Watershed Analysis Version History

1. Version 1 of the Bartle Watershed Analysis was completed on January 1, 1997.

2. The Bartle Watershed Analysis was converted from Applix format to MS Word on January 23, 2003. During the conversion process all of the tables were corrupted and all formatting (i.e. font sizes, boxes, shading, page numbering, headers/footers) was lost. The resulting word documents contain all of the content of the original Applix version but have not been edited to fix the tables or formatting problems. The original Applix documents are filed in the applix version folder and should be saved until the MS Word documents are fixed.

3. Formatting problems with the tables and document text were fixed sometime between 2003 and 2005.

4. In January 2008 minor edits were made to Chapter 6 – Recommendations so recommendations were aligned with management direction for Riparian Reserves in the Shasta-Trinity National Forest Land and Resource Management Plan. The reader is cautioned that all of the data and information found in the analysis are based on 1996 WA methodologies, data and policy.

5. Converted to PDF on April 29, 2008 (R. Velarde)

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Hydrologist
Shasta-McCloud Management Unit

Preface

This Watershed Analysis is presented as part of the Aquatic Conservation Strategy adopted for the President's Plan (*Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, including Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species*).

Announcements were published in local newspapers in Redding and Southern Siskiyou County inviting public input to the analysis. Open Houses were held in Redding, McCloud and Big Bend, where resource specialists presented information on existing conditions and management direction for National Forest lands within the Bartle Watershed.

The Bartle Watershed Analysis was prepared with input and involvement from the following resource specialists:

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Bill Brock	Fisheries Biologist	U.S. Fish and Wildlife Service
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Tom Ward	Ecologist	Shasta-McCloud Management Unit
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Additional input was provided by:

Julie Cassidy	Archaeologist	Shasta-McCloud Management Unit
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1/31/97

Bartle Watershed Analysis
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Appendix

Chapter 1

Characterization of the Bartle Watershed

The purpose of this chapter is to place the watershed in context within the river basin, provinces, and the broad geographical area. This chapter will briefly describe the dominant physical, biological, and human dimension features, characteristics, and uses of the watershed. It will also highlight important land allocations and management plan objectives which influence the watershed.

The major topics covered in this chapter are:

- Location
- Watershed Setting
- Physical, Biological, and Social Features of the Watershed
- Landscape Components
- Land Allocations and Management Direction

Location

The Bartle Watershed is located near the town of Bartle, within Siskiyou County, California. The watershed lies about 20 miles east of Mount Shasta and falls entirely within the boundary of the Shasta-Trinity National Forests (see Map 1 - Vicinity Map).

Watershed Setting

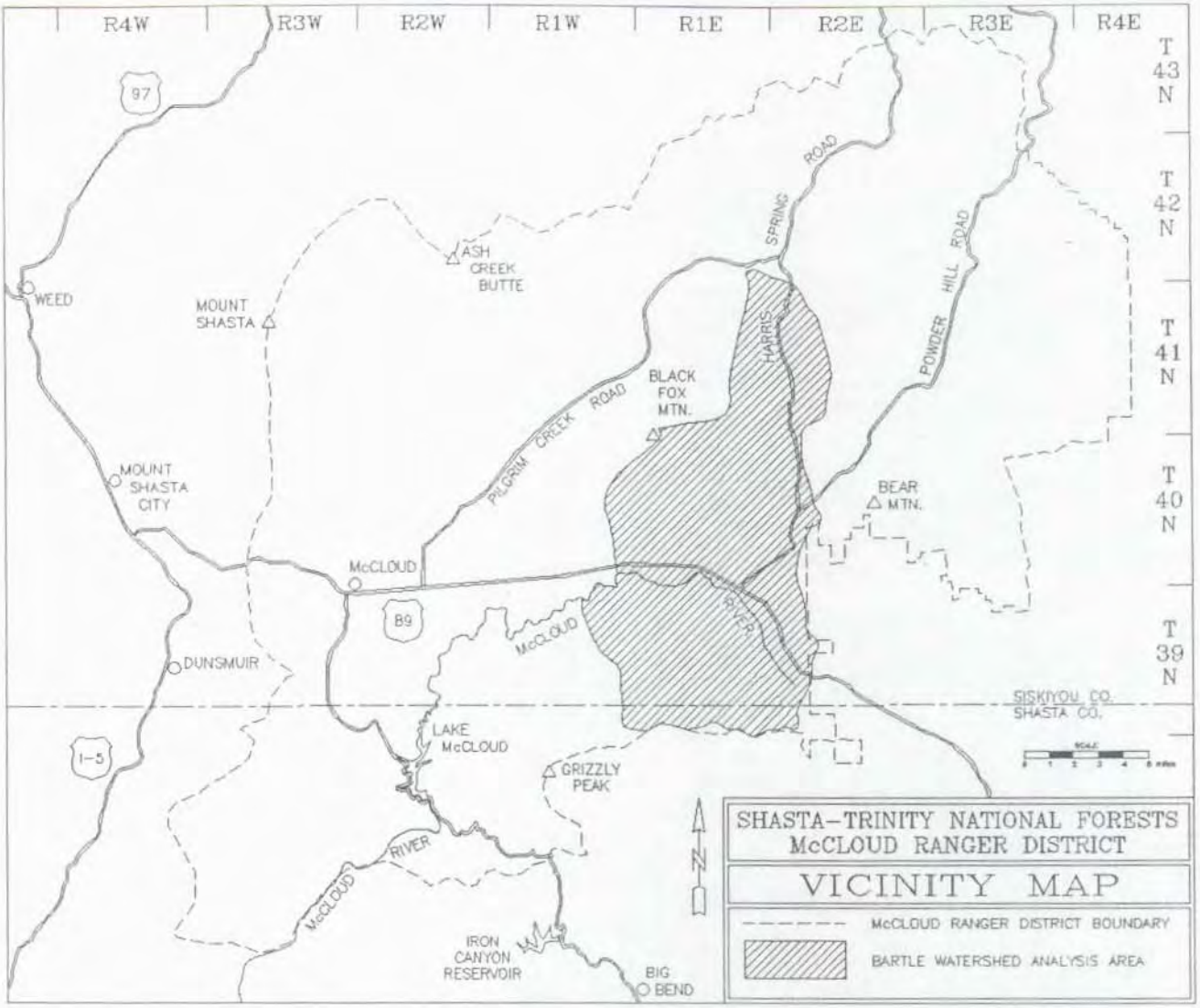
Watershed Boundaries

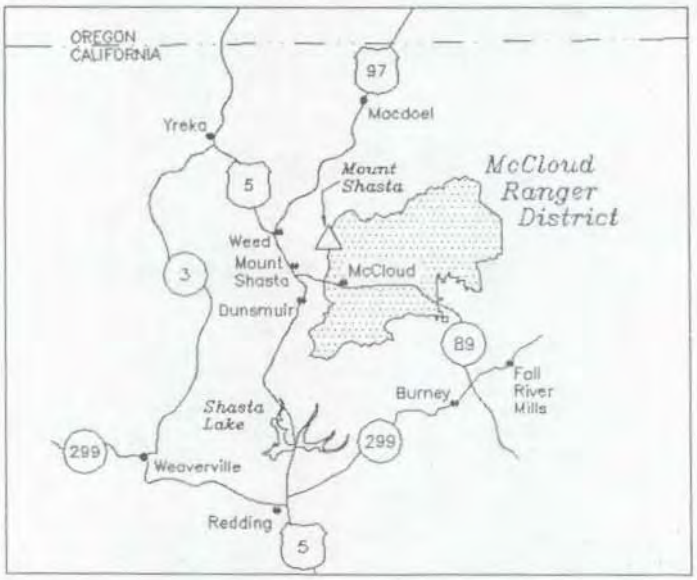
The Bartle Watershed is about 116,442 acres in size, of which 55,217 acres are National Forest. Watershed boundaries in the southern half of the watershed are defined by distinctive major ridgetops. The northern half of the watershed extends into an area of flat terrain and few topographical features. Boundaries in this area are poorly defined and are often difficult to locate on the ground.

The McCloud River Basin

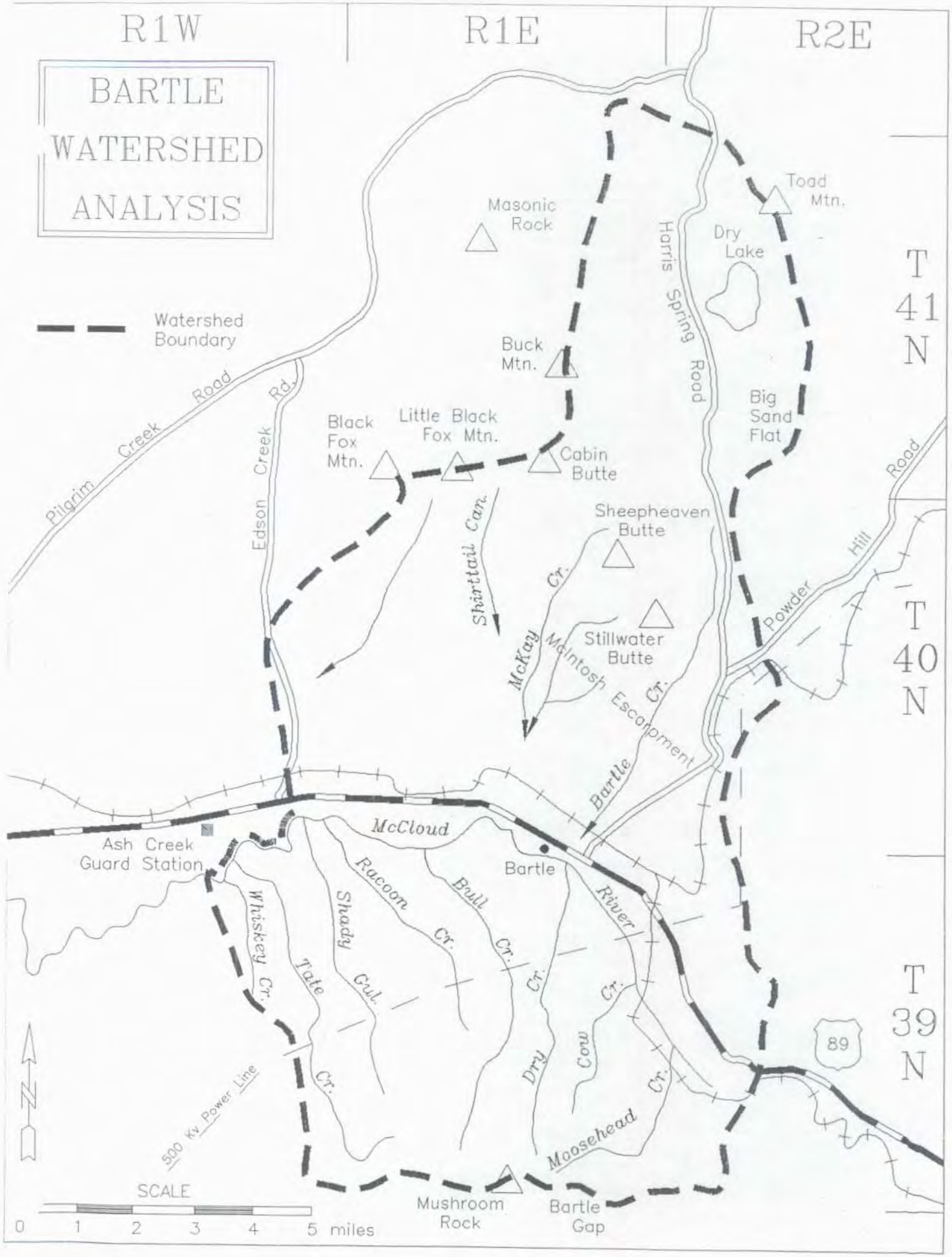
The Bartle Watershed forms the headwaters of the McCloud River Basin (see Map 3 - McCloud River Basin) which drains an area of roughly 800 square miles. The McCloud River flows westerly for approximately 50 miles from its origin near Colby Meadows to its terminus at Shasta Lake.

Timber management is the predominant land use in the McCloud River Basin. The vegetation type is almost entirely second-growth mixed-conifer and white fir-ponderosa pine forests. The upper river basin is extensively grazed. Recreational activities include fishing, camping, hiking, hunting, sight-seeing, photography, limited mountain biking, and snowmobiling in winter.

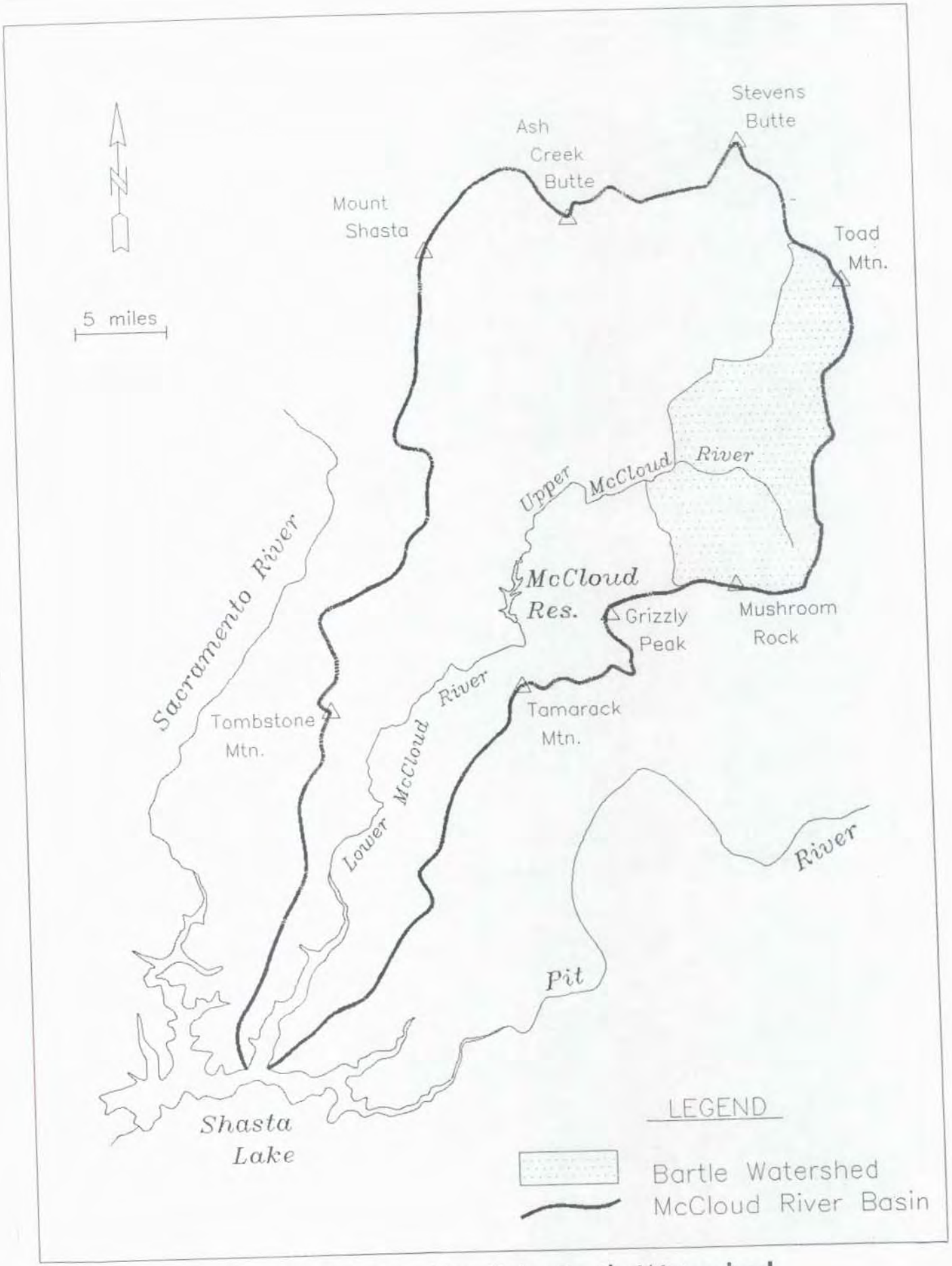




Map 1. Vicinity Map



Map 2. Dominant Features



Map 3. Relationship of the Bartle Watershed to the McCloud River Basin

Physical Features

Dominant Physical Features

The Bartle Watershed is bisected by the McCloud River which flows westerly across the watershed. North of the river is the "McCloud Flats", an area of level lava flows and low volcanic buttes. The drainage density in this area is very sparse. South of the river is a landscape of steep mountains. The drainage pattern in this area consists of several perennial tributaries.

Hydrology

The hydrology of the Bartle Watershed is characterized by limited surface flow and a low drainage density north of the McCloud River, and increased surface flow and a higher drainage density south of the McCloud River. Streams in the northern watershed are perennial at higher elevations and intermittent or ephemeral at lower elevations. Sheepheaven/McKay Creek and Bartle Creek are the only clearly defined stream systems on the north side of the McCloud River. Other significant perennial streams within the watershed include the McCloud River, Moosehead, Tate, Raccoon, Bull, and Cow Creeks (see Map 2 - Dominant Features).

Roads

The transportation system in the watershed consists of approximately 200-250 miles of road, with an estimated road density of 4.2+ miles per section. The existing road system is essentially complete with only minor additional road construction anticipated in the future to meet land management needs.

Fire

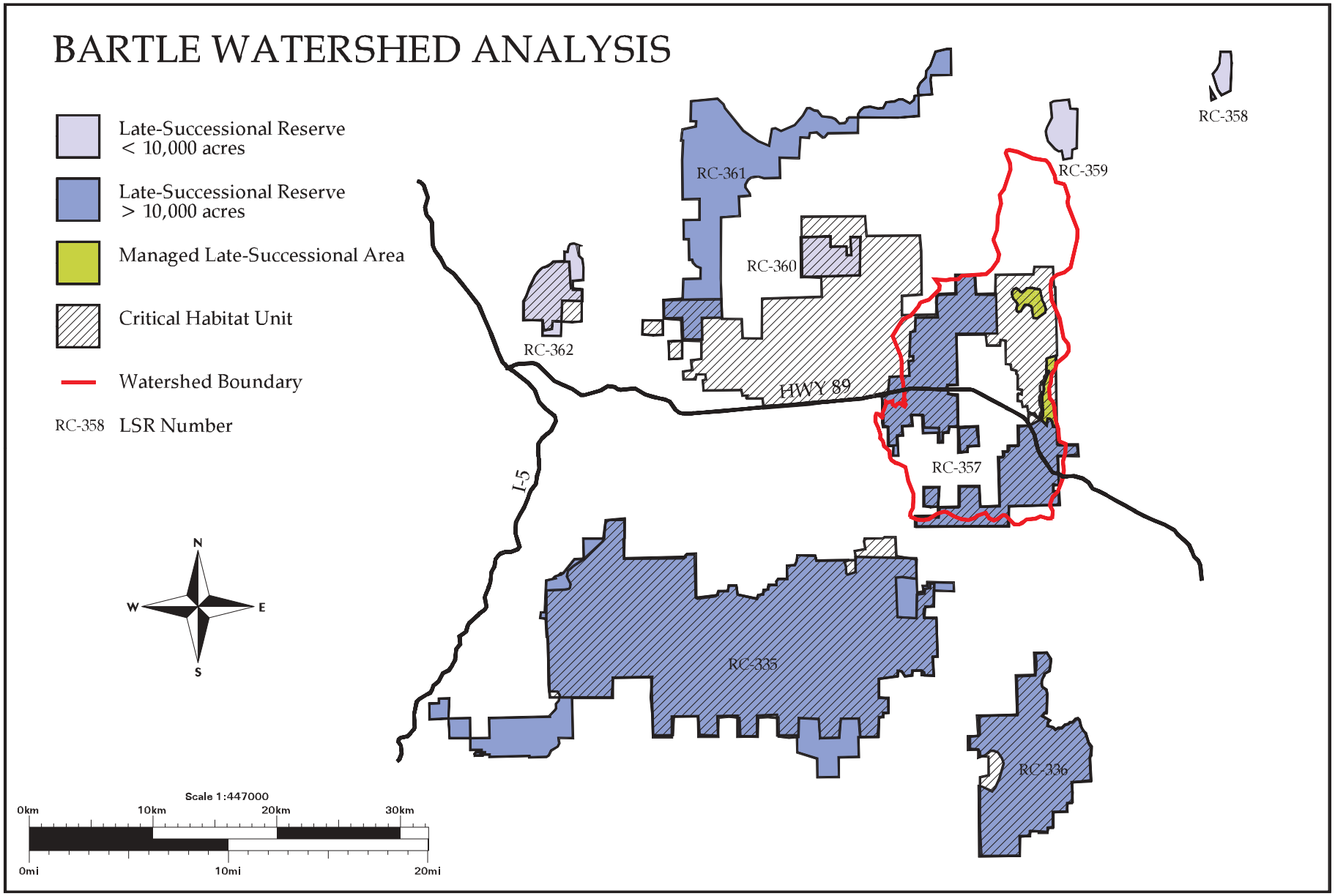
Fire is a significant disturbance factor within the Bartle Watershed. The mixed conifer stands within the focus area are typically described by a short return interval, low intensity, surface fire regime with disturbance intervals of 5 to 30 years. Such regimes are typically dominated by fire adapted, fire resistant species. Fire exclusion, as well as other human caused disturbances, have initiated the transition to a regime typified by infrequent, high intensity, stand replacing fire events. Similarly, there has been a transition from a primarily horizontal, low residual fuel structure typical of low intensity regimes, to one of moderate to high residual fuels with connecting vertical fuel ladders. Fire occurrence indicates a moderate risk of 0.6 fires expected per 1,000 acres per decade.

Biological Features

Wildlife

The Bartle Watershed is important to many species for population viability and distribution. The watershed is either part of the eastern or northernmost boundary for the Northern spotted owl, wolverine, and willow flycatcher. It contains a large part of the species historical distribution for the Cascades frog, and is an island of suitable habitat for the tailed frog, the fisher, and the redband trout.

Because of its size and location, the Bartle Watershed area is important to the viability of northern spotted owl populations in the McCloud Flats. Several land allocations have been made



Map 4. Late-successional Reserves

to ensure that adequate habitat is provided for the spotted owl (see Map 4 - Late-Successional Reserves), including:

- Late-Successional Reserve RC-357
- Critical Habitat Unit (CHU) CA-2
- Managed Late-Successional Areas

Further discussion on these areas is provided in Chapter 3.

The Bartle Watershed is used by six deer herds for summer range. The watershed makes up approximately 7% of the total summer range used by these herds.

The Bartle Watershed, contains 25% of the known goshawk nest sites on the Forest. A bald eagle nest site (unconfirmed) is recorded as occurring on private land at the headwaters of the McCloud River.

Most of the redband trout habitat on the McCloud Ranger District is found within the Bartle Watershed.

Vegetation

The Bartle Watershed is considered to be highly productive timberland because of the high percentage of Site I & II ground. Areas of lower productivity are found on the south slopes of Little Black Fox Mountain, along the McIntosh Escarpment, and on the higher terrain around Mushroom Rock. Dry Lake is not suitable for timber production due to seasonal flooding.

Timber types are mostly mixed conifer with white fir as the dominant species on higher terrain and ponderosa pine as the dominant species on the lower flats. Red fir is the dominant species on the highest terrain around Black Fox Mountain and Mushroom Rock. Lodgepole pine occurs in pure stands in the Dry Lake area and is often the dominant species in riparian areas. A few small stands of pure knobcone pine exist, but typically it is found as a minor species scattered throughout white fir stands. Hardwoods are found throughout many mixed conifer stands, and are common in riparian areas. In several areas it forms almost pure stands.

Sensitive Plants

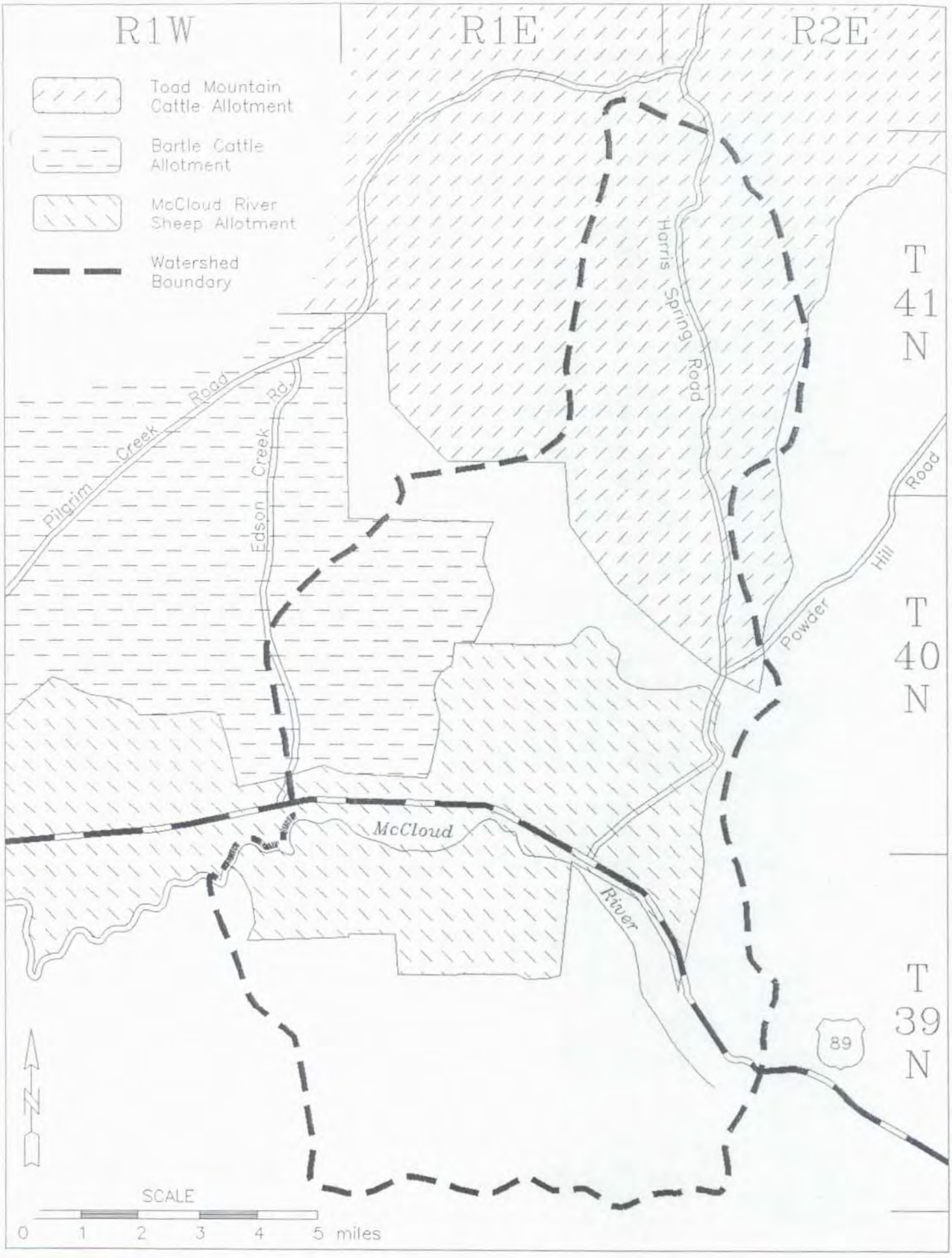
Three U.S. Forest Service designated sensitive plants are found within the Bartle Watershed. *Calochortus longebarbatus* var. *longebarbatus* (long-haired star-tulip), *Rorippa columbiae* (Columbia cress), and *Trillium ovatum* ssp. *oettingeri* (Salmon Mountains wakerobin).

Grazing

The Bartle Watershed has two cattle grazing allotments and one sheep allotment (see Map 5 - Grazing Allotments). Additional discussion on cattle grazing is provided in Chapter 3.

Social Environment

The Bartle analysis area is in southeastern Siskiyou County and northern Shasta County. The closest community is the town of McCloud which is a typical timber dependent community. Occupational categories can be identified as "loggers", "sawmill workers", and "community businesses". Population figures indicate that McCloud exhibited an annual growth rate of zero for the period between 1970-1987. The projected growth rate for the period from 1987-2010 is



Map 5. Grazing Allotments

only 0.3 percent. Because of limited job availability, most growth has been in the form of second homeowners and retirees.

The area of the McCloud River inside the Bartle analysis area experiences limited recreational use in the form of fishing, camping, and hunting. The remainder of the Bartle analysis area is popular for hunting. A scenic byway is also being proposed along the Harris Springs Road, which will increase the popularity of the area for sight seeing. Visitor and recreationist concerns generally deal with access, availability of facilities, and preservation of the forests.

Several areas have sacred or spiritual significance to various local Native American tribes. According to one member of the Pit River Indians, Black Fox Mountain is considered sacred, and is recognized as a "church". The McCloud River is also considered to be culturally and spiritually important.

Landscape Components

Based on current knowledge, the watershed was stratified into six Landscape Components (LC) to facilitate subsequent analysis. These landscape components are used extensively later in this document as a means of identifying and discussing specific areas within the watershed with similar conditions. This section provides a generalized description of those landscape components found in the Bartle Watershed. It is generally arranged by descending elevation from the upper slopes down to the McCloud River (see Map 6 - Landscape Components).

LC-1. Midslopes and Mountain Tops

Elevation: 4,800 - 6,500 feet

Landform: This landscape component is a complex set of landforms that include composite cones, cinder cones, lava domes, and tertiary lava flows. Named features include Sheepheaven Butte, Stillwater Butte, Lookout Point, Bartle Gap, Black Fox Mountain, Little Black Fox Mountain and Mushroom Rock.

Soils: Soils are generally deep and productive but include frequent rock outcrops in and near drainages.

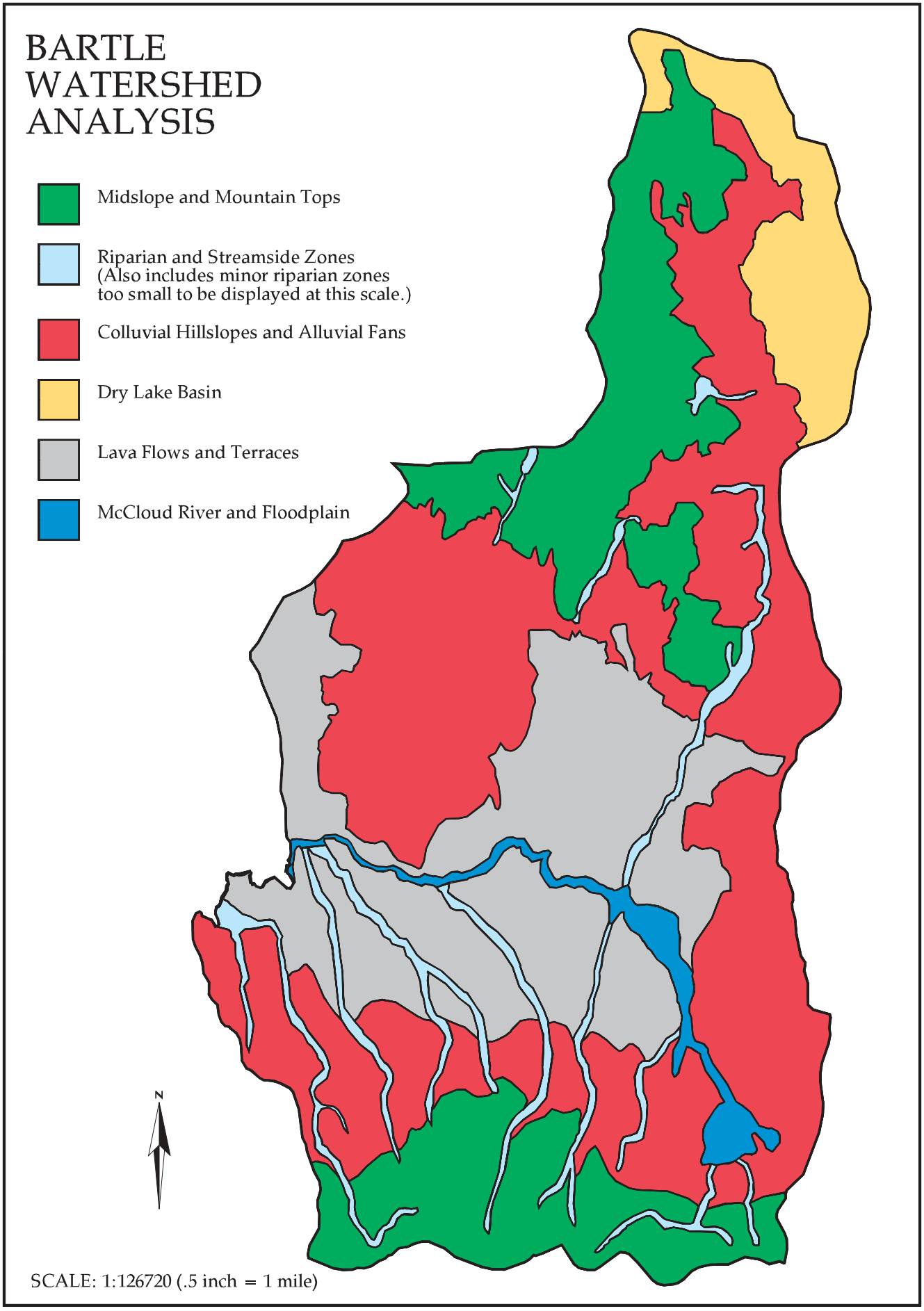
Vegetation: The dominant vegetation is white fir forest. Red fir forests are found at the highest elevations. White fir - ponderosa pine mixed conifer forests are found at the lower elevations. Also included in this landscape component are inclusions of upland wet meadows.

Ecological Types:
- midslopes - McKay fine sandy loam - white fir mixed conifer.
- mountain tops - Cabinbutte fine sandy loam - white fir/red fir forest.
- terraces - Typic Humaquepts - lodgepole pine/sedge meadow.

LC-2. Riparian and Streamside Zones

Elevation: Varies - occurs as inclusions within all other landscape components.

Landform: This landscape component includes wet meadows, springs, seeps, perennial and intermittent streams, and Dry Lake. Streamside Riparian Reserves are included in this landscape component. Named features include Stillwater Meadows, Colby Meadows, and Dry Lake. Some of these features are too small to depict on a map and are included with other landscape components.



Map 6. Landscape Components

Soils: Soil material from natural erosion processes (termed colluvium) collected at the base of the uplands resulting in deep, productive, sandy soils. Streams that flow off the uplands have deposited fans of alluvium which also have deep, productive soils.

Vegetation: Usually includes vegetation typical of the adjacent landscape component plus additional plant species typical of riparian and aquatic conditions such as willow, aspen, and lodgepole pine.

Ecological Types:
- grass/sedge wet meadows.
- lodgepole pine/Douglas spirea stands.
- vernal ponds.
- mixed conifer stands with high water tables.

LC-3. Colluvial Hillslopes and Alluvial Fans

Elevation: 4,400 - 4,800 feet

Landform: This landscape component includes the footslopes of the Black Fox and Mushroom Rock uplands.

Soils: Soil material from natural erosion processes (termed colluvium) collected at the base of the uplands resulting in deep, productive, sandy soils. Streams that flow off the uplands have deposited fans of alluvium which also have deep, productive soils.

Vegetation: This landscape component is characterized by mixed conifer forests.

Ecological Types:
- Colluvial Hillslopes - Mermac sandy loam - Douglas-fir mixed conifer.
- Terraces - Wyntoon fine sandy loam - Douglas-fir mixed conifer.
- Alluvial fans - McIntosh fine sandy loam - Douglas-fir mixed conifer.

LC-4. Dry Lake Basin

Elevation: 4,550 - 4,650 feet

Landform: This landscape component consists of terraces, fans and basins associated with Dry Lake. However, Dry Lake itself is considered to be a riparian area and is included within LC-2. This basin was formed by tectonic block faulting; the landscape was lowered relative to the surrounding terrain. The resulting feature, termed a graben, became the recipient of post-glacial outwash deposits and stream deposits from the adjacent uplands. The area is essentially level. This landform includes numerous low hills that are relics of the older, buried surface.

Soils: Soils are deep, gravelly, sandy loams. In the vicinity of Dry Lake they are seasonally flooded. The low hills are characterized by stoney sand clay loams.

Vegetation: This landscape component is characterized by pure stands of lodgepole pine in areas that experience seasonal flooding and a mixture of lodgepole pine, ponderosa pine and white fir on elevated terrain that is not susceptible to flooding.

Ecological Types:
- Terraces - Mudwell sandy loam - lodgepole pine
- Tilted block - Redtank stony sandy loam - white fir-ponderosa pine forest.

LC-5. Lava Flows and Terraces

Elevation: 3,850 - 4,250 feet

Landform: This landscape component is characterized as gently sloping lava flows that have been inundated by alluvium. This landform is broad at the mouths of Bartle Creek, McKay Creek and Bull Creek and very narrow at the mouths of Raccoon Creek and Shady gulch. Terrain is level to gently sloping.

Soils: These alluvial deposits are highly variable in depth and soil texture. They range from deep, fine-textured deposits to moderately deep, coarse-textured deposits with occasional basalt outcrops.

Vegetation: This landscape component is characterized by ponderosa pine and white fir-ponderosa pine stands.

Ecological Types:
- Lava Flows - Jaystreet sandy loam - ponderosa pine/bitterbrush.
- Terraces - LeTrab cobbly sandy loam - white fir/ponderosa pine forest.

LC-6. <u>McCloud River and Floodplain</u>

Elevation: 3,850 - 3,900 feet

Landform: This landscape component includes the meander and flood plain for the McCloud River and is characterized by high water tables and seasonal flooding. Much of this area is known as Curtis Meadow. Terrain is essentially level. Much of the landform has been cleared for grazing.

Soils: Meadow areas are characterized by soils derived from sandy alluvium and organic material. The river and its canyon are characterized by shallow soils and rock outcrops.

Vegetation: Usually includes vegetation typical of the adjacent landscape component plus additional plant species associated with riparian and aquatic conditions such as willow, aspen, and lodgepole pine.

Ecological Types: Floodplain - Typic Humaquepts - lodgepole pine/Douglas spirea.

Land Allocations and Management Direction

Management direction for the Bartle Watershed is found in the Shasta-Trinity National Forests Land and Resource Management Plan (LMP) which incorporates direction from the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Additional information on management direction in the Bartle Watershed can be found in Appendix B.

The ROD identifies four land allocations within the watershed (see Map 7 - Land Allocation):

- Late-Successional Reserves (LSR)

  Late-Successional Reserves are areas that have been established to protect and enhance conditions of late-successional and old-growth forest ecosystems and to insure the support of related species, including the northern spotted owl (LMP 4-37).
- Managed Late-Successional Areas (MLSA)

  Managed Late-Successional Areas are similar to Late-Successional Reserves but are identified for certain owl activity centers on the eastside of the forest where regular and frequent fire is a natural part of the ecosystem. Certain silvicultural treatments and fire hazard reduction treatments are allowed to help prevent complete stand destruction

from large catastrophic events such as high intensity, high severity fires; or disease or insect epidemics (ROD A-4).

- Riparian Reserves

  Riparian Reserves provide an area along streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving, for example, as dispersal habitat for certain terrestrial species (ROD A-5).

- Matrix

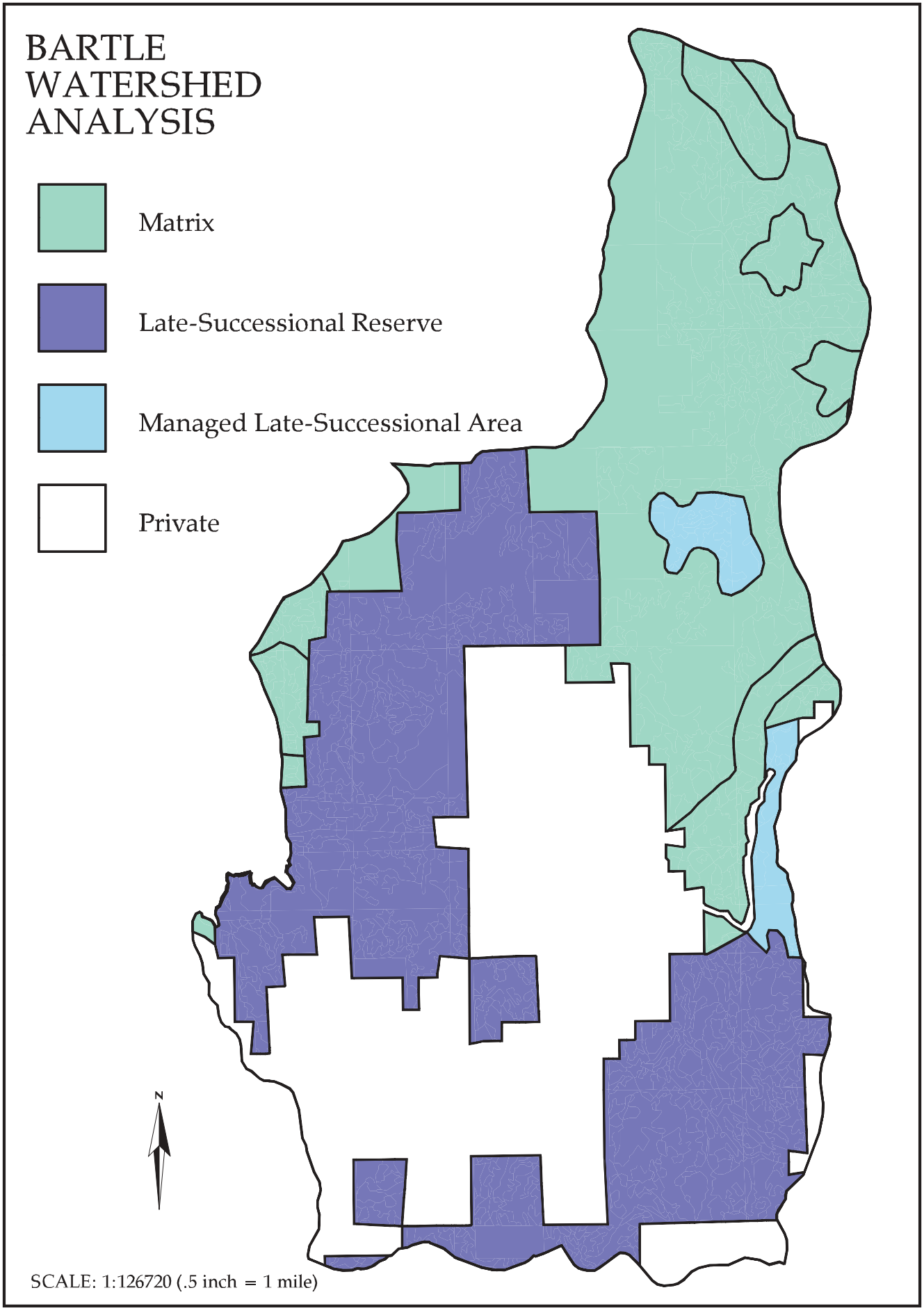
  The Matrix consists of those federal lands outside the three categories of designated areas listed above (ROD A-5). The Matrix are lands on which most timber harvest will occur and where standard and guidelines are in place to assure for appropriate conservation of ecosystems as well as provide habitat for rare and lesser known species (ROD B-10).

In addition to the four land allocations identified in the ROD, the Shasta-Trinity National Forests Land and Resource Management Plan identifies six Management Prescriptions in the Bartle Watershed (see Map 8 - Management Prescriptions). These are:

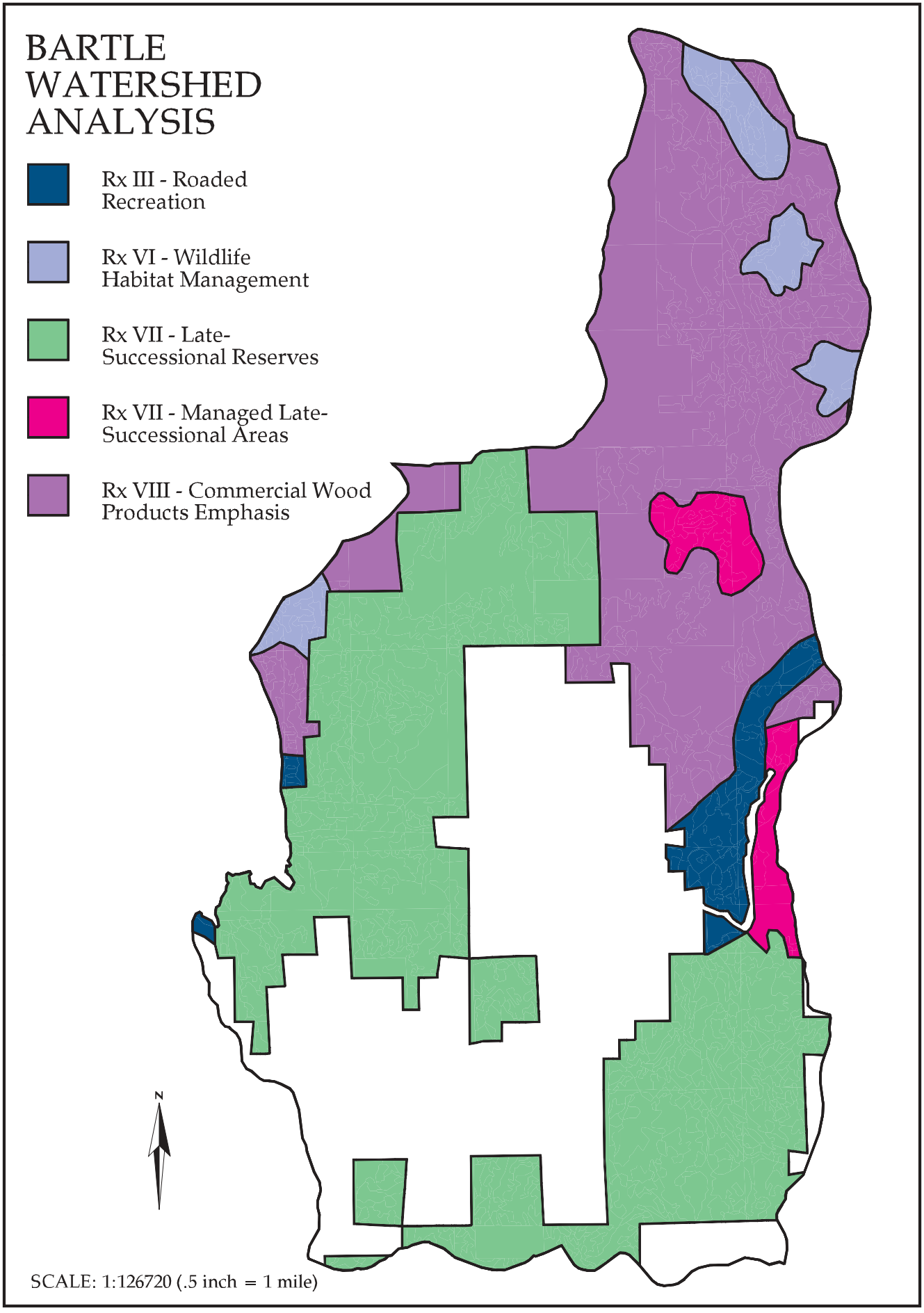
- III - Roaded Recreation (LMP 4-64)
- VI - Wildlife Habitat Management (LMP 4-66)
- VII - Late-Successional Reserves and TES Species (LMP 4-43)
- VIII - Commercial Wood Products Emphasis (LMP 4-67)
- IX - Riparian Management (LMP 4-59)
- XI - Heritage Resource Management (LMP 4-50)

Supplemental management direction for specific units of land is provided in the LMP under Management Area Direction (LMP-Chapter 4-Section G). The LMP identifies three Management Areas in the Bartle Watershed (see Map 9 - Management Areas):

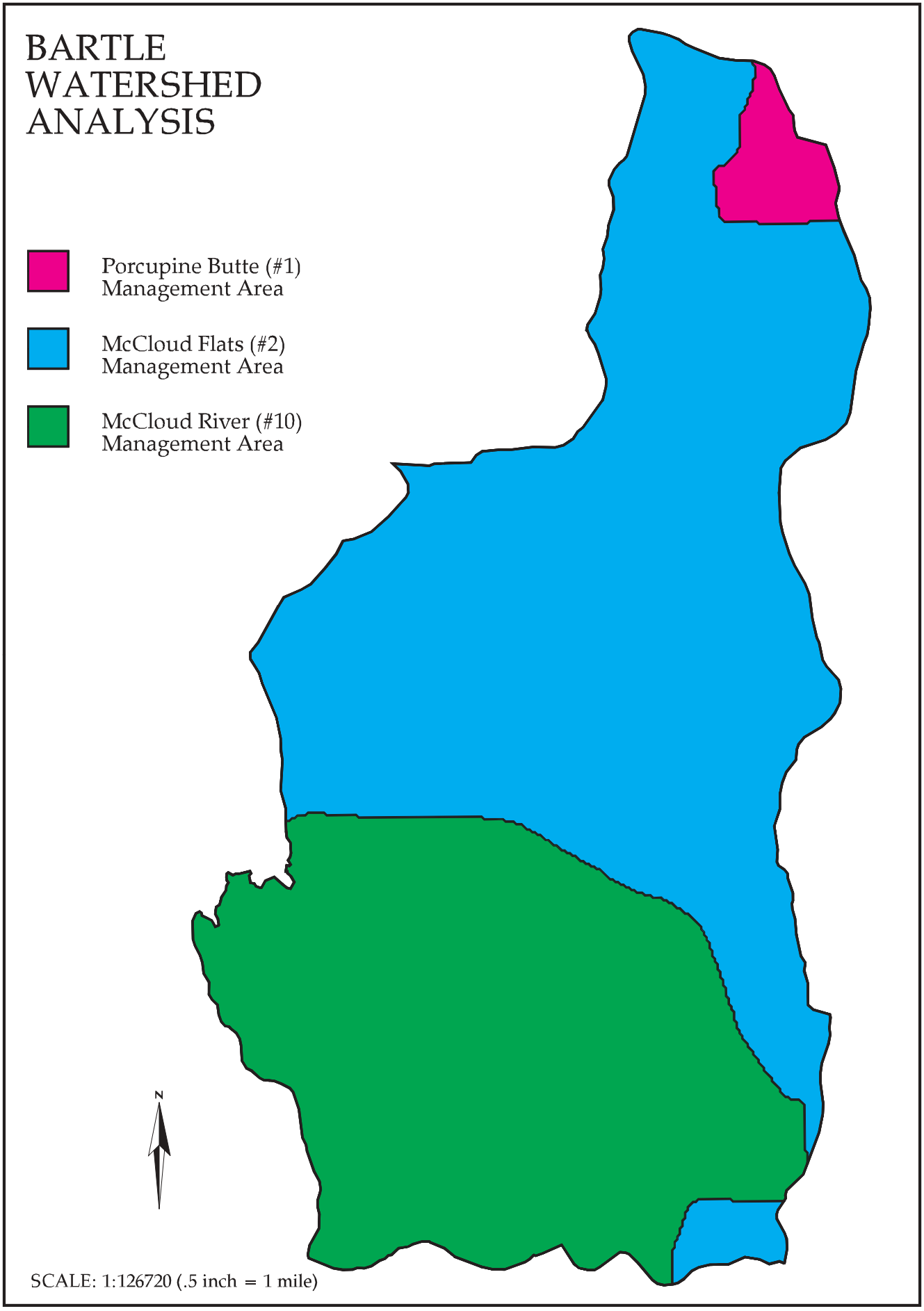
- Porcupine Butte (#1) (LMP 4-77)
- McCloud Flats (#2) (LMP 4-81)
- McCloud River (#10) (LMP 4-123)



Map 7. Land Allocation



Map 8. Management Prescriptions



Map 9. Management Areas

Chapter 2

Issues and Key Questions

The purpose of this chapter is to focus on the key elements of the ecosystem relevant to future land management activities, and to identify the data and analysis needed to provide broad direction for future projects. Issues and key questions were developed by the interdisciplinary team. Major issues of immediate concern are identified and characterized, and corresponding key questions asked.

The major issues covered in this chapter are:

- Forest Health
- Wildlife Biodversity
- TES Species and Habitat
- Aquatic Ecosystems
- Socio-Economic

Forest Health

Issue: Fire Regimes

What is the sustainability and desirability of current fire regimes? Where do we exceed Standards and Guides for dead and down material?

With the advent of forest management and fire suppression the fire regime has shifted from a frequent low intensity surface fire regime to one of moderate to high intensity fires at infrequent intervals. As a result, the Bartle landscape exhibits a fuel profile that can increase the risk of catastrophic fires. In much of Bartle watershed residual fuel loads are characteristic of high intensity fuel models. There is a concern that current forest conditions are not sustainable, and that a high-intensity, stand replacing fire is imminent. These areas are usually found in stands that are undergoing high mortality. Areas where snag density, residual fuel loads and stand density exceed desirable levels may be identified for possible treatment.

Issue: Stocking Levels

How are current stocking levels affecting insects, disease, growth rates, and the fuel profile?

Much of the Bartle watershed area is characterized as overstocked, even-aged stands and much of the remainder is characterized as multi-aged stands with a very dense understory of white fir. These dense forests are more vulnerable to insect infestation, have reduced growth rates, and have altered forest succession. They also exhibit a fuel profile, termed a "fuel ladder", whereby ground fires can spread into middle and overstory canopy layers and cause destructive crown

fires. High stocking levels will continue to increase mortality and lead to greater risk of catastrophic wildfire.

Issue: Acceptable or Needed Mortality

Does or will tree mortality meet or exceed snag and down log requirements, and produce high levels of fuels that may adversely affect forest health? What treatments are appropriate and available to protect resources and meet management objectives?

Decadence and mortality are characteristic of late-successional forests. Snags and down woody material provide habitat for a wide array of organisms. At some point, however, the level of mortality exceeds that which is a healthy component of the forest ecosystem. At excessive levels, forest mortality creates a risk of damaging wildfire. Those areas with excessive levels of mortality may be identified for possible treatments. The levels of decadence and mortality that are adequate to meet habitat needs should be determined so that risks to the landscape from fire, insects and pathogens can be minimized.

Issue: Species Composition

What species composition is appropriate given the water availability and the fire regime?

Past forest management practices and fire suppression over most of the Bartle watershed have fostered changes in species composition and vegetative habitat:

> Many of the mixed conifer stands have developed a dense understory of white fir. If the understory is allowed to mature it will change the stand composition toward a dominance of white fir. The black oak understory will be extirpated.
>
> Shrubland and lodgepole pine types are being invaded by an understory of white fir. Without fire or other continuing disturbance these forest types will be dominated by white fir.

Issue: Forest Landscape Design

How do we manage this landscape to maintain diversity in forest composition, given the current land allocation? Diversity in forest composition includes:

- **Diversity within stands**
- **Diversity of seral stages**
- **Diversity of vegetation types across the landscape**

This question examines three main considerations in forest diversity:

> Diversity within stands - A healthy forest maintains a diversity of stand structural composition. Factors of a diverse structure are: layering, age distribution, snags and dead and down material.
>
> Diversity of seral stages - A healthy forest exhibits a mosaic of stands at varying seral stages with all seral stages represented.

Diversity of vegetation types across the landscape - This landscape exhibits a diversity of vegetation types including dry and wet meadows, lodgepole stands, mixed conifer stands etc. Active management may be necessary to prevent a shift to more monotypic forest types.

Wildlife Biodiversity

Issue: Snag Densities

What is the acceptable snag density and distribution? What is the required recruitment? Do we meet the acceptable snag densities and distribution?

Thirty-two species (17%) of wildlife suspected of occurring in the watershed are cavity nesters (snag guild - see Appendix C). These species are dependent upon cavities in live or dead snags for nesting, foraging, food storage, and perch/roost sites. The numbers and distribution of snags within the watershed are an important contribution to species diversity and to the maintenance of healthy populations of snag-dependent species. The Land Management Plan (LMP) for the Forest set snag management guidelines for these species. Snag production and longevity is dependent upon snag distribution, forest structure, and age. Snag recruitment models can help managers determine the number of 'green trees' required to provide a healthy snag regime over time. Current snag densities for the watershed are unknown.

Issue: Dead and Down Material

In what areas do we not meet Standards & Guides for dead and down material?

Dead and down wood is used by wildlife for nesting, denning, thermal/escape cover, and foraging (small animals and insects). Management guidelines in the LMP, and Habitat Capability Models (see LMP Appendix G), indicate the amounts of dead and down believed to be necessary to maintain healthy populations of dead and down-dependent wildlife. The current amount and distribution of dead and down material within the watershed is known and can be compared with management guidelines for those dependent wildlife species.

Issue: Wildlife Species of Concern

Is the current habitat suitable for or capable of meeting the needs of Wildlife Species of Concern (e.g., game animals, pygmy short horned lizard)? To what extent is the watershed being used by these species?

Other wildlife species of concern, besides TES species, are provided for through management guidelines found in the LMP. A list of survey and manage species in the LMP (LMP Appendix R) includes those old-growth dependent species known or suspected to occur on the Shasta-Trinity National Forests and requiring additional or unique management. The Survey and Manage standard and guide requires management of known sites of these species. Very little is known about the distribution, abundance, and habitat needs of most of these species. Protocols for species surveys, databases of known sites, and management recommendations are being developed by the Regional Ecosystems Office (REO), but are not currently available.

In addition to survey and manage species, management practices for other wildlife species of concern, under direction of the ROD and LMP, include wildlife habitat management for State deer herd plans and other consumptive species, neotropical migrant birds, bats, cavity nesting species, and wildlife species of local importance.

Issue: Road Densities

Are road densities consistent with standards and guides? How do current road densities contribute to the disturbance of wildlife and fragmentation of their habitat?

The amount of road mileage within the watershed that could be decommissioned is a subject for study. Human encroachment follows construction of roads, resulting in disturbance of wildlife populations. Human disturbance can affect reproduction, increase mortality, and cause displacement. Roads also tend to fragment wildlife habitat, limiting the movement of and range available for forest-interior species, increasing the amount of edge-habitat within the watershed, exposing wildlife to predation and nest parasitism, and reducing the habitat quality. Roads also increase the opportunity for poaching of game animals. Roads also directly remove forest acreage from production.

TES Species and Habitat

Issue: TES Species of Concern

Is the current habitat suitable for or capable of meeting the needs of Northern spotted owls, Northern goshawks, and furbearers? To what extent is the watershed being used by these species?

Within the watershed, the threatened, endangered, and sensitive species not considered aquatic/riparian dependent, are late seral and/or snag cavity dependent species. These wildlife species require suitable habitat consisting of late seral habitat components and structures, and dispersal habitat consisting of mature to late seral forest habitat types. Though areas within the watershed have been designated for maintaining suitable and dispersal habitat (such as: Late-Successional Reserves, Managed Late-Successional Areas, Riparian Reserves, Critical Habitat Units, retention of a percentage of habitat in Matrix lands, retention of 100 acre cores around known owl activity centers) the actual amount, condition, and distribution of the habitat throughout the watershed has not been explored. By coupling the understanding about the required habitats to the needs and current distribution of the wildlife which use them, the most effective management for suitable and dispersal habitat can be determined.

Issue: Plant Species of Concern

Is present habitat suitable for plant species of concern? What management scheme would best enhance both habitats and existing populations?

Habitat for vascular plant species of concern, both TE&S and Survey and Manage species (S&M species will be discussed further under Biodiversity), has undergone considerable degradation from the effects of logging, grazing, water diversion, and recreation. Riparian areas, in

particular, exhibit the effects of continued grazing by cattle: changes in species composition, loss of willow and aspen regeneration, soil compaction, and erosion of streambanks is evident in many parts of the watershed. The opening of the forest canopy through logging has resulted in a loss of the shady, moist conditions required by many old-growth associated plant species, while fire suppression efforts have, at the same time, resulted in overcrowded understory conditions. Stricter control of grazing livestock, preservation/restoration of riparian areas, the reintroduction of fire as an ecosystem component, and enhancement of stand structure to restore old-growth conditions would allow plant populations to rebound in most areas.

Aquatic Ecosystems

Issue: Water Quality and Quantity

How have land use activities and natural processes affected water quality and quantity?

Water quality and quantity are affected by grazing practices, roads, water diversions and variations in precipitation. Grazing activities concentrated north of Highway 89 have degraded riparian areas resulting in bank erosion, increased sediment delivery to streams and loss of riparian vegetation. Roads located in upland areas south of Highway 89 are chronic sources of sediment to streams. Spring developments have lowered watertables in riparian areas and water diversions have redistributed the supply of available water. These activities have increased the amount of surface water available for cattle and wildlife and have reduced the size of riparian areas in the northern portion of the watershed.

Issue: Grazing Impacts

What effects do present grazing practices have on aquatic/riparian dependent species? What methods have been practical and effective in mitigating grazing impacts and maintaining functional ecosystems?

Grazing activities have resulted in impacts to riparian ecosystems. Impacts include a reduction in available water for plant and animal species, higher turbidity levels, stream sedimentation, loss of willow flycatcher nesting habitat, soil compaction, and removal of riparian canopy cover. The latter has resulted in a reduction of cover for redband trout. Practices seeking to keep cattle out of riparian areas such as fencing and spring developments have only partially improved riparian condition. The effectiveness of these and other proposed mitigation measures (fewer cattle, shorter season) is being evaluated. Without effective mitigations, grazing activities may conflict with aquatic conservation strategy objectives.

Issue: Redband Trout Habitat

What habitat attributes presently limit redband trout production, and in which streams? What treatments would improve habitat conditions for redband trout?

Small streams and a lack of deep pools appear to be the primary limiting factors for redband trout. Siltation of creeks due to disturbance may also be degrading instream habitat. These conditions are prevalent in Moosehead, Sheepheaven, and portions of Tate Creek. Protection

and restoration of riparian areas would aid in limiting further siltation, as will the establishment of buffer zones along stream channels.

Issue: Riparian Species of Concern

Does the existing riparian habitat meet the needs of riparian dependent wildlife and plant species of concern? To what extent do riparian associated species exist within the watershed?

Approximately 22% of the wildlife species suspected to occur within the watershed are aquatic or riparian dependent species. Of these, nine are species of concern, having state or federal 'listed', 'candidate' or 'species of special concern' status. Most of the remaining wildlife species use riparian habitats to varying degrees. Of these, 13 are species of concern. Riparian habitats are important to both riparian dependent and non-dependent wildlife in providing thermal cover, hiding cover, nesting habitat and material, a prey base, and travel corridors within the riparian vegetation and between upland habitats. Riparian habitat may be impacted by timber harvest practices, grazing, fire, natural occurrences and other disturbances. These disturbances may degrade riparian habitat and reduce potential wildlife benefits. Knowledge of which wildlife and plant species exist or may exist within riparian habitat, where they exist within the watershed, and their habitat needs will help determine the required condition of the habitat. Based on this knowledge, various healthy riparian habitats can be maintained to provide for wildlife and plant species viability and diversity.

Socio-Economic

Issue: Heritage Resources

How will heritage resources be affected by expected increases in public recreation use?

Trail construction along the McCloud River would occur in areas with a high concentration of heritage resources. Designation of the Modoc Volcanic Scenic Byway along Highway 89 and the Harris Springs Road is expected to increase the number of visitors to the watershed.

Issue: Native American Religious and Ceremonial Sites

Where are the known significant Native American religious and ceremonial sites? What considerations need to be made to protect their integrity?

Black Fox Mountain is known to be a Native American religious site. There is a concern that management activities in the Black Fox viewshed could affect the site.

Issue: Public Uses

In what ways should management activities be conducted to balance public uses with other resource needs?

Mushroom picking occurs within the watershed. Several popular picking areas are north of Slagger Camp. Ground disturbance appears to have set back the production of boletus mushrooms.

Lodgepole pine stands in the northeast portion of the analysis area are some of the most heavily used areas for personal use firewood cutting. Management activities have the potential to reduce the amount of lodgepole pine firewood available to the public.

There are opportunities to develop fishing access along the Upper McCloud River through construction of the McCloud River Trail. Due to the concern with redband trout, there is an opportunity to provide information to the public that encourages the taking of other trout species and promotes the catch and release of redband trout.

The proposed McCloud River Trail would provide sight-seeing and wildlife viewing opportunities.

Siskiyou County is one of the heaviest used areas for deer hunting in California. Deer hunters use numerous dispersed and undeveloped campsites throughout the watershed.

Issue: Local employment and economy

What management activities provide commodities and other opportunities that can enhance local employment?

Management activities on National Forests provide a source of employment for local communities. Timber harvest has traditionally been the major source of woods-related employment.

Issue: Visual Quality

In what ways can the scenic byways be enhanced?

The Harris Spring Road (FA #15) has been designated as a scenic byway. This designation could provide opportunities for creating vistas and installing interpretive signing.

Chapter 3

Current Conditions

This chapter will identify the current conditions and trends of the physical, biological, and human ecosystem elements. For this analysis, current conditions for each issue and key question will be discussed in terms of the watershed as a whole followed by a discussion of each of the Landscape Components (LC) identified in Chapter 1.

Forest Health

Fire Regimes

Watershed Overview

The current fire regime is in transition from a short return interval, low intensity regime to one of moderate to high intensity at infrequent intervals. Return intervals which are normally at 5-30 years in this fire adapted regime, have extended to over 60 years due to fire exclusion. The exception to this is Dry Lake Basin (LC-4), where return intervals and regimes differ from the mixed-conifer and pine series that occur in a larger portion of the watershed. Current conditions reflect the absence of fire in dense, overstocked stands of fire intolerant species, and in moderate to high accumulations of residual down woody fuels. As the regime is a consequence of the interaction of several variables such as frequency of ignition, climate, and topography, the Bartle Watershed, although described largely by a single fire regime, has several components that display different effects to fire disturbance. A Hazard and Risk assessment based on probable fire behavior, ignition starts, and sustainability (probability of loss) based on these predictions is displayed in the summary at the end of this section and on Map 10 - Fire Hazard and Risk.

LC-1. Midslopes and Mountain Tops

The general fire regime is as described above in the Watershed Overview.

Hazard/Risk rating = Moderate/Moderate

Higher elevation zones within this component exhibit:

- longer fire return intervals due to a cooler, wetter climate.
- higher accumulations of down residual fuel loads.
- low to moderate fire behavior due to differing moisture conditions under a dominant fir component.

Multi-age and multi-storied stands within the midslope area of this component exhibit:

- shorter fire intervals.
- moderate to high residual fuels building a vertical fuel structure to stand canopies.
- current return intervals and resulting fire behavior which exceed natural characteristics.

LC-2. Riparian and Streamside Zones

This zone resides within the same general fire regime described in the overview.

Hazard/Risk rating = Low/Low.

LC-3. Colluvial Hillslopes and Alluvial Fans

This component is one of the most vulnerable to catastrophic fire replacement within the watershed.

Hazard/Risk ratings:

- even-aged, higher elevation zone = Moderate/Moderate.
- multi-storied, lower elevation zone = High/High

This landscape component is characterized by:

- return intervals that have been artificially lengthened by fire suppression.
- horizontal and vertical fuel profiles conducive to catastrophic wildfire.
- mosaic patches which are evidence of intensity variations within an altered regime.
- increased fuel continuity due to successional changes such as invasion of shade tolerant trees and moderate to heavy accumulations of residual fuels
- enhanced vulnerability due to higher occurrence of insect and disease mortality

As fire return intervals lengthen:

- fuel accumulations can be expected to increase.
- higher proportions of fire intolerant species within the understory can be expected.
- infrequent high intensity stand replacement fires will be the dominant characteristic of this landscape component.

LC-4. Dry Lake Basin

Hazard/Risk rating = Moderate/Moderate.

This landscape component is described by:

- a moderate intensity regime.
- a variety of low, moderate, and high severity fires over time.
- average return intervals of probably 60-80 years, and seldom exceed 100 years without fire disturbance.
- moderate residual fuels with areas of heavier concentrations.

LC-5. Lava Flows and Terraces

Hazard/Risk rating = Moderate/High.

This landscape component is characterized by:

- a transition from a low intensity to a moderate intensity regime.
- more apparent evidence of fire exclusion in the lower and drier pine sites where normal return intervals of 5-15 years have been lengthened to 60 plus years.
- highest risk to fire starts due to high travel volumes.
- an existing history of human caused starts along the Highway 89 corridor.

LC-6. McCloud River and its Floodplain

Hazard/Risk rating = Low/Moderate.

This component is similar to LC-2 with the exception of an increased Risk rating due to high travel volumes, and a history of human caused starts.

Summary

Fire Regime: In transition from a short interval, low intensity regime to a moderate to high intensity regime at infrequent intervals.

Overall Hazard/Risk for Bartle Watershed: Moderate/Moderate

Table 3-1. Hazard/Risk and probability of loss by landscape component:

	LC-1	LC-2	LC-3	LC-4	LC-5	LC-6
Hazard/Risk	M/M	L/L	H/H	M/M	M/M	L/M
Probability of Loss	M	L	H	M	M	L

L = Low M = Moderate H = High

Stocking Levels

Watershed Overview

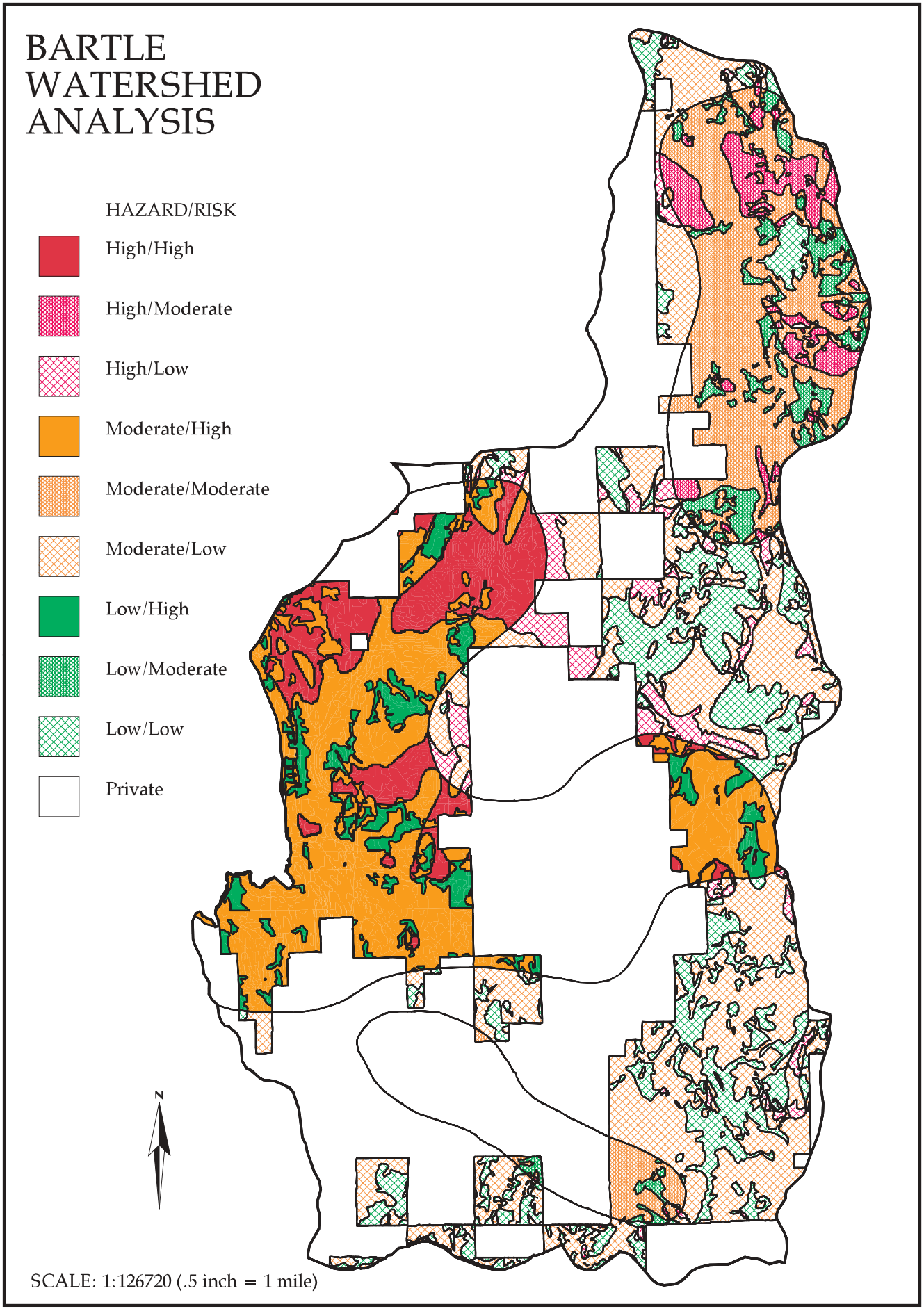
Much of the watershed is characterized by very dense conifer stands with the associated problems of insects, and disease. Growth rates and fuel profiles are also affected. The effect stocking levels have on forest health varies widely with site productivity and species composition. Stocking in pine stands and on coarser soils, generally doesn't reach levels where stand density associated problems occur. Riparian and streamside areas have highly variable stocking levels with low fire hazard and risk. Riparian and streamside sites are less sensitive to periodic droughts, and therefore can support higher stocking levels. Most of the problems associated with stocking levels are found in landscape components LC-1 and LC-3.

There is a direct correlation between stocking densities and fire hazard assessment ratings. Dense stocking contributes to vertical fuel ladders that in turn provide opportunities for crowning and catastrophic wildfire events. The hazard assessment for the entire watershed results in a "moderate" rating. Approximately 80% of the entire watershed is within a moderate to high hazard level due to stocking density. "Moderate" describes fuel models that produce 4-8 ft. flame lengths where direct attack suppression opportunities are lost.

LC-1. Midslopes and Mountain Tops

This landscape component can be characterized by:

- high current conifer stocking levels.
- insect and disease prone high density stands, despite high site carrying capacity.
- localized centers of cytospora and dispersed outbreaks of fir-engraver beetle within high density stands.
- retarded potential stand growth to a later successional stage on moderate to high productivity sites due to high stand density.



Map 10. Fire Hazard & Risk

- high stand densities which contribute to drought-related mortality and high to extreme fuel loads.

In the even-aged, single-storied, mid-mature fir stands that are found at the higher elevations on Stillwater Butte, Buck Mountain, and Lookout Point, vertical fuels are generally absent. In the multi-aged, multi-storied fir stands that are found at the 4,800 to 5,500 ft. elevations across the landscape, fuel ladders are strongly exhibited. Another stand type found in this landscape component is brush fields undergoing invasion by white fir. In contrast to the other stand types found in this landscape component, there are no major outbreaks of disease exhibited in these stands. Growth rates are limited by brush competition rather than tree stocking levels, and it is brush density that forms the fuels profile rather than tree density.

LC-2. Riparian and Streamside Zones

The problems with high density stocking are not generally applicable to this landscape component. The current stocking levels are highly variable. Stocking levels have not been associated with disease or insects on these sites, nor are they a recognized factor in limiting growth.

LC-3. Colluvial Hillslopes and Alluvial Fans

This landscape component is characterized by:

- multi-aged, multi-storied mixed conifer stands.
- very high conifer stocking levels.
- stands with very high productivity.
- stands that are drought sensitive at very high stocking levels despite very high carrying capacity.
- the inclusion of major centers of insect outbreaks and disease infection, including cytospora, black stain, fir-engraver beetles and bark beetles.
- expected high mortality levels during prolonged drought.
- retarded potential stand growth to a later successional stage due to high stand density despite very high site productivity.
- presence of a vertical fuel profile due to high basal area and multi-storied conditions.

LC-4. Dry Lake Basin

This landscape component is characterized by:

- lodgepole pine stands with inclusions of white fir and ponderosa pine.
- highly variable conifer stocking levels.
- widespread infection by pine gall and rust, that is not directly attributed to stocking levels.
- stands of lodgepole pine that have high stocking levels and high risk fuel profiles but which are not widespread and are dispersed across the landscape.

LC-5. Lava Flows and Terraces

This landscape component is characterized by:

- ponderosa pine stands and white fir/ponderosa pine stands.
- low to moderate current conifer stocking levels.
- no identified major disease or insect centers.

- open stands with the potential to produce 10 to 15 large trees per acre and characterized by a low level of ground fuels, with vertical fuels absent.

LC-6. McCloud River and its Floodplain (See LC-2)

Acceptable or Needed Mortality

Watershed Overview

Because of mortality brought on by the effects of drought in dense forest stands, snags are common across the Bartle landscape. Fuels maps indicate that the dead and down requirement specified in the LMP is met or exceeded everywhere in the watershed.

LC-1. Midslopes and Mountain Tops

This landscape component is characterized by:

- dead and down material levels: high
- snag densities: high in all size classes
- potential for future recruitment:
- potential for adverse effects on forest health: high

LC-2. Riparian and Streamside Zones

This landscape component is characterized by:

- dead and down material level: adequate
- snag densities: adequate
- potential for future recruitment: high
- potential for adverse effects on forest health: low

LC-3. Colluvial Hillslopes

This landscape component is characterized by:

- dead and down material level: high
- snag densities: moderate to high
- potential for future recruitment: localized areas have low potential due to current levels of mortality
- potential for adverse effects on forest health: moderate

LC-4. Dry Lake Basin

This landscape component is characterized by:

- dead and down material level: adequate to high
- snag densities: highly variable; deficient in middle size classes due to aggressive woodcutting.
- potential for future recruitment:
- potential for adverse effects on forest health:

LC-5. Lava Flow and Terraces

This landscape component is characterized by:

- dead and down material level: largely deficient - because of the open nature of the stands and the high concentration of plantations where dead and down materials are concentrated in smaller size classes.

- snag densities: largely deficient - because of the open nature of the stands and the high concentration of plantations where snags are generally absent.
- potential for future recruitment:
- potential for adverse effects on forest health:

LC-6. McCloud River and Floodplain (See LC-2)

Species Composition

Watershed Overview

Appropriate species composition assumes that we want to maintain stands in their most stable and sustainable form and composition.

LC-1. Midslopes and Mountain Tops

This landscape component is dominated by true fir stands which are well-suited and appropriate to higher elevations.

LC-2. Riparian and Streamside Zones

This landscape component is characterized by a variety of forest types including grass/forb, lodgepole pine stands, willow stands, and others. The species composition is generally appropriate and stable.

LC-3. Colluvial Hillslopes and Fans

This landscape component is dominated by mixed conifer stands but has developed a dense understory of white fir and incense cedar. Dense understories are seen as a destabilizing element. They create a fuels ladder and make the stand prone to drought-related mortality. This condition creates a high potential for adverse impacts on forest health.

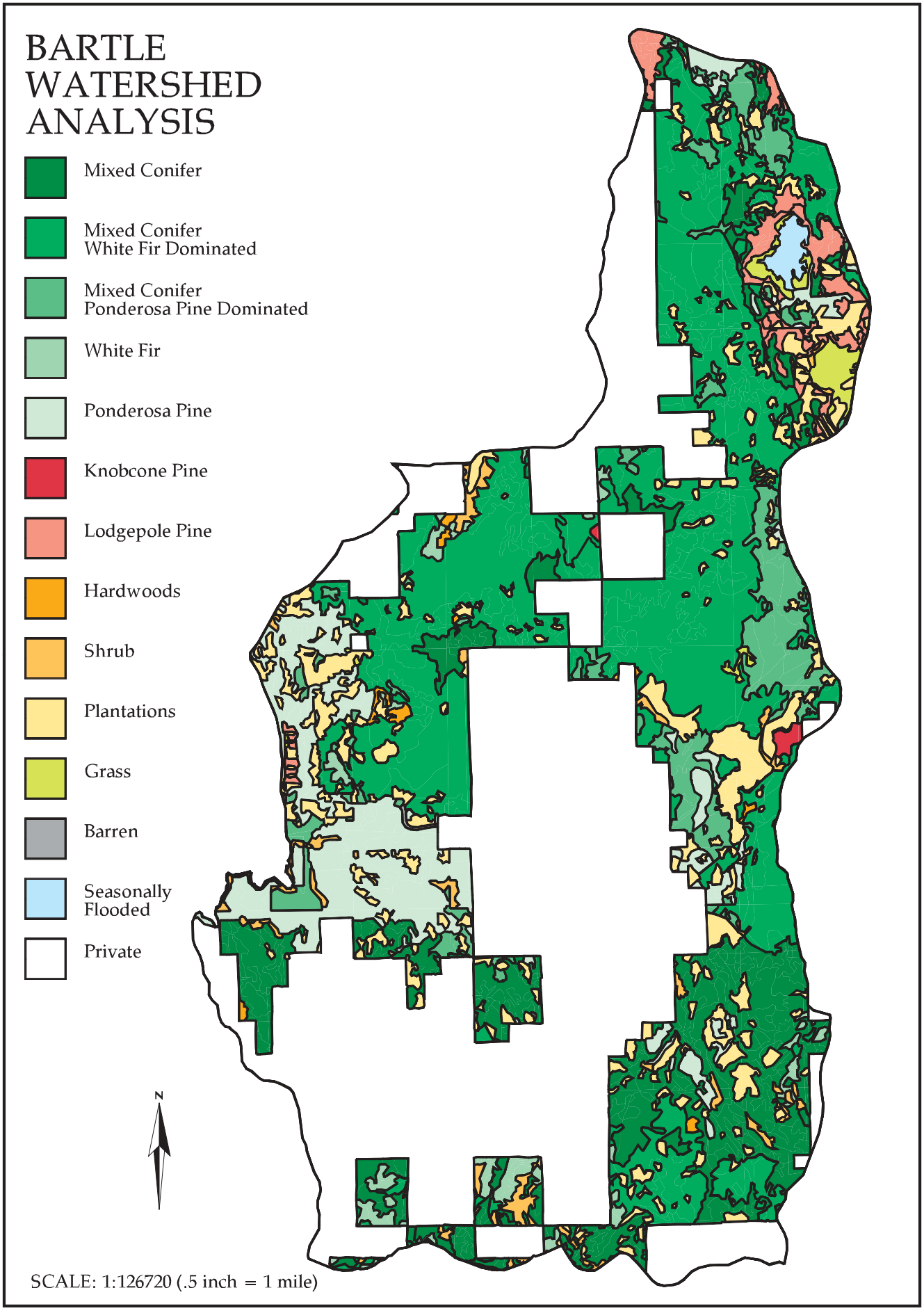
LC-4. Dry Lake Basin

This landscape component is dominated by lodgepole pine stands. Many of the stands are seral in nature and are developing an understory of white fir. The fir understory is seen as a destabilizing agent in these stands. It leads to overstocked conditions and creates a fuels ladder which can lead to more destructive wildfires. This condition creates a moderate potential for adverse impacts on forest health.

LC-5. Lava Flows and Terraces

This landscape component is dominated by ponderosa pine and white fir/ponderosa pine stands. These are generally open stands but they too are developing a white fir understory. This understory is seen as a destabilizing element. This condition creates a moderate potential for adverse impacts on forest health.

LC-6. McCloud River and Floodplain (See LC-2)



Map 11. Major Vegetation Types

Forest Landscape Design

Watershed Overview

This issue includes three diversity considerations:

- diversity within stands.
- The elements of diversity within stands are: layering, age distribution, and snags and dead and down material.
- diversity of seral stages.
- diversity of vegetation types across the landscape.

  Diversity across the landscape is demonstrated by the fact that six landscape components are recognized with a diversity of stands within them.

LC-1. Midslopes and Mountain Tops

Diversity Within Stands

This landscape component includes several different types of stands conditions:

- Even-aged, single storied fir stands exhibit a lack of layering and age distribution, and have abundant snags and dead and down material.
- Multi-aged, multi-storied fir stands exhibit well-defined layering and age distribution, and abundant snags and dead and down material.
- Brushfields exhibit a lack of layering and age distribution, and a lack of snags and dead and down material.

Diversity of Seral Stages

Diversity of seral stages is demonstrated by the fact that three seral types are recognized in this landscape component.

LC-2. Riparian and Streamside Zones

Diversity Within Stands

Stands in riparian areas tend to exhibit well-defined layering and age distribution, and abundant snags and dead and down material. Stands frequently include a shrub/willow type understory.

Diversity of Seral Stages

Diversity of seral stages is demonstrated by the presence of layered grass/sedge types, shrub/willow types, and a variety of tree types.

LC-3. Colluvial Slopes and Fans

Diversity Within Stands

This landscape component is characterized by dominant multi-age, multi-storied mixed conifer stands. Stands exhibit strong layering and age distribution.

Diversity of Seral Stages

With the exception of scattered clearcuts that are 5-10 years old, this landscape component is very homogenous and exhibits little seral diversity.

LC-4. Dry Lake Basin

Diversity Within Stands

The lodgepole pine stands in this landscape component are even-aged with a lack of layering and age distribution. Dead and down quantities are variable ranging from deficient to excessive. Lodgepole pine is a preferred species for firewood cutting. While larger snags are preserved, those snags under 14" dbh are generally absent.

Diversity of Seral Stages

Recent plantations have introduced a diversity of seral stages into an otherwise homogeneous landscape.

LC-5. Lava Flows and Terraces

Diversity Within Stands

Stands that characterize this landscape component are generally multi-aged and exhibit stand layering and a distribution of age classes.

Diversity of Seral Stage

This landscape component tends to be more open and exhibits a diversity of seral stages.

LC-6. McCloud River and Floodplain (See LC-2)

Wildlife Biodiversity

Snags

Watershed Overview

Cavity Nesters

Thirty-two (32) wildlife species believed to occur within the Bartle watershed are dependent on snags for nesting (see Appendix C or see discussions for individual landscape components). These make up 15% of all the wildlife species within the Bartle Watershed. Thirteen of the snag dependent wildlife species are primary excavators - those species which create cavities. This group includes the white-headed woodpecker, black-backed woodpecker, and pygmy nuthatch. Snag densities are required to provide for these species at the 100% population level (LMP 95). Forest observation records, breeding bird surveys, Christmas bird counts, and spotted owl surveys have confirmed their distribution on the McCloud Ranger District.

General nest tree habitat requirements for primary excavator species are:

- snags with signs of heart rot and firm sapwood.
- over 50% of the bark remaining (i.e. decay class 2 or 3).
- 15" dbh or greater.

Some species, like the pileated woodpecker, are able to excavate in firmer wood (decay class 1), whereas others, like the pygmy nuthatch, require softer wood (decay class 4). Forest habitat requirements vary from open canopy (western bluebird) to moderate and dense canopy habitat (house wren and flammulated owl).

Snag density requirements vary from 1.9 to 4.0 snags per acre, with the majority of snags in the 15 - 20" dbh size class. Recruitment required to maintain this snag density over time is unknown and is dependent on the age, productivity and species composition of the forested area.

Bark Cavity Dwellers

Some species nest or roost primarily under the bark, such as the brown creeper and long-legged bat. These bats roost under the bark of snags, within snags, under wooden bridges, within caves, in tree foliage, and other similar areas.

General nest tree habitat requirements for bark cavity dwellers are:

- hollow snags or snags with peeling bark of 1" thickness or greater.
- locations where snags can be warmed by solar radiation.
- 20' height or greater.

During the summer, bats may use a variety of roost sites, moving from one site to another depending on the time of day and temperature of the roost. Maternity roosts are very sensitive to disturbance during the summer months, as are hibernacula during the winter. Eleven species of bats are suspected to occur within the watershed. No bat roost sites have been detected within the watershed. Formal surveys for bat roost sites have not been conducted.

Current Condition

A majority of the watershed (over 60%) is in small to medium size trees. Snags currently existing in the watershed, therefore, are expected to be in the small to medium size classes (<15" dbh). Medium to large snags are expected to exist in fewer numbers within the mid-mature and late-seral stands. Remnant old-growth snags may exist within the watershed, but are expected to be very limited because of past silvicultural practices. Though actual snag densities, size classes, distribution and recruitment are unknown, the suitability of the watershed for snag density dependent wildlife is believed to be low, with snag densities and size classes not meeting current LMP standards.

In time, and possibly in areas with high concentrations of wildlife suitable snags, snag density requirements for species listed in the snag guild are expected to be met through snag management using Late-successional Reserve (LSR) silvicultural guidelines, Matrix snag retention and recruitment guidelines, and Administratively Withdrawn or Congressionally Reserved Areas.

Snag densities given in the following landscapes are not from formal surveys, but are a general overview, with snags considered to be dead trees over 11" dbh and 15' tall.

LC-1. Midslopes and Mountain Tops

Habitat types: lodgepole pine and red fir forest

Snag dependent species

- Number of snag dependent species using this habitat type: 12 (WHR 1990)
- Representative species: white-headed woodpecker, black-headed woodpecker, flammulated owl, brown creeper, mountain bluebird.
- Patches of beetle mortality will be important foraging areas for the black-backed woodpecker.

Species preferred snag requirements

- 2.5 per acre over 17" dbh with two larger than 25" dbh for every 100 acres.
- Depending on the size of snags, some areas with higher mortality may exceed this standard, whereas other areas will be deficient until the stand is able to produce sufficient numbers.
- Number of recruitment snags and/or trees needed to maintain this density: 7.5/ac.

Current snag density (>11"dbh and 15' tall)

- 1.2 to 4 per acre (based on personal observation by T. Ward, 1995)

LC-2. Riparian and Streamside Zones

Habitat types: riparian

Snag dependent species

- Number of snag dependent species using this habitat type: 23 (WHR 1990)
- Representative species: downy woodpecker, red-breasted sapsucker, Lewis' woodpecker, flammulated owl, Northern pygmy owl, Northern flying squirrel, common merganser, long-legged bat.

Species preferred snag requirements

- 2.9 per acre 15 - 17" dbh with three larger than 25" dbh for every 100 acres.
- Depending on the size of snags, some areas with higher mortality may exceed this standard, whereas other areas will be deficient until the stand is able to produce sufficient numbers.
- Number of recruitment snags and/or trees needed to maintain this density: 9.0/ac.

Current snag density (>11"dbh and 15' tall)

- 0.9 to 6 per acre (based on personal observation by T. Ward, 1995)

LC-3. Colluvial Hillslopes and Alluvial Fans

Habitat types: mixed-conifer

Snag dependent species

- Number of snag dependent species using this habitat type: 18 (WHR 1990)
- Representative species: pileated woodpecker, white-headed woodpecker, mountain chickadee, pygmy nuthatch, Northern pygmy owl.
- Patches of beetle mortality will be important foraging areas for the black-backed woodpecker.

Species preferred snag requirements

- 4.0 per acre over 17" dbh with two larger than 25" dbh for every 100 acres.
- Depending on the size of snags, some areas with higher mortality may exceed this standard, whereas other areas will be deficient until the stand is able to produce sufficient numbers.
- Number of recruitment snags and/or trees needed to maintain this density: 12.0/ac.

Current snag density (>11"dbh and 15' tall)

- 0 to 9 per acre with few greater than 15" dbh. (based on personal observation by T. Ward, 1995)

LC-4. Dry Lake Basin

Habitat types: lodgepole pine

- Number of snag dependent species using this habitat type: 11 (WHR 1990)
- Representative species: white-headed woodpecker, black-headed woodpecker, flammulated owl, mountain bluebird.
- Patches of beetle mortality will be important foraging areas for the black-backed woodpecker.

Species preferred snag requirements

- 2.0 per acre 15 - 17" dbh with two larger than 25" dbh for every 100 acres.
- Depending on the size of snags, some areas with higher mortality may exceed this standard, whereas other areas will be deficient until the stand is able to produce sufficient numbers.
- Number of recruitment snags and/or trees needed to maintain this density: 6.0/ac.

Current snag density (>11"dbh and 15' tall)

- 1 to 3 per acre (based on personal observation by T. Ward, 1995)
- Based on the current use of the area for woodcutting, snag densities (>15" dbh) are believed to be deficient and not meet current standards.

LC-5. Lava Flows and Terraces

Habitat types: ponderosa pine, Jeffrey pine, eastside ponderosa pine

Snag dependent species

- Number of snag dependent species using this habitat type: 22 (WHR 1990)
- Representative species: white-headed woodpecker, Northern spotted owl, pygmy nuthatch, mountain chickadee.
- Patches of beetle mortality will be important foraging areas for the black-backed woodpecker.

Species preferred snag requirements

- 3.3 per acre 15 - 17" dbh with two larger than 25" dbh for every 100 acres.
- Number of recruitment snags and/or trees needed to maintain this density: 10.0/ac.

Current snag density (>11"dbh and 15' tall)

- over 2.5 per acre (based on personal observation by T. Ward, 1995)

LC-6. McCloud River and Floodplain

Habitat types: lodgepole pine, riparian

Snag dependent species

- Number of snag dependent species using this habitat type:
- Representative species: western bluebirds, bats, and other aerial foragers listed under the lodgepole pine and riparian habitats.

Species preferred snag requirements

- 2.9 per acre 15 - 17" dbh with three larger than 25" dbh for every 100 acres.
- Depending on the size of snags, some areas with higher mortality may exceed this standard, whereas other areas will be deficient until the stand is able to produce sufficient numbers.
- Number of recruitment snags and/or trees needed to maintain this density: 9.0/ac.

Current snag density (>11"dbh and 15' tall): unknown

- Based on the current use of the area for woodcutting, snag densities are believed to be deficient and not meet current standards.

Dead/Down Material

Watershed Overview

Ten species of dead/down wood dependent wildlife species occur within the Bartle Watershed (see Appendix C or discussions for individual landscape components).

General characteristics of the dead/down wood required by these species are:

- medium to large size (15" - 40"+ dia.).
- hollow or soft heartwood.
- sapwood with large sections of bark remaining.
  Bark helps to retain the moisture required by salamanders and warmth required by reptiles.

Dead/down material requirements are divided into three categories:
Small mammal requirements:

- provide cover and nesting sites for small mammals, birds and reptiles.
- piles of small diameter dead/down material (<10" dbh).
- if available, these small animals may also use shrubs for cover and duff for burrows.
- approximately 25% of an area should be covered with small diameter dead/down material 8" depth or greater (Maser, 1979).

Foraging requirements for medium to larger animals:

- provide suitable amounts of medium to large diameter logs for foraging.
- varies by species from 10 tons/acre (fisher) to 15 tons/acre (black bear).

Denning requirements for medium to larger animals:

- provide 20-40" dia. logs, with at least one required per 17 acres (bear).

The present amount of dead/down material varies within the watershed, ranging from 14 tons/acre in riparian habitats (LC-2 & LC-6) to 30 tons/acre in mixed-conifer habitats (LC-3). Approximately 50% of dead/down material is less than 10" dia. and 50% is greater. Dead/down logs in the larger size classes (20"+ dia.) are expected to be a low percentage (<10%) of the 10"+ dia. size class, because most of the watershed (>60%) is in early to mid-seral stages (small to medium size stands).

Current conditions for the watershed:

- small mammal requirements: met or exceeded.
- foraging requirements for medium to larger animals: met or deficient.
- denning requirements for medium to larger animals: deficient.

LC-1. Midslopes and Mountain Tops

Habitat types: fir
Dead/down dependent species

- Number of dead/down dependent species using this habitat type: 7
- Representative species: ensatina, deer mouse, long-tailed weasel, fisher, marten, bear, California mountain kingsnake.

Current conditions:

- Small mammal requirements (small diameter dead/down <10" dia.): exceeded
- · Foraging requirements (medium to large diameter dead/down): met

- Denning requirements (larger diameter dead/down 20 - 40" dia.): deficient.
- Recruitment potential:
  Low for larger size classes.
  Moderate for medium size classes.

LC-2. Riparian and Streamside Zones
Habitat types: riparian
Dead/down dependent species
- Number of dead/down dependent species using this habitat type: 10
- Representative species: Pacific giant salamander, ensatina, deer mouse, long-tailed weasel, rubber boa, fisher, marten, bear, common kingsnake, California mountain kingsnake.

Current conditions:
- Small mammal requirements (small diameter dead/down <10" dia.): met
- Foraging requirements (medium to large diameter dead/down): deficient
- Denning requirements (larger diameter dead/down 20 - 40" dia.): deficient.
- Recruitment potential: low for medium to large size classes because of past timber harvesting.

LC-3. Colluvial Slopes and Fans
Habitat types: mixed-conifer
Dead/down dependent species
- Number of dead/down dependent species using this habitat type: 8
- Representative species: ensatina, deer mouse, long-tailed weasel, fisher, marten, bear, common kingsnake, California mountain kingsnake.

Current conditions:
- Small mammal requirements (small diameter dead/down <10" dia.): exceeded
- Foraging requirements (medium to large diameter dead/down): deficient
- Denning requirements (larger diameter dead/down 20 - 40" dia.): deficient.
- Recruitment potential:
  - high for small to medium size dead/down, especially in disease infested areas
  - low for larger size classes because of past timber harvest, snag management and the current age and size classes of forested areas.

LC-4. Dry Lake Basin
LC-5. Lava Flows and Terraces (See LC-1)

LC-6. McCloud River Floodplain
Habitat types: wet meadows, riparian
Dead/down dependent species
- Number of dead/down dependent species using this habitat type: 5
- Representative species: Pacific giant salamander, ensatina, deer mouse, rubber boa, common kingsnake.

Current conditions:
- Small mammal requirements (small diameter dead/down <10" dia.): met
- Foraging requirements (medium to large diameter dead/down): deficient
- Denning requirements (larger diameter dead/down 20 - 40" dia.): deficient.

- Recruitment potential: sufficient for larger size classes due to presence of mature to late-seral forest habitat in riparian areas.

Wildlife Species of Concern

Watershed Overview

Documentation from sightings, nest locations, and habitat/distribution models have indicated that 200 species of wildlife are associated with the habitat and elevations characteristic of the Bartle watershed (see Appendix C). Seventeen of these are species of special concern. Species of special concern are defined as those listed under the Federal and State endangered species act (including proposed, category 1 or 2), the Record of Decision (survey and manage, 'protection buffers', and other standards and guides), and the US Forest Service Sensitive Species program. Those species of special concern are discussed below as groups or as individuals. Species listed under the Neotropical Migratory Birds (NTMB) program or considered 'game' species are also discussed. Further discussions can be found elsewhere in this analysis under issues pertaining to wildlife biodiversity, specifically: Wildlife Biodiversity, TES Species and Habitat, and Aquatic Ecosystems.

Late-Seral Dependent Species

Thirty-two late-seral dependent species are believed to occur within the Bartle Watershed (see Appendix C). Suitable nesting, roosting, foraging (NRF) habitat, as defined for Northern spotted owls habitat requirements for old-growth dependent species, are expected to be provided through LSR, MLSA, Unmapped LSRs, and Matrix 'old-growth' retention guidelines. See TES Species and Habitat for a discussion of suitable habitat in the watershed. Matrix guidelines require 15% old-growth retention in the watershed. Approximately 512 acres (1%) of the watershed are currently considered old-growth[1/]. Of this, 8% is in Matrix lands and occurs in LMP Prescription III.

Survey and Manage (S&M) Species

Five species of bats listed as S&M species suspected to occur within the watershed require caves, mines, abandoned wooden bridges, and buildings for roosting sites (LMP 95). These are the long-eared myotis, fringed myotis, long-legged myotis, pallid bat, and silver-haired bat. Some of these species also use snags (see Snag Requirements section under Wildlife Biodiversity). Foraging areas vary from shrub, chaparral and open fields to streams, lakes and or meadows; essentially, anywhere insects can be found.

General Wildlife (Early-Mid Seral and Multi Guild species)

Of the 200 species thought to occur in the watershed, 20 are game species (10%). Some of these species include blue grouse, California quail, mountain quail, common snipe, band-tailed pigeon, mourning dove, snowshoe hare, black-tailed hare, grey squirrel, coyote, gray fox, black bear, and mule deer. The majority are considered common species, and are found within their suitable habitat throughout the watershed. Viability of these species is expected to be provided through special management direction for riparian areas, downed logs, snags, old-growth species, green-tree retention, hardwood

[1/] Old growth was queried in the database as vegetation size and density classes 4N & 4G.

retention, seral stage diversity management, forest health, and management plans for special land allocations. In addition to these management directions are special land allocations and individual species management plans.

Deer

A deer management plan for the McCloud Deer Herd was established in 1985 by the California Dept. of Fish and Game, Region 1 in cooperation with U.S. Forest Service, U.S. Bureau of Land Management, and the U.S. Park Service. This plan indicates the population trends, suitable fawning habitat, and management for winter and summer range. Population trends for the McCloud Deer Herd are currently declining because of limited suitable summer range. Optimal summer range includes natural or man-made openings which include palatable grasses, forbs, and shrubs. Browse species maintained in age classes less than 20 years old and within 600 feet or less of hiding cover are preferred by deer. Suitable hiding cover is early to mature-seral stands of shrub or trees with 60% or more canopy closure and 600 to 1,200 feet wide. Thermal cover is similar, but preferred size is 2 to 5 acres with minimum width of 300 feet.

Summer range is found throughout the watershed and is used primarily by the Butte Creek, Mount Dome Shasta Lake, and Lake Britton winter deer herds. Approximately 10% of the watershed is in the early seral - shrub stage. These areas are often the result of post-1980 timber sales. Naturally occurring shrub fields, or those created through clearcuts or fire before 1970, are now considered to be in a decadent state, i.e. over 20 yrs old. To have entire shrubfields in this condition removes potentially suitable summer forage. Mast from the remaining oak stands also provides summer forage. Suppression of oaks in the understory and invasion of oak stands by white fir also contributes to the declining amount of summer forage in the watershed. Winter range occurs outside the watershed.

Specific fawning areas have not been identified for the watershed. Preferred fawning habitat includes low shrubs or small trees from 2 to 6 ft tall under a tree overstory of approximately 50% canopy closure. Areas are usually 2 to 5 acres and located where vegetation is succulent and plentiful. Within the watershed, forested areas near moist riparian areas could be considered suitable habitat.

Elk

Very few elk sightings have been recorded for the Bartle Watershed. These may be stragglers from the Shasta Lake herd. Because of the limited information available and their incidental occurrence, elk are considered to be issue for the Bartle Watershed at this time.

Bear

Bear sightings are recorded throughout the watershed. Suitable habitat includes interspersion of conifer, riparian, oak woodland, mast or berry-producing brush fields. Denning sites include large snags, scarfaced trees or hollow logs, talus slopes, caves or mine shafts. Mature to late-seral conifer and oak woodland habitat are important for thermal and hiding cover. Riparian habitats are required for cooling, seasonal foods, escape cover and travel corridors. Bears feed on acorns, berries, fruits, nuts, terrestrial invertebrates, and plants high in protein and low in cellulose.

The mature brushfields found within the watershed as well as the remaining oak stands and medium to large dead/down material all provide suitable foraging habitat. Denning areas do occur. A small percentage may be provided for by snags and dead and down material, yet this is not thought to be limiting since the bear population is believed to be at healthy levels.

Pygmy Short-horned Lizard

The pygmy short-horned lizard, suspected to be a subspecies of the short-horned lizard (phrynosoma douglasii), is found inhabiting open pockets of semi-arid habitat in the forested lands of eastern Siskiyou County. A proposal to designate the pygmy short-horned lizard as a subspecies has been submitted, based on the genetic studies of Kelly Zamudio. On the Forest, know populations occur in Grasshopper Flat and may still occur in Big Sand Flat. The main components of suitable habitat include loose, friable soils for burrowing and hibernation, and brush vegetation, such as bitterbrush, for thermoregulation and cover.

Populations occurring in Grasshopper Flat are described as healthy and occurring at a density greater than found elsewhere within the range of the short-horned lizard (K. Zamudio, personal communication 4/96). The high densities are suspected to be a function of the location of the suitable habitat, pockets found within forested habitat, restricting dispersal. Only when the forest floor is 'opened' through thinning or a natural disaster, are lizards expected to disperse (K. Zamudio, 1992, memo re: Hopper Timber Sale).

Until six years ago, pygmy short-horned lizards were know to inhabit Big Sand Flat (K. Zamudio, pers. comm. 4/96), with a substantial population existing ten years ago. Site preparation and cattle grazing contributed, if not caused the decline, and possible extirpation, of the lizards from Big Sand Flat. Through site preparation of the flat and cattle grazing, the bitterbrush habitat was removed, the soil became compacted and lizards were trampled. Because of the isolated nature of the pygmy short-horned lizard populations, the conditions of the Big Sand Flat population, if one still exists, may have little affect on the condition and viability of other populations. Should Big Sand Flat be rehabilitated and reinhabited, it would be important as a buffer population, should other populations, such as the Grasshopper Flat population, undergo a decline or extirpation.

Neotropical Migratory Birds (NTMB) (Watchable Wildlife Program - 'NatureWatch')

Approximately 72 NTMBs are suspected to occur within the watershed. Examples include Cooper's hawk, sharp-shinned hawk, yellow warbler, and merlin in the riparian guild, green-tailed towhee in the open-shrub guild and osprey in the aquatic guild. These species require breeding habitat and migration corridors. Because of alteration to breeding habitat and increased exposure to predation and parasitism, many of these populations have undergone significant declines. Habitat preservation and restoration is the backbone of maintaining current populations of NTMBs. The general Forests standards and guidelines state that habitat is to be managed for neotropical migrant birds to maintain viable population levels. Management of riparian reserves, hardwoods, old-growth and late seral habitat, diverse seral stages, visual quality, protection buffers, snags, dispersal habitat, and special lands will help preserve breeding habitat for NTMBs. Following proper management of breeding habitat, exposure to predation and parasitism is expected to become reduced.

Great Gray Owl

Great gray owls can be found in a wide variety of habitat types, wherever forests can meet their life needs. Most nests are located within 1,000' of a natural meadow or man-made opening greater than 10 acres, that has sufficient prey numbers. They do not build their own nests, instead relying on abandoned raven, northern goshawk, or red-tail hawk nests, broken-top snags or live trees, or mistletoe brooms which are large enough to accommodate the species and provide a natural depression. They can be found in mature stands (80+ years, >60% crown canopy [3N]) deciduous or coniferous forests, 3,000-9,200 ft. in elevation. Prey items in the western U.S. are primarily voles and pocket gophers.

No known great gray owl nest sites occur on the Shasta-Trinity National Forests, and only a limited number of sightings have been reported. However, the ROD requires surveys prior to ground disturbing activities in suspected ranges or within the habitat types or vegetation communities occupied by this species. Five meadow areas in the Bartle watershed, >10 acres and within 1000' of a 3N stand, are under consideration as suitable habitat for the great gray owl. These areas include Dry Lake, Big Sand Flat, Colby Meadows, Stillwater Meadows, and meadows along the McCloud River. In areas considered suitable, a 300' no harvest buffer must be created around the designated opening, regardless of presence.

Wildlife Management Areas (Prescription VI)

Four areas within the watershed are designated for wildlife habitat management, LMP Prescription VI. The areas are Dry Lake, Toad Mountain area, Big Sand Flat, and an area just west of Bear Wallow. The objective is to maintain and enhance big game, small game, upland game bird, and non-game habitat, providing adequate hunting and viewing opportunities. Vegetation is manipulated to meet wildlife habitat management objectives and to maintain healthy, vigorous stands.

Interpretive signing or displays are expected to be placed at Dry Lake with the designation of the Harris Springs Road as a scenic byway. Dry Lake is used by both upland and aquatic species, depending on the size and duration of the vernal pool. Big Sand Flat may be used by a number of reptiles and small rodents, and therefore an important foraging area for larger predators. The uniqueness of the remaining wildlife areas is not fully understood. Dry Lake, Toad Mountain, and Big Sand Flat are within Matrix land, Prescription VI. The Bear Wallow area is bordered by the LSR to the east and Matrix land, Prescription VIII to the south.

LC-1. Midslopes and Mountain Tops

Number of wildlife species of special concern: 10

LC-2. Riparian and Streamside Zones

Number of wildlife species of special concern: 9

LC-3. Colluvial Slopes and Fans

Number of wildlife species of special concern: 8

LC-4. Dry Lake Basin

Number of wildlife species of special concern: 7

Species of special concern: pygmy short-horned lizard, great gray owl
Current condition:
Pygmy short-horned lizards once inhabited Big Sand Flat, though this population is believed to have been extirpated.

No known great gray owl nest sites occur within the watershed. However, Dry Lake and Big Sand Flat are two of the five sites identified within the watershed as suitable habitat.

LC-5. Lava Flows and Terraces
Number of wildlife species of special concern: 9

LC-6. McCloud River Floodplain
Number of wildlife species of special concern: 8

Road Densities

Watershed Overview

Roads contribute to increased noise levels, road kill, and losses of game species through hunting and poaching. Fragmentation of habitat by road corridors modifies temperature, light, and wind in adjacent stands of vegetation and increases access by predators. Roads also can present a physical barrier to migration and dispersal, for example to amphibian species.

Most impacts to wildlife are caused by use and development of secondary roads (Thomas, 1975). These roads further divide the habitat into smaller areas. Human use on these roads is expected to rise during the spring and summer when many wildlife species are more vulnerable to disturbance.

Road closures have been implemented in association with past timber sales in the area and range from road obliteration to gates and barricades. There has been some success, and also some problems in maintaining these closures. Generally speaking, the closures in the steeper terrain have been more effective than those on the flats. Factors affecting the open road density include the intermix of private and public land and the popularity of woodcutting, mushroom gathering, and hunting. Many local roads have been closed "naturally" in the last few years as a result of windthrow from winter storms and falling dead trees.

Existing open road density in this watershed is estimated at 4.2 miles per section. Preferred road densities for wildlife are 1/2 mile per section, though densities up to 2 miles per section are acceptable.

LC-1. Midslopes and Mountain Tops
Road density: 4.0 miles per section
Typical road uses: timber management, access to adjacent private lands.
Effectiveness of road closures: good - due to steeper terrain.
Impacts related to road densities: wildlife disturbance, habitat loss, hunting pressure.

LC-2. Riparian and Streamside Zones
Road density: 5.5 miles per section
Typical road uses: fishing, camping

Effectiveness of road closures: good - because most recent closures in riparian areas have been through road obliteration.

Impacts related to road densities:

- degradation of riparian habitat.
- displacement of wildlife, abandonment of young, nest failures.
- disruption of wildlife travel corridors.
- increased sediment loads into streams due to poor drainage (examples: Sheepheaven and Moosehead Creeks).

LC-3. Colluvial Hillslopes

Road density: 4.1 miles per section

Typical road uses: timber management, hunting.

Effectiveness of road closures: good - due to steeper terrain

Impacts related to road densities: wildlife disturbance, habitat loss, hunting pressure.

LC-4. Dry Lake Basin

Road density: 3.3 miles per section of established transportation system roads plus numerous unmapped woodcutting roads.

Typical road uses: timber management, woodcutting, hunting.

Effectiveness of road closures: poor - due to flat terrain and open vegetation conditions.

Impacts related to road densities: direct impacts from vehicle use in and adjacent to Dry Lake to wildlife and sensitive plants including: western spadefoot toad, fairy shrimp, Columbia Cress, and cavity nesters in lodgepole pine stands. Dry Lake is also potential habitat for great gray owls, although none are know to use the area at this time (see Wildlife Biodiversity/Wildlife Species of Concern and Aquatic Ecosystems/Species of Concern for further discussion of these species).

LC-5. Alluvial Fans and Terraces

Road density: 4.6 miles per section

Typical road uses: timber management, hunting, access to adjacent private lands.

Effectiveness of road closures: poor - due to flat terrain and open vegetation conditions.

Impacts related to road densities: wildlife disturbance, habitat loss, hunting pressure.

LC-6. McCloud River and Floodplain

Road density: 3.4 miles per section

Typical road uses: fishing, camping

Effectiveness of road closures: good - because most recent closures in riparian areas have been through road obliteration.

Impacts related to road densities:

- degradation of riparian habitat.
- displacement of wildlife, abandonment of young, nest failures.
- disruption of wildlife travel corridors.
- increased sediment loads into streams due to poor drainage (examples: Sheepheaven and Moosehead Creeks).

TES Species and Habitat

TES Species of Concern

Watershed Overview

TES wildlife Species of Concern in the Bartle Watershed include:

- Northern spotted owl
- Northern goshawk
- Pacific fisher
- American marten
- bald eagle
- willow flycatcher *
- Northwestern pond turtle *

* discussed under Aquatic Ecosystems

The willow flycatcher and Northwestern pond turtle are discussed under Aquatic Ecosystems. The remaining five species are discussed in this section. Bald eagles are not considered an issue in the watershed since no nest sites are confirmed, sightings are rare, and foraging habitat is limited. The remaining TES species are distributed throughout the watershed.

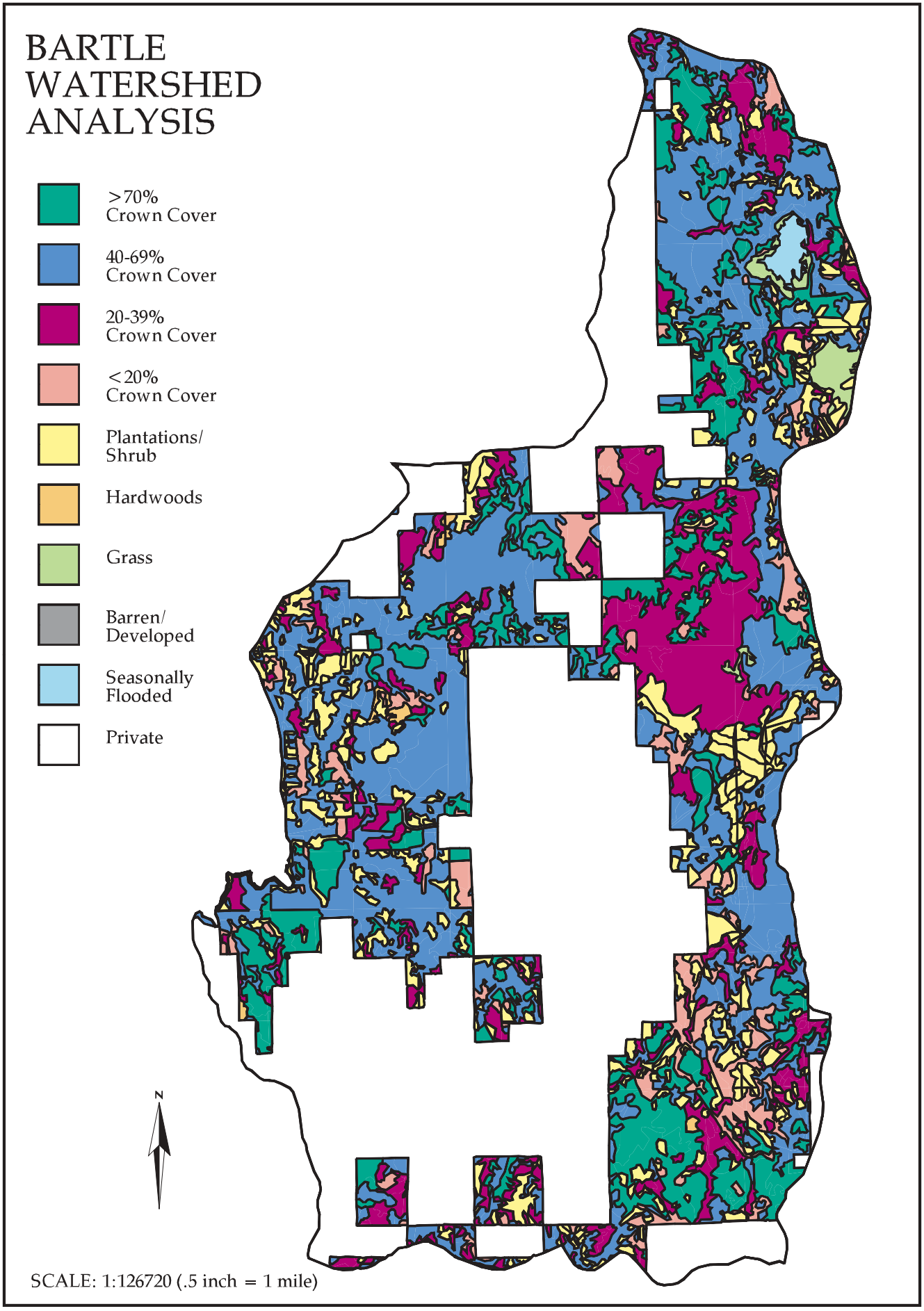
Nesting, Foraging and Roosting Habitat
Generally, suitable nesting, foraging, and roosting (NRF) habitat includes late-seral, multistory forest habitats with >70% canopy cover. Northern spotted owls require large (>24" dbh) snags or broken top trees for nesting. Pacific fisher and American marten require large (>20" dbh) dead/down woody material for denning.

Suitable nesting, roosting, and foraging as defined for Northern spotted owls habitat requirements for old-growth dependant species are expected to be provided through the LSR, MLSAs, Unmapped LSRs, and Matrix 'old-growth' retention guidelines. Suitable NRF habitat is fragmented and exists on approximately 19% of the capable Federal lands in the watershed (7,165 acres - see Table 3-2 and Map 13). The largest single patch of continuous suitable NRF habitat is approximately 1,000 acres in size. In addition to suitable habitat, another 30,826 acres (69%) of the Federal lands in the watershed are forested and capable of becoming suitable habitat (see Table 3-2 and Map 13). The combined LSR/MLSA contains approximately twice as much suitable habitat as the Matrix lands.

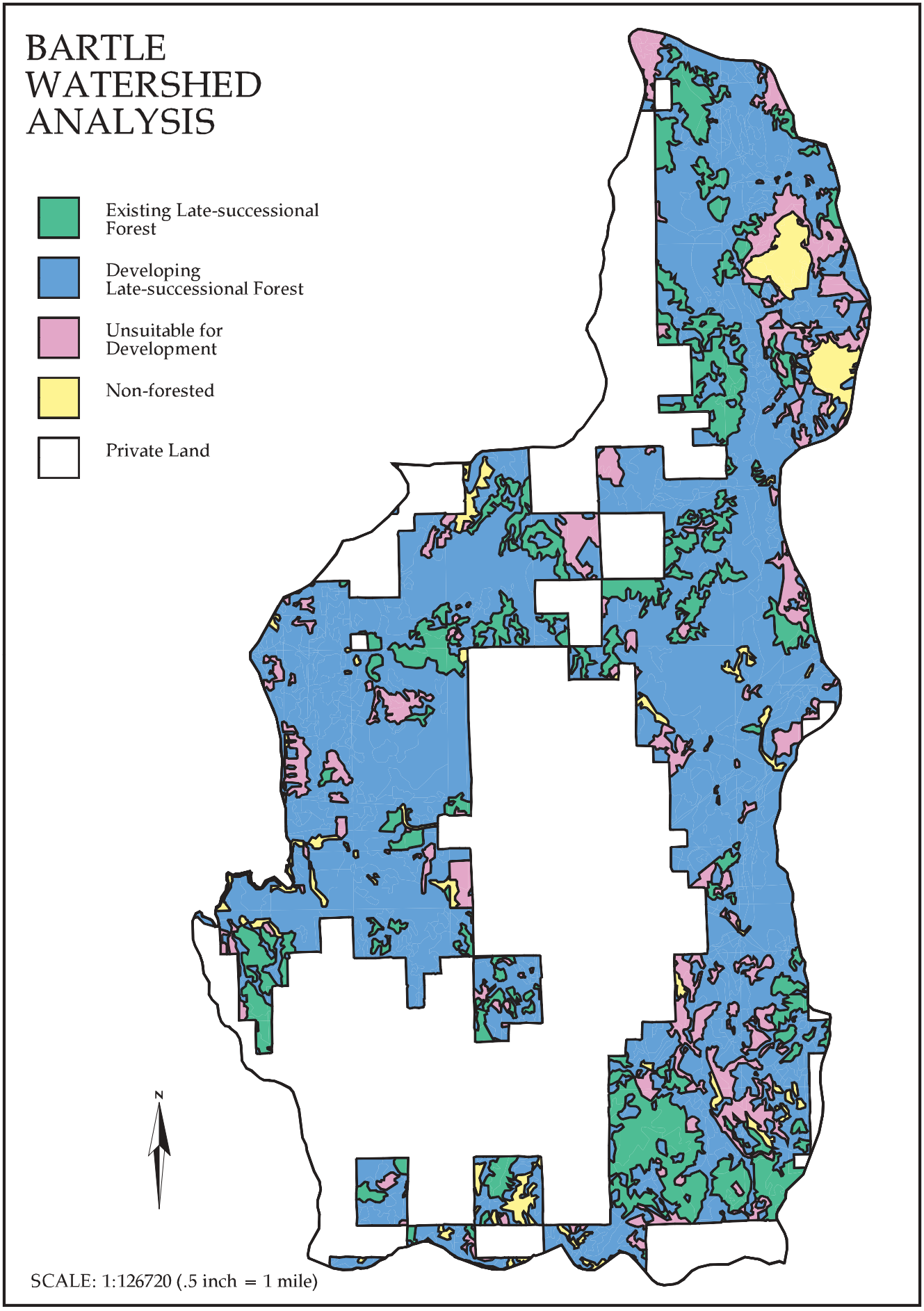
Table 3-2. - Suitable nesting, roosting and foraging (NRF) habitat on Federal lands within the Bartle Watershed by land allocation.

Habitat Condition	LSR		MLSA		Matrix		Total
	acres	%	acres	%	acres	%	acres
Existing suitable habitat [1/]	4,198		342		2,625		7,165
Potential suitable habitat [2/]	15,336		1,695		13,795		30,826
Not capable of supporting suitable NRF habitat [3/]	3,027		124		3,241		6,528

[1/] includes 4N, 4G, 3G on high site
[2/] includes 2P, 2N, 2G, 3P, 3N, 4P, 3G on low site, plantations
[3/] includes hardwoods, non-commercial conifers, grass, shrubs, barren



Map 12. Forest Canopy Cover



Map 13. Suitable Habitat for Late-successional Forest Dependent Species

Dispersal Habitat

All species require dispersal habitat between areas of suitable NRF habitat. Generally, dispersal habitat is mid to late-seral forested habitats with 40% or greater canopy closure. Dispersal habitat is described as stands meeting 11-40 guidelines - average diameter exceeds 11"dbh and crown canopy cover exceeds 40%. Riparian reserves containing riparian or forested habitat are also important dispersal corridors. Dispersal habitat for late-seral dependent species is expected to be provided outside the LSR through management of the MLSA's suitable nesting habitat, riparian reserves, and following 11-40 guidelines. Of the capable habitat outside the LSR, 72% currently meets dispersal habitat (see Table 3-3 and Map 14).

Table 3-3. - Dispersal habitat on capable Federal lands within the Bartle Watershed outside LSR RC-357 (within Matrix lands and MLSA only).

	acres	%
Existing dispersal habitat - currently meets 11-40	13,806	72
Potential future dispersal habitat - does not currently meet 11-40	5,438	28
Total existing & potential dispersal habitat	19,244	100

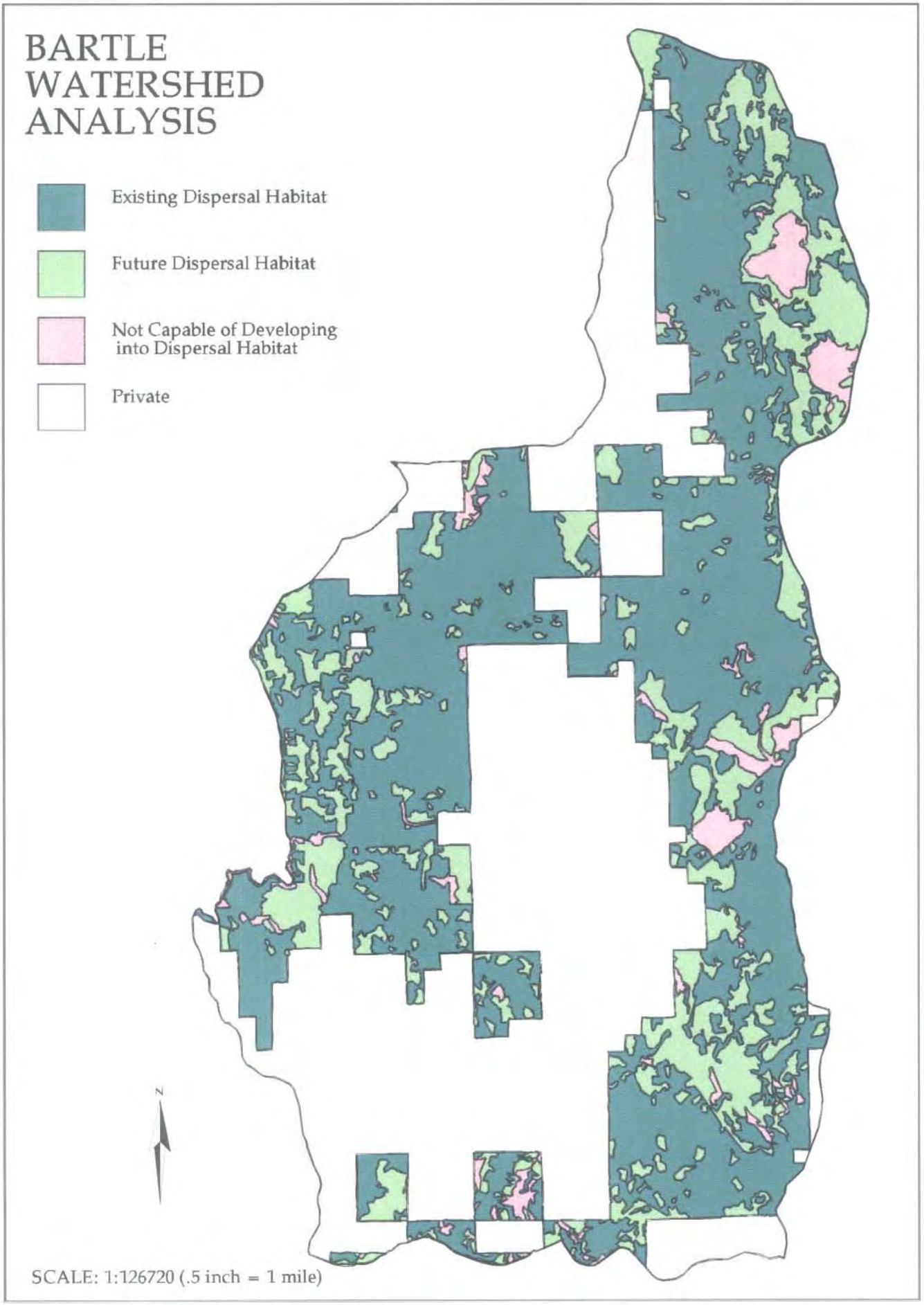
Table 3-4. - The percentage of capable Federal lands which meet dispersal habitat for each quarter township in the Bartle Watershed.

T	R	Quarter Township	Code	% of Dispersal Habitat	Outside LSR	Outside CHU
39N	1E	NE	39N01EA	39		
39N	2E	NW	39N02EB	97		
40N	1E	NE	40N01EA	30		
40N	1E	NW	40N01EB	45		
40N	1E	SW	40N01EC	100		
40N	1E	SE	40N01ED	28	✓	
40N	1W	SE	40N01WD	28		
40N	2E	NW	40N02EB	36	✓	
40N	2E	SW	40N02EC	52	✓	
40N	2W	NE	40N02WA	46		
41N	1E	NE	41N01EA	68	✓	✓
41N	1E	SE	41N01ED	82	✓	✓
41N	2E	NW	41N01EB	40	✓	✓
41N	2E	SW	41N02EC	39	✓	✓
42N	1E	SE	42N01ED	15	✓	✓
42N	2E	SW	42N02EC	30	✓	✓

Source: Vestra, 1990

Dispersal habitat within the LSR will be provided by management for late-seral, suitable (NRF) habitat conditions.

Dispersal of wildlife within the watershed may be hindered by congested fire suppressed understories, habitat fragmentation, and sparsely vegetated lava fields. Open lava fields, marginal dispersal habitat, and urban development may hinder dispersal of wildlife to larger suitable habitat reserves outside the watershed (see Map 4). Though existing dispersal habitat within the watershed is >50% (see Table 3-3), dispersal habitat is <50%



Map 14. Dispersal Habitat for Late-Successional Forest Dependent Species

within the tabulated 1/4 townships 'affected' by the watershed (see Table 3-4) and appears to be a function of insufficient dispersal habitat adjacent to the watershed. Owls outside the watershed which may be affected include Activity Centers (AC) 216, 218 (LSR RC 359), and Goshawk nest sites 206, 250, 232, 202, 212, 224, and 218.

Critical Habitat Unit

Critical Habitat Unit CA-2 (see Map 4) was designated to provide nesting, roosting, foraging, and dispersal habitat for 15 owl pairs. This area covers 90,634 acres and includes three LSRs located from 3.5 to 8.5 miles apart.

Table 3-5. - LSR acerage and owl occurrence within Critical Habitat Unit CA-2.

LSR #	Total acres in LSR	Acres within CHU	# of owl Acs in CHU		Location
			pairs	terr. single	
RC-357	25,782	25,782	4	1	Bartle Area
RC-360	3,052	3,052	1	0	Elk Flat Area
RC-361	14,286	2,640	1	0	Mud Creek Dam Area

The Bartle Watershed contains the largest of the three LSRs (RC-357) in the CHU and supports 60% of the owl pairs. In addition, the CHU contains three MLSAs, two of which are within the watershed. All five owl activity centers are within the CHU as well as within an MLSA or LSR. Though most of the LSRs and both MLSAs are within the CHU, only 71% of the CHU is included in the LSR/MLSAs (see Table 3-6). The rest is in Matrix lands where the CHU is expected to serve as dispersal habitat.

Table 3-6. - Critical Habitat on Federal lands within the Bartle Watershed.

Habitat Condition	**LSR**		**MLSA**		**Matrix**		**Total**
	acres	%	acres	%	acres	%	acres
CHU-CA2 (% of CHU)	22,120	66	1,195	5	9,689	29	33,724
Watershed outside CHU	441	4	246	2	9,972	94	10,659

Northern Spotted Owl (Federally Threatened)

Suitable nesting habitat for the spotted owl is typically conifer or mixed-conifer and hardwood forest, a total crown closure of 70% or greater, an overstory crown closure of 40% or more and large diameter trees, and two or more canopy layers providing the remaining canopy closure. A multi-layered canopy that simultaneously provides cover while allowing for easy flying passage is preferred. Spotted owls nest in cavities that form in decadent or broken topped trees and snags. Their prey base of small mammals depends on the presence of snags and large down woody material.

Ten spotted owl sites are located within the Bartle Watershed (see Table 3-7). Nine of these sites are designated as activity centers (AC) due the determination that they have been occupied by a territorial single or pair in the last five years. Though considered unmapped LSRs, a 100 acre core, based on suitable habitat around the activity center, has not been mapped. Owl sites within Matrix lands, (#222, 224), are considered unmapped LSRs as the activity centers were established before January 1994. Owl site #223 is not an unmapped LSRs since it is not an activity center.

Table 3-7. - Spotted owl sites (by number) within the Bartle Watershed by land allocation. Status is shown in parenthesis.

CHU		Matrix
LSR	MLSA	
203 (P)	217 (TS)	222 (TS)
204 (P)	219 (P)	223 (S)
209 (TS)		224 (TS)
210 (P)		
225 (TS)		

(P) = pair (TS) = territorial single (S) = single

At the territory level (0.7 mile radius around activity center), eight territories are below the incidental take threshold (500 acres of suitable habitat) and one is above (#210). At the home range level (1.3 mile radius), all nine activity centers have less than the incidental take threshold (1,336 acres). See Table 3-8.

Table 3-8. - Amount of suitable habitat in acres for each spotted owl activity center

Owl #	Circle Radius	
	0.7 Mile	1.3 Mile
203	310	446
204	233	446
209	14	221
210	692	1,250
217	51	81
219	321	628
222	317	604
224	161	422
225	5	198

Four activity centers (#203, 204, 210, 225) are within close proximity (<1 mile) to northern goshawk nest sites . Though goshawks are predators of spotted owls, two of the activity centers were reproductively successful in 1992, and one was active in 1995. What habitat components allow the two to coexist so closely is unknown as is any negative affects on the pairs.

Approximately 50 percent of the watershed has been surveyed to protocol for calling routes, SOHAs, and timber sales from 1991 to 1994. From 1989 to 1994 District biologists or private individuals conducted unofficial surveys within 65% of the watershed (see Table 3-9). About 35% of the watershed has not been surveyed for spotted owls. These areas are in the Colby Meadows and Cow Creek areas, Sheepheaven Butte, and Stillwater Butte, west to Shirttail Canyon.

Table 3-9. - Spotted owl survey areas within the Bartle Watershed, years surveyed, and years surveyed to protocol.

Survey Areas	Years Surveyed	Years to Protocol
Coonrod Timber Sale	1989, 1991	1991
Mermac T.S.	1989, 1990	
Kinyon T.S.	1989, 1994(HV)*	
Slagger T.S.	1989, 1990, 1991, 1992(HV)	1991
Toad Mountain T.S.	1989, 1991(HV)	
Bear Wallow	1990(HV), 1992(HV)	
Whiskey Creek	1990-1994(HV)	
Algoma	1988, 1989	
Moosehead Creek	1990-1992(HV)	
Deadhorse –1	1990	
Deadhorse – 2	1990, 1991-1992(HV)	
Stillwater	1989, 1990, 1991-1992(HV), 1994(HV)	
Flats T.S.	1993, 1994	1993, 1994
Plantation T.S.	1993, 1994	1993, 1994

* HV = Historic Visit to check on a known nest

Table 3-10. - Reproductive History of Spotted Owl Activity Centers

AC#	Status	Status Verified	Young Verified
203	Pair	1978-80, 1982, 1984-92	1980, 1984, 1988, 1992
204	Pair	1989, 1991, 1995	no reproduction
209	T. Single	1989, 1991, 1992	no reproduction
210	Pair	1983, 1986-92, 1995	1988
217	T. Single	1983, 1990	1983
219	Pair	1989-1993	no reproduction
222	T. Single	1989, 1991, 1995	no reproduction
223	Single	1991	no reproduction
224	T. Single	1989, 1991, 1992	no reproduction
225	T. Single	1981, 1987-89	no reproduction

Northern Goshawk (FS Sensitive, CA Spp. Special concern)

Suitable habitat for goshawks is described as late-seral, dense coniferous, riparian, or upland forests near early seral openings. Prey are medium to large birds or small mammals. According to the LMP, 'preferred' nest stand structure is seral stage 4b, 4c, 5 conifer habitats, with 40% of the nest stand containing a habitat mosaic with >60% canopy closure, 20% brush or small trees, and two or more 1/10 acre openings. The remaining 60% is dense mature forest with no openings and greater than 60% canopy closure. Forage stands also contain 60% habitat mosaic with the remaining 40% having younger stands and openings.

Eleven goshawk nest sites are recorded for the watershed. Four nest sites are within the Matrix (#210A, 210C, 216A, 236) and seven within the LSR (#201, 211, 211N, 211S, 220, 223, 225).

Table 3-11. - Reproductive History of Northern Goshawk Activity Centers.

#	Status	Status Verified	Young Verified
201			
210	Active	1981-82, 1985, 1990, 1992	1981, 1990, 1992
211	Active	1981-85, 1990, 1992-93, 1994 (inactive), 1995	1981, 1983-85, 1990, 1992-93
216	Active	1981-83, 1990 (nest gone)	1982, 1983 (failed)
220	Active	1983, 1986-87, 1990, 1993	1983, 1986 (failed), 1987, 1990, 1993
223	Active	1984-85, 1987-92	1984-85, 1987-89, 1990 & 1991 (failed), 1992
225	Active	1984	1984
236			

Based on nest stand descriptions, habitat would mostly be classified as 'required', with nest sites seldom occurring in 'preferred' habitat.

Pacific Fisher (FS Sensitive, Ca. Spp of Special Concern)
Suitable habitat for fishers consists of large areas of mature dense forest stands below 6,000 ft., with snags and canopy closure greater than fifty percent (Ahlborn 1982a). Fishers use cavities in large trees, snags, logs (>30" DBH), rock areas, and brush piles for cover and den sites. This species is largely carnivorous, taking small mammals and birds. Riparian habitats are used as travel corridors and key habitat. Preferred road densities are <1 mi./section, with 1-2 mi./section acceptable for maintaining moderate habitat.

In 1990, fisher were reported in the Buck Mountain, McCloud River, and Medicine Lake areas (Criss and Kerns 1990). These observations suggested that fisher were more widespread than previously thought and ranged elevationally with snowmelt (Criss and Kerns 1990). In subsequent years, fisher were not detected, even in a yearly study where fisher were initially trapped in the Buck Mountain area (Self and Kerns 1992 and 1993). A 'no detection' does not indicate an absence, instead it is assumed that fisher still utilize the area, though possibly in low numbers.

Habitat for Pacific fisher is expected to be provided through management for Northern spotted owl habitat, riparian reserves, old-growth reserves, dead/down guidelines, green-tree retention, and snag management in Matrix lands .

American Marten (FS Sensitive, Ca. Spp of Special Concern)
Suitable habitat consists of various mixed conifer forests types under 4,000 ft. in elevation, with more than forty percent crown closure with large trees and snags (Ahlborn 1982b). Martens use tree cavities, snags, stumps, logs, burrows, caves, and rocky crevices for cover and den sites. Habitat with limited human use is important (Ahlborn 1982b). Small clearings, meadows, and riparian areas provide forage habitat. This species is mostly carnivorous, taking small mammals and birds, but insects, fruit, and fish are also consumed. Road densities are the same as for the Pacific fisher.

There is a high concentration of marten sightings adjacent to the western side of the watershed (Self and Kerns 1993). Within the watershed marten sightings and tracks are

widely dispersed (McCloud Log 19xx, Ward 1995). American marten detections are more abundant than Pacific fisher. This may be a function of a larger marten population than fisher, more suitable habitat for marten than fisher, or of marten having less secretive habits than fisher.

Habitat for marten is expected to be provided through management for Northern spotted owl habitat, riparian reserves, old-growth reserves, dead/down, green-tree retention, and snag management in Matrix lands .

Bald Eagle (Federally Threatened)

The Bartle Watershed falls within the Pit River zone (Recovery 1985). Known areas of use within this zone include the McCloud Reservoir and Lake Britton. The rest of this zone, especially north of the McCloud River is not considered suitable eagle breeding habitat. Suitable breeding habitat consists of a group of large diameter trees or snags, usually ponderosa pine, sugar pine, or Douglas-fir, with well spaced large limbs. One of the group of trees must have an open crown to serve as a nest tree. Nests are generally within one mile of a permanent body of water containing an adequate prey base of fish and waterfowl.

LC-1. Midslopes and Mountain Tops

NRF Habitat

This landscape component contains large amounts of both existing and developing NRF Habitat.

Dispersal Habitat

North of the McCloud River, dispersal habitat meets 11-40 standards (see page 3-21). Habitat south of the river does not meet 11-40 standards.

Critical Habitat Unit

Approximately two-thirds of this landscape component is located within the Critical Habitat Unit.

Northern spotted owl: 2 activity centers
Northern goshawk: one nest site
Pacific fisher: sightings
American marten: sightings
Bald eagle: no sightings and no habitat

LC-2. Riparian and Streamside Zones

All TES species found in the Bartle watershed utilize riparian and streamside zones for cover while obtaining water, traveling, and for thermal regulation.

NRF Habitat

NRF habitat occurs along many riparian and streamside zones as a result of less intensive timber harvest.

Dispersal Habitat

Dispersal habitat within this LC meets 11-40. Riparian reserves containing riparian or forested habitat are important dispersal corridors.

Critical Habitat Unit

The majority of riparian and streamside zones in the watershed occur within the Critical Habitat Unit. Riparinan zones outside the Critical Habitat Unit (the area

generally north of Slagger Spring) are minor intermittent streams that filter into the ground in Dry Lake Basin.

Northern spotted owl: 2 activity centers
Northern goshawk: one nest site
Pacific fisher: sightings
American marten: sightings
Bald eagle: none

LC-3. Colluvial Hillslopes and Alluvial Fans

The four TES species which are discussed in this landscape component are also found within other landscape components. These wildlife species are more tied to habitat characteristics (late seral, snags, dead/down) than landscape features or forested habitat types.

NRF Habitat

This landscape component contains large amounts of both existing and developing NRF Habitat.

Dispersal Habitat

Dispersal habitat within this LC meets 11-40.

Critical Habitat Unit

Approximately 80% of this landscape component falls within the Critical Habitat Unit.

Northern spotted owl: 4 activity centers
Northern goshawk: 3 nest sites
Pacific fisher: sightings
American marten: sightings
Bald eagle: none

LC-4. Dry Lake Basin

NRF Habitat

This landscape component is generally lacking in NRF habitat and has the lowest potential for developing such habitat in the future. Soil conditions and seasonal flooding tend to discourage the development of late-successional forests suitable for NRF habitat.

Dispersal Habitat

Dispersal habitat in this LC does not meet 11-40, and averages 36%.

Critical Habitat Unit

This landscape component falls outside the area designated as a Critical Habitat Unit.

Northern spotted owl: single bird sighted north of Dry Lake in 1991.
Northern goshawk: one nest site south of Dry Lake (#206) was last verified in 1989, young were last verified in 1983, nest was reported gone in 1990.
Pacific fisher: no record of use
American marten: sightings
Bald eagle: The last detections of bald eagles at Dry Lake occurred in 1983. In years of high precipitation, Dry Lake which is north of the McCloud River is believed to become habitat to migratory waterfowl and consequently a stop over for bald eagles. This condition though, only occurs every 5 to 10 years. See LC-6 for further discussion.

The bald eagle is the only TES species actually detected around Dry Lake (see below). Other TES species may use the area during years of extremely high winter precipitation when the water's edge is within or in close proximity to the surrounding forested habitat.

LC-5. Lava Flows and Terraces

NRF Habitat

This landscape component is generally lacking in existing NRF habitat as a result of past timber harvest. However, there are large acerages of potential NRF habitat developing in younger conifer stands.

Dispersal Habitat

Dispersal habitat in this LC does not meet 11-40, and is around 40-45%.

Critical Habitat Unit

This entire landscape component falls within the area designated as a Critical Habitat Unit.

Northern spotted owl: 3 activity centers
Northern goshawk: one nest siteHabitat:
Pacific fisher: no record of use1
American marten: sightingsHabitat:
Bald eagle: none

Owl AC #204 has 2-5 times the amount of suitable habitat as the other two, and is the only AC of the three which has a pair which was verified in 1995 and was reproductively active (1992). Goshawk nest site #220 was last verified in 1993 and young last verified in 1993. This nest site is located within 1.5 miles of owl AC 209, though this AC has not been verified since 1989.

LC-6. McCloud River and Floodplain

NRF Habitat

Although the McCloud River is capable of providing a prey base for bald eagles, there is no habitat considered suitable for nesting in the area north of the McCloud River and within the Bartle watershed. Dry Lake is only infrequently suitable for bald eagles.

Dispersal Habitat

Dispersal habitat in this landscape component does not meet 11-40, with the headwaters of the McCloud River and Skunk Hollow areas being most deficient.

Critical Habitat Unit

This entire landscape component falls within the area designated as a Critical Habitat Unit.

Northern spotted owl: 2 activity centers
Northern goshawk: one nest site
Pacific fisher: sightings
American marten: sightings
Bald eagle: Within the watershed, only one possible nest site was recorded. This nest site is located on private land at the headwaters of the McCloud River (one mile east of Walking Bear Camp).

Plant Species of Concern

Watershed Overview

The Bartle Watershed is, at present, not well studied botanically. Past surveys have covered portions of the watershed in the course of project work, such as the California-Oregon power project, but no systematic survey of the watershed as a whole has been attempted.

Threatened and Endangered Plants

No vascular plant species listed as Threatened or Endangered have been reported as occurring in the Bartle watershed.

Sensitive Species

The following Sensitive plant species are known to occur in the Bartle Watershed:

- Salmon Mountains Wakerobin (Trillium ovatum ssp oettingeri)
  Habitat is shaded areas near springs, seeps, and along streams. The species is sensitive to disturbance. Populations in the Stillwater Meadows area and near Slagger Springs have suffered considerable damage from livestock.
- Long-haired Star Tulip (Calochortus longebarbatus var longebarbatus)
  Habitat is wet meadows. Grazing by cattle or sheep in meadows prevents formation of seed heads, forcing the plant to rely on clonal growth.
- Columbia Cress (Rorippa columbiae)
  Habitat includes vernal pools, seasonal lakebeds, and wet meadows. The species is known to occur in the seasonal lakebed at Dry Lake and is being impacted by current grazing practices.

Habitat for the following Sensitive plant species occurs within the Bartle Watershed; however, these plants have not been found within the watershed at this time:

- Howell's Lewisia (Lewisia cotyledon howellii)
  This species occurs in rock outcrop-canyon wall habitat and is sensitive to disturbance.
- Rough Raillardella (Raillardella scabrida)
  Habitat is dry, open ridges.

Survey and Manage Species

The following vascular plants are listed in Appendix R of the LMP as Survey and Manage Species on the Shasta-Trinity National Forest:

- Sugarstick (Allotropa virgata) - known to occur on the Forest
- Dwarf mistletoe (Arceuthobium tsugense) - suspected to occur on the Forest
- Mingan moonwort (Botrychium minganense) - suspected to occur on the Forest
- Western goblin (Botrychium montanum) - suspected to occur on the Forest
- Clustered lady's slipper (Cypripedium fasciculatum) - know to occur on the Forest
- Mountain lady's slipper (Cypripedium montanum) - known to occur on the Forest

The above species are all listed as survey strategies 1 & 2.

- Survey Strategy 1 = manage known sites.
- Survey Strategy 2 = survey prior to activities and manage sites.

No information is available at this time concerning TE&S or Survey & Manage non-vascular plants or fungi within the Bartle Watershed, but suitable habitat does exist.

LC-1. Midslopes and Mountain Tops
LC-3. Colluvial Hillslopes and Alluvial Fans
LC-5. Lava Flows and Terraces

No TE&S or Survey & Manage vascular plants are know to occur within these landscape components.

LC-2. Riparian and Streamside Zones:

Trillium ovatum spp oettingeri is widespread within the drainage, with populations along the McCloud River and its tributaries, Bartle Creek, Sheepheaven Creek, Red Tank Springs, and near Slagger Camp. Habitat for this plant is being impacted by grazing.

Calochortus longebarbatus var longebarbatus has been reported in the Red Tank Springs area. Habitat for this plant is being impacted by grazing.

Rorippa columbiae occurs in the watershed only around the edge of Dry Lake. This plant is being impacted by grazing and possibly by off-road vehicles traveling in and around Dry Lake.

LC-4. Dry Lake Basin

See LC-2 for Rorippa columbiae at Dry Lake.

LC-6. McCloud River and Floodplain:

See LC-2 for Trillium ovatum.

Aquatic Ecosystems

Water Quality and Quantity

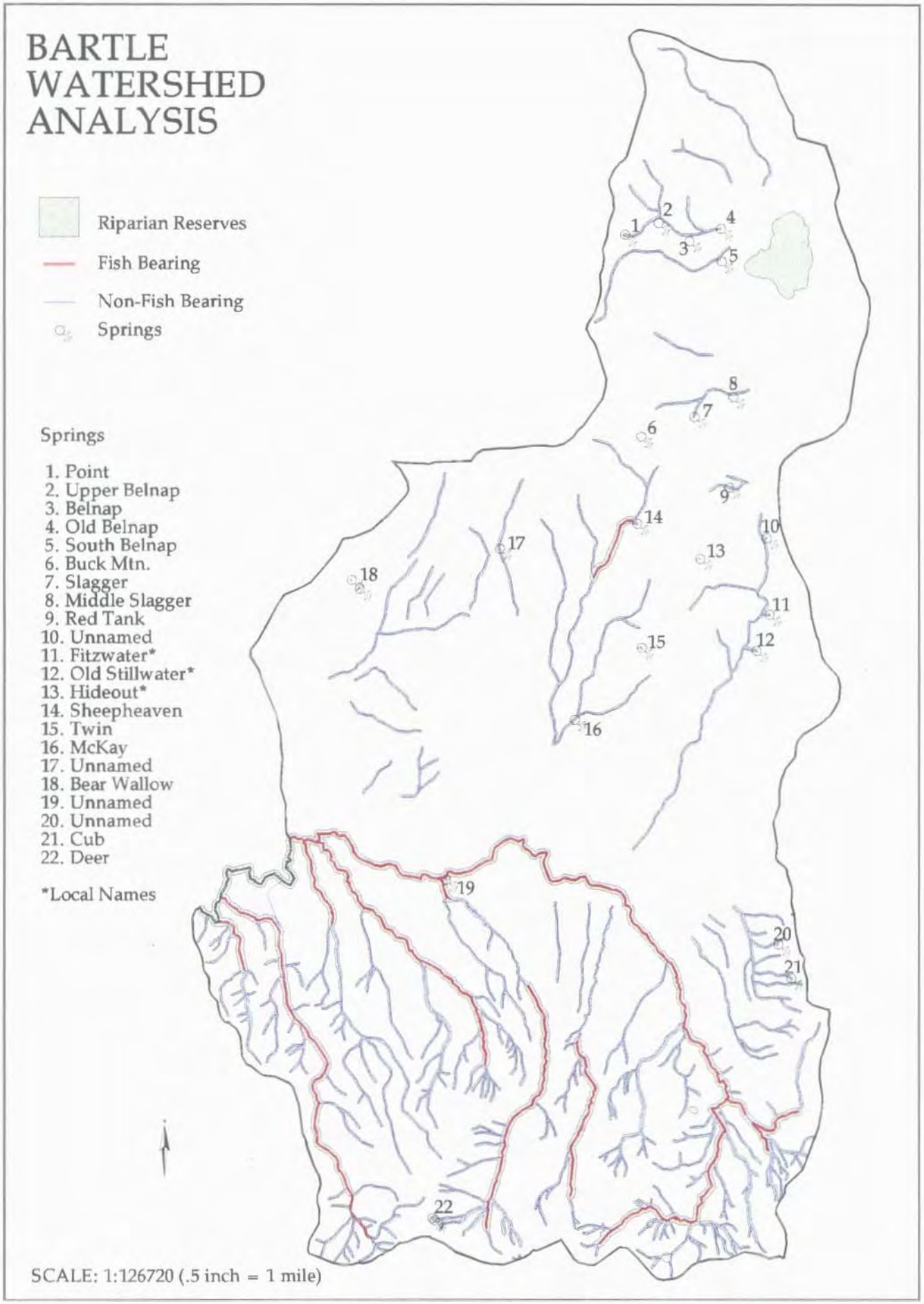
Watershed Overview

The majority of the aquatic environment in the Bartle Watershed lies within the Riparian and Streamside Zones, and the McCloud River and Floodplain landscape components (Map 6). The Riparian and Streamside Zones are interspersed within the four terrestrial landscape components. The amounts and types of riparian habitat differ across the watershed. The following discussion provides a description of riparian habitat types and the factors that affect water quality and quantity in each landscape component.

Water Availability

The amount of water available to cattle and wildlife is very limited in the northern portion of the watershed. The amount of water available annually varies due to the location of the watershed in a transition area between two different precipitation regimes. Areas located west of the watershed receive approximately 50 inches of precipitation annually, while areas east of the watershed receive approximately 30 inches of precipitation annually. The eastward trend in decreasing precipitation combined with short term variability in weather patterns and long term climatic fluctuations creates a highly variable rainfall regime in the Bartle Watershed.

BARTLE WATERSHED ANALYSIS



Map 15. Riparian Reserves

During dry years water availability is severely limited. Water diversions and spring development further limit available water for riparian vegetation. Spring developments occur at Stillwater Meadows, Buck Mountain, Slagger, Belnap, Point, and Red Tank springs. Following the spring runoff period, available water is confined to springs, spring developments, and wells. Most wells and spring developments in the Bartle Watershed are simple dug-out pits. The creation of these pits creates a flow gradient to the pit, thereby lowering the surrounding water table. The gradient is increased as water from each pit is consumed by cattle or lost to evaporation. This lowers soil moisture in the vicinity of the spring developments and subsequently reduces the amount of water available to riparian vegetation. These effects may not be significant in the larger meadow systems. Impacts may be greater in small riparian communities of less than one acre that are associated with springs. Cattle have also impacted spring developments by compacting the soil surrounding the outflow. In some cases such as Point and Hideout Springs, the compaction has reduced the flow of water to the surface. Water diversions and spring developments may have also reduced the duration of intermittent streamflow and the amount of riparian vegetation below the springs.

In addition to the spring developments, several water diversions occur in the watershed including:

- Slagger Springs
  A pipeline routes water from Slagger Springs over a distance of two miles to Slagger Camp. Two 10,000 gallon storage tanks store water for road maintenance and fire. Flow from Slagger Springs is perennial and it is not known if the diversion has affected riparian vegetation in Slagger Meadows.
- Tate Creek
  Water is routed from Tate Creek to the Ash Creek Station.
- McIntosh Well
  McIntosh Well has not been used for over 30 years. The well was originally built for the extensive sheep grazing operations in the watershed.

LC-1. Midslopes and Mountain Tops
LC-3. Colluvial Hillslopes and Alluvial Fans
LC-5. Lava Flows and Terraces

These landscape components do not include riparian zones. Any riparian areas occurring within these landscape components are included within LC-2.

LC-2. Riparian and Streamside Zones

With the exception of the McCloud River, the entire aquatic ecosystem is located within LC-2. This landscape component consists of:

- upland ephemeral drainages
- perennial and intermittent tributaries to the McCloud River
- wet meadows
- springs
- one intermittent lake (Dry Lake).

The Bartle Watershed can be divided into the Black Fox Uplands and the Bartle Gap/Mushroom Rock Uplands. These areas differ with respect to their geologic and hydrologic properties. The following table compares these areas. Map 15 (Riparian Reserves) also displays many of these differences.

Black Fox Uplands (North of McCloud River)	Bartle Gap/Mushroom Rock Uplands (South of McCloud River)
Lower drainage density.	Higher drainage density.
Less riparian habitat due to limited surface water flow; typically associated with springs and short reaches of perennial stream channels that occur immediately below springs.	More riparian habitat due to more surface water flow.
Riparian zones are generally associated with meadows and springs.	Riparian zones are generally associated with mountain streams.
Ephemeral and intermittent channels tend to be linear and exhibit less of a dendritic drainage pattern.	Ephemeral and intermittent channels exhibit a dendritic drainage pattern.
Greater groundwater component.	Lesser groundwater component.
Streams rarely have surface connectivity with the McCloud River; therefore, there is very little risk to water quality in the McCloud River.	Surface flow from tributaries into the McCloud River occurs at a higher frequency.
Impacts to riparian areas have resulted from the grazing of riparian vegetation and the erosion of streambanks by cattle.	Impacts to riparian areas have resulted from sediment problems associated with roads and the past draining of upland meadows with shallow ditches.

Riparian and streamside zone habitat types also vary by channel position. The purpose of the following discussion is to characterize the current condition of the channel network and riparian habitat from the point of channel initiation in the headwaters, to the confluence of each channel with the McCloud River.

Upland and Midslope Streams

The drainage network in the watershed contains numerous ephemeral and intermittent stream channels and several springs. The majority of the precipitation falls as snow. As a result streamflow in the ephemeral and intermittent channels not associated with springs, occurs only for short periods during snowmelt or during high intensity rainfall.

Depending upon location in the watershed, upland channels converge to form intermittent or perennial streams. The latter are almost solely a feature of the southern portion of the landscape. Springs and streamflow from ephemeral and intermittent channels converge to form intermittent or perennial streams and small riparian meadow systems in the northern portion of the watershed.

All streams draining the Bartle Gap/Mushroom Rock uplands exhibit a north trending channel orientation. Channel gradients for ephemeral and intermittent streams range from 3 to 40 percent. In most cases the steeper gradients occur in the uplands while the lower gradients occur on the midslopes. Channel gradients at the headwaters of Moosehead Creek at Bartle Gap are not as steep as in other areas due to flat upland terrain. Stream channel beds are mainly composed of soil, boulders, cobbles, and small amounts of woody debris in the upper reaches and stones, cobbles, and gravels in the lower reaches.

Streams on Alluvial Flats

Below the midslopes, streams enter a relatively flat, featureless landscape consisting of alluvial deposits and lava flows. Stream channel gradients decrease and surface flow in most streams begins to dissipate. Surface flow is lost to groundwater recharge as streams flow through the alluvial deposits. The loss of surface flow to groundwater recharge is so great that the lower ephemeral portions of Bartle and McKay Creeks only flow south of Highway 89 approximately once every two years during winters with above normal precipitation. In this respect Bartle and McKay Creeks are similar to streams such as Ash Creek which drains similar country to the west of the Bartle Watershed. Because these channels only rarely flow through the fans and terraces and do not have surface connectivity with the McCloud River, there is very little risk to water quality in the McCloud River. Surface flow to the McCloud River from the southern tributaries occurs at a higher frequency than surface flow north of Highway 89. Whiskey, Shady Gulch, Bull, and Dry Creeks usually go dry by June in most years.

Wet Meadows

Two types of wet meadows occur in the watershed:

1. Northern meadows
    - tend occur in the northern portion of the watershed (Black Fox Uplands).
    - tend to occur in narrow bands along intermittent stream courses.
    - tend to be associated with springs and/or streams.
    - intermittent streams in the meadows have gradients ranging from 3-5 percent.
2. Upland meadows
    - tend to occur in the southern portion of the watershed (Bartle Gap/Mushroom Rock Uplands).
    - tend to occur at a higher elevation than their northern counterparts.
    - tend to be fed by numerous intermittent feeder creeks that flow consistently enough to support riparian vegetation.
    - riparian vegetation is abundant within these meadows.

LC-4. Dry Lake Basin

This landscape component is essentially devoid of any streams or riparian areas with the exception of Dry Lake. See Grazing Impacts (LC-2) for a description of Dry Lake.

LC-6. McCloud River and Floodplain

The McCloud River is a 5th order channel and the surface flow outlet for the Bartle Watershed. The headwaters of the McCloud River originate in Colby Meadows in the southeastern corner of the watershed. Streamflow increases significantly at its confluence with Moosehead Creek (a tributary larger than the McCloud River). The McCloud River enters the alluvial fan deposits and flows through Curtis Meadows. The river runs west through the watershed paralleling the railroad and Highway 89.

The McCloud River is perennial for most of its length, however portions of the river in the vicinity of Colby Meadows have been known to go dry following unusually dry winters. The river is continuously perennial below Curtis Meadows. A distinct band of riparian vegetation composed primarily of willows occurs along the entire length of the river corridor. The thickness of this band fluctuates considerably along its length. Channel bed material consists primarily of cobbles and gravels. It is important to note

that all perennial tributaries to the McCloud enter from the south. Bartle and McKay Creek only rarely flow all of the way to the McCloud (approximately once every 2 years).

Grazing Impacts

Watershed Overview

Grazing allotment boundaries are show on the Grazing Allotment Map (Map 5). Allotment use is summarized in the following table.

Table 3-12. - Grazing allotment use.

Allotment	Use	Period
Toad Mountain Cattle Allotment	200 cattle	June 16 to Sept. 30
Bartle Cattle Allotment	<20 cattle	June and July
McCloud River Sheep Allotment	light	July and August

Grazing standards have been maintained in the portion of the Bartle Allotment that occurs within the Bartle Watershed. Sheep use in the watershed is light and the permittee maintains excellent grazing standards.

All issues concerning range focus on grazing impacts to riparian ecosystems.

LC-1. Midslopes and Mountain Tops
LC-3. Colluvial Hillslopes and Alluvial Fans
LC-5. Lava Flows and Terraces

These landscape components do not include riparian zones. Any riparian areas occurring within these landscape components are included within LC-2.

LC-2. Riparian and Streamside Zones

Riparian conditions have drastically declined due to cattle numbers being allocated on the basis of upland forage predictions. These predictions were not only overestimated, but did not recognize that cattle prefer to graze riparian areas (USFS Range Files, 1951).

Grazing management by fencing, herding, and salting has not effectively relieved overgrazing in riparian areas. Cattle prefer riparian areas due to high water needs and preference for soft moist vegetation. Riparian areas are dispersed in numerous small meadows, so fencing attempts are ineffective. Snow damage to fences occurs during most years and repairs are economically unjustifiable. Fencing as a management option has concentrated overgrazing on unfenced riparian areas and nearby tree plantations, compounding the problem in other areas of the watershed. Impacts to riparian areas are also exacerbated by excessive numbers of livestock. Additional cattle also tend to migrate into the allotment from neighboring allotments south of the watershed.

All riparian areas in the cattle allotment are in unsatisfactory ecological condition. Long-term transects reflect a continual decline in vegetation conditions (USFS Toad Well Range file) due to cattle grazing.

Cattle grazing has contributed to the decline of many animal and plant species in riparian areas. Some examples of animal species impacted by grazing include redband trout and willow flycatcher. Common plant species which are having difficulty sustaining vigor or

reproductive success are preferred forage species to cattle, including: willow, aspen, redstem dogwood, bluegrass, oat grass, wet sedges, and Dutch clover. Details may be found in the Shasta-Trinity National Forest Grazing Biological Evaluation of 1995.

Grazing is affecting sensitive plants which grow in riparian areas. The Salmon Mountain Wakerobin (Trillium ovatum) is found south of Slagger Camp in several meadows. The Columbia Cress (Rorippa columbiana) is found on the shores of Dry Lake. Data is lacking on how grazing affects these plants, but local observations indicate that the wakerobin is stunted and does not set seed under heavy grazing situations. The wakerobin blooms early, but is eaten and trampled before it goes to seed. The cress is unstudied but may be affected by trampling (see Dry Lake ecosystem and Sensitive Plant discussions).

LC-4. Dry Lake Basin

This landscape component is essentially devoid of any streams or riparian areas with the exception of Dry Lake.

Dry Lake is a large, shallow intermittent lake of about 600 acres, resembling a large vernal pool. This lake has some characteristics of both a lake and a vernal pool. In wet years, the lake is large and appears to overflow south into Big Sand Flat. In dry years, the lake is small, and retreats into two dugout ponds in the lake bed. These ponds were dug out in the 1970s to provide a water source for cattle. Both holes usually dry up in August, but sometimes hold water all year. In the 21 year period from 1974-1995, there were eight wet years in which Dry Lake probably flooded to its maximum extent.

The vegetation around Dry Lake is influenced by water levels. During dry years, lodgepole pine invades the lake basin. When the water level rises for extensive periods the pine is flooded and killed. The oatgrass on the shores, bogbean in the deeper areas, Columbia cress (sensitive plant), and various understory species seem to vary in numbers every year.

Cattle grazing the emergent lakeshore habitat at Dry Lake have been observed to adversely affect native grasses and sensitive plants. These conditions and other adverse effects are also found in current literature. Cattle avoid the dense mat muhly grass which dominates the lake bed, but search for and select oatgrass for grazing. Cattle often wade into the lake for this preferred forage species and appear to pull oatgrass out by the roots. Grazing and trampling appears to be converting the lake shore and lake bed entirely to mat muhly and weeds. Pine seedlings appear in dry years, but primroses and penstemons also invade the bare spots. Lakeshore overgrazing degrades the habitat of Columbia cress, which is found in only two places on the forest.

LC-6. McCloud River Corridor and Floodplain

The McCloud River Allotment has a term permit for 1,200 sheep from May 16 to October 15. About 30% of this allotment lies in the south half of the watershed. Most of the allotment in the watershed is on private land in the McKay-Dry Creek area, but includes some of the McIntosh-Cow Creek area. The herd is used mainly in plantation areas to clear undergrowth and is not allowed in riparian zones. This operation is highly successful and well-managed with very few noticeable effects on other resources. Sheep are easily controlled as grazing animals because they are small in size and stay together

as a herd. They have few observable effects on natural processes under the present management system and have favorable effects on vegetation compared to predominantly adverse effects from cattle grazing.

Redband Trout Habitat

Watershed Overview

Redband trout constitute a subspecies of rainbow trout native to western North America. Originally native to much of the Pacific Northwest, redband trout distribution has undergone a reduction, primarily due to hybridization and competition with non-native trout species. The Upper McCloud Redband Trout presently occur as small, isolated, relic populations within a few streams in the Upper McCloud River Drainages. The redband trout appear to tolerate higher siltation conditions, lower water velocities, and higher water temperatures than typical for most trout. Within the Bartle Watershed, redband trout are found in the McCloud River, Sheepheaven Creek, Tate Creek, and Moosehead Creek. Native rainbow trout have also been found in Shady Gulch, Bull Creek, and Dry Creek. Genetic samples have been collected from these three streams and are presently under evaluation. Results of the genetic evaluation are pending, but it does not appear that the populations in these three streams may be redband trout.

The McCloud River redband trout has been designated as a candidate species by the U.S. Fish and Wildlife Service. This designation indicates that there is enough information on biological vulnerability and threat(s) on file to support proposals to list the redband as threatened or endangered under the Threatened and Endangered Species Act. Listing of this species is likely unless Federal (and State) agencies give consideration to the species in environmental planning to the extent that listing is no longer warranted. In order to avoid listing, the Forest Service, in cooperation with other State and Federal agencies as well as private landowners, has formed a the Upper McCloud Redband Trout committee for the purpose of developing a conservation strategy that will insure the continued viability of McCloud River redband trout populations. It is anticipated that this conservation strategy will be completed by early 1997. The redband trout is the only trout native to the upper McCloud River drainage.

Habitat condition for fish is quite variable, but in general is considered fair to poor except in portions of Tate Creek and the McCloud River where habitat condition is considered quite good. Habitat factors that presently limit fish production within the tributary streams include small stream size and a general lack of deep water habitat such as pools. Cover, particularly in the form of large woody debris, is generally sparse throughout all of the streams. This may also be limiting fish abundance. Some of the smaller streams such as Moosehead Creek also have a limited amount of suitable spawning gravel. Within the McCloud River, deeper pools are common, however flows become subsurface in portions of the river during dry years which further limits the ability of the river to produce fish.

LC-1. Midslopes and Mountain Tops
LC-3. Colluvial Hillslopes and Alluvial Fans
LC-4. Dry Lake Basin

LC-5. Lava Flows and Terraces

These landscape components do not include redband trout streams. Any redband trout streams occurring within these landscape components are included within LC-2 or LC-6.

LC-2. Riparian and Streamside Zones

The only redband stream discussed in this landscape component is Sheepheaven Creek (upper reaches of McKay Creek). Other redband trout streams tributary to the McCloud River are discussed in LC-6.

Sheepheaven Creek

Fish-bearing section:	The 0.7 miles of fish-bearing section of stream can vary depending on flow conditions.
Occurrence:	Present
Flow:	Because Sheepheaven Creek is spring fed, most of the stream is perennial. The lower reaches are intermittent. During wet years, surface flow occurs throughout the entire channel from Sheepheaven Spring to the McCloud River. It is possible that trout may be able to migrate up and down the creek during these wet periods.
Riffle, run habitat:	This stream has an abundance of low gradient riffles and steep runs. Though not as abundant as riffles and stepruns, flat water habitats such as glides and runs make up the majority of the stream's volume.
Pool habitat:	Though pools are common, they tend to be shallow and small, and offer limited depth. Those pools, formed by large woody debris, provide the best rearing habitat, but this particular type of pool is not common.
Gravels:	Trout spawning gravels were common in this stream, but were impacted with fine sediments. Non-point sources of sediment delivered by the adjacent road appears to be the source of fines.
Large woody debris:	Large woody debris is not common.
General habitat condition:	Fish habitat condition is considered as low to fair, limited by the small stream size and shallow depth. The adjacent road appears to be contributing fine sediments.

LC-6. McCloud River and Floodplain

Though the remaining redband tributaries originate in the mountains of the McCloud/Pit divide and are also within the riparian streamside zone, they will be addressed under this landscape component as they flow into the McCloud River and are considered significant redband streams. There are presently three known redband streams in this landscape component: Moosehead Creek, Tate Creek, and the upper McCloud River (including Colby Creek).

Moosehead Creek

Fish-bearing section:	A fish barrier was constructed in the early 1980s in order to keep other fish out and protect the genetic integrity of the redband trout. There is approximately 1.3 miles of stream above the barrier.

Occurrence:	Moosehead Creek is a resident trout stream with redband trout occurring in the upper reach.
Flow:	Perennial - some low flows in dry years.
Riffle, run habitat:	Upper Moosehead Creek has an abundance of step runs, runs, and riffle habitats. Instream cover overall is moderate with pools having the best cover; however, cover within riffles is very limited.
Pool habitat:	Pools are common and in general provide good rearing habitat, except during low water years.
Gravels:	Trout spawning gravels are relatively clean and free of fines, but are extremely limited in abundance. Some bank cutting does take place at high flows and ultimately contributes fine sediments to the McCloud River.
Large woody debris:	Large woody debris, though fairly common in the channel, does not provide much low flow cover as it is suspended above the stream.
General habitat condition:	In general, fish habitat condition in the upper reach (redband area) is considered fair, limited by the lack of spawning habitat, a limited amount of large stable woody debris in the low flow channel, and during low water years a lack of residual pool volume and small stream size.

Tate Creek

Fish-bearing section:	Tate Creek has approximately 6 miles of perennial fish bearing water.
Occurrence:	The upper and middle reaches (4.5 miles) appear to have significant numbers of redband trout while the lower reaches appear to be dominated by other trout species.
Flow:	Perennial
Riffle, run habitat:	Instream cover is moderate.
Pool habitat:	Pools and riffles comprise the majority of the habitat types in the upper two reaches, while flat water habitat is uncommon. Though pools are relatively common they tend to be somewhat shallow, particularly as distance upstream increases. Pools are formed primarily by rocks and boulders as there is not much large wood in the channel.
Gravels:	Spawning habitat appears to be adequate as gravels are common, but gravels are moderately impacted with fines. These fines appear to be a result of several small slides in the middle reach. Spawning habitat quality improved in the upper reach, but gravels become less abundant.
Large woody debris:	Large woody debris in the channel is limited.
General habitat condition:	In general, fish habitat condition is considered good.

Upper McCloud River

Fish-bearing section:	The Upper McCloud River, within the analysis area, has approximately 11 miles of fish bearing stream with redband trout scattered throughout the upper river.
Occurrence:	Present

Flow:	In 1990, approximately 1.6 miles of river dried up during low flow in the area of Curtis Meadows.
Riffle, run habitat:	Low gradient riffles and flatwater habitat were the most abundant habitat types.
Pool habitat:	Pools accounted for over 44% of the stream volume.
Gravels:	Spawning gravels are common and in good condition. Much of the suitable spawning habitat is located in the tailouts of pools.
Large woody debris:	Large woody debris was scarce, comprising less than 4% of all cover types.
General habitat condition:	Fish habitat within the Upper McCloud River is generally in good condition. Cover is moderate, dominated by boulders, white water, and terrestrial vegetation. Shade canopy generally increased with distance upstream, but only averaged 21% overall, which is considered light.

Riparian Species of Concern

Watershed Overview

Aquatic and/or riparian dependent Species of Concern and their status in the Bartle Watershed include:

- western spadefoot toad CSC
- tailed frog CSC
- cascades frog CSC
- willow flycatcher FS, CaE
- northwest pond turtle FS, CSC

where:

CaE = California State-listed Endangered
CSC = CDF 'Species of Special Concern'
FS = Forest Service Sensitive

Plant species of special concern are discussed in the chapter on Vascular Plant Species of Concern under TES Species and Habitat.

Western Spadefoot Toad

Within the Bartle Watershed, the western spadefoot toad is only known to occur in Dry Lake (Simons, 1995 and Zustak, 1995). Other areas in the watershed which may be suitable for the western spadefoot toad, such as quiet sections of intermittent creeks north of the McCloud River, have not been surveyed.

The western spadefoot toad prefers areas of open vegetation and shortgrass where the soil is sandy or gravelly. Breeding occurs in quiet streams and temporary pools. It is a species of the lowlands, floodplains, washes, and alluvial fans, but does range into foothills and mountain valleys (Stebbins, 1966). Adults emerge from underground burrows at the first rains of fall, and breeding activities conclude in March. Tadpoles transform by late spring.

Tailed Frog

No tailed frogs have been detected in the Bartle Watershed, though the watershed falls within their natural geographical and elevational distribution (0-6,000'). Lee Simons made casual observations of amphibians while surveying streams and noted an absence of tailed frogs (Simons, 1994). Absence of sightings may be a function of the species rareness or a lack of suitable habitat.

Suitable habitat for tailed frogs is considered to be permanent, clear, cold mountain streams (<15 degrees Celsius) located within steep drainages, bordered by dense, moist forests. Riffles with small, clean cobbles are important for larval stages.

Cascades Frog

From 1988 to 1993, Lee Simons reported casual observations of cascades frogs while conducting studies in riparian habitats in the McCloud River and adjacent drainages south of the river. When surveying the isolated riparian habitats north of the McCloud River, Simons did not observe the frog. A non-observation does not indicate absence in these habitats, such as those found at Shirttail Canyon, Bartle Creek, Sheepheaven Springs/ McKay Creek, or Red Tank Springs. Cascades frogs can apparently occupy a site unobserved, at least by casual observers, for many years (Simons, 1994). These observations and museum specimens are the only records for the Bartle Watershed. Because of the few sightings recorded, despite the number of years Simons visited the areas, Simons concluded that cascades frogs were rare, especially in isolated riparian habitats.

Suitable habitat for the cascades frog is defined as slow, permanent bodies of water surrounded by a moist forested habitat with herbaceous cover for thermoregulation and escape cover. Cascades frogs are strongly tied to water. Other tributaries flowing directly into the McCloud River may be suitable for the cascades frog based on current sightings in Tate Creek (Simons, 1994).

Willow Flycatcher

Willow flycatchers detected along the McCloud River in the Bartle Watershed are part of the most northerly population. Suitable habitat south of the McCloud River may occur at Colby Meadows. The nearest known population is in Bigelow meadow, four miles west of the watershed boundary.

Suitable habitat for willow flycatchers is considered to be dense stands of willows and other shrubs associated with riparian areas and large, open wet meadows, at 2,000 to 8,000' (Gaines, 1983). Trees and shrubs with low branches are required for nesting (Serena, 1982). The nesting site is usually near water, as wet areas provide a diversity of insects on which to feed. This species also eats berries and seeds.

Suitable habitat south of the McCloud River may occur at Colby Meadows. Most riparian areas in the remainder of the watershed are disjunct, narrow, and associated with small meadows. Since 1989, portions of Stillwater Meadows have been fenced off to enhance willow flycatcher habitat and are expected to become suitable habitat with continued protection. Other isolated riparian habitats may also support willow flycatchers, but the size and condition of these habitats is unknown (Simons, L., Mangels, F., personal communication).

Northwest Pond Turtle

Northwestern pond turtles were not detected during habitat typing of tributaries south of the McCloud River (Zustak, 199_). No other detections are recorded for the Bartle Watershed. Pond turtles are known to occur along the McCloud River further downstream. Their absence may be a function of rarity or a lack of suitable habitat.

Suitable habitat consists of mainly open, quiet pools, and suitable open areas of clay/silt soils for nesting. The northwestern pond turtle needs a combination of aquatic, riparian, and terrestrial habitats in close proximity to one another in order to maintain population viability.

Habitat

Approximately fourteen (14) aquatic systems in the Bartle Watershed may provide habitat for these species. Habitat requirements vary from intermittent streams or bodies of standing water with varied types and amounts of vegetation, to perennial streams with cool water temperatures, instream cover, and surrounded by dense riparian vegetation.

LC-1. Midslopes and Mountain Tops
LC-3. Colluvial Hillslopes and Alluvial Fans
LC-5. Lava Flows and Terraces

These landscape components do not include habitat for aquatic and/or riparian dependent Species of Concern. Any aquatic and/or riparian habitat occurring within these landscape components is included within LC-2.

LC-2. Riparian and Streamside Zones

Occurrence: The cascades frog has been observed in tributary drainages south of the McCloud River. None of the other Species of Concern have been observed in this landscape component. However, absence may be a function of rareness, lack of surveying, and a lack of suitable habitat.

Habitat: Suitable habitat for all of the five Species of Concern occurs within this landscape component. Management of riparian reserves is expected to provide for species listed in the aquatic and riparian guilds. Possible conflicts with Aquatic Conservation Strategy objectives affecting these aquatic species include cattle grazing in alpine meadows and riparian areas.

LC-4. Dry Lake Basin

Occurrence: The western spadefoot toad has been observed in Dry Lake. None of the other Species of Concern occur in this landscape component.

Habitat: Habitat for the western spadefoot toad is provided in Dry Lake and quiet sections of intermittent creeks north of the McCloud River. This landscape component does not provide suitable habitat for any of the other Species of Concern.

LC-6. McCloud River and Floodplain

Occurrence: All species which occur in LC-2 are expected to occur along the McCloud River and Floodplain. The cascades frog and the willow flycatcher have been observed in this landscape component.

Habitat: Suitable habitat for all of the five Species of Concern occurs within this landscape component. Management of riparian reserves is expected to provide for species listed in the aquatic and riparian guilds. Possible conflicts with Aquatic Conservation Strategy objectives affecting these aquatic species include cattle grazing in alpine meadows and riparian areas.

Neotropical Migratory Birds (NTMB):

Eighteen (18) NTMBs are suspected to occur within the McCloud River and Floodplain riparian habitat. NTMBs have been discussed previously in this chapter under Wildlife Species of Concern.

Socio-Economic

Public Uses

Watershed Overview

In 1994, the McCloud Ranger District sold firewood permits for 1,181 cords of personal-use firewood. The Bartle Watershed is the most popular area on the McCloud District for firewood cutting due to the availability of wood and the flat terrain. No records are available to determine what portion of woodcutting on the McCloud District actually occurs within this watershed.

Mushroom picking occurs in all landscape components in the watershed.

Hunting and dispersed camping by hunters are seasonal activities that occur throughout the watershed.

LC-1. Midslopes and Mountain Tops

The Pacific Crest Trail is located along the main ridgetop near Mushroom Rock.

LC-2. Riparian and Streamside Zones

Dispersed hunter camps are frequently located in riparian and streamside zones.

LC-3. Colluvial Hillslopes and Alluvial Fans

There is a proposal to designate a Scenic Byway along the Harris Spring Road. The majority of route through the watershed passes through this landscape component. No changes to resource management are required; however, this designation provides opportunities for developing vistas and interpretive signing.

LC-4. Dry Lake Basin

This is the most heavily used area on the McCloud District for firewood cutting due to the flat terrain and the abundance of dead lodgepole pine. The actual number of cords removed is unknown. Timber harvest and the conversion to ponderosa pine plantations in this landscape component has reduced the amount of land available for woodcutting.

There is a proposal to designate a Scenic Byway along the Harris Spring Road. A portion of the route passes through this landscape component. This designation provides opportunities for developing vistas and interpretive signing, especially near such features as Dry Lake.

LC-5. Lava Flows and Terraces (Same as LC-3)

LC-6. McCloud River and Floodplain

The McCloud River and the lower reaches of the larger tributaries are popular fishing areas. A semi-developed campground is located at Algoma and four undeveloped campgrounds are located along the river. The proposed McCloud River Trail would be constructed along the north side of the river.

There is a proposal to designate a Scenic Byway along Highway 89 and the Harris Spring Road. The route passes through this landscape component. No changes to resource management are required; however, this designation provides opportunities for developing vistas and interpretive signing.

Local Employment and Economy

Watershed Overview

The Bartle Watershed has provided an average timber harvest of 7 mmbf per year for the last 30 years. This generates employment for approximately 50 people per year in jobs related to timber harvest. Additional jobs have been provided by reforestation and plantation maintenance.

Grazing in the watershed also employs a small number of individuals.

Mushroom picking occurs in the watershed and provides a source of income to individuals.

Hunting and fishing are seasonal activities that affect local businesses.

Heritage Resources

Watershed Overview

The Bartle Watershed contains a number of heritage resource sites, most of which are concentrated along the McCloud River. The potential for disturbance of these sites increases as public use of the watershed increases. Public use is expected to increase with the completion of the McCloud River Trail, and the designation of the Modoc Volcanic Scenic Byway which runs along Highway 89 and the Harris Springs Road.

LC-2. Riparian and Streamside Zones

Sensitivity for heritage resources is high in most riparian and streamside zones. Slagger Camp is a dispersed camping site located just off the Harris Springs Road which is especially popular during hunting season and as a work camp.

LC-6. McCloud River and Floodplain

Public use is concentrated along the river. Camping occurs at the one semi-developed campsite at Algoma, and three dispersed campsites (Skunk Hollow, Nitwit Camp, and McCloud Bridge) elsewhere along the river. One day use area exists at Fourmile Flat. The McCloud River Trail, which is planned to run from Pine Tree Hollow to Algoma, is currently under construction.

There are eight archaeological sites recorded along the upper McCloud River corridor in the Bartle Watershed. The flat terraces, availability of water, and good fishing along the upper McCloud River made it attractive for early Native American use. This is reflected by the high density of 5 sites per mile in Section 36, T 40N, R 1W. This trend continued in the historic period when the upper river watershed was used by the McCloud River Lumber Company and other companies near the turn of the century for logging. Today, current undeveloped recreation, including camping and picnicking, fishing, etc., occur on top of many sites.

Additional trail construction, campground and day-use development, road obliterations, watershed restoration, site testing, and eventual outcome on eligibility to the National Register all have a different mix of effects upon heritage resources.

Native American Religious and Ceremonial Sites

Watershed Overview

Black Fox Mountain, which is in the Midslopes and Mountain Tops Landscape Component, has been identified both historically and currently by members of the Pit River tribe as a "power place". In 1981, the McCloud District received a petition from five council members of the Legitimate Pit River Tribe stating that they were opposed to any activity that would destroy the natural state of Black Fox Mountain. They recognized it for traditional religious and ceremonial purposes. In 1991, Floyd Buckskin described Black Fox Mountain as a doctor mountain and place where power quests were done. During a field trip in May 1993, he noted that he was opposed to clearcuts on sacred Mountains but was in favor of thinning, burning, and saving the dogwoods.

The evaluation of Black Fox Mountain to the National Register of Historic Places as a traditional cultural property has not yet been done, nor have boundaries of the property been defined.

Visual Quality

Watershed Overview

The Modoc Volcanic Scenic Byway, which runs along Highway 89 and up the Harris Springs Road, passes through the watershed. The only existing vista along the scenic byway is the McIntosh Vista which has views of Mt. Shasta, Castle Crags, and the management activities out at the McIntosh plantations. Current plans are to move and expand McIntosh Vista with the addition of a picnic area. Another feature of interest is the unique character of Dry Lake Basin which is adjacent to the scenic byway.

Expectations are that with the designation of the scenic byway will come increased usage of the road by tourists, and with that, benefits to the local economy.

Chapter 4

Reference Conditions

The intent of this chapter is to provide a reference for comparison with current conditions by attempting to explain how ecological conditions have changed over time as the result of human influences and natural disturbances. For the purpose of this analysis, reference conditions will be broken into two time periods:

- Pre-European Settlement (pre-1850)
- Historic (1850 - present)

Forest Health

Pre-European Settlement Conditions

The disturbance factors that shaped the forest under pre-European settlement conditions were mainly fire and drought. Fire disturbance was wide-spread and relatively frequent. Drought was periodic and infrequent.

Both Native Americans and lightning were sources of fire disturbance. Native Americans burned the forest regularly as indicated from recorded accounts (Lewis 1973). However, research on fire modeling based on long-term climatic data including lightning frequency suggests that much of the early fire history can be explained by lightning occurrence alone (Van Wagtendonk 1972).

The general pattern of forest types probably existed then, as they do today, and under the specific characteristics of each of these types, the stocking levels differed and were not necessarily static. A general model of the disturbance regimes affecting stocking levels is that the ponderosa pine stands at lower elevations had a short interval fire regime and open stands. The fir stands at higher elevations had lengthened fire intervals and demonstrated a disturbance cycle with low to high stocking levels.

Wildfires were generally low-intensity surface fires. Ecosystems maintained by surface fires such as ponderosa pine and drier mixed conifer types are a result of fire tolerant successional species that are generally shade intolerant. These regimes contain persistent successional species that generally are shade intolerant and have developed adaptations to survive fire and maintain a constant or fluctuating population in response to disturbance. In the absence of fire beyond the normal return interval, these fire adapted species are replaced by late-successional species that are predominantly shade tolerant thus producing the development of fuel ladders that alter fire behavior and effects.

There is no evidence to suggest that drought conditions and effects under Pre-European Settlement Conditions were very dissimilar from current conditions. Rainfall records dating back to 1905 show periods of drought that are probably indicative of the pre-settlement climatic pattern. Such droughts probably created the same opportunity for insect infestation and caused a similar pattern of tree mortality as is seen today.

Historic Conditions

Under historic conditions, disturbance regimes have been altered. Human influences affected natural disturbance regimes and began to shape the forest.

Alteration of the natural fire regimes has had several direct effects on Forest Health:

- It has permitted stands to attain much higher stocking levels than would be found under natural conditions. Stands have developed dense understories of shade tolerant species that contribute to vertical fuel continuity.
- It has fostered a shift in species composition in much of the watershed. Stands that were traditionally dominated by pine or mixed conifer are shifting in species composition to shade tolerant and fire intolerant species.
- It has reduced seral diversity among stands. Openings and early seral stages are reduced from pre-suppression conditions.

The introduction of logging as a disturbance factor has direct effects on Forest Health:

- It has changed stocking levels. Widespread logging opened mixed conifer stands and shifted the distribution of seral stages from a primarily old-growth composition with fewer stems per acre to a far greater proportion of early to mid-mature stages with greater stand densities.
- Logging has affected species composition through a prolonged practice of selecting the most valuable species for harvest. Sugar pine, ponderosa pine, and Douglas-fir were selected over incense cedar and white fir. Logging also maintained openings that permitted shade-intolerant species such as black oak to persist even in the absence of fire.
- Logging has affected the diversity of seral stages. The pre-settlement forest was dominated by older seral stages. Early logging caused a widespread shift to early seral stages. The second growth stands are now mostly mid-mature and, in some extensive areas, are homogenous in age and demonstrate little seral diversity.

Fire exclusion coupled with logging impacts have altered the current fire regime from a short interval, low intensity regime to one of moderate to high intensity at infrequent intervals. It appears that natural fire regimes may have been intact in the early 1800s, with fire intervals at 5-30 years. Fire intervals are now greater than 70 years, and the probability of catastrophic wildfire is greatly increased.

In historic times, fire suppression has allowed the incursion of white fir into the understory of mixed conifer and ponderosa pine stands. This phenomenon has added diversity within stands, in that it has created layering and a wider distribution of age classes. Diversity of seral stages was reduced by wildfire suppression as fewer and smaller openings were created. Clearcut logging added to the diversity of seral stages by creating openings.

LC-1. Midslopes and Mountain Tops

Higher elevations have probably experienced less transitions in fuel profiles than midslopes. Fire history shows a pattern of lengthening fire intervals with increasing elevation. About 10% of the total acres burned from large fires in the past 75 years has been above 5,000 ft. in elevation. The large brush fields in this component may largely be attributed to pre-settlement fire events or residue from logging in the early 1900's which fueled stand-replacing wildfires. However, early logging essentially ignored the

less valuable fir stands. Stocking levels in historic times have slowly increased with forest succession.

LC-3. Colluvial Hillslopes and Alluvial Fans

This component reflects the greatest transition due to the effects of grazing, logging, and fire suppression. At least 75% of the past large fire history has occurred in this component. Natural regimes were likely intact in the early 1800s; but, as the effects of long-term suppression were felt, changes in stand density, species composition, and seral diversity were manifested.

Under present conditions, it is in mixed conifer stands that the greatest drought-caused mortality is seen. With drought, white fir and to a lesser extent ponderosa pine are less able to fend off pathogenic insects and disease. High levels of mortality follow periods of drought. With the fire regime reaching an increasingly altered state, stocking levels have increased and competition for moisture has increased. The effects of drought are more severe in recent times in over-stocked stands.

LC-4. Dry Lake Basin

Lodgepole pine stands generally have 60-80 year fire intervals. Early in the century the Dry Lake Basin was swept by large scale wildfires. The entire landscape component came back to a dense regeneration of lodgepole pine. As the stands matured, stocking levels have decreased. It is probable that this regime is at the beginning stages of change due to human disturbance.

LC-5. Lava Flows and Terraces

A variety of historical sources, including "Pines Across the Mountain" (Hanft 1971) and McCloud River Lumber Company records, describe the "McCloud Flats" as open, park-like stands dominated by ponderosa pine. Typical stocking levels were in the range of five to ten trees per acre as a result of natural, non-selective thinning by recurring, low-intensity surface fires.

The pine stands on this landscape component were the focus of early logging. Entire sections were logged and came back to "dog-hair" thickets of ponderosa pine reproduction. As the stands matured overstory stocking levels have decreased but white fir understories have developed.

Table 4-1 - Activities Contributing Toward Current Fire Regime Conditions.

Year	Grazing	Logging	Fire Suppression	Condition of Fire Regime
Pre 1800				Natural
1850				
1880				Lightly Altered
1890				
1905				Moderately Altered
1930				
1946				
1950				Highly Altered
1975				
Present				

Wildlife Biodiversity

Watershed Overview

No historic records concerning wildlife population estimates, densities, or distributions are known to exist for the Bartle Watershed. Wildlife use, species composition, and population trends are projected based on the habitat regime, known European influences, and wildlife sighting records from 1971 to 1995. The distribution and abundance of wildlife species in the Bartle Watershed is dependent on the habitat regime and human use of the area. General information about these factors is available and has been utilized in these estimates.

Pre-European Settlement Conditions

Wildlife

Prior to European settlement in the mid-1800s, use of the watershed consisted of hunting, fishing, and trading by native peoples, with some European trappers and traders passing through the region. This use is unlikely to have had major impacts on the system.

Many of the wildlife species familiar today were present: herd animals such as deer and elk, far-ranging animals like the black bear and wolverine, the snag-and-cavity nesters and old-growth specialists (bats, pileated woodpecker, spotted owl), and aquatic-dependent species like the beaver. It is likely that many of these were present in greater numbers before the advent of activities such as logging (spotted owl) and market hunting (elk).

Vegetation

The presence in the watershed of dead and dying black oak indicates a regime of frequent low to moderate intensity fires during pre-settlement times. Oak is sensitive to fire. The cambium is often damaged, even through thick bark, and crown fires generally kill the entire above-ground portion of the tree. Black oak has evolved under a regime of frequent (return interval of 3-4 years) fire, as is evidenced by intense seedling initiation following low-intensity burns; sprouting from root crowns is also vigorous in young trees, whereas older trees may not re-sprout.

Roads

Prior to settlement in the mid-1800's, the transportation system consisted of trails associated with hunting, fishing, trading, and other activities of the native inhabitants, primarily along the McCloud River corridor. Some early explorers and trappers probably passed through this watershed in the early 1800s.

Historic Conditions

Wildlife

In the late 1800s and early 1900s, the railroad, timber harvest, livestock grazing, and homesteading began to have noticeable effects on the landscape. Wildlife and plant species requiring special habitats or which were sought after for recreational or commercial use began to decline in numbers, or were displaced to less disturbed areas. Species that adapt easily to such human-altered environments are probably more common today than a century ago, e.g., coyotes and raccoons.

Due to timber harvest, which was made more efficient by the railroad, old-growth trees were removed throughout the watershed. The loss of these trees, and their replacement by younger, smaller trees, affected the rate of recruitment of large diameter snags and down logs necessary for the maintenance of historic populations of cavity-nesting or dead and down dependent species such as the pileated woodpecker, fisher, and black bear . The deliberate removal of snags, begun in the late '20s to benefit timber production, would almost certainly have triggered a considerable reduction in both biodiversity and individual populations of snag dependent species.

The other side of this snag removal operation was a considerable short-term increase in the amount of large and small diameter material on the forest floor. In combination with fire suppression efforts (motorized by this time) this increase would have temporarily improved habitat conditions for black bear and marten -- as recent accumulation of fine fuels have for smaller forest-floor dwelling species, such as woodrats and deer mice -- creating safe feeding, breeding, and denning areas out of reach of their normal predators. Indeed, the unusually large accumulations of material on the forest floor, which can be seen in some areas today, may actually be allowing small mammal populations to exist at higher than historic levels.

The beginning of effective fire suppression efforts in the mid-1920s began to change the pattern of forage availability for deer and other herbivores. The once open grass/forb covered understories of the older ponderosa pine stands now became choked with small seedling trees and brush. This cover was often able, in the absence of fire, to attain an age and condition that made it worthless as forage, and which effectively stopped regeneration of the shade-intolerant pines. Fire suppression has also resulted in a decline in the hardwood component of forests, particularly in mixed-conifer stands. This decline may well have affected wildlife populations which utilize acorns as forage -- deer, band-tailed pigeons, gray squirrels, and others. The lack of fire also reduced the productivity of meadow areas, as well as allowing encroachment by trees, further reducing grass and forb production. Replacement of late-seral and old-growth forest conditions with an understory composed of "dog-hair" seedlings also continued the process of making hunting conditions more difficult for predators such as spotted owls. The large numbers of cattle and sheep grazing the watershed reduced available grass and forb species, possibly furthering a decline in deer population numbers. Hoof rot and other diseases, picked up from domestic livestock in the '50s, further reduced the deer herds. With the

conversion of many of the remaining brushfields to plantations in the '60s, the loss of forage and cover was exacerbated, making recovery of populations even more difficult. Only in recent years have efforts been made to enhance forage and cover for game species.

The railroad, and later the automobile, also brought about the first opening of transportation corridors, fragmenting the forest into large blocks of habitat, and creating edge habitat which once was forest interior. This fragmentation changed the effect of winds, affected moisture retention, and exposed forest-interior species to predation, disturbance, and parasitism. This first wave of road building is estimated to have reduced the effectiveness of habitat by 3% (Thomas 1975). The proliferation of roads for timber harvest and other uses continued, further fragmenting the previously large blocks of habitat, until by the mid '70s habitat effectiveness for wildlife was reduced by 28% (Thomas 1975). Road or corridor density has been relatively high north of Hwy 89 since the beginning of timber harvest; the southern portion of the watershed was not so impacted until much later. Public use of the transportation corridors has increased in recent years, with the abundance of roads for access to hunting, fishing, and woodcutting areas being a major factor in the area's popularity.

Roads

With homesteading in the general McCloud area and the increase in human population (and travel) came gradual improvements to trails allowing wagon access. By 1887, a stageline ran through Bartle. By the early 1900's, railroad logging had begun throughout the area; this formed the basis of the transportation network that still remains. Many of today's roads were built on or over existing railroad grades. At the same time that railroad logging went into decline in the 1920's, improvements were being made in automobiles and roads. As motorized fire suppression evolved, road access on National Forest land became more important. With improved access for automobiles came increased popularity of public recreation like hunting, camping, and fishing.

During and after WW II, demand for wood products climbed again. Utilization of smaller logs and other species besides pine meant a return to areas previously logged, using the same general transportation corridors but changing from rail log haul to truck haul. Tractor logging also opened up areas hitherto untouched due to slope or other factors, and necessitated road construction requiring more drainage and maintenance considerations than that on flatter areas of the watershed. These activities increased through the 1960's and 70's and peaked on National Forest land in the late 1980's with spotted owl legislation, although generally they have been steady on adjacent private timberlands. Road maintenance of the National Forest road system also peaked and declined along with timber management activities.

The road (or "corridor") density has been relatively high north of Highway 89 since the railroad logging days. The area south of the highway in the Bartle Gap-Lone Pine Ridge area was not impacted by roads until much later.

Meanwhile, public use of the transportation system has steadily increased due to several factors, not the least of which is population growth. Part of the attraction of the area is the abundance of roads which have and continue to offer access to many traditional recreation opportunities like hunting, camping, fishing, mushroom gathering, snowmobiles, the Pacific Crest Trail, sight-seeing, etc.

TE&S Species and Habitat

Pre-European Settlement Conditions

Large expanses of old-growth forest habitat were probably the norm in the western portion of the watershed, which is, and probably has been throughout the recent climatic period, predominantly mixed-conifer forest. These large areas of old-growth would have been interspersed with patches of early-seral forest, the result of windthrow and fire, and with patches of hardwood. With the exception of aquatic species (addressed under Aquatic Ecosystems) and the great gray owl, many TE&S and Survey & Manage species in the watershed are dependent upon old-growth habitats; these species may well have been present in greater numbers before this habitat was changed by European land-use practices. In the eastern portion of the watershed, the pine stands were probably dominated by large trees in rather open stands. This old-growth pine habitat would have been typified by a relatively open understory of grasses and forbs, with a mosaic of early and late-seral bitterbrush and manzanita dominating openings and providing forage and cover for native herbivores.

TE&S and Survey & Manage vascular plants may well have been more abundant at this time, and for much the same reasons: the lack of European land-use practices. Grazing has been demonstrated to have an effect on native vegetation; streams and springs diverted for livestock use reduce the water available for native plants. Logging eliminates the old-growth forest conditions required by many species of shade-adapted plants.

Historic Conditions

Timber harvest activities in the mid-1800s and early 1900s removed much of the overstory, principally large pines, important in providing nesting habitat and thermal/escape cover for wildlife. The buildup of debris from logging may well have improved habitat for small forest-floor mammals even while reducing the ability of predators such as goshawks and spotted owls to see them. Forage conditions began to deteriorate with the coming of domestic livestock -- cattle and sheep -- reducing the forage available for elk and deer. Cattle, which require large amounts of water and prefer softer forage, also placed pressure on riparian and wet meadow areas, caving in streambanks, browsing down and trampling willow thickets and aspen seedlings, and reducing populations of riparian dependent plant and animal species. Grazing regulations went into effect in 1905, though the numbers of animals, approximately 35,000 head, remained high into the mid 40's. This began the initial decline of old-growth dependent species. Continued timber harvest, snag removal, slash buildup which perhaps augmented the occasional catastrophic wildfire, and the crowded understories brought about by the increased fire suppression efforts of the 30's further reduced the amount of available old-growth habitat. The loss of snags, in particular, reduced not only the habitat required by snag/cavity nesters, but also removed the source of later recruitment of large woody debris for the forest floor and streams, effectively removing large areas of habitat for such species as marten and fisher. The loss of snags and coarse woody debris on the forest floor, in combination with disturbance of soil by machinery, would also have had a negative impact on both above-ground and hypogeous fungi, and on algal and lichen species.

By the middle of this century however, timber harvest rates had slowed, and slash from logging operations was being piled and burned rather than being left to accumulate on the forest floor. This allowed some stands to reach old-growth stature, and others to develop the multi-story

conditions which mimic old-growth characteristics; both opening up the forest floor for freer movement and removing a large part of the small-tree decadence component of the stands. It may well be at this time that TE&S populations began to slow their declines, or to stabilize populations at lower numbers. The advent of clear-cut logging in the '70s once again began placing pressure on old-growth dependent species, particularly such species as spotted owl, goshawk, and fisher. Recently, reductions in and restrictions on timber harvest have been put in place, due primarily to awareness of the effect of such harvest systems on wildlife and plant populations, and the collateral effects on fisheries, recreation, and municipal water supplies. Local populations of TE&S species are still thought to be declining, though at an unknown rate. The effect on Survey & Manage species cannot be estimated, as data is lacking on locations and distribution of populations.

Along with timber harvest activity and grazing, fire suppression programs were put into effect to protect valuable timber stands. These programs were, in some ways, too successful:

- lack of fire reduced the "patchiness" of shrub fields, resulting in the dominance of decadent shrubs as opposed to stands of early-seral shrubs
- understories became densely populated with young shade tolerant trees, which pose a risk of catastrophic, stand-replacing fire in old-growth and late-seral forest stands
- hardwoods, particularly fire-adapted species such as black oak, could not regenerate, which reduced habitat for game species such as deer and gray squirrels, and for band-tailed pigeon (a hardwood dependent neotropical migrant).

Aquatic Ecosystems

Pre-European Settlement Conditions

Water Quality and Quantity

Due to the absence of prehistoric information, it is difficult to determine how natural processes influenced the aquatic ecosystem. Geologic disturbances have undoubtedly influenced water quality and quantity over the past 100,000 years. Catastrophic disturbances associated with volcanic activity altered flow regimes and affected the distribution of surface and groundwater in the watershed. The impacts to water quality and quantity from catastrophic volcanic disturbances were far greater than other impacts associated with other types of disturbance. Water quality was probably very good during the interim periods between large disturbance events.

Water quantity was also affected by long term changes in climate. It is likely that limited surface and groundwater was available to wildlife and plants during prolonged drought cycles that occurred in prehistoric times. The limited supply of water may have affected vegetative composition and the distribution of wildlife within the watershed. Catastrophic volcanic eruptions also increased water quantity by removing vegetation and decreasing evapotranspiration. The increased water supply was gradually reduced following subsequent soil development and vegetative recovery.

The distribution of surface and groundwater in the watershed is controlled by geologic processes. A brief discussion pertaining to the geology of the area is necessary in order to understand how geologic processes have operated to control the amount of surface runoff and groundwater levels in the riparian and stream side zones. The watershed is located at the junction of three major geologic provinces: The Cascade Range, Klamath Mountains, and Basin and Range (Jasso and

Haskins, 1983). The processes controlling the development of each of these provinces are different from one another and the geology along the interface of these provinces is very complex. The watershed is dissected by a series of parallel faults arranged in a north-south orientation. Tectonic extension along the faults has created a series of horsts and grabens (ridges and valleys) across the watershed. Groundwater and surface water flow is concentrated within the grabens. The faults act as barriers to groundwater movement. The movement of groundwater from upland areas to the grabens results in an elevated water table along the fault lines. The numerous springs, creeks, and riparian meadows associated with high water tables occur adjacent to these faults (Jasso and Haskins 1983). Examples of riparian systems occurring along fault lines are Stillwater Meadows/Bartle Creek and Dry Lake. Further discussion pertaining to the geology of the Bartle Watershed is beyond the scope of the water quality and quantity issue. See Jasso and Haskins, 1983 for a complete geologic overview of the watershed.

In addition to volcanic disturbance and long term variations in climate, other processes influenced water quality and quantity over shorter time scales. Large runoff events (peak flows) probably had short term impacts to water quality in the southern tributaries to the McCloud River. Impacts from peak flows were probably greatest following volcanic disturbances and wildfires. It is likely that the steep hillslopes adjacent to tributaries of the McCloud River contributed substantial amounts of fine sediments and coarse colluvial material to streams following hillslope destabilization by wildfires. Peak flows occurring during the last 10,000 years are not believed to have influenced water quality or channel morphology in the northern portion of the watershed due to high permeability of the volcanic soils and an overall scarcity of surface runoff. Impacts from peak flows were probably minimal at higher elevations throughout the watershed where most of the precipitation fell as snow.

Grazing

Little information is available concerning pre-settlement range conditions in the watershed. Natural controls on range conditions within and adjacent to riparian areas included fire, seasonal flooding, and natural grazers. Early range was abundant in and adjacent to wet meadows and was utilized by elk and deer. These natural grazers may have had impacts to wet meadow habitat (see Species of Concern). Frequent fires maintained good forage and preserved wet meadows by eliminating encroaching vegetation. Wildfires also recycled woody debris and maintained an open canopy over much of the rangeland in the terrestrial ecosystem.

Seasonal flooding also maintained range habitat in the Dry Lake Basin. Invading lodgepole pines encroaching on the shores of Dry Lake were killed off during unusually wet winters when the lake remained flooded through the summer. Seasonal flooding also occurred in swales and other ponds outside the watershed such as White Deer Lake. The quality of forage produced within the intermittent lakes varied depending on the duration of inundation. The lake shores produced good riparian oatgrass forage when grazing and the submergence period were not excessive.

Fisheries

The fisheries of the upper McCloud River prior to the formation of the upper, middle, and lower falls was different from what is presently found. River conditions and fish populations were dependent on the climate and geologic events. Salmon and steelhead were probably a dominant component and driving influence of the biological component of the aquatic ecosystem. They provided food not only for the very early human inhabitants, but also to many of the fish species that lived in the river. These probably included: rainbow/redband trout, California roach,

hardhead minnows, Sacramento suckers, Sacramento squawfish, riffle sculpin, speckled dace, hitch, tui chubs, and bull trout. The existence of the bull trout, as well as some of the other fish species was closely tied to the annual migration of these anadromous fish. The ecology of the upper McCloud River changed dramatically with the development of the waterfalls on the upper river. Salmon and steelhead were no longer able to access the upper river and those fish dependent on these runs, such as the bull trout and squawfish would have disappeared from the upper river. The extirpation of these species in the upper river took place gradually as the waterfalls developed. The formation of the waterfalls also genetically isolated the upper river rainbow trout. As climatic and river conditions changed, the rainbow trout began to differentiate and over time became what we now know as redband trout.

Although the waterfalls eliminated salmon migration, the fishery in the upper river was probably still important to early inhabitants. Suckers, rainbow trout, and the larger minnow species such as hitch and hardheads were significant dietary staples for many early Native Americans. During autumn, the early inhabitants of this area probably shifted their fishing efforts to below the falls where salmon and steelhead were still abundant.

Species of Concern

Little information is available concerning reference conditions for plant and wildlife species in the watershed. Natural grazers such as elk, and browsers such as deer, utilized meadow and riparian areas. Impacts to riparian vegetation from elk and deer are unknown and could have varied based on numbers of deer and elk using the area. Elk wallows would have created shallow depressions and displaced meadow habitat. Browsing on riparian shrubs would have occurred. Beavers would also have impacted the hydrology of riparian systems. The removal of riparian vegetation for forage and the creation of dams would have impacted other wildlife species dependent on the vegetation for cover and nesting and the flowing, cool water for habitat. Slow water associated species, if present, would have benefited from the creation of dams and slow water areas within the stream channel. Springs would have flowed naturally and created wet meadow habitat or maintained areas of moist duff. Species that were restricted to aquatic or riparian habitats (amphibians, willow flycatcher) may have been present in greater numbers and more widespread prior to European settlement.

Historic Conditions

Water Quality and Quantity

Land-use activities implemented by the Europeans had varied impacts to water quality and quantity throughout the watershed. Timber harvest affected hydrologic conditions in the watershed by disturbing forest soils and removing vegetative cover. Removal of large stands of timber increased water quantity by reducing evapotranspiration and reducing interception. Corresponding increases in peak flows may have occurred following timber harvest, but these would have only been significant in the McCloud River and its tributaries. Summer base flows in the perennial and intermittent streams may have increased for several years following timber harvest. Increases in available water (water quantity) were gradually reduced following post-harvest vegetative recovery.

The removal of the forest overstory fragmented riparian habitats and created a diversity of vegetation types in riparian areas. The removal of timber adjacent to stream channels resulted in increased water temperatures and in some areas the propagation of dense shrub understories.

This condition is particularly evident in wet meadows occurring in the Bartle Gap/Mushroom Rock uplands. The size of riparian area and the amount of riparian vegetation increased in the meadows due to the removal of the forest overstory. Natural succession to a closed forest canopy has been hindered by the dense growth of riparian vegetation.

Stand removal adjacent to streams also decreased the amount of woody material available to stream channels. Large woody debris stabilizes stream banks, creates sediment traps and pool habitat, and also controls channel gradient. The scarcity of woody debris in stream channels resulted in decreased bank stability, loss of pool habitat, and in some cases channel instability. Stream surveys indicate that woody debris is scarce in Sheepheaven, Bull, and Moosehead Creeks. It is likely that this condition also exists in other drainages that were logged prior to the implementation of streamside protection zones.

The majority of the impacts to water quality from logging and roads occurred in upland areas and drainages with steep topography in the southern portion of the watershed. The headwaters of Moosehead Creek were relatively undisturbed until 1985 when timber harvest began to occur in the Bartle Gap/Mushroom Rock uplands. Prior to the 1980's logging had been confined to the northern portion of the watershed and mostly to the lower elevations where no hillslope stability problems existed and surface flow was rare. Upland areas, such as the Moosehead Creek basin, were initially avoided due to their steep topography.

Several drainage ditches were constructed in conjunction with timber harvest and road construction in the Bartle Gap/Mushroom Rock uplands to facilitate snowmelt drainage. Little historic information is available concerning the origin of the ditches. The drainage ditches altered the timing of runoff from the uplands and reduced the residence time of water at these locations possibly affecting the size and types of vegetation in riparian areas.

Impacts from road construction have occurred throughout the watershed, however they were mostly concentrated in upland areas. Impacts to stream channels from roads are mostly associated with poor drainage and steep terrain. Impacts to water quality from road construction were greatest in streams draining the Mushroom Rock/Bartle Gap uplands and along Sheepheaven Creek. Many roads located adjacent to stream channels have poor drainage and are chronic sources of sediment to streams. Roads constructed in the uplands resulted in an increase in fine sediment sources and increased flood peaks. Large quantities of sediment were released into streams immediately following road construction activities. Other notable impacts to stream channels from roads and timber harvest have occurred at Belnap Springs (Soils Report, Slagger Timber Sale, 1981), Bull Creek (Watershed Report for Bull Timber Sale, 1986), and Stillwater Meadows. Road obliteration at Stillwater Meadows successfully reduced impacts to riparian areas adjacent to Bartle Creek and Stillwater Meadows.

Fires and fire suppression activities occurring in the watershed affected riparian vegetation and the size of riparian areas but they are not believed to have significantly impacted water quality or quantity. One large fire occurred in the Moosehead Creek drainage in 1917. The majority of the drainage was burned over and it is likely that water quality was impacted the following winter. Probable effects of the fire included increased sediment delivery to streams, channel aggradation, and increased flood peaks.

Water diversions and spring developments impacted riparian habitats and altered surface and groundwater flow within the watershed. Early water developments were developed to supply water to sheep. Later they were also used for dust abatement, fire suppression, and human consumption. As described in current conditions spring developments impacted riparian vegetation in riparian areas located immediately adjacent to the developments.

Recreation activities have not affected water quantity and have only recently been developed to the extent that they may have the potential to impact water quality. The only major recreational development in the watershed is the Algoma Campground located on the McCloud River. To date no negative impacts to water quality from the campground have been recorded.

Grazing

Early historical records indicate livestock grazing activities first occurred in the watershed in the 1880's. The early range was expansive and supported large numbers of livestock. Grazing activities increased steadily across the forest from 1880 through the early 1900's. Grazing was completely unregulated until 1907 when the Shasta National Forest was established.

Historical records indicate that early management sought to reduce the risk of fire through grazing activities. Cattle and sheep were used to reduce fuels build-up and create bare ground for fire prevention purposes. Despite these efforts, major fires occurred in the watershed from 1917-1924. These fires created additional range habitat and increased forage for deer and livestock. The expanded range period lasted from approximately 1920-1960. The size of the expanded range was slowly reduced as fire suppression allowed dense forests to develop and "shade out" forage.

The sheep industry peaked in the watershed in the early 1900's. A sheep stockyard and railhead established at Bartle served as a distribution point for sheep in the watershed. Sheep were unloaded and driven up Bartle Creek through Stillwater Meadows and spent the summer in the uplands. In the fall they were herded back the same route to the stockyard for transport. Old sheep troughs at McIntosh Well, Buck Mountain Spring, Sheepheaven Creek, Red Tank Spring, Slagger Camp, Belnap Spring, White Deer Lake, and Toad Well show that sheep grazing was extensive.

Despite the expanded range, range conditions declined steadily due to over-utilization of the watershed. Over-grazing of the watershed resulted in soil disturbance which encouraged conifer reproduction and timber encroachment in riparian areas. Land managers first began to take notice of the declining range conditions in 1935 and began issuing permits to control range use in 1941. New regulations were adopted and range improvement programs were implemented. In 1946 the wool market collapsed and sheep grazing became unprofitable. As a result the number of sheep allotments declined drastically across the forest and range conditions improved from 1946-55. Range improvements were quickly offset by conversion of rangeland to forests.

The Toad Allotment was converted from sheep to cattle in 1946. Several problems with drift and over-utilization, especially in riparian areas, are continually mentioned in subsequent management plans. Cattle were apparently overusing riparian areas before 1951. Herding, salting , and fencing were ineffective methods of control in following years. Impacts from livestock were greatest in and around spring developments and at Stillwater, Sheepheaven and Slagger Meadows, and Dry Lake. Impacts included trampling and suppression of riparian vegetation and bank erosion along intermittent streams. Overgrazing in and around Dry Lake eliminated oatgrass and allowed mat muhly grass to replace it. Unpalatable mat muhly grass has adapted to grazed intermittent lake basins.

Despite the overall decrease in the numbers of livestock, grazing conditions in riparian areas continued to decline steadily due to the impacts mentioned above. This decline is supported by long term range studies that have monitored the ecological condition of rangeland. Range

transect records from Toad Well (Dry Lake Area) show a decline from excellent vegetative conditions in 1964 to poor vegetative conditions in 1994. Vegetative condition at Slagger Camp Meadows declined from fair in 1969 to very poor in 1994. Steady declines in range conditions also occurred east of the watershed.

The number of head utilizing the watershed (approximately 200 cattle) remained constant until 1985 when a sheep allotment consisting of 1,200 head was added to the watershed. Use for this allotment was focused primarily around the McCloud River corridor.

Reference conditions for grazing activities in the McCloud River Corridor are similar to those occurring in the Riparian and Streamside Zones landscape component. Current range reports indicate that riparian areas along the river corridor are seldom affected by the sheep allotment. Grazing is not permitted within riparian areas.

Fisheries

Between 1850 and 1890 there was little change in the fisheries and the aquatic habitat of the upper McCloud River. Early white settlers were beginning to inhabit the area, but had little impact on the river. Fishing, grazing, and logging were still small in scope and were associated primarily with homesteading. However, a change was inevitable as the area was prime for timber harvest and the hatchery at Mt. Shasta had been constructed.

The turn of the century brought significant changes to the areas fishery and aquatic habitat. Large scale timber harvest had begun and as land was cleared and forage became abundant, livestock grazing began in earnest. Large fires in 1910 also created new range and provided additional forage. The extent of the effects that timber harvest and grazing had on the watershed in the early 1900s are unknown as records are incomplete. As little thought was given to environmental consequences, the effects most likely were dramatic and would have included such things as loss of vegetative cover, bank trampling, increase sedimentation, loss of shade canopy, channel alterations, loss of aquatic habitat, and reductions in aquatic food production. These impacts on the aquatic system would have resulted in habitat simplification, a reduction in fish populations, and may have helped extirpate some fish species from the upper McCloud River. The effects of grazing on the upper river continued until well after 1945, when livestock numbers declined and new range management programs were implemented. The effects of timber harvest on the aquatic environment continued for some time afterwards.

Fish stocking in the Bartle Watershed began in the early 1900s. The introduction of exotic fish species had a dramatic effect on local native fish populations. Species such as brown trout, brook trout, and rainbow trout were planted in the McCloud River as early as 1914. Stocking of these species in the upper river continued until 1994. Other fish species that were introduced into the watershed, but failed to become established, include grayling in 1910, catfish in 1914, and golden trout in the 1920s. In 1935 trout rearing ponds were constructed in the area of Tate Creek and stocked with 15,000 rainbow trout from the Burney hatchery. The success and duration of these rearing ponds is unknown. The stocking of catchable size hatchery trout in the upper river began in the early 1950s and continued until the practice was stopped in 1994. The construction of the Lakin Dam in 1925 and the McCloud River Dam in 1965 probably had little if any effect on the streams within the analysis area.

The effects of exotic fish introductions and stocking over a 90 year period on the local native fish fauna was dramatic. Competition, predation, and probably diseases have changed the areas

aquatic ecology and are probably the major cause in reductions and extirpation of local native fishes during this time. The introduction of hatchery rainbow trout also resulted in the contamination of the redband gene pool as these two fish readily hybridize. In this situation, the rainbow phenotype has become the dominate form in the upper McCloud River. Relatively pure strains of redband are still present in the headwaters of several tributary streams.

The continued existence of the redband trout is of major concern to several Federal, State, and County agencies as well as to local landowners. In an effort to keep this species from being listed under the Threatened and Endangered Species Act, the redband trout committee was formed and the stocking of hatchery fish was stopped within this watershed as well as other portions of the McCloud River in June of 1994. The redband committee is presently working on a conservation strategy for this species and is evaluating ways to insure this fish's survival.

Species of Concern

Impacts to sensitive species from land-use activities are primarily related to use of the watershed as rangeland. By the late 1800's unregulated livestock grazing was occurring throughout the watershed. Many springs were confined or developed into waterholes. By the 1950's elk had been extirpated and cattle were the main grazer species in the watershed. In 1966 an attempt was made to extirpate beaver because they caused loss of palatable livestock forage and created wet marshlands. No further attempts were made to extirpate beaver after 1966. Impacts to riparian systems from beavers may have lessened or returned to that of prehistoric times. Riparian habitat conditions continued to decline as cattle continued to concentrate in and around springs and meadows. Riparian habitat was grazed severely reducing suitable nesting habitat for many neotropical migratory bird species. Likewise, aquatic amphibians dependant upon emergent vegetation for reproduction and cover were impacted by grazing.

Despite the decline in livestock numbers after 1945, the condition of riparian habitats continued to decline. Springs were developed to provide water to cattle troughs and waterholes. Stream water also was diverted to provide water for fire suppression and human consumption. Sediment from roads impacted spawning gravels and may have affected habitat conditions for aquatic species such as the Pacific giant salamander which requires water with low turbidity levels and clean gravel.

Much of the damage to riparian habitat, meadows, and springs occurred in the early 20th century and it is possible that existing wildlife populations have adapted (western spadefoot toad), maintained 1960s population levels, or may have become locally extirpated. Sightings indicate limited western spadefoot toad and cascade frog populations; other species of concern have not been reported.

Socio-Economic

Pre-European Settlement Conditions

Heritage Resources

There is a high density of prehistoric archaeological sites recorded along the upper McCloud River corridor in the Bartle Watershed. The flat terraces and good fishery made it attractive for early Native American use. Recent excavations and a long term study that has been instituted along the McCloud River suggest that prehistoric peoples inhabited the area from around 5,000 years to 900 years before the present (Sundahl and Cassidy 1995). Bartle Creek was also heavily used by early Native Americans, as determined by the numbers of recorded prehistoric sites, but no archaeological studies have been conducted.

Native American Religious and Ceremonial Sites

Black Fox Mountain is identified by a number of sources as a power place (Olmsted and Stewart 1978, Theodoratus 1984). It was used by members of the Pit River tribe. Its use most likely dates pre-1850 because the Pit River Indians have been in the area for over 3,300 years (Baumhoff and Olmsted 1963).

Historic Conditions

Heritage Resources

There are also historic archaeological sites along the river corridor related to early sawmilling and lumbering. The first known sawmill was set up in 1887 near Bartle on the McCloud River (Sisson Headlight, July 6, 1905). The mill was owned by the Red Cross Lumber Company at Mott, California, and was known as Red Cross Mill No. 2.

Another mill, the Westover Lumber Mill (a recorded site) was in operation by early 1903 at Algoma (Sisson Mirror, April 30, 1903). By 1904 the mill was able to ship lumber on the McCloud River Railroad as the rails reached Algoma at the end of 1904. The sawmill changed ownership in September 1904 and became the Bridgeford-Cunningham company. The mill was destroyed by fire in 1909 and never rebuilt (Sisson Mirror, March 12, 190?).

The McCloud River Lumber Company began building spurs and setting up camps throughout the watershed soon after the railroad was completed through Bartle in 1906.

Native American Religious and Ceremonial Sites

Black Fox Mountain was logged by the McCloud River Lumber Company in the early 1910s, and a lookout was established on it in 1922 (Elliott 1988).

Public Uses

Although there is an increasing population trend in Siskiyou County, there has been a decline in the removal of personal-use firewood. Permits were issued for the removal of approximately

3,300 cords of firewood from the McCloud Ranger District in 1987. By 1994, this volume had dropped to approximately 1,100 cords. In 1994, the process for issuing permits was changed. Instead of each individual Ranger District issuing it's own permits, permits were issued that allowed cutting on any District on the Shasta side of the Forest. This change meant that the volume of firewood removed from individual Districts could no longer be tracked. However, a comparison of the total permits issued on both the Mount Shasta and McCloud Districts seems to verify that the use of firewood in the area is declining.

Factors that have probably contributed to the decline of firewood removal include:

- an increased popularity of alternative heat sources such as pellet stoves and kerosene heaters.
- the exclusion of large tracts of land from firewood cutting due to the designation of Late-Successional Reserves.
- less logging residue available due to fewer timber sales.
- the increased use of chipping during logging has reduced the number of cull decks and slash piles that are available to woodcutters.

Even though woodcutting is declining, lodgepole pine stands in the Dry Lake Basin remain some of the heaviest used woodcutting areas on the Shasta side of the Forest. The conversion of much of this area to ponderosa pine plantations in the last 15 years is reducing the availability of lodgepole pine for firewood.

Outdoor recreation use on National Forests in California increases in response to population pressure. The use of recreation facilities along the McCloud River has been increasing over the years and is expected to increase into the future as population increases.

Chapter 5

Interpretation

The purpose of this chapter is to compare existing, historical, and reference conditions of specific ecosystem elements and to explain significant differences, similarities, or trends and their causes.

Forest Health

Watershed Overview

The most important difference between reference conditions and current conditions as related to forest health has been the change in the fire regime. The trend has been away from the high-frequency, low-intensity fire regime found under Reference Conditions to a low-frequency regime. This shift has had several related effects, including:

- stand densities that are far greater than are found under Reference Conditions.
- an accumulation of woody debris which has created horizontal fuel continuity and the development of vertical fuel ladders, conditions that greatly increase the risk of catastrophic wildfire.
- unnaturally high levels of tree mortality occurring in localized pockets.
- a shift in seral diversity from a mosaic of seral stages that was sustained under reference conditions to a more homogenous pattern.
- a shift in species composition where, under reference conditions, shade intolerant species were sustained in openings created by fire; shade-tolerant, fire-intolerant species have become more dominant.

Timber harvest has been another factor that contrasts the differences between reference conditions and present conditions. Widespread regeneration harvests led to a lack of seral diversity and to higher stand densities typical of second-growth forests.

The following table summarizes the issues addressed under the topic of Forest Health:

Present Condition	Causal Mechanism(s)	Trend
Overstocking/layering	• Fire exclusion	Continued increase in stocking density and mortality.
Hazardous horizontal and vertical fuel profiles	• Fire exclusion • Past harvest	Continued increase in residual fuels that connect to standing vegetation and trees.
Pockets of high mortality	• Drought/insects • Overstocking	General increase in mortality with increase in stocking. Varies in response to climate.
Lack of seral stage diversity	• Past harvest • Fire exclusion	Continued decline.
Shift in species composition	• Fire exclusion	Increase in white fir encroachment. Black oak decline.

Overstocking/Layering

Present Condition:

Much of the watershed reflects problems associated with overstocked stand conditions, including:

- diminished growth rates.
- retarded development of later successional stages.
- increased insect and disease activity.
- vertical fuel profiles that are contributing to the potential for stand replacement fire behavior.

Landscape components currently exhibiting problems associated with overstocked conditions are:

- LC-1. Midslopes and Mountain Tops.
- LC-3. Colluvial Hillslopes and Alluvial Fans.

Landscape components which are less sensitive to periodic drought and can support higher stocking levels are:

- LC-2. Riparian and Streamside Zones.
- LC-6. McCloud River and Floodplain

Causal Mechanism(s):

- Fire exclusion

Trends:

- Stocking density will continue to increase.
- Mortality will generally increase in response to stocking density as well as climatic fluctuations.
- The potential for altered fire behavior and stand replacement wildfire events will increase.

Conclusion:

This watershed is described by a short return, low intensity surface fire regime. Under this regime, fires burned at intervals of 5-30 years and maintained stocking densities at levels that contributed to forest health. The absence of these recurring intervals is a result of fire suppression efforts over the past century. Where low intensity surface fires once non-selectively retarded overstocking, its exclusion has allowed its transition to the current condition.

There is a need in the watershed to reduce stocking density in overstocked stands (especially in LC-1 and LC-3) and to create conditions that will reduce the possibility of fire becoming a stand replacing event.

Reductions in stocking levels will also reduce mortality during drought periods.

Hazardous Horizontal/Vertical Fuel Profiles

Present Condition:

- The fuel profiles within the Bartle Watershed have transitioned to critical hazard conditions.
- Aerial fuels have developed by understory densities that connect surface fuels to overstory tree canopies.
- Surface fuels are increasing, thus producing higher fire intensities which makes the connection to understory aerial fuels.
- The watershed is at moderate to high risk of stand replacement wildfires.

Causal Mechanism(s):

- Past harvest
- Fire exclusion

Trend:

- Residual fuels are expected to increase in the absence of recurring surface fires.
- Harvest practices that include conventionally created slash deposits without removal, will continue to contribute to this trend.
- Stand replacement wildfires will continue to be a threat with vertical fuel ladders that exist in the watershed.

Conclusion:

Fire exclusion has resulted in critical fuel profiles that contribute to stand replacement fires. There is a need to alter this fuel profile within high risk landscape components by:

- reducing surface fuel loads in excess of resource needs that contribute to high intensity fire behavior.
- reducing understory canopy densities that create continuous vertical fuel ladders.

Pockets of High Mortality

Present Condition:

Some of the stands in the watershed exhibit very high levels of tree mortality. Stands with high levels of mortality represent a wildfire hazard.

Causal Mechanism(s):

- Overstocking and excessive competition

Trend:

- Stocking levels on the colluvial hillslopes and alluvial fans can be expected to continue to exhibit excessive levels of tree mortality.
- The effect of overstocking on individual tree vigor is related to climate. In years when moisture is adequate, mortality levels will be lower. In drier years, mortality will increase.

Conclusion:

There is a need in the watershed to maintain stocking and competition at levels that allow stands to withstand drought conditions without excessive mortality, but still provide adequate snags for wildlife needs and future down woody debris. Emphasis should be placed on treating overstocked stands within LC-3, especially stands with a preponderance of white fir.

Lack of Seral Stage Diversity

Present Condition:

- Colluvial hillslopes and alluvial fans (LC-3) are characterized by homogeneous forest age and seral stages.
- While isolated openings from recent clearcuts can be found to represent early seral stages, most other stages in this landscape component are absent.

Causal Mechanism(s):

- Lack of disturbance.
- Past harvest.

Trend:

- Homogeneity of seral types is likely to continue with continued fire suppression and lack of disturbance.
- The recent shift in emphasis from regeneration harvest to thinning means that fewer openings and early seral stage conditions will be provided by timber harvest activities.

Conclusion:

There is a need for both snag and dead & down large wood recruitment, and for the reestablishment of normal disturbance regimes (fire, gaps from falling trees, etc.).

Shift in Species Composition

Present Condition:

- White fir is invading most stands in the watershed.
- Stands are shifting to a higher proportion of white fir with less Douglas-fir and ponderosa pine.
- Black oak is being extirpated.
- Lodgepole pine stands are shifting to white fir stands.

Causal Mechanism(s):

- Fire exclusion

Trend:
In the absence of disturbance:

- the shift will continue toward more white fir in most stands in the watershed.
- black oak will continue to decline.
- lodgepole pine stands will be reduced in area and white fir will develop in the understory.

Conclusion:

There is a need to re-introduce fire as an ecosystem component to maintain seral diversity and promote fire tolerant species in fire dependent fire regimes.

Wildlife Biodiversity

Watershed Overview

Timber harvest and removal of snags and decadent trees has contributed to the decline of old-growth, snag/cavity dependent species, and in some measure has contributed to the decline of riparian and aquatic dependent species via removal of shade and loss of instream large wood. Many of these are TE&S species such as spotted owls, bats, and martens, which are currently at risk of being unable to maintain viable populations within the Bartle Watershed; others are S&M species such as the great gray owl, bats, and neotropical migrant birds. Given implementation of LMP and ROD direction in the future, this situation may stabilize, or even reverse itself.

Fire suppression efforts have been a factor, along with hunting and poaching, in the fluctuation in numbers and the current downward trend of deer populations in the area, and in the decline in numbers of other early-seral and shrub dependent species. The lack of fire may also figure in the decline of S&M plants, lichens, and fungi. Frequent fire will create newly cleared habitat for plant species and early-seral forage for deer, as well as clearing fine woody debris from the forest floor. It should be noted that the increase in dead and down wood on the forest floor is primarily from smaller material, not the large (>24" dbh) woody debris necessary for fisher or black bear. While this increase has caused a rise in the populations of smaller animals - important in themselves as ecosystem components - such as woodrats and mice, the rise is probably temporary, as the risk of catastrophic wildfire in late-seral and old-growth stands has increased.

Road building and the increase in use of forest primary and secondary roads by the public has contributed in some measure to loss of species diversity in the watershed by opening up areas of forest-interior habitat to edge effects (wind, sun, predation, and parasitism) and to disturbance by humans (OHVs, firewood cutting, hunting, poaching). The high (~4 miles/section) road density in the watershed has effectively eliminated forest-interior refugia, causing those species that require moist, shady forest conditions, or that require a lack of anthropogenic disturbance, to decline in numbers either through attrition or through migration. Again, given LMP and ROD direction for management of LSRs, this situation should stabilize as road density is decreased.

The following table summarizes the present wildlife and habitat conditions within the watershed, the reasons for these conditions, and the outlook for the future:

Present Condition	Causal Mechanism(s)	Trend
Decline in late seral forest conditions	• Habitat Fragmentation • Past timber harvest • Fire exclusion • Road Density	Will continue without some intervention; situation should become stable given LMP direction.
Decline in TE&S and S&M species	• Timber harvest • Fire exclusion • Habitat fragmentation due to road construction • Cattle grazing in riparian areas	Will continue without some intervention; situation should become stable given LMP direction.
Decline of snag cavity dependent species	• Timber harvest • Snag removal programs • Short rotation schedules	Expect population recovery given snag/green tree retention.
Decline in deer and other early-seral dependent species	• Fire Exclusion • Poaching • Human disturbance • Brush conversion programs	Continuing decline given no active intervention.
Lack of hardwood and ponderosa pine regeneration	• Fire exclusion	Continuing in the absence of fire.

Decline in Late Seral Forest Conditions

Present Condition:

- Lack of old-growth conditions
- Decline of old-growth and late-seral dependent species

Causal Mechanism(s):

- Past timber harvest
- Fire exclusion
- Habitat fragmentation and disturbance

Trend:

- Current emphasis on thinning encourages the development of stands of larger trees; however, stands that have been intensively managed through thinning tend to lack old-growth components such as snags, large woody debris, and a multiple-canopy forest structure.
- Fragmentation and disturbance due to roads has probably stabilized since the transportation system in the watershed is essentially complete.
- The decline in old-growth and late-seral forest conditions is expected to stabilize or improve as direction in the LMP is implemented.

Conclusion:

The removal of large overstory trees during past timber harvest, in combination with fire exclusion efforts, has resulted in the loss of multiple-canopy forest structure, and in the establishment of dense understories of shrubs and tree seedlings. The forest floor has seen a buildup of fine (<3" dia.) fuels without a corresponding incidence of large (> 15" dia.) woody debris. This buildup of fine debris has probably increased small animal populations at the same time it masks these prey items from late-seral-adapted predators such as spotted owls and goshawks. The lack of large debris has reduced the amount of available habitat for species such as black bear and fisher, which require large woody debris for denning and foraging. There is a need to restore these features in younger developing stands, to accelerate the development of younger stands into larger size classes, and to maintain existing old-growth areas.

Increased road density and use has contributed to habitat fragmentation and disturbance of wildlife. There is a need to reduce human-caused disturbance in stands being managed for old-growth conditions.

The effects of past timber harvest activities should be ameliorated by the establishment of LSRs, and of LMP and ROD direction in Matrix lands. Given proper implementation of these directions, the situation of late-seral and old-growth populations should improve in the near future.

Decline in TE&S and Survey & Manage Species

Present condition:

Decline in TE&S and Survey & Manage species populations

Causal mechanism(s):

- Past timber harvest activities
- Fire exclusion
- Habitat fragmentation due to road construction and logging

Trend:

Populations of TE&S and S&M species are expected to stabilize as management direction in the LMP is implemented.

Conclusion:

Habitat degradation caused by timber harvest activities and exacerbated by the exclusion of fire has caused a decline in the populations of TE&S species within the watershed; it is likely that this decline encompasses S&M species also, though a lack of survey data makes this only supposition. Direction supplied by the LMP and ROD regulating harvest activities and mandating surveys for and protection of sites of TE&S and S&M populations will, when implemented, allow these populations to stabilize and perhaps to increase in number. Fire exclusion is currently being debated, with an increased awareness of both the ecological importance of fire, and of the increasing risk of catastrophic, stand replacing, wildfire as fuels build up within stands. The use of fire in maintaining natural levels of dead & down material, and in maintaining areas of early-seral shrub vegetation would allow for a mosaic of habitat suitable for both TE&S and S&M wildlife and plants.

Habitat fragmentation caused by the proliferation of roads for timber harvest, and for fire suppression and recreational access, will probably continue within Matrix lands, while LSRs may see a decrease in open-road density as roads are obliterated or blockaded.

There is a need to ensure habitat connectivity, particularly by reducing road-caused fragmentation and disturbance.

Decline of Snag Cavity Dependent Species

Present condition:

Decline of snag cavity dependent species populations

Causal mechanism(s):

- Timber harvest
- Past snag removal

Trend:

Populations of snag cavity dependent species can be expected to respond to the availability of snags in the area. Current snag levels are expected to slowly increase due to changes in management practices and to direction provided in the LMP.

Conclusion:

Past timber harvest activities have reduced the number of snags, particularly in the larger (>17"dbh) size classes, available for snag and cavity dependent species. The removal of most of the large overstory trees within the watershed also affects recruitment of future large snags. The effect of the 1995 "salvage" sales is difficult to estimate at this time, but may not be serious. Direction stated in the LMP, when implemented, should stabilize this situation; the possibility of snag creation via silvicultural treatment may make recovery of these populations more rapid than would be the case given natural snag recruitment timetables. There exists a need for preserving existing large snags and ensuring recruitment of replacement snags over time.

Decline in Deer and other Early-Seral Dependent Species

Present condition:

There has been a decline in deer and other early-seral dependent species populations.

Causal mechanism(s):

- Fire exclusion
- Brush conversion programs
- Human disturbance
- Poaching

Trend:

- Large-scale brushfield conversion to plantations is no longer occurring.
- Some older plantations are functioning as early-seral habitat as brush develops in them.
- Existing brushfields are losing their effectiveness as early-seral habitat as shrubs become decadent and conifers and hardwoods begin encroaching on them.

Conclusion:

The decline of local deer and other early-seral dependent populations can be linked to a decrease in the area of early-seral brushfields in the watershed, primarily due to a lack of fire to clear patches of decadent (>20 year old) shrubs. Deer, in particular, require some areas of young shrubs as summer forage, along with areas of older brush as thermal and hiding cover. Given the advent of new fire policies, the restoration of early-seral shrub fields could be quite rapid. Brushfield conversions, while a factor in the loss of some areas of brush, have ceased, and brush now growing in older plantations is providing some cover for deer, rodent, and bird populations, as well as berries for species which utilize them.

Disturbance due to easy vehicle access will continue to be a problem, particularly when roads run too close to, or even through, fawning areas such as meadows. Road closures in LSRs, and possibly in the Matrix areas, will reduce the levels of this disturbance. Poaching, increasing levels of which are also due in part to road density, will also be reduced to some extent by road closures, resulting in a slower rate of attrition for deer and other game species.

There is a need to reestablish periodic fire in shrublands and meadows, and to close roads which traverse meadow areas.

Aquatic Ecosystems

Watershed Overview

Cumulative impacts from land-use activities have interacted with natural processes to degrade riparian habitat in portions of the watershed. The majority of impacts have occurred in and adjacent to streams and lakes in the midslopes and mountain tops, riparian and streamside zones, Dry Lake Basin and the McCloud River and Floodplain landscape components.

The following table identifies areas where current habitat conditions differ significantly from reference conditions. Management recommendations will focus on methods of returning the aquatic environment to conditions similar to historical conditions and desired future conditions as specified in the LMP.

Present Condition	Causal Mechanism(s)	Trend
Degradation of Riparian Meadow/Spring Habitat	• Grazing • Fire suppression • Habitat fragmentation from roads and stream crossings.	Continued decline in areas where cattle are concentrated. Gradual recovery provided LMP guidelines are implemented.
Degradation of In-Stream Habitat	• Grazing • Sediment from roads • Past timber harvest	Gradual decrease in water temperature, increase in large woody debris, bank stabilization over time in southern tributaries. Improvement in northern watershed in areas where cattle are controlled. Slow improvement of fish habitat condition.
Decline in Aquatic Wildlife and Plant Species	• Grazing • Past fish stocking • Habitat fragmentation • Past timber harvest • Water diversion	Varied projections for recovery according to types of species. Continuing decline in willow flycatcher habitat in grazed areas. Reduced competition between redband and non-native fish as stocking has been discontinued.

Degradation of Riparian Meadow Habitat

Present Condition:

Riparian meadow habitat is in a degraded condition throughout the northern half of the watershed. Riparian plant communities have undergone a shift in species composition from grass/forb species to non-palatable exotic weeds. This effect is most pronounced in the Dry Lake Basin where native oat grass and sensitive plants are being replaced by exotic weeds, annual grasses, and other exotic plants. Riparian vegetation such as willow and aspen is suppressed and is not regenerating in the meadows.

Conifer encroachment is occurring in most of the riparian meadows. The invasion of conifer species has resulted in a gradual decrease in the size of riparian meadows, with the possible exception of Dry Lake, which is maintained by periodic floods.

Small riparian areas associated with high water tables and/or springs are in a degraded condition. Groundwater supplies, water table elevations, and surface flowpaths have been altered by land-

use activities. The size of riparian areas associated with springs has been decreasing over the past 100 years. Vegetation in the vicinity of the springs has been trampled. In some cases riparian vegetation adjacent to springs has been completely removed and the bare soils have eroded, locally harming water quality. Water quality has also been impacted by waste from cattle. Cattle waste has the potential to harm deer fawning habitat and infect deer populations with diphtheria, hoof-rot, and Brucellosis. These diseases are readily transferred from one host to another at dug-out ponds.

Causal Mechanism(s):

- Cattle grazing
- Roads
- Off-road vehicle use
- Fire suppression
- Water diversions and spring developments

Trends:

- Riparian habitat will continue to decline in areas grazed by cattle.
- In some cases, meadow habitat has stabilized in a poor condition; but in many areas, riparian conditions continue to decline due to continued conifer encroachment and continued grazing.
- Grazing impacts to isolated riparian areas associated with springs have stabilized in a poor condition.

Conclusion:

Riparian habitat will continue to decline in areas grazed by cattle. Fenced exclosures have not proven to be effective barriers to cattle. In some cases, meadow habitat has stabilized in a poor condition; but, in many areas riparian conditions continue to decline due to continued conifer encroachment and continued grazing. Grazing impacts to isolated riparian areas associated with springs have stabilized in a poor condition. There is a need to modify current grazing management to reduce impacts to riparian habitat and to provide alternative water sources away from riparian areas. There is also a need to stop or reverse conifer encroachment in meadow habitat.

Riparian habitats adjacent to streams in the McCloud River corridor are in good condition. The sheep allotment is widespread and sheep are not concentrated within riparian areas. The sheep grazing system appears to be working well as a tree plantation management system and seems to have no noticeable effect on riparian or upland forage resources.

Degradation of In-Stream Habitat

Present Condition:

The loss and degradation of aquatic habitats within the McCloud headwaters has been significant. Though water quality problems are relatively isolated, much of the fish habitat remains in various degrees of alteration or degradation. Specifically there has been a reduction in the quality and quantity of pools and suitable fish spawning areas, a reduction in the amount of large woody debris, a reduction in the quality of riparian habitat, and a loss of benthic

invertebrate production. These changes in the aquatic environment have resulted in a reduction in local native fish populations.

Water quality has been diminished by erosion, sedimentation, and waste pollution. Fine sediment levels have increased in tributaries to the McCloud River due to an increase in sediment sources. Water temperatures are believed to be slightly higher than historical temperatures in most of the streams in the watershed. Coarse sediments such as gravels are lacking in streams in the southern portion of the watershed. Streambanks in the northern portion of the watershed have been compacted and stream banks are becoming unstable. Some streambanks are actively eroding resulting in increased contributions of fine sediments to streams. Streambank riparian vegetation is largely absent or has been suppressed along streams in the northern watershed.

Causal Mechanism(s):

- timber harvest
- road construction
- grazing

Trend:

- Fish habitat is slowly recovering as those practices that initiated habitat decline are brought into check and mitigation measures are implemented.
- Sources of sediment associated with roads, surface erosion, cut banks, and slides will continue to contribute fine sediments to streams. The contribution of this material will eventually decline as sediment filters, buffers, and catchment basins are restored.
- Spawning habitat and benthic production will improve as sediment sources are brought into balance with stream capacity. Pool habitat and abundance will also improve as sediment sources become stabilized.
- Riparian and streamside vegetation will recover relatively quickly which will help stabilize streambanks and improve cover. Levels of woody debris will continue to decrease but will eventually recover following recovery of the surrounding forest to late seral conditions. Streambanks in the northern meadows should stabilize over time assuming that cattle are excluded from streamside zones.

Conclusion:

Loss and degradation of aquatic habitat in the Bartle Watershed has resulted in the reduction in local native fish populations. Logging, roads and grazing have contributed to increased sediment yields into streams. Past timber harvest has removed thermal cover from streams resulting in higher water temperatures. Cattle have trampled streambanks resulting in bank erosion and channel instability.

There is a need to remove sediment sources from roads, sideslopes and stream banks. Implementation of Standards and Guidelines for Riparian Reserves will provide for recruitment of large woody debris. There is a need to modify current grazing practices to reduce impacts in riparian areas, especially in the northern watershed. Opportunities exist to improve aquatic habitat and stream conditions in the watershed.

There is a need to improve instream habitat to accelerate redband recovery.

Decline in Aquatic Wildlife and Plant Species

Present Condition:

Aquatic dependent wildlife and plant species are not as abundant as they were prior to European settlement. Populations of Trillium (Salmon Mountains Wakerobin) and Calochortus (Long-haired Star Tulip) have been reduced. Aspen and willow have been suppressed or removed from streambanks and wet meadows resulting in a loss of willow-flycatcher, amphibian, and insect habitat. Vegetation removal adjacent to streams has resulted the destruction of riparian habitats needed by trout, frogs, birds, sensitive plants, and most forms of wildlife. Riparian habitats have become fragmented due to cumulative effects of land-use activities.

Redband trout populations have decreased in the McCloud River and its tributaries. Redband trout have been recently classified by the U.S. Fish and Wildlife Service as a candidate species under the Endangered Species Act which indicates that the species may warrant listing under the act. This is due to the possibility of extirpation of this fish as demonstrated by the small overall population numbers and the compromise of the species genetic integrity.

Causal Mechanism(s):

- Timber harvest
- Road construction
- Grazing
- Water diversions
- Fire suppression
- Stocking of non-native fish species

Trend:

Historically most wildlife and plant species have been in a state of continuous decline. Most sensitive plants and wildlife species should recover providing that riparian habitat is managed to provide for these species. Willow flycatcher habitat and populations should recover if grazing is controlled or excluded from riparian areas.

Hatchery fish are no longer stocked in the upper McCloud River and a conservation strategy is being developed for the redband trout. The natural recovery of this species, particularly with respect to genetic dilution, will be very slow. This species is expected to benefit as habitat conditions improve. Eventual recovery is expected particularly in the light of increased management awareness. Steps to increase or improve the recovery rate are available and should be considered.

Currently, federal lands containing redband trout streams (Moosehead Creek) are being considered for exchange. This would result in loss of federal control of redband trout habitat within areas of proposed land exchange.

Conclusion:

Aquatic dependent wildlife and plant species have declined in the watershed. Vegetation has been reduced adjacent to streams and riparian habitats have become fragmented by roads and other land management activities.

Implementation of Standards and Guidelines for Riparian Reserves will allow riparian vegetation to recover. However, there is a need to modify current grazing practices and restore riparian habitat to improve willow flycatch habitat and habitat for sensitive plant species. There is also a need to reduce roads and stream crossings that are fragmenting riparian habitat.

There is a need to inventory for Survey & Manage species and other species of concern.

LMP direction to divest of public lands in the Mushroom Rock area (LMP 4-123) should be reviewed and consideration given to the effects of losing federal control of redband trout habitat in the southern portion of the watershed.

Chapter 6

Recommendations

The purpose of this chapter is to identify those management activities that could correct undesirable conditions identified in Chapter 5 and move the system towards reference conditions or management activities, as appropriate.

The tables on pages 6-2 thru 6-4 bring forward the existing conditions identified in Chapter 5 and recommend various management activities to move towards the desired condition. These management recommendations are then combined, refined, and explained on the pages following these tables.

Recommendations discussed in this chapter include:

- Thinning
- Fuel treatment
- Salvage
- Snag levels
- Road closure
- Grazing management
- Restoration and protection of riparian meadow and spring habitat
- Restoration of redband trout habitat
- Redband trout management
- Surveying and monitoring

Forest Health

Existing Conditions	Recommendation	Rationale / Objective
Overstocked conditions	Thin Underburn	Reduce competition and improve stand health by selectively removing surplus stems. Non-selective thinning of understory
Hazardous fuel profiles	Thin; underburn Treatment of surface fuels, including: • underburning • pile and burn • chip and remove	Reduce understory canopy densities that create continuous vertical fuel ladders. Reduce surface fuel loads in excess of resource needs
Pockets of high mortality	Thin	Reduce competition and improve stand health by selectively removing surplus stems.
Lack of seral stage diversity	Reintroduce fire as an ecosystem component.	Simulate natural disturbance regime to create openings and gaps in stands.
Shift in species composition	Reintroduce fire as a n ecosystem component. Consider species as a selection criteria in thinning.	Stop incursion of white fir; encourage development of oaks. Favor ponderosa pine, sugar pine, hardwoods.

Wildlife Biodiversity

Existing Conditions	Recommendation	Rationale / Objective
Lack of old-growth conditions	Reintroduce fire as an ecosystem component Reduce open road density (with emphasis on LSR) Thin	Protect existing old growth and late-successional stands from stand replacing wildfire. Simulate natural fire regime. Reduce habitat fragmentation and disturbance. Reduce fragmentation. Promote development of existing stands and protect them from stand replacing wildfire.
Decline in TE&S and S&M species	Reintroduce fire as an ecosystem component Reduce open road density (with emphasis on LSR) Thin Follow Standards and Guidelines in LMP Inventory for TE&S, S&M species and other species of concern.	Protect existing old growth and late-successional stands from stand replacing wildfire. Simulate natural fire regime. Reduce habitat fragmentation and disturbance. Reduce fragmentation. Promote development of existing stands and protect them from stand replacing wildfire. Maintain adequate snags and coarse woody debris. Verify occurrence and condition od populations.
Decline in snag cavity dependent species	Follow Standards and Guidelines in LMP	Maintain adequate snags and coarse woody debris and provide for future recruitment.
Decline in deer and other early seral stages dependent species	Reintroduce fire as an ecosystem component. Reduce open road density.	Fire creates and maintains areas of early seral stage. Reduces exposure of deer to poaching.

Aquatic Ecosystems

Existing Conditions	Recommendation	Rationale / Objective
Degradation of riparian meadow habitat.	Control cattle grazing. Reintroduce fire as an ecosystem component. Remove roads in meadows. Restore and protect spring developments. Restore riparian vegetation along Bartle Creek.	Reduce impacts to riparian meadow habitat and allow recovery. Maintain or expand meadow habitat by reducing encroaching young conifers. Reduce habitat fragmentation and reduce wildlife disturbance. Reduce cattle impacts around springs and allow recovery. Improve riparian conditions.
Degradation of in-stream habitat	Control cattle grazing. Reduce road density and maintain roads. Follow Standards and Guidelines in LMP. Identify and implement in-stream habitat improvement projects.	Reduce impacts to in-stream habitat and allow recovery. Reduce sediment sources. Provide for future recruitment of large woody debris. Improve instream habitat conditions.
Decline in aquatic wildlife and plant species	Control cattle grazing. Identify and implement riparian habitat improvement projects. Reduce roads and stream crossings in riparian areas. Inventory for S&M species and other species of concern. Review LMP direction to divest of public lands in the Mushroom Rock area.	Reduce impacts to riparian and aquatic habitat and allow recovery. Improve riparian habitat conditions. Reduce habitat fragmentation and reduce wildlife disturbance. Verify occurrence and condition of populations. Land exchange would mean loss of federal control of redband trout habitat.

1. THINNING

Present Condition:

- Overstocked conditions are retarding the development of forest stands and reducing stand health.
- There has been a shift in species composition from a pine dominated to a white fir dominated forest.
- There has been a decline in old-growth and late-successional conditions.
- There has been a loss of old-growth dependent species.
- There has been a decline in the grass/forb layer on the forest floor.
- Habitat between Lookout Point and Toad Mountain is inadequate for owl dispersal.
- Suitable habitat is below incidental take requirements within the eight owl territories and home ranges (see Table 3-8).

Recommendations:

Late-Successional Reserves & Managed Late-Successional Reserves

within existing late-successional stands

- ❖ focus
  - maintain existing late-successional conditions
  - protect stand from wildfire
- ❖ objectives
  - maintain nesting, roosting, and foraging habitat
  - reduce risk of catastrophic wildfire
  - encourage development of hardwoods
  - encourage development of grass/forb layer
  - maintain forest health while still providing adequate snag levels
- ❖ treatments
  - thin by reducing understory vegetation (fuel ladders).
  - follow snag guidelines described in Section 4 - Snag Levels.

within developing late-successional stands

- ❖ focus
  - accelerate development of late-successional conditions
  - protect the LSR from wildfire by creating a mosaic of developing late-successional stands that have been treated to reduce fuel loads.
- ❖ objectives
  - develop nesting, roosting, and foraging habitat
  - reduce the threat of catastrophic loss of habitat in the LSR by treating selected areas to create a mosaic of stands across the landscape that will be resistant to crown fire.
  - encourage development of hardwoods
  - encourage development of grass/forb layer
  - maintain forest health while still providing adequate snag levels
- ❖ treatment
  - thin from below to reduce understory vegetation (fuel ladders).
  - follow snag guidelines described in Section 4 - Snag Levels.

Matrix

- ❖ focus
  - obtain optimum timber yield consistent with other resource needs.
  - promote healthy forest conditions.
- ❖ objectives
  - encourage optimum timber growth conditions consistent with other resource needs.
  - reduce the risk of catastrophic wildfire.
  - reduce conifer stocking to levels that promote healthy stand conditions.
  - maintain adequate dispersal habitat.
  - encourage development of grass/forb layer.
  - maintain adequate snag levels.
- ❖ treatment
  - thin from below to promote optimum tree growth and to reduce understory vegetation (fuel ladders).
  - Provide for dispersal and connectivity within the Critical Habitat Unit (CHU) by following the "General Strategy" and "Design Principles" described in the document titled "Managing Dispersal and Connectivity on Matrix Lands" (Appendix E).

    This item was inserted on April 22, 1997 following development of a strategy for "Managing Dispersal and Connectivity on Matrix Land". This stategy was developed by the U.S. Forest Service and U.S. Fish & Wildlife Service to implement management direction on land designated as Critical Habitat Unit within the Matrix land allocation. This document has been included in the appendix.
  - activity centers/nest sites
    - Focus on hazard and risk reduction around the home ranges of:
      - northern spotted owl activity centers: #203, 204, 219, 222
      - goshawk nest sites: #223, 220, 210
    - Focus on increasing the amount of suitable habitat within the home ranges of:
      - northern spotted owl activity centers: #209, 217, 224, 225
      - goshawk nest sites: #225
  - follow snag guidelines described in Section 4 - Snag Levels.

Riparian Reserves

- ❖ focus
  - meet Aquatic Conservation Strategy Objectives.
  - reduce potential for damage in event of wildfire.
- ❖ objectives
  - reduce fuel loads within Riparian Reserves
  - maintain a long-term source of large woody debris for streams.
  - maintain conditions favorable to good water quality.
  - open up dense understory vegetation to improve forage, access and travel for wildlife.
  - stop encroachment of young conifers into existing meadow areas.
- ❖ treatments

- apply guidelines for Riparian Reserve widths as listed in the LMP.
- verify Riparian Reserve class on a site-by-site basis during project design.
- apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.
- thin or remove young conifers that are encroaching on existing meadows (also refer to meadow restoration recommendations in Section 7).
- during project design, determine appropriate removal methods on a site-by-site basis. Track-mounted shears are appropriate where they enter and leave the Riparian Reserve without turning and where no significant disturbance occurs to the duff layer. No equipment will be allowed within stream inner gorges.

Rationale/Objectives:

- Trees compete for limited nutrients, moisture and light. In overstocked conditions, trees are stressed and become susceptible to attack by insects and pathogens. Thinning improves tree vigor by reducing competition.
- Overstocked conditions provide vertical fuel ladders and continuous crown canopies which are susceptible to catastrophic crown fires. Thinning reduces understory fuels and increases the spacing between crowns.
- Overstocked conditions encourage the development of shade tolerant species in the understory. This results in a shift of species composition away from pine and towards true fir. Hardwoods decline as dense overstories develop. Thinning opens the crown cover and encourages the development of pines and hardwoods. The thinning operation also provides the opportunity to selectively remove or retain certain species in a stand.
- Growth rates are reduced in trees growing in crowded conditions. Overstocked conditions delay the development of old growth and late-successional conditions in younger stands. Thinning of younger stands accelerates the growth of individual trees and encourages the development of old growth and late-successional conditions.
- Closed canopy conditions inhibit the development of the grass/forb layer. Thinning opens the crown canopy and provides conditions on the forest floor that encourage the development of the grass/forb layer.
- Activity centers and nest sites with a substantial history of occupancy and/or reproduction, and which are within high fire hazard or risk areas, are considered of higher priority than other activity centers or nest sites for stand treatment.
- By increasing the suitable habitat within activity centers and nest sites without a substantial history of occupancy and/or reproduction to a level at least equal to those activity centers which are successful, the potential for the area to provide for the spotted owl will be increased.
- Dispersal habitat is important to wildlife, especially young or migrating animals, allowing safe passage and utilization of otherwise inaccessible habitat.
- There is a need to extend suitable dispersal habitat from Lookout Point to LSR 359 (Harris Mountain), located 2-3 miles northeast of Lookout Point.

2. FUELS TREATMENTS

Present Condition:

- Overstocked conditions have created vertical fuel ladders.
- Unnaturally heavy accumulations of down/dead fuels are occurring.
- The watershed is at a moderate to high risk of stand replacing wildfire.
- Old growth stands are susceptible to catastrophic loss from wildfire.
- There has been a decline in seral stage diversity.
- There has been a shift in species composition towards more shade tolerant species.
- There has been a decline in early seral stages in within the Matrix land allocation.
- Meadow habitat is in a degraded condition due to lack of fire.

The following recommendations apply to the treatment of fuels in the normal forest setting. Additional recommendations are listed on page 6-11 for use in areas of high mortality.

Recommendations:

- Focus fuels reduction primarily in LC-3 (Colluvial Hillslopes and Alluvial Fans) where hazard/risk assessment indicates M/M or above.
- Establish a mosaic of treatment areas with natural fire barriers, plantations, road systems and fire tolerant fuel profiles.
- Underburn:
    - in stands with slopes greater than 35% where mechanical removal of heavy fuels is not viable.
    - in stands with slopes less than 35% where mechanical removal of heavy fuels can be followed by recurring underburning for maintenance.
    - in stands under 40 tons/ac. of residual fuels to reduce fire intensity levels.
    - as an option for reducing fuel loads within Riparian Reserves
    - as an option for reducing encroaching small conifers in meadow areas.
- Mechanical Pile/Burn:
    - in stands with slopes less than 35% and with over 40 tons/ac. residual fuel load.
- Hand Pile/Burn:
    - in stands with slopes greater than 35% where mechanical removal of heavy fuels and underburning is not viable.
    - in roadside corridors within high risk areas.
    - along the scenic byway.
    - during firelane construction on slopes greater than 35% in preparation for underburns.
    - as an option for reducing fuel loads in Riparian Reserves outside of sensitive areas.
    - as an option for reducing encroaching small conifers in meadow areas.
- Chip and Remove:
    - Require whole-tree removal on all thinning harvest activities within hazard/risk areas of M/M or above to reduce the accumulation of fuels.
    - Apply biomass removal to overstocked stands to eliminate fuel ladders that connect residual ground fuels to overstory canopies.

Recommendations for spotted owl activity centers.

Recommendations	Spotted owl activity centers								
	203	204	209	210	217	219	222	224	225
Apply treatments for developing suitable habitat and reducing fire risk around home ranges.	✓			✓		✓			
Apply treatments for risk and hazard reduction around home ranges.		✓					✓		
Apply treatments for habitat enhancement through release of understory. Risk and hazard reduction may be considered, but is a low priority.			✓		✓			✓	✓

Recommendations for goshawk nest sites.

Recommendations	Goshawk nest sites				
	210	211	220	223	225
Apply treatments for developing suitable habitat and reducing fire risk around home ranges.	✓	✓		✓	
Apply treatments for risk and hazard reduction around home ranges.			✓		
Apply treatments for habitat enhancement through release of understory. Risk and hazard reduction may be considered, but is a low priority.					✓

Late-Successional Reserves

- Reducing risk shall focus on, but not be limited to, younger stands.
- Retain logs in advanced state of decay; these will not be counted toward coarse woody debris requirements.
- In areas of high fuel hazard, snag and dead & down management recommendations for Matrix can be utilized as minimums to reduce the fuel hazard to medium to low levels. Afterwhich, snag and dead & down levels would be retained at naturally occurring levels.

Riparian Reserves

- Objective: Maintain or enhance riparian areas, wildlife and fisheries habitat, and water quality.
- Keep felled trees on sites when needed to meet coarse woody debris objectives.
- Allow fuelwood cutting if required to attain Aquatic Conservation Strategy objectives when riparian condition is degraded because of natural disasters.

Matrix Lands

- Manage to provide renewable supply of large down logs to meet the needs of species and provide ecological function (see wildlife requirements below).
    - Rx III:
        - Maintain avg. 10 tons/acre of dead/down material on slopes <40%.
        - Where feasible, apply to slopes >40%.
        - (See small animal and fisher/marten foraging habitat below).
    - Rx VI:

        - Help provide additional habitat for fisher, marten, and goshawk.
        - Maintain/enhance big-game and hunting/fishing opportunities.
        - (See black bear foraging habitat below).
    - Rx VIII:
        - Obtain an optimum timber yield/rotation length (110 yr avg).
        - Maintain average 10 tons dead/down per acre.
        - (See small animal and fisher/marten foraging habitat below).

Wildlife requirements for dead/down wood:

- Small animals - maintain 25% of area as covered to depth of 8" or more with small diameter dead/down.
- Amphibians - maintain largest dead/down in advanced stages of decay (4-5). Preferred, but optional in Matrix lands.
- Fisher/marten foraging habitat - maintain 10 tons/acre (1 ton = 36 cu.ft.); maintain largest diameter and longest pieces of dead/down expected to persist until stand begins producing dead/down again.
- Black bear foraging habitat - maintain 40 tons/acre (e.g. two logs 24" x 80', two logs 20" x 60', etc. (shorter length but more pieces)).
- Black bear/marten/fisher denning habitat - maintain three 30"+ dia. logs or stumps per 17 acres.
- When possible, minimize charring on dead/down >15" dia. logs and snags (see Salvage/Snag Levels) to be maintained for wildlife.

  (Bartels et al. 1985; Bartels, R., J.D. Dell, R. L. Knight, G. Schaefer. 1985. Dead and Down Woody Material. pp 171-186. in Brown, E.R. Tech. Ed. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. Pt.1 - chapter narratives. 332 pp).

<u>Rationale/Objective:</u>

- Emphasis is on LC-3 (Colluvial Hillslopes and Alluvial Fans) because:
    - LC-3 contains the highest residual fuel loads within the watershed.
    - 75% of the historical large fire occurrence is in LC-3
    - 75% of the High Hazard and High Risk areas are in LC-3
- Provide suitable amounts of forage and denning habitat for dead/down dependent species.
- Bring small mammal populations down to, and maintain them at, historic levels.
- Create and maintain browseways and fawning habitat for deer.
- Limiting tree encroachment into meadows and improve cubbing and foraging habitat for black bear.
- Reducing the accumulation of dead vegetation in meadows encourages new growth and limits the intensity of future fires.
- Improve habitat for fire-adapted species such as hardwoods, ponderosa pine, etc.
- Create natural fire regime in late-seral/old-growth/suitable habitat areas by allowing regeneration of historic understory species.

3. SALVAGE

Present Condition:

- Pockets of mortality are occurring in excess of ecosystem needs.
- Pockets of mortality create concentrations of heavy fuel.
- There is a deficit of medium to large snags and dead/down wood.
- The natural recruitment of medium to large snags and dead/down wood in the future is limited.
- There has been a reduction in populations of cavity-dependent wildlife species.
- Actual numbers, sizes, distribution, and wildlife use of snags is unknown.

Recommendations:

LSR & MLSA

- Salvage dead and dying trees within LSRs only where disturbed sites exceed 10 acres and canopy cover has been reduced below 40% (LMP 4-38 #1).
- In areas greater than 10 acres where disease and insect attack have left excessively high fuel loads that pose a threat to other resources, dead trees may be removed provided that snags are left standing in minimum levels recommended for Matrix lands until naturally occurring snag levels for the LSR are determined.
- In salvage areas within LSRs, focus on retaining snags that are likely to persist until late-successional conditions have developed and the new stand is again producing new snags (LMP 4-38 #3).
- Remove snags identified as hazards. This material may need to remain on site if the amount of medium to large down wood is low.

Matrix

- Maintain enough trees so that forest health is not jeopardized, yet the stand still provides forage habitat and storage trees (>11" dbh) for wildlife.
- In Matrix lands, when maintaining snags, include the largest, oldest live trees, decadent or leaning trees, and hard snags occurring in the unit (LMP 4-61 #2).

Riparian Reserves

- In Riparian Reserves, allow salvage if required to attain Aquatic Conservation Strategy objectives (LMP 4-54 1A(1)), and when WA determines that present and future coarse woody debris needs are met.

Rationale/Objectives:

- Accumulations of heavy fuels pose a threat to late-successional stands if wildfire occurs.
- Maintenance of some small snags (11-14" dbh) is important for dead/down recruitment and for providing wildlife habitat, even if in less desired size classes.
- Increase habitat for snag/cavity-dependent species at the 40% population level and 100% population level (for white-headed and black-backed woodpeckers, flammulated owl, and pygmy nuthatch).
- Provide recruitment for medium to large dead/down wood.
- Manage to maintain snags at the levels listed in the table below (see Snag Levels).
- Ascertain distribution and wildlife use of snags to determine watershed condition and how guidelines are being met.

4. SNAG LEVELS

Present Condition:

- There is a deficit of medium to large snags and dead/down wood.
- The natural recruitment of medium to large snags and dead/down wood in the future is limited.

Recommendations:

- Manage to maintain snags and snag recruitment trees at levels listed below.

Matrix

Recommended levels for snags and snag recruitment trees per 100 acres by size class for each landscape component on Matrix land within the Bartle Watershed based on forest snag model.

Landscape Components	Snags		Recruitment Trees	
	17-24" dbh	>24" dbh	17-24" dbh	>24" dbh
1. Midslope and Mountain Tops	250	2	750	6
2. Riparian and Streamside Zones	290	3	870	9
3. Colluvial Hillslopes and Alluvial Fans	400	2	1200	6
4. Dry Lake Basin	200	--	600	--
5. Lava Flows and Terraces	330	--	990	--
6. McCloud River and Floodplain	290	3	870	9

The selection of snag recruitment trees should emphasize the largest trees in forest stands. Large snags are the most difficult to replace and an abundance of large recruitment trees is necessary if snags in the largest size classes are going to be provided in the future. Trees with characteristics such as broken tops, flat tops, cavities, large limbs, and other signs of decadence are favored.

Snag recruitment is not generally a concern in the watershed at this time because stand regeneration is not being emphasized. Criteria for selecting snag recruitment trees should be incorporated into silvicultural prescriptions.

LSR & MLSA

All snags will be left standing within LSRs and MLSAs unless they are a hazard or pose a threat to other resources. The emphasis on management for late-successional conditions is expected to provide for adequate snag recruitment trees for the future.

In areas where disease and insect attack have left excessively high fuel loads that pose a threat to other resources, dead trees may be removed provided that snags are left standing in levels recommended for Matrix lands.

5. ROAD CLOSURE

Present Condition:

- Poaching and other human disturbance have been identified as a factor in the decline of deer herds.
- Roads contribute to a decline in old growth/late-successional conditions by fragmentation and disturbance.
- Roads degrade meadow habitat.
- For sedimentation condition, see Redband Trout section.

Recommendations:

- Consider closing the following roads:
  - 40N02Y Sec. 6, T40N, R2E
  - 41N48 Sec. 13, T41N, R1E
  - 41N39 Sec. 7-8-17, T41N, R2E
  - 40N06 Sec. 23-24, T40N, R1E
  - 39N92 Sec. 12-13, T39N, R1E
  - 39N94 Sec. 20-30, T39N, R2E
- Consider obliterating the following roads:
  - 40N31 in the west half of Section 14 and east of 40N31D where the road goes down a creek bed.
  - 41N89 west of 41N89A.
  - 41N89A obliterate those portions that will not disturb archaeology site.
  - 40N05 obliterate and remove stream crossing.
  - 40N83 obliterate road sections on each side of Bartle Creek to isolate the section that crosses the riparian area.
- Barricade roads that are not used on a routine basis but will be needed for management activities in the next 15 years.
- Obliterate roads that are not expected to be needed in the next 15 years - especially in Late-Successional Reserves.
- In Late-Successional Reserves, apply measures to reestablish vegetation on obliterated roads.

Rationale/Objectives:

- It is less expensive to obliterate roads that will have little use over the next 15 years and replace them later than to provide regular maintenance.
- Roads occupy over two acres of land per mile that can be returned to a vegetated condition which can provide habitat for wildlife.
- Roads through meadows can alter the movement of groundwater, cause fragmentation of meadow habitat, and inhibit the development of vegetation by compacting the soil.
- With reforestation of roads, interior forests will be protected and the historic conditions can be restored
- Allow deer and other wildlife species to utilize more of the habitat found next to roads and often preferred by foraging species
- Increase dispersal of wildlife through reforestation or limited road use.

6. GRAZING MANAGEMENT

Present Condition:

- There is a lack of hardwood and riparian vegetation regeneration.
- Riparian meadow and spring habitats are in a degraded condition.
- Habitat has declined for willow flycatcher and other riparian dependent species (amphibian, NTMBs, etc.).
- Cattle compete for forage with deer and other game animals.
- There is a potential spread of disease to deer populations by cattle at waterholes.
- Archaeological sites have been degraded in areas of concentrated cattle use.

Recommendations:

- Set opening dates for cattle allotments to later in the season (August 1).
- Modify grazing permits to regulate livestock numbers.
- Develop a grazing management system that will protect sensitive plant species in Dry Lake, Stillwater Meadows and other areas.
- Consider sheep as a livestock management option.
- Maintain and expand existing willow exclosures along Bartle Creek.
- Protect springs by fencing out cattle. It is recognized that extensive fencing is difficult and expensive to maintain due to snow damage and falling trees and limbs. Fencing around springs is recommended for small areas (1/10 - 1/4 acre) of high sensitivity where fences can be maintained on an annual basis.
- Provide alternative water sources (ponds, troughs, etc.) with hauled water to be placed outside of riparian areas.

Rationale/Objectives:

- Implementing LMP and ROD Standards and Guidelines and Supplemental Management Direction for Management Areas 2 and 10 will mitigate most resource problems associated with grazing in riparian areas.
- Allow hardwoods to regenerate to natural levels.
- Restoration of riparian meadow habitats will benefit sensitive plant and wildlife species and improve water quality (i.e., willow flycatcher, Columbia cress).
- Restoration of small spring-fed riparian habitats will benefit plant and wildlife species and restore the natural groundwater flow regime.
- Protect those areas preferred for birthing and raising of large game animals.
- Provide a riparian forage base for large game animals (deer).
- Hoofrot has been a problem associated with mud in waterholes. General riparian protection to avoid concentration and trampling will reduce incidence of the disease among cattle and avoid the spread of the disease to the deer herd.

7. RESTORATION AND PROTECTION OF RIPARIAN MEADOW AND SPRING HABITATS

Present Condition:

- Spring habitat has been degraded.
- Archaeological sites associated with springs have been degraded.
- Some waterholes predispose livestock and deer to disease from overuse by cattle.
- Meadow habitat is in a degraded condition due to lack of fire.

Recommendations:

- Consider the construction of spring exclosures at locations to be identified in future NEPA analysis.
- Review the condition of the following spring developments and maintain, improve or restore to a natural condition on a case by case basis:
    - all Belnap Springs
    - Red Tank Spring
    - Buck Mountain Spring
    - Hideout Spring
    - other locations that may be identified in future NEPA analysis.
- Control cattle grazing season of use and numbers to prevent trampling and contamination.
- Use prescribed burning or hand piling to reclaim meadow habitat that has been lost to encroaching small conifers.

Rationale/Objectives:

- Restoration of small spring-fed riparian habitats will benefit sensitive plant and wildlife species and restore the natural groundwater flow regime.

8. RESTORATION OF REDBAND TROUT HABITATS

Present Conditions:

- Redband trout habitat has been degraded.

Recommendations:

- Restore in-stream habitat with emphasis on southern tributaries to the McCloud River.
    - Improve pool habitat.
    - Improve spawning habitat.
    - Remove sources of fine sediment from roads, sideslopes and streambanks.
    - Improve riparian vegetative condition along stream courses.
- Provide for recruitment of large woody debris.
- Continue development and implement redband conservation strategy.
- Investigate acquisition of private land in drainages with redband trout streams (see recommendations on following page).

Rationale/Objectives:

- The improvement of pool habitat, spawning habitat, food producing areas and an increase in the amount of large woody debris is needed to restore proper aquatic/riparian ecosystem function and to enhance redband trout habitat.

9. REDBAND TROUT MANAGEMENT

Present Condition:

- Supplemental management direction for Management Area 10 (LMP pg. 4-123 #6) includes the direction to "Divest of public lands in the Mushroom Rock area".
- Supplemental management direction for Management Area 2 (LMP pg. 4-81 #8) includes the direction to pursue acquisition of private lands along redband trout streams - including Sheepheaven Creek.

Recommendations:

- The direction in the LMP to divest of public lands in the Mushroom Rock area should be reviewed due to conflicts with the preservation of redband trout habitat in Tate, Bull, Dry and Moosehead Creeks.
- Investigate the possibility of acquiring Sec. 11, T40N, R1E as recommended in supplemental management direction for Management Area 2 (LMP pg. 4-81 #8).

Rationale/Objectives:

- The Forest Service is recommending measures to restore redband trout habitat in Management Area 10. This appears to be in conflict with existing direction to divest of public lands in the area. Effective management of redband trout habitat may favor consolidation of ownership in drainages that contain redband trout streams. This recommendation may affect restoration recommendations for streams in the Mushroom Rock area.
- Acquisition of Sec. 11, T40N, R1E would improve the effectiveness of managing redband trout habitat by consolidating ownership in the Sheepheaven Creek drainage.

10. SURVEYING AND MONITORING

Great Gray Owl

Determine suitability of Big Sand Flat, Dry Lake, and other designated meadows for great gray owl. Once suitability has been determined, survey for nest locations using the established protocol. Protect all discovered sites as per LMP S&Gs. Begin surveys in May 1996.

Columbia Cress

A need has been identified to survey for Columbia cress in Dry Lake. Vehicle use in Dry Lake may be impacting Columbia cress but there is insufficient data to determine if disturbance to the plant is actually occurring.

Grazing Impacts

Monitor vegetation damage and recovery to determine the needed extent of protection of riparian areas.

Dead/Down Wood

Determine "naturally" occurring levels for snags and dead/down material, using the best representatives of "natural" systems at each seral stage and habitat type. Conduct snag and down log surveys within entire watershed with emphasis on project areas. Repeat surveys at two year intervals to ensure that management requirements and S&Gs are being met.

Hardwoods

Monitor hardwood regeneration in treated areas and riparian habitat to determine the effects of management recommendations.

Riparian Habitat

Conduct vegetative and wildlife surveys in sensitive riparian areas to ensure aquatic conservation strategy objectives are being met and enclosures are effective.

Deer

Conduct cooperative efforts with California Department of Fish & Game to determine population status and effectiveness of road closures.

Spotted Owls and Goshawks

Continue and expand current monitoring of existing nests, with emphasis on those known to be historically active, to:

- Monitor response to habitat management and project implementation.
- Enable expedient projects through previous knowledge of nest sites.
- Determine status of local population, habitat use, and conditions of nest groves.
- Maintain and expand knowledge of the condition and function of the LSRs.

Furbearers

Determine presence of fisher in the watershed, particularly in LC-1 and LC-3, and the population and habitat trends of marten in a minimum of 10% of the watershed. To remove the uncertainty of fisher occurring within the watershed, monitor effectiveness of dead/down wood and late-seral management.

Appendix

Table of Contents

Bartle Watershed Analysis
Possible Management Practices

	WA Recommendation	Possible Management Practice	Required Documentation	Linkages	Scheduling
1.	Thin/Reduce Down Fuels outside LSR & MLSAs	Timber Sale(s) plus Fuel Treatment	EA	Suggest separate Eas for #1 & 2 due to different issues; but treatments in #1 & 2 could be combined or mixed after Eas to create more logical projects on the ground.	NEPA 6/97; implement 3/98
2.	Thin/Reduce Down Fuels within LSR & MLSAs	Timber Sale(s) plus Fuel Treatment	EA; LSRA	" "	NEPA 6/97; implement 3/98
3.	Reintroduce fire as an ecosystem component	Prescribed Underburning	EA/CE; LSRA	Possible link to #1 & 2 thru KV	
4.	Salvage Dead & Dying Trees	Timber Sales(s)	EA/CE; LSRA		
5.	Road Projects a. closures and obliteration	Gates, barriers, obliteration.	EA/CE; exempt (LSRA)	Possible link to #1 & 2 thru KV	
6.	Stream Improvement Projects a. restore pools	Remove cobbles; add logs and boulders.	EA; exempt (LSRA)	Similar actions - #6, 8, 9; possible link to #1 & 2 thru KV	
7.	Modify Grazing Management	Grazing Allotment Plans	EA; LSRA		
8.	Limit conifer encroachment in meadows	Prescribed burning	CE; exempt LSRA	Similar actions - #6, 8, 9; possible link to #1 & 2 thru KV	
9.	Protect aquatic/riparian habitat.	Fencing, water troughs.	CE; exempt (LSRA)	Similar actions - #6, 8, 9; possible link to #1 & 2 thru KV	
10.	Review Land Exchange Policy	Administrative decision.	EA; (LSRA)	(none identified)	

EA – Environmental Assessment required
CE – Categorical Exclusion is probably adequate
EA/CE – Scope of the project will determine which documentation is appropriate.
LSRA – LSR Assessment required with REO review (applies only to projects within LSR or MLSAs).
exempt (LSRA) – LSR Assessement required but exempt from REO review (applies only to activities within LSR or MLSAs)

Proposed Projects

Project: Timber Sale (outside LSR and MLSAs)

Main Activities:

- thinning
- slash treatment (piling and burning, biomass removal, etc.)

Related Activities:

- road closures and obliteration that fall within project boundary.
- stream improvement activities that fall within project boundary.

This project has been proposed as a separate project from the timber sale within the LSR (next page) due to differences in issues and required documentation. However, after completion of all required environmental documentation, treatment units from these two projects could be combined or mixed to create more logical projects and contract packages.

Required Documentation: EA; BE

Scheduling:

NEPA should be done in FY 1997. Implementation would occur in FY 1998.

Funding:

Thinning, slash treatments, road maintenance would all be covered by the timber sale. Any road construction or reconstruction would be covered by purchaser credit. Road closures and obliteration, wildlife projects, and any stream improvement projects that occur within or adjacent to the timber sale could be covered by KV funding.

LMP Consistency: All activities in this project would be consistent with LMP direction.

Proposed Projects

Project: Timber Sale (within LSR and MLSAs)

Main Activities:

- thinning
- slash treatment (piling and burning, biomass removal, etc.)

Related Activities:

- road closures and obliteration that fall within project boundary.
- stream improvement activities that fall within project boundary.

This project has been proposed as a separate project from the timber sale outside the LSR (previous page) due to differences in issues and required documentation. However, after completion of all required environmental documentation, treatment units from these two projects could be combined or mixed to create more logical projects and contract packages.

Required Documentation: EA; BE; LSR Assessment (REO review required).

Scheduling:

NEPA should be done in FY 1997 to be covered by as LSRA. Implementation would occur in FY 1999.

Funding:

Thinning, slash treatments, road maintenance would all be covered by the timber sale. Any road construction or reconstruction would be covered by purchaser credit. Road closures and obliteration, wildlife projects, and any stream improvement projects that occur within or adjacent to the timber sale could be covered by KV funding.

LMP Consistency: All activities in this project would be consistent with LMP direction.

Proposed Projects

Project: Prescribed Underburning

Main Activities:

This project would apply prescribed underburning to areas outside harvest units to reduce ground fuels and understory vegetation and to create and maintain areas of early seral stage.

Related Activities: none

Required Documentation: EA/CE; LSR Assessment (exempt from REO review) if within LSR.

Scheduling: FY 1998.

Funding:

Projects that occur within or adjacent to timber sale could be covered by KV funding; otherwise, funding would come from PF2 funding allocated for prescribed natural fire.

LMP Consistency: This project would be consistent with LMP direction.

Proposed Projects

Project: Salvage Timber Sale

Main Activities:

Salvage dead and dying timber surplus to other resource needs.

Related Activities:

Typically none; however, road closures and minor habitat improvement projects could be implemented through KV funding.

Required Documentation: EA/CE; LSR Assessment if within LSR (REO review required).

Scheduling: This would be a recurring activity depending on yearly levels of tree mortality.

Funding:

Salvage, slash treatments, road maintenance would be covered by the timber sale. Road closures and obliteration, wildlife projects, and other habitat improvement projects that occur within or adjacent to the timber sale could be covered by KV funding.

LMP Consistency: All activities in this project would be consistent with LMP direction.

Proposed Projects

Project: Watershed Improvement Projects

Main Activities:

This proposal would include all watershed improvement projects that would not be implemented during timber sales or supported by KV funds generated by timber sales. It includes:

- correcting road problems that contribute fine sediments to streams
- road closures and obliteration
- restore pools
- fence sensitive riparian areas (springs, etc.) that are being impacted by cattle
- install water sources for cattle away from riparian areas
- apply prescribed fire to meadows to limit conifer encroachment

Related Activities: none

Required Documentation: CE; LSR Assessment (exempt from REO review) if within LSR.

Scheduling: projects could be implemented as funding is available

Funding:

This group includes those projects that would not be covered by KV funding from timber sales. Projects would be funded with appropriated money.

LMP Consistency: These projects would be consistent with LMP direction.

Proposed Projects

Project: Revise Grazing Allotment Plans

Main Activities:

Current grazing plans will be revised to incorporate recommendations for protecting riparian habitat, sensitive plant species, and other resource values.

Related Activities: none

Required Documentation: EA; LSR Assessment if within LSR

Scheduling: currently scheduled for FY 1999

Funding: allocated money

LMP Consistency: The revised plan would be consistent with LMP direction.

Proposed Projects

Project: Review Land Exchange Policy

Main Activities:

This activity would involve an administrative decision on whether or not to consider a possible change to the LMP. Current direction in the LMP encourages divesting of public land in the Mushroom Rock area. This direction could result in loss of federal control of redband trout habitat in Moosehead Creek and other streams in the area.

Related Activities: none

Required Documentation:

none unless a decision is made to further evaluate this recommendation.

Scheduling: unknown

Funding: unknown

LMP Consistency: This action could result in an amendment to the LMP

Appendix B
Management Direction

Management direction for the Bartle Watershed is provided by the Shasta-Trinity National Forests Land and Resource Management Plan (LMP) which incorporates direction from the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.

Land Allocation

The ROD identifies four land allocations within the Bartle analysis area (see Map B-1):

- Late-Successional Reserve (LSR)

  Late-Successional Reserves are identified with an objective to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest related species including the northern spotted owl. Limited stand management is permitted, subject to review by the Regional Ecosystem Office (ROD A-4).
- Managed Late-Successional Area (MSLA)

  Managed Late-Successional Areas are similar to LSRs but are identified for certain owl locations in the dryer provinces where regular and frequent fire is a natural part of the ecosystem. Certain silvicultural treatments and fire hazard reduction treatments are allowed to help prevent complete stand destruction from large catastrophic events such as high intensity, high severity fires; or disease or insect epidemics (ROD A-4).
- Riparian Reserve (RR)

  Riparian Reserves provide an area along streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving, for example, as dispersal habitat for certain terrestrial species (ROD A-5).
- Matrix

  The matrix consists of those federal lands outside the three categories of designated areas listed above (ROD A-5).

Management Prescriptions

Management Prescriptions apply a management theme to specific types of land. Within the general framework of the Forest Standards and Guidelines, they identify specific activities that are to be emphasized or permitted on that land and their associated standards and guidelines.

The LMP identifies six Management Prescriptions in the Bartle analysis area (see Map B-2):

- III Roaded Recreation
  - The purpose of this prescription is to provide for an area where there are moderate evidences of the sights and sounds of humans (LMP 4-64).
  - This prescription emphasizes recreational opportunities associated with developed road systems and dispersed and developed campsites (LMP 4-64).
  - This prescription applies to the Matrix land allocation.

- VI Wildlife Habitat Management
    - The primary purpose of this prescription is to maintain and enhance big game, small game, upland bird game and non-game habitat (LMP 4-66).
    - While this prescription does not emphasize those wildlife species dependent on late seral stages, habitat favorable to these species will occur within this prescription (LMP 4-66).
    - This prescription applies to the Matrix land allocation.
- VII LSRs and Threatened, Endangered, and Selected Sensitive Species
    - The purpose of this prescription is to provide special management for LSRs and Threatened and Endangered species (LMP 4-43).
    - This prescription emphasizes retention and enhancement of sensitive plant species, old-growth vegetation, and hardwoods (LMP 4-43).
    - This prescription applies to the Late-Successional Reserve and Managed Late-Successional Area land allocations in the ROD.
- VIII Commercial Wood Products Emphasis
    - The purpose of this prescription is to obtain optimum timber yield of woof fiber products from productive forest lands within the context of ecosystem management (LMP 4-67).
    - Timber stands will be managed to obtain optimum growth and yields using cultural practices which control competing vegetation, obtain stocking control, and minimize mortality (LMP 4-67).
    - This prescription applies to the Matrix land allocation.
- IX Riparian Management
    - The purpose of this prescription is to maintain or enhance riparian areas, wildlife and fisheries habitat, and water quality by emphasizing streamside and wetland management (LMP 4-59).
    - Multiple resource uses and activities will occur in support of, and to the extent that they do not adversely affect the maintenance of riparian area dependent resources (e.g., fish, wildlife, water quality) (LMP 4-59).
    - This prescription applies to the Riparian Reserve land allocation and is unmapped in the LMP.
- XI Heritage Resource Management
    - The primary theme of this prescription is to protect designated cultural resource values, interpret significant archaeological and historical values for the public, and encourage scientific research of these selected properties (LMP 4-50).
    - This area is unmapped and applies to all land allocations.

Management Areas

Supplemental management direction for specific units of land is provided in the LMP under Management Area Direction (LMP - Chapter 4 - Section G). A management area is a contiguous unit of land with separate, distinct management direction in response to localized issues and resource opportunities.

The LMP identifies three Management Areas in the Bartle analysis area (see Map B-2). Supplemental management direction that applies to the Bartle Watershed is summarized as follows:

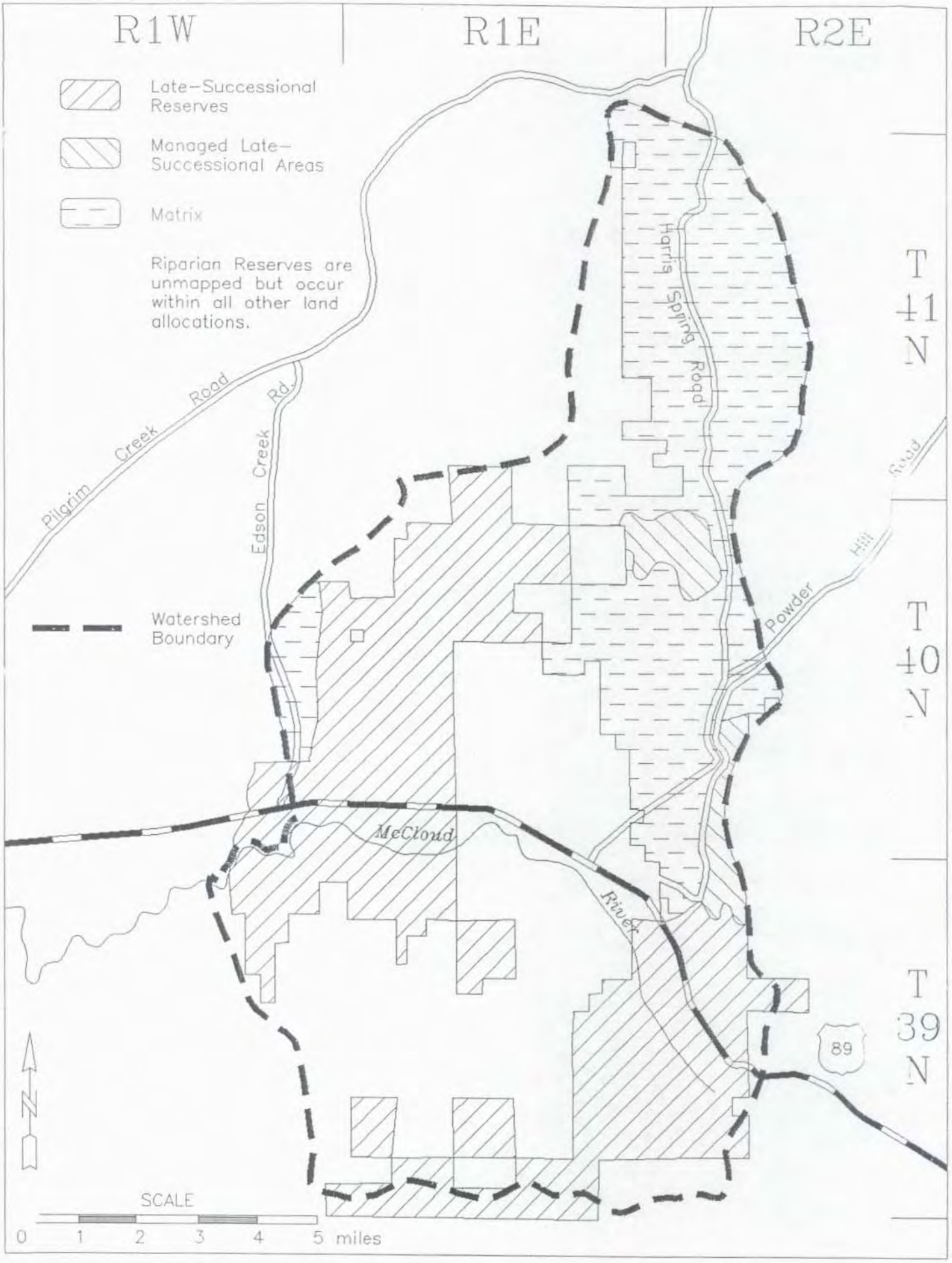
- Porcupine Butte (#1) (LMP - 4-77)
  - Interpret archaeological sites in areas of high visitor use.
  - Manage for bitterbrush in selected areas mapped as Prescription VI.
  - Allow fire to play its natural role through natural ignitions.
  - Maintain the existing and planned fuelbreak system to a level which will result in wildfires generally not exceeding 40 acres in size.
  - Manage for old-growth pine stands along the Modoc Scenic Byway.
  - Locate, develop, and maintain water sources.
  - Emphasize seasonal vehicle closures for wildlife management in the East McCloud Road Management Area. Reduce road density and rejuvenate browse species to enhance big game species habitat.
  - Develop forest stands that are resistant to epidemic insect or disease attack.
  - Maintain and enhance a sustainable level of wood fiber production.
  - Consider and evaluate regulation of tentatively suitable land presently allocated to withdrawn or reserved areas.
  - Evaluate opportunities to enhance elk populations and habitat.
  - Emphasize management of hardwoods including aspen as a stand component where they exist.

- McCloud Flats (#2) (LMP - 4-81)
  - Survey for additional populations of long-haired star tulip, Salmon Mountains wake robin, and Columbia cress. Pending completion of conservation strategies, identify key habitat for the three plants and manage these areas for maintenance or enhancement of the species.
  - Implement a thematic study of the archaeological sites representing the McCloud River Lumber Company operations.
  - Conduct an evaluation program at archaeological sites in heavily used dispersed recreation areas. If sites are eligible for the National Register, carry out protection measures such as fencing and public education.
  - Manage the non-timbered portions of Big Sand Flat primarily for earlier seral stage vegetation.
  - Manage for bitterbrush in selected areas mapped as Prescription VI.
  - Protect and enhance redband trout habitat in Sheepheaven Creek. Pursue acquisition of private lands along this stream.
  - Regulate the collection of edible mushrooms to a level compatible with sustaining viable populations.
  - Maintain Big Sand Flat in its current condition pending evaluation of its suitability as a Special Interest Area.
  - Develop forest stands that are resistant to epidemic insect or disease attack.
  - Maintain and enhance a sustainable level of wood fiber production.
  - Consider and evaluate regulation of tentatively suitable land presently allocated to withdrawn or reserved areas.

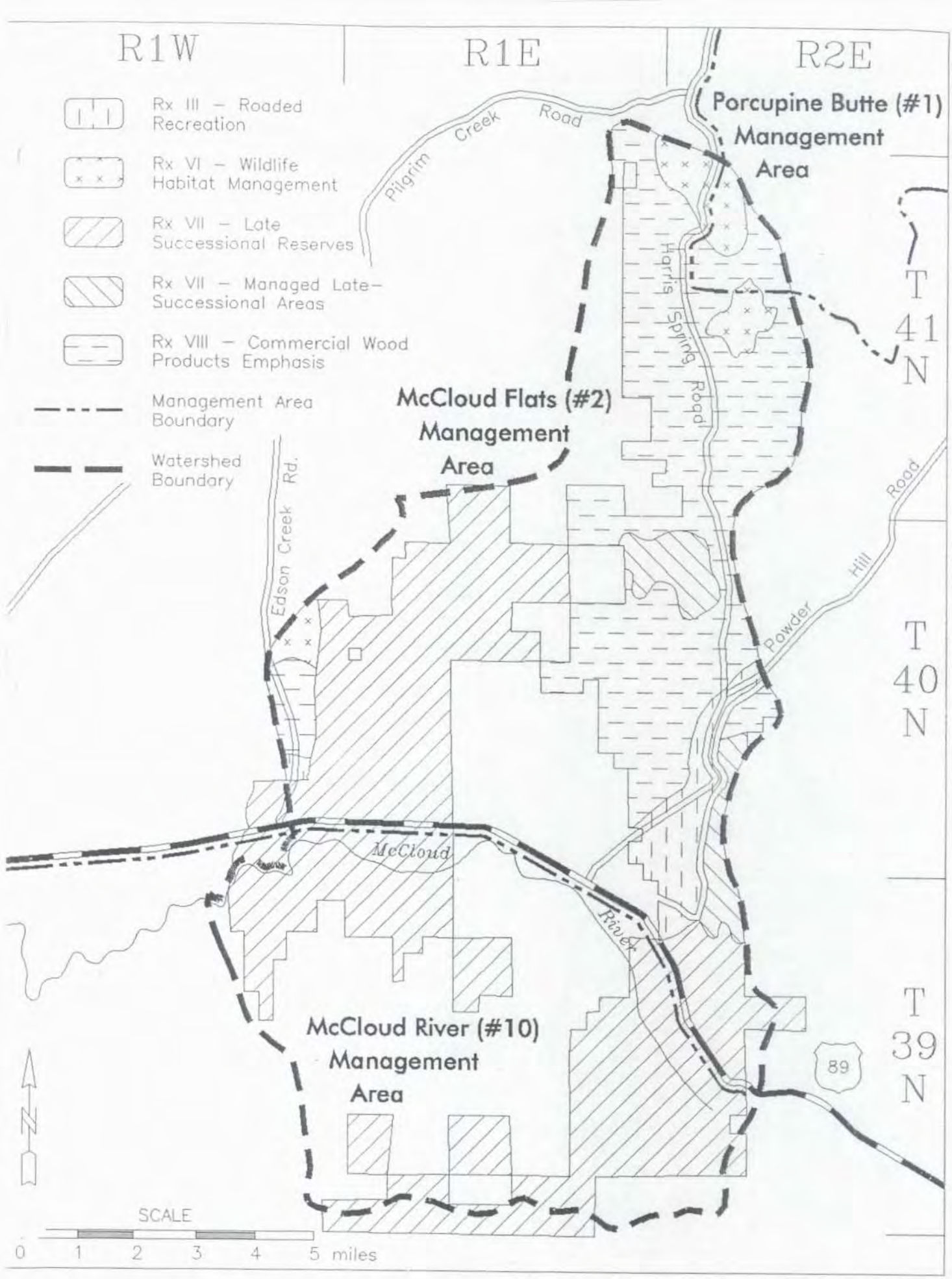
- Locate, develop, and maintain water sources.
- Evaluate opportunities to enhance elk habitat management.
- Consider expanding the East McCloud Road Management Area to emphasize seasonal vehicular closures for wildlife management. Reduce road density and rejuvenate browse species to enhance big game species habitat.
- Emphasize management of hardwoods including aspen as a stand component where they exist.

- McCloud River (#10) (LMP - 4-123)
  - Conduct a thematic study of the archaeological sites representing the Native American uses of the McCloud River. Emphasize sites that are being disturbed by dispersed recreation activities such as Four Mile Flat.
  - Interpret archaeological sites along the McCloud River in areas where visitors are already being directed.
  - Emphasize fuel management strategies that will reduce risk and hazard from wildfires adjacent to the California-Oregon Transmission Project (COPT) powerline corridor.
  - To enhance forest health, develop a natural fire program to reinstate fire into the ecosystem.
  - Divest of public lands in the Mushroom Rock area.
  - Where the opportunity arises, acquire public access along the McCloud River.
  - Continue to develop trail access to and along the McCloud River.
  - Complete the implementation of the Upper McCloud Management Plan.
  - Maintain or improve selected habitats for black bear, spotted owls, deer, elk, and turkey.

The above Supplemental Management Direction consists only of those excerpts from the LMP that apply to the Bartle Watershed. Refer to the LMP (Chapter 4 - Section G) for a complete list of supplemental management direction.



Map B-1. Land Allocation



Map B-2. Management Areas and Prescriptions

Appendix C
Species List

List of Wildlife Species Possibly Occurring in the Bartle Watershed.
Species Listed by Guild Association.

HABITAT TYPES

- MCN Mixed Conifer
- PPN Ponderosa Pine
- EPN Eastside Ponderosa Pine
- LPN Lodgepole Pine
- BBR Bitterbrush
- MRI Montane Riparian
- RIV Riverine

GUILD(S)

- AQFA Fast water required, usually indicating streams or river
- AQSL Areas of slow water required, either lacustrine or riverine habitat
- AQUAT Can use either fast or slow water components
- C/C Cliffs and caves
- CHAP Chaparral communities
- DEAD/D Dead and down material (logs, stumps, slash, litter, duff)
- HDWD Hardwoods
- LATE Late seral stages (4a, 4b, 4c) and multi-layered
- OPEN Meadows, open areas, seral stages 1, 2, and 3a
- OPEN-GRASS Seral stage 1; mutually exclusive from OPEN-SHRUB
- OPEN-SHRUB All forested habitat types; openings, seral stages 2 and 3a
- RIPAR Associated with riparian vegetation
- SNAGCAV Tree cavity dependent species found in snags or live trees
- T/R Talus and rocks

WHRI Wildlife Habitat Relationship ID code

STATUS

- S&M Survey and Management species listed in Appendix R of the Shasta-Trinity LMP, 1995
- CSC CDF 'Species of Special Concern' (Special 8/94)
- CaE California State-listed Endangered (TES&P 1/95)
- CaT California State-listed Threatened (TES&P 1/95)
- FS Forest Service Sensitive (TES&P Animals of the Pacific Southwest Region 1/95)
- FT Federally Listed Threatened (Endangered and Threatened Animals of Calif. 1/95)
- FE Federally Listed Endangered (Endangered and Threatened Animals of Calif. 1/95)

NT Neotropical Migratory Birds

Wildlife Species Possibly Occurring in the Bartle Watershed
and Associated with Habitat Types MCN, PPN, LPN, EPN, BBR, MRI, and RIV.
Canopy Closure 0-100% and Seral Stage seedling to mature (<1" to 24" DBH)

GUILD(S)	WHRI	COMMON NAME	STATUS	NT
AQFA	A004	PACIFIC GIANT SALAMANDER		
	A026	TAILED FROG	CSC	
	B373	AMERICAN DIPPER		
AQSL	A003	LONG-TOED SALAMANDER		
	A006	ROUGH-SKINNED NEWT		
	A028	WESTERN SPADEFOOT TOAD	CSC	
	A032	WESTERN TOAD		
	A039	PACIFIC TREEFROG		
	A042	CASCADES FROG	CSC	
	A046	BULLFROG		
	B006	PIED-BILLED GREBE		
	B051	GREAT BLUE HERON		
	B067	TUNDRA SWAN		
	B079	MALLARD		
	B149	AMERICAN COOT		
	R004	NORTHWESTERN POND TURTLE	CSC, FS	
AQUAT	B105	COMMON MERGANSER		
	B170	SPOTTED SANDPIPER		
	B293	BELTED KINGFISHER		✓
	B343	CLIFF SWALLOW		✓
	M112	BEAVER		
	M163	RIVER OTTER		
C/C	B108	TURKEY VULTURE		✓
	B126	GOLDEN EAGLE	CSC	✓
	B129	PEREGRINE FALCON	FE, CaE	✓
	B131	PRAIRIE FALCON	CSC	✓
	B343	CLIFF SWALLOW		✓
	B344	BARN SWALLOW		✓
	M021	LITTLE BROWN MYOTIS		
	M023	YUMA MYOTIS		
	M025	LONG-EARED MYOTIS	S&M	
	M026	FRINGED MYOTIS	S&M	
	M027	LONG-LEGGED MYOTIS	S&M	
	M028	CALIFORNIA MYOTIS	CSC	
	M032	BIG BROWN BAT		
	M037	TOWNSEND'S BIG-EARED BAT	CSC	
	M038	PALLID BAT	CSC, S&M	
CHAP	B319	GRAY FLYCATCHER		✓
	B404	WATER PIPIT		✓
	B482	GREEN-TAILED TOWHEE		✓
	M038	PALLID BAT	CSC, S&M	
	M088	GREAT BASIN POCKET MOUSE		
	M119	BRUSH MOUSE		
	M149	GRAY FOX		
	M181	MULE DEER		
	R023	SAGEBRUSH LIZARD		
	R054	STRIPED WHIPSNAKE		
DEAD/D	A003	LONG-TOED SALAMANDER		
	A004	PACIFIC GIANT SALAMANDER		

	A012	ENSATINA		
	M117	DEER MOUSE		
	M151	BLACK BEAR		
	M154	AMERICAN MARTEN	CSC, FS	
	M155	PACIFIC FISHER	CSC, FS	
	M157	LONG-TAILED WEASEL		
	R046	RUBBER BOA		
	R058	COMMON KINGSNAKE		
	R059	CALIFORNIA MOUNTAIN KINGSNAKE		
HDWD	B116	COOPER'S HAWK	CSC	✓
	B251	BAND-TAILED PIGEON		✓
	B296	ACORN WOODPECKER		
	B303	DOWNY WOODPECKER		
	B362	WHITE-BREASTED NUTHATCH		
	B418	WARBLING VIREO		✓
	M077	WESTERN GRAY SQUIRREL		
LATE	B051	GREAT BLUE HERON		
	B117	NORTHERN GOSHAWK	CSC, FS	✓
	B134	BLUE GROUSE		
	B270	NORTHERN SPOTTED OWL	FT	
	B304	HAIRY WOODPECKER		
	B305	WHITE-HEADED WOODPECKER		
	B306	BLACK-BACKED WOODPECKER		
	B308	PILEATED WOODPECKER		
	B309	OLIVE-SIDED FLYCATCHER		✓
	B317	HAMMONDS' FLYCATCHER		✓
	B345	GRAY JAY		
	B346	STELLER'S JAY		
	B356	MOUNTAIN CHICKADEE		
	B357	CHESTNUT-BACKED CHICKADEE		
	B361	RED-BREASTED NUTHATCH		
	B363	PYGMY NUTHATCH		
	B364	BROWN CREEPER		✓
	B375	GOLDEN-CROWNED KINGLET		✓
	B390	VARIED THRUSH		✓
	B415	SOLITARY VIREO		✓
	B438	HERMIT WARBLER		✓
	B539	RED CROSSBILL		
	B546	EVENING GROSBEAK		
	M012	TROWBRIDGE'S SHREW		
	M030	SILVER-HAIRED BAT	S&M	
	M034	HOARY BAT		
	M079	DOUGLAS' SQUIRREL		
	M080	NORTHERN FLYING SQUIRREL		
	M129	WESTERN RED-BACKED VOLE		
	M151	BLACK BEAR		
	M154	AMERICAN MARTEN	CSC, FS	
	M155	PACIFIC FISHER	CSC, FS	
	M159	WOLVERINE	CaT	
OPEN	A028	WESTERN SPADEFOOT TOAD		
	B108	TURKEY VULTURE		✓
	B126	GOLDEN EAGLE	CSC	✓
	B140	CALIFORNIA QUAIL	CSC	
	B141	MOUNTAIN QUAIL		
	B264	WESTERN SCREECH OWL		
	B265	GREAT HORNED OWL		
	B276	COMMON NIGHTHAWK		✓
	B277	COMMON POORWILL		✓
	B281	VAUX'S SWIFT	CSC	✓

	B289	CALLIOPE HUMMINGBIRD		✓
	B349	PINYON JAY		✓
	B350	CLARK'S NUTCRACKER		
	B351	BLACK-BILLED MAGPIE		
	B354	COMMON RAVEN		
	B366	ROCK WREN		✓
	B380	WESTERN BLUEBIRD		✓
	B489	CHIPPING SPARROW		✓
	B494	VESPER SPARROW		✓
	B505	SONG SPARROW		✓
	B512	DARK-EYED JUNCO		✓
	B524	BREWER'S BLACKBIRD		✓
	B542	PINE SISKIN		✓
	B543	LESSER GOLDFINCH		✓
	M021	LITTLE BROWN MYOTIS		
	M025	LONG-EARED MYOTIS	S&M	
	M026	FRINGED MYOTIS	S&M	
	M028	CALIFORNIA MYOTIS	CSC	
	M032	BIG BROWN BAT		
	M049	SNOWSHOE HARE	CSC	
	M051	BLACK-TAILED HARE		
	M145	PORCUPINE		
	M146	COYOTE		
	M147	RED FOX		
	M151	BLACK BEAR		
	M156	ERMINE		
	M162	STRIPED SKUNK		
	M165	MOUNTAIN LION		
	M166	BOBCAT		
	M181	MULE DEER		
	R004	NORTHWESTERN POND TURTLE		
	R022	WESTERN FENCE LIZARD		
	R042	NORTHERN ALLIGATOR LIZARD		
OPEN-GRASS	B123	RED-TAILED HAWK		✓
	B124	FERRUGINOUS HAWK		✓
	B125	SWAINSON'S HAWK		✓
	B127	AMERICAN KESTREL		✓
	B131	PRAIRIE FALCON	CSC	✓
	B158	KILLDEER		✓
	B262	COMMON BARN OWL		
	B333	WESTERN KINGBIRD		✓
	B344	BARN SWALLOW		✓
	B389	AMERICAN ROBIN		✓
	B404	WATER PIPIT		✓
	B411	EUROPEAN STARLING		
	B537	CASSIN'S FINCH		✓
	M018	BROAD-FOOTED MOLE		
	M070	BELDING'S GROUND SQUIRREL		
	M072	CALIFORNIA GROUND SQUIRREL		
	M084	WESTERN POCKET GOPHER		
	M113	WESTERN HARVEST MOUSE		
	M133	MONTANE VOLE		
	M136	LONG-TAILED VOLE		
	M160	BADGER		
	R036	WESTERN SKINK		
	R051	RACER		
	R057	GOPHER SNAKE		
OPEN-SHRUB	B287	ANNA'S HUMMINGBIRD		✓
	B318	DUSKY FLYCATCHER		✓

	B360	BUSHTIT		
	B376	RUBY-CROWNED KINGLET		✓
	B382	TOWNSEND'S SOLITAIRE		✓
	B407	CEDAR WAXWING		✓
	B426	NASHVILLE WARBLER		✓
	B435	YELLOW-RUMPED WARBLER		✓
	B436	BLACK-THROATED GRAY WARBLER		✓
	B471	WESTERN TANAGER		✓
	B477	LAZULI BUNTING		✓
	B483	RUFOUS-SIDED TOWHEE		✓
	B504	FOX SPARROW		✓
	B510	WHITE-CROWNED SPARROW		✓
	B536	PURPLE FINCH		✓
	M055	YELLOW-PINE CHIPMUNK		
	M057	ALLEN'S CHIPMUNK		
	M075	GOLDEN-MANTLED GROUND SQUIRREL		
	M152	RINGTAIL		
	M161	WESTERN SPOTTED SKUNK		
	R039	WESTERN WHIPTAIL		
	R040	SOUTHERN ALLIGATOR LIZARD		
RIPAR	A026	TAILED FROG		
	A039	PACIFIC TREEFROG		
	B115	SHARP-SHINNED HAWK	CSC	✓
	B129	PEREGRINE FALCON	FE, CaE	✓
	B293	BELTED KINGFISHER		✓
	B299	RED-BREASTED SAPSUCKER		✓
	B311	WESTERN WOOD-PEWEE		✓
	B315	WILLOW FLYCATCHER	FS, CaE	✓
	B338	PURPLE MARTIN	CSC	✓
	B339	TREE SWALLOW		✓
	B340	VIOLET-GREEN SWALLOW		✓
	B369	HOUSE WREN		✓
	B370	WINTER WREN		
	B385	SWAINSON'S THRUSH		✓
	B386	HERMIT THRUSH		✓
	B430	YELLOW WARBLER		✓
	B460	MACGILLIVRAY'S WARBLER		✓
	B461	COMMON YELLOWTHROAT		
	B475	BLACK-HEADED GROSBEAK		✓
	B506	LINCOLN'S SPARROW		✓
	B528	BROWN-HEADED COWBIRD		✓
	M003	VAGRANT SHREW		
	M010	WATER SHREW		
	M052	MOUNTAIN BEAVER		
	M112	BEAVER		
	M153	RACCOON		
	M158	MINK		
	M163	RIVER OTTER		
	R061	COMMON GARTER SNAKE		
	R062	WESTERN TERRESTRIAL GARTER SNAKE		
	R063	WESTERN AQUATIC GARTER SNAKE		
SNAGCAV	B105	COMMON MERGANSER		
	B127	AMERICAN KESTREL		✓
	B263	FLAMMULATED OWL		✓
	B264	WESTERN SCREECH OWL		
	B267	NORTHERN PYGMY OWL		
	B270	NORTHERN SPOTTED OWL	FT	
	B274	NORTHERN SAW-WHET OWL		
	B281	VAUX'S SWIFT	CSC	✓

	B294	LEWIS' WOODPECKER		✓
	B296	ACORN WOODPECKER		
	B299	RED-BREASTED SAPSUCKER		✓
	B300	WILLIAMSON'S SAPSUCKER		✓
	B303	DOWNY WOODPECKER		
	B304	HAIRY WOODPECKER		
	B305	WHITE-HEADED WOODPECKER		
	B306	BLACK-BACKED WOODPECKER		
	B307	NORTHERN FLICKER		✓
	B308	PILEATED WOODPECKER		
	B338	PURPLE MARTIN	CSC	✓
	B339	TREE SWALLOW		✓
	B340	VIOLET-GREEN SWALLOW		✓
	B356	MOUNTAIN CHICKADEE		
	B357	CHESTNUT-BACKED CHICKADEE		
	B361	RED-BREASTED NUTHATCH		
	B362	WHITE-BREASTED NUTHATCH		
	B363	PYGMY NUTHATCH		
	B380	WESTERN BLUEBIRD		
	B381	MOUNTAIN BLUEBIRD		✓
	B411	EUROPEAN STARLING		
	M077	WESTERN GRAY SQUIRREL		
	M079	DOUGLAS' SQUIRREL		
	M080	NORTHERN FLYING SQUIRREL		
	M155	PACIFIC FISHER	CSC, FS	
T/R	B366	ROCK WREN		✓
	B367	CANYON WREN		
	M043	PIKA		
	M066	YELLOW-BELLIED MARMOT		
	R076	WESTERN RATTLESNAKE		

Appendix D

Vascular Plant Species of Concern

The following is additional information provided by the team botanist that was not included in the watershed analysis document. It consists mostly of plant and habitat descriptions.

The following is a listing of the TE&S and the Survey & Manage vascular plant species known or suspected to occur within the Bartle watershed.

Threatened and Endangered:
No vascular plant species listed as threatened or endangered have been reported as occurring in the Bartle watershed.

Sensitive species:
Salmon Mountains Wakerobin (Trillium ovatum ssp oettingeri), a perennial member of the family Liliaceae, is widespread within the watershed, occurring in shaded areas near springs, seeps, and along streams. The species is restricted to shaded, moist areas in conifer woodlands. Herbaceous associates may include stream violets, Calochortus, and Mimulus. The species is sensitive to disturbance, requiring 5-7 years of growth before flowering; thus, picking the flower will result in several years of non-reproduction. Populations surveyed in the Stillwater Meadows area and near Slagger Springs have suffered considerable damage from livestock.

Long-haired Star Tulip (Calochortus longebarbatus var longebarbatus) is another perennial lily, reaching 12 to 18 inches in height. Small bulblets appear near the base of the stem, just above ground. These bulblets are capable of generating new plants, but such clonal reproduction forces a lack of genetic variability on an isolated population. Grazing by cattle or sheep will prevent formation of, or destroy, seed heads, making clonal growth a "fall-back" position for this plant. Star-tulip has been reported in the Red Tank Springs area of the Bartle watershed. The wet meadow habitat for this species occurs in several other areas of the watershed; these meadows are currently being impacted by livestock use. This species is listed as "rare" by the California Native Plant Society.

Howell's Lewisia (Lewisia cotyledon howellii), a perennial member of the Portulacaceae, is a 3 to 12 inch tall plant, with several stems rising from a basal rosette of 2 to 6 inch spatulate leaves. The species is sensitive to disturbance, but its preferred habitat -- in clefts in vertical rock faces -- tends to protect it from most herbivore predators. This flower has not been reported as occurring in the watershed, but the rock outcrop-canyon wall habitat for this species is fairly widespread along the McCloud River.

Columbia Cress (Rorippa columbiae), a perennial member of the family Brassicaceae, is a low-growing, often prostrate plant found in and around vernal pools, seasonal lakebeds, and wet meadows. The species is known to occur in the seasonal lakebed at Dry Lake. This species is being impacted under current grazing practices, and is listed as "rare" by the CNPS.

Rough Raillardella (Raillardella scabrida), a perennial aster, has not been reported in the Bartle watershed. Suitable dry, open ridge habitat may exist, but would need to be surveyed for.

Survey and Manage species:

Sugarstick (Allotropa virgata), of the Ericaceae family, is a perennial saprophyte. It has a fleshy white stem with vertical red stripes, no leaves, and is non-photosynthesizing. Sugarstick is found in low or high elevation conifer forests -- mixed conifer, red fir, or mountain hemlock -- generally in areas of deep forest duff. Dry soils and abundant coarse woody debris are normal habitat components. This species is one which may be suffering from fire suppression efforts: the frequent low-intensity burns of the pre-suppression era would have made new habitat continually available. This species is currently not recorded as occurring in the Bartle watershed area.

Dwarf mistletoe (Arceuthobium tsugense), a member of the Viscaceae family, is a parasite on hemlock and western white pine. It causes abnormal branching ("witches brooms") in host trees, and is regarded as a major pathogen of timber. Currently there is no information as to its presence within the Bartle watershed.

Clustered lady's slipper (Cypripedium fasciculatum), a perennial orchid, is an old-growth associate found in open, moist coniferous forests on a variety of soil types at elvations ranging from 300 to 6,000 ft. Ranging from the northern Sierras to British Columbia, Colorado, and Montana, this species is declining in population. All of the populations of this species found on the Shasta-Trinity National Forests occur along streams, making disturbance by grazing livestock a major problem.

Mountain lady's slipper (C. montanum), a close relative of the clustered lady's slipper, is associated with moist areas in mixed conifer or evergreen forests. Ranging from the central Sierra Nevada to Alaska, this species is also thought to be declining. As with C. fasciculatum, shady, moist areas are required for successful growth. Seed set is low, and many years of rhizome growth are necessary to store up energy for reproduction. Habitat degradation and grazing by livestock can seriously impact both of these orchids.

Mingan moonwort (Botrychium minganense), a perennial fern of the family Ophioglossaceae, is a rare resident of streamside coniferous forests. Western goblin (B. montanum) is another moonwort associated with shady coniferous forests. Listed as "rare" by the CNPS, neither of these species have been recorded in the Bartle watershed.

A summary of known occurrences of TE&S and Survey & Manage species within the applicable landscape components (LC) of the watershed follows:

LC-2. Riparian and Streamside Zones:

Trillium ovatum oettingeri is widespread within the drainage, with populations along the McCloud River and its tributaries, Bartle Creek, Sheepheaven Butte, Red Tank Springs, and near Slagger Camp.

Rorippa columbiae occurs in the watershed only on the shores of Dry Lake.

Habitat for both of these plant species is being heavily impacted by grazing.

LC-4. Dry Lake Basin

See Riparian and Streamside Zones for Rorippa columbiae at Dry Lake.

LC-6. McCloud River and Floodplain:

See Riparian and Streamside Zones for Trillium ovatum oettingeri.

No information is available at this time concerning TE&S or Survey & Manage non-vascular plants or fungi within the Bartle watershed, but suitable habitat does exist.

April 22, 1997

Managing Dispersal and Connectivity on Matrix Land

Shasta-McCloud Management Unit
Shasta-Trinity National Forests

On March 6, 1997, planning team members from the Shasta-McCloud Management Unit (SMMU), the Shasta-Trinity National Forest Supervisor's Office, and the U.S. Fish and Wildlife Service met to develop a strategy for implementing management direction for dispersal and connectivity on Matrix land. The purpose of this meeting was to pursue resolution of issues related to the dual purposes of critical habitat of the northern spotted owl in Matrix lands and the emphasis on commercial wood products in the Matrix.

Although this analysis focused primarily on the spotted owl, it provides dynamic linkages for other species as well as preserving native diversity.

General Strategy

The strategy developed at this meeting was to identify general linkages for spotted owls based on:

- existing habitat conditions
- the potential for areas to support desirable habitat conditions
- topographic barriers
- the location of known activity centers
- land ownership patterns

At the project design stage, the project planning team will identify forest stands that will provide connectivity along these linkages. These stands will be reevaluated in the future with each new entry and adjustments made as younger stands develop. The arrangement of forest stands providing connectivity will change over time and all stands will eventually be available for harvest at some time in the future.

Linkages were not confined to Critical Habitat Units (CHU). They were also drawn to provide linkage to adjacent Late-Successional Reserves (LSRs) outside the CHU. Although the strategy described in this narrative applies only to CHU lands, project teams should consider opportunities to provide connectivity on non-CHU Matrix land based on information in this report.

Linkages

Linkages were established at the March 6 meeting and identify general patterns across the landscape based on the factors listed above under ``General Strategy''. The term ``linkages'' was deliberately used (rather than ``corridors'') to avoid any implication that final location and widths had been set at the meeting. Linkages may range from indistinct and separate islands of like habitat in a naturally fragmented landscape, to distinct corridors where available dispersal habitat is already at minimal width. It is intended that the final design will occur at the project design stage.

Linkages are dynamic on the landscape. The location, configuration, extent, degree of continuity and relative value of these linkages will change over time with seral stage development, natural disturbance, and management activities. This allows a certain responsiveness to changing conditions that should provide better, higher quality habitat in the Matrix while not significantly impacting forest health or harvesting. Initial actions must work with the existing stands and established timber program, but over time, management will help to determine, in the context of natural disturbances, the location and quality of these linkages. Linkages are not a land allocation; they are a dynamic and functional component of the management program of the landscape.

Connectivity

Connectivity identifies those forest stands that will provide dispersal habitat conditions along linkages. Only a portion of forest stands along linkages provide connectivity of dispersal habitat at any time. Connectivity will shift over time as younger stands develop. Although continuity is important for the functionality of linkages, it is not absolute. Fragmented islands of like habitat may also provide some linkage value, depending on the separation and the organism, but may increase the likelihood of predation during dispersal. It is the project team's task to design their project to minimize the fragmentation produced by these projects through timing, scale, scope and design of the project.

Mapping

Linkages were roughly identified and agreed to at the March 6 meeting. These locations were later refined by SMMU planners and biologists based on aerial photography and vegetation information. Linkages were then digitized and mapped on a clear overlay and are available from Jonna Cooper at the McCloud Ranger Station.

Design Principles

The following design principles were generated in order to better maintain and develop, through normal timber management practices, connectivity between designated LSRs. The principles help identify opportunities in the matrix to improve habitat conditions through silvicultural practices. Linkages between core reserves serve as habitat for foraging and breeding, routes for seasonal movements, natal dispersal and habitat shifts due to disturbance. These linkages function at all scales and must be recognized as being dynamic on the landscape. These design principles, when integrated into project designs, should help improve the overall capability of these areas to maintain links between core reserves.

Design Principles:

1. **Forest stands identified for providing connectivity are not permanent.**
   Forest stands identified to provide connectivity at any planning cycle are not to be considered as permanent land allocations. Linkages and connectivity will be reevaluated at each planning period and redesigned as other younger stands develop optimum conditions for dispersal habitat. Stands designated for providing connectivity will be regarded as deferred treatments and available for harvest following Matrix guidelines at a future entry. Land allocations and management prescriptions in the Forest Plan will not be modified.

2. **Widths of linkages are not fixed.**
   No widths have been established along linkages. The overall width at any point will be determined during project design based on habitat conditions. For example, linkages in areas of highly fragmented dispersal habitat may need to be wider than in areas of continuous habitat.
3. **Connectivity along linkages is more important than width.**
   The continuity and quality of connectivity along linkages may need to be increased to compensate for minimal widths resulting from existing habitat conditions, topographic features, or land ownership patterns,.
4. **Achieve the greatest connectivity over time given the condition of forest stands.**
   There may be times when it is advantageous to reduce connectivity over one period in order to increase it over a longer period later in the rotations.
5. **Crown canopy is dependent on site capabilities.**
   Lava rims and soils with low water holding capacity occur throughout the McCloud Flats. These areas are often not capable of supporting stands with high crown canopies. Project design must recognize the limited capability of some areas to provide optimum dispersal habitat. Linkage width can be adjusted to compensate for site capability.
6. **Linkage design should consider other management needs and objectives.**
   Other management needs and objectives need to be considered in the selection and treatment of stands identified for providing connectivity. Such considerations include fuel loads, fuel arrangement, and forest health.
7. **Treatment may still occur in stands identified for connectivity.**
   Stands identified for providing connectivity are still available for treatments consistent with conditions for dispersal habitat. Treatments in these stands would be designed to provide conditions for dispersal habitat while still benefiting timber growth, forest health, and fuel loading.

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ABBREVIATIONS

ac.	acres
CFS	cubic feet per second
dbh	diameter at breast height
EA	Environmental Assessment
est.	estimate
LMP	Land and Resource Management Plan (Shasta-Trinity National Forests)
LSR	Late Successional Reserve
n/a	not applicable
NR	nesting and roosting (habitat)
ROD	Record of Decision (from "Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl")
S&M	Survey and Manage
TES	Threatened, Endangered, and Sensitive
WIN	Watershed Improvement Needs (inventory)

GLOSSARY

Abiotic - The non-living material components of the environment such as air, rocks, soil, plant litter, and water.

Accelerated Erosion and Sediment Yield - The increase in erosion and sediment yield above natural levels as caused by human activities.

Aggradation - The up building performed by a stream in order to establish or maintain uniformity of grade or slope.

Alluvial - Deposited by a stream or running water.

Aquatic Ecosystem - A water based ecosystem (see ecosystem). An interacting system of water with aquatic organisms (plants and animals).

Anadromous - Fish that swim from the ocean up streams to spawn.

Beneficial Uses - The range of items directly associated with the flow and distribution of water through a watershed. The uses of the waters of the state that may be protected against quality degradation, including but not necessarily limited to domestic, municipal, agricultural, and industrial supply; power generation; recreation; esthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources of preserves.

Benthic - aquatic related.

Best Management Practice (BMP) - A practice or a combination of practices, that is determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Biodiversity - see Biological Diversity

Biological Diversity - The variety of life and its processes, including the variety in genes, species, ecosystems, and the ecological processes that connect everything in ecosystems.

Biomass - The total mass (weight, volume) of living organisms in a biological system. The above-ground portions of shrubs and trees, excluding material that meets commercial sawlog specifications.

Biome - A major portion of the living environment of a particular region characterized by its distinctive vegetation and maintained by local conditions of climate.

Bioregion - A system of related, interconnected ecosystems.

Biota - All the species of plants and animals occurring within an area or region.

Biotic - All the plants and animals and their life processes within the planning area.

Biotic Community - Any assemblage of populations living in a prescribed area or physical habitat: an aggregate of organisms which form a distinct ecological unit.

Candidate Species - A species of plant or animal being considered for listing as a federally endangered or threatened species.

Canopy - The more or less continuous cover of leaves and branches collectively formed by the crowns of adjacent trees in a stand or forest.

Canopy Closure - The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy as openings in the branches and crowns must be accounted for.

Catastrophic event - A large-scale, high-intensity natural disturbance that occurs infrequently.

Cemented (embedded) - Under general stream dynamics, fine sediment gets trapped in the interstitial spaces between rocks, especially on spawning sites or riffles. Natural, seasonal flushing flows cleanse trapped fines from the riffle areas allowing little

accumulation. However, either a natural or man-made event may add such an excessive amount of fine sediment that natural flows cannot flush the fines from the riffles. Overtime the riffles "harden" or become cemented thereby making them unsuitable for spawning.

Channel (streamcourse) - An open outlet either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. River, creek, run, branch, anabranch, and tributary are some of the terms used to describe natural channels. Natural channels may be single or braided.

Climax Community - The final or stable biotic community in a successional series which is self-perpetuating and in dynamic equilibrium with the physical habitat.

Colluvium - Any loose and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of gentle slopes or hillsides.

Community - An aggregation of living organisms having mutual relationships among themselves and to their environment.

Corridor - Route that permits the movement of species from one Ecoregion, Province, landscape or ecosystem to another.

Corridor, Landscape - The landscape elements that connect similar patches through a dissimilar matrix or aggregation of patches.

Crown - The upper part of a tree or other woody plant carrying the main branch system and foliage above a more or less clean stem.

Crown diameter - The diameter of a tree's crown.

Crown Scarp - The outward-facing scarp, bordering the upper portion of a landslide.

Cubic feet per second - the amount of water, in cubic feet, passing a given spot in a stream each second.

Cumulative Effects Analysis - An analysis of the effects on the environment which results from the incremental impact of a proposed action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency or person undertakes such other actions.

Cumulative Watershed Analysis - An analysis of Cumulative Watershed Effects, described below.

Cumulative Watershed Effects - Impacts occurring away from the site of primary development which are transmitted through the fluvial system. The impacts occur through both increases in peak stream flows and through increased sediment levels. The effects generally are concentrated within stream channels which can lead to bank undercutting, channel aggradation, degradation and inner gorge mass wasting.

Debris Torrents - A mass wasting process which results from a debris slide or avalanche entering and flowing down a steep gradient stream channel. As the mass entrains more water, it scours and transports large quantities of organic material and sediment. This material is generally deposited as the channel gradient decreased or a significant obstruction is met. Torrents generally contribute to secondary mass wasting along the margins of the scoured channel.

Debris Slide/Avalanche - A mass wasting process characterized by a relatively shallow failure plane, which generally corresponds to the soil/bedrock interface. The distinction between an avalanche and a slide is that a slide moves slower, and retains more of a coherent slide mass. An avalanche generally fails rapidly, with the slide mass disaggregating, and sometimes flowing, depending on the water content.

Decadence - exhibition of symptoms of decline or decay of overall health or vigor.

Desired Future Condition - Objectives for physical and biological conditions within the watershed. They may be expressed in terms of current conditions, ecosystem potential, or social expectations. They describe the conditions that are to be achieved and are phrased in the present tense.

Diorite - A plutonic rock intermediate in composition between acidic and basic.

Dispersal Habitat - habitat that supports the life needs of an individual animal during dispersal. Generally satisfies needs for foraging, roosting, and protection from predators.

Disturbance - A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

Diversity - The distribution and abundance of plant and animal species and communities in an area.

Dormant Mass Wasting Feature - A landform which can be defined as originating through mass wasting. There are different degrees of dormancy, from a feature which has been active less than 50 years ago, to one which has been dormant for over one thousand years.

Drainage Area - The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is enclosed by a drainage divide.

Ecological Unit - A mapped landscape unit designed to meet management objectives, comprised of one or more ecological types.

Ecological Classification - A multi-factor approach to categorizing and delineating, at different levels of resolution, areas of land and water having similar characteristic combinations of the physical environment (such as climate, geomorphic processes, geology, soil, and hydrologic function), biological communities (such as plants, animals, microorganisms, and potential natural communities), and the human dimension (such as social, economic, cultural, and infrastructure).

Ecological Processes - see Ecosystem Functions

Ecology - The science of the interrelationships between organisms and their environments.

Ecoregion - A continuous geographic area in which the environmental complex, produced by climate, topography, and soil, is sufficiently uniform to develop characteristics of potential major vegetation communities.

Ecosystem - The complex of a community of organisms and its environment functioning as an ecological unit in nature.

Ecosystem Functions - The major processes of ecosystems that regulate or influence the structure, composition and pattern. These include nutrient cycles, energy flows, trophic levels (food chains), diversity patterns in time/space development and evolution, cybernetics (control), hydrologic cycles and weathering processes.

Ecosystem Processes - see Ecosystem Functions

Ecosystem Management - Using an ecological approach to achieve the multiple-use management of national forests and grasslands by blending the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems. The careful and skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity and desired conditions, uses, products, values, and services over the long-term.

Ecosystem Sustainability - The ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Ecotone - A transition between two or more biotic communities.

Ecotype - A locally adapted population of a species which has a distinctive limit of tolerance to environmental factors: a genetically uniform population of a species resulting from natural selection by the special conditions of a particular habitat.

Edaphic - Resulting from or influenced by factors inherent in the soil or other substrate.

Endangered Species - A species which is in danger of extinction.

Endemic - Restricted to a specified region, locality, or attribute of the environment.

Environment - The complex of climatic, soil and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival.

Environmental Change - A shift in the rate or timing of a physical process or a shift in state of physical or biotic character.

Erosion - The group of processes whereby earthy or rock material is worn away, loosened or dissolved and removed from any part of the earth's surface. It includes the processes of weathering, solution, corrosion, and transportation. Erosion is often classified by: the eroding agent (wind, water, wave, or raindrop erosion); the appearance of the erosion (sheet, rill, or gully erosion); the location of the erosional activity (surface, or shoreline); and/or by the material being eroded (soil erosion or beach erosion).

Erosion Hazard Rating - A relative (not absolute) rating of the potential for soil loss due to sheet and rill erosion from a specific site. Commonly used to address erosion response expected from a given land management activity. Ratings are the result of a cumulative analysis of the following factors: soil, topography, climate, and vegetative and protective cover.

Eyrie - A raptor's cliff nest, such as a peregrine falcon.

Exotic Species - Non-native species which occur in a given area as the result of deliberate or accidental introduction of the species from a foreign country.

Fault Zone - A fault that is expressed as a zone of numerous small fractures.

Fauna - All animals, including birds, mammals, amphibians, reptiles, fish and invertebrates (clams, insects, etc.).

Fire Regime - The characteristic frequency, extent, intensity, severity, and seasonality of fires in an ecosystem.

Fragmentation - Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation.

Fuel Loading - The amount of combustible material present per unit of area, usually expressed in tons per acre.

Fuels - Any material capable of sustaining or carrying a forest fire, usually natural material, both live and dead.

Gap Analysis - Process to determine distribution and status of biological diversity and assess adequacy of existing management areas to protect biological diversity.

Geologic (or Geomorphic) Province - An area of regional areal extent that is distinguished from adjacent areas by unique bedrock and structural characteristics.

Guild - A group of species that have similar habitat requirements. Can also be known as an assemblage.

Habitat element (component) - A component of wildlife habitat. Snags and hardwoods are examples.

Habitat Type - The collective land area in which one vegetation type is dominant or will come to be dominant as succession advances.

Habitat Connections - A network of habitat patches linked by areas of like habitat. The linkages connect habitat areas within the watershed to each other and to areas outside the watershed. These connections include riparian areas, mid-slopes, and ridges.

High intensity (fire) - A wildfire event with severe ecological impacts; usually but not always of high severity.

Home Range - The geographic area within which an animal travels to carry out its activities.

Impact - A negative environmental change. The value judgement of "negative" is generally construed to mean that conditions or processes are moving away from desired states.

Inpool Cover - Cover for fish within pools provided by undercut banks, submerged vegetation, and submerged objects. Examples include logs, rocks, floating woody material, water depth, and water turbulence.

Integrated Resource Management - The simultaneous consideration of ecological, physical, economic, and social aspects of lands, waters, and resources in developing and carrying out multiple-use, sustained-yield management.

Island Arc - A chain of islands rising from the deep-sea floor and near to the continents.

Issue - Refers to a topic, a subject, a category, or a value which is registered by a person as something in which they have a high level of interest. Used synonymously with the term "concern". Identification of issues can occur through formal solicitation, content analysis of publication and periodicals, or informal communications.

Jurassic - A period of geologic time covering the span of time between 190 to 135 million years ago.

Key Questions - Questions that Watershed Analysis attempts to answer. These are the interdisciplinary team's expectations for the analysis.

Landscape - The mixture of topographic, vegetative, and biologic attributes within an area. An area composed of interacting and interconnected patterns of habitats, that are repeated because of the geology, land forms, soils, climate, biota, and human influences throughout the area. Landscape structure is formed by patches, connections, and the matrix. Landscape function is based on disturbance events, successional development of landscape structure, and flows of energy and nutrients through the structure of the landscape.

Landscape Connectivity - The spatial contiguity within the landscape. A measure of how easy or difficult it is for organisms to move through the landscape without crossing habitat barriers.

Landscape Ecology - The study of spatial and temporal interactions and exchanges across heterogeneous landscapes, the influences of spatial heterogeneity on biotic and abiotic process, and the management of spatial heterogeneity.

Landscape Unit - A continuous geographic area with fairly consistent landform and vegetation communities.

Lentic - A still water aquatic system as in pond or lake.

Linkage - Route that permits movement of individual plant (by dispersal) and animals from a Landscape Unit and/or habitat type to another similar Landscape Unit and/or habitat type.

Lithology - The description of rocks on the basis of such characteristics as color, mineralogy, and grain size.

Lotic - A running water aquatic system as in a stream or river.

Mass wasting - A general term for the dislodgement and downslope transport of soil and rock material under the direct application of gravitational body stresses. In contrast to other erosional processes, the debris removed by mass wasting is not carried within, on or under any other medium. Mass wasting includes many processes, including relatively slow displacement, such as creep, or rapid movement such as rock falls, debris avalanches, or debris torrents.

Melange - A mappable body of rock characterized by the inclusion of fragments and blocks of all sizes, both exotic and native, embedded in a fragmented and generally sheared matrix of more tractable material.

Microclimate - The climate of a particular site or small area, as a cave, forest, or habitat.

Microsite - A rock outcrop, snag, seep, stream pool, and other environmental features small in scale but unique in character.

Montane - Pertaining to or inhabiting mountains.

Monitoring - To watch, observe, or check, especially for a specific purpose, such as to keep track of, regulate, or control.

Multi-aged stand - A forest stand that has more than one distinct age class arising from specific disturbance and regeneration events at various times.

Multi-layered Canopy - Forest stands with two or more distinct tree layers in the canopy; also called multi-storied stands.

Natural Range of Variability- The spectrum of conditions possible in ecosystem composition, structure, and function considering both temporal and spatial factors.

non-system road(s) - forest roads which are not maintained or serviced regularly, and that are not considered part of the official road network.

Obligate - Restricted to one particular attribute of habitat or life cycle.

Peak Streamflows - The highest level of streamflow in response to a rainstorm or period of snow melt.

Peridotite - A coarse grained, ultramafic plutonic rock composed chiefly of olivine.

Phyllite - A metamorphosed rock, intermediate in grade between slate and mica schist.

Physical Process - The rate and timing of the interaction of biotic and abiotic ecosystem components.

Plant Association - A potential natural plant community of definite floristic composition and uniform appearance. The lowest level of potential natural community classification.

Pool/riffle ratio - The ratio of surface area or length of riffles in a given stream reach.

Population - A group of individuals of a species living in a certain area. They have a common ancestry and are much more likely to mate with one another than with individuals from another area.

Potential Natural Community - The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbances under present environmental conditions. Grazing by native fauna, natural disturbances such as drought, floods, wildfire, insects, and disease, are inherent in the development of potential natural communities which may include naturalized non-native species.

Plutonic - Igneous rocks formed at great depth.

Pool Frequency - The number (occurrence) of pools or a certain size pool within a general or selected stream reach.

Proposed Species - Any species that is proposed in the Federal Register to be listed as threatened or endangered.

Province - A continuous geographic area wherein species composition, both plant and animal, is more homogeneous than between adjacent areas.

Range of Variability (Natural Variability, Historic Variability) - The spectrum of conditions possible in ecosystem composition, structure, and function considering both temporal and spatial factors.

Rehabilitation - Returning of land to productivity in conformity with a prior land use plan, including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values.

Resilience - The ability of an ecosystem to maintain diversity, integrity and ecological processes following disturbance.

Restoration - The process of restoring site conditions as they were before a land disturbance.

Riparian Ecosystem - Ecosystems transitional between terrestrial and aquatic ecosystems. Streams, lakes, wet areas and adjacent vegetation communities and their associated soils which have free water at or near the surface.

Riparian Reserve - The area which encompasses streams, lakes, and wetlands and is designed to protect aquatic and riparian functions and values. The Riparian Reserve is a function of site characteristics, physical processes linked to the area, and the type and timing of activity proposed.

River Basin - An area, defined by physical boundaries, in which all surface water flows to a common point. River basins are associated with large river systems and are typically 1000s of square miles in size.

River Basin Analysis - The collection and organization of aquatic and fisheries issues and processes or condition, at a scale greater than watershed analysis.

Schist - A strongly foliated rock, formed by metamorphism, that can be readily split into thin flakes or slabs due to the well developed parallelism of the minerals present.

Sediment - Fragmental material that originates from weathering of rocks and is transported by, suspended in, or deposited by water or air or is accumulated in beds by other natural agencies.

Sensitive Species - A species not formally listed as endangered or threatened, but thought, by a Regional Forester in the USDA Forest Service, , to be at risk.

Seral - A biotic community which is a developmental, transitory stage in an ecologic succession.

Seral Stage - A biological community viewed as a single developmental or transitional stage in an ecological succession.

Serpentinite - A rock high in iron-magnesium content. Commonly green, greenish yellow, or greenish gray and often veined or spotted with green and white.

Shear Zone - A tabular zone of rock that has been crushed and brecciated by many parallel fractures due to shear strain.

Shrub - An upscale term for brush.

Site - An area described or defined by its biotic, climatic, and soil condition as related to its capacity to produce vegetation; an area sufficiently uniform in biotic, climatic, and soil conditions to produce a particular climax vegetation.

Soil Map Units - Groupings of soils that are too intricately mixed to be mapped discretely at the scale of soils survey mapping being conducted.

Soil Series - Soils of discrete, relative uniform and repeatable character.

Spawning Sites - Gravelled areas within a stream system having the appropriate attributes, i.e., dissolved oxygen, water depth, water velocity, water temperature, substrate composition, and cover that are selected as suitable for spawning by adult fish.

Species Richness - A component of community species diversity that is expressed by simple ratios between total number of species and importance values (such as numbers, biomass, productivity)

Stochastic - Random or uncertain variation.

Stand - A community of trees occupying a specific area sufficiently uniform in composition, age arrangement and condition distinguishable as a silvicultural of management unit. Typically, stand sizes vary from about 5 to over 30 acres on National Forest System lands.

Stand replacing wildfire - a wildfire that kills nearly 100% of the stand involved.

Stratification - The delineation of areas within a watershed which will respond relatively uniformly to a given process or set of conditions.

Stream Order - A method of numbering streams as part of a drainage basin network. The smallest unbranched mapped tributary is called first order, the stream receiving the tributary is called second order, and so on. It is usually necessary to specify the scale of the map used. A first-order stream on a l:62,500 map, may be a third-order stream on a 1:12,000 map. Tributaries which have no branches are designated as of the first order, streams which receives only first-order tributaries are of the second order, larger branches which receive only first-order and second-order tributaries are designated third order, and so on, the main stream being always of the highest order.

Streamside Management Zone - A designated zone along streams and wetlands which acts as an effective filter and absorbtive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habitat; protects channel and streambanks; and keeps the floodplain surface in a resistant, undisturbed condition to limit erosion by floodflows.

Succession - An orderly process of biotic community development that involves changes in species, structure and community processes with time. It is reasonably directional and therefore, predictable.

Suitable Habitat - An area of forest vegetation with the age-class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life needs of the northern spotted owl.

Sustainability - The ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Tectonic - Regional assembling of structural features or the forces involved there in, by crustal dynamics of the earth's surface.

Terrestrial - Living primarily on land rather than in water.

Terrestrial Ecosystem - An interacting system of soil, geology, topography with plant and animal communities.

Threatened Species - A species which is likely to become an endangered species.

Threshold of Concern (TOC) - Used in cumulative watershed effects analyses to describe the point (in terms of percent equivalent road area) where the risk of watershed degradation is significant if mitigation measures are not employed.

Transient Snow Zone - The area between 2,500 and 5,000 feet elevation subject to rain-on-snow events during winter months.

Translational-Rotational Landslides - This type of mass wasting feature is characterized as having a planar failure surface which generally parallels the ground surface (translational), or a failure surface which is circular about an imaginary axis located above the ground surface (rotational). In practice, there is a gradation between the two features; different portions of a landslide complex can either be translational or rotational in character. These types of features generally have low to moderate movement rates.

Ultramafic - Said of an igneous rock having a silica content lower than that of a basic rock.

Underburning - The prescribed use of fire beneath a forest canopy.

Understory - The lower layer of trees and shrubs under the forest canopy.

Valley Inner Gorge - A zone with slopes adjacent to stream channels, having slope gradients greater than 65%, which are separated from the upslope area by a distinctive break in slope. Valley inner gorges are formed by mass wasting and therefore are noted for their instability.

Viability - The likelihood of continued existence in an area for some specified period of time.

Watershed - A region or area bounded peripherally by a water parting feature and draining ultimately to a particular watercourse or body of water. There are many watersheds within a river basin. Watershed areas range from 20 to 200 square miles in size.

Watershed Analysis - Development and documentation of a scientifically based understanding of the processes and interactions occurring within a watershed in order to make more sound management decisions.

Watershed Product - Terrestrial ecosystem components that move in the fluvial system: water, sediment, chemicals, organic debris, and heat.

Weir - An obstruction placed across a stream thereby causing the water to pass through a particular opening.

Wetland - An area at least periodically wet or flooded: an area where the water table stands at or above the land surface.