosa Pine Forest	102,785 (52,082 optimum habitat)	85,000 51,486
Merriam's shrew	All	Ponderosa Pine Forest Dry Mixed Conifer	131,299 14,606 145,905 total	known
Dwarf shrew	North Kaibab	Montane Subalpine Grassland	6,545	unknown
Kaibab northern pocket gopher	North Kaibab	Mixed Conifer with Aspen Spruce Fir Forest Montane Subalpine Grassland	19,848 2,828 6,545 29,221 total	unknown

There are three sensitive species that are not tied to any particular PNVT. The three species are the American peregrine falcon, pale Townsend's big-eared bat, and western red bat.

The peregrine falcon and pale Townsend's big-eared bat will both forage in a variety of PNVTs. The primary limiting factor for the peregrine falcon is cliffs for nesting. The Forest's current GIS layers provide crude estimates of potential cliff features and it is not currently known how many acres of suitable cliff habitat are located on the Forest. In general this habitat is located on mountains or within canyon habitats. There are 16 occupied eyries on the Forest.

Caves and mines are most limiting for the Townsend's big-eared bat; a species that needs specific habitat components within these structures. While Townsend's big eared bat has been mist-netted on the forest, there are only three records of different mine roosting sites.

The western red bat is associated with low-elevation deciduous riparian habitat for roosting and is believed to be found only in the Mogollon Rim area on the Williams Ranger District. The western red bat could forage in areas outside of riparian habitat. There is a limited amount of roosting habitat in portions of Sycamore Canyon on the Forest. While the western red bat has been found on the Coconino National Forest along the Mogollon Rim, it has not been found roosting on the KNF and there is no known occupied habitat on the Forest. There is approximately 21,000 acres in the Sycamore Canyon area but it is not known how much of this is within deciduous riparian habitat.

Environmental Consequences

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions) there can be no direct effects. However, there may be implications, or longer term environmental consequences, resulting from forest management under this programmatic framework.

Table 12 lists the habitat elements and provides the likelihood of the habitat becoming a limiting factor for the species that are dependent on the habitat element. It also displays the management effect under each alterative for that habitat element. This table was developed by the interdisciplinary team for the forest plan and is supported by the other specialist reports.

The following is the key to the variable used in Table 12 (see methods section for full description of the rating codes):

Key to Variables – see methods section for description of the rating codes

Abundance: R (rare) – found on < 1% of the planning area

O (occasional) – found on 1 to 10% of the planning area

C (common) – found on >10% of the planning area

Distribution*:* P (poor) – the habitat distribution is greatly reduced from reference level

F (fair) – the habitat distribution is are is not at reference level

G (good) – the habitat is similar or better distributed from reference level.

Likelihood of limitation: L (low); M (moderate); & H (high)

Management Effects:

1 = Provide optimal protection and management for all habitat occurrences

2= Improve habitat abundance and distribution through restoration

3= Maintain habitat abundance and distribution that is currently on forest planning area

4 = Reduce habitat abundance and distribution as result of external factors

5= Decline in habitat abundance and distribution as a result of management or lack of management.

Table 12. Summary of expected abundance, distribution, likelihood of limitation, and management effects for habitat elements by forest plan revision alternatives

Habitat Element	Alternatives

	A	B	C	D
Pinyon-juniper communities (general)				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Pinyon-juniper grasslands				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Pinyon-juniper shrublands				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Pinyon-juniper woodlands persistent				
Abundance	O	O	O	O
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Ponderosa pine - bunchgrass				
Abundance	C	C	C	C
Distribution	P	G	P	P
Likelihood of limitation	M	L	M	M
Management Effects	3	2	3	3
Ponderosa pine – Gambel oak				
Abundance	C	C	C	C
Distribution	P	G	P	P
Likelihood of limitation	M	L	M	M
Management Effects	3	2	3	3
Ponderosa Pine - uneven aged forest with vertical heterogeneity				
Abundance	C	C	C	C
Distribution	P	G	P	P
Likelihood of limitation	M	L	M	M
Management Effects	3	2	5	5
Ponderosa Pine - uneven age forest with horizontal heterogeneity				
Abundance	C	C	C	C
Distribution	P	G	F	F
Likelihood of limitation	M	L	L	L
Management Effects	3	2	5	5
Frequent fire mixed conifer				
Abundance	O	O	O	O
Distribution	P	F	P	P
Likelihood of limitation	H	M	H	H
Management Effects	4	3	5	5

Habitat Element	Alternatives			
	A	B	C	D
Mesic mixed conifer/spruce fir				
Abundance	O	O	O	O
Distribution	P	F	F	F
Likelihood of limitation	H	M	M	M
Management Effects	4	3	3	3
Aspen - general				
Abundance	O	O	O	O
Distribution	F	F	F	F
Likelihood of limitation	M	M	M	M
Management Effects	3	2	2	2
Aspen – within ponderosa pine and frequent fire mixed conifer (MC)				
Abundance	O	O	O	O
Distribution	P	F	F	F
Likelihood of limitation	H	M	M	M
Management Effects	3	2	2	2
Aspen – with Mesic mixed conifer and spruce fir				
Abundance	R	R	R	R
Distribution	G	G	G	G
Likelihood of limitation	M	M	M	M
Management Effects	3	3	3	3
Sagebrush shrublands				
Abundance	O	O	O	O
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Montane/subalpine meadows and grasslands				
Abundance	O	O	O	O
Distribution	F	G	G	G
Likelihood of limitation	M	L	L	L
Management Effects	3	2	2	2
Grasslands (general)				
Abundance	O	O	O	O
Distribution	F	F	F	F
Likelihood of limitation	M	M	M	M
Management Effects	3	2	2	2
Colorado Plateau/Great Basin grasslands				
Abundance	O	O	O	O
Distribution	F	G	G	G
Likelihood of limitation	M	L	L	L
Management Effects	3	2	2	2
Semi-desert grassland				
Abundance	O	O	O	O
Distribution	F	F	F	F
Likelihood of limitation	M	M	M	M

Habitat Element	Alternatives			
	A	B	C	D
Management Effects	4	4	4	4
Desert communities				
Abundance	R	R	R	R
Distribution	F	F	F	F
Likelihood of limitation	H	H	H	H
Management Effects	3	3	3	3
Woodlands and savanna				
Abundance	R	R	R	R
Distribution	F	G	F	F
Likelihood of limitation	H	M	H	H
Management Effects	3	2	2	2
Gambel oak shrublands				
Abundance	R	R	R	R
Distribution	F	F	F	F
Likelihood of limitation	H	H	H	H
Management Effects	3	3	3	3
Rocky outcrops, cliffs, and canyons				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Wetland/Cienega				
Abundance	R	R	R	R
Distribution	F	F	F	F
Likelihood of limitation	H	H	H	H
Management Effects	3	2	2	2
Cottonwood-willow riparian forest				
Abundance	R	R	R	R
Distribution	P	P	P	P
Likelihood of limitation	H	H	H	H
Management Effects	4	4	4	4
Snags				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Downed wood				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	3	3	3
Natural waters				
Abundance	O	O	O	O
Distribution	F	F	F	F

Habitat Element	Alternatives			
	A	B	C	D
Likelihood of limitation	M	M	M	M
Management Effects	3	2	2	2
Constructed water				
Abundance	C	C	C	C
Distribution	G	G	G	G
Likelihood of limitation	L	L	L	L
Management Effects	3	2	2	2
Caves and mines				
Abundance	R	R	R	R
Distribution	G	G	G	G
Likelihood of limitation	M	M	M	M
Management Effects	4	4	4	4
Connectivity or “connectedness”				
Abundance	C	C	C	C
Distribution	F	F	F	F
Likelihood of limitation	L	L	L	L
Management Effects	3	2	2	2

Species viability evaluation for the Kaibab National Forest included consideration of 69 species (see methodology section on how this species list was created). Of these species, 5 are federally listed and 18 are Regional Forester sensitive species know to occur on the Kaibab National Forest or could be affected by forest management activities. From the 69 species, 39 species had a rating of F?-F3 and will be carried forward in this analysis. There was also an additional four federally listed or Forest Service sensitive species with a rating of FN or FO that were also carried forward into the analysis.

The following is the key to the variables used in Table 13(see methods section for full description of the rating codes):

Status: F (Federally listed or proposed as Threatened or Endangered)
S (Regional Forester’s sensitive species list)
O (Locally rare & other)

F Rank: F? (Information insufficient to develop rank);
F1 (Extremely rare on the forest);
F2 (Very rare on the forest);
F3 (Rare and uncommon on the forest)
FN (non-breeding population)
FO (off forest)

Viability Risk:
VH (Very High)
H (High)
MH (Moderately High)
M (Moderate)

L (Low)

Table 13. Risk to species viability for each species/habitat relation by forest plan revision alternative.

Common Name	Status	FRank	Habitat element	Viability Risk by Alternative			
				A	B	C	D
Northern goshawk	S	F3	Ponderosa pine - bunchgrass	M	L	M	M
			Ponderosa pine – Gambel oak	M	L	M	M
			Ponderosa pine- vertical heterogeneity	M	L	M	M
			Ponderosa pine – horizontal heterogeneity	M	L	L	L
			Frequent fire mixed conifer	MH	M	MH	MH
			Snags	L	L	L	L
			Downed wood	L	L	L	L
Golden eagle	O	F2	Sagebrush shrubland	M	M	M	M
			Montane/subalpine meadows & grasslands	MH	M	M	M
			Colorado Plateau/Great Basin grassland	MH	M	M	M
			Semi-desert grassland	MH	MH	MH	MH
Western burrowing owl	S	FN	Montane/subalpine meadows & grasslands	M	L	L	L
			Colorado Plateau/Great Basin grassland	M	L	L	L
			Semi-desert grassland	M	M	M	M
Evening grosbeak	O	F3	Frequent fire mixed conifer	MH	M	MH	MH
			Aspen - general	M	M	M	M
			Aspen –mesic mixed conifer & spruce fir	M	M	M	M
Olive-sided flycatcher	O	F3	Ponderosa pine - bunchgrass	M	L	M	M
			Ponderosa pine – Gambel oak	M	L	M	M
			Ponderosa pine- vertical heterogeneity	M	L	M	M
			Ponderosa pine – horizontal heterogeneity	M	L	L	L
			Frequent fire mixed conifer	MH	M	MH	MH
			Aspen –mesic mixed conifer & spruce fir	M	M	M	M
Dusky (blue) grouse	O	F3	Aspen –mesic mixed conifer & spruce fir	M	M	M	M
			Snags	M	M	M	M
			Downed wood	M	M	M	M
American peregrine falcon	S	F2	Rocky outcrops, cliffs, and canyons	M	M	M	M
California condor	F	F2	Rocky outcrops, cliffs, and canyons	M	M	M	M
Bald eagle	S	F2	Ponderosa pine - bunchgrass	MH	M	MH	MH
			Ponderosa pine – Gambel oak	MH	M	MH	MH
			Snags	M	M	M	M
			Constructed waters	M	M	M	M
Lewis' woodpecker	O	F3	Ponderosa pine - grassland	M	L	M	M

Common Name	Status	FRank	Habitat element	Viability Risk by Alternative			
				A	B	C	D
			Ponderosa pine – Gambel oak	M	L	M	M
			Ponderosa pine- vertical heterogeneity	M	L	M	M
			Snags	L	L	L	L
MacGillivray's warbler	O	F2	Aspen - general	MH	MH	MH	MH
			Aspen –mesic mixed conifer &spruce fir	MH	MH	MH	MH
			Natural waters	MH	MH	MH	MH
Purple martin	O	F3	Pinyon-juniper grasslands	L	L	L	L
(western spp.)			Pinyon-juniper shrublands	L	L	L	L
			Snags	L	L	L	L
Golden-crowned kinglet	O	F3	Aspen –mesic mixed conifer & spruce fir	M	M	M	M
			Springs and streams	M	M	M	M
Red-naped sapsucker	O	F3	Aspen – ponderosa pine & frequent fire MC	MH	M	M	M
			Aspen –Mesic mixed conifer & spruce fir	M	M	M	M
			Snags	L	L	L	L
Mexican spotted owl	F	F2	Ponderosa pine – Gambel oak	MH	M	MH	MH
			Ponderosa pine- vertical heterogeneity	MH	M	MH	MH
			Ponderosa pine – horizontal heterogeneity	MH	M	M	M
			Frequent fire mixed conifer	H	MH	H	H
			Mesic mixed conifer/spruce fir	H	MH	MH	MH
			Snags	M	M	M	M
			Downed wood	M	M	M	M
Orange-crowned warbler	O	F3	Aspen (general)	M	M	M	M
			Aspen – ponderosa pine & frequent fire MC	MH	M	M	M
			Aspen –mesic mixed conifer & spruce fir	M	M	M	M
			Natural waters	M	M	M	M
Gray vireo	O	F3	Pinyon-juniper grasslands	L	L	L	L
			Pinyon-juniper shrublands	L	L	L	L
Spikedace	F	FO	Pinyon-juniper communities (general)	L	L	L	L
			Ponderosa pine –bunchgrass	M	L	M	M
			Ponderosa pine- Gambel oak	M	L	M	M
			Grasslands (general)	M	M	M	M
Apache (Arizona) trout	F	F1	Natural waters	H	H	H	H
Loach minnow	F	FO	Pinyon-juniper communities (general)	L	L	L	L
			Ponderosa pine –bunchgrass	M	L	M	M
			Ponderosa pine- Gambel oak	M	L	M	M

Common Name	Status	FRank	Habitat element	Viability Risk by Alternative			
				A	B	C	D
			Grasslands (general)	M	M	M	M
Western skink	O	F3	Pinyon-juniper grasslands	L	L	L	L
			Pinyon-juniper shrublands	L	L	L	L
			Ponderosa pine - bunchgrass	M	L	M	M
			Rocky outcrops, cliffs, and canyons	L	L	L	L
			Downed wood	L	L	L	L
Arizona (mountain) treefrog	O	F3	Ponderosa pine - bunchgrass	M	L	M	M
			Ponderosa pine – Gambel oak	M	L	M	M
			Ponderosa pine- vertical heterogeneity	M	L	M	M
			Wetland/Cienega	MH	MH	MH	MH
			Natural waters	M	M	M	M
			Constructed waters	L	L	L	L
Milksnake	O	F3	Colorado Plateau/Great Basin grassland	M	L	L	L
			Semi-desert grasslands	M	M	M	M
			Rocky outcrops, cliffs, and canyons	L	L	L	L
Northern leopard frog	S	F?	Wetlands/cienega	VH	VH	VH	VH
			Natural waters	H	H	H	H
			Constructed waters	MH	MH	MH	MH
Great basin spadefoot	O	F3	Pinyon-juniper Communities	L	L	L	L
			Sagebrush shrublands	L	L	L	L
			Colorado Plateau/Great Basin grassland	M	L	L	L
			Semi-desert grasslands	M	M	M	M
			Wetlands/cienega	MH	MH	MH	MH
			Natural waters	M	M	M	M
			Constructed waters	L	L	L	L
Kaibab fairy shrimp	S	F3	Wetlands/cienega	MH	MH	MH	MH
			Natural waters	M	M	M	M
Desert green hairstreak	O	F?	Pinyon-juniper Communities	MH	MH	MH	MH
			Pinyon-juniper grasslands	MH	MH	MH	MH
			Sagebrush shrublands	MH	MH	MH	MH
Kaibab variable tiger beetle	O	F?	Montane/subalpine meadows & grasslands	H	MH	MH	MH
Hoary skimmer	O	F?	Montane/subalpine meadows & grasslands	H	MH	MH	MH
			Natural Waters	H	H	H	H
Nokomis fritillary	O	F?	Ponderosa pine - bunchgrass	H	MH	H	H

Common Name	Status	FRank	Habitat element	Viability Risk by Alternative			
				A	B	C	D
			Ponderosa pine – Gambel oak	H	MH	H	H
			Frequent fire mixed conifer	VH	H	VH	VH
			Mesic mixed conifer/spruce fir	VH	H	H	H
			Wetland/cienega	VH	VH	VH	VH
Pale Townsend's big-eared bat	S	F3	Cave and mines	L	L	L	L
Gunnison's prairie dog	O	F3	CO Plateau/Great Basin grassland	M	L	L	L
			Semi-desert grassland	M	M	M	M
House Rock Valley chisel-toothed kangaroo rat	S	F2	Semi-desert grasslands	MH	MH	MH	MH
Spotted bat	S	F3	CO Plateau/Great Basin grassland	M	L	L	L
			Semi-desert grassland	M	M	M	M
			Sagebrush shrublands	L	L	L	L
			Montane/subalpine meadows and grasslands	M	L	L	L
			Rocky outcrops, cliffs, and canyons	L	L	L	L
Allen's lappet- browed bat	S	F3	Ponderosa pine - bunchgrass	M	L	M	M
			Ponderosa pine – Gambel oak	M	L	M	M
			Frequent fire mixed conifer	MH	M	MH	MH
			Snags	L	L	L	L
			Cave and mines	L	L	L	L
Long-tailed vole	S	F3	Montane/subalpine meadows & grasslands	M	L	L	L
			Wetland/cienega	MH	MH	MH	MH
			Natural waters	M	M	M	M
Western red bat	S	F2	Cotton-willow riparian forest	H	H	H	H
Navajo Mogollon vole	S	F3	Montane/subalpine meadows & grasslands	M	L	L	L
			CO Plateau/Great Basin grassland	M	L	L	L
			Downed wood	L	L	L	L
Kaibab least chipmunk	S	F3	Mesic mixed conifer/spruce fir	MH	M	M	M
			Aspen –mesic mixed conifer & spruce fir	M	M	M	M
			Rocky outcrops, cliffs, and canyons	L	L	L	L
Desert bighorn sheep	S	F3	Desert communities	MH	MH	MH	MH
			Rocky outcrops, cliffs, and canyons	L	L	L	L
Merriam's shrew	S	F3	Ponderosa pine - bunchgrass	M	L	M	M
			Ponderosa pine – Gambel oak	M	L	M	M
			Ponderosa pine – horizontal heterogeneity	M	L	L	L
			Frequent fire mixed conifer	MH	M	MH	MH
Dwarf shrew	S	F3	Montane/subalpine meadows & grasslands	M	L	L	L

Common Name	Status	FRank	Habitat element	Viability Risk by Alternative			
				A	B	C	D
			Rocky outcrops, cliffs, and canyons	L	L	L	L
Kaibab northern pocket gopher	S	F3	Mesic mixed conifer/spruce fir	MH	M	M	M
			Aspen –mesic mixed conifer &spruce fir	M	M	M	M
			Montane/subalpine meadows and grasslands	M	L	L	L

Ratings of risk to viability for each species/habitat relationship by alternative are presented in the above table (Table 13). To facilitate comparison of effects of alternatives on species viability, the number of very-high, high, and moderately-high risk ratings are summarized for each alternative by habitat element (Table 14), management effects (Table 15), and species status (Table 16). In Table 13, two federally listed species, 12 Forest Service sensitive species and 12 other species were found to have at least one element ranked as either very-high, high or moderate-high risk. While there are 26 species that have at least one habitat element that has one of the three high rankings to viability risk, the numbers in the following tables will be higher than 24 since a single species may have more than one habitat element associated with it. For example, the MacGillivray's warbler has three habitat elements with a moderate-high rating, so each habitat element would be counted in the following tables.

Table 14. Number of species/habitat relationships rated as of very high, high, and moderately high risk to wildlife and fish species viability for each habitat element by forest plan revision alternative.

Habitat Element	Alternatives			
	A	**B**	**C**	D
Pinyon-juniper Communities (general)				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**
Pinyon-juniper grasslands				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**
Pinyon-juniper shrublands				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Pinyon-juniper woodlands persistent				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Ponderosa pine - bunchgrass				

Habitat Element	Alternatives			
	A	**B**	**C**	D
Very High	0	0	0	0
High	1	0	1	1
Moderately High	1	1	1	1
Total	**2**	**1**	**2**	**2**
Ponderosa pine – Gambel oak				
Very High	0	0	0	0
High	1	0	1	1
Moderately High	2	1	2	2
Total	**3**	**1**	**3**	**3**
Ponderosa Pine - uneven aged forest with vertical heterogeneity				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	0	1	1
Total	**1**	**0**	**1**	**1**
Ponderosa Pine - uneven age forest with horizontal heterogeneity				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	0	0	0
Total	**1**	**0**	**0**	**0**
Frequent fire mixed conifer				
Very High	1	0	1	1
High	1	1	1	1
Moderately High	5	0	5	5
Total	**7**	**1**	**7**	**7**
Mesic mixed conifer/spruce fir				
Very High	1	0	0	0
High	1	1	1	1
Moderately High	1	1	1	1
Total	**3**	**2**	**2**	**2**
Aspen -general				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**
Aspen – within ponderosa pine and frequent fire mixed conifer				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	2	0	0	0
Total	**2**	**0**	**0**	**0**
Aspen – with Mesic mixed conifer and spruce fir				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**

Habitat Element	Alternatives			
	A	**B**	**C**	D
Sagebrush shrublands				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**
Montane/subalpine meadows and grasslands				
Very High	0	0	0	0
High	2	0	0	0
Moderately High	1	2	2	2
Total	**3**	**2**	**2**	**2**
Grasslands (general)				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Colorado Plateau/Great Basin grasslands				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	0	0	0
Total	**1**	**0**	**0**	**0**
Semi-desert grassland				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	2	2	2	2
Total	**2**	**2**	**2**	**2**
Desert communities				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**
Woodlands and savanna				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Gambel oak shrublands				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Rocky outcrops, cliffs, and canyons				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0

Habitat Element	Alternatives			
	A	**B**	**C**	D
Total	**0**	**0**	**0**	**0**
Wetland/Cienega				
Very High	2	2	2	2
High	0	0	0	0
Moderately High	4	4	4	4
Total	**5**	**5**	**5**	**5**
Cottonwood-willow riparian forest				
Very High	0	0	0	0
High	1	1	1	1
Moderately High	0	0	0	0
Total	**1**	**1**	**1**	**1**
Snags				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Downed wood				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Natural waters				
Very High	0	0	0	0
High	3	3	3	3
Moderately High	1	1	1	1
Total	**5**	**5**	**5**	**5**
Constructed waters				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	1	1	1	1
Total	**1**	**1**	**1**	**1**
Caves and mines				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Connectivity or “connectedness”				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
Totals for All Habitat Elements				
Very High	4	2	3	3

Habitat Element	Alternatives			
	A	**B**	**C**	D
High	10	6	8	8
Moderately High	29	19	25	25
Total	**43**	**27**	**37**	**37**

Table 15. Number of species/habitat relationships rated as very high, high, and moderately high risk to wildlife and fish species viability for each category of management effect and forest plan revision alternative.

Management Effect/Risk	Alternatives			
	A	B	C	D
1. Provide Optimal Protection and Management for all Habitat Occurrences				
Very High	0	0	0	0
High	0	0	0	0
Moderately High	0	0	0	0
Total	**0**	**0**	**0**	**0**
2. Improve Habitat Abundance and Distribution Through Restoration				
Very High	0	2	2	2
High	0	3	3	3
Moderately High	0	11	9	9
Total	**0**	**16**	**14**	**14**
3. Maintain habitat Abundance and Distribution				
Very High	2	0	0	0
High	7	2	3	3
Moderately High	20	6	8	8
Total	**28**	**8**	**11**	**11**
4. Reduce Habitat Abundance and distribution as Result of External Factors				
Very High	2	0	0	0
High	3	1	1	1
Moderately High	9	2	2	2
Total	**14**	**3**	**3**	**3**
5. Decline in Habitat Abundance and distribution as Result of Management				
Very High	0	0	1	1
High	0	0	1	1
Moderately High	0	0	7	7
Total	**0**	**0**	**9**	**9**
Total for all Management Effect Categories				
Very High	4	2	3	3
High	10	6	8	8

Management Effect/Risk	Alternatives			
	A	B	C	D
Moderately High	29	19	26	26
Total	**43**	**27**	**37**	**37**

Planning for, and evaluation of, species viability for forest plan revision has focused primarily on providing desired abundance and distribution of habitat elements, in compliance with NFMA regulations. Additional species-based provisions included in all forest plan revision alternatives supplement existing law and policy. All alternatives include general and species-specific provisions for federally listed species, developed through coordination planning with the FWS.

Many of the high risk species will be conserved through desired conditions and guidelines included in the Forest Plan, as well as through forestwide objectives related to forest health and community restoration.

Table 16. Number of species/habitat relationships rated as very high, high, and moderately high risk to wildlife and fish species viability for each category of species status by forest plan revision alternative.

Management Effect/Risk	Alternatives			
	A	B	C	D
Federally listed or Proposed as Threatened or Endangered				
Very High	0	0	0	0
High	3	1	2	2
Moderately High	3	2	3	3
Total	**6**	**3**	**5**	**5**
Regional Forester's Sensitive Species				
Very High	1	1	1	1
High	2	2	2	2
Moderately High	11	4	10	10
Total	**14**	**7**	**13**	**13**
Locally Rare and Other Species				
Very High	3	1	2	2
High	5	3	4	4
Moderately High	15	13	13	13
Total	**23**	**17**	**19**	**19**
Total for all Management Effect Categories				
Very High	4	2	3	3
High	10	6	8	8
Moderately High	29	19	26	26
Total	**43**	**27**	**37**	**37**

EFFECTS BY ALTERNATIVE

Changes in wildlife habitat suitability occur at several scales and at differing intensities depending on the home range size and habitat requirements of individual species. The planning alternatives vary generally by programmatic goals and management prescriptions. Therefore, effects analyses for wildlife are broad, forestwide, and programmatic by design. At project scales, analyses would consider species with low mobility and restricted home ranges, such as constructing a parking lot, clearing a wildlife opening, clearing or paving a special-use communication facility, or plowing a fire control line.

Probable management activities that could potentially affect wildlife communities can be grouped into three broad categories: (1) changes in the type, quantity, quality and spatial arrangement of suitable habitat; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and, (3) increased disturbance.

EFFECTS THAT ARE SIMILAR TO ALL ALTERNATIVES

For some habitat elements, there is very limited potential to affect current abundance or distribution. All four alternatives would maintain the current habitat abundance and distribution of all pinyon-juniper associated habitat elements; aspen with mesic mixed conifer and spruce/fir; sagebrush shrubland; semi-desert grassland; desert communities; Gambel oak shrubland; rocky outcrops, cliffs, and canyons; riparian forest; snags; and downed wood because the conditions and trends in these habitat types did not raise significant concerns and did not emerge as a priority need for change. Therefore, no objectives were developed for them. The forest has however, identified desired conditions for these areas and would implement management to make progress toward desired conditions as capacity allows. For the species in table 15 (golden eagle, MacGillivray's warbler, desert green hairstreak, House Rock Valley chisel-tooth kangaroo rat, western red bat, and desert bighorn sheep) associated with these habitat elements, the current abundance and distribution would continue to provide for viable populations over time.

Five habitat elements emerged as having a high likelihood of being a limiting factor for all alternatives. These include desert communities, Gambel oak shrublands, wetland/cienega, riparian forest, and cottonwood-willow riparian forest. All of these habitat elements naturally occur on less than 1 percent of the landscape across the Forest. It is not the Forest's intent to make these naturally rare habitat features more common than they were historically. For desert communities, wetland/cienega, and cottonwood-willow riparian forest, it is highly unlikely that forest management would be able to achieve reference conditions due to limited ability/knowledge in the desert communities and other laws and regulations for wetlands/cienega and cottonwood-willow riparian forest. The cottonwood-willow riparian forest (Kanab Creek) is impacted by off-forest upstream water use and diversion. Gambel oak shrubland is not a priority need for change and has a rare abundance and fair distribution rating. This combination gives it a high likelihood of being limited.

When looking at the viability risk to species, some species face an additional threat simply by virtue of their relatively limited range-wide distribution. These species can be affected by localized and/or stochastic events and would likely have a high viability risk, regardless of management. A species was considered to have a Restricted Distribution if it occurs to a limited extent in the Southwest; a species was also considered to be a Narrow Endemic if it has extremely limited distribution and/or habitat in northern Arizona. Table 17 shows the species determined in the Species Diversity Report that have either a Restricted Distribution or are considered a Narrow Endemic. The Kaibab fairly shrimp was added after the report was written.

Table 17. Forest Planning Species classified as having Restricted Distributions or Narrow Endemic species

Species	Restricted Distributions	Narrow Endemic
California condor	X	
Apache trout	X	
Arizona black rattlesnake	X	
Utah Mountain kingsnake	X	
Persephone's darner	X	
Kaibab fairy shrimp		X
Kaibab variable tiger beetle		X
Kaibab Indra swallowtail		X
House Rock Valley chisel-toothed kangaroo rat		X
Kaibab least chipmunk		X
Kaibab tree squirrel		X
Kaibab northern pocket gopher		X

For most of these species listed in Table 17, their habitat elements may be common on the forest, but the species are naturally limited in abundance or distribution. For these species, it is not the intent of the forest to increase their populations outside of areas they would naturally occur. Species that meet these criteria include the species listed in Table 17(except Apache trout) and the desert green hairstreak, hoary skimmer, Nokomis fritillary, four-spotted skippering and dwarf shrew.

For all the action alternatives, desired conditions and guidelines for managing Rare and Narrow Endemics species were developed to help reduce the risk of removing habitat or refugia for these species.

- **Rare and Narrow Endemics desired conditions:** Habitat and refugia are present for narrow endemics or species with restricted distributions and/or declining populations. Location and conditions of rare and narrow endemic species are known.
- **Guideline**: Project design should incorporate measures to protect and provide for rare and narrow endemic species where they are likely to occur.

In collaboration with researchers at the Museum of Northern Arizona and Northern Arizona University, The Forest is currently developing a guidebook which consolidates information regarding rare and narrow endemic species along with the desert green hairstreak, hoary skimmer, and Nokomis fritillary. The intent of the guidebook is to help project specialists incorporate appropriate guidelines and design features that will better protect habitat for these species during project implementation. Protective measures incorporated into project design should help provide for continued viability of these species. While alternative A would not have the guideline for rare and endemic species, the Forest would still use the guidebook to help maintain these species. The dwarf shrew and four-spotted skippering were not shown to have a "high rating" for viability risk under any alternative.

For several species, such as the Apache trout (which is found in less than 2 miles of natural waters on the Forest), a limited amount of the habitat is available and the species has a low occurrence on the Forest. As a result, these kinds of species would always have a high viability risk. Other species with both limited habitat abundance and low species occurrence include MacGillivray's warbler, Great Basin spadefoot, Arizona treefrog, long-tailed vole, northern leopard frog, House Rock Valley chisel-toothed kangaroo rat, western red bat, and desert bighorn sheep. The habitat elements for most of these species with a "high rating" are wetlands/cienegas or natural waters. The threat to most of these species (and including the Kaibab fairy shrimp) is the loss of habitat due to change in sediment flows, or water flows or the introduction of non-native species or disease. The following forest plan desired conditions were developed to reduce these risks:

- **Wetland/Cienega desired condition:** Wetlands conditions are consistent with their flood regime and flood potential. Plant and animal species that require wetland habitats have healthy populations within the natural constraints of the particular wetland community. Wetlands infiltrate water, recycle nutrients, resist erosion, and function properly.
- **Natural Waters desired condition:** Stream channel stability and aquatic habitats retain their inherent resilience to disturbances and climate fluctuations. Stream channel morphology reflects changes in the hydrological balance, runoff, and sediment supply appropriate to the landscape setting. Springs and ponds have the necessary soil, water, and vegetation attributes to be healthy and functioning. Water levels, flow patterns, groundwater recharge rates, and geochemistry are similar to historic conditions. Within its capability, stream flow and water quality is adequate to maintain aquatic habitat and water sources for native and selected non-native wildlife. The necessary physical and biological components, including cover, forage, water, microclimate, and nesting/breeding habitat, provide habitat for a diverse community of plant and wildlife species. Riparian-dependent plant and animal species are self-sustaining and occur in natural patterns of abundance and distribution. Within its capability, streamflow and water quality are adequate to maintain aquatic habitat and water sources for native and desired nonnative species. Native macroinvertebrates are appropriately abundant and diverse. Unwanted non-native species do not exert a detectable impact on aquatic and wetland ecosystems. Native amphibians are free from or minimally impacted by non-native predation and diseases. Springs, streams, and ponds have appropriate plant cover to protect banks and shorelines from excessive erosion. Hydrophytes and emergent vegetation exist in patterns of natural abundance in wetlands and springs in levels that reflect climatic conditions. Overhanging vegetation and floating plants such as water lilies exist where they naturally occur. Where springs or other natural waters have been modified for livestock and/or human consumption, developments are operational.
- **Constructed Waters desired condition:** Drinkers have escape ramps that provide safe access and egress for wildlife. Constructed waters do not contribute to the spread of chytrid fungus or unwanted non-native species. Reservoirs maintain high quality for parameters such as temperature, dissolved oxygen, and water levels within the seasonal range of variable conditions. Desirable non-

native fish species provide recreational fishing opportunities in reservoirs and constructed lakes consistent with the needs of native species.

- **Wilderness and Recommended Wilderness desired condition**: A reproducing population of Apache trout is maintained in North Canyon Creek.

Finally, proposed management activities would have very limited effects for some species. The desert bighorn sheep is limited to certain areas on the North Kaibab Ranger District (see Appendix D for a map of sheep/goat allotments and bighorn sheep locations). The biggest threats to this species are predators and diseases which are typically associated with domestic goats and sheep. There are no domestic sheep or goat allotments on the North Kaibab or Tusayan Ranger Districts; therefore there is no risk to bighorn sheep from current range management on the forest. Western red bat is associated with riparian habitat and is only believed to be found in the Mogollon Rim area on the Williams Ranger District. The habitat for this species is contained within the wilderness boundaries and is unlikely to be affected by management. For these two species, the forest management would not affect their viability in the long term and none of the alternatives would lead toward federal listing of these species.

Neither the loach minnow nor spikedace (both federally listed as endangered) nor their designated critical habitats occur on the Kaibab NF. However, critical habitat is within an area that could be affected by Forest actions or inactions. There are no direct effects to these species; only indirect effects since all effects would be off-forest. The biggest treat to either fish or their critical habitat is a large uncharacterized wildfire in the portions of the Kaibab NF that is within the Verde River Drainage. See appendix C for desired conditions that would reduce the potential for these kinds of events. Generally, the overall intent of the desired conditions is to protect resources while maintaining multiple-use activities. Indirect effects from management actions such as vegetation management and fuel reductions would likely not be measureable or distinguishable from other off-forest activities due to the fact that downstream habitat is 12 miles away from the forest boundary. None of the alternatives would adversely affect the species or their critical habitat.

Risk to species viability is also reduced by provisions in existing law and policy. For all alternatives, the Forest would continue to follow the intent of all approved recovery plans for federally listed species even if actions within those plans do not match the Forest's desired conditions for the particular resource area. These include specific consideration of effects to federally listed species (proposed, threatened, and endangered species) and Regional Forester's Sensitive Species, in biological assessments and evaluations conducted as part of all national forest management decisions. These assessments and evaluations identify where additional protective measures are warranted to provide for continued existence of the species on NFS land. Projects that may affect federally listed or proposed species must be coordinated with the U.S. Fish and Wildlife Service during the planning stage to mitigate potential impacts to listed species under Section 7(a)(2) of the ESA.

In addition, Federal agencies are directed, under section 7(a)(1) of the ESA, to use their authorities to carry out programs for conserving threatened and endangered species. For all listed species, the Forest currently fulfills this duty in the ways described below. The Forest will continue these activities. In addition, desired conditions and some guidelines will provide additional conservation measures (see the Biological Assessment for listed species and appendix C for these additional conservation measures.)

California condor

The Kaibab NF is an active member of the Southwest Condor Workgroup and a cooperating partner on a MOU which includes representatives from other agencies and organizations. The North Kaibab wildlife biologist is the designated forest representative and participates regularly on conference calls and annual meetings. The purpose of the MOU is to establish a general framework for cooperation and participation among all cooperators to promote the recovery of the California condor. The MOU applies to the

Southwest California condor reintroduction program and designated nonessential experimental population with three primary objectives:

- Support a long-term program to reestablish a viable self-sustaining population of California condors in the southwestern United States through the release of captive-reared individuals, and management of the wild population.
- Achieve recovery goals for this species as cited in the California Condor Recovery Plan (USFWS 1996a), following the current management recommendations established by the California Condor Recovery Team as authorized by the Fish and Wildlife Service, and implement recommendations of the California Condor 5-year review (2012b).
- Address emerging issues through the Southwest Condor Working Group's representatives of the primary cooperators.

Public outreach and education is conducted in a variety of ways. The Kaibab NF maintains a Web link to The Peregrine Fund's California Condor Restoration website. This comprehensive website explains the goals of the restoration program, threats (e.g., health impacts posed by the use of lead ammunition and recommendations to reduce such impacts), and reintroduction and research efforts to date. It maintains a library of reports, presentations, and peer-reviewed literature relative to condors, as well as a contact list for key personnel and cooperating partners, which includes the Kaibab NF. Other outreach efforts include postings, signs and information cards distributed by Forest Service personnel explaining the harmful effects of lead ammunition to the public. In August 2012, the Forest entered into an agreement with the Arizona Game and Fish Department and provided $20,000 to help support the state's voluntary lead reduction program. This effort helps to provide educational and outreach materials on the positive impacts of lead reduction on the condor.

Through the special use permitting process, outfitter guides on the North Kaibab Ranger District are urged to use non-lead ammunition for the hunts they provide to help reduce the risk to condors. These provisions include: within game management Units 12A and 12B, the Arizona Game and Fish Department offers non-lead rifle ammunition to big game hunters. It is recommended that hunters in these units consider using 100 percent copper bullets to reduce lead exposure to California condors. If the hunters choose to use lead ammunition, they are strongly encouraged to remove all shot animals and gut piles from the field. When this isn't possible, to hide them with rocks and brush, or remove all blood shot flesh.

The Forest has worked with the Fish and Wildlife Service to develop measures to minimize risk of harmful interactions with condors that could occur near project-related activities. These mitigation measures include:

- Project work sites will be cleaned up at the end of each day to avoid trash accumulation that may attract condors.
- If a condor shows up near project-related activities, a Forest Service wildlife biologist will be contacted immediately and any project-related activity likely to harm the condor will halt temporarily until the condor flies away or is driven away by permitted personnel.
- Project workers will be instructed to avoid any interaction with condors.
- The wildlife biologist will be notified if any project-related vehicle fluid leak or spill occurs that could result in condor poisoning.

The Forest incorporated significant alterations to the Navajo Transmission Line EIS for the portion of the line crossing the Tusayan Ranger District. The EIS calls for high-visibility wire to minimize avian

collisions and a monitoring/adaptive management approach to retrofit the line if collisions exceed stated limits for a variety of birds, including California condors.

Finally, the Forest provides field, logistical, and funding support to The Peregrine Fund as needed during reintroduction and recovery actions. This includes providing equipment such as snowmobiles and personnel to help in the distribution of winter feed for condors, as well as maintaining numerous roads which provide the necessary access for condor monitoring. In 2009, the Forest entered into a Challenge Cost Share Agreement with the Peregrine Fund and provided critical and timely funding support for the North Kaibab Ranger District release efforts that year. The purpose of that agreement was to study the movement and locations of condors on the Kaibab NF and adjacent lands. Objectives were focused on increasing production, refining release techniques, and monitoring released birds, while minimizing mortality factors to establish a self-sustaining population. Additional goals included continuing education and public awareness regarding the deleterious effects of lead on condors, the environment, and human health implications. The results of that work were written up in a final report that provides valuable insight on movement and foraging behavior across the Kaibab Plateau and adjacent areas. The forest is currently working with Arizona Game and Fish Department along with The Peregrine Fund to provide support and funding for the further transmitter monitoring of the condors. The forest is providing $20,000 in 2013 toward this effort.

Mexican Spotted Owl

- The Forest works with the Fish and Wildlife Service to establish PACs for Mexican spotted owls using criteria set forth in the recovery plan.
- The Forest conducts fuels reduction projects which may benefit the Mexican spotted owl in the future. These projects focus on reducing the potential for stand-replacing, uncharacteristic wildfires that are a threat to the species while still maintaining or enhancing structural habitat features (e.g. large trees, snags and down woody materials). The forest is an active partner in the Four Forest Restoration Initiative (4FRI).
- The Forest monitors PACs and provides USFWS with monitoring and project survey results annually.
- A new population and habitat monitoring approach was developed within the recently published Revised Recovery Plan (USFWS 2012a). The Forest Service has agreed to meet with the USFWS to discuss its future participation under the new Recovery Plan monitoring plan, to be done in conjunction with the USFWS and other land management agencies. Initial discussions have taken place.

Apache Trout

- The Forest partners with personnel from Arizona Game and Fish Department in monitoring Apache trout and their habitat in North Canyon Creek.
- In 2010, the KNF worked with the Arizona Game and Fish Department to improve in-stream structures within the Apache trout habitat. The old check dams were old and failing, resulting in the loss of important pool habitat for the Apache trout population that was established in this stream. The new structures are providing the habitat structure required for the trout.
- Trail maintenance near the trout habitat has reduced sedimentation into the creek. The trails are checked annually to make sure they are in good conditions.
- The forest assesses all wildfires that start in the proximity of the North Canyon watershed, regarding potential impacts to the stream and the Apache trout.

Table 18 is a summary of the federally listed and sensitive species that where shown to have low or moderate viability risk for all alternatives based on Table 13. For species that were ranked as moderate to low risk viability in all the alternatives, the proposed alternatives would provide for long-term viability of the species.

Table 18. Listed & Sensitive Species where Viability is Provided for in all Alternatives.

Species
Western burrowing owl
American peregrine falcon
California condor
Spikedace
Loach minnow
Pale Townsend's big-eared bat
Spotted bat
Navajo Mogollon vole
Dwarf shrew

ALTERNATIVE A-CURRENT PLAN, CURRENT MANAGEMENT (NO ACTION)

Alternative A has the most species and associated habitat elements with very high (4), high (10), or moderate-high (29) viability ratings (Tables 13-16). This alternative also has the greatest number of habitat elements that are departed from reference conditions as shown in Table 12 (12 with fair rating and 8 with poor rating). Most of these ratings correspond with those vegetation types identified as having a high priority need for change (KNF 2009).

Currently, the use of managed wildfire in most of the mixed conifer types (frequent fire and mesic) to maintain or improve stand structure, stimulate aspen regeneration, maintain fuel loads, or achieve other resource benefits, is not permitted under the current Plan. This would continue under Alternative A. With the continued lack of fire disturbance, the risk of losing most or all of these vegetation types to stand replacing wildfire and the resulting uncharacteristic open state increases with each passing year (Vegetation and Fire Specialist Report; KNF 2013a). In addition, the decline or loss of aspen, as a component of the mixed conifer types on the North Kaibab Ranger District, is due primarily to lack of fire disturbance. Due to the loss of habitat components from high severity wildfires that could cover large areas, this potential could have a negative effect on Mexican spotted owl, red-faced warbler, evening grosbeak, olive-sided flycatcher, dusky grouse, MacGillivray's warbler, golden-crowned kinglet, red-naped sapsucker, orange-crowned warbler, Nokomis fritillary, Nokomis fritillary ssp. nokomis, southwestern myotis, Kaibab least chipmunk, red squirrel, and Kaibab northern pocket gopher.

Most of the standards and guidelines that would benefit wildlife in the existing LMP can be found within the three action alternatives either as part of a desired condition, a guideline, or management approach. A caveat to this is those standards and guidelines which are already contained within existing law, regulation or policy. Plan direction contained within existing law regulation or policy is not reiterated in the alternative actions, but is incorporated by reference and will be implemented at the project level.

The current forest plan lacks a description of desired conditions for many of the habitat elements. This lack of description makes it harder to insure projects are implemented in a consistent manner and that projects are moving toward a common set of desired conditions. Alternative A does not have the desired conditions and guidelines that were developed specifically to benefit wildlife species that are included in the action alternatives. These include retention strategies for wildlife habitat components such as mistletoe brooms, partial snags, providing for interconnected habitats for wide-ranging species, and

guidance on rare and narrow endemic species. It also does not include prevention measures for the spread of certain wildlife diseases (e.g. WNS, chytrid fungus), guidance which influences animal movement such as wildlife friendly fence improvements (e.g. pronghorn), or bat gates.

The current plan has very prescriptive (restrictive) direction making it difficult to implement adaptive management in a timely manner. This limits managers' ability to be responsive to change as their understanding about management effects on ecosystems and wildlife evolves. Adaptive management will be essential to effectively manage for climate change and invasive species in changing and uncertain conditions.

As discussed in the "Revision Topics Addressed in this Analysis" section (above), there are several actions that have been recommended that can help the Forest cope with climate change and its potential effects to wildlife. Several of these recommendations are not likely to occur under Alternative A. These include: 1) manage for diverse conditions; 2) reduce nonclimate stressors on ecosystems; 3) reduce the risk of uncharacteristic high intensity fires; 4) conduct medium- and long-range planning; 5) ensure ecosystem processes; and 6) employ monitoring and adaptive management. Another recommendation is the control of invasive plant species. Impacts to invasive species prevention and control would initially remain similar to Alternative B Forest wide, with the potential for invasive species populations to increase over time resulting from increased stand replacing fires (Non Native Invasive Species Specials Report, KNF 2013b). Climate change has the potential to affect all wildlife species, and also influences the likelihood of large-scale disturbance (e.g. fire, bark beetle outbreaks) across the landscape. The current forest plan (Alternative A) does not recognize climate change, and offers limited guidance associated with management activities (e.g. salvage logging) related to such disturbance events. The forest would continue to follow existing law, regulation, policy and best management practices to address species viability concerns in areas affected by large-scale disturbance.

In addition to federally listed species and Forest Service sensitive species, the evening grosbeak, olive-side flycatcher, golden eagle, red-naped sapsucker, and orange-crowned warbler all had a moderate high viability rating for the current plan (table 15). All of these wildlife species are found in multiple habitat elements with most of the habitat elements having a low to moderate viability rating. The evening grosbeak and olive-sided flycatcher both have the "high" rating in frequent fire mixed conifer habitat element. The golden eagle "high" rating was for both montane/subalpine meadows and Colorado Plateau/Great Basin grasslands. The red-naped sapsucker and orange-crowned warbler high rating was for aspen in ponderosa pine and frequent fire mixed conifer habitat elements. For all the species except for the golden eagle, this rating is based on the limited amount of habitat improvement (progress toward desired conditions) expected under the current forest plan. For golden eagle, the rating is due to the rarity of the species and the limited amount of work occurring within grasslands and montane meadows. For these habitat elements, the forest currently has ongoing habitat improvement projects, such as removing pinyon-juniper in historic grasslands, restoring frequent fire mixed conifer stands and fencing aspen clones to re-establish aspen stands on the Williams Ranger District. However, at the current rate of implementation, these projects maintain current amounts and are not likely to have a substantive increase in quality or quantity for the habitat elements. The viability of the species would be maintained through the habitat elements that are at a low or moderate viability rating, and the level of habitat treatment occurring within the habitat elements at a "high" viability rating.

Federally Listed Species and Sensitive Species

The current forest plan would have impacts to threatened, endangered, and sensitive species and critical habitat for the Mexican spotted owl. All species require evaluation of projects to determine effects to the

species and for listed species to determine if consultation with Fish and Wildlife Service is appropriate. The current land management plan has numerous standards and guidelines that require the evaluation and protection of federally listed and regionally sensitive species.

The California condor is federally endangered. The condor population on the Kaibab NF is further classified as a §10(j) experimental non-essential population under ESA section 10. By definition, a non-essential experimental population is not essential to the continued existence of the species. While the 10(j) rule provides considerable discretion and management flexibility to address potential conflicts with existing human land uses and activities (e.g., hunting) in the reintroduction area, that discretion must not preclude recovery of the species. California condors have rarely been found on the Kaibab NF outside of the §10(j) area. If any condors are found outside of the §10(j) area, they are protected as a federally endangered species under Section 7(a)(2). Most of the standards and guidelines for protection of wildlife and forest management are beneficial for the condor. The primary threat to the Arizona population of condors is ingestion of lead ammunition. The ability of the forest to affect the use of lead ammunition is outside the scope of this document; this is not a forest management activity used to determine viability risk from the implementation of the forest plan (see Cumulative Environmental Consequence section for effect from lead shot). See the ESA section 7(a)(1) discussion above in Effects Similar for All Alternatives for actions the forest has taken to help reduce the effects of lead ammunition to the condor.

Of the 69 fatalities noted in the current Five Year Review on the condor reintroduction program (USFWS 2012b), a collision (mainly with powerlines) is the only threat affected by forest management actions. There are standards and guidelines that limit development of utility corridors. Utility corridor easements would have some impacts on the condors. The current plan contains a guideline that allows recreation use to continue at current levels includes hunting and could be viewed as a negative impact. However, because the forest only provides access for hunting, and does not manage harvest of game animals, there is little influence from forest management. The condor has a moderate viability risk rating for the one habitat element shown for them. This is based on the limited impacts to this habitat element and the forest ranking for the condor. While some individual birds could be impacted by actions on the forest and cumulatively there is a negative effect to the southwest population from lead shot, the alternative management activities would not adversely affect the viability of the species. It is estimated the amount of grasslands would not change under this alternative, however, it is predicted that the overall condition of grasslands would continue to decline.

Mexican spotted owl (federally threatened) and its designated critical habitat is protected by the standards and guidelines that were included in the 1996 plan amendment (KNF 1988, as amended). The Forest recognizes that projects and program activities implemented under the current plan may occur near or within Mexican spotted owl PACs and within Critical Habitat. While the standards and guidelines provide protection for the owl and maintain their viability on the forest, activities may be permitted, authorized, or funded which may negatively affect individuals or affect designated critical habitat. There are moderate high viability risk for ponderosa pine habitat elements and high viability risk to mixed conifer habitat elements for the Mexican spotted owl. These risks are based on the limited ability of the forest to make progress toward the desired conditions and the increased risk of losing these habitat elements to wildfires by having unnaturally high fuel loads in these stands. Based on VDDT modeling, it is estimated that the amount of mixed conifer available for nesting and roosting would increase in 15 years by approximately 640 acres to 35,760 acres and ponderosa pine/Gambel oak stands would stay the same at approximately 13,294 acres for a total of 49,054 acres.

The Saddle Mountain Wilderness, in North Canyon Creek, contains the only population of Apache trout (federally threatened) on the forest. Alternative A would retain the standard that the maximum size

objective for any fire within a 2-mile radius of North Canyon Spring is 5 acres. The intent of the standard is to prevent a high severity fire in Apache trout habitat, so it would positively affect the trout in that regard. Alternatively, the standard does not allow for low intensity fire (which could benefit the trout by helping prevent a high intensity fire), so this limitation could negatively affect the Apache trout because the greatest risk to the species is a high-severity wildfire in the canyon. The resulting sedimentation and potential loss of shaded canopy from such an event could cause a loss of the local population. The forest is currently limited (unable) to use mechanical fuel reduction methods in this area due to wilderness management regulations. Because of this limitation imposed on the fuels reduction program, the overstory canopy would continue to close and the forested areas around the creak could become unnaturally dense. As the forest density increases and moves toward a closed state, there would be an increased risk for high-intensity fires, because canopy fuel volumes would increase as stands became increasingly dense. Further, an increase in tree density would also put the forest at greater risk for bark beetle attacks, which could increase the potential for high-severity wildfire due to the increased amount of susceptible fuels (drier vegetation and greater fuel loads). Increased frequency and extent of high-severity wildfires could greatly affect the Apache trout habitat by removal of shade trees near the stream and increase sediment in the water. Depending on the severity of the fires, amount of habitat loss, and location of fire within the watershed, there would be a potential to affect the viability of this population.

Sensitive species that depend on ponderosa pine and mixed conifer habitat would be affected by the 1996 plan amendment. The standards and guidelines for the goshawk and Mexican spotted owl would provide for the goshawk, bald eagle, Allen's lappet-browed bat, Kaibab least chipmunk, Kaibab tree squirrel, Merriam's shrew and Kaibab northern pocket gopher. Table 13 shows that alternative A has a low to moderate viability risk for these habitat elements for the Kaibab squirrel and a moderate-high ranking for bald eagle in ponderosa pine. The rating for bald eagle is due to rarity of bald eagles and the limited amount of habitat improvement in ponderosa pine habitats. The VDDT model shows the following changes for ponderosa pine and mixed conifer acreage in 15 years:

- Goshawk[1] ponderosa pine habitat would increase by 10,914 acres for a total of 196,949 acres.
- Bald eagle and Allen's lappet-browed bat ponderosa pine habitat would increase by 4,942 acres for a total of 415,781 acres.
- Kaibab least chipmunk and Kaibab northern pocket gopher mixed conifer with aspen habitat is estimated to stay approximately the same.
- Kaibab tree squirrel overall ponderosa pine habitat would decrease by 1,685 acres for a total of 101,100 acres; optimum habitat would increase by 3,064 acres for a total of 55,146 acres.
- Merriam's shrew ponderosa pine habitat would increase by 82,062 acres for a total of 213,361 acres.

The goshawk, Allen's lappet-browed bat, and Merriam's shrew show moderate-high viability rating only within frequent fire mixed conifer habitat element (Table 13). This habitat element is only one of several different habitat elements these species use. Based on VDDT modeling (summarized in Table 19 below) the following shows the change in frequent fire habitat conditions in 15 years:

- Goshawk habitat would increase by 3,832 acres for total of 39,593 acres

[1] For all the alternatives goshawk habitat acreage refers to only their nesting and roosting habitat as discussed in existing conditions.

- Allen's lapped-browed bat habitat would decrease by 4,010 acres for total of 80,463 acres
- Merriam's shrew habitat would increase by 3,584 acres for a total of 18,190 acres

The Kaibab least chipmunk and Kaibab northern pocket gopher show moderate-high viability rating only within mesic mixed conifer/spruce fir habitat element (Table 13). This habitat element is only one of several different habitat elements these species use. Based on VDDT modeling, the following shows the change in mesic mixed conifer/spruce fir habitat conditions in 15 years:

- Kaibab least chipmunk and Kaibab northern pocket gopher habitat would show an increase of 694 acres for a total of 3,522 acres

Based on the risk to viability rating and the amount of habitat provided for each of the above species, viability would be maintained for each of these species dependent on conifer habitat under the no-action alternative. While individual animals could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

Sensitive species that depend on riparian or wetland habitat and either constructed or natural waters have several standards and guidelines in the current plan that protect wetland habitat on the forest. These include invasive weed management, riparian habitat protection and grazing requirements. These requirements would improve the viability of the bald eagle, Kaibab fairy shrimp, northern leopard frog and long-tailed vole. The bald eagle had a low to moderate viability risk for these habitat elements. The desired condition discussed above in "Effects Similar for All Alternatives" for the water elements would mitigate impacts to Kaibab fairy shrimp, northern leopard frog and long-tailed vole. The amount of habitat is not likely to change from the current condition, but the quality of habitat would be expected to increase. As wetlands and springs are surveyed and monitored, the forest would be able to better assess which areas are no longer in proper functioning condition and improvements can be done. While individual species could be impacted from actions under the no-action alternative, it would not lead toward Federal listing for any of these species.

The current plan has have very few standards or guidelines that relate directly to features needed by sensitive species that depend on grasslands, meadows, shrublands, desert communities, caves and mines, and rocky outcrops, or cliffs and canyons. These species and features are indirectly affected by standards and guidelines for recreational uses and mineral development. Their main protection is the requirements to protect sensitive species which are addressed outside the plan. The species that depend on these habitat elements are the western burrowing owl, peregrine falcon, pale Townsend's big-eared bat, House Rock Valley chisel-toothed kangaroo rat, spotted bat, Allen's lappet-browed bat, long-tailed vole, Navajo Mogollon vole, Kaibab least chipmunk, desert bighorn sheep, dwarf shrew, and Kaibab northern pocket gopher. Table 13 shows a low to moderate viability risk for the habitat elements for these species except for House Rock Valley chisel-toothed kangaroo rat and desert bighorn sheep under this alternative. These two species are discussed above in "Effects Similar for All Alternatives".

Shrublands, desert communities, caves and mines, and rock outcrops, cliffs and canyon habitat is not expected to change under the current forest plan. The forest has actively been removing pinyon-juniper in grasslands on the Williams Ranger District. On average, the Forest is restoring approximately 2,000 acres a year. Over 15 years, this rate would restore approximately 30,000 acres. While this would improve habitat conditions, it would not increase the amount of the PNVT. Active management activities could affect individual animals, but would not lead toward Federal listing or affect viability of the populations.

Other Federal Law Compliance

There would be no programmatic take under the Bald and Golden Eagle Protection Act. There is one nesting bald eagle site on the forest. In 2012, the bald eagles nested and fledged young on the Williams Ranger District. The Forest along with Arizona Eagle Watch volunteers will monitor the site for nesting in 2013 to see if the eagles will return. If nesting occurs than the Eagle Watch group will monitor the nest site and will work with the public at the recreation site about the need to avoid the nesting area. Most of the use on the Forest is migrating bald eagles that use the Forest during the winter with no known established winter roost sites. There are golden eagle nest sites on the Forest, but there are no management standards or guidelines within the Plan that adversely affect these nest sites.

Alternative A was implemented before Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds was signed in January 10, 2001, to promote the conservation of migratory birds. As a result, many of the topics that must be considered pursuant to this order were not incorporated into plan direction. During the planning stage of any project, under the current plan, project-led planning under NEPA requires a review of effects and the development of mitigations to reduce impacts to migratory birds.

EFFECTS COMMON TO THE ACTION ALTERNATIVES B, C, & D

A fine filter approach was used to develop plan components to improve the viability of species populations on the forest. Appendix E is a crosswalk that shows how desired conditions, objectives, standards, and guidelines were developed to meet species' specific habitat needs. These fine filter measures were developed in addition to more the broad coarse filter plan components that provide for the viability of all species. The high-risk species would be conserved through desired conditions, standards, and guidelines, as well as through forest wide objectives related to forest health and ecosystem restoration. For listed species, this also meets the requirements to develop conservation actions under ESA § 7(a)(1).

All of the action alternatives address some of the strategies identified by the Wildlife Society (Inkley et al. 2004) for coping with the challenges of climate change through desired conditions, objectives, standards, guidelines or management approaches. All action alternatives (1) recognize that climate change may affect wildlife; (2) do not rely on historical weather and species data; (3) control invasive species; (4) conduct medium- and long-range planning; and (5) employ monitoring and adaptive management.

Related to climate change is the increasing potential for large-scale disturbance (e.g. widespread drought, uncharacteristic fire, bark beetle epidemics) events which have the potential to affect a number of ecosystems, in particular forest and woodland communities. The action alternatives recognize the increased potential for these events in the future through a post disturbance response strategy that includes guidelines and objectives to ensure important wildlife habitat is specifically considered and retained during activities such as salvage logging operations that might respond to such events. While there is the potential for some negative effects on wildlife during salvage operations (e.g. incidental crushing, disturbance), those effects would be outweighed by the overall goal of long term ecosystem recovery. Current knowledge regarding effects of salvage logging on wildlife and associated ecosystems continues to evolve. For all management activities, the forest intends to use the best available science. The forest would consult the scientific literature and area experts to be sure current thinking is incorporated into project design and implementation. In addition, during salvage operations the forest would mitigate for wildlife threats through specific plan components as mentioned below and appropriate BMPs. The guidelines and objectives for large-scale disturbance are in addition to existing law, regulation and policy and relevant plan components (e.g. desired conditions for the respective vegetation types, guidelines for

vegetation management in forested communities, guidelines for threatened, endangered, and sensitive species etc.).

In addition to federally listed species and Forest Service sensitive species, golden eagle, red-naped sapsucker, and orange-crowned warbler all had a moderate viability rating for all action alternatives (table 13) for some habitat elements. The golden eagle moderate rating was for both montane/subalpine meadows and Colorado Plateau/Great Basin grasslands. The red-naped sapsucker and orange-crowned warbler rating was for aspen in ponderosa pine and frequent fire mixed conifer habitat element.

Federally Listed Species and Sensitive Species

The action alternatives would have the same impacts to the federally listed and sensitive species except for those species that depend upon ponderosa pine and frequent fire mixed-conifer forest. The action alternatives specify the same desired conditions, objectives, and standards for all the other habitat elements. The guideline for presettlement tree retention, the differing amounts of land managed for timber production, and lands recommended for wilderness are the substantive differences between alternative B and alternatives C and D. For some areas, the guidance for alternatives C and D would have the same effect as in alternative B. All other plan components are the same for the three action alternatives.

The desired conditions and guidelines for wildlife and threatened, endangered, and sensitive species provide the overall directions for providing habitat and protection for listed and sensitive species.

- **Wildlife desired condition**: Native wildlife are distributed throughout their potential natural range. Desirable nonnative wildlife are present and in balance with healthy, functioning ecosystems. Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of vertebrate and invertebrate species. Species with specific habitat needs such as snags, logs, large trees, interlocking canopy, and cavities are provided for. Grasses, forbs, and shrubs provide forage, cover, fawning, and nesting sites. Interconnected habitats allow for movement of wide-ranging species and promote natural predator-prey relationships, particularly for strongly interactive species (e.g., mountain lions). Habitat configuration and availability allow wildlife populations to adjust their movements (e.g., seasonal migration, foraging, etc.) in response to climate change and promotes genetic flow between wildlife populations. Human-wildlife conflicts are minimal. Hunting, fishing and other wildlife based recreation opportunities exist, but do not compromise species populations or habitat.
- **Threatened, Endangered, and Sensitive Species desired condition:** Threatened, endangered, and sensitive species have quality habitat, stable or increasing populations, and are at low risk for extirpation. Goshawk nest areas are multi-aged forests dominated by large trees with interlocking crowns and are generally denser than the surrounding forest.
- **Guideline:** Project activities and special uses occurring within federally listed species habitat should integrate habitat management objectives and species protection measures from approved recovery plans. Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of Forest Service Sensitive Species. Activities occurring near areas used by bald eagles should follow recommendations identified in the National Bald Eagle Management Guidelines and Arizona Conservation Assessment and Strategy for the Bald Eagle.

The following desired conditions and guidelines were done to help mitigate the potential of habitat loss or disturbance to the federally listed and sensitive species from the implementation of management activities. These desired conditions and guidelines were developed to help ensure that habitat components for these species are incorporated into management activities on the forest. For example the livestock

grazing guidelines help to ensure that grasses and forbs are available to provide habitat for grassland or understory species. These guidelines are in addition to livestock grazing manual and handbook policy and direction. Operating instructions for livestock grazing permittees are reviewed annually and an adaptive management strategy is used to adjust use with capacity and minimize any adverse effects. Beside the listed or sensitive species that are associated with these habitat types, it also provides habitat for prey species for some listed or sensitive species that forage on grassland or understory species.

- **Recreation and Scenery desired conditions**: A wide spectrum of high-quality recreations settings exist. Use levels are compatible with other resource values. Opportunities for off-highway vehicle (OHV) riding and driving for pleasure are available on the designated system of NFS roads and motorized trails.
- **Guidelines**: Any new motorized trailheads should be located in front-country areas, incorporate or convert existing roads, protect open space, and protect natural and cultural resources. Group uses should be concentrated in front-country areas. Resource impacts should be reduced in front and back-country areas by directing camping to existing dispersed and designated campsites. New campsites are designated only when necessary to further reduce resource damage.
- **Livestock Grazing desired condition**: Grasses and forbs provide adequate forage for permitted livestock. Livestock use is consistent with other desired conditions.
- **Guidelines**: Livestock management should favor the development of native cool season grasses and forbs. Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g., forage production, weeds, fawning habitat, soils, etc.). Post-fire grazing should not be authorized until Forest Service range staff confirms range readiness. Livestock use in aspen areas should be authorized at levels that are consistent with the desired conditions for aspen regeneration and establishment. Livestock use in and around wetlands should be evaluated on an allotment specific basis. Mitigation measures such as deferment and fencing (full or partial) should be implemented as needed to minimize potential livestock effects.
- **Forestry and Forest Products desired condition:** Wood products (e.g., wood pellets for home and industrial heating, wood molding, pallets, structural lumber, firewood, post and poles, biomass for electricity) and other products (e.g., Christmas trees, boughs, wildflowers, mushrooms, grasses, seeds, nuts, cones, etc.) are available to businesses and individuals in a manner that is consistent with other desired conditions on a sustainable basis within the capacity of the land.
- **Guidelines:** Timber harvest activities should be carried out in a manner consistent with maintaining or making progress toward the desired conditions in this plan. Harvesting systems should be selected based on their ability to meet desired conditions and not on their ability to provide the greatest dollar return. On suitable timber lands, timber harvest activities should only occur when there is reasonable assurance of restocking within 5 years after final regeneration harvest. On suitable timber lands, even-aged stands should have reached or surpassed 95% of the culmination of mean annual increment prior to having a regeneration harvest, unless it is needed to reduce fire hazard within the wildland-urban interface, or would contribute toward achieving the desired uneven aged vegetation conditions over the long term. On lands classified as not suited for timber production, timber harvesting should only be used for making progress toward desired conditions or for salvage, sanitation, public health, or safety.
- **Transportation and Forest Access desired conditions**: Forest roads, bridges, and trails provide safe, legal, and reasonable access for recreation opportunities and resource management. Resource impacts from roads and trails are balanced with the benefits of having the road or trail available for use. All designated routes open to wheeled motorized vehicles are shown on a motor vehicle use

map (MVUM) that is readily available to the public. The inventoried roadless areas are free from activities that would alter their roadless character.

- **Standard:** Motor vehicle use off the designated system of roads, trails, and areas is prohibited, except as identified on the MVUMs and as authorized by law, permits, and orders in connection with resource management and public safety.
- **Guidelines**: Motorized uses in semiprimitive nonmotorized areas should be restricted, except for necessary minimal administrative activities, permitted activities, and emergency access needs. Construction of permanent roads or temporary roads in semiprimitive nonmotorized areas should be avoided unless required by a valid permitted activity. If authorized, roads should be constructed and maintained at the lowest maintenance level needed for the intended use. Roads should be decommissioned when no longer needed.
- **Recreation Special Uses standard:** Competitive OHV and motorized events are not permitted on the forest.
- **Lands Special Use guidelines:** Uses should be combined to the extent possible in light of technical and environmental constraints.
- **Communications and Electronic Sites guidelines**: The number of communication and electronic sites should be the minimum that is consistent with appropriate public services that require the use of forest lands. Environmental disturbance should be minimized by co-locating communications and electronic sites.
- **Energy Transmission and Development desired conditions**: Energy transmission and development on the forest meets the legal mandates to facilitate the transmission and development of energy resources in a manner that minimizes adverse impacts and does not detract from meeting other desired conditions applicable to the area. Energy transmission lines are not visible (usually underground) across the landscape.
- **Standard**: Major utility corridor development is confined to the area identified and mapped in the "West-wide Energy Corridor Programmatic EIS".
- **Guidelines**: Environmental disturbance should be minimized by co-locating pipelines, power lines, fiber optic lines, and associated infrastructure. Existing energy corridors should be used to their capacity with compatible upgraded powerlines, before evaluating new routes. When compatible with protection of heritage resources, the use of below-ground utilities should be optimized in order to avoid potential conflicts with wildlife, scenery, wildfire, and long-term vegetative management.
- **Minerals and Mining Activities desired condition:** Minerals and mining activities meet the legal mandates to facilitate development of mineral on the forest in a manner that minimizes adverse impacts to surface and groundwater resources, and that do not detract from meeting other desired conditions applicable to the area.
- **Guideline:** Surface use should be restricted or prohibited in areas with habitat for threatened, endangered, and sensitive plant and animal species, and for heritage resources nominated or posted to the National Register. Use and occupancy should be restricted yearlong in areas supporting populations of threatened, endangered and sensitive plant species.

The threats to the California condor are the same as discussed in the alternative A section. Most of the standards and guidelines for protecting wildlife and for range management are beneficial for the condor. Utility corridor easements would have some impacts on the condor. There is a small threat to the condor from rock climbing or blasting if it was allowed to occur within nesting or roosting areas. While some individual birds could be impacted by actions on the Forest, the species would continue to be viable. Table 13 shows there is moderate viability risk to the California condor habitat elements. The desired

condition, guidelines, and standards that provide protection for the condor from utility development and other activities are as follows:

- **Cliffs and Rocky Features desired condition:** Cliff ledges provide cover and nesting habitat for wildlife such as American peregrine falcon, California condor, snakes, bats, birds, and small mammals. Rock climbing and related recreational activities do not disrupt the life processes of rare or threatened species or diminish the function of specialized vegetation, such as mosses, lichens, and fleabanes.
- **Guideline:** Activities involving heavy machinery or blasting should minimize impacts to habitat associated with rocky features and cliffs. Near known active raptor nest sites, temporary closures and use restrictions should be implemented for rock climbing and other potentially disruptive activities.
- **Recreation and Scenery desired conditions**: Visitors have access to information that enriches their recreation experiences and contributes to an understanding of their role in public land stewardship. "Leave No Trace," "Tread Lightly," fire prevention, wild life awareness (e.g. lead reduction, Bear Aware, Animal Inn, etc.), and archaeological resource protection principles are promoted and practiced by the visiting public.
- **Lands Special Uses guideline:** Uses should be combined to the extent possible in light of technical and environmental constraints.
- **Communications and Electronic Sites guideline**: The number of electronic sites should be the minimum that is consistent with appropriate public services that require the use of forest lands. Environmental disturbance should be minimized by co-locating communications and electronic sites.
- **Energy Transmission and Development desired conditions:** Energy transmission and development on the forest meets the legal mandates to facilitate the transmission and development of energy resources in a manner that minimizes adverse impacts and does not detract from meeting other desired conditions applicable to the area. Energy transmission lines are not visible (usually underground) across the landscape.
- **Standard**: Major utility corridor development is confined to the area identified and mapped in the West-wide Energy Corridor Programmatic EIS.
- **Guidelines**: Environmental disturbance should be minimized by co-locating pipelines, power lines, fiber optic lines, and associated infrastructure. Existing energy corridors should be used to their capacity with compatible upgraded powerlines, before evaluating new routes. When compatible with protection of heritage resources, the use of below-ground utilities should be optimized in order to avoid potential conflicts with wildlife, scenery, wildfire, and long-term vegetative management.

Two Mexican spotted owl habitat elements have the same viability risk for all three action alternatives. Ponderosa pine horizontal heterogeneity has a moderate viability risk rating and mesic mixed conifer/spruce fir has a moderate-high viability risk rating.

Beside the desired conditions discussed above in "Effects Similar to all Alternatives", the Apache trout would no longer have the standard that the maximum size objective for any fire within a 2-mile radius of North Canyon Spring is 5 acres. This would benefit the trout by allowing for managed wildfires that could reduce the risk of large-scale wildfires within the watershed. None of the alternatives would increase the amount of habitat available for the trout. Because of the limited habit and the population being in only one small section of the stream, there would always be a high viability risk for this species. The proposed forest management is intended to help provide for the viability of this species.

Sensitive species that depend on ponderosa pine and mixed conifer habitat elements would be affected by desired conditions and guidelines for ponderosa pine and mixed conifer. The desired conditions and

guidelines for these PNVTs would provide for the goshawk, bald eagle, Allen's lappet-browed bat, Kaibab least chipmunk, Kaibab squirrel, Merriam's shrew, and Kaibab northern pocket gopher. Table 13 shows that all the action alternatives have a low to moderate viability risk for these habitat elements for the bald eagle, Kaibab least chipmunk, Kaibab squirrel, and Kaibab northern pocket gopher. While individual species could be negatively impacted by some management activities, the populations for these species on the forest would still be viable. Threats to the species include loss of the following habitat components; mature trees, snags, down logs, removal of mistletoe, and oak trees/mast. There are differences in the amount of acreage for these habitat elements due to the differences in the presettlement tree guidelines between alternative B and alternatives C and D, acreage for these habitat elements are shown in the next sections. However, all other desired conditions, objectives, standards and guidelines would be the same for all three action alternatives.

The goshawk, Allen's lappet-browed bat, and Merriam's shrew show a "high" viability rating only within frequent fire mixed conifer habitat element (Table 13). This habitat element is only one of several different habitat elements these species use. For the rest of their habitat elements, there is low to moderate viability risk for all action alternatives. In addition, the following desired conditions, objectives and guidelines would reduce the threat to species from habitat loss and would provide long-term viability for the species that depend on the following habitat elements (including Mexican spotted owl). For a full description of the vegetation desired condition see appendix C. This section highlights some of the important wildlife components.

- **Ponderosa Pine desired condition**: *Fine*: Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking and consist of approximately 2 to 40 trees per group. Gambel oak mast (acorns) provides food for wildlife species. Where Gambel oak comprises more than 10% of the basal area, it is not uncommon for canopy cover to be greater than 40%. Isolated infestations of dwarf mistletoe may occur, but the degree of severity and amount of mortality varies among the infected trees. Witch's brooms may form on infected trees, providing habitat for wildlife species. *Mid-Scale:* Forest conditions in some areas contain 10 to 20 % higher basal area in mid-aged to old tree groups than in the general forest (e.g., goshawk post-fledging family areas, Mexican spotted owl protected areas, drainages, and steep north-facing slopes). Snags 18 inches diameter at breast height (d.b.h.) or greater average 1 to 2 snags per acre. Snags and green snags of variable size and form are common. Downed logs (greater than 12 inches diameter at mid-point, and greater than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons per acre. *Landscape*: The ponderosa pine forest is composed predominantly of vigorous trees, but declining trees are present. Snags, green snags, and coarse woody debris occur across the landscape. Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing and maintaining or expanding its presence within its natural range. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- **Objectives:** To make progress toward the desired conditions and reduce the potential for active crown fire in ponderosa pine communities at a rate that would maintain the desired conditions over time: (1) Mechanically thin 11,000 to 19,000 acres annually using a combination of group selection cuts with matrix thinning and all-size free thinning. (2) Treat an average of 13,000 to 55,000 acres annually using a combination of prescribed fire and naturally ignited wildfires.
- **Frequent Fire Mixed Conifer desired condition**: *Fine:* Dwarf mistletoe infections may be present on ponderosa pine and Douglas-fir, and rarely on other tree species, but the degree of infection

severity and amount of mortality vary among infected trees. Witch's brooms may be present with these infestations, providing habitat for wildlife. *Mid-scale:* Forest conditions in some areas contain 10 to 20 **%** higher basal area in mid-aged to old tree group than in the general forest; these include goshawk post-fledging family areas (PFAs), Mexican spotted owl protected habitat, and north-facing slopes. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. Where they naturally occur, groups or patches of aspen and all structural stages of oak are present. Snags and green snags, 18 inches d.b.h. or greater average 3 per acre. Downed logs (greater than12 inches diameter at mid-point and greater than 8 feet long) average 3 per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre. *Landscape:* Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). The frequent fire mixed conifer forest community is composed predominantly of vigorous trees, but declining trees are present and snags, top killed, lightning- and fire-scarred trees, and coarse woody debris (greater than 3-inch diameter) are well-distributed throughout the landscape. Dwarf-mistletoe is present and infects ponderosa pine and Douglas-fir, but occurs at endemics levels, which allows for the establishment and sustainability of the desired uneven aged forest structure over time.

- **Objective**: To reduce the potential for active crown fire and restore frequent fire mixed conifer communities: Burn an average of 1,000 to 13,000 acres annually, using prescribed fire and/or naturally ignited wildfires. Mechanically thin 1,200 to 2,100 acres annually.
- **Mesic Mixed Conifer/Spruce-Fir desired condition**: *Fine:* Mid-aged and older trees are typically variably-spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Dwarf mistletoe infections may be present on Douglas-fir or spruce and rarely on other tree species, but the degree of infection severity and amount of mortality vary among infected trees. Witch's brooms may be present with these infestations, providing habitat for wildlife. *Mid-Scale:* Forest conditions in some areas contain higher basal area than the general forest; examples include goshawk post family fledgling areas, Mexican spotted owl nesting/roosting habitat, and north-facing slopes. The number of snags and downed logs (> 12-inch diameter at mid-point, greater than 8 feet long) and coarse woody debris (> 3-inch diameter) vary by seral stage. Snags 18 inches or greater at d.b.h. typically range from 1 to 5 snags per acre, with the lower range associated with early seral stages and the upper range associated with late seral stages. Coarse woody debris varies by seral stage, but ranges from 5 to 20 tons per acre for early seral, 20 to 40 tons per acre in mid seral, and 35 tons per acre in late seral areas. *Landscape*: The forest landscape is a functioning ecosystem that contains all components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, wind, snow, and fire), including snags, downed logs, and old trees. Dwarf mistletoe infestations may be present in stands that are composed of Douglas-fir or spruce and rarely in other tree species. Witch's brooms may be scattered throughout the infestations providing structural diversity in the stand and improved foraging and nesting habitat for wildlife species such as small mammals (e.g. tree squirrels), and raptors (e.g. goshawks, spotted owls).
- **Vegetation Management in All Forested Communities guidelines**: Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. As such, the largest and oldest trees are usually retained. Project design and treatment prescriptions should generally not remove: (1) Mature trees with large mistletoe brooms suitable for wildlife nesting, caching, and denning, except where retaining such trees would prevent the desired development of uneven-aged conditions over time; (2) Large snags, partial snags and trees (> 18" dbh) with broken tops, sloughing bark, lightning scars > 4 inches wide, and large stick nests **(**> 18 inches in diameter); and

(3) Known bat roost trees. Trees established after 1890 should generally not be retained in areas where biophysical conditions would have supported stable openings over time. Vegetation management should favor the development of native understory species in areas where they have the potential to establish and grow.

- **Large-scale Disturbance Events in Forest and Woodland Communities objectives:** To reestablish ponderosa pine in areas with inadequate seed source and reduce the time to achieve the desired forest structure: Plant 300 to 700 acres annually.
- **Guidelines:** Recovery and restoration project design should seek to establish a trajectory toward the desired conditions for the affected vegetation type. Where conifer seed sources are lost or poorly distributed due to high-intensity fire, artificial regeneration (planting, etc.) should be implemented to promote the desired forest structure and accelerate the recovery of habitat conditions for native wildlife species. Some snags and coarse woody debris should be retained to provide for wildlife habitat, soil stabilization, and other resource benefits. Some clumps of large (18 inches d.b.h.) standing dead trees should be retained. Project design should incorporate measures to protect regeneration and reforestation investments.
- **Threatened, Endangered, and Sensitive Species guideline:** For each goshawk territory, a minimum of 6 nest areas (known and replacement) should be established. Nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should be 25 to 30 acres in size. Goshawk territories (post-fledging family areas) of approximately 420 acres in size should be designated surrounding the nest areas. Project-related activities should be minimized in occupied goshawk nest areas during the goshawk nesting season, March 1 through September 30. Potentially disturbing project-related activities should be restricted within 300 yards of active raptor nest sites between April 1 and August 15.

Sensitive species that depend on riparian or wetland habitat and either constructed or natural waters have several desired conditions, objectives, and guidelines in the action alternatives that protect wetland habitat on the forest and are designed to reduce threats to the species. These threats include invasive weeds, loss of riparian habitat, and grazing. These desired conditions, objectives and guidelines would help provide for viability of the bald eagle, Kaibab fairy shrimp, northern leopard frog and long-tailed vole. The bald eagle had a low to moderate viability risk for all habitat elements. In addition, the desired condition discussed above in "Effects Similar for All Alternatives" for the water elements, the following objectives and guidelines also mitigate impacts to Kaibab fairy shrimp, northern leopard frog and long-tailed vole:

- **Wetland/Cienega objective:** Restore native vegetation and natural water flow patterns on at least 6 acres of wetlands within 5 years of plan approval.
- **Natural Waters objective**: Protect and/or restore at least 10 individual springs within 5 years of plan approval.
- **Guideline**: Access to natural waters should be restricted to designated trails and points of entry to mediate erosion and prevent trampling and inadvertent introduction of non-native and undesirable biota and disease. Activities in and around waters should use decontamination procedures to prevent the spread of chytrid fungus. Diversions of water sources that recharge wetlands should be assessed and appropriate actions should be identified to mitigate or minimize effects. Spring source areas should be preferentially protected. Water rights for springs should be secured where there are no existing water rights or claims. The impacts of management activities on springs, streams, and wetlands should be evaluated and minimized.
- **Constructed Waters guideline**: Scholz Lake should not be managed for recreational sport fishing. In riparian aquatic areas, current protocols for preventing the spread of chytrid fungus should be

followed. If new drinkers are necessary, they should be constructed in areas that reduce ungulate impact to sensitive vegetation or soils such as riparian, aspen, and wet meadow areas.

- **Invasive Species desired condition**: Invasive species are contained and/or controlled so that they do not disrupt the structure or function of ecosystems.
- **Guideline:** All ground-disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species. New populations are detected early, monitored, and treated as soon as possible. Treatment approaches should use Integrated Pest Management (IPM) practices to treat noxious and nonnative invasive species. IPM includes manual, biological, mechanical, and herbicide/pesticide treatments. Use of pesticide, herbicide, and biocontrol agents should minimize impacts on non-target flora and fauna.
- **Livestock Grazing guideline**: Livestock use in and around wetlands should be evaluated on an allotment-specific basis. Mitigation measures such as deferment and fencing (full or partial) should be implemented as needed to minimize potential livestock effects. The concentrated use of montane meadows for livestock grazing should be minimized when soils are saturated to reduce grassland impacts. When no other options are available, use should be rotated annually.

The amount of riparian or wetland habitat and waters could have a slight increase from the current amount of habitat due to restoration work. The quality of existing habitat should increase as wetlands and springs are surveyed and monitored, the Forest would be able to better assess which areas are no longer in proper functioning condition and improvements can be done. The listed desired conditions, objectives and guidelines should provide long-term viability for the Kaibab fairy shrimp, northern leopard frog and long-tail vole and would not lead toward federal listing of these species.

Sensitive species that depend on grasslands, meadows, shrublands, desert communities, caves and mines, and rocky outcrops, cliffs and canyons have desired conditions, objectives, standards, and guidelines to help protect these habitat elements or species dependent on them (see appendix C). The species that depend on these habitat elements are the western burrowing owl, peregrine falcon, pale Townsend's big-eared bat, House Rock Valley chisel-toothed kangaroo rat, spotted bat, Allen's lappet-browed bat, long-tailed vole, Navajo Mogollon vole, Kaibab least chipmunk, desert bighorn sheep, dwarf shrew, and Kaibab northern pocket gopher. Table 18 shows that the action alternatives have a low to moderate viability risk for these habitat elements for all of these species except House Rock Valley chisel-toothed kangaroo rat, and desert bighorn sheep. These two species are discussed above in "Effects Similar for All Alternatives". In addition the Forest will continue to protect bighorn sheep from disease that may come from contact with domestic sheep or goats with the following guideline:

- **Livestock Grazing Guideline:** Grazing of domestic sheep and goats should not be authorized on the Tusayan and North Kaibab Ranger Districts due to the proximity of bighorn sheep in Grand Canyon and Kanab Creek to prevent the spread of disease between domestic and wild populations.

Shrublands, desert communities, caves and mines, and rock outcrops, cliffs and canyons habitat is not expected to increase under any of the three action alternatives. The objective for restoring grassland is stated as following: "Reduce tree and shrub density to less than 10 percent on 5,000 to 10,000 acres of historic grasslands annually." This would restore between 75,000 to 150,000 acres of grasslands and meadows in 15 years. This work would shift some areas of existing vegetation from ponderosa pine or pinyon-juniper stands to grasslands. These areas are within the grassland PNVT for grasslands because they were historically grasslands. It would not change the amount of the PNVT, but would improve the quality of the habitat. Species that depend on grassland habitat elements would maintain their viability for

all three action alternatives, and none of the alternatives would lead toward Federal listing of these species.

Other Federal Law Compliance

No programmatic take will be requested under the Bald and Golden Eagle Protection Act for any of the three action alternatives. Migrating bald eagles use the forest during the winter with no known established winter roost sites. In 2012, the first known bald eagle nesting occurred on the forest, with the young of the year fledging from the nest site. There are golden eagle nest sites on the Forest. There are no management standards or guidelines within the Plan that would promote removing the nest sites of either eagle species. In addition, the following guidelines would provide protection for these species:

- **Vegetation Management in All Forested Communities:** Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. As such, the largest and oldest trees are usually retained. Project design should manage for replacement structural stages to assure continuous representation of old growth over time. Project design and treatment prescriptions should generally not remove: Large snags, partial snags and trees with broken tops (> 18" dbh), sloughing bark, lightning scars greater than 4 inches wide, and large stick nests (> 18" in diameter).
- **Wildlife:** Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of wildlife, particularly for raptors. Project activities and special uses should incorporate recommended measures for golden eagle management such as closures to limit human disturbance in the vicinity of golden eagle nests. Potentially disturbing project-related activities should be restricted within 300 yards of active raptor nest sites between April 1 and August 15.
- **Threatened, Endangered, and Sensitive Species:** Activities occurring near areas used by bald eagles should follow recommendations identified in the National Bald Eagle Management Guidelines and Arizona Conservation Assessment and Strategy for the Bald Eagle.
- **Activities on or near Cliffs and Rocky Features**: Activities involving heavy machinery or blasting should minimize impacts to habitat associated with rocky features and cliffs. Near known active raptor nest sites, temporary closures and use restrictions should be implemented for rock climbing and other potentially disruptive activities.
- **Communication and Electronic Sites**: The number of communication and electronic sites should be the minimal that is consistent with appropriate public services that require the use of forest lands. Environmental disturbance should be minimized by co-locating communication and electronic sites.
- **Energy Transmission and Development**: Environmental disturbance should be minimized by co-locating pipelines, power lines, fiber optic lines, and associated infrastructure. Existing energy corridors should be used to their capacity with compatible upgraded power lines, before evaluating new routes. When compatible with protection of heritage resources, the use of below ground utilities should be optimized in order to avoid potential conflicts with wildlife, scenery, wildfire, and long-term vegetative management.

Requirements of Executive Order 13186 were followed while developing plan components that provide for migratory birds. During the development of plan components, migratory birds were considered and desired conditions and guidelines were incorporated to help provide for their conservation. The Important Bird Areas Program (IBA) is a global effort lead by the Audubon Society which focuses on the identification and conservation of areas that are vital to birds and other biodiversity. No important bird areas are identified on the Kaibab NF. During the planning stage of all national forest management

decisions, a review of effects and development of mitigations to reduce impacts to migratory birds is required. The following are steps that were taken in compliance with the Executive Order 13186 and the MOU with Fish and Wildlife Service:

- Where desired conditions coincide with reference conditions, returning habitats to desired conditions should protect, restore, and conserve habitat of migratory birds.
- The Forest worked with the Fish and Wildlife Service, Arizona Game and Fish Department, and non-federal partners to develop the forest planning species list, which includes migratory birds that are on the Fish and Wildlife Service Birds of Conservation Concern (USFWS 2008), the Arizona Partner in Flight list, and are Arizona Species of Greatest Conservation Concern.
- Numerous desired conditions and guidelines provide for and protect migratory bird habitat (see appendix C).
- The monitoring plan (chapter 5) also addresses some migratory birds; Wildlife and Fish (MIS) by asking the question: "What is the estimated population density and trend for Graces warbler, western bluebird and ruby-crowned kinglet?" The Forest does not just survey for these species within their habitat type. While collecting point data for these species, all bird species located are recorded. For species that have enough detections, population density estimates can be calculated. Species information will vary by location.

ALTERNATIVE B - PREFFERRED ALTERNATIVE

Alternative B has the least amount of species and associated habitat elements that rate out in a very high (2), high (6) or moderate-high (19) viability risk rating (table 13-16). It also has the least amount of habitat elements departed from reference conditions (12 with fair rating and 1 with poor rating). In general, the reason the habitat elements had the fair or poor rating is due to other laws and regulations, the need to work with other agencies, or the vegetation type is of lower priority for management. The Forest is unlikely to receive the additional funding required to improve these habitat types to reference conditions.

Desired conditions are based on the best scientific information available that describes reference condition for the different vegetation types of ponderosa pine, mixed-conifer and woodlands and savannas. Alternative B is the alternative that would set these vegetation types on a trajectory that would most be most likely to achieve reference conditions. Moving habitat elements to reference condition or at least toward reference condition should provide for viable species populations for those species who co-evolved with these systems.

The following is the presettlement tree retention guideline for ponderosa pine and frequent fire mixed conifer for Alternative B: "Project design and treatment prescriptions should generally not remove: Large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs (e.g. Thomson's age class 4, Dunning's tree class 5 and/or Keen's Tree Class 4, A and B."

Beside the recommendations for coping with climate change that were discussed in effects similar for all action alternatives, this alternative is better suited to meeting the following: (1) reducing nonclimate stressors on ecosystems; (2) managing for more diverse conditions; (3) maintaining healthy, connected diverse populations; (4) reducing risk of catastrophic fires; and (5) reducing likelihood of catastrophic events affecting populations. Alternative B is better at meeting the above recommendations because it has a greater ability to create desired openings, which should promote greater regeneration of the herbaceous

understory. Over time this should increase the likelihood of restoring natural fire regimes and achieving desired vegetation densities.

According to the Non Native Invasive Species Specialist Report (KNF 2013b) alternative B is the most beneficial for preventing and controlling invasive species. Although the preferred alternative proposes the highest amount of vegetation treatments and planned disturbance out of the four alternatives, thereby creating the highest risk of the spread/introduction of invasive species, it also generates the highest potential for long term native understory enhancement. This in turn increases the ability for native species to out-compete invasive species over the long term, decreasing susceptibility to uncharacteristic fire.

In addition to federally listed species and Forest Service sensitive species, the evening grosbeak and olive-side flycatcher both had a moderate viability rating for the frequent fire mixed conifer habitat element under the proposed action (table 13). This alternative has the lowest viability risk to these species.

Federally Listed Species and Sensitive Species

The Mexican spotted owl has a moderate-high viability rating only in the frequent fire mixed conifer and a moderate viability rating for the ponderosa pine/Gambel oak, ponderosa pine vertical heterogeneity and horizontal heterogeneity habitat components in alternative B. Overall for alterative B in 15 years, the Mexican spotted owl ponderosa pine/Gambel oak habitat component would increase by 1,460 acres for a total of 14,602 and mixed conifer habitat would decrease by 639 acres for a total of 34,484 acres. However, while the VDDT model shows a decline in mixed conifer habitat, the model likely overstates the amount of habitat loss. Most of the loss habitat is due to wildfires within closed canopy systems. The rest of the habitat loss due to individual thinning or logging projects would likely not occur due to project level mitigations employed to meet the recovery plan for the owl. The viability of the species would continue under this alternative.

The goshawk, Allen's lappet-browed bat, and Merriam's shrew have a moderate viability rating for frequent fire mixed conifer habitat element (table 13).

For all sensitive species within ponderosa pine and mixed conifer habitat, in 15 years the VDDT modeling (summarized in Table 19 below) shows the following changes in habitat acreage from current conditions:

- Goshawk ponderosa pine habitat would increase by 49,237 acres for a total of 235,244 acres. Frequent fire mixed conifer would increase by 5,350 acres for a total of 35,310 acres. Overall goshawk habitat would increase 54,587 acres for an overall total of 270,554 acres.
- Bald eagle and Allen's lappet-browed bat ponderosa pine habitat would decrease by 6,018 acres for a total of 404,839 acres. The Allen's lappet-browed bat frequent fire mixed conifer habitat would decrease by 3,253 acres for a total of 67,517 acres. The total change in habitat for the bat would be a decrease of 9,271 acres for a total of 472,356 acres of habitat.
- Kaibab least chipmunk and Kaibab northern pocket gopher mixed conifer with aspen habitat is estimated to stay at the same acreage. Both species would have an increase of 4,279 acres for a total of 7,107 acres of mesic mixed conifer/spruce fir habitat. This would provide for a total of 27,005 acres of conifer habitat for both species.
- Kaibab tree squirrel ponderosa pine habitat would decrease by 1,685 acres for a total of 101,100 acres; optimum habitat would increase by 13,756 acres for a total of 65,868 acres.

- Merriam' shrew ponderosa pine habitat would increase by 142,241 acres for a total of 273,540. Frequent fire mixed conifer would increase by 22,095 acres for a total of 36,701. Overall Merriam's shrew habitat would increase 164,336 acres for a total of 310,241 acres.

Based on the risk to viability rating and the amount of habitat provided for each of the above species, viability would be maintained for each of these species under this alternative. While individual species could be impacted by the actions under this alternative, the alternative would not lead toward Federal listing of the above sensitive species.

ALTERNATIVES C&D

Alternatives C and D would have similar affects for all the wildlife forest planning species; as a result they are analyzed together. While the effects to the viability ratings are the same between both alternatives, there is a difference in the amount of habitat affected between alternatives C and D.

While the alternatives are similar in the total number of habitat elements departed from reference condition as in Alternative A (Table 12), they have more in fair condition and less in poor condition (13 in fair and 5 in poor). These alternatives have more species rated in very high, high, or moderate-high viability rating than Alternative B and less than Alternative A (tables 13-16).

The presettlement tree-retention guideline for alternatives C and D would replace the following guideline in alternative B: "Project design and treatment prescriptions should generally not remove: Large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or gnarled limbs " replaced with "Projects should retain trees with physical characteristics typical of those that were established prior to 1890 (i.e., generally larger than 16" in diameter at breast height, with yellowing platy bark."

The presettlement tree-retention guideline in Alternatives C and D would likely be implemented as a diameter cap of a particular size (based on site conditions). Because all coniferous trees above the diameter cap would be retained, treatment would likely be less effective than alternative B for developing the desired conditions for ponderosa pine, frequent fire mixed conifer and aspen (Williams Ranger District) habitat elements for the following reasons:

- In order to achieve the desired mix of clumps and openings (horizontal heterogeneity), in ponderosa pine and frequent fire mixed conifer stands that have many large trees, it becomes necessary to remove most or all of the smaller trees. This results in more single storied even-aged stands and reduces vertical and horizontal heterogeneity.
- Retaining and regenerating aspen would not be as effective if some of the larger, older conifers cannot be removed to reduce shading and competition.
- Restoration treatments of grasslands would be less effective at restoring historic reference conditions in some areas.
- Restoration treatments of woodlands and savannas would be less effective at restoring historic reference conditions in some areas.

The combined effect of the above guideline and the increased risk of stand-replacing fires is one which could negatively impact wildlife species through a reduction in foraging, breeding, and nesting habitat. The following species could be negatively impacted by implementing this guideline: Mexican spotted owl, northern goshawk, evening grosbeak, Grace's warbler, olive-sided flycatcher, Lewis' woodpecker, McGillivray's warbler, green-tailed towhee, golden-crowned kinglet, red-naped woodpecker, orange-crowned warbler, Arizona black rattlesnake, Arizona treefrog, Allen's lappet-browed bat, southwestern

myotis, Abert's squirrel, Kaibab tree squirrel, and Merriam's shrew. While these species could be negatively affected at the local scale, overall, the other habitat improvements within these vegetation types would still help maintain overall viability for each of these species.

Alternatives C and D are the least effective at controlling and preventing invasive weeds for several reasons. The Vegetation and Fire Section notes the potential for increased stand-replacing fire that would occur at later time intervals due to potential guidelines in alternatives C and D. Because invasive species populations are correlated with increased stand-replacing fires (see Non Native Invasive Species Specialist Report; KNF 2013b), there is the potential for invasive species to increase over time under these alternatives. This also negatively affects the forest's ability to cope with climate change. Finally, the following species would be directly affected by an increase in invasive weeds: golden eagle, western burrowing owl, milksnake, Great Basin spadefoot, Gunnison's prairie dog, House Rock Valley chisel-tooth kangaroo rat, and Navajo Mogollon vole. Invasive weeds have the potential to outcompete native plants necessary for foraging, nesting, and burrowing by these species.

In addition, for federally listed species and Forest Service sensitive species, the evening grosbeak and olive-side flycatcher had a moderate-high viability rating for these alternatives (Table 13) for the frequent fire mixed conifer habitat element. Both these species are found in multiple habitat elements that have a low to moderate viability rating. The viability of the species would be maintained through the habitat elements that are at a lower risk and the level of habitat treatment occurring within the habitat element at a high risk of viability.

Federally Listed Species and Sensitive Species

The Mexican spotted owl has a moderate-high viability risk for ponderosa pine-Gambel oak and vertical heterogeneity habitat elements, and a high viability risk for the frequent fire mixed conifer habitat element. These risks are based on the potential effect of the presettlement tree retention guideline in areas that have an abundance of large trees within stands, limiting the Forest's ability to restore those areas. Overall for alternative C in 15 years, the Mexican spotted owl habitat ponderosa pine/Gambel oak would decrease by 985 acres for a total of 12,309 acres and mixed conifer habitat would decrease by 7,025 acres for a total of 28,098 acres. For alterative D, in 15 years the Mexican spotted owl habitat ponderosa pine/Gambel oak would decrease by 1,477 acres for a total of 11,817 acres and mixed conifer habitat would decrease by 9,579 acres for a total of 25,544 acres. However, while the VDDT model shows a decline in both conifer habitats, the model likely overstated the amount of habitat loss. While most of the loss to habitat is due to wildfires, the remaining habitat loss is due to individual thinning or logging projects that would not likely occur due to project level mitigations used to meet the recovery plan for the owl.

The goshawk, Allen's lappet-browed bat, and Merriam's shrew show moderate-high viability rating only within frequent fire mixed conifer habitat element (table 13). This habitat element is only one of several different habitat elements these species used.

For all sensitive species within ponderosa pine and mixed conifer habitat, in 15 years the VDDT modeling shows the following changes from current conditions for alterative C.

- Goshawk ponderosa pine habitat would increase by 5,471 acres, for a total of 191,478 acres. Frequent fire mixed conifer would decrease by 3,745 acres, for a total of 26,215. Overall goshawk habitat would increase by 1,726 acres, for a total of 217,693 acres.

- Bald eagle and Allen's lappet-browed bat ponderosa pine habitat would increase by 4,924 acres, for a total of 415,781 acres. The Allen's lappet-browed bat frequent fire mixed conifer habitat would decrease by 4,430 acres, for a total of 66,340 acres of habitat. The total change in habitat for the bat would be an increase of 443 acres for a total of 482,121 acres of habitat.
- Kaibab least chipmunk and Kaibab northern pocket gopher mixed conifer with aspen habitat is estimated to stay at the same acreage. Both species would have an increase of 3,491 acres, for a total of 6,319 acres of mesic mixed conifer/spruce fir habitat. This would provide a total of 26,167 acres of conifer habitat for both species.
- Kaibab tree squirrel overall ponderosa pine habitat would decrease by 4,748 acres for a total of 98,037 acres; optimum habitat would increase by 1,532 acres for a total of 53,614 acres.
- Merriam's shrew ponderosa pine habitat would increase by 125,829 acres for a total of 257,128. Frequent fire mixed conifer would increase by 18,029 acres for a total of 32,635. Overall, Merriam's shrew habitat would increase 143,858 acres for a total of 289,763 acres.

For all sensitive species within ponderosa pine and mixed conifer habitat, in 15 years the VDDT modeling (summarized in Table 19 below) shows the following changes from current conditions for alterative D.

- Goshawk ponderosa pine habitat would decrease by 10,941 acres, for a total of 175,066 acres. Frequent fire mixed conifer would decrease by 4,280 acres, for a total of 25,680. Overall, goshawk habitat would decrease by 15,221 acres, for a total of 200,746 acres.
- Bald eagle and Allen's lappet-browed bat ponderosa pine habitat would increase by 4,924 acres, for a total of 415,781 acres. The Allen's lappet-browed bat frequent fire mixed conifer habitat would decrease by 6,570 acres, for a total of 64,200 acres of habitat. The total change in habitat for the bat would be a decrease of 1,646 acres, for a total of 479,981 acres of habitat.
- Kaibab least chipmunk and Kaibab northern pocket gopher mixed conifer with aspen habitat is estimated to stay the same acreage. Both species would have an increase of 3,491 acres, for a total of 6,319 acres of mesic mixed conifer/spruce fir habitat. This would provide a total of 26,167 acres of conifer habitat for both species.
- Kaibab tree squirrel overall ponderosa pine habitat would decrease by 7,812 acres, for a total of 94,973 acres; optimum habitat would decrease by 3,064 acres, for a total of 49,018 acres.
- Merriam's shrew ponderosa pine habitat would increase by 131,299 acres, for a total of 262,598 acres. Frequent fire mixed conifer would increase by 20,062 acres, for a total of 34,668. Overall, Merriam's shrew habitat would increase 151,361 acres, for a total of 297,266 acres.

Based on the risk to viability rating and the amount of habitat provided for each of the above species, viability would be maintained for each of these species under both alternatives. While individual species could be impacted by the actions under both alternatives, neither alternative would lead toward Federal listing of the above sensitive species.

SUMMARY OF COMPARISON OF ALTERNATIVES

Alternative A has the greatest potential to negatively affect wildlife species because it lacks clear desired conditions and guidelines that were developed using the best available science. This alternative also is least able to respond and adapt to a changing environment.

Alternative B has the greatest ability for maintaining viable wildlife populations over time. This alternative is the best at setting the vegetation types on a trajectory towards one which will be most likely to achieve reference conditions. Alternative B is best at meeting the recommendations proposed to help

wildlife species coping with climate change because it includes specific guidance that provides for resilient ecosystems.

The main difference between Alternative B and Alternatives C&D is the large tree retention guideline. This guideline affects all vegetation management activities associated with ponderosa pine, frequent fire mixed conifer, and woodlands and savannas. This guideline has the potential, for areas that currently contain a high number of large trees, in not achieving the desired clumps and openings within conifer stands. This guideline could also affect savanna and woodland habitat restoration by retaining a higher density of conifer trees than would naturally occur in these areas. Alternative C&D is better than Alternative A in providing for species viability and promoting the ability to cope with climate change for most species, but not as good as Alternative B.

Table 19. Changes in Acres of Ponderosa Pine and Mixed Conifer Habitat by Alternative

	Change in Habitat Acres by Alternative				
Species	Current	Alt A	Alt B	Alt C	Alt D
Mexican spotted owl (nesting/roosting habitat)	48,417	49,054	49,255	40,407	37,361
Northern goshawk (nesting/roosting)	215,967	236,542	270,554	217,693	200,746
Bald eagle	410,857	415,781	404,839	415,781	415,781
Allen's lappet-browed bat	481,627	496,244	472,356	482,121	479,981
Kaibab least chipmunk	22,676	23,370	27,005	26,167	26,167
Kaibab northern pocket gopher	22,676	23,370	27,005	26,167	26,167
Kaibab tree squirrel					
All habitat	102,785	101,100	101,100	98,037	94,973
Optimum habitat	52,082	55,146	65,868	53,614	49,018
Merriam's shrew	145,905	231,551	310,241	289,763	297,266

MANAGEMENT INDICATOR SPECIES

The white paper "Management Indicator Species Selection for the Kaibab National Forest Plan Revision" outlines the full selection process and rationale for the species selected for the three action alternatives (KNF 2011; Appendix I of FEIS.)

The KNF four priority "needs for change" identified during the Analysis of the Management Situation (AMS), guided the selection process; 1) Modify stand structure and density towards reference conditions and restore historic fire regimes 2) Regenerate aspen to insure long-term healthy aspen populations 3) Restore natural waters and wetlands to insure healthy riparian communities 4) Restore historic grasslands by reducing tree encroachment and restoring fire.

Based on these priority needs for change, complimentary lines of evidence, the proposed action, and plan alternatives, the Forest identified four MIS species that it believes would serve as strong indicators of management. The four species were selected because they have special habitat needs that may be influenced significantly by planned management under the alternatives. The results are summarized below. All the species were selected as species with special habitat needs that may be influenced significantly by planned management programs. In addition, the pronghorn is a species that is commonly hunted and has strong local interest. Under alternative A, the forest would continue to use the current MIS

list. However, for the purposes of analysis and comparison, only the proposed MIS are used to evaluate the alternatives.

Table 20. MIS used in the evolution of all alternatives

Species	What they are a Indictor for	Priority Need for Change	Different in Plan alternatives
Grace's Warbler (*Setophaga graciae*)	Clumps of mature ponderosa pine/pine-oak forests, yellow pine, (park-like environments, such as reference condition).	Modify stand structure and density towards reference conditions and restore historic fire regimes.	In ponderosa pine, will show the difference in stand structure between alternatives.
Western Bluebird (*Sialia mexicana*)	Understory development within openings in ponderosa pine stands	Modify stand structure and density towards reference conditions and restore historic fire regimes.	Will show the difference between alternatives in openings within stands.
Ruby-crowned Kinglet (*Regulus calendula*)	Mixed conifer (frequent fire) mature forest, overstory.	Modify stand structure and density towards reference conditions and restore historic fire regimes.	Will show the potential for moving toward reference conditions between alternatives.
Pronghorn (*Antilocapra americana*)	Grasslands	Restore historic grasslands by reducing tree encroachment and restoring fire.	Will show the potential for moving toward reference conditions between alternatives.

Songbirds are considered to be sensitive to a variety of "environmental quality" attributes, and are commonly monitored to assess the impacts of management activity due to their sensitivity to changes in vegetation structure and composition (Saracco et al. 2008; Dickson et al. 2009). Songbirds are relatively easy to survey for because data can be collected on many species at a time without additional effort. Forest-wide breeding bird surveys have been conducted on the KNF by the Forest and the Rocky Mountain Bird Observatory (RMBO) since 2005. Survey data are analyzed using widely accepted statistical methods. Under the existing sample design, it is possible to detect an average annual population change of three percent within 15 to 30 years. The methodology yields robust and statistically sound density estimates for the proposed MIS species. Existing breeding bird survey data suggest a stable to increasing trend for all three bird species across the Forest (Birek et al. 2010). These data serve as a solid baseline for future analyses and help to evaluate consequences across all planning alternatives.

Further, existing land bird survey methodology also incorporates data collection on fine scale vegetation variables at each point count station. These data will be incorporated into species-habitat models to discern which predictor variables are most tightly linked to each MIS species. Forest Service projects would concurrently collect data on these same variables to ascertain how well projects are meeting the needs of these species over time. A comprehensive review after 5 years should allow the Forest enough time to reasonably assess if any management changes are warranted.

The Arizona Game &Fish Department is already monitoring and tracking population trend data for pronghorn on the KNF; the forest would continue to use those data to assess population trends and relate it to habitat.

While MIS are to be selected to reflect the major management issues (needs for change), MIS are not always be the best approach to evaluate management. Two of the needs for change, aspen and natural waters, would be better served by "Ecological Indicators." Ecological indicators are plants or animal species, communities, or special habitats that have a narrow range or ecological tolerance that are part of monitoring plan. They differ from MIS in that there is no requirement to estimate populations trends, rather a number of different parameters can be assessed to evaluate management effects.

Aspen stands are an integral component of southwestern forests. In fact, aspen acts as a keystone species in the sense that its removal or addition may have significant impacts on community composition and structure. Second only to riparian systems in terms of biodiversity, loss of aspen represents a loss of diversity in the forest that affects numerous wildlife species, plants, and abiotic processes (Campbell and Bartos 2001). The proposed plan details specific objectives for aspen, however because aspen has a declining trend and the primary factors affecting aspen health are outside of Forest Service control, aspen was not considered a good MIS. The monitoring plan in the action alternatives would monitor aspen directly as an ecological indicator with questions focused on regeneration, extent and mortality.

Fencing and ungulate removal should allow aspen to regenerate and facilitate long-term restoration. The forest currently dedicates some resources to aspen monitoring already, primarily on the Williams RD, and peer reviewed protocols for sampling aspen exist (USDA Forest Service 2004, Jones et al. 2005). Aspen on the North Kaibab is abundant enough to be tracked through the Forest Service's existing Forest Inventory and Analysis (FIA) program.

Natural waters and wetlands emerged as key theme in the CER because the value of KNF waters is disproportionately greater than the area they represent. As oases across a primarily arid landscape, these features are extremely valuable to flora and fauna and provide important recreational, cultural and economic benefit. Springs and wetlands are highly variable depending on available water, elevation, soils, and other site factors. There is no single terrestrial or aquatic species common enough or cost-effective enough to serve as a good MIS. There are instead a suite of indicators that indicate healthy (water quality) or disturbed (non-native invasive) aquatic ecosystems.

The forest has conducted two cycles of wetland surveys and has baseline trend data for this resource. In addition, the Forest has entered into an agreement with the Museum of Northern Arizona to conduct an inventory and assessment of springs which is to be managed in a user friendly database. This inventory would serve as a baseline for future survey work, monitoring and trend analysis. Improved spring and wetland habitat should be visible over time as the new plan is implemented and the effects of ground disturbance by humans and/or ungulates are abated.

BACKGROUND FOR ALTERNATIVE A: MIS FOR CURRENT PLAN

In 1988, the KNF selected 18 MIS species (Table 21), all of which are still maintained as MIS for the current plan. Each species was selected to represent a particular habitat or habitat characteristic found on the forest. As indicators, they were selected to represent all wildlife and rare plant species found or associated with habitat or habitat components thought to indicate forest health and effects of management activities.

Table 21. Current Management Indicator Species for the Kaibab National Forest and the habitat or habitat components they represent.

Management Indicator Species	Habitat or Habitat Component
Aquatic macroinvertebrates	Riparian
Cinnamon teal (*Anas cyanoptera)*	Late-seral wetlands
Northern goshawk (*Accipiter gentilis)*	Late-seral ponderosa pine
Pygmy nuthatch (*Sitia pygmaea*)	Late-seral ponderosa pine
Turkey (*Meleagris gallopavo*)	Late-seral ponderosa pine
Mexican spotted owl (*Strix occidentalis lucida)*	Late-seral mixed conifer and spruce-fir
Red squirrel (*Tamiasciurus hudsonicus*)	Late-seral mixed conifer and spruce-fir
Lucy's warbler (*Vermivora luciae*)	Late-seral, low elevation (<7,000') riparian
Yellow-breasted chat (*Icteria virens*)	Late-seral, low elevation (<7,000') riparian
Lincoln's sparrow (*Melospia lincolnii*)	Late-seral, high elevation (>7,000') riparian
Hairy woodpecker (*Picoides villosus*)	Snags in ponderosa pine, mixed conifer and spruce-fir
Juniper titmouse (*Baeolophus ridgwayi*)	Late-seral pinyon-juniper and snags in pinyon- juniper
Red-naped sapsucker (*Sphyrapicus varius)*	Late-seral aspen and snags in aspen
Elk (*Cervis elaphus*)	Early-seral ponderosa pine, mixed conifer, spruce-fir
Mule deer (*Odocoileus hemionus*)	Early-seral aspen and pinyon-juniper
Pronghorn (*Antilocapra americana*)	Early- and later seral grassland
Tassel-eared squirrel (*Sciurus aberti*)	Early-seral ponderosa pine
Arizona bugbane (*Actea arizonica*)	Forest Plan describes habitat where the plant is found.

When the MIS species were originally selected, the Forest Plan called for even-aged timber management. Therefore, the species represent vegetation types by early and late seral stage. Eventually, as management continues under the revised 1996 Forest Plan, descriptions of "seral stage" and "stand conditions" will no longer apply due to application of uneven-aged management prescriptions. The 1996 amendment also included the Mexican spotted owl recovery plan. In areas where MSO habitat is located or are suspected to be, standards for the MSO take precedence.

It is important to note that not all of the species selected in 1986 specifically have value as MIS on the forest. Some of the selected MIS do not actually occur on the KNF or occur too infrequently to be reliable indicators for the habitats they were selected to represent. Habitats for these species are either limited in frequency or only occur in areas too limited to maintain a population of the species. Some species have proven to be impractical to monitor and others are poor indicators of management effects on the Forest. The current MIS list has proven to provide limited utility in support of adaptive management.

The Kaibab National Forest Forest-wide assessment for MIS (KNF 2011) provides the documentation on why certain species on the current list do not make a good MIS. The following is a summary for each of those species.

- Cinnamon teal – KNF supports individual birds rather than a population of cinnamon teal on the forest. No ability to do a population trend and associate any changes to management actions.

- Northern goshawk - Difficult to effectively assess population trends. Population fluctuations may be more closely tied to variable weather conditions and the interrelated response by the species' mammalian prey base. Habitat generalist.
- Mexican spotted owls - Species is not well distributed in the planning area. Limited to six PACs on the Williams Ranger District. Difficult to assess population trends and relate to habitat changes and assess differences between management alternatives.
- Lucy's warbler – Very limited habitat, little is known how habitat changes affect this bird, and likely have individual birds rather than a population of Lucy's warbler on the forest.
- Yellow-breasted chats – Very limited habitat and it is unknown if the species occurs on the forest.
- Lincoln's sparrows – Habitat is limited and there is no resident population.
- Tassel-eared squirrel – is shown as an indicator for early-seral ponderosa pine when in fact this is not the habitat type they use.

Beside the species discussed in the Kaibab Forest-wide MIS Assessment, elk and mule deer also do not make good MIS. They both use a wide variety of habitats and have many outside factors that affect population trends. It is not possible to tie management activities with forest-wide population trends for these two species.

As noted above, the forest would continue to use the current MIS list if alternative A is selected. However, for the purposes of analysis and comparison, only the new proposed MIS are used to evaluate the alternatives.

MANAGEMENT INDICATOR SPECIES CURRENT POPULATION AND HABITAT TRENDS

In the following analyses, for the three bird MIS, both density and occupancy estimates were used as complimentary lines of evidence for evaluating habitat and population trends. Density estimates are presented for data collected since 2005. The Forest switched sampling design methodology in 2010 to support occupancy estimation, a robust analytical tool for assessing presence/absence of difficult to detect, cryptic and or wide-ranging species. Occupancy data, when analyzed with environmental covariates (e.g. plant composition, structure etc.) can also provide meaningful information on habitat use at both local and landscape scales. Data for both density and occupancy estimates are presented where available. In some instances, where sample size was limited, data provide a meaningful baseline, which will support future analyses. Occupancy data are further correlated with habitat quality to provide more meaningful insight on existing and potential habitat rends.

Grace's Warbler

In Stacier and Guzy (2002), they cite a study across pine and pine-oak forests of northern Arizona (Kaibab National Forest, north rim of Grand Canyon, Camp Navajo, and three districts of Coconino National Forest) that the Grace's warbler is the fifth-most common bird species. In this study, the Grace's warbler was present in 22 of 23 stands. Ranges of habitat measurements: canopy cover 20–64% ponderosa pine and 2–14% Gamble's oak; basal area 12–36 m2/ha pine and 1–6 m2/ha oak; herbaceous cover 10–71%. Density of pines in 5 size classes: 26–2,067 stems/ha for trees 2.5–12.5 cm (<1 to 5"); 47–496 stems/ha for trees 12.6–30.4 cm (5 to 12"); 22–136 stems/ha for trees 12.7–45.6 cm (5 to 18"); 4–46 stems/ha for trees 45.7–60.9 cm (18 to 24"); 1–30 stems/ha for trees >61 cm (>24"). In another study in Coconino Co., Grace's warbler was found to be common on silviculturally thinned and control plots, averages were: 90 and 92% ponderosa pine; 10 and 8% oak or juniper. The Grace's warbler foraging niche is in ponderosa-pine forest where it feeds mostly in tall pines, picking insects from finer foliage,

perching on needles and twigs. In mature pines, foraging height typically ranges from 17–27 m (55 to 89') (Stacier and Guzy 2002).

The main concern for this species across it range is habitat alteration and fragmentation. Present-day ponderosa-pine forests differ greatly from presettlement forests because of logging, fuelwood harvest, fire suppression, grazing, and urban development. Size-class distributions are now skewed to smaller trees, with a more closed canopy, higher levels of disease, depleted understories, and high susceptibility to crown fires (Stacier and Guzy 2002). On the Kaibab National Forest, this is seen more on the Williams and Tusayan Ranger District than on the North Kaibab Ranger District. Previously, park-like forests with clumps of large trees and grassy openings were maintained by low-intensity ground fires every 1–12 yr, limiting dense growth of young pines. It is likely then that Grace's warbler who relies on large trees is less common in ponderosa-pine forests now than they were historically. Information suggests that pine forests that more closely mimic naturally open parklands with stands of large, mature trees, will eventually benefit this species. Previous research suggests that some manipulation of dense, nonvirgin stands may be beneficial. In northern Arizona, Grace's warbler was most abundant in a silviculturally thinned forest (236 trees/ha of mixed-age and heterogeneous vertical and horizontal structure) than in unthinned, dense forest (646 trees/ha but similar foliage volume); greater levels of thinning (to 181 trees/ha), however, resulted in lower abundance (Stacier and Guzy 2002).

Current Habitat and Population Tend

Grace's warbler is an indicator for ponderosa pine mature clumps within stands. On the Forest there is approximately 515,148 acres of ponderosa pine cover type and the PNVT for ponderosa pine covers 541,000 acres (KNF 2009 and 2010). The main difference between cover type and PNVT is that cover type reflects what is currently found on the forest while PNVT reflects what was on the Forest historically, depending on soil type, historic fire regime, and natural disturbance. Occupancy model results for the Grace's warbler show that 245,417acres are of high quality and 132,161 acres are of moderate quality, for a total of 377,578 acres within ponderosa pine based on occupancy potential.

The ponderosa pine forest on the KNF is highly departed from reference condition (KNF CER 2009). This trend would continue under existing management (Vegetation and Fire Specialist Report, KNF 2013a). The amount and arrangement of forest developmental stages, and increased tree density/canopy cover are the primary characteristics that are departed. Only 19% of the PNVT is currently in the reference condition. The reference condition is defined as mature to old forest with various-sized patches of young regenerating forest. With the current rate of treatment within ponderosa pine forest, the current habitat trend would be considered stable; however there would not be progression towards the habitat reference condition.

The Forest has conducted bird surveys on the forest since 2005 with surveys being contracted out to Rocky Mountain Bird Observatory (RMBO) since 2007 (Table 22). The RMBO incorporated data collected by the forest in 2005 and 2006 with the data from their surveys done since 2007. Currently, density estimate tables and graphs (Table 23 and Figure 2) on the RMBO website reflect data up to 2008. This website was checked again in January 2013 and the data had not been updated for any of the species. The 2009 and 2010 reports show a density of 36.79 and 25.26 respectively (Birek et al. 2010, White et al. 2011). With the 2010 survey data the RMBO was able to do estimated proportion of transects (Psi) occupied by species. A Psi estimate equal to 1 indicates the species was detected on all transects surveyed. In total, 45 transects were surveyed on the KNF in 2010. The Grace's warbler had a Psi of .425, with the species found on 19 transects (White et al. 2011). Population trends based on forest monitoring appear to be stable within ponderosa pine habitats.

Table 22. Count of Grace's Warbler by year on KNF (RMBO website; access 05/16/2011)

Counts by Species

Species	2005	2006	2007	2008	2009	2010	TotalYear
Grace's Warbler	128	155	135	220	488	473	1599

Table 23. Grace's Warbler Density Estimates (RMBO Website)

Habitat	years	D	%CV	LCL	UCL	n
MC	2005	36.78	49	15.72	86.10	10
MC	2006	4.93	39	2.65	9.20	18
MC	2007	14.76	61	5.59	38.97	13
MC	2008	24.14	41	12.39	47.03	50
PP	2005	34.21	23	23.19	50.48	97
PP	2006	25.24	23	17.14	37.18	76
PP	2007	24.84	23	16.99	36.32	114
PP	2008	24.76	24	16.79	36.51	147

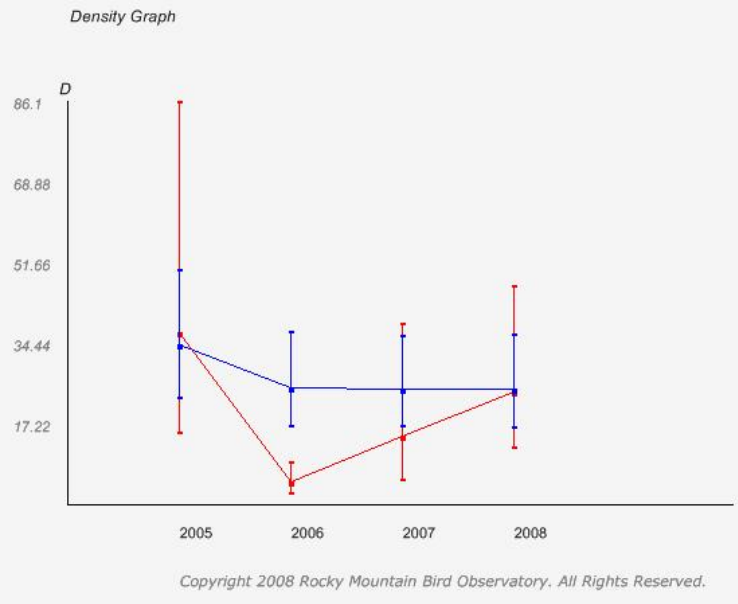
D = Density (birds/km^2)

%CV = Percent Coefficient of Variation

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

n = Number of detections used to estimate D



D = Density (birds/km^2)
Red - MC
Blue - PP

Figure 2. Grace's Warbler Density Estimates Graph (Rocky Mountain Bird Observatory Website)

Trends in occupancy for Grace's warbler indicate an initial decrease in occupancy from 2006 to 2007 followed by an increase in subsequent years. As more bird surveys are done this may help influence the model results (Dickson et al. 2011). Results for Grace's warbler indicate a strong relationship with habitat variables.

Modeling results for Grace's warbler indicate that basal area and canopy cover were strong positive predictors of occupancy for that species. Northeastern orientation, while not a "strong" predictor, did appear to negatively affect occupancy and indicated an affinity for more xeric habitat conditions. These results are consistent with other studies that have generally found Grace's warbler in xeric pine or pine-oak dominate habitats with a diversity of tree size classes (Stacier & Guzy 2002).

Annual estimates of occupancy for Grace's Warbler were highest in 2006, lowest in 2007, and appeared to increase slightly between 2008 and 2009. Similarly, this species displayed annual increases in colonization while local extinction rates were similar across years. Multi-season occupancy models indicated increasing (although variable) trends for Grace's warbler (Dickson et al. 2011). In Figure 3, the occupancy probability colors range from high occurrence (shown in blue with a value of 1) to no occurrence (shown in orange with a value of 0).

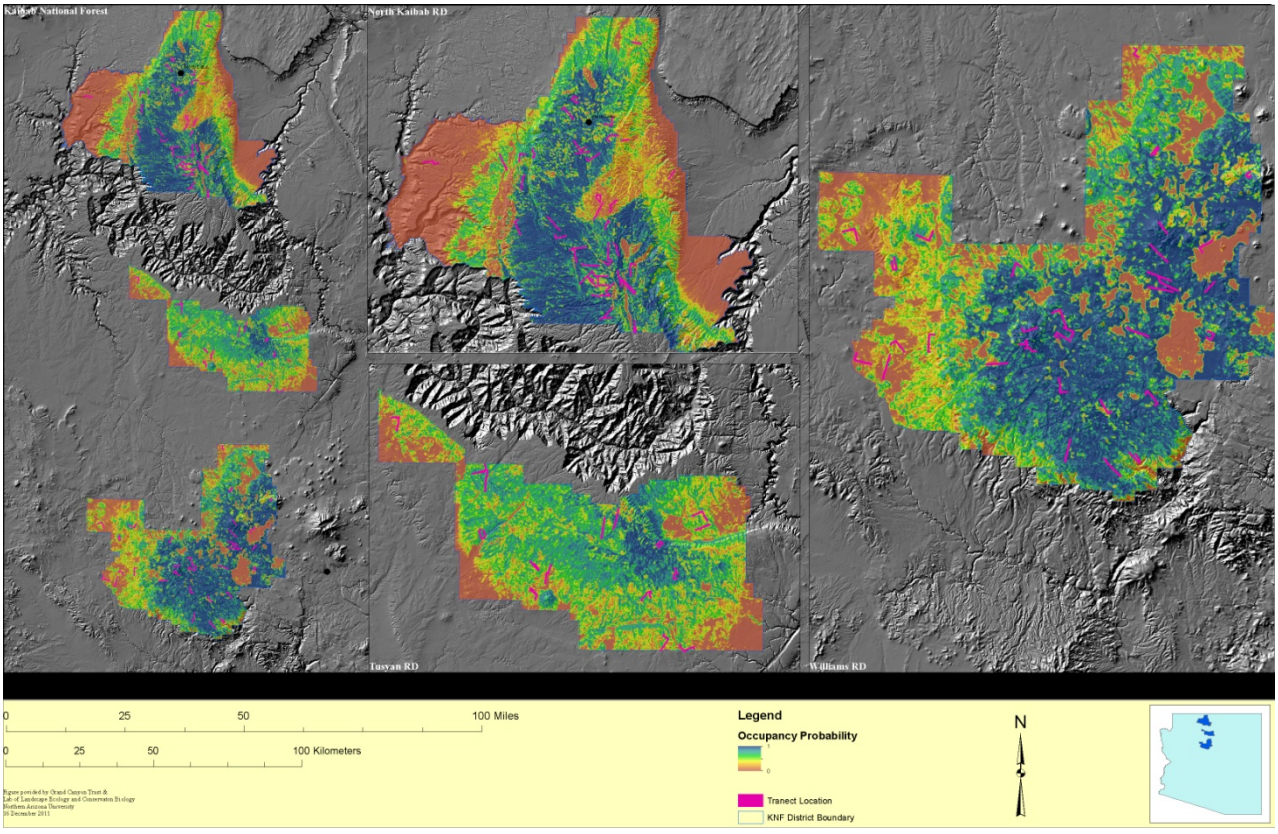


Figure 3. Spatially explicit model of Grace's Warbler occupancy on the Kaibab and Coconino National Forests (Arizona, USA), 2010 (Dickson et al. 2011).

In summary the current forest-wide habitat and population trend for the Grace's warbler is stable.

Western Bluebird

Western bluebirds are typically found in open, park like forests, edge habitats, burned areas and where moderate amounts of logging have occurred, provided a sufficient number of larger trees and snags remain to provide nest sites and perches. The species does not favor large, open meadows. Clear-cutting, snag removal, fire suppression, and any changes in land use that cause open forest and edge habitat to be diminished adversely affect western bluebird populations (Guinan et al. 2008).

In much of western bluebird range, the species is commonly associated with ponderosa pine forests and has a preference for open overstory; abundant in moderately disturbed areas, including moderately logged forests, and burned areas, where sufficient nest sites and foraging perches are available. In northern Arizona, breeding densities were greatest in a moderately thinned study plot of ponderosa pine forest with a tree density of 181 trees/ha, canopy volume of 6,526 m^3/ha and a mean tree height of 11.5 m. In mixed fir-pine forest of the White Mountains., Arizona, western bluebirds bred only in treated areas with a tree density 167.7 trees/ha and were absent from the control area that had 626.2 trees/ha (Guinan et al. 2008).

Western bluebirds may benefit from some thinning of forests. In Guinan et al. (2008), they cite that moderate logging increased density of breeding western bluebirds in northern Arizona from 8 pairs/40 ha to 31 pairs/40 ha on a thinned plot (225 trees/ha) and 35 pairs/40 ha on an open plot (69 trees/ha.. In that study, the restoration of ponderosa pine forests by thinning of dense stands, followed by controlled burns and reseeding, increased nest and fledgling success, and decreased predation. The effects of fire and salvage logging in burned forests however are unclear. In some areas, there is a higher abundance of birds in areas of low snag density, but with more nests in areas of medium to high snag density. In other areas, there are more nests in areas of low – medium snag density than in areas with higher snag density (Guinan et al. 2008).

Long-term measures proposed to develop and provide habitat for the western bluebird include the following: Controlled and natural burning can be used to prevent dense forest growth and overgrowth of open areas; retention of snags, and preservation of older, large, and partially dead trees. Silvicultural practices that retain snags, leave sufficient numbers of mature trees to ensure adequate snag recruitment for the future, and retain smaller saplings and scattered shrubs for cover and foraging perches will provide suitable habitat in managed forests. Recommendations developed from research on habitat restoration treatments and nesting success include: increasing herbaceous ground cover; reduction of ponderosa pine density to $\leq$ 270 stems/ha (no lower threshold established, but suggested to range from 57 to 150 stems/ha); retain Gambel oak trees and snags where present (Guinan et al. 2008).

Recommendations for fire-management include: mimicking of natural fire regimens (size, timing, frequency, and severity), allowing for stand replacement burns where historic; consideration of effects of burn geometry (size, heterogeneity in terms of burn severity, and burn-to-edge ratio) in management policies (Guinan et al. 2008).

Current Habitat and Population Trend

The western bluebird, a ground foraging species, which depends largely on the understory for, capture of invertebrate prey is an indicator for understory development within openings in mature ponderosa pine forest. On the Forest there is approximately 515,148 acres of ponderosa pine and the PNVT for ponderosa pine covers 541,000 acres (KNF 2009 and 2010). Occupancy model results for the western bluebird show that 417,111 acres within the ponderosa pine are high quality habitat while 64,315 acres are of moderate habitat quality, for a total of 481,426 acres with potential occupancy.

Vegetation models created for the forest plan revision process suggest that the ponderosa pine forest on the KNF is highly departed from reference condition. Under current management, these forests will remain highly departed from reference conditions. The amount and arrangement of the developmental stages, and increased tree density/canopy cover are the primary characteristics that are departed. Only 19% of the PNVT is currently in the historic condition. Historic condition is defined as mature to old forest with various-sized patches of young regenerating forest (KNF 2009 and 2010). While the Forest is out of reference condition, the current rate of treatment within ponderosa pine should keep the habitat condition at a stable trend. However, it would not move the habitat toward reference condition.

The Forest has conducted bird surveys across all three of its ranger districts since 2005, with surveys contracted out to Rocky Mountain Bird Observatory (RMBO) since 2007(Table 24). Currently, the RMBO website only reflects data through 2008 on their density estimates table and graphs (Table 25 and Figure 4). The 2009 report showed a density of 33.59 (Birek et al. 2010). The 2010 report (White et al. 2011) showed the western bluebird had a .626 Psi and had the 5th highest occupancy rate out of 62 species that occupancy could be estimated for. Due to a change in sample design methodology, the density number for 2010 is not comparable to the previous data. There was a reduction of transects within the ponderosa pine habitat. Population trends based on forest monitoring appeared to be stable.

Table 24. Count of Western Bluebird by year on KNF (Rocky Mountain Bird Observatory Website; access 05/16/2011)

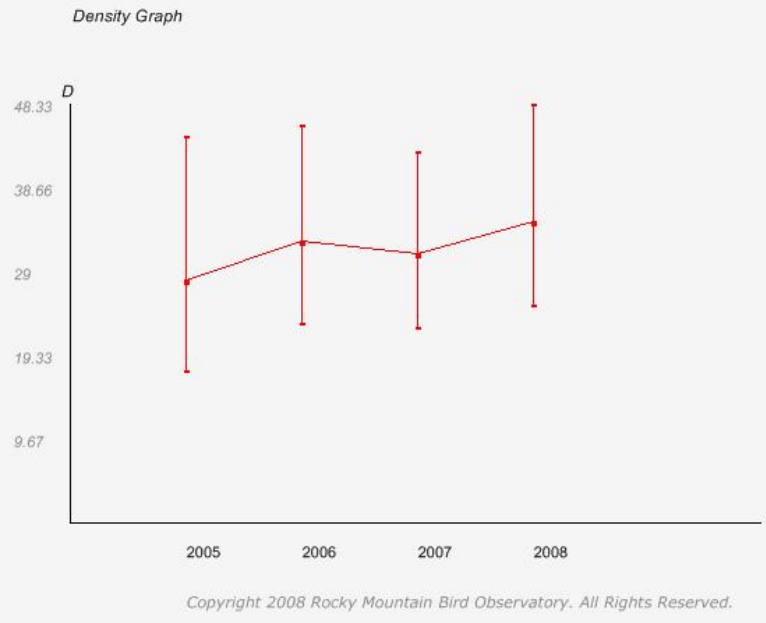
Counts by Species

Species	2005	2006	2007	2008	2009	2010	TotalYear
Western Bluebird	44	83	87	151	414	284	1063

Table 25. Western Bluebird Density Estimates (Rocky Mountain Bird Observatory Website)

Habitat	years	D	%CV	LCL	UCL	n
PP	2005	28.08	27	17.66	44.66	38
PP	2006	32.56	20	23.05	45.99	47
PP	2007	31.14	19	22.60	42.91	64
PP	2008	34.95	19	25.28	48.33	96

D = Density (birds/km^2)
%CV = Percent Coefficient of Variation
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
n = Number of detections used to estimate



D = Density (birds/km^2)

Red - PP

Figure 4. Western Bluebird Density Estimates Graph (Rocky Mountain Bird Observatory Website)

Trends in occupancy for the western bluebird indicated an initial decrease in occupancy from 2006 to 2007 followed by an increase in subsequent years. Western bluebird occupancy were positively associated

with both basal area and those locations with canopy cover <30%. This is consistent with the species' preference for more open, park-like forested settings. The presence of ponderosa pine habitat was a strong predictor for western bluebird (Dickson et al. 2011).

Western Bluebird occupancy was also fairly steady throughout the analysis period, with the exception of decline in 2007 and subsequent increase in 2008.

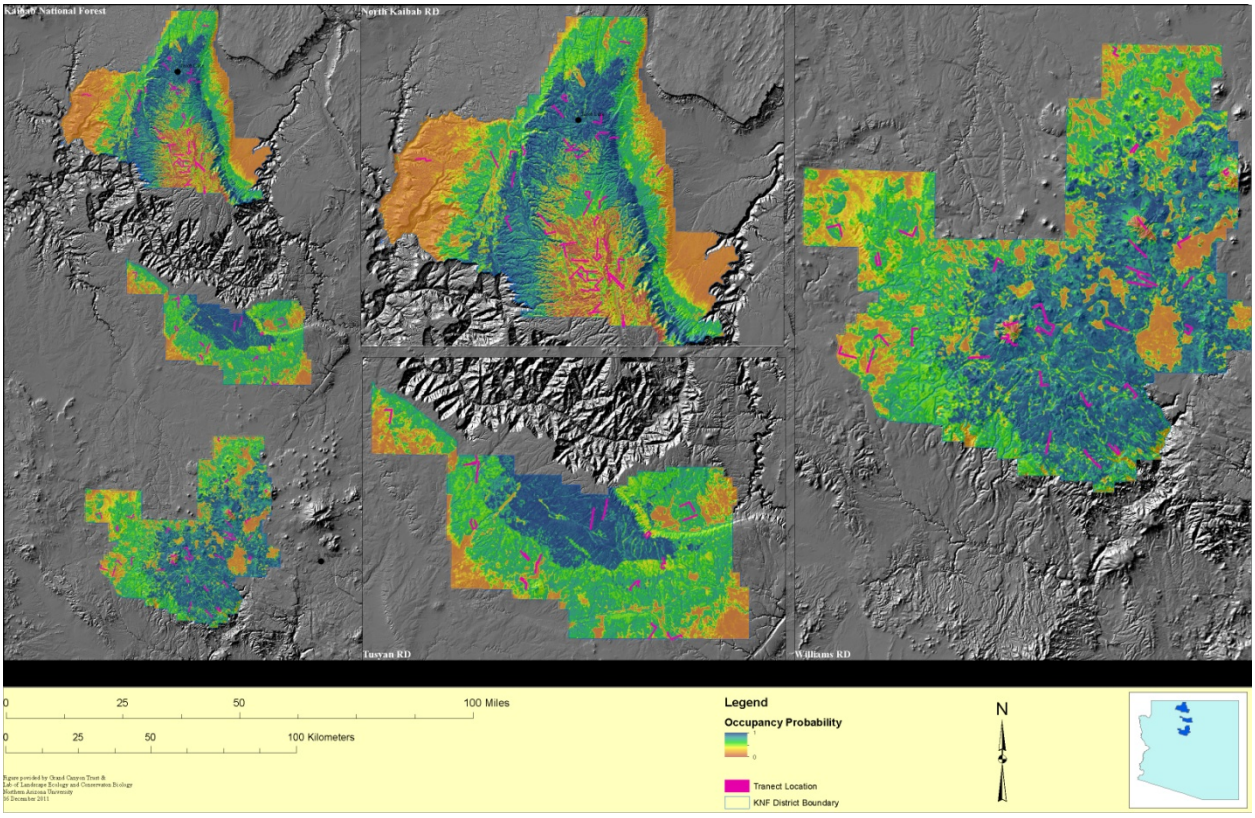


Figure 5. Spatially explicit model of Western Bluebird occupancy on the Kaibab and Coconino National Forests (Arizona, USA), 2010 (Dickson et al. 2011).

In summary, the current Forest-wide habitat and population trend for the western bluebird is stable.

Ruby-crowned Kinglet

During the breeding season, ruby-crowned kinglets typically forage and nest in dense foliage high in the conifer forest treetops. In Arizona, they reach their highest densities in mixed-conifer forests. Breeding ruby-crowned kinglets are most abundant and widespread on the Kaibab Plateau and in the White Mountains. They are also found regularly in the San Francisco Mountains, Sitgreaves and Bill Williams mountains (Corman and Wise-Gervais 2005). This species breeds in dry, open coniferous and mixed forests at high elevations.

While this species is not a mixed-conifer obligate (Swanson et al. 2008), it does appear to be strongly associated with this habitat type. Predicting the effects of future forest management action on this species will require information at fine scales as management actions are more likely to impact existing forest structure for the species at that level.

Current Habitat and Population Trend

The ruby-crowned kinglet is an indicator for mature overstory in frequent fire mixed conifer. On the Forest there is approximately 39,130 acres of mixed conifer cover type and the PNVT for mixed conifer covers 127,900 acres (KNF 2009 and 2010). These numbers also include mesic mixed-conifer, which is too difficult to differentiate based on the sampling and modeling methods used for forest planning. However, the majority of the acreage in the mixed conifer PNVT is classified as frequent fire mixed-conifer (~107,000; KNF 2008b) and for this analysis the whole PNVT will be treated as frequent fire mixed conifer. This is consistent with analyses in the Vegetation and Fire Specialist Report (KNF 2013a). Since there is a wide difference between the cover type and PNVT, the occupancy mapping (Figure 7) done by Williamson and Dickson (2011) for the PNVT appears to provide better estimates for the amount of habitat that could potentially be available for the species. The occupancy modeling results for the ruby-crowned kinglet show that 17,112 acres within the mixed-conifer are of high quality habitat while 2,997 acres are moderate quality.

The majority of the mixed conifer cover type and PNVT occurs at high elevations on the North Kaibab Ranger District with a small amount (~14,200 acres) on the Williams Ranger District. This PNVT is younger and denser than during the reference period. About 5% of the area exists in a mature uneven-age state and only 23% of the area is comprised of uneven aged groups. Recent management has focused on moving towards reference conditions. The prescriptions have primarily thinned small trees around or under older trees. In some cases, group selection cuts have removed patches of large trees to promote regeneration within larger uneven-aged areas. Wildland fires within this PNVT are suppressed (KNF 2009 and 2010). While the Forest is out of reference condition, the current rate of treatment within the mixed conifer stands should keep the current habitat trend stable however; it would not move the habitat toward reference conditions over a large portion of the forest.

The Forest has collected data on the ruby-crowned kinglet since 2005 (Table 26). Currently the RMBO website only includes data up to 2008 on their density estimate tables and graphs (Table 27 and Figure 6). The 2009 reports show a density of 102.23 (Birek et al. 2010). In 2010 surveys were based on a new sample design and the amount of surveys within mixed conifer stands was greatly reduced. As a result there were not enough ruby-crowned kinglets found to conduct a density estimate, with only 47 birds found. However, an estimated proportion of transects occupied for the 2010 surveys for the ruby-crowned kinglet was completed with a .113 Psi, being found on 5 transects (White et al. 2011). Their greatest population density, 74 birds/40 ha, was recorded in unlogged, mixed conifers in Arizona (Swanson et al. 2008). Trends based on forest monitoring from 2005-2009 suggest this species appears to be increasing (but is variable) at this time.

Table 26. Count of Ruby-crowned kinglet by year on KNF (RMBO website; access 05/16/2011)

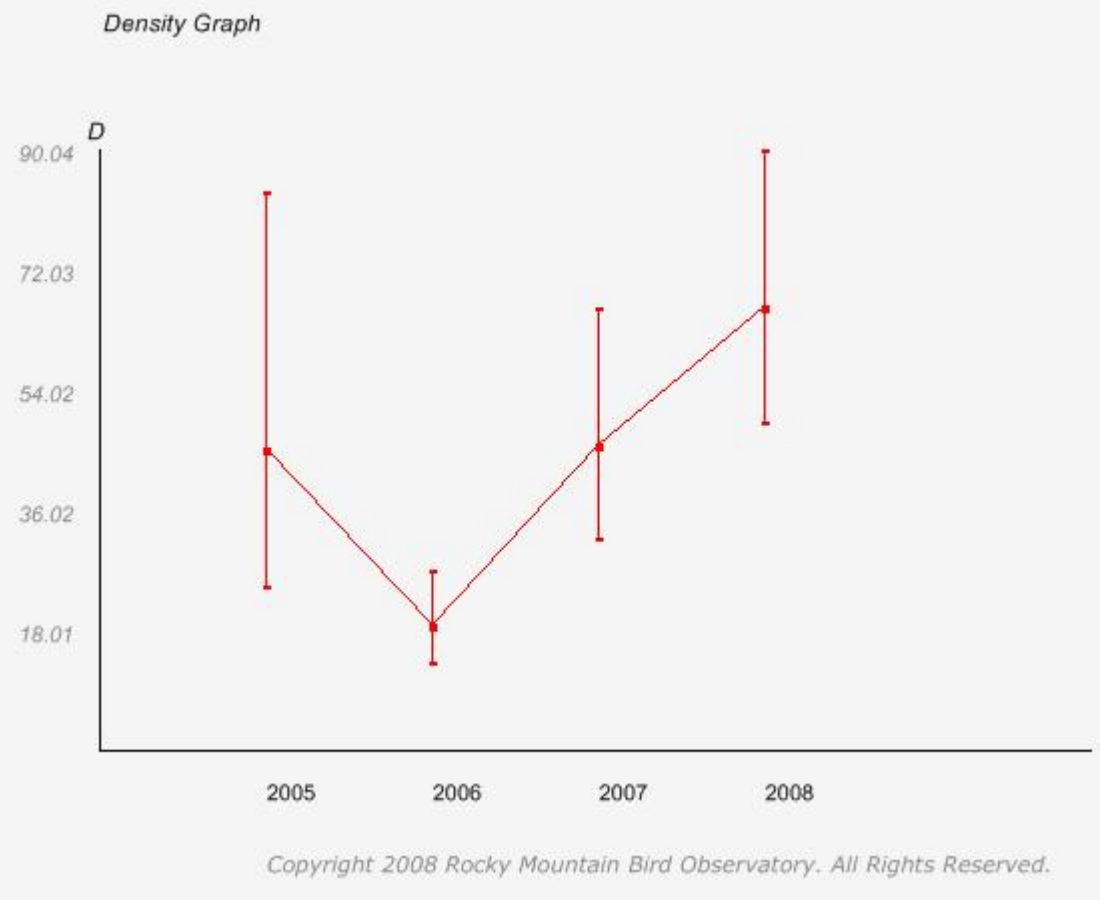
Counts by Species

Species	2005	2006	2007	2008	2009	2010	TotalYear
Ruby-crowned Kinglet	41	173	66	217	301	53	851

Table 27. Ruby-crowned Kinglet Density Estimates (RMBO Website)

Habitat	years	D	%CV	LCL	UCL	n
MC	2005	45.47	34	24.64	83.90	17
MC	2006	19.13	22	13.44	27.24	96
MC	2007	46.22	21	32.08	66.61	56
MC	2008	66.69	18	49.39	90.04	189

D = Density (birds/km^2)
%CV = Percent Coefficient of Variation
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
n = Number of detections used to estimate D



D = Density (birds/km^2)
Red - MC

Figure 6. Ruby-crown Kinglet Density Estimates Graph (Rocky Mountain Bird Observatory Website)

Variation in vegetation type was the strongest predictor of ruby-crowned kinglet occupancy; however, the magnitude of the parameter estimate for the mixed-conifer habitat type is likely to be a stronger contributor to the development of spatial models. This species appears to be strongly associated with the mixed-conifer habitat type. Model results show a strong association between the ruby-crowned kinglet and selected habitat variables.

Occupancy trends were not presented for the ruby-crowned kinglet due to the sharp change in detectability from 2006 to 2007 and insufficient sample sizes to estimate colonization and local extinction for those first two years of surveys.

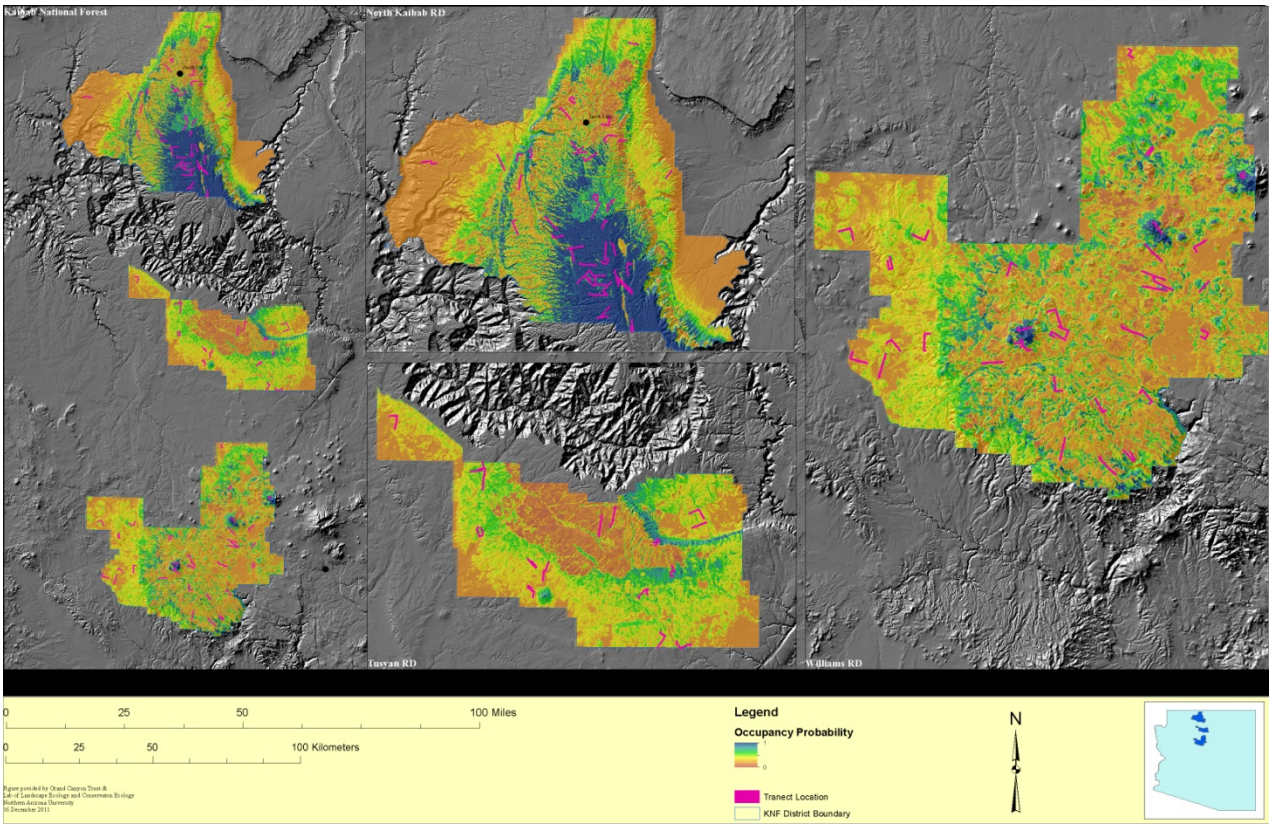


Figure 7. Spatially explicit model of Ruby-crowned Kinglet occupancy on the Kaibab and Coconino National Forests (Arizona, USA), 2010 (Dickson etal. 2011).

In summary, the current Forest-wide habitat trend for the ruby-crowned kinglet is stable. While the Forest monitoring data seems to imply an increasing population trend, the occupancy modeling could not determine a trend in support of the density data. To be conservative, the Forest-wide population trend is considered stable at this time.

Pronghorn

Pronghorn are the only current MIS species retained for the revised plan. In the current plan pronghorn are an indicator of early- and late-seral grasslands. For this analysis they are an indicator of grasslands. The 2010 Forest-wide MIS Assessment (KNF 2011) provided information about pronghorn on the forest and is incorporated by reference in this report.

Causes of decline in pronghorn herds across Arizona are numerous, but generally consistent. Paramount to the persistence of any wildlife species is presence of quality habitat. Continued urban sprawl and associated highway construction has fragmented and damaged quality pronghorn habitat (the latter continues to cause direct mortality via collision with vehicles and barriers for movement). Grasslands on the forest have been reduced in size by invasion of conifers, juniper, and shrub species resulting from decades of fire suppression. Past livestock grazing and historic fencing practices have reduced habitat

quality and created barriers to pronghorn movement and migration routes. Finally, persistent drought and predation has impacted pronghorn populations to varying degrees statewide. The combination of these factors has led to a reduction in habitat availability and quality, a substantial decline in fawn recruitment, and a correlated increase in efficiency of pronghorn predators (AZGFD 2011).

The Statewide Pronghorn Management Plan (AZGFD 2011) discusses many of the issues for pronghorn populations. The following are the issues that could result from forest management activities.

- Pronghorn traverse fences by passing under, rather than over the fence; woven wire or fences with bottom wires below 20 inches act as barriers to pronghorn movements. Fences become more impervious barriers to pronghorn movement when they are placed near high-traffic roads.
- Isolated populations become increasingly vulnerable to extirpation as population size decreases. (population fragmentation)
- Fawning cover is generally provided by herbaceous vegetation that is >11 inches in height, with little shrub cover.
- Pronghorn generally occupy open grassland or shrub-steppe habitats. Encroachment of shrubs or trees have reduced suitability of habitat, resulted in habitat abandonment, and isolated herds from historic interchange.
- Pronghorn rely on forbs as the predominant food item, although shrubs may be important seasonally. Optimal vegetative composition should be short (<25 inches tall) shrubs (10-35% ground cover) and forb and grass (30-50% ground cover), emphasizing a diversity of forb species. Nutritional considerations of digestibility, quality, and nutrient levels are also important.

Pronghorn are found on all the Game Management Units (GMU) that occurs on the forest. Table 27 shows the units and how they are distributed on the forest.

Table 28. GMU and portion on the Kaibab National Forest

GMU	Ranger District	Portion on KNF	Comments
7	Williams RD	~ 45% of unit	Pronghorn can be found in most of unit
8	Williams Rd	~55% of unit	Found throughout the unit
9	Tusayan RD	~45% of unit	Most habitat is on state and private land
10	Williams RD	~ 8.5% of unit	Found throughout FS land in unit
12A	North Kaibab RD	100% of unit	Pronghorn are only on a very limited part of the unit

Current Habitat and Population Trend

During Forest Plan Revision the grassland PNVT included all grasslands including montane/subalpine grassland, a habitat type that is not suitable for pronghorn. As such, montane/subalpine grasslands will not be included as part of the habitat trend analysis. Figure 8 shows the grasslands that provide habitat for the pronghorn. Within the PNVTs there is approximately 112,250 acres of grassland habitat for the pronghorn. Not all of these acres provide habitat for the pronghorn at this time. Currently, Forest-wide pronghorn habitat appears to be stable (KNF 2010).

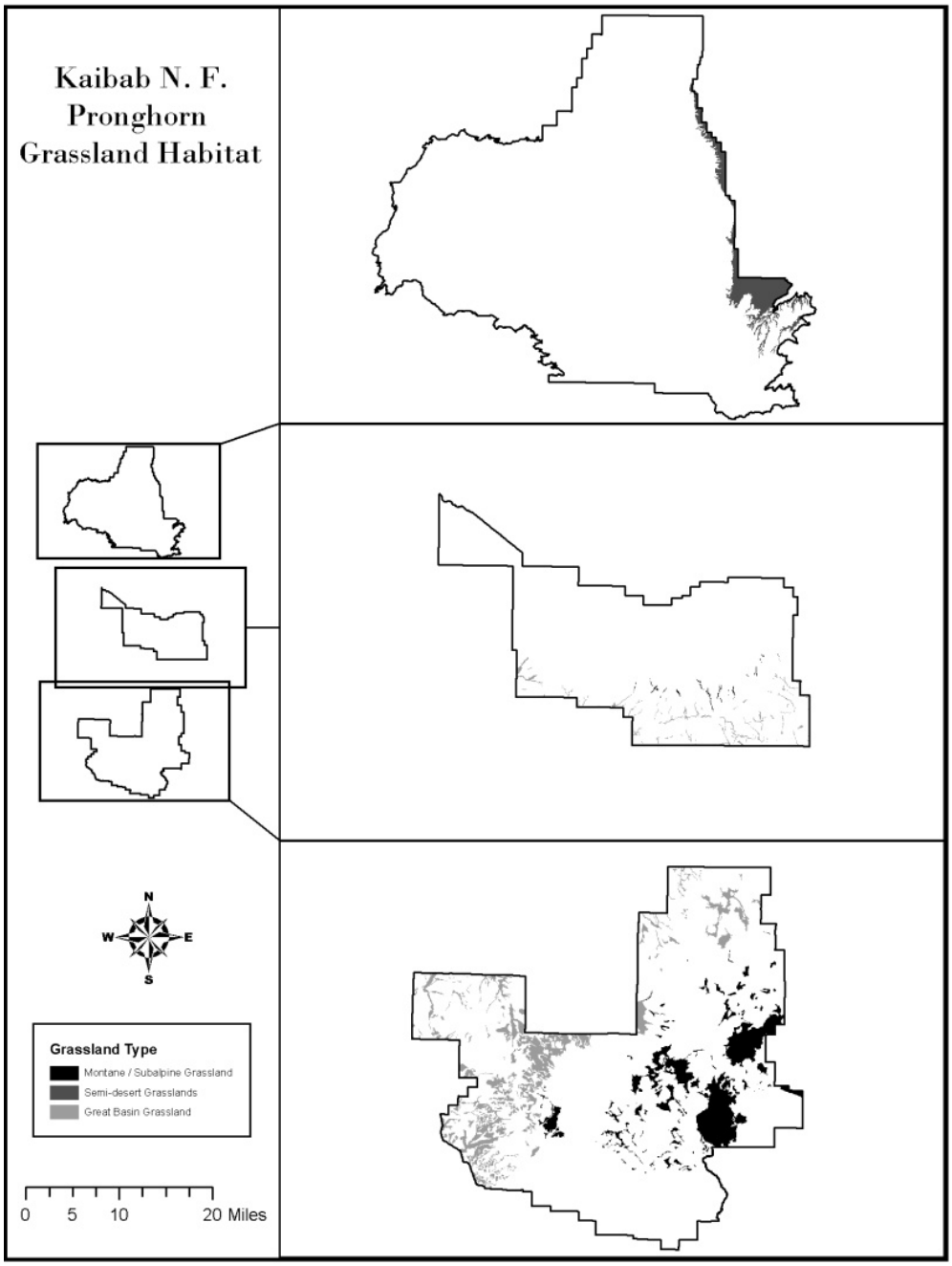


Figure 8. Pronghorn habitat on the Kaibab National Forest.

In 2010, The Arizona Game and Fish Department began a new process for determining population trends for GMUs 7, 8, and 9. Trends are determined using population models. The inputs for the models are harvest, male-female ratios, and young-female ratios, estimated mean mortality rates, and estimated starting populations. The best model is estimated by changing mortality rates of the starting population so

that the predicted male-female ratios from the models for each year match those that are based on surveys (McCall 2011).

Table 29. Trends in Pronghorn Populations based on AGFD data (2012)

Unit	3-Year	10-Year
7	Stable	Stable
8	Decreasing	Decreasing
9	Increasing	Increasing

Beside the above listed GMUs, pronghorn are also found in GMU 10 and 12A on the forest. All of these game units have a portion of the unit on the forest. Pronghorn numbers on GMU 12A appear to be sustaining an increasing trend (KNF 2010) and overall GMU 10 appears to be decreasing. However, the Kaibab National Forest has about 25-35 mi^2 of good quality pronghorn habitat located on the Forest in the southeast corner of Unit 10. Pronghorn inhabiting this area frequently exhibit the highest level of fawn survival in the unit as a whole (AZGFD 2011). All of the units have a hunting season for pronghorn, even the units that show a decreasing trend. An assessment of the overall forest contribution to the pronghorn population trend suggests the forest-wide population trend appears to be stable at this time.

Comparison of Alternatives

MIS in Ponderosa Pine and Frequent Fire Mixed Conifer

Environmental Consequences for Management Indicator Species: Alternative A (No Action)

Under the no-action alternative, no changes would be made to the current Kaibab Land Management Plan, and current management practices would continue at current rates. The following excerpt is from the Vegetation and Fuels Section:

"Currently, the forest treats around 2,100 acres a year in ponderosa pine with mechanical treatments to alter or restore stand structure, and around 200 acres per year in frequent fire mixed conifer. The current Plan was signed in 1988, before the 1995 Federal Wildland Fire Policy was enacted, and no objectives for acres burned by beneficial fire exist in the current Plan. Currently fire managers are burning about 8,500 acres per year with prescribed fire, and manage wildfires to achieve multiple objectives on around 11,700 acres per year. This equates to just over 20,000 acres per year that receive beneficial fire disturbance. Due to the restriction of having managed fire with mixed conifer stands most of the fire acreage occurs outside of the frequent fire mixed-conifer habitat. While these treatments would improve habitat quality for the Grace's warbler, western bluebird and ruby-crowned kinglet, there would not be an increase in the amount of ponderosa pine or frequent fire mixed conifer within the PNVTs.

In the mixed conifer vegetation types, suppression action must be taken on all wildfires in accordance with the terms and conditions associated with the Wildland Fire Use Amendment to the Plan in 2000. For the North Kaibab Ranger District, frequent fire mixed conifer stands are at a high risk of moving most or all of this vegetation type to an uncharacteristic open state, with minimal natural regeneration, as the result of one or several high-severity wildfire incidents. This has been demonstrated by wildfires that have occurred during the past 15 years. The current Plan restrictions also encumber cross-boundary fire management of wildfires burning on the Kaibab Plateau between the Grand Canyon National Park and the

forest that could be otherwise be used to reduce the risk of stand-replacing fires. Objectives for wildfires must change from resource benefit to protection when fires cross the fence from the park onto the forest; conversely wildfires initiated on the forest that could benefit park lands must be suppressed and so they do not cross on to the park".

The forestwide assessment for MIS (KNF 2010) shows that the current level of forest treatments is maintaining a stable forestwide habitat trend for both ponderosa pine and frequent fire mixed conifer habitats. This trend is not expected to change over time.

With the forestwide habitat trend staying the same for the ponderosa pine and mixed conifer habitat, it is likely that the forestwide population trends for the Grace's warbler, western blue bird, and ruby-crowned kinglet would not change and all three population trends would remain stable. However, this alternative has the highest potential for uncharacteristic wildfires and insect outbreaks. If these would occur within the next 15 years, population trends for the three species would experience a downward trend.

Description of Action Alternatives

Under all three action alternatives the highest priority need for change is to modify forest stand structure and density towards reference conditions and restore historic fire regime. Desired conditions will not change between all three action alternatives. Since the desired condition is based on the reference condition for ponderosa pine and frequent fire mixed conifer, projects which move the forest toward this condition will be beneficial to the Grace's warbler, western bluebird, and ruby-crown kinglet. The main difference between the alternatives is how long it would take and how well they would meet the desired conditions.

Objectives under all alternatives would be similar for ponderosa pine and frequent fire mixed confer. Annually in ponderosa pine the Forest would mechanically thin 11,000 to 19,000 acres and an average of 13,000 to 50,000 acres per year would be treated with wildland fire, whether from prescribed burns or wildfires exhibiting beneficial fire effects. Over the period of the plan within frequent fire mixed conifer, the forest would mechanically thin 30,000 to 60,000 and an annually treat with wildland fire between 1,000 to 13,000 acres per year.

Proposed guidelines for Vegetation Management in All Forested Communities include:

- Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. As such, the largest and oldest trees are usually retained.
- Project design should manage for replacement structural stages to assure continuous representation of old growth over time.
- Project design and treatment prescriptions should generally not remove:
    - Large, old ponderosa pine trees with reddish-yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs (alternative B only).
    - Mature trees with large mistletoe brooms suitable for wildlife nesting, caching, and denning, except where retaining such trees would prevent the desired development of uneven-aged conditions over time.
    - Large snags, partial snags and trees (>18 inches dbh) with broken tops, sloughing bark, lightning scars (> 4 inches wide), and large stick nests (> 18 inches in diameter).
    - Known bat roost trees.

- The location and layout of vegetation management activities should effectively disconnect large expanses of continuous predicted active crown fire.
- Vegetation management prescriptions should provide for sufficient canopy breaks to limit crown fire spread between groups, allow for the redevelopment and maintenance of a robust understory, and mimic the spatial arrangement of the references conditions.
- Vegetation management activities in mixed conifer forests should incorporate experimental design features and monitoring to accelerate learning and adaptive management.
- Trees established after 1890 should generally not be retained in areas where biophysical conditions would have supported stable openings over time
- Vegetation management activities should meet or exceed goals for scenic beauty (scenic integrity objectives) by creating natural patterns, structure, and composition of trees, shrubs, grasses and other plants.
- Vegetation management should favor the development of native understory species in areas where they have the potential to establish and grow.
- Even aged silvicultural practices may be used as a strategy for achieving the desired conditions over the long term, such as bringing dwarf mistletoe infection levels to within a sustainable range, or old tree retention.
- Seed and plants used for revegetation should originate from the same PNVT and general ecoregion (i.e. southern Colorado Plateau) as the project area.
- Heavy equipment and log decks should not be staged in montane meadows.

Alternatives C and D would replace the management guideline in both ponderosa pine and frequent fire mixed conifer that "Large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs" for presettlement trees with the following guideline "Projects should retain trees with physical characteristics typical of those that were established prior to 1890 (i.e., generally larger than 16 inches in diameter at breast height, with yellowing platy bark, and full crowns)."

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE B

Over a 15 year period the alternative would treat between 360,000 to 541,000 acres of ponderosa pine and 33,000 to 127,900 acres of frequent fire mixed conifer. These areas were historically either ponderosa pine or frequent fire mixed conifer in the past and are already shown as part of the PNVTs for these vegetation types, so it would not change the amount of the PNVTs but would improve the quality of the habitat.

Alternative B would result in more area in the mid-scale desired condition than the other alternatives. This is based on the VDDT modeling done for the Vegetation and Fuels Specialist Report (KNF 2013a). This report shows that the preferred alternative is the best at creating the clumps and openings desired within the ponderosa pine and frequent fire mixed conifer vegetation types. The model also shows that this alternative is the best at creating interspersions and relative understory diversity for both vegetation types. The preferred alternative also has the lowest temporal departure from the mid-scale desired conditions (KNF 2013a).

The alternative B has the least amount of risk for of stand replacing fire. The Vegetation and Fire Specialist Report shows that this alternative maintains the highest percentage of open states and fine scale interspersions for both vegetation types. The preferred alternative has the least amount of risk for stand replacing fires at all time marks.

In summary, the preferred alternative is the best at moving the ponderosa pine and frequent fire mixed conifer vegetation types toward reference conditions over time. This would change the Forest-wide habitat trend for both ponderosa pine and frequent fire mixed conifer to an increasing trend under Alternative B.

Since it is believed that Grace's warbler populations have been affected by the loss of ponderosa pine habitat (Stacier and Guzy 2002) it is reasonable to expect that if the habitat is restored then there would be an increase in populations at the local level. This would change the Forest-wide population trend from stable to increasing for Alternative B.

Based on studies that show an increase in local populations of western bluebirds following habitat improvement (Guinan et al. 2008), it is expected that if the habitat is restored then there would be an increase in populations at the local level. This would change the Forest-wide population trend for western bluebird from stable to increasing for Alternative B.

Since heterogeneity within the mixed conifer stands is a strong predictor for ruby-crowned kinglet it is likely that an increase in the habitat trend would result in preferred alternative having a change in population trend from stable to increasing over time.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE C and D

Over a 15 year period the alternatives would treat between 360,000 to 541,000 acres of ponderosa pine and 33,000 to 127,900 acres of frequent fire mixed conifer. These areas were historically either ponderosa pine or frequent fire mixed conifer in the past and are already shown as part of the PNVTs for these vegetation types, so it would not change the amount of the PNVTs but would improve the quality of the habitat. The main different between the three action alternative is how much ponderosa pine or frequent fire mixed conifer quality would be improved to provide habitat for the MIS species under each alternative.

Alternatives C or D would result in less of the forest being in the desired condition. This is because some areas have contiguous areas of presettlement trees. In these areas, there would be a need to remove most or all of the smaller trees to achieve the desired openness or result in denser conditions than desired. This would result in more even-aged single-storied stands. Group selection cutting with matrix thinning (preferred alternative) is more effective at creating multi-storied, uneven-aged states than treatments that retain most of the larger trees. With a presettlement tree-retention guideline, it would likely take longer to achieve an uneven-aged multi-storied state. Alternatives C and D would result in forest conditions that are denser, more contiguous, and susceptible to stand-replacing fire (KNF 2013a).

The tree retention guideline in Alternatives C and D would only restrict treatments where there are currently many contiguous presettlement trees. In areas where larger, older trees are underrepresented or within the range of historic variation, all of the action alternatives would likely result in similar progress towards the desired conditions as the preferred alternative. This would change the Forest-wide habitat trend to an increasing trend for Alternatives C and D, although Alternative B would provide for more acres of suitable habitat over time.

While the habitat trend would change from stable to increasing, it is not clear how the presettlement tree-retention guideline in alternatives C and D would affect the forest-wide population trend for the Grace's warbler and western blue bird. It is not known if there would be enough habitat improvement for the

forestwide population trends for the Grace's warbler and western bluebird to change from stable to increasing. The forestwide population trend for both species for these alternatives is expected to be between stable to increasing in the long term. The higher likelihood for stand-replacing fire associated with these alternatives has the potential to decrease forestwide population trends for both species.

Variation within the mixed conifer stands is a strong predictor for ruby-crowned kinglet, so it is possible that alternatives C and D would not substantially change forestwide population trends for the ruby-crowned kinglet. The population trend for this species is expected to be between stable to increasing. It is possible that stand homogeneity created as a result of the presettlement tree-retention guideline in alternatives C and D would lead to a decreased population trend for ruby-crowned kinglet over time.

MIS in Grassland

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE A

One of the priority needs for change is to restore historic grasslands by reducing tree encroachment and meadows. State and transition models developed during the forest plan revision process suggest that all grasslands on the Kaibab NF are trending away from historic reference conditions. The trend away for Great Basin Grasslands and Semi-Desert Grasslands was found to be low to moderate, while the trend for montane grasslands was high. Conifer encroachment is expected to continue to negatively affect montane grasslands, while pinyon-juniper encroachment is expected to reduce Great Basin and Semi-Desert Grasslands (KNF 2009). On average, the Forest is restoring approximately 2,000 acres a year. Over 15 years, this would restore approximately 30,000 acres. While this would improve habitat conditions, it would not increase the amount of the PNVT.

Alternative A has no specific plan direction for the removal of encroaching conifers from grasslands, nor are there any plan objectives. The Williams and Tusayan Ranger Districts have implemented some grassland restoration projects, subject to available funding and grants. It is not expected that the current rate of implementation is enough to change trends shown in the models. The models show that the Forest-wide habitat trend for pronghorn would change from stable to decreasing under Alternative A.

Pronghorn need open grasslands with good forage availability to provide for fawning habitat and health of the adults. The current habitat trend would result in the loss of some of these important habitat components on the Forest. Based on these facts, the forest-wide population trend for the pronghorn would change from stable to decreasing under Alternative A.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE B, C, & D

Under all three action alternatives the priority need for change is to restore historic grasslands by reducing tree encroachment and restoring fire. Desired conditions, objects and guidelines are the same for all three action alternatives.

Objectives under all alternatives include:

- Reduce tree and shrub density to less than 10 percent on 5,000 to 10,000 acres of historic grasslands annually.
- Modify fences and/or install crossings to facilitate pronghorn movement on 50 miles of fence within 10 years of plan approval.

Proposed guidelines that affect pronghorn include:

- **Restoring Grasslands:** Pronghorn fence crossings should be installed along known movement corridors.
- **Livestock Grazing:** Livestock management should favor the development of native cool season grasses and forbs. New construction and reconstruction of fences should have a barbless bottom wire and be at least 18 inches high. Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g., forage production, weeds, fawning habitat, soils, etc.) and make adjustments as appropriate.

The Kaibab NF works closely with the AZ Game and Fish Department to meet the needs of pronghorn antelope. The forest-wide guideline above meets current recommendations for all wildlife species (AZGFD 2011). However, where needed, in areas that pronghorn are known to use, the bottom wire may be higher (e.g. 20 inches) and goat bars may be installed to facilitate pronghorn passage.

All three alternatives would restore between 75,000 to 150,000 acres of grasslands in 15 years. Some of this acreage would change the current land designation of ponderosa pine or pinyon-juniper stands to grasslands. These areas were historically grasslands in the past and are already shown as part of the PNVT for grasslands so it would not change the amount of the PNVT but would improve the quality of the habitat.

All action alternatives have a tree-retention guideline. The guideline would apply to all vegetation management activities including removing encroaching conifers from grasslands. In some areas this could reduce the effectiveness of grassland restoration work.

In Alternative B, the guideline for large tree retention would generally retain only the largest and oldest trees that provide for quality raptor perches. Alternatives C&D would add the management guideline that projects should retain trees with physical characteristics typical of those that were established prior to 1890. For some projects, this guideline may be implemented with a diameter cap. This could result in all trees above a certain size being retained. The effectiveness of treatments is likely to be reduced in grasslands that would have a higher amount of trees above the diameter cap. Overall, the amount of grassland restoration treatment is not expected to be significantly different between the action alternatives (KNF 2013a).

It is expected that an increased focus on grassland treatments would change the forest-wide habitat trend for pronghorn for all three alternatives from stable to increasing in the future. The resulting improvement of habitat should help local populations of pronghorn on the Forest. However, since pronghorn are also affected by drought and predators, the habitat improvements alone might not be enough to change the forest-wide trend, but it should at least help maintain the local populations. The forest-wide population trend for all three alternatives should be between stable to increasing in the long-term.

Cumulative Environmental Consequences

Cumulative effects from the implementation of the Kaibab LMP include effects of the management on national forest plus potential effects from land management on adjacent lands of other ownership (i.e. private, state, tribal, other federal agencies, county, etc.). In general, cumulative effects include impacts from past activities and potential future activities, such as agricultural use, forestry, fire, human development, and recreation. Past activities/actions are only considered if their contribution to the existing condition is still ongoing.

To compare the effects of Kaibab proposed management to the surrounding landscape, cumulative effects are evaluated considering the management actions of other entities of a similar planning scope within a relevant spatial and temporal context. The analysis area for wildlife includes the Kaibab National Forest, and relevant portions of Arizona Game and Fish Region II and Bird Conservation Regions (BCR) 16 (the Southern Rockies/Colorado Plateau) and 34 (Sierra Madre Occidental). This encompasses the three counties immediately adjacent to and/or surrounding the KNF (Coconino, Yavapai, and Mohave Counties) and is of a spatial extent that should account for effects on wide ranging species such as big game and migratory birds; species that travel across numerous land jurisdictions. The area encompasses similar habitat types as identified in the proposed action area and reflects similar ecological settings which wildlife species referenced in this report could or would use. We evaluated these effects for the life of the Forest Plan, approximately 10-15 years.

Departures from reference conditions exist in all vegetation types on the Kaibab, and most continue to trend further from reference conditions. This trend is also common on adjacent lands. Forests have become denser and grasslands are being invaded by conifers. The landscape has become more fragmented as a result of activities that include urban development, ranching, and fire suppression. As a result, there has likely been a net loss of intact, potential habitat and an increased risk to viability for wildlife on adjacent lands; this trend is expected to continue in the future. As a result, the Kaibab NF will play an increasing role in the conservation of these habitats and associated wildlife species on Forest lands.

The action alternatives strive to create and maintain natural communities and habitats in the amounts, arrangements, and conditions capable of supporting viable populations of existing native and desired non-native plants, aquatic, and wildlife species within the planning area, while contributing to broader landscape scale initiatives where appropriate. As such, wildlife and fish are distributed throughout their natural potential range. The adaptive management process helps to inform and realize these conditions on the ground. Alternatives C and D also promote the same conditions as Alternative B, but with some areas not meeting the desired conditions.

These goals and strategies are consistent with and complimentary to strategies identified in Arizona's Comprehensive Wildlife Conservation Strategy: 2005-2015, as well as the State Wildlife Action Plan: 2012-2022 (AZGFD 2012). These plans both emphasize sustainability, a return to historic (reference) conditions and are based on the principles of best science, best management practices, and an adaptive management process that includes measurable goals objectives, strategies and approaches.

The Arizona Partners in Flight Bird Conservation Plan (Latta et al. 1999) and the Inter mountain West Joint Venture Agreement which provide overall statewide direction for the management of migratory land birds, shorebirds, and waterfowl in BCRs 16 and 34 emphasize protection of key habitats for birds and outline goals and objectives for inventory and monitoring, research, information and education, management, and issues involving neotropical migratory bird species. Federal recovery plans for the California condor (USFWS 1996a) and the Mexican Spotted Owl (USFWS 2012a) further guide activities for those species.

Forest plan revisions on two neighboring forests, the Coconino and the Apache Sitgreaves are ongoing and a large scale forest restoration project, the Four Forest Restoration Initiative (4FRI) is currently developing its proposed action. These planning efforts are all following a similar process as the Kaibab NF with an emphasis on regionally consistent desired vegetation conditions, forest restoration in fire adapted ecosystems, and outcomes that should yield more diverse and sustainable ecosystems.

Finally, the General Land Management Plan for the Grand Canyon National Park (NPS 1995) and the Approved Resource Management Plan for the Arizona Strip (BLM 2008) which manages public lands in

the northern portions of Coconino and Mohave counties, Arizona, north and west of the Colorado River, focus on desired conditions and monitoring and adaptive management with mutually common goals of promoting native vegetative communities and ecological processes. These goals should provide healthy habitat for wildlife and sustainable, resilient ecosystems.

The net effect of these planning efforts, when combined with the preferred alternative is expected to be a beneficial one for wildlife by providing for better coordination across the landscape and perpetuating the habitat conditions necessary to insure for species viability into the future. Alternatives C & D would have similar effects however in some areas in ponderosa pine, frequent fire mixed conifer, and woodlands and savannas, there would be less benefit than in alternative B. Alternative A (no action) would not contribute to a cumulative benefit for wildlife species

Detailed

Wildlife and Forest Restoration

Under the three action alternatives, prescribed fires and thinning will continue across the forest (and adjacent lands) in the coming years to reduce accumulated fuels that can cause uncharacteristic wildfire, with alternatives C and D providing less benefit. Cumulatively, these actions are expected to improve habitat while decreasing the overall long term viability risk to wildlife species.

Rationale

Forest thinning and prescribed fires can affect wildlife habitat in various ways. Projects are mitigated on a site specific basis to reduce negative effects that might result from habitat modification. Collectively projects can affect foraging, nesting, hiding and thermal cover, and potentially daily movements on a short term basis, but most wildlife species will benefit over the long term. Much of the forest and woodland across Northern Arizona has become denser than under historic (presettlement conditions) because of decreased wildfire frequency (Swetnam et al. 1999, Covington and Moore 1994, Covington 2003). Forest restoration activities identified in the proposed action are likely to move habitat structure and composition back to conditions more consistent with conditions that occurred during the recent evolutionary past for wildlife species on the Kaibab National Forest and adjacent lands.

Because wildlife species are subject to movement, and frequently over great distances, efforts on adjacent lands are an important consideration in this process. Continuity is important and projects which span numerous land management jurisdictions will likely be most effective in providing adequate habitat distribution for wildlife over time, further minimizing viability risk. This requires collaboration among various organizations and stakeholder groups.

For example, under the action alternatives, wildfires could be managed more consistently with the Grand Canyon National Park by allowing wildfires to move across Forest-Park boundaries to achieve similar restoration objectives. This continuity would improve overall resiliency of the mixed conifer type on the Plateau and should benefit numerous wildlife species. Barriers to such cross boundary management do not exist outside of current Plan restrictions because an interagency Fire Management organization comprised of both Park and Forest Service personnel is responsible for all fire management on the Kaibab Plateau.

Similar forest planning efforts are underway on two neighboring forests, the Coconino National Forest and the Apache-Sitgreaves National Forest. Both are also revising their land management plans concurrently with the Kaibab based upon the same Regional vegetative desired conditions, standards and

guidelines, and similar objectives for ponderosa pine and mixed conifer. The cumulative restoration activities from the action alternatives from these plans could have a pronounced effect on modifying stand structure to be less susceptible to stand replacing fire in these vegetation types, while promoting resiliency with regard to climate change. Collectively, the net result of these revised LMPs should be positive and beneficial for wildlife species by ensuring the persistence of these habitats into the future and by providing continuity of suitable habitats. This should decrease the overall risk to species viability.

Another large scale planning effort in the analysis areas focused on improving resiliency in fire-adapted ecosystems is the 4FRI. If implemented, the 4FRI could treat up to 50,000 acres annually across the KNF and adjacent forest lands. The cumulative effect of this process could have widespread beneficial outcomes in restoration across the KNF including decreased susceptibility to large disturbances (e.g. uncharacteristic wildfire and insect outbreaks) and increased water yields from winter snowfall through the creation of interspaces. The scale of this project is such that these changes could have a meaningful impact on wildlife habitat by improving adaptability of ponderosa pine type to a changing climate and providing for it well into the future.

Wildlife and Development

Some wildlife species are especially at risk with regard to development. For example; birds, bats, and wide ranging species can be affected by transmission lines, turbines, roads, and other activities associated with renewable energy endeavors. These types of activities, which frequently cross multiple land use boundaries, are anticipated to increase in the future. The USFWS has issued interim guidelines for site specific development of wind energy facilities that may affect wildlife (USFWS 2011). On the KNF, proposals for development are dealt with on a case by case basis through special uses and the permitting process. In general, no new development is being encouraged on the Forest. To that end, the KNF will work closely with the AZGFD, the county, ADOT, and other entities to help preserve open spaces and connectedness of wildlife habitat. Much of the land surrounding the KNF consists of a checkerboard of state and private land in holdings. Existing collaborations between the AZGFD and Coconino County generally encourage the protection of open lands and the preservation of the land's natural character within local and regional contexts. Cumulatively, these strategies should decrease the potential for future land fragmentation while improving the overall integrity of the landscape. This should also provide for more resilience with regard to climate change for those wildlife species that may need to adjust migration routes, foraging corridors, or breeding grounds.

Riparian systems have decreased in size over the past 100 years, largely a result of human development. There has been a 90% reduction of this habitat type in Arizona compared to historic (reference) conditions. On the KNF, this vegetation community is located only within the Kanab Creek Wilderness. Historically, annual flooding was a major disturbance needed to maintain the historic vegetation levels necessary for many wildlife species, which utilize this habitat type. This community is currently departed from historic conditions due to upstream diversions, impoundments and tamarisk invasion. This watershed is not wholly contained within the Forest and the KNF has little control over upstream water management. Water resource management activities, including maintaining perennial water quality, quantity, and timing of flows contribute a very important role in overall ecological function and sustainability of these watersheds. For this reason, it will be difficult for the KNF to fully restore this habitat to reference conditions. As a result riparian dependent species such as the Western red bat and the Arizona toad, which could use this habitat, will not realize its full potential. Detailed information on natural flooding regimes and water use can be found in the Soils and Watershed Specialist Report (KNF 2013c).

Wildlife and Recreation

A wide ranging species that could be negatively affected by the use of lead for hunting is the California condor, a federally listed species which primarily occurs within and along the south rim of the Grand Canyon, the Kaibab Plateau on the north side of Grand Canyon, Marble Canyon, the Vermillion Cliffs, and parts of southern Utah (Southwest Condor Review Team 2007). The Peregrine Fund has extensive radio-tracking data which documents heavy use of the Kaibab Plateau (North Kaibab Ranger District) for travel and forage (Peregrine Fund 2010). While condors are common a few miles to the north along the South Rim of the Grand Canyon, birds have rarely been observed on the southern portion of the Forest. There have been no known successful nesting attempts on the Forest. The condor's primary use of the forest is for dispersal habitat and foraging; condors are opportunistic scavengers that feed primarily on large dead mammals such as deer, elk, bighorn sheep, and domestic livestock.

The proposed plan provides the condor with healthy and sustainable dispersal and foraging habitat. Management activities under the proposed action and alternatives would not affect the amount or distribution of carrion. The biggest threat to the condor is lead poisoning (USFWS 2012b). The AGFD regulates hunting in the State and actively encourages the use of non-lead ammunition. This voluntary lead reduction program and related hunter education campaign includes free distribution of non-lead ammunition to hunters in the condor range and thus far has been very successful with an 80-90 % participation rate. The Department is optimistic that this trend will continue. Although voluntary lead reduction efforts have significantly reduced the amount of lead available to condors in Arizona, the condor reintroduction program has yet to observe a corresponding reduction in condor lead exposure rates (USFWS 2012b). Although 80% to 90% of hunters in much of the Arizona portion of condor range have participated in the voluntary program since 2007, hunter participation rates in southern Utah's lead reduction program are significantly lower. Condor foraging in southern Utah has increased considerably since 2004. Additionally, foraging in Utah during the fall hunting season has risen consistently since 2005. This shift in condor movement provides a likely explanation for why lead exposure levels have remained essentially static throughout this reporting period rather than declining (USFWS 2012b). The KNF will continue to support this program focused on heavy advocacy, hunter education and readily available non-lead ammunition. The net result of these collaborations should be positive for the condor.

The third five-year review (USFWS 2012b) notes that lead poisoning is affecting the southwest population from becoming a reproductively self-sustaining population. While it was expected that deaths from lead and other sources of mortality would occur when the condors were released, it was noted these deaths would be compensated for by both natural and captive reproduction (USFWS 1996a). To date, this compensation has come primarily from captive reproduction. Any change to the hunting regulations in the experimental population area in Arizona or Utah would require action by the states (USFWS 2012b). Cumulatively this is having a negative effect to the southwest condor population.

Unavoidable Adverse Impacts, Irreversible and Irretrievable Commitment of Resources

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Before any ground-disturbing actions take place, they must be authorized in a subsequent site-specific environmental analysis. Therefore none of the alternatives cause unavoidable adverse impacts. Because the land management plan does not authorize or mandate any site-specific project or activity (including ground-disturbing actions), none of the alternatives cause an irreversible or irretrievable commitment of resources.

Adaptive Management

All alternatives assume the use of adaptive management principles. Forest Service decisions are made as part of an on-going process, including planning, implementing projects, and monitoring and evaluation. The land management plan identifies a monitoring program. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action or the land management plan. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information. The Forest Supervisor annually evaluates the monitoring information displayed in the evaluation reports through a management review and determines if any changes are needed in management actions or the plan itself. In general, annual evaluations of the monitoring information consider the following questions:

- What are the effects of resource management activities on the productivity of the land?
- To what degree are resource management activities maintaining or making progress toward the desired conditions and objectives for the plan?
- What management changes are needed to account for unanticipated changes in forestland conditions?

In addition to annual monitoring and evaluation, the Forest Supervisor reviews the conditions on the land covered by the plan at least every 5 years to determine whether conditions or demands of the public have changed significantly. The forest plan is ordinarily revised on a 10-year cycle and the Forest Supervisor may amend the plan at any time.

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APPENDIX A

Using the "Best Available Science" during Forest Plan Revision-Wildlife

Introduction

Wildlife biologists consulted with a variety of resources during the Kaibab National Forest Plan Revision process. From development of the initial forest planning species list, to writing plan components, monitoring approaches, and analyzing the effects of forest planning alternatives on species viability, the "Best Available Science" was consulted and used to ensure wildlife species would be afforded the best protection possible under the proposed action. Although not an exhaustive list, some of the more prominent sources are described in detail below.

Literature

The Forest Service maintains access to two separate but associated online libraries. The National Agricultural Library is one of four national libraries of the United States. It houses one of the world's largest and most accessible agricultural information collections and serves as the nexus for a national network of state land-grant and U.S. Department of Agriculture field libraries. http://www.nal.usda.gov/ Within this context, the National Forest Service Library provides information services, access to e-journals and bibliographic databases, current literature alerting services, and a full range of document delivery and Inter library loan services to Forest Service employees. http://www.fs.fed.us/library/

Using these resources, Forest Service biologists consulted with premier journals during all phases of the plan revision process, namely the development of fine scale plan components for wildlife species, summarizing the effects analyses for species viability and development of the proposed Management Indicator Species list. Top journals referenced included: Science, Nature, Ecology, Forest Science, Ecological Restoration, Biological Conservation, Journal of Wildlife Management, Conservation Biology, Frontiers in Ecology and the Environment, the Condor, and the Birds of North America online, among others. These journals support the wildlife analyses by providing timely and relevant results, peer reviewed data on emerging trends, and high-impact articles and conference proceedings.

Wildlife biologists also consulted with lesser known documents including non-published "gray literature" such as technical reports, white papers, internal reports, theses, systematic reviews, and meta-analyses. Many of these documents are maintained through the Rocky Mountain Research Station library and locally based academic institutions including The Forestry Department and Ecological Restoration Institute at Northern Arizona University.

Databases and Data Management Systems

NatureServe, a non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action was consulted largely during development of the "forest planning species "list. This list provided the foundation for the Forest's viability analysis and helped to focus plan components as needed.

NatureServe and its network of natural heritage programs are the leading source for information about rare and endangered species and threatened ecosystems. NatureServe represents an international network of biological inventories-known as natural heritage programs or conservation data centers-operating in all 50 U.S. states, Canada, Latin America and the Caribbean. Detailed information is collected

and managed on plants, animals, and ecosystems. Information products, data management tools, and conservation services are also developed to help meet local, national, and global conservation needs. The objective scientific information about species and ecosystems developed by NatureServe is used by all sectors of society-conservation groups, government agencies, corporations, academia, and the public-to make informed decisions about managing our natural resources. More information on NatureServe can be found here: http://www.natureserve.org/

Additionally, databases and species lists managed by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department were consulted regarding threatened, endangered and sensitive species as well as other local species of concern (e.g. narrow endemics and/or species likely to be affected by local processes).

The Heritage Database Management System (HDMS) managed by the AZGFD, is part of a global network of more than 80 Natural Heritage Programs and Conservation Data Centers. HDMS information allows managers, stakeholders and decision makers to make prudent decisions weighing future development, economic growth, and environmental integrity by identifying elements of concern in Arizona. The system consolidates information about wildlife species distribution and status throughout the state. This includes, but is not limited to, plants and animals with special status at the federal, tribal, or state level, or specific habitat(s) necessary for their survival. Information included in the HDMS comes from published and unpublished reports, data collected by cooperating agencies, museum and herbarium collections, the scientific and academic communities, and many other sources, generally opportunistic in nature. Data managed under the HDMS is site specific in nature, and appropriate for project level planning. As such, these data help Forest Service Biologists develop forest planning guidelines. In addition to HDMS species, biologists also considered species listed under the State Wildlife Action Plan (SWAP), for helping to develop desired conditions and guidelines. SWAP species consist of Species of Greatest Concern (SGCN) or Species of Economic and Recreation Importance (SERI). The SWAP also developed range maps for these species using wildlife models that broadly represent where a species habitat exists, and where the species itself may occur. Although all features of the SWAP mapping tools are not currently available to the public, forest service biologists obtained draft species list from AZGF biologists for reference during the plan revision process.

More information on these species lists and planning tools can be found here: http://www.azgfd.gov/w_c/edits/species_concern.shtml, http://www.azgfd.gov/w_c/cwcs.shtml, http://www.fws.gov/southwest/

Contemporary Modeling Tools and Approaches

In collaboration with local researchers and scientists, KNF biologists developed and used several wildlife related habitat models to help assess the suitability of proposed select management indicator species and to set a “baseline” for future monitoring. Further, these tools provide the Kaibab National Forest with an empirically based platform for assessing wildlife habitat and species population change over time under each planning alternative, and provide a basis for refining future management.

The models, described in more detail below, incorporate the most current vegetation structural data based on remotely sensed and plot level data, with population data on density, occupancy, and/or movement patterns for select wildlife species.

- **Vegetation Dynamic Development Tool (VDDT):** The Vegetation Dynamics Development Tool (VDDT) is a Windows-based computer tool which provides a state and transition landscape modeling framework for

examining the role of various disturbance agents and management actions in vegetation change. It allows users to create and test descriptions of vegetation dynamics, simulating them at the landscape level. Projecting changes in vegetation structure and composition over time is an important part of landscape-level analyses, and VVDT model runs were foundational to the Kaibab NF plan revision process. Vegetation may change for a variety of reasons, such as human activity, fires, insects, pathogens, mammals, weather, or growth and competition. The interaction of these factors is complex and the combined effects are difficult to predict over long periods. VDDT provides a common platform for specialists from different disciplines (e.g., fire ecology, silviculture, wildlife biology), to collectively define the roles of various processes and agents of change on landscape-level vegetation dynamics. The model runs allowed specialists from different resource areas on the planning team to evaluate how the on the ground changes to vegetation likely to occur from implementation of the different planning alternatives might affect their resource area. Specifically, wildlife biologists used VDDT model runs to assess availability of habitat for certain species of interest (e.g., threatened and endangered species, forest planning species, management indicator species (MIS) and other species of concern) under the different planning alternatives.

- **Ripleys K:** The Ripley's K spatial test is a tool that can be used to quantify the spatial arrangement of trees across the landscape. As treatments include more structural heterogeneity at various scales, this statistical test should help the Forest achieve desired conditions by allowing the Kaibab NF to verify if the forest structure outlined in the thinning prescription was achieved on-the-ground (i.e. are prescriptions implemented as planned?). To examine tree aggregation patterns, a quantitative assessment of the resulting structure retained after thinning treatments was compared to historic range of variability by using the Ripley's K function. This function statistically analyzes spatial patterns between pairs of points and tests the degree to which the remaining trees were spatially aggregated to determine whether or not treatments result in an evenly-spaced, random, or aggregated (clumpy) forest structure. This helps to inform what changes need to be made in future forest treatments to meet objectives for restoring historic forest structure on the Kaibab National Forest. This information could be used for a variety of wildlife species over time.

- **PatchMorph:** Vegetation structural characteristics and composition are frequently used to define wildlife habitat needs. A few of the metrics used to examine wildlife habitat include spatial heterogeneity, structural diversity, and vegetation temporal dynamics. Variation in these metrics across the landscape, in patches of optimal, sub-optimal, and deficient habitat, are what allows species to co-exist and be sustainable over time. A patch delineation algorithm called PatchMorph (Evan Girvetz;http://arcscripts.esri.com) was used to characterize functionally connected habitat for two focal species (Abert's squirrel and pronghorn) likely to be affected by increased rates of forest restoration treatments in ponderosa pine and grassland habitat types. The PatchMorph algorithm allows for the use of natural history characteristics specific to the focal species of interest to inform the threshold values for habitat suitability, habitat gaps, and habitat spurs on the landscape. This tool helped KNF wildlife biologist to assess how effectively focal species are moving across the landscape under the current forest plan, and how those patterns might change under the planning alternatives. These tools could be applied to additional species in the future, depending on management needs.

- **Occupancy and Population Trend Models:** Spatially explicit occupancy modeling techniques were used in a monitoring context to estimate the current state (e.g., proportion of area occupied) of select management indicator species (Grace's warbler, Western bluebird, and Ruby-crowned kinglet) and provide information on trends. These methods allow managers to make inferences about the effects of habitat change (both natural and human caused) as it relates to population change over time. Occupancy

models were developed to: 1) Evaluate the suitability of the three MIS, 2) Establish baseline trend estimates for future MIS monitoring and analyses, and 3) Incorporate adaptive management into the KNF monitoring process and subsequent management decisions. An Information Theoretic approach was used to find the "best fit" model for each species. The models also provide a basis for adaptive management. As projects are implemented, post treatment data can be collected on forest structural variables to assess how well management prescriptions meet the needs of these species over time. More information on wildlife habitat modeling tools for management can be found at:http://www.cefns.nau.edu/Academic/EnvSci/Lab/

The Arizona Game and Fish began a new process for determining population trends for pronghorn in 2010 .Trends are determined using population models bases on inputs on harvest, male-female ratios, and young-female ratios, estimated mean mortality rates, and estimated starting populations. The best model is estimated by changing mortality rates of the starting population so that the predicted male-female ratios from the models for each year match those that are based on surveys. These data were referenced for estimates of pronghorn during the MIS analysis process and set a baseline for future trend monitoring.

Finally, managing wildlife and wildlife habitat under an uncertain climate was expressly considered during evaluation of the different planning alternatives, and for developing plan components and/or management approaches. Biologists referenced the literature, as well as innovative tools such as a System for Assessing Vulnerability of Species (SAVS), a decision support tool for assessing wildlife vulnerability to climate change during project level planning. For more information on this application see: http://www.fs.fed.us/rm/grassland-shrubland-desert/products/species-vulnerability/

Scientific Conferences, Workshops, and Collaborations

Forest Service biologists attended and made contributions to several scientific conferences and workshops during the forest plan revision process including:

- Flagstaff Climate Change Adaptation Workshop
- National Workshop on Climate and Forests: Planning Tools and Perspectives on Adaptation and Mitigation Options.
- The 11th Biennial Conference of Research on the Colorado Plateau: "Cultural and Natural Resource Management on the Colorado Plateau: Science and Management at the Landscape Scale".
- Society for Conservation Biology North American Conference for Conservation Biology. Bridging the Gap: Connecting people, nature, and climate. Oakland, CA.

The KNF sponsored two locally based workshops with regard to monitoring and the wildlife viability and management indicator selection process. Ecologists and biologists from other federal agencies, non-profit organizations, and academia were among the attendees representing a wide range of expertise in the fields of forestry, fire, restoration, wildlife, and spatial ecology, among others. Recommendations from these collaborations were integrated into various aspects of the draft Forest Plan and/or wildlife viability analysis. KNF Wildlife biologists also engaged in several locally held "Collaborwriting" sessions" focused on group and public involvement. Plan content was developed in conjunction with this process which involved a variety of "expert" representatives from local stakeholder groups, academia and other agencies.

Appendix B

VDDT Model Data Used to Determine Wildlife Acres in Analysis

The VDDT model is fully described in the Vegetation and Fire Specialist Report (for a more general discussion see Appendix A). The current vegetation is separated into different "states" (see definitions below) to describe what is available on the forest. The model then predicts how the vegetation will change over time, based on different scenarios. The VDDT model was run at the mid-scale level (100 – 1000 acres). The percentage of canopy cover averages interspaces (openings) and tree cover over the entire mid-scale areas. This means for areas smaller than the mid-scale, there will be areas with less canopy closure and areas with higher canopy closure than what is actually shown by the state description. The same theory applies to the diameter class, that it is averaged over the mid-scale area.

Table 1. VDDT states and definitions

State	Definition
A	Grass, forb, shrubland; <10% canopy cover
B	Seeding/sapling, open; <10% canopy cover
C	Small trees, open; 10-30% canopy cover; 5-10" diameter class
D	Medium trees, open, single story; 10-30% canopy cover; 10-20" diameter class
E	Very large trees, open, single story; 10-30% canopy cover; 20+" diameter class
F	Seeding/sapling, closed; >30% canopy closure; 0-5" diameter class
G	Small trees, closed; >30% canopy closure; 5-10" diameter class
H	Medium trees, closed, single-story; >30% canopy closure; 10-20" diameter class
I	Very large trees, closed, single-story; >30% canopy closure; 20+" diameter class
J	Medium trees, open, multi-story; 10-30% canopy closure; 10-20" diameter class
K	Very large trees, open, multi-story; 10-30% canopy closure; 20+" diameter class
L	Medium trees, closed, multi-story; >30% canopy closure; 10-20" diameter class
M	Very large trees, closed, multi-story; >30% canopy closure; 20+" diameter class
N	Uncharacteristic wildfire; <10% canopy cover

To determine the effects to species that depend on ponderosa pine or mixed conifer, the Forest first defined which states would provide habitat for those species. The habitat types were selected based on the associated PNVT within the Species Diversity Report. Table 2 shows the species and the states that were associated to each species habitat. First, the current amount of habitat was determined. This was done by selecting a vegetation type (e.g. ponderosa pine) and then the tab for "Initial Conditions". The percentage for each state was then converted into acres. To determine how the vegetation would change under each alternative, the biologist used the predicted amount of the states in 15 years. This was done for each vegetation type by selecting for each alternative the "Forest-wide Totals" tab and then using the Average Percent of Acres in Each State in Each Decade to determine percentage amount. Using the decade 1.5 resulted in a percentage for year 15. The percentages were then converted to acreages.

For some species there was a need to include additional assumptions:

The Mexican spotted owl only uses ponderosa pine/Gambel oak habitat within the pine type. However, the VDDT model lumps this habitat type in with all ponderosa pine. Base on the GIS layer for the Williams Ranger District there is approximately 49,440 acres of the ponderosa pine that is considered to be ponderosa pine/oak currently on the district. Therefore to estimate the amount of change in this habitat, the selected

states in ponderosa pine were multiply by 9%, which is the percentage of pine-oak within the total amount of ponderosa pine acreage on the Forest.

The Kaibab tree squirrel is only found in ponderosa pine on the North Kaibab Ranger District (RD). Based on the Kaibab National Forest Ecological Sustainability Report (Version 1.01, December 19, 2008), the district has approximately 28% of the ponderosa pine cover type on the Forest. Therefore, the states selected for the Kaibab tree squirrel were multiplied by 28% to estimate the amount of habitat affected on the district.

The Kaibab least chipmunk and Kaibab northern pocket gopher both use mesic mixed conifer and spruce-fir habitat on the North Kaibab RD. While there is a small amount of mesic mixed conifer found on the Williams RD, almost all of the vegetation type is found on the North Kaibab RD. Since there is only a limited amount of habitat on the Williams RD, the total acres of mesic mixed conifer was used to determine the amount of habitat for these species.

Table 2. Species analysis for Ponderosa Pine and Mixed Conifer and Their Associated States

Species	States	Comments
Mexican spotted owl	K,L,M	Is associated with large trees in multi-story stands and >40% canopy closure. Uses ponderosa pine/Gambel oak and mixed conifer stands.
Goshawk	J,K,L,M	Is associated with large trees in multi-story stands both open and closed. Show nesting, roosting and PFA habitat acres. Uses ponderosa pine and frequent fire mixed-conifer stands.
Bald eagle	D,E,H,I,J,K,L,M	Is associated with large ponderosa pine trees. Will used both open and closed stands.
Allen lappet-browed bat	D,E,H,I,J,K,L,M	Is associated with large trees with loose bark. Will used both open and closed stands. Is found in ponderosa pine and frequent fir mixed-conifer.
Merriam's shrew	C,D,E,J,K	Is associated with open conifer stands. Is found in ponderosa pine and frequent fire mixed-conifer
Kaibab tree squirrel	E,H,I,J,K,L,M Optimum habitat J,K,L,M	The squirrel will use a variety of stands for foraging within ponderosa pine stands. Optimum habitat (nesting habitats) is more restricted to large trees with interlocking crowns within the groups.
Kaibab least chipmunk	C,D,E,J,K	Is associated with openings within mesic mixed-conifer stands.
Kaibab northern pocket gopher	C,D,E,J,K	Is associated with openings within mesic mixed-conifer stands.

Table 3. - VDDT model results used for Species Dependent on Mixed Conifer Habitat – Current VS. 15 years

Mixed conifer - total acres on PNVT 127,719 (acreage includes Dry and mesic MC: 107,000 +20,719)

States	Current	Current Acres	Alt. A	Alt. A acres	Alt. B	Alt. B acres	Alt. C	Alt. C acres	Alt. D	Alt. D acres
A	6%	7,804	0%	0	1%	1,660	1%	1,277	1%	1,788
B	1%	1,277	1%	1,277	1%	1,660	1%	1,277	2%	2,554
C	7%	8,429	0%	0	1%	1,660	1%	1,277	1%	1,788
D	1%	1,405	5%	6,386	8%	10,218	6%	7,663	7%	8,940
E	5%	6,322	5%	6,386	8%	10,218	16%	20,435	15%	19,158
F	0.21%	268	17%	21,712	16%	20,435	17%	21,712	17%	21,712
G	8%	10,141	8%	10,218	6%	7,663	7%	8,940	7%	8,940
H	32%	40,806	18%	22,989	12%	15,326	13%	16,603	12%	15,326
I	0.14%	179	4%	5,109	2%	2,682	3%	3,193	2%	2,554
J	0.50%	639	3%	3,832	6%	7,663	3%	3,193	4%	5,109
K	0.50%	639	4%	5,109	11%	14,049	5%	6,386	5%	6,386
L	17%	21,712	15%	19,158	10%	12,772	11%	14,049	10%	12,772
M	10%	12,772	9%	11,495	6%	7,663	6%	7,663	5%	6,386
N	12%	15,326	11%	14,049	11%	14,049	11%	14,049	11%	14,305
	100%	127,719	100%	127,719	100%	127,719	100%	127,719	100%	127,719

Single story open 0-10" (B,C)		Single story open 10-20" (D)		Single story open 20+" (E)		Multi story open 0-20" (J)		Multi story open 20+" (K)		>10% trees (A,N)	
current	9,707	current	1,405	current	6,322	current	639	current	639	current	23,130
Alt A	1,277	Alt A	6,386	Alt A	6,386	Alt A	3,832	Alt A	5,109	Alt A	14,049
Alt B	3,321	Alt B	10,218	Alt B	10,218	Alt B	7,663	Alt B	14,049	Alt B	15,709
Alt C	2,554	Alt C	7,663	Alt C	20,435	Alt C	3,193	Alt C	6,386	Alt C	15,326
Alt D	4,342	Alt D	8,940	Alt D	19,158	Alt D	5,109	Alt D	6,386	Alt D	16,093

Mult story close 0-10" (F,G)		Single story close 10-20" (H)		Single story closed 20+" (I)		Mult story close 10-20" (L)		Multi story open 20+" (M)	
current	10,409	current	40,806	current	179	current	21,712	current	12,772
Alt A	31,930	Alt A	22,989	Alt A	5,109	Alt A	19,158	Alt A	11,495
Alt B	28,098	Alt B	15,326	Alt B	2,682	Alt B	12,772	Alt B	7,663
Alt C	30,653	Alt C	16,603	Alt C	3,193	Alt C	14,049	Alt C	7,663
Alt D	30,653	Alt D	15,326	Alt D	2,554	Alt D	12,772	Alt D	6,386

Goshawk Habitat (J, K, L,M)		MSO habitat (K,L,M)	
current	35,761	current	35,123
Alt A	39,593	Alt A	35,761
Alt B	42,147	Alt B	34,484

Allen LEB (D,E,H,I,J,K,L,M)		Merriam's shrew (C,D,E,J,K)	
current	84,473	current	17,434
Alt A	80,463	Alt A	21,712
Alt B	80,591	Alt B	43,808

Alt C	31,291	Alt C	28,098		Alt C	79,186	Alt C	38,954	
Alt D	30,653	Alt D	25,544		Alt D	76,631	Alt D	41,381	

Dry Mixed conifer - total acres on PNVT 107,000 acres

States	Current	Current Acres	Alt. A	Alt. A acres	Alt. B	Alt. B acres	Alt. C	Alt. C acres	Alt. D	Alt. D acres
A	6%	6,538	0%	0	1%	1,391	1%	1,070	1%	1,498
B	1%	1,070	1%	1,070	1%	1,391	1%	1,070	2%	2,140
C	7%	7,062	0%	0	1%	1,391	1%	1,070	1%	1,498
D	1%	1,177	5%	5,350	8%	8,560	6%	6,420	7%	7,490
E	5%	5,297	5%	5,350	8%	8,560	16%	17,120	15%	16,050
F	0.21%	225	17%	18,190	16%	17,120	17%	18,190	17%	18,190
G	8%	8,496	8%	8,560	6%	6,420	7%	7,490	7%	7,490
H	32%	34,187	18%	19,260	12%	12,840	13%	13,910	12%	12,840
I	0.14%	150	4%	4,280	2%	2,247	3%	2,675	2%	2,140
J	0.50%	535	3%	3,210	6%	6,420	3%	2,675	4%	4,280
K	0.50%	535	4%	4,280	11%	11,770	5%	5,350	5%	5,350
L	17%	18,190	15%	16,050	10%	10,700	11%	11,770	10%	10,700
M	10%	10,700	9%	9,630	6%	6,420	6%	6,420	5%	5,350
N	12%	12,840	11%	11,770	11%	11,770	11%	11,770	11%	11,984
	100	107,000	100	107,000	100	107,000	100	107,000	100	107,000

Single story open	0-10" (B,C)	Single story open	10-20" (D)	Single story open	20+" (E)	Multi story open	0-20" (J)	Multi story open	20+" (K)	>10% trees (A,N)	
current	8,132	current	1,177	current	5,297	current	535	current	535	current	19,378
Alt A	1,070	Alt A	5,350	Alt A	5,350	Alt A	3,210	Alt A	4,280	Alt A	11,770
Alt B	2,782	Alt B	8,560	Alt B	8,560	Alt B	6,420	Alt B	11,770	Alt B	13,161
Alt C	2,140	Alt C	6,420	Alt C	17,120	Alt C	2,675	Alt C	5,350	Alt C	12,840
Alt D	3,638	Alt D	7,490	Alt D	16,050	Alt D	4,280	Alt D	5,350	Alt D	13,482

Mult story close	0-10" (F,G)	Single story close	10-20" (H)	Single story closed	20+" (I)	Mult story close	10-20" (L)	Multi story open	20+" (M)
current	8,721	current	34,187	current	150	current	18,190	current	10,700
Alt A	26,750	Alt A	19,260	Alt A	4,280	Alt A	16,050	Alt A	9,630
Alt B	23,540	Alt B	12,840	Alt B	2,247	Alt B	10,700	Alt B	6,420
Alt C	25,680	Alt C	13,910	Alt C	2,675	Alt C	11,770	Alt C	6,420
Alt D	25,680	Alt D	12,840	Alt D	2,140	Alt D	10,700	Alt D	5,350

Goshawk Habitat (J, K, L,M)		MSO habitat (K,L,M)		Allen LEB (D,E,H,I,J,K,L,M)		Merriam's shrew (C,D,E,J,K)	
current	29,960	current	29,425	current	70,770	current	14,606
Alt A	33,170	Alt A	29,960	Alt A	67,410	Alt A	18,190
Alt B	35,310	Alt B	28,890	Alt B	67,517	Alt B	36,701

Alt C	26,215	Alt C	23,540	Alt C	66,340	Alt C	32,635
Alt D	25,680	Alt D	21,400	Alt D	64,200	Alt D	34,668

Mesic Mixed conifer - total acres on PNVT 20,719 acres

States	Current	Current Acres	Alt. A	Alt. A acres	Alt. B	Alt. B acres	Alt. C	Alt. C acres	Alt. D	Alt. D acres
A	6%	1,266	0%	0	1%	269	1%	207	1%	290
B	1%	207	1%	207	1%	269	1%	207	2%	414
C	7%	1,367	0%	0	1%	269	1%	207	1%	290
D	1%	228	5%	1,036	8%	1,658	6%	1,243	7%	1,450
E	5%	1,026	5%	1,036	8%	1,658	16%	3,315	15%	3,108
F	0.21%	44	17%	3,522	16%	3,315	17%	3,522	17%	3,522
G	8%	1,645	8%	1,658	6%	1,243	7%	1,450	7%	1,450
H	32%	6,620	18%	3,729	12%	2,486	13%	2,693	12%	2,486
I	0.14%	29	4%	829	2%	435	3%	518	2%	414
J	0.50%	104	3%	622	6%	1,243	3%	518	4%	829
K	0.50%	104	4%	829	11%	2,279	5%	1,036	5%	1,036
L	17%	3,522	15%	3,108	10%	2,072	11%	2,279	10%	2,072
M	10%	2,072	9%	1,865	6%	1,243	6%	1,243	5%	1,036
N	12%	2,486	11%	2,279	11%	2,279	11%	2,279	11%	2,321
	100%	20,719	100%	20,719	100%	20,719	100%	20,719	100%	20,719

Single story open	0-10" (B,C)	Single story open	10-20" (D)	Single story open	20+" (E)	Multi story open	0-20" (J)	Multi story open	20+" (K)	>10% trees (A,N)	
current	1,575	current	228	current	1,026	current	104	current	104	current	3,752
Alt A	207	Alt A	1,036	Alt A	1,036	Alt A	622	Alt A	829	Alt A	2,279
Alt B	539	Alt B	1,658	Alt B	1,658	Alt B	1,243	Alt B	2,279	Alt B	2,548
Alt C	414	Alt C	1,243	Alt C	3,315	Alt C	518	Alt C	1,036	Alt C	2,486
Alt D	704	Alt D	1,450	Alt D	3,108	Alt D	829	Alt D	1,036	Alt D	2,611

Mult story close	0-10" (F,G)	Single story close	10-20" (H)	Single story closed	20+" (I)	Mult story close	10-20" (L)	Multi story open	20+" (M)
current	1,689	current	6,620	current	29	current	3,522	current	2,072
Alt A	5,180	Alt A	3,729	Alt A	829	Alt A	3,108	Alt A	1,865
Alt B	4,558	Alt B	2,486	Alt B	435	Alt B	2,072	Alt B	1,243
Alt C	4,973	Alt C	2,693	Alt C	518	Alt C	2,279	Alt C	1,243
Alt D	4,973	Alt D	2,486	Alt D	414	Alt D	2,072	Alt D	1,036

MSO habitat (K,L,M)		K. least chipmunk, K. N. Pocket gopher (C,D,E,J,K)	
current	5,698	current	2,828

Alt A	5,801	Alt A	3,522
Alt B	5,594	Alt B	7,107
Alt C	4,558	Alt C	6,319
Alt D	4,144	Alt D	6,713

Table 4. - VDDT modeling used for Species Dependent on Ponderosa Pine Habitat – Current VS. 15 years

Ponderosa Pine - VDDT - total acres on forest						547,080	acres			
States	Current	Current Acres	Alt. A	Alt. A acres	Alt. B	Alt. B acres	Alt. C	Alt. C acres	Alt. D	Alt. D acres
A	9%	48,237	4%	21,833	5%	27,354	5%	27,354	5%	27,354
B	1%	4,924	3%	16,412	3%	16,412	3%	16,412	3%	16,412
C	4%	21,833	3%	16,412	4%	21,883	3%	16,412	3%	16,412
D	8%	43,766	10%	54,708	8%	43,766	12%	65,650	14%	76,591
E	3%	16,412	12%	65,650	11%	60,179	14%	76,591	18%	98,474
F	1%	5,471	4%	21,833	4%	21,883	4%	21,883	4%	21,883
G	8%	43,766	8%	43,766	8%	43,766	7%	38,296	7%	38,296
H	25%	136,770	15%	82,062	10%	54,708	13%	71,120	10%	54,708
I	5%	27,901	3%	16,412	2%	10,942	2%	10,942	2%	10,942
J	7%	38,296	9%	49,237	13%	71,120	10%	54,708	8%	43,766
K	2%	10,942	5%	27,354	14%	76,594	8%	43,766	5%	27,354
L	22%	120,358	18%	98,474	13%	71120	14%	76,591	17%	93,004
M	3%	16,412	4%	21,883	3%	16412	3%	16,412	2%	10,942
N	2%	10,942	2%	10,942	2%	10,942	2%	10,942	2%	10,942
	100%	547,080	100%	547,080	100%	547,080	100%	547,080	100%	547,080

Single story open	0-10" (B,C)	Single story open	10-20" (D)	Single story open	20+" (E)	Multi story open	10-20" (J)	Multi story open	20+" (K)	>10% trees (A,N)	
current	26,807	current	43,766	current	16,412	current	38,296	current	10,942	current	60,179
Alt A	32,825	Alt A	54,708	Alt A	65,650	Alt A	49,237	Alt A	27,354	Alt A	32,825
Alt B	38,296	Alt B	43,766	Alt B	60,179	Alt B	71,120	Alt B	76,591	Alt B	38,296
Alt C	32,825	Alt C	65,650	Alt C	76,591	Alt C	54,708	Alt C	43,766	Alt C	38,296
Alt D	32,825	Alt D	76,591	Alt D	98,474	Alt D	43,766	Alt D	27,354	Alt D	38,296

Mult story close	0-10" (F,G)	Single story close	10-20" (H)	Single story closed	20+" (I)	Mult story close	10-20" (L)	Multi story closed	20+" (M)
current	49,237	current	136,770	current	27,901	current	120,358	current	16,412
Alt A	65,650	Alt A	82,062	Alt A	16,412	Alt A	98,474	Alt A	21,883
Alt B	65,650	Alt B	54,708	Alt B	10,942	Alt B	71,120	Alt B	16,412
Alt C	60,179	Alt C	71,120	Alt C	10,942	Alt C	76,591	Alt C	16,412

Alt D	60,179	Alt D	54,708	Alt D	10,942	Alt D	93,004	Alt D	10,942

Goshawk Habitat (J, K, L,M)		MSO habitat (K,L,M) (9% of PP meets PP/oak)		B. eagle/Allen LEB (D,E,H,I,J,K,L,M)		Merriam's shrew (C,D,E,J,K)	
current	186,007	current	13,294	current	410,857	current	131,299
Alt A	196,949	Alt A	13,294	Alt A	415,781	Alt A	213,361
Alt B	235,244	Alt B	14,771	Alt B	404,839	Alt B	273,540
Alt C	191,478	Alt C	12,309	Alt C	415,781	Alt C	257,128
Alt D	175,066	Alt D	11,817	Alt D	415,781	Alt D	262,598

Kaibab squirrel (28% of PP on NKRD (E,H,I,J,K,L,M)		(J,K,L,M optimum hab)
current	102,785	52,082
Alt A	101,100	55,146
Alt B	101,100	65,868
Alt C	98,037	53,614
Alt D	94,973	49,018

Figure 1 is a flow chart that provides more detail on the different states. The chart provides a visual representation of each state. There are a few minor errors on the chart. They are as follows:

State C – 0-5 inch diameter class should be 5-10 inch diameter class

State J – 10-10 inch diameter class should be 10-20 inch diameter class

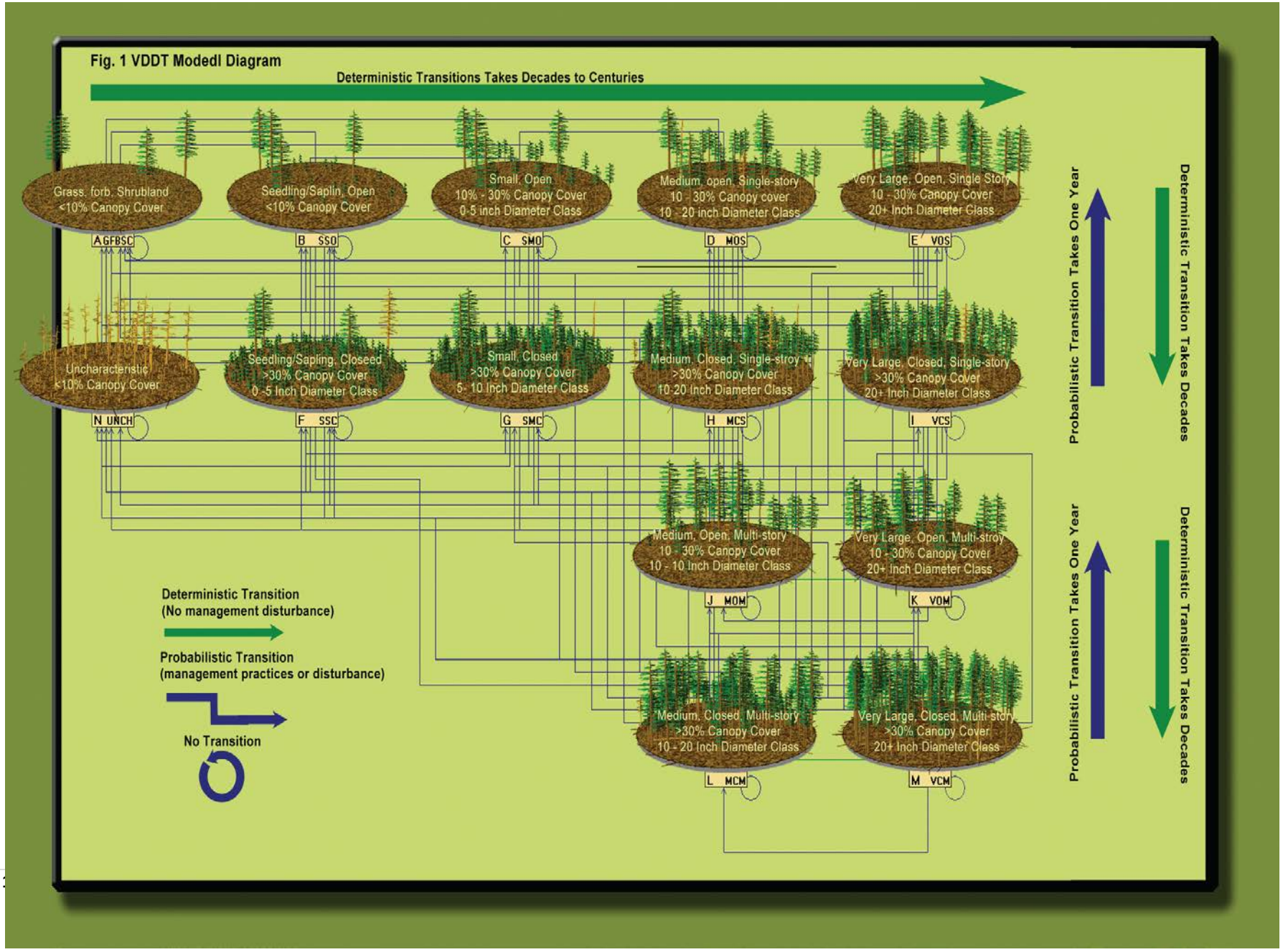
Fig. 1 VDDT Modedl Diagram
Deterministic Transitions Takes Decades to Centuries
Grass, forb, Shrubland
<10% Canopy Cover
A GFBSC
Seedling/Saplin, Open
<10% Canopy Cover
B SSO
Small, Open
10% - 30% Canopy Cover
0-5 inch Diameter Class
C SMO
Medium, open, Single-story
10 - 30% Canopy cover
10 - 20 inch Diameter Class
D MOS
Very Large, Open, Single Story
10 - 30% Canopy Cover
20+ Inch Diameter Class
E VOS
Uncharacteristic
<10% Canopy Cover
N UNCH
Seedling/Sapling, Closeed
>30% Canopy Cover
0 -5 Inch Diameter Class
F SSC
Small, Closed
>30% Canopy Cover
5- 10 Inch Diameter Class
G SMC
Medium, Closed, Single-stroy
>30% Canopy Cover
10-20 Inch Diameter Class
H MCS
Very Large, Closed, Single-story
>30% Canopy Cover
20+ Inch Diameter Class
I VCS
Medium, Open, Multi-story
10 - 30% Canopy Cover
10 - 10 Inch Diameter Class
J MOM
Very Large, Open, Multi-stroy
10 - 30% Canopy Cover
20+ Inch Diameter Class
K VOM
Medium, Closed, Multi-story
>30% Canopy Cover
10 - 20 Inch Diameter Class
L MCM
Very Large, Closed, Multi-story
>30% Canopy Cover
20+ Inch Diameter Class
M VCM
Probabilistic Transition Takes One Year
Deterministic Transition Takes Decades
Probabilistic Transition Takes One Year
Deterministic Transition Takes Decades
Deterministic Transition
(No management disturbance)
Probabilistic Transition
(management practices or disturbance)
No Transition

Appendix C. Crosswalk between Species Habitat Risk/Threats and Plan Components

This table is a cross walk used to show plan components that meet species specific habitat needs and provide for viability Detailed information on individual species contained within groups can be found in the Species Diversity Report, version 1.2.5.

DC = Desired Conditions, OBJ = Objectives, ST = Standards, GD = Guidelines

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
Tree dependent Northern goshawk, golden eagle, juniper titmouse, ferruginous hawk, red-faced warbler, evening grosbeak, olive-sided flycatcher, dusky grouse, Grace's warbler, black-throated gray warbler, bald eagle, Lewis's woodpecker, purple martin, red-naped sapsucker, Mexican spotted owl, gray vireo, western skink, Utah Mountain kingsnake, pale Townsend's big-eared bat, Allen's lappet-browed bat, southwestern myotis , Merriam's shrew	large trees and snags, cavities, downed logs, woody debris, mistletoe broom	Logging, wildfire, forest treatments such as prescribed fire and thinning, fuelwood collection, pile burning	**Pinyon-Juniper Communities DC:** Pinyon-juniper communities occur as a shifting mosaic across the landscape interspersed with openings. Old growth occurs throughout the landscape, generally in small areas as individual components, or as clumps. The mature groups of trees are structurally diverse, containing large live trees, as well as trees with dead or broken tops, gnarls, and burls. Snags, green snags and downed trees > 10" at root collar are present and average 1-2 /acre. **Pinyon-Juniper Shrub Communities DC:** The pinyon-juniper sagebrush shrub forest type is a mix of trees and shrubs that occur as shifting vegetation states (herbaceous-dominated, shrub-dominated, and tree-dominated) in even-aged and uneven-aged patches with a variable understory. There is a mix of large and small to mid-size juniper. **Pinyon-Juniper Woodland DC:** Some very old trees (>300 years old) are present. Disturbances rarely affect the composition, structure, and function. Insects, disease and mistletoe occur at endemic levels. **Pinyon-Juniper Communities GD:** Restoration efforts should emphasize the retention of groups of mature trees where they occurred historically, with a mix of mature trees, snags, and partially dead, or dying trees. Where pinyon-juniper obligate species occur (e.g., gray vireo), project designs should use methods (e.g., selective pruning, lop and drop, etc.) that emphasize the retention of key habitat features including snags, and partially dead or dying trees, and downed logs. **Ponderosa Pine DC:** *Fine-scale:* Tree groups are made up of clumps of various age classes and size classes that typically occur in areas less than one acre, but may be larger, such as on north-facing slopes. Large tree form oaks, snags and partial snags with hollow boles or limbs are present. Isolated infestations of Southwest dwarf mistletoe may occur, but the degree of severity and amount of mortality varies among the infected trees. Witches' brooms may form on infected trees, providing habitat and food for wildlife and invertebrate species. *Mid-scale:* The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages present. Basal area within forested areas generally ranges from 20 to 80 ft^2/ acre,

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			with larger trees (i.e. >18 inches d.b.h.) contributing the greatest percent of the total basal area. Snags 18" d.b.h. or greater average 1 to 2 snags/acre. Snags and green snags of various size and forms are common. Downed logs (>12" diameter at mid-point, and > 8' long) average 3 logs/acre. Coarse woody debris greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons/acre. *Landscape:* The ponderosa pine forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Groups of old trees are mixed with groups of younger trees. The ponderosa pine forest is composed predominantly of vigorous trees, but declining trees are present. Snags, green snags, and coarse woody debris are well-distributed throughout the landscape. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). The landscape is a functioning ecosystem that contains all its components, processes, and conditions associated with endemic levels of disturbances (e.g. fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind). **Frequent Fire Mixed Conifer DC:** *Fine-scale:* Trees within groups are of similar or variable ages, often containing more than one species. Dwarf mistletoe infections may be present on ponderosa pine and Douglas-fir, and rarely on other tree species, but the degree of infection severity and rate of mortality varies among infected trees. Witches' brooms may be present with these infestations, providing habitat for wildlife. *Mid-scale:* The frequent fire mixed conifer forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. Basal area within forested areas generally ranges from 30 to100 ft^2/acre, with larger trees contributing the greatest percent of the total basal area. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. Snags and green snags, 18" d.b.h. or greater average 3/acre. Downed logs (greater than12" diameter at mid-point and > 8' long) average 3/acre within the forested area of the mid-scale. Coarse woody debris, including downed logs, ranges from 5 to 15 tons/acre. *Landscape:* At the landscape scale, the frequent fire mixed conifer forest community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The frequent fire mixed conifer forest community is composed predominantly of vigorous trees, but declining trees are present and snags, top killed, lightning and fire scarred trees, and coarse woody debris (> 3 inch diameter) are well-distributed throughout the landscape. The landscape is a functioning ecosystem that contains all components, processes, and conditions that result from endemic levels of disturbances (e.g., fire, insects, diseases, and wind). Dwarf-mistletoe is present and infects ponderosa pine and Douglas-fir, but occurs at endemics levels, which allows for the

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			establishment and sustainability of the desired uneven aged forest structure over time. **Mesic Mixed Conifer/Spruce-Fir DC:** *Fine-scale:* Trees within groups can be of similar or variable species and ages. Dwarf mistletoe infections may be present on Douglas-fir or spruce and rarely on other tree species, but the degree of infection severity and amount of mortality varies among infected trees. Witches' brooms may be present with these infestations, providing habitat for wildlife. *Mid-scale:* The number of snags and downed logs (>12" diameter at mid-point, over 8" long) and coarse woody debris (>3" diameter) vary by seral stage. Snags 18" or greater at d.b.h. typically range from 1 to 5 snags/acre, with the lower range associated with early seral stages and the upper range associated with late seral stages. Coarse woody debris, including downed logs, varies by seral stage, but ranges from 5 to 20 tons/acre for early seral, 20 to 40 tons/acre for mid seral, and > 35 tons/acre in late seral areas. Fire and other disturbances maintain overall desired tree density, structure, species composition, coarse woody debris, and nutrient cycling. *Landscape:* The vegetation community is a mosaic of structural and seral stages ranging from young trees through old and is composed of multiple species. The landscape is composed predominantly of vigorous trees, but older declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris. The forest landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, wind, snow, and fire), including snags, downed logs, and old trees. Dwarf mistletoe infestations may be present in stands that are composed of Douglas-fir or spruce and rarely in other tree species. Infestation size, degree of severity, and amount of mortality varies among infested stands. Witches' brooms may be scattered throughout the infestations providing structural diversity in the stand and improved foraging and nesting habitat for wildlife species such as small mammals (e.g. tree squirrels), and raptors (e.g. goshawks, spotted owls). Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. **Aspen (General) DC:** Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes. **Aspen within Ponderosa Pine and Frequent Fire Mixed Conifer Forests DC:** In ponderosa pine and frequent fire mixed conifer vegetation types, the size, age and spatial extent of aspen stands reflect reference condition. **Aspen within Mesic Mixed Conifer / Spruce-Fir Forests DC:** Downed aspen and woody debris are scattered across the landscape and provide habitat for a variety of wildlife species (e.g. small mammals, reptiles, amphibians, and birds) while contributing to efficient nutrient cycling. The size, age, and spatial

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			extent of aspen stands reflect large-scale disturbance patterns and processes. **Aspen GD**: Aspen trees 10" or > d.b.h. (both live and dead) should be protected during project activities, except where they may pose a risk to fences lines or regeneration efforts. **Vegetation Management in all Forested Communities GD:** Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. As such, the largest and oldest trees are usually retained. Project design and treatment prescriptions should generally not remove: 1) Large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs (e.g. Thompson's age class 4, Dunning's tree class 5 and/or Keen's tree class 4, A and B). 2) Mature trees with large mistletoe brooms suitable for wildlife nesting, caching, and denning, except where retaining such trees would prevent the desired development of uneven aged conditions over time. 3) Large snags, partial snags and trees (>18" dbh) with broken tops, cavities, sloughing bark, lightning scars >4" wide, and large stick nests (>18" in diameter). 4) Gambel oak >8" d.r.c. & 5) Known bat roost trees. **Activities Following Large Scale Disturbances GD:** Recovery and restoration project design should seek to establish a trajectory toward the desired conditions for the affected vegetation type. Some snags and coarse woody debris should be retained to provide for wildlife habitat, soil stabilization, and other resource benefits. Some clumps of large (18" d.b.h.) standing dead trees should be retained. Snag retention should be balanced with desired fuel levels over time. **Cottonwood Willow Riparian DC:** Snag and gallery tree components comprised 55% mid-aged to mature cottonwood and willow trees, 25% younger trees and 20% in grass, shrubs, suckers, seedlings, and tree sprouts. Mature cottonwood and other trees provide cavities for cavity-dependent wildlife such as woodpeckers, sapsuckers and secondary cavity users. Tall trees provide lookouts and opportunities for nesting raptors. **Wildlife DC:** Species with specific habitat needs such as snags, logs, large trees, interlocking canopy, and cavities are provided for. **GD:** Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of wildlife, particularly for raptors. Project activities and special uses should incorporate recommended measures for golden eagle management such as closures to limit human

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			disturbance in the vicinity of golden eagle nests. **Threatened, Endangered, and Sensitive Species GD:** Project activities and special uses occurring within federally listed species habitat should integrate habitat management objectives and species protection measures from approved recovery plans. Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of Forest Service Sensitive Species. **Personal Fuelwood Collection GD:** The following should be permitted for personal use fuelwood gathering: 1) Dead and downed ponderosa pine, Douglas-fir and spruce, juniper, pinyon pine, Gambel oak, or aspen. 2) Standing dead: a) Ponderosa pine, Douglas-fir or spruce < 12" DBH or <15 feet in total height; b) Juniper without green foliage; c) Pinyon pine <12" DRC or < 12' in height; d) Gambel oak: < 8" DRC; & e) Aspen, < 12" DBH **Wildland Fire Management GD:** Decision documents for wildland fires should address wildlife desired conditions for key habitat features that provide structural diversity such as snags, logs, large tree form oaks, and oak thickets. Associated courses of action or management practices to address those objectives should also be developed. **WUI DC:** Logs and snags, which often pose fire control problems, are present in the WUI, but at the lower end of the range given in the vegetation community desired conditions. Dead and down fuel load is between 1 and 5 tons/acre.
Multi layered canopy, interlocking canopy and old growth Northern goshawk, juniper titmouse, red-faced warbler, evening grosbeak, olive-sided flycatcher, dusky grouse, black-throated gray warbler, pinyon jay, Lewis's woodpecker,	Interlocking canopy, old growth and denser stands	Logging, Fire (natural and prescribed)	**Pinyon Juniper Communities DC:** Pinyon-juniper communities occur as a shifting mosaic across the landscape interspersed with openings. Old growth occurs throughout the landscape, generally in small areas as individual components, or as clumps. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). At the mid-scale and above, canopy cover is at least 10% with a mix of young and mature groups and clumps of trees. The mature groups of trees are structurally diverse, containing large live trees, as well as trees with dead or broken tops, gnarls, and burls. Some tree groups have 30% to 40% canopy cover that provides habitat for nesting, bedding, and foraging. **Pinyon-Juniper Shrub Communities DC:** The pinyon-juniper sagebrush shrub forest type is a mix of trees and shrubs that occur as shifting vegetation states (herbaceous-dominated, shrub-dominated, and tree-dominated) in even-aged and uneven-aged patches with a variable understory. **Pinyon-Juniper Communities GD:** Restoration efforts should emphasize the retention of mature stands

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
MacGillivray's warbler, green-tailed towhee, golden-crowned kinglet, Mexican spotted owl, Arizona treefrog, Abert's squirrel, Kaibab tree squirrel, dwarf shrew, red squirrel			where they occurred historically, with a mix of mature trees, snags, and partially dead, or dying trees. **Ponderosa Pine DC**: *Fine-scale:* Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking and consist of approximately 2 to 40 trees/group. Where Gambel oak comprises more than 10% of the basal area, it is not uncommon for canopy cover to be greater than 40%. *Mid-scale:* The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages present. Forest conditions in some areas contain 10 to 20% higher basal area in mid-aged to old tree groups than in the general forest (e.g. goshawk post-fledging family areas, Mexican spotted owl nesting/roosting habitat, drainages, and steep north facing slopes). *Landscape:* The ponderosa pine forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. The forest is generally uneven-aged and open. Groups of old trees are mixed with groups of younger trees. Denser tree conditions exist in some locations such as north facing slopes, canyons, and drainage bottoms. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). **Frequent Fire Mixed Conifer DC:** *Fine-scale:* Trees typically occur in irregularly shaped groups and are variably-spaced with some tight clumps. Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking. Tree groups are typically > 1 acre size and consist of 2 to 50 trees/group, but are sometimes larger, such as on north facing slopes. Density is variable, with canopy ranging from very open to very closed. *Mid-scale:* The more biologically productive sites contain more trees per group and more groups per area. Forest conditions in some areas contain 10 to 20% higher basal area in mid-aged to old tree group than in the general forest; these include goshawk post-fledging family areas (PFAs), Mexican spotted owl nesting/roosting habitat, and north facing slopes. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. *Landscape:* At the landscape scale, the frequent fire mixed conifer forest community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Forest appearance is variable but generally uneven-aged and open; occasional patches of even-aged structure are present. The forest arrangement is in small clumps and groups of trees interspersed within variably sized openings of native grass/forb/shrub vegetation

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			associations similar to reference conditions. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Denser tree conditions exist in some locations such as north facing slopes, canyons, and drainage bottoms. **Mesic Mixed Conifer/Spruce-Fir DC:** *Fine-scale:* Mid-aged and older forests trees are typically variably-spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Trees within groups can be of similar or variable species and ages, contributing to vertical and horizontal heterogeneity. *Mid-scale:* Forest conditions in some areas contain higher basal area than the general forest; examples include goshawk post family fledgling areas, Mexican spotted owl nesting/roosting habitat, and north facing slopes. Density ranges from 20 to 250 ft^2 of basal area per acres, depending upon disturbance and seral stages of groups and patches. *Landscape:* The vegetation community type is a mosaic of structural and seral stages ranging from young trees through old and is composed of multiple species. The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation similar to reference conditions. Old growth generally occurs over large areas as stands or forests where old growth is concentrated. Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). **Aspen (General) DC:** Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes. **Aspen within Ponderosa Pine and Frequent Fire Mixed Conifer Forests DC:** In ponderosa pine and frequent fire mixed conifer vegetation types, the size, age and spatial extent of aspen stands reflect reference condition. **Vegetation Management in All Forested Communities GD:** Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. On suitable timberlands, projects should retain somewhat higher frequencies of trees across broad diameter classes to allow for future tree harvest. Project design should manage for replacement structural stages to assure continuous representation of old growth over time. **Wildlife DC:** Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of vertebrate and invertebrate species.

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			Threatened, Endangered, and Sensitive Species DC: Goshawk nest areas are multi-aged forests dominated by large trees with interlocking crowns and are generally denser than the surrounding forest. **GD**: Project activities and special uses occurring within federally listed species habitat should integrate habitat management objectives and species protection measures from approved recovery plans. Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of Forest Service Sensitive Species. A minimum of 6 nest areas (known and replacement) should be located per territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should generally be 25 to 30 acres in size. Goshawk territories (post-fledging family areas) of approximately 420 acres in size should be designated surrounding the nest areas.
Understory dependent Dusky grouse, red-faced warbler, Nevada point-head grasshopper, Persephone's darner, desert green hairstreak, Kaibab Indra swallowtail, four-spotted skippering, Nokomis fritillary, Nokomis fritillary ssp. nokomis, pronghorn, Navajo Mogollon vole, Merriam's shrew, dwarf shrew	Native grasses and shrubs/ underbrush	Pile burning, non-native plant invasion	**Pinyon-Juniper Communities DC:** Pinyon-juniper communities occur as a shifting mosaic across the landscape interspersed with openings. At the mid-scale and above, canopy cover is at least 10% with a mix of young and mature groups and clumps of trees. Plant litter (leaves, needles, etc.) and understory plant cover is present in sufficient quantity to stabilize soils, prevent erosion, promotes nutrient cycling, improve water retention, and provide the microclimate conditions necessary for pinyon seed germination. **Pinyon-Juniper Grasslands DC:** Pinyon-juniper grasslands are generally uneven-aged and open in appearance. Trees occur as individuals, but occasionally are in small groups and range from young to old. Scattered shrubs and a dense herbaceous understory including native grasses, forbs and annuals are present to maintain soil productivity, resist soil erosion and can support frequent low intensity surface fires. Understory composition is within the natural range of variability and contains diverse native herbaceous plant species that provide nutrition for pronghorn and other species. Depending on soil type and vegetation potential, bare soil varies between 10 and 60%. Basal vegetation varies between 5 and 50% ground cover. Organic litter varies between 30 and 50% of the ground cover. The relative proportion of vegetation canopy cover averages 40 to 60% grass, 10 to 30% forbs, and 5 to 20% shrub. **Pinyon-Juniper Shrub DC:** The shrub component consists primarily of sagebrush, but oak, cliffrose, and other shrub species may also be present. The understory is dominated by shrubs depending on structural stage. The shrub component consists of one or more shrub species, which are well-distributed. Litter and rock comprise the greatest percentage of ground cover. Grasses and forbs are sparse due to shrub dominance. **Pinyon-Juniper Communities GD:** Pinyon-juniper communities should maintain tree densities that maximize herbaceous plant growth and wildlife species diversity typical for their respective community subtype. Project design for vegetation management activities should prioritize treatment areas along

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			known wildlife corridors, in the wildland-urban interface, and historic openings. **Ponderosa Pine DC** *Fine-scale:* Trees typically occur in irregularly shaped groups and are variably-spaced with some tight clumps. The interspaces between groups are variably shaped and comprised of a grass/forb/shrub mix and may contain individual trees or snags. Organic ground cover and herbaceous vegetation provide protection for soil and moisture infiltration, and contribute to plant and animal diversity and ecosystem function. Herbaceous vegetation reflects the site potential. *Mid-scale:* Basal area within forested areas generally ranges from 20 to 80 ft^2/ acre, with larger trees (i.e. >18 inches d.b.h.) contributing the greatest percent of the total basal area. Interspaces with grass/forb/shrub vegetation are variably shaped and typically range from 10% to 70%, with the more open conditions typically occurring on less productive sites. *Landscape:* The forest is generally uneven-aged and open. **OBJ:** Mechanically thin 11,000 to 19,000 acres annually. Treat an average of 13,000 to 55,000 acres annually, using a combination of prescribed fire and naturally ignited wildfires. **Frequent Fire Mixed Conifer DC:** *Fine-scale:* Trees typically occur in irregularly shaped groups and are variably-spaced with some tight clumps. Interspaces between groups are variably shaped, are comprised of native grasses-forbs- shrubs mix, and may contain individual trees or snags. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Herbaceous vegetation reflects the site potential. *Mid-scale*: Basal area within forested areas generally ranges from 30 to 100 ft^2/ acre, with larger trees contributing the greatest percent of the total basal area. Openings with native grass, forb, and shrub vegetation typically range from 10 to 50% of the area. *Landscape:* The forest arrangement is in small clumps and groups of trees interspersed within variably sized openings of native grass-forb-shrub vegetation associations similar to reference conditions. **OBJ:** Burn an average of 1,000 to 13,000 acres annually, using prescribed fire and/or naturally ignited wildfires. Mechanically thin 1,200 to 2,100 acres annually. **Mesic Mixed Conifer/Spruce-fir DC:** *Fine-scale:* Small openings (gaps) are present as a result of past disturbances. Organic ground cover and herbaceous vegetation provide protection for soil and moisture infiltration, and contribute to plant diversity and ecosystem function. Understory vegetation reflects site potential. *Mid-scale:* Density ranges from 20 to 250 ft^2 of basal area/acre, depending upon disturbance and seral stages of groups and patches. Grass, forb, and shrub dominated openings created by disturbance may make up 10 to 100% of the mid-scale patches (100-1,000 acres).

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			Aspen (General) DC: Understory vegetation consists of shrubby or herbaceous species, providing forage and cover for wildlife and habitat for invertebrates such as pollinators. **Vegetation Management in All Forested Communities GD:** Vegetation management prescriptions should provide for sufficient canopy breaks to limit crown fire spread between groups, allow for the redevelopment and maintenance of a robust understory, and mimic the spatial arrangement of the references conditions. Trees established after 1890 should generally not be retained in areas where biophysical conditions would have supported stable openings over time. Vegetation management activities should meet or exceed goals for scenic beauty (scenic integrity objectives) by creating natural patterns, structure and composition of trees, shrubs, grasses and other plants. Vegetation treatments should favor the development of native understory species in areas where they have the potential to establish and grow. Seed and plants used for revegetation should originate from the same PNVT and general ecoregion (i.e. southern Colorado Plateau) as the project area. **Desert Communities DC:** Desert communities are characterized by extensive grasses with a shrub cover less than 30%. Ground cover canopy ranges from 5% to 40%. Shrubs contribute to native plant diversity and structure. **Cottonwood-Willow Riparian Forest DC:** Vegetation is characterized by willow and other herbaceous understory species. Snag and gallery tree components comprised 55% mid-aged to mature cottonwood and willow trees, 25% younger trees and 20% in grass, shrubs, suckers, seedlings, and tree sprouts. **Soil DC:** Soils provide for diverse native plant species. Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration. **Wildlife DC:** Grasses, forbs, and shrubs provide forage, cover, fawning, and nesting sites. **Non-Native Invasive Species DC:** Invasive species are contained and controlled so that they do not disrupt the structure or function of ecosystems. **GD:** All ground disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species. New populations are detected early, monitored, and treated as soon as possible. Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna. **Livestock Grazing DC:** Livestock use is consistent with other desired conditions.

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			GD: Livestock management should favor the development of native cool season grasses and forbs. Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g. forage production, weeds, fawning habitat, soils, etc.). Post-fire grazing should not be authorized until Forest Service range staff confirms range readiness. **Mineral and Mining GD:** Restoration and reclamation of surface disturbance associated with mineral activities should be implemented to achieve 70% of ground cover (as compared to nearby undisturbed areas) with permanent native vegetation within three growing seasons.
Grassland dependent Golden eagle, western burrowing owl, ferruginous hawk, savannah sparrow, Arizona black rattlesnake, milksnake, Great Basin spadefoot, Kaibab Indra swallowtail, pronghorn, Gunnison's prairie dog, House Rock Valley chisel-toothed kangaroo rat, spotted bat, Navajo Mogollon vole	Native plant composition, openness	Invasive plants, conifer/woodland encroachment, unmanged grazing	**Pinyon-Juniper Grassland DC:** Pinyon-juniper grasslands are generally uneven aged and open in appearance. Trees occur as individuals, but occasionally are in small groups and range from young to old. Scattered shrubs and a dense herbaceous understory including native grasses, forbs and annuals are present to maintain soil productivity, resist soil erosion and can support frequent low intensity surface fires. Understory composition is within the natural range of variability and contains diverse native herbaceous plant species that provide nutrition for pronghorn and other species. Depending on soil type and vegetation potential, bare soil varies between 10 and 60%. Basal vegetation varies between 5 and 50% ground cover. Organic litter varies between 30 and 50% of the ground cover. The relative proportion of vegetation canopy cover averages 40 to 60% grass, 10 to 30% forbs, and 5 to 20% shrub. **Grasslands DC:** Vegetation is composed of a mix of native grasses and forbs. The structure, composition, and distribution of vegetation are within the range of natural variability and occur in natural patterns of abundance and diversity, which vary depending on soil type and microclimate. Disturbance processes are similar to reference conditions and play a primary role in the function of the ecosystem. Vegetation height and cover are sufficient to support the historic fire return interval. Understory composition is within the natural range of variability and contains diverse native herbaceous plant species that provide nutrition for pronghorn and other species. Depending on soil type, bare soil varies between 5 and 80%. Basal vegetation varies between 5 and 60% ground cover. Organic litter varies between 30 and 50% of the ground cover. Vegetation composition will average 40 to 60% grass, and 10 to 30% forbs. Understory vegetation reflects the site potential. Tree and shrub canopy cover are each less than 10%. **OBJ:** Reduce tree density to >10% on 5,000 to 10,000 acres of historic grasslands annually. **GD:** In areas where native herbaceous cover is sparse and seed sources do not exist, seeding should be considered.

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			Colorado Plateau/Great Basin Grasslands DC: Vegetation height and canopy cover are sufficient to carry fire under low wind conditions to support fire on a 10- to 30-year return interval. **Semi-desert Grasslands DC:** Vegetation height and canopy cover are sufficient to carry fire under low wind conditions to support fire on a 10- to 30-year return interval. **Soil DC:** Soils provide for diverse native plant species. Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration. **Wildlife DC:** Grasses, forbs, and shrubs provide forage, cover, fawning, and nesting sites. **Non-Native Invasive Species DC:** Invasive species are contained and controlled so that they do not disrupt the structure or function of ecosystems. **GD:** All ground disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species. New populations are detected early, tracked, and treated as soon as possible. Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna. **Livestock Grazing DC:** Grasses and forbs provide adequate forage for permitted livestock. Livestock use is consistent with other desired conditions. **GD:** Livestock management should favor the development of native cool season grasses and forbs. Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g. forage production, weeds, fawning habitat, soils, etc.). Post-fire grazing should not be authorized until Forest Service range staff confirms range readiness.
Meadow dependent Golden eagle, American peregrine falcon, California condor, savannah sparrow, Kaibab variable tiger beetle, four-spotted	Moist meadows, loss of forbs, soil substrate	Erosion, tree invasion, mechanical thinning, fire, trampling/soil compaction	**Vegetation Management Activities GD:** Heavy equipment and log decks should not be staged in montane meadows. **Grasslands DC:** Vegetation is composed of a mix of native grasses and forbs. The structure, composition, and distribution of vegetation are within the range of natural variability and occur in natural patterns of abundance, which vary depending on soil type and microclimate. Disturbance processes are similar to reference conditions and play a primary role in the function of the ecosystem. Vegetation height and cover are sufficient to support the historic fire return interval. Understory composition is within the natural range of variability and contains diverse native herbaceous plant species that provide nutrition for

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skippering, pronghorn, Gunnison's prairie dog, spotted bat, greater western mastiff bat, long-tailed vole, Navajo Mogollon vole, big free-tailed bat, dwarf shrew, Kaibab northern pocket gopher			pronghorn and other species. Depending on soil type, bare soil varies between 5 and 80%. Basal vegetation varies between 5 and 60% ground cover. Organic litter varies between 30 and 50% of the ground cover. Vegetation composition will average 40 to 60% grass, and 10 to 30% forbs. Understory vegetation reflects the site potential. Tree and shrub canopy cover are each less than 10%. **Montane/Subalpine Grasslands DC:** Montane meadows and subalpine grassland vegetation have high soil productivity and biological diversity. Native species occur in natural patterns of abundance, composition, and distribution. Vegetation is healthy and at least stable. Vegetation and litter is sufficient to maintain and improve water infiltration, nutrient cycling, and soil productivity. **Soil DC:** Soils provide for diverse native plant species. Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration. **Wildlife DC:** Grasses, forbs, and shrubs provide forage, cover, fawning, and nesting sites. **Non-Native Invasive Species DC:** Invasive species are contained and controlled so that they do not disrupt the structure or function of ecosystems above the fine scale. **GD:** All ground disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species. New populations are detected early, tracked, and treated as soon as possible. Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna. **Livestock Grazing DC:** Grasses and forbs provide adequate forage for permitted livestock. Livestock use is consistent with other desired conditions. **GD:** Livestock management should favor the development of native cool season grasses and forbs. Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g. forage production, weeds, fawning habitat, soils, etc.). Post-fire grazing should not be authorized until Forest Service range staff confirms range readiness. The concentrated use of montane meadows for livestock grazing should be minimized when soils are saturated to reduce grassland impacts. When no other options are available, use should be rotated annually. **Transportation GD:** Roads should not be located in meadows when they can be located in other areas.

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Shrubland dependent Sage sparrow, golden eagle, ferruginous hawk, sage thrasher, green-tailed towhee, Brewer's sparrow, Arizona black rattlesnake, Utah Mountain kingsnake, Persephone's darner, desert green hairstreak, pronghorn, spotted bat, bat free-tail bat, desert bighorn sheep	Native shrubs-species composition, openings	Woodland invasion/succession unmanaged grazing	**Pinyon-Juniper Shrub DC:** The pinyon-juniper sagebrush shrub forest type is a mix of trees and shrubs that occur as shifting vegetation states (herbaceous-dominated, shrub-dominated, and tree-dominated) in even-aged and uneven-aged patches with a variable understory. There is a mix of large and small to mid-size juniper. The shrub component consists primarily of sagebrush, but, oak, cliffrose, and other shrub species may also be present. The understory is dominated by shrubs depending on structural stage. The shrub component consists of one or more shrub species, which are well-distributed. Shrubs typically are in a closed-canopy state during the later successional stages. The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, and severity of disturbances including insects, diseases, fire, and climate variability. **Sagebrush Shrublands DC:** The composition, structure, and function of biotic and abiotic components of sagebrush shrublands are within or moving toward reference conditions. The majority of sagebrush is in mid-seral or mature states. Enough shrub cover exists to meet the needs of a variety of sagebrush-obligate wildlife species. A vigorous, but not necessarily dense, understory community of native grasses and forbs are present. Understory vegetation reflects the site potential. Single trees or groups of trees cover less than 10 percent of any Terrestrial Ecosystem Survey (TES) map unit polygon and less than 5% of the community. Shrub cover is at least 5%, and typically makes up 20% to 50% of any TES soil unit. Characteristic disturbances play a role in the function of the ecosystem. **GD:** Prior to developing project proposals for restoring sagebrush communities, a determination should be made of the sagebrush sub-species because the differing sub-species indicate different desired reference conditions. Management activities should be designed to mimic the historic disturbance. Where sagebrush communities are severely degraded, waters should be strategically placed to improve animal distribution and reduce grazing impacts. **Desert Communities DC:** Desert communities are characterized by extensive grasses with a shrub cover less than 30%. Ground cover canopy ranges from 5% to 40%. Shrubs contribute to the native plant diversity and structure. Plant litter occupies up to 5 percent of the soil surface. Density of juniper and other shrubby species is maintained at levels which promote natural fire regimes and long fire return intervals. Fire occurrence is low and infrequent. Natural disturbance regimes include soil engineers such as arthropods and sometimes small mammals. Rocky outcroppings and shrubby plant species provide abundant browse and foraging opportunities for mule deer and bighorn sheep. Native ungulates are free from disease. Domestic livestock are absent. **GD:** Fire should not be used as a vegetation management tool in desert communities.

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			Gambel Oak Shrublands DC: The system is dominated by native tall shrubs and hardwood trees. Some areas contain many trees with relatively large hollow boles or limbs. Coniferous trees are widely scattered and are frequently mature or old. Young Gambel oak thickets and sometimes other species comprise a patchy shrub layer. Ground cover is mostly comprised of oak litter, with grasses and forbs present. Low intensity fire occurs regularly with intervals of > 25 years. Non-native species are absent or comprise less than 1% of the total cover. Old stands contain habitat for birds and arboreal nesting or roosting mammals. A variety of oak growth forms, sizes, and densities that benefit wildlife species can be found across the landscape. **Wildland Fire Management GD:** Decision documents for managing fire should evaluate the risk of cheatgrass invasion. When there is a moderate to high risk of cheatgrass invasion (e.g. lower elevation areas), mitigation measures should be implemented and/or fire should be excluded if adequate treatments are not available or if they are cost prohibitive. **Wilderness Areas GD:** Wildfires should be suppressed in the desert communities of the Kanab Creek Wilderness.
Pinyon-Juniper dependent Juniper titmouse, black-throated gray warbler, pinyon jay, purple martin, gray vireo, Arizona black rattlesnake, western skink, Utah Mountain kingsnake, Great Basin spadefoot, Persephone's darner, desert green hairstreak, Kaibab Indra swallowtail, big free-tail bat	Openness of stands, diversity of stands	Erosion, tree invasion, mechanical thinning, fire, trampling/soil compaction	**Pinyon-Juniper Communities DC:** Pinyon-juniper communities occur as a shifting mosaic across the landscape interspersed with openings. The configuration of vegetation and openings provides enough sighting distance and hiding cover for pronghorn to escape predators. Old growth occurs throughout the landscape, generally in small areas as individual components, or as clumps. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). At the mid-scale and above, canopy cover is at least 10% with a mix of young and groups and clumps of trees. The mature groups of trees are structurally diverse, containing large live trees, as well as trees with dead or broken tops, gnarls, and burls. Snags, green snags and downed trees > 10" at root collar are present and average 1-2/acre. Some clumps have 30% to 40% canopy cover that provides habitat for nesting, bedding, and foraging. The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (e.g. insects, diseases, and fire) and climate variability. Plant litter (leaves, needles, etc.) and understory plant cover contributes to soil stabilization, prevents erosion, promotes nutrient cycling, improves water retention, and provides the microclimate conditions necessary for pinyon seed germination. Nurse trees provide understory microclimate with improved nutrient and soil properties, higher soil moisture, and lower temperatures, and lower light levels, which increases the survival of pinyon seedlings under harsh conditions. A robust crop of pinyon pine nuts are regularly produced. **Pinyon-Juniper Grasslands DC:** Pinyon-juniper grasslands are generally uneven aged and open in

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			appearance. Trees occur as individuals, but occasionally are in small groups and range from young to old. Scattered shrubs and a dense herbaceous understory including native grasses, forbs and annuals are present to maintain soil productivity, resist soil erosion and can support frequent low intensity surface fires. The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (including insects, diseases, and fire) and climate variability. Understory composition is within the natural range of variability and contains diverse native herbaceous plant species that provide nutrition for pronghorn and other species. Depending on soil type and vegetation potential, bare soil varies between 10 and 60%. Basal vegetation varies between 5 and 50% ground cover. Organic litter varies between 30 and 50% of the ground cover. The relative proportion of vegetation canopy cover averages 40 to 60% grass, 10 to 30% forbs, and 5 to 20% shrub. **Pinyon-Juniper Shrub DC:** The pinyon-juniper sagebrush shrub forest type is a mix of trees and shrubs that occur as shifting vegetation states (herbaceous-dominated, shrub-dominated, and tree-dominated) in even-aged and uneven-aged patches with a variable understory. There is a mix of large and small to mid-size juniper. The shrub component consists primarily of sagebrush, but, oak, cliffrose, and other shrub species may also be present. The understory is dominated by shrubs depending on structural stage. The shrub component consists of one or more shrub species, which are well-distributed. Shrubs typically are in a closed-canopy state during the later successional stages. Litter and rock comprise the greatest percentage of ground cover. Grasses and forbs are sparse due to shrub dominance. The composition, structure, and function of vegetation conditions are resilient to the frequency, extent and severity of disturbances including insects, diseases, fire, and climate variability. **Pinyon-Juniper (Persistent) Woodlands DC:** Pinyon-Juniper Woodland (persistent) is characterized by even-aged patches of pinyons and junipers that at the landscape level form multi-aged woodlands. Tree density and canopy cover are high, shrubs are sparse to moderate, and herbaceous cover is low and discontinuous due to soil and other site conditions. Some very old trees (>300 years old) are present. Disturbances rarely affect the composition, structure, and function. Insects, disease and mistletoe occur at endemic levels. **Pinyon-Juniper Communities GD:** The pinyon-juniper vegetation type (pinyon-juniper grassland, shrubland, or woodland) should be determined before developing project proposals to ensure the applicable desired conditions are applied. Restoration efforts should emphasize the retention of groups of mature trees where they occurred historically, with a mix of mature trees, snags, and partially dead, or dying trees. Pinyon-juniper communities should maintain tree densities that maximize herbaceous plant growth and wildlife species diversity typical for their respective community subtype. Where pinyon-juniper obligate species occur (e.g., gray vireo), project designs should use methods (e.g., selective

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			pruning, lop and drop, etc.) that emphasize the retention of key habitat features including snags, and partially dead or dying trees, and downed logs. Project design for vegetation management activities should prioritize treatment areas along known wildlife corridors, in the wildland-urban interface, and in historic openings. Restoration treatments in pinyon-juniper should be rotated over time and various successional stages to maximize wildlife habitat and diversity.
Riparian dependent American peregrine falcon, bald eagle, migratory birds, Arizona toad, Arizona treefrog, northern leopard frog, Great Basin spadefoot, western red bat	Lowering of the water table, dense thickets of shrubby vegetation, structural heterogeneity, full complement of tree age size classes, snags, streamside vegetation,	Dewatering or channelization, invasion by non-native species, treatments of exotic plant species (mechanical removals, herbicides), livestock/grazing, wildfire	**Wetland/Cienega DC:** Wetlands conditions are consistent with their flood regime and flood potential. Plant and animal species that require wetland habitats have healthy populations within the natural constraints of the particular wetland community. Wetlands infiltrate water, recycle nutrients, resist erosion, and function properly. **OBJ:** Restore native vegetation and natural water flow patterns on at least 6 acres of wetlands within 5 years of plan approval. **Cottonwood Willow Riparian DC:** The extent, diversity and condition of riparian habitat contribute to ecological sustainability. Dense shrubbery and high levels of vegetative diversity (structural and compositional) and permanent water provide food, cover, and water for wildlife, including terrestrial and aquatic invertebrates and vertebrates. Vegetation is characterized by willow and other herbaceous understory species. Snag and gallery tree components comprise 55% mid-aged to mature cottonwood and willow trees, 25% younger trees and 20% in grass, shrubs, suckers, seedlings, and tree sprouts. Vegetation is structurally diverse and provides habitat for high bird species diversity and abundance with nesting and foraging opportunities for neotropical migrants. Mature cottonwood and other trees provide cavities for cavity-dependent wildlife such as woodpeckers, sapsuckers and secondary cavity users. Tall trees provide lookouts and opportunities for nesting raptors. Water flow regime approximates reference conditions (i.e. perennial flows) and flows freely. Sedimentation is minimized. Springtime flooding contributes to ecosystem sustainability by optimizing germination conditions for seedlings and/or suckering opportunities from the parent plant. When nonnative vegetation is present, the spatial and structural composition contributes to overall faunal diversity. Grazing from domestic ungulates is minimal or absent. Soil is free from compaction and includes sand and gravelly reaches and provides suitable germination sites for desirable plant species. Sandy and vegetated terraces provide habitat for reptiles and amphibians. Shallow exposed watersides provide drinking and foraging opportunities for wildlife. Fire is limited or absent in this system. **Soils and Watersheds GD:** Seeds and plants used for revegetation should originate from the same PNVT and general ecoregion (i.e. southern Colorado Plateau) as the project area.

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			Natural Waters DC: The necessary physical and biological components, including cover, forage, water, microclimate, and nesting/breeding habitat, provide habitat for a diverse community of plant and wildlife species. Riparian-dependent plant and animal species are self-sustaining and occur in natural patterns of abundance and distribution. Native macroinvertebrates are appropriately abundant and diverse. Unwanted nonnative species do not exert a detectable impact on aquatic and wetland ecosystems. Springs, streams and ponds have appropriate plant cover to protect banks and shorelines from excessive erosion. **Non-Native Invasive Species GD:** Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna. **Livestock Grazing GD:** Livestock use in and around wetlands should be evaluated on an allotment-specific basis. Mitigation measures such as deferment and fencing (full or partial) should be implemented as needed to minimize potential livestock effects.
Water dependent **(wetlands, seeps/springs, waters)** American peregrine falcon, bald eagle, migratory birds, spikedace, Apache trout, loach minnow, Arizona toad, Arizona treefrog, northern leopard frog, Great Basin spadefoot, Kaibab fairy shrimp, Nevada point-head grasshopper, Persephone's darner, hoary skimmer, four-spotted skippering,	Lowering or depletion of the water table, edge vegetation, connectivity/stopover habitat for migrating birds	Wetland drainage, spring capping, flood scouring, overgrazing, trampling	**Wetland/Cienega DC:** Wetlands conditions are consistent with their flood regime and flood potential. Plant and animal species that require wetland habitats have healthy populations within the natural constraints of the particular wetland community. Wetlands infiltrate water, recycle nutrients, resist erosion, and function properly. **OBJ:** Restore native vegetation and natural water flow patterns on at least 6 acres of wetlands within 5 years of plan approval. **Watershed DC:** Vegetation conditions within watersheds contribute to downstream water quality and quantity. **Natural Waters DC:** Stream channel stability and aquatic habitats retain their inherent resilience to natural and other disturbances and climate fluctuations. Stream channel morphology reflects changes in the hydrological balance, runoff, and sediment supply appropriate to the landscape setting. Springs and ponds have the necessary soil, water, and vegetation attributes to be healthy and functioning. Water levels, flow patterns, groundwater recharge rates, and geochemistry are similar to reference conditions. Within its capability, stream flow and water quality is adequate to maintain aquatic habitat and water sources for native and selected nonnative wildlife. The necessary physical and biological components, including cover, forage, water, microclimate, and nesting/breeding habitat, provide habitat for a diverse community of plant and wildlife species. Riparian-dependent plant and animal species are self-sustaining and occur in natural patterns of abundance and distribution. Within its capability, streamflow and water quality are adequate to maintain aquatic habitat and water sources for native and desired nonnative species. Native

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Nokomis fritillary, Nokomis fritillary ssp. nokomis, pale Townsend's big-eared bat, spotted bat, greater western mastiff bat, Allen's lappet-browed bat, western red bat, southwestern myotis			macroinvertebrates are appropriately abundant and diverse. Unwanted nonnative species do not exert a detectable impact on aquatic and wetland ecosystems. Native amphibians are free from or minimally impacted by non-native predation and diseases. Springs, streams and ponds have appropriate plant cover to protect banks and shorelines from excessive erosion. Hydrophytes and emergent vegetation exist in patterns of natural abundance in wetlands and springs in levels that reflect climatic conditions. Overhanging vegetation and floating plants such as water lilies exist where they naturally occur. Where springs or other natural waters have been modified for livestock and/or human consumption, developments are operational. **OBJ:** Protect and/or restore at least 10 individual springs within 5 years of Plan approval. **GD:** Access to natural waters should be restricted to designated trails and points of entry to mediate erosion and prevent trampling and inadvertent introduction of nonnative and undesirable biota and disease. Fences constructed around natural waters should allow bats and other desirable wildlife to pass through unharmed. Diversions of water sources that recharge wetlands should be assessed and appropriate actions should be identified to mitigate or minimize effects. Spring source areas should be preferentially protected. Water rights for springs should be secured where there are no existing water rights or claims. The impacts of management activities on springs, streams, and wetlands should be evaluated and minimized. **Constructed Waters DC:** Drinkers have escape ramps that provide safe access and egress for wildlife. Constructed waters do not contribute to the spread of chytrid fungus or unwanted nonnative species. Reservoirs maintain high quality for parameters such as temperature, dissolved oxygen, and water levels within the seasonal range of variable conditions. Desirable nonnative fish species provide recreational fishing opportunities in reservoirs and lakes consistent with the needs of native species. **GD:** Scholz Lake should not be managed for recreational sport fishing. In riparian aquatic areas, current protocols for preventing the spread of chytrid fungus should be followed. If new drinkers are necessary, they should be constructed in areas that reduce ungulate impact to sensitive vegetation or soils such as riparian, aspen, and wet meadow areas. Drinkers should be maintained to provide water during times of scarcity. **Livestock Grazing GD:** Livestock use in and around wetlands should be evaluated on an allotment-specific basis. Mitigation measures such as deferment and fencing (full or partial) should be implemented as needed to minimize potential livestock effects.

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			Wilderness DC: A reproducing population of Apache Trout is maintained in North Canyon Creek. **Frank's Lake Geologic-Botanic Area GD:** Livestock should be excluded from the Frank's Lake Geologic Botanic Area.
Species affect by sediments into natural waters Spikedace, Apache trout, loach minnow, Arizona toad, Arizona treefrog, northern leopard frog. Kaibab fairy shrimp	Loss of habitat function, increase in sediments above background level	Erosion, unmanaged grazing	**Pinyon-Juniper Communities DC:** Plant litter (leaves, needles, etc.) and understory plant cover contributes to soil stabilization, prevents erosion, promotes nutrient cycling, improves water retention, and provides the microclimate conditions necessary for pinyon seed germination. **Ponderosa Pine DC:** *Fine:* Organic ground cover and robust herbaceous vegetation provide protection for soil, and moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Herbaceous vegetation reflects the site potential. **Frequent Fire Mixed Conifer DC:** *Fine:* Organic ground cover and robust herbaceous vegetation provide protection for soil, and moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Herbaceous vegetation reflects the site potential. **Mesic Mixed Conifer/Spruce-fir DC:** *Fine:* Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Understory vegetation reflects the site potential **Following Large Scale Disturbances GD:** Recovery and restoration projects design should seek to establish a trajectory toward desired conditions for the affected vegetation type. Erosion control should be implemented to protect significant resource values and infrastructure such as stream channels, roads, structures, and archeological or historic sites. Practices that restore nutrient cycling and stabilize soils (revegetation, mulching, lop and scatter, etc.) should be implemented. **Montane/Subalpine Grasslands DC:** Montane and subalpine meadow vegetation has high soil productivity and biological diversity. Vegetation and litter is sufficient to maintain and improve water infiltration, nutrient cycling, and soil productivity. **Wetland/Cienega DC:** Wetlands provide habitat consistent with their flood regime and flood potential. Wetlands infiltrate water, recycle nutrients, resist erosion, and function properly. **Soil DC:** Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration. Accelerated soil loss is minimal, especially on sensitive or highly erodible sites.

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			Soils can readily absorb, store, and transmit water vertically and horizontally, accept, hold, release nutrients, and resist erosion. Infiltration rates are good in TES soil units that are described as well drained and moderately well-drained. **Watershed DC:** Vegetation conditions within watersheds contribute to downstream water quality and quantity. Surface runoff, sheet, rill, gully erosion and subsequent sedimentation into connecting waters downstream is minimal. Flooding maintains normal stream characteristics (e.g., water transport, sediment, woody material) and dimensions (e.g., bankfull width, depth, slope, sinuosity). Vertical down cutting and embeddedness are absent in drainages. Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare. The fuels composition within watersheds does not put the watersheds at risk for uncharacteristic disturbance. Water quality meets or exceeds State of Arizona or Environmental Protection Agency water quality standards for designated uses. Water quality meets critical needs of aquatic species. **Soils and Watershed GD:** Projects should include design features to protect and improve watershed condition. In disturbed areas, erosion control measures should be implemented to improve soil conditions. **Natural Waters DC:** Stream channel stability and aquatic habitats retain their inherent resilience to natural and other disturbances and climate fluctuations. Stream channel morphology reflects changes in the hydrological balance, runoff and sediment supply appropriate to the landscape setting. **GD:** Access to natural waters should be restricted to designated trails and points of entry to mediate erosion and prevent trampling and inadvertent introduction of nonnative and undesirable biota and disease. **Wildland Fire Management DC:** Wildland fire maintains and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role. Regular fire entry protects social, economic, and ecological values at risk from high-severity disturbance effects. Wildland fires burn within the range of intensity and frequency of the historic fire regime of the vegetation community. Uncharacteristic high-severity fires rarely occur, and do not burn at the landscape scale. **Transportation System OBJ:** Obliterate or naturalize 20 miles of non-system roads (unauthorized, unneeded, and decommissioned) within 10 years of plan approval. **GD:** Roads should be decommissioned when no longer needed. **Mineral and Mining Activities GD:** Adverse surface impacts should be minimized through the

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			appropriate administration of mining and mineral laws and regulations. Soil disturbance should be kept to a minimum. Restoration and reclamation of surface disturbance associated with mining operations should be implemented to achieve 70% of ground cover (as compared to nearby undisturbed areas) with permanent native vegetation within 3 growing seasons.
Aspen dependent Red-faced warbler, evening grosbeak, olive-sided flycatcher, dusky grouse, MacGillivray's warbler, red-naped sapsucker, orange-crowned warbler, Kaibab least chipmunk, Kaibab northern pocket gopher	Regenerating of stands, diversity in age within stands, conifer encroachment	Ungulate grazing,	**Frequent Fire Mixed Conifer DC:** *Landscape:* Where they occur naturally, groups of aspen and all structural stages of oak are present. **Mesic Mixed Conifer/Spruce-Fir DC:** *Mid-scale:* Aspen is occasionally present in large patches. **Aspen (General) DC:** Aspen stands are characterized by disturbances which may include fire, mechanical thinning, insects, pathogens and abiotic factors. Collectively these agents of change promote healthy tree regeneration, decadence, and nutrient cycling. These processes further contribute to high quality wildlife habitat and biodiversity. Aspen occurs in natural patterns of abundance and distribution at levels similar to or greater than those at time of plan approval. Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes. Fire intervals are similar to reference conditions and maintain aspen. Understory vegetation consists of shrubby or herbaceous species, providing forage and cover for wildlife and habitat for invertebrates such as pollinators. **Aspen within Ponderosa Pine and Frequent Fire Mixed Conifer Forest DC:** In ponderosa pine and frequent fire mixed conifer vegetation types, the size, age and spatial extent of aspen stands reflect reference conditions. Coniferous species comprise less than 10% of the overstory on the Tusayan and Williams Districts. Isolated aspen stands, diverse in vegetation structure and composition, provide wildlife refugia and diversity in an otherwise conifer-dominated landscape. **Aspen within Mesic Mixed Conifer /Spruce-Fir Forest DC:** Downed aspen and woody debris are scattered across the landscape and provide habitat for a variety of wildlife species (e.g., small mammals, reptiles, amphibians, and birds) while contributing to efficient nutrient cycling. Aspen occurs as a shifting mosaic across its range with new aspen clones establishing over time. The size, age, and spatial extent of aspen stands reflect large-scale disturbance patterns and processes. **Aspen on Williams & Tusayan RDs OBJ:** Fence 200 acres of aspen within 10 years of Plan approval to exclude ungulates. Reduce conifer encroachment on 800 acres of aspen within 10 years of Plan approval. **GD:** Small patch clear-cuts (less than 5 acres in size), conifer removal, and wildland fire should be used

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			to stimulate aspen sprouting in areas that have or previously had aspen. Aspen trees 10" or greater d.b.h. (both live and dead) should be protected during project activities, except where they may pose a risk to fences or regeneration efforts. Fences should be regularly inspected and maintained while aspen recovers. Fences should be removed when no longer needed. **Constructed Water DC:** Artificial waters do not concentrate ungulate use in aspen stands. **GD:** If new drinkers are necessary, they should be constructed in areas that reduce ungulate impact to sensitive vegetation or soils such as riparian, aspen, and wet meadow areas. **Livestock Grazing GD:** Livestock use in aspen areas should be authorized at levels that are consistent with the desired conditions for aspen regeneration and establishment.
Rock/cave and other abiotic dependent Golden eagle, American peregrine falcon, California condor, Arizona black rattlesnake, western skink, Utah Mountain kingsnake, milksnake, Great Basin spadefoot, pale Townsend's big-eared bat, House Rock Valley chisel-toothed kangaroo rat, spotted bat, greater western mastiff bat, Allen's lappet-browed bat, southwestern myotis, big free-tailed bat,	Rocks (canyons, caves, mines, ledges, talus slopes, and cliffs), man-made habitat (buildings, bridges)	Rock collection, cliff blasting, recreational rock climbing/caving, mining/mineral activities.	**Caves, Karst, and Mines DC**: Caves maintain moisture and temperature levels consistent with reference conditions. Archeological, geological, and biological features of caves and mines are not disturbed by visitors. Caves, karst features and abandoned mines provide quality habitat for bat species. Disease is within natural levels. Mine closures do not compromise habitat for species that require specialized niches for roosting and overwintering (e.g., bats). **GD:** Project design should include protections for subsurface geologic features to minimize disruptions to cave microbiology and other aspects of cave ecology. When entering caves or mines, decontamination procedures should be followed for preventing the spread of white-nose syndrome (WNS; *Geomyces destructans*). Caves containing endemic species should be managed for the protection of that species over other uses. Before closing caves or mines, they should be inspected to determine if bats are using these areas. If roost sites are present, closure structures should allow bats to continue to use the cave or mine, such as wildlife friendly bat gates that meet the most current recommendations. **Cliffs and Rocky Features DC:** Cliff ledges provide cover and nesting habitat for wildlife such as the American peregrine falcon, California condor, snakes, bats, birds, and small mammals. Rocks and rocky areas promote seedling germination and maintain cover for vertebrate and invertebrate species. Rock climbing and related recreational activities do not disrupt the life processes of rare or threatened species or diminish the function of specialized vegetation, such as mosses, lichens, and fleabanes. Rockslides and talus slopes are natural, undisturbed features that provide habitat for wildlife such as lizards, snakes, and land snails. **GD:** Activities involving heavy machinery or blasting should minimize impacts to habitat associated with

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dwarf shrew,			rocky features and cliffs. Near known active raptor nest sites, temporary closures and use restrictions should be implemented for rock climbing and other potentially disruptive activities. Talus slopes should be surveyed for endemic species prior to authorizing quarrying, rock hounding, or construction activities that may alter them. **Transportation GD:** Surveys should be conducted to assess wildlife use (bats, birds, etc.) and intensity before demolishing and/or modifying structures such as old bridges. If surveys determine that wildlife are actively using the structures, project design should include efforts to minimize impacts. **Developed Recreation Sites GD:** Surveys should be conducted to assess bat activity and intensity of use before demolishing and/or modifying structures such as old buildings. If surveys determine that bats are actively roosting in such structures and no alternate bat roost sites exists in the immediate vicinity, project design should include efforts to minimize impacts and to provide for alternate roost sites such as bat boxes where feasible.
Species needing connected habitat/movement corridors Pronghorn, Gunnison's prairie dog, elk, mule deer, mountain lion	Large contiguous blocks of habitat	Habitat fragmentation	**Pinyon-Juniper Communities DC:** Pinyon-juniper communities occur as a shifting mosaic across the landscape interspersed with openings. The configuration of vegetation and openings provides foraging and browsing opportunities for wildlife, and enough sighting distance and hiding cover for pronghorn to escape predators. **GD:** Pinyon-juniper communities should maintain tree densities that maximize herbaceous plant growth and wildlife species diversity typical for their respective community subtype. Project design for vegetation management activities should prioritize treatment areas along known wildlife , in the wildland-urban interface, and in historic openings. Restoration treatments in pinyon-juniper should be rotated over time and various successional stages to maximize wildlife habitat and diversity. **Restoring Grasslands OBJ:** Reduce tree density to less than to 10 percent on 5,000 to 10,000 acres of historic grasslands annually. Modify fences and install crossings to facilitate pronghorn movement on 50 miles of fence within 10 years of plan approval. **GD:** Pronghorn fence crossings should be installed along known movement corridors. **Wildlife DC:** Native wildlife species are distributed throughout their potential natural range. Desirable nonnative wildlifeare present and in balance with healthy, functioning ecosystems. Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of

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			vertebrate and invertebrate species. Interconnected habitats allow for movement of wide-ranging species and promote natural predator-prey relationships, particularly for strongly interactive species (e.g. mountain lions). Habitat configuration and availability allows wildlife populations to adjust their movements (e.g. seasonal migration, foraging etc.) in response to climate change and promote genetic flow between wildlife populations. **Livestock Grazing DC:** Allotment fencing allows for passage of animals prone to movement restrictions such as pronghorn. **GD:** New construction and reconstruction of fences should have a barbless bottom wire and be at least 18 inches high. **Transportation and Forest Access DC:** Roads allow for safe and healthy wildlife movement in areas of human development. Vehicular collisions with animals are rare. **GD:** Roads should be decommissioned when no longer needed. **Lands DC:** NFS lands exist in a pattern that promotes efficient management, which consist of large contiguous areas that provide efficient and effective resource management and wildlife connectivity within and across NFS lands. **Wilderness DC:** Wilderness provides opportunities for nonmotorized and non-mechanized primitive and unconfined recreation and contiguous wildlife habitat. **Recommended Wilderness DC:** The recommended wilderness areas provide non-motorized and non-mechanized opportunities for primitive and unconfined recreation and contiguous wildlife habitat.
Rare endemics/restricted distributions Arizona black rattlesnake, Utah Mountain kingsnake, Persephone's darner, Kaibab variable tiger	Rare habitat and the species itself. Direct loss of vegetation, change in species composition and micro site	Collecting, trampling, herbicide treatments, misidentification and accidental eradication, pile burning, Unmanaged	**Wildlife GD:** Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of wildlife, particularly raptors. **Rare and Narrow Endemics DC:** Habitat and refugia are present for narrow endemics or species with restricted distributions and/or declining populations. Location and conditions of rare and narrow endemic species are known. **GD:** Project design should incorporate protective measures to provide for rare and narrow endemic species where they occur.

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beetle, Kaibab Indra swallowtail, House Rock Valley chisel-toothed kangaroo rat, Kaibab least chipmunk, Kaibab tree squirrel, Kaibab northern pocket gopher	conditions	livestock grazing and excessive wildlife herbivore	**Caves, Karst, and Mine GD:** Caves containing endemic species should be managed for the protection of those species over other uses.
Risk of Large scale Wildfire All species	loss of habitat components on a large scale.	Fire behaving unnaturally within the system	**Pinyon-Juniper Communities DC:** The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (including insects, diseases, and fire) and climate variability. Fires are typically low severity with a 0- to 35-year return interval (Fire Regime I). **Pinyon-Juniper Grasslands DC:** The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (including insects, diseases, and fire) and climate variability. Fires are typically low-severity with a 0 to 35 year return interval (Fire Regime I). **Pinyon-Juniper Shrub DC:** The composition, structure, and function of vegetation conditions are resilient to the frequency, extent and severity of disturbances including insects, diseases, fire, and climate variability. Fires are mixed to high severity and have fire return interval of 35 to more than 200 years (Fire Regimes III and IV, with occurrences of stand replacing fire at longer intervals). **Pinyon-Juniper (Persistent) Woodlands DC:** Disturbances rarely affect the composition, structure, and function. Fire disturbance is infrequent and variable due to lack of continuous ground cover. **Ponderosa Pine Forest DC:** *Fine-scale*: Fires generally burn as surface fires, but single-tree torching and isolated group torching is not uncommon. *Mid-scale*: Disturbances sustain the overall variation in age and structural distribution. Fires primarily burn on the forest floor and typically do not spread between tree groups as crown fire. *Landscape:* The landscape is a functioning ecosystem that contains all its components, processes, and conditions associated with endemic levels of disturbances (e.g. fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind). Grasses and needle cast provide the fine flashy fuels needed to maintain the natural fire regime. Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris loads, and nutrient cycling. The risk of uncharacteristic high intensity fire and associated loss of key ecosystem components is low. Frequent, low severity fires (Fire Regime I) occur across the entire landscape with a return interval

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			of 0 to 35 years. **OBJ:** Mechanically thin 11,000 to 19,000 acres annually, using a combination of group-selection cuts with matrix thinning and all-size free thinning. Treat an average of 13,000 to 55,000 acres annually, using a combination of prescribed fire and naturally ignited wildfires. **Frequent Fire Mixed Conifer DC:** *Fine-scale*: Fires generally burn as surface fires, but single tree torching and isolated group torching occasionally occurs. *Mid-scale*: Fires primarily burn on the forest floor and typically do not spread between tree groups as crown fire. *Landscape:* The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, severity of disturbances, and to climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g. fire, insects, diseases, and wind). Grasses and needle cast provide the fine flashy fuels needed to maintain the natural fire regime. Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. Frequent, low severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years. **OBJ:** Burn an average of 1,000 to 13,000 acres annually, using prescribed fire and/or naturally ignited wildfires. Mechanically thin 1,200 to 2,100 acres annually. **Mesic Mixed Conifer/Spruce-Fir DC:** *Fine-scale*: Due to the presence of ladder fuels, fires usually burn either with low intensity, smoldering combustion, or transition rapidly in the canopy as passive or active crown fire. *Mid-scale*: During moister conditions, fires exhibit smoldering low-intensity surface fires with single-tree and isolated group torching. Under drier conditions, fires exhibit passive to active crown fire behavior with conifer tree mortality up to 100% across mid-scale patches (100 to 1,000 acres). High-severity fires generally do not result in areas of mortality exceeding 1,000 acres. Other smaller disturbances occur more frequently. Fire and other disturbances maintain overall desired tree density, structure, species composition, coarse woody debris, and nutrient cycling. Fire severity is mixed or high, with a fire return interval of 35 to over 200 years (Fire Regimes III, IV, and V). *Landscape:* The forest landscape is a functioning ecosystem that contains all components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, wind, snow, and fire), including snags, downed logs, and old trees. The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances and climate variability. Mixed severity fire (Fire Regime III) is characteristic at the lower elevations of this type. High severity fires (Fire Regime IV & V) are more common at the higher elevations.

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			Aspen (General) DC: Fire intervals are similar to reference conditions and maintain aspen. **Vegetation Management in all Forested Communities GD:** The location and layout of vegetation management activities should effectively disconnect large expanses of continuous predicted active crown fire. Vegetation management prescriptions should provide for sufficient canopy breaks to limit crown fire spread between groups, allow for the redevelopment and maintenance of a robust understory, and mimic the spatial arrangement of the references conditions. **Large-scale Disturbance Events in Forest and Woodland Communities OBJ**: To reestablish ponderosa pine in areas with inadequate seed source and reduce the time to achieve the desired forest structure: Plant 300 to 700 acres annually. **GD**: Recovery and restoration project design should seek to establish a trajectory toward the desired conditions for the affected vegetation type. Where conifer seed sources are lost or poorly distributed due to high-intensity fire, artificial regeneration (planting, etc.) should be implemented to promote the desired forest structure and accelerate the recovery of habitat conditions for native wildlife species. Some snags and coarse woody debris should be retained to provide for wildlife habitat, soil stabilization, and other resource benefits. Some clumps of large (18 inches d.b.h.) standing dead trees should be retained. Project design should incorporate measures to protect regeneration and reforestation investments. **Sagebrush Shrublands DC:** Characteristic disturbances play a role in the function of the ecosystem. **GD:** Management activities should be designed to mimic the historic disturbance. **Grasslands DC:** Disturbance processes are similar to reference conditions and play a primary role in the function of the ecosystem. **Desert Communities DC:** Density of juniper and other shrubby species is maintained at levels which promote natural fire regimes and long fire return intervals. Fire occurrence is low and infrequent. **GD:** Fire should not be used as a vegetation management tool in Desert Communities. **Gambel Oak Shrublands DC:** Low intensity fire occurs regularly with intervals of < 25 years. **Cottonwood-Willow Riparian Forest DC:** Fire is limited or absent in this system. **Watersheds DC:** The fuels composition within watersheds does not put the watersheds at risk for

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			uncharacteristic disturbance. **Livestock Grazing GD:** As grazing permits are waived back to the forest, they should be evaluated for conversion to forage reserves to improve flexibility for restoring fire-adapted ecosystems and range management in times of drought. **Forestry and Forest Products DC:** A sustainable supply of wood is available to support a wood harvesting and utilization industry of a size and diversity that can effectively and efficiently restore and maintain the desired conditions for ponderosa pine and frequent fire mixed conifer communities. **Wildland Fire Management DC:** Wildland fire maintains, and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role. Regular fire entry protects social, economic, and ecological values at risk from high severity disturbance effects. Wildland fires burn within the range of intensity and frequency of the historic fire regime of the vegetation community. Uncharacteristic high severity fires rarely occur, and do not burn at the landscape scale. Wildland fire is understood, both internally and by the public, as a necessary natural disturbance process integral to the sustainability of the forest's fire adapted vegetation communities. **ST:** Managers will use a decision support process to guide and document wildfire management decisions. **GD:** Decision documents for wildland fires that progress past initial attack should include interdisciplinary input to assess site specific values at risk and develop project or incident objectives and courses of action to enhance or protect those values. Decision documents for wildland fires should include objectives to minimize fire-created openings to those within the reference range of variability for the vegetation community. Associated courses of action to address those objectives should also be developed. Decision documents for wildland fires should address wildlife desired conditions for key habitat features that provide structural diversity such as snags, large oaks, and oak thickets. Associated courses of action or management practices to address those objectives should also be developed. If current or anticipated fire behavior and fire effects exceed the desired fire behavior and effects, protection objectives should be developed, or a more conservative prescription window produced. Strategies and tactics to mitigate those effects should be implemented on active wildland fires. **Wilderness DC:** Natural processes are maintained within the wildernesses. Fires function in their natural ecological role. **GD:** Wildfires should be suppressed in the desert communities of the Kanab Creek Wilderness.

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			Recommended Wilderness DC: Natural processes are maintained within the wildernesses. Fires function in their natural ecological role. **GD:** Wildfires should be suppressed in the recommended wilderness areas adjacent to Kanab Creek in the desert communities PNVT. **Garland Prairie Management Area DC:** Lightning fires are able burn naturally within the area. **Bill Williams Mountain Management Area OBJ:** Implement a project to improve the health and sustainability of forested conditions on and surrounding Bill Williams Mountain within 5 years of Plan approval.
Invasive Species Interactions, e.g. but not limited to noxious weeds, crayfish and bullfrogs Sage sparrow, golden eagle, western burrowing owl, ferruginous hawk, sage thrasher, savannah sparrow, green-tailed towhee, Apache trout, Arizona toad, Arizona black rattlesnake, Arizona treefrog, northern leopard frog, Great Basin spadefoot, pronghorn, Navajo	Competition for resources (food, space, water), and/or hybridizations which can lead to direct mortality and decreases in populations within the planning area, loss of native species and changes in vegetation structure	Introduction of non-native species; loss of habitat component	**Grasslands DC:** Vegetation is dominated by herbaceous plants composed of a mix of native grasses and forbs. **Montane/Subalpine Grasslands DC:** Native species occur in natural patterns of abundance, composition, and distribution. Vegetation is healthy and at least stable. **Gambel Oak Shrublands DC:** The system is dominated by native tall shrubs and hardwood trees**.** Non-native species are absent or comprise less than 1% of the total cover. **Cottonwood-Willow Riparian Forest DC:** When nonnative vegetation is present, the spatial and structural composition contributes to overall faunal diversity. **Natural Waters DC:** Unwanted nonnative species do not exert a detectable impact on aquatic and wetland ecosystems. Native amphibians are free from or minimally impacted by nonnative predation and diseases. **GD:** Access to natural waters should be restricted to designated trails and points of entry to mediate erosion prevent trampling and inadvertent introduction of nonnative and undesirable biota and disease. **Constructed Waters DC:** Constructed waters do not contribute to the spread of chytrid fungus or unwanted nonnative species. **Non-Native Invasive Species DC:** Invasive species are contained and/or controlled so that they do not disrupt the structure or function of ecosystems.

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Mogollon vole			**GD:** All ground disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species. New populations are detected early, monitored, and treated as soon as possible. Treatment approaches should use Integrated Pest Management (IPM) practices to treat noxious and nonnative invasive species. IPM includes manual, biological, mechanical, and herbicide/pesticide treatments. Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna. **Wildland Fire Management GD:** Decision documents for managing fire should evaluate the risk of cheatgrass invasion. When there is a moderate to high risk of cheatgrass invasion (e.g. lower elevation areas), mitigation measures should be implemented and/or fire should be excluded if adequate treatments are not available or if they are cost prohibitive. **Wilderness DC:** Wilderness areas have minimal to no nonnative, invasive species. **GD:** Wildfires should be suppressed below the rim of the Kanab Creek Wilderness. Nonnative, invasive species should be treated within wilderness in order allow natural processes to predominate. **Recommended Wilderness DC:** Recommended wilderness areas have few to no nonnative, invasive species. **GD:** Wildfires should be suppressed in the recommended wilderness areas adjacent to Kanab Creek in the desert community vegetation type. Nonnative, invasive species should be treated within recommended wilderness areas in order allow natural processes to predominate. **Pediocactus Conservation Area GD:** Nonnative invasive weeds should be regularly monitored and promptly treated.
Poisoning/Pesticide Use Golden eagle, California condor, bald eagle, pale Townsend's big-eared bat, Gunnison's prairie dog, Allen's lappet-browed bat,	Unintentional poisoning of species or miss use of herbicide or pesticide	Non-target species poisoning	**Invasive Species GD:** Treatment approaches should use Integrated Pest Management (IPM) practices to treat noxious and non native invasive species. IPM includes manual, biological, mechanical, and herbicide/pesticide treatments. Pesticides should be properly labeled and stored as per the manufacturer's recommendations.

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big free-tailed bat			
Disease Arizona toad, Arizona treefrog, northern leopard frog, pale Townsend's big-eared bat, Gunnison's prairie dog, spotted bat, greater western mastiff bat, Allen's lappet-browed bat, southwestern myotis, big free-tailed bat, desert bighorn sheep	Human activities that result in the spread of disease through infected soil and water from one occupied site to another can kill wildlife-activities can include recreation, research, and fire and grazing management	Loss of populations or decline in habitat effeteness	**Desert Communities DC:** Native ungulates are free from disease. **Natural Waters DC:** Native amphibians are free from or minimally impacted by non-native predation and diseases. **GD:** Access to natural waters should be restricted to designated trails and points of entry to mediate erosion prevent trampling and inadvertent introduction of nonnative and undesirable biota and disease. Activities in and around waters should use decontamination procedures to prevent the spread of chytrid fungus. **Constructed Waters DC:** Constructed waters do not contribute to the spread of chytrid fungus or unwanted nonnative species. **GD:** Activities in and around waters should use decontamination procedures to prevent the spread of chytrid fungus. **Caves, Karst, and Mines DC:** Disease is within natural levels. **GD:** When entering caves or mines, decontamination procedures should be followed for preventing the spread of white-nose syndrome (WNS; *Geomyces destructans*) **Livestock Grazing GD:** Grazing of domestic sheep and goats should not be authorized on the Tusayan and North Kaibab Ranger Districts due to the proximity of bighorn sheep in Grand Canyon and Kanab Creek to prevent the spread of disease between domestic and wild populations.
Development (facilities, roads, fences, powerlines) Golden eagle, western burrowing owl, ferruginous hawk, California condor, bald eagle, milksnake,	Human structures such as fences, buildings and bridges, electrical power lines, demolition of existing	Potential removal of habitat components, creating barrier to movement	**Restoring Grasslands OBJ:** Modify fences and/or install crossings to facilitate pronghorn movement on 50 miles of fence within 10 years plan approval. **GD:** Pronghorn fence crossings should be installed along known movement corridors. **Natural Waters DC:** Where springs or other natural waters have been modified for livestock and/or human consumption, developments are operational. **GD:** Fences constructed around natural waters should allow bats and other desirable wildlife to pass through unharmed. Diversions of water sources that recharge wetlands should be assessed and

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pronghorn, Gunnison's prairie dog, bats, raptors	structures		appropriate actions should be identified to mitigate or minimize effects. The impacts of management activities on springs, streams, and wetlands should be evaluated and minimized. **Constructed Waters DC:** Drinkers have escape ramps that provide safe access and egress for wildlife. Reservoirs maintain high quality for parameters such as temperature, dissolved oxygen, and water levels within the seasonal range of variable conditions. Artificial water sources do not concentrate ungulate use in aspen stands. **GD:** If new drinkers are necessary, they should be constructed in areas that reduce ungulate impact to sensitive vegetation or soils such as riparian, aspen, and wet meadow areas. Drinkers should be maintained to provide water during times of scarcity. **Recreation and Scenery DC:** Opportunities for off-highway vehicle (OHV) riding and driving for pleasure are available on the designated system of NFS roads and motorized trails. **Recreation Front Country DC:** Constructed facilities in front country settings provide for user comfort and resource protection. The number and size of constructed facilities is appropriate for the use and activities that occur at each site. **GD:** Any new motorized trailheads should be located in front country areas, incorporate or convert existing roads, protect open space, and protect natural and cultural resources. **Livestock Grazing DC:** Allotment fencing allows for passage of animals prone to movement restrictions such as pronghorn. **GD:** New construction and reconstruction of fences should have a barbless bottom wire and be at least 18 inches high. **Transportation and Forest Access DC:** All designated routes open to wheeled motorized vehicles are shown on a motor vehicle use map (MVUM) that is readily available to the public. Roads allow for safe and healthy wildlife movement in areas of human development. Vehicular collisions with animals are rare. **ST:** Motor vehicle use off the designated system of roads, trails, and areas is prohibited, except as identified on the MVUMs and as authorized by law, permits, and orders in connection with resource management and public safety.

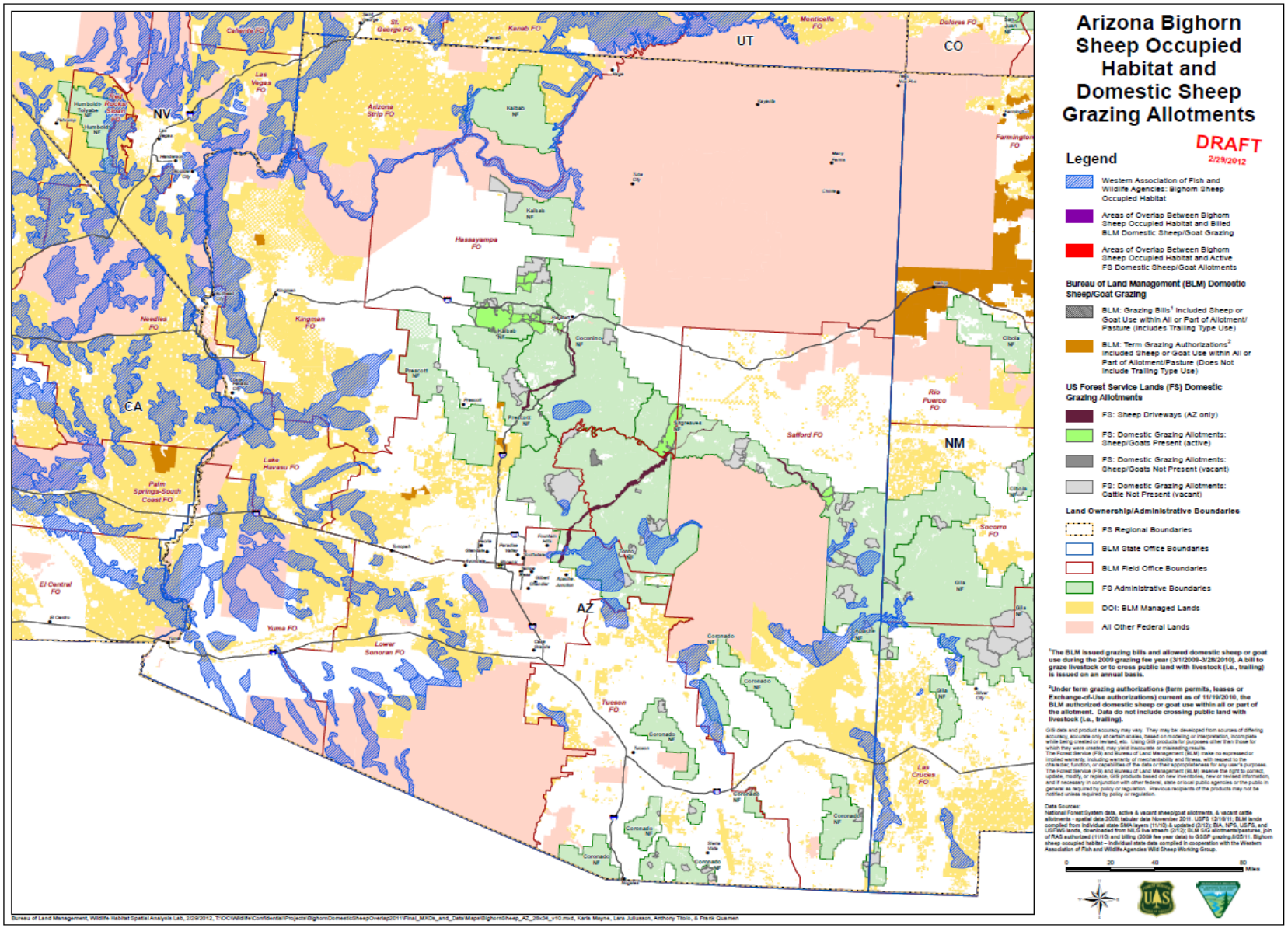
Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			GD: Construction of permanent roads or temporary roads in semi-primitive non-motorized areas should be avoided unless required by a valid permitted activity. If authorized, roads should be constructed and maintained at the lowest maintenance level needed for the intended use. Roads should not be located in meadows when they can be located in other areas. Roads should be decommissioned when no longer needed. Surveys should be conducted to assess bat activity and intensity of use before demolishing and/or modifying structures such as old bridges. If surveys determine that wildlife are actively using structures, project design should include efforts to minimize impacts. **Energy Transmission and Development DC:** Energy transmission and development on the forest meets the legal mandates to facilitate the transmission and development of energy resources in a manner that minimizes adverse impacts and does not detract from meeting other desired conditions applicable to the area. Joint use of rights-of-way are provided to concentrate uses to the extent possible. Energy transmission lines are not visible (usually underground) across the landscape. Vegetative conditions and land uses within energy rights-of-way facilitate the operation and maintenance of the associated facilities and infrastructure. They may differ from the surrounding PNVT desired conditions in that they generally consist of low-growing or non-woody vegetation. **ST:** Major utility corridor development is confined to the area identified and mapped in the West-wide Energy Corridor Programmatic EIS. **GD:** Environmental disturbance should be minimized by co-locating pipelines, power lines, fiber optic lines, and associated infrastructure. Existing energy corridors should be used to their capacity with compatible upgraded powerlines, before evaluating new routes. When compatible with protection of heritage resources, the use of below-ground utilities should be optimized in order to avoid potential conflicts with wildlife, scenery, wildfire, and long-term vegetative management. **Frank's Lake Geologic-Botanic Area DC:** There is minimal evidence of human disturbance. **Developed Recreation Sites GD:** Reconstruction and improvements of private sector developed sites should be within site capacity allocations. Surveys should be conducted to assess bat activity and intensity of use before demolishing and/or modifying structures such as old buildings. If surveys determine that bats are actively roosting in such structures and no alternate bat roost sites exists in the immediate vicinity, project design should include efforts to minimize impacts and to provide for alternate roost sites such as bat boxes where feasible. Developed recreation site vegetation management plans should guide thinning and burning activities in the campgrounds.

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			Bill Williams Mountain Management Area GD: The existing term permit for the Elk Ridge Ski Area on Bill Williams Mountain should be restricted to the existing established permit area. High use roads within the municipal watershed should be maintained to prevent erosion and sedimentation. **Red Butte Management Area GD:** The helipad on Red Butte should only be used for administrative purposes. **Pediocactus Conservation Area GD:** Motorized access should be restricted
Disturbance to wildlife from management activities Goshawk, golden eagle, American peregrine falcon, California condor, raptors	Potential disturbance to species during breeding season	Timber harvest, recreation activities, fuel reduction activates, road building, mineral collections	**Wildlife DC:** Human-wildlife conflicts are minimal. **Wildlife GD:** Potentially disturbing project-related activities should be restricted within 300 yards of active raptor nest sites between April 1 and August 15. **Threatened, Endangered, and Sensitive Species GD**: Potentially disturbing project-related activities should be minimized in occupied goshawk nest areas during nesting season of March 1 through September 30. **Cliffs and Rocky Features GD:** Near known active raptor nest sites, temporary closures and use restrictions should be implemented for rock climbing and other potentially disruptive activities. **Recreation and Scenery GD:** Group uses should be concentrated in frontcountry areas. Resource impacts should be reduced in front and backcountry by directing camping to existing dispersed campsites. **Transportation Management ST:** Motor vehicle use off the designated system of roads, trails, and areas is prohibited, except as identified on the MVUMs and as authorized by law, permits, and orders in connection with resource management and public safety. **Wilderness Areas DC:** Wilderness provides opportunities for nonmotorized and nonmechanized primitive and unconfined recreation and contiguous wildlife habitat. Human encounters are only with individuals or small parties, are infrequent, and opportunities for solitude are common. **ST:** Group size in Wilderness is limited to 12 people. Competitive events are not permitted in wilderness areas. Establishment geo-caches will not be permitted in wilderness areas. **Frank's Lake Geologic-Botanic Area GD:** Camping within the fenced boundary of Frank's Lake

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			should not be permitted. **Recommended Wilderness Areas DC:** Wilderness provides opportunities for nonmotorized and nonmechanized primitive and unconfined recreation and contiguous wildlife habitat. Human encounters are only with individuals or small parties, are infrequent, and opportunities for solitude are common.
Providing additional protection for federally listed species, Region 3 sensitive species, migratory birds, or raptors not cover in the above categories	Loss of habitat components;	Logging, fuel management,	**Ponderosa Pine DC:** *Fine-scale:* Where historically occurring, there are oak thickets with various diameter stems, and low-growing, shrubby oak. These thickets provide forage, cover, and habitat for species that depend on them such as small mammals, foliage-nesting birds, deer and elk. Gambel oak mast (acorns) provides food for wildlife species. *Landscape:* Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing and maintaining or expanding its presence on suitable sites across the landscape. **Forestry and Forest Projects GD:** Timber harvest activities should be carried out in a manner consistent with maintaining or making progress toward the desired conditions in this Plan. **Mineral and Mining Activities DC:** Mineral and mining activities meet the legal mandates to facilitate the development of minerals on the forest in a manner that minimizes adverse impacts to surface and groundwater resources, and that do not detract from meeting other desired conditions applicable to the area. **GD:** Surface use should be restricted or prohibited in areas with habitat for threatened, endangered and sensitive plant and animal species, and for heritage resources nominated or posted to the National Register. Use and occupancy should be restricted yearlong in areas supporting populations of threatened, endangered and sensitive plant species. **Wild and Free Roaming Burro Territory DC:** A biologically sound and genetically viable burro population is in balance with native wildlife, permitted livestock, and other resource values. **GD:** Population control measures should be implemented to maintain genetic diversity and desired resource conditions in the area. **Kaibab Squirrel National Natural Landmark DC:** The Kaibab Squirrel National Natural Landmark provides quality ponderosa pine habitat for the Kaibab squirrel. **Bill Williams Mountain Management Area DC:** Bill Williams Mountain provides quality habitat for

Species or Species Group	Characteristic at risk	Potential Management Threats	Plan Components which address risks to species viability
			Arizona Bugbane, Mexican spotted owls, and culturally important plants.

Appendix D: Arizona Bighorn sheep Occupied Habitat and Domestic Sheep Grazing Allotments (green=d.sheep)


Arizona Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments
DRAFT
2/29/2012
Legend
Western Association of Fish and Wildlife Agencies: Bighorn Sheep Occupied Habitat
Areas of Overlap Between Bighorn Sheep Occupied Habitat and Billed BLM Domestic Sheep/Goat Grazing
Areas of Overlap Between Bighorn Sheep Occupied Habitat and Active FS Domestic Sheep/Goat Allotments
Bureau of Land Management (BLM) Domestic Sheep/Goat Grazing
BLM: Grazing Bills[1] Included Sheep or Goat Use within All or Part of Allotment/ Pasture (Includes Trailing Type Use)
BLM: Term Grazing Authorizations[2] Included Sheep or Goat Use within All or Part of Allotment/Pasture (Does Not Include Trailing Type Use)
US Forest Service Lands (FS) Domestic Grazing Allotments
FS: Sheep Driveways (AZ only)
FS: Domestic Grazing Allotments: Sheep/Goats Present (active)
FS: Domestic Grazing Allotments: Sheep/Goats Not Present (vacant)
FS: Domestic Grazing Allotments: Cattle Not Present (vacant)
Land Ownership/Administrative Boundaries
FS Regional Boundaries
BLM State Office Boundaries
BLM Field Office Boundaries
FS Administrative Boundaries
DOI: BLM Managed Lands
All Other Federal Lands
[1]The BLM issued grazing bills and allowed domestic sheep or goat use during the 2009 grazing fee year (3/1/2009-3/28/2010). A bill to graze livestock or to cross public land with livestock (i.e., trailing) is issued on an annual basis.
[2]Under term grazing authorizations (term permits, leases or Exchange-of-Use authorizations) current as of 11/19/2010, the BLM authorized domestic sheep or goat use within all or part of the allotment. Data do not include crossing public land with livestock (i.e., trailing).
Miles
UT
CO
NM
AZ
NV
CA
Monticello FO
Dolores FO
Farmington FO
St George FO
Kanab FO
Las Vegas FO
Arizona Strip FO
Kaibab NF
Hassayampa FO
Needles FO
Kingman FO
Prescott NF
Coconino NF
Lake Havasu FO
Palm Springs-South Coast FO
Rio Puerco FO
Safford FO
Socorro FO
Gila NF
El Centro FO
Yuma FO
Lower Sonoran FO
Tucson FO
Coronado NF
Las Cruces FO