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Edson Watershed Analysis

Shasta-McCloud Management Unit
Shasta-Trinity National Forest

Siskiyou County California

Swamp Creek – Fish Passage Improvement Project

Edson Watershed Analysis

Siskiyou County, California **March 2011**

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USDA FOREST SERVICE

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Preface

Watershed analyses are iterative, or living, documents that can be updated as new information becomes available. The following edits were made on May 12, 2011.

1. The date of the last edit and this preface was inserted on the Title Page.
2. Several citations in Step 2, Core Topic – Vegetation, Issue: Vegetation and Forest Resiliency were corrected. Figure 13 source was referenced.
3. A paragraph and supporting citations were added to Step 2, Core Topic – Vegetation, Issue: Vegetation and Forest Resiliency pertaining to observed fire severity and climate change in the Sierran Nevada and Southern Cascades. The information is useful background for managers in consideration of forest resiliency to climate change.
4. "Subpart A" was added to footnote 19 in reference to 36 CFR 261.113.
5. Footnote 31 was inserted in Step 6; Core Topic Hydrology, Issue: Riparian Reserve Management to clarify that specific project design and methodology to implement Riparian Reserve opportunities will be analyzed in site specific National Environmental Policy Act analyses, and may include a variety of tools including manual and mechanical.

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Introduction

About This Analysis

This watershed analysis is presented as part of the Aquatic Conservation Strategy [ACS] adopted for the President's Northwest Forest Plan [NWFP] Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl [NSO], including Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species (NWFP, 1994).

The preparation of the Edson Watershed Analysis follows direction in the ACS that requires watershed analysis "for roadless areas in non-key watersheds, and Riparian Reserves prior to determining how land management activities meet Aquatic Conservation Strategy objectives".[1]

This document is guided by:

I. **Core topics** - provide a broad, comprehensive understanding of the watershed.

Core topics are provided in "Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis", Version 2.2 [Guide] (Guide, 1995) to address basic ecological conditions, processes, and interactions at work in the watershed.

II. **Issues** - focus the analysis on the main management questions to be addressed.

Issues are those resource problems, concerns, or other factors upon which the analysis will be focused. Some of these issues prompted initiation of the analysis. Other issues were developed from public input on other projects in the area or were identified by the team during the analysis process. Issues are further described in Step 2.

Key analysis questions are developed for each issue. These questions are organized by analysis step to help focus the analysis and to provide organization to the document while addressing the issues.

The purpose of this analysis is to provide district resource managers with an understanding of the ecological processes and interactions occurring within the watershed area and how past and present activities and events interact with the physical, biological, and social environments. This information can then be used as a basis from which to make future decisions about the management of resources in the Edson watershed. While this document provides management recommendations, it is not a decision document. No direct changes in the management of resources in this watershed will occur without separate documentation, public involvement, and further environmental analysis.

Federal agencies will conduct multiple analysis iterations of watersheds as new information becomes available or as ecological conditions, management needs, or social issues change. Subsequent analysis iterations may be triggered when existing analyses do not adequately support

[1] (NWFP, 1994), p. B-20

informed decision-making for particular issues or projects. Future iterations also may be necessary to fill critical data gaps identified during earlier analyses.

The Analysis Process

This analysis used the six-step process as outlined in the Guide. The six-step process includes the following:

Step 1: Characterization – identifies the dominant physical, biological and human processes or features of the watershed that affect ecosystem function and conditions.

Step 2: Identification of Resource Issues and Key Questions – focuses the analysis on the key elements of the ecosystem that are most relevant to the management objectives, human values or resource conditions within the watershed.

Step 3: Description of Current Conditions – documents the current range, distribution and condition of the relevant ecosystem elements.

Step 4: Description of Reference Conditions – documents how ecological conditions have changed over time as a result of human influence and natural disturbances.

Step 5: Synthesis and Interpretation of Information – compares existing and reference conditions of specific ecosystem elements to explain significant differences, similarities or trends and their causes.

Step 6: Opportunities – brings the results of the previous steps to conclusion, focusing on management opportunities that are responsive to watershed processes identified in the analysis.

Watershed analysis is a continuous process. This report is a dynamic document and is intended to be revised and updated as new information becomes available.

Step 1. Characterization of the Watershed

Location

The Edson watershed analysis area is within the Shasta-Trinity National Forest, Shasta-McCloud Management Unit in Siskiyou County, California. The general legal location is within Townships 39N-42N, Ranges 3W-1E Mount Diablo Meridian (Figure 1).

Contained within the McCloud River basin, Rainbow Ridge bounds the Edson watershed on the north, which also forms the northern most boundary of the Shasta-Trinity National Forest. The eastern boundary of the watershed follows a topographic divide that includes Buck and Black Fox Mountains. The southern boundary of the watershed extends downs to the McCloud River below Highway 89. The lower slopes of Mount Shasta form the western boundary (see Figure 2).

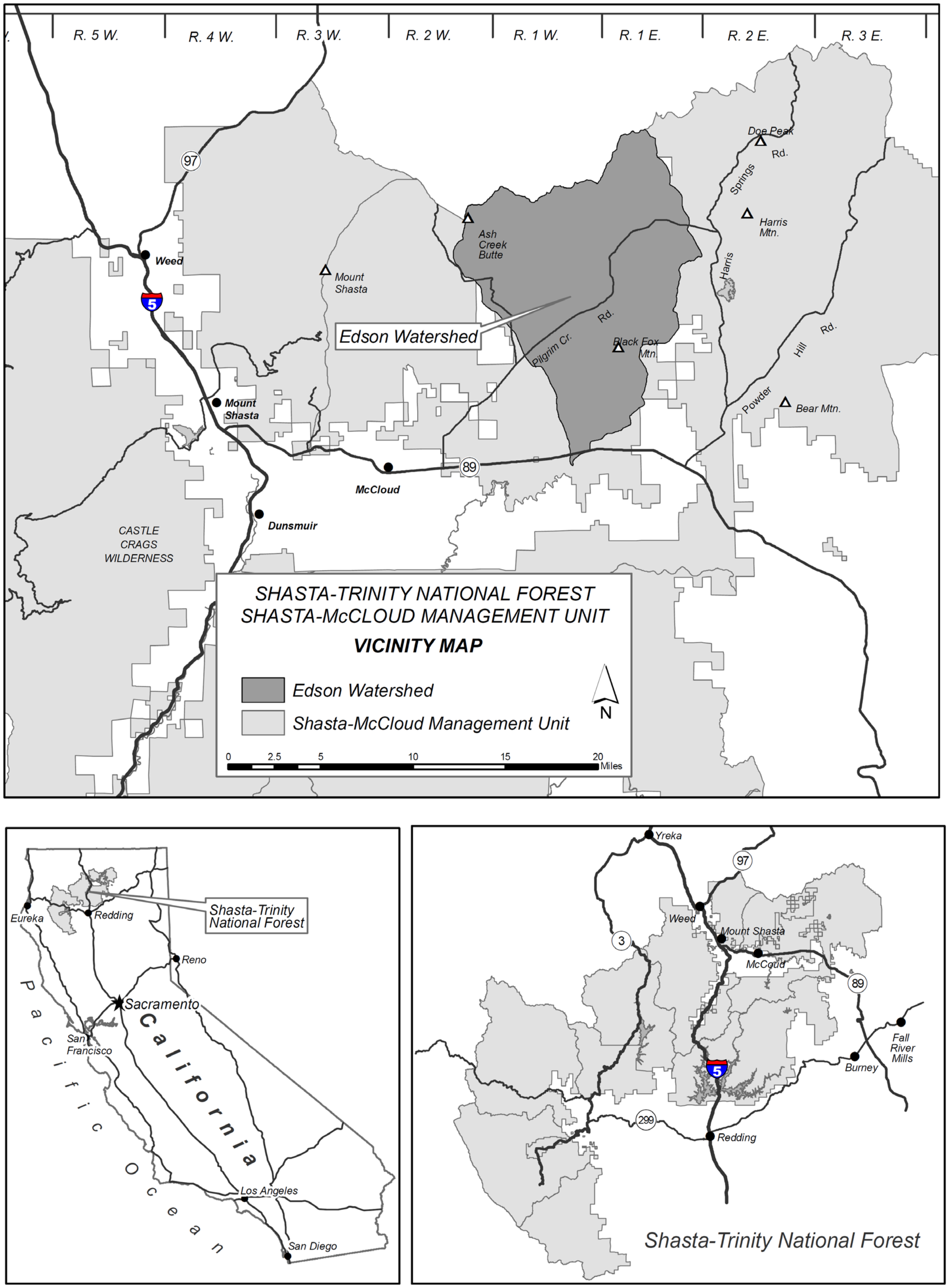

Figure 1 – Vicinity Map

Watershed Setting

The Edson watershed analysis area [Edson watershed, watershed, analysis area] is a planning unit that lies within the larger Ash Creek Hydrologic Unit Code [HUC] five watershed. The Ash Creek watershed follows the same boundaries as the Edson watershed on all but the western extent. The higher elevation area of Mount Shasta was not included in the Edson watershed analysis area because the Forest Service plans to analyze the high country surrounding Mount Shasta in a separate ecosystem analysis. See Figure 1 - Vicinity Map and Figure 3 the watershed's dominant physical features.

Relationship to Larger Scale Setting – McCloud River Basin

Located in north-central California, the McCloud River basin drains an area of roughly 435,700 acres. The headwaters of the McCloud River originate near Colby Meadows, about 20 miles east of the town of McCloud. The river flows approximately 50 miles to its terminus at Shasta Lake. Its largest tributaries include Squaw Valley Creek and Hawkins Creek. The Edson watershed comprises approximately 19 percent of the McCloud River basin.

The segment of the Upper McCloud that flows westward from the headwaters to the McCloud Reservoir defines the boundary between two distinct landscapes. North of the river is the McCloud Flats, an area of level lava flows and low volcanic buttes. The drainage pattern from this area is very sparse. Mud Creek is the only perennial tributary from the volcanic landscape to the north. South of the river is the Eastern Klamath Paleozoic Belt, a landscape of steep, metamorphic mountains. Many perennial tributaries enter the south side of the river. The Upper McCloud River flows in a relatively low gradient for its entire length except for three distinctive waterfalls. Downstream of the falls the Upper McCloud River is confined within a very narrow canyon prior to entering the McCloud Reservoir. Below McCloud Reservoir, the river flows to the southeast through the Eastern Klamath Mountains until it enters Shasta Lake. The gradient is steeper and the river lies in a wide canyon that has a well-defined inner gorge and riparian zone.

Primary beneficial uses of the water resources are wildlife, fisheries and recreation. The Upper McCloud River basin is known for its population of redband trout [McCloud redband]. Recreation is most popular in the area along Upper, Middle and Lower McCloud Falls.

Physical Characteristics

The Edson watershed analysis area drains an area of 80,700 acres (126 square miles) of relatively flat Terrain. Watershed elevations range from approximately 3,700 feet above sea level at the Ash Creek confluence with the McCloud River to approximately 8,400 feet on the summit of Ash Creek Butte. The steepest terrain in the watershed is found on the slopes immediately adjacent to the northern and eastern boundaries along with several ridges and buttes located in the upper two-thirds of the analysis area. Prominent features located on or immediately adjacent to the northern boundary include Ash Creek Butte, Dry Creek Peak, Rainbow Mountain, Stephens Butte, Hemlock Ridge and Horse Peak. Steeper features on or immediately adjacent to the eastern boundary include

Buck, Little Black Fox and Black Fox mountains with the latter dominating the central-eastern portion of the watershed. A number of buttes and ridges occur within the interior of the watershed including Trout Creek Butte, Fons Butte, Watakma Butte, Sugar Pine Butte, Masonic Rock and Swamp Creek Ridge.

Geology

The geologic features of the Edson watershed are characterized by a predominance of volcanic landforms and broad areas of nearly flat basalt plains. The prominence of the basalt plains result in the area being characterized as a plateau; however, the watershed as a whole is far from being the high essentially undiversified plain that the term plateau implies. The watershed actually consists of a series of northwest-to north-trending block-faulted ranges, with the intervening basins filled with broad-spreading “plateau” basalt flows, or with small shield volcanoes, steeper sided lava or composite cones, cinder cones, and lake deposits resulting from disruption of the drainage by faulting or volcanism.

Soils

The analysis area falls across two ecological subsections (USDA and USDI, 1997), the High Cascades (M261Df) and McCloud Flat (M261Dg). The portion of the watershed that falls within the High Cascades subsection is characterized by upland soils in the frigid temperature regime. Dominant subgroups include Typic Vitrixerands and Typic Haploxerands. The northeastern portion is mantled by up to 12” of pumice. Being in the outwash plain of Mt. Shasta, McCloud Flat subsection soils tend to have a deeper mantle of glacial outwash or alluvium, with frequent rock outcrops of basalt. Dominant soil subgoups include Humic Haploxerands and Humic Vitrixerands. The temperature regime is mesic.

Climate

The watershed is located within the Mediterranean Highland climate region characterized by warm dry summers and cool wet winters. Occurring primarily as snowfall, the mean annual precipitation averages 40 inches. Approximately 90 percent occurs between October and April. Snowfall is common at all elevations during the winter months. Runoff is generally attenuated by the high infiltration capacities of the volcanic soils; however, warm temperatures and rain-on-snow events can produce rapid snowmelt conditions leading to peak flow events.

Stream Channels

Approximately 295 miles of streams constitute the Edson watershed. Perennial streams tend to be confined to the headwaters. Streamflow in all reaches becomes increasingly intermittent downstream from headwater sources. Named streams from west to east include Ash, Swamp, Dry, Trout and Edson Creeks. All flow into Ash Creek before its confluence with the McCloud River south of Cattle Camp Campground. The groundwater dominated influence of the watershed is so prevalent that Ash Creek only flows to the McCloud River during very large winter floods (e.g. 1997) or during water years where precipitation is well above normal. Most of the precipitation falling in the watershed percolates into the ground to be eventually released into the McCloud River at Big Springs below the Ash Creek confluence.

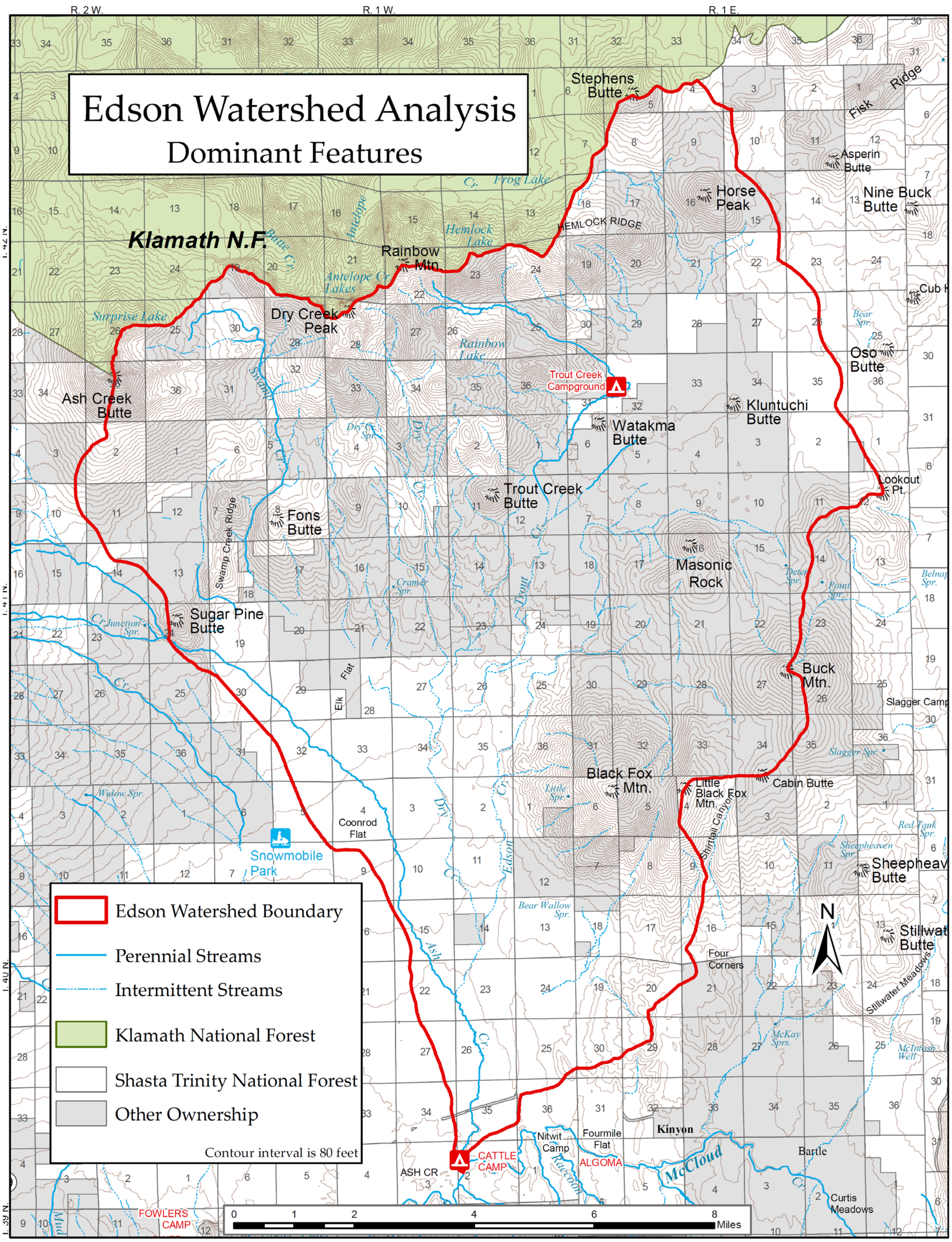

Figure 2 – Dominant Features

Biological Characteristics

Vegetation

The watershed consists mainly of mixed conifer and ponderosa pine forests. Of the 36,200 acres of National Forest System [NFS] lands within the watershed, approximately 91.2 percent currently carry forest vegetative cover. Dominant conifer species in these forest types include ponderosa pine, white fir and red fir. Minor species include incense cedar, sugar pine, Douglas-fir, lodgepole and knobcone pine. Other forest types occurring in minor amounts include black oak, willows and aspen. The remaining NFS lands consist of grass (1.4 percent) and brush (6.0 percent) vegetative types and approximately 0.5 percent non-capable lava outcrops (Table 3.

Riparian vegetation consists mainly of willows. Alder occurs along perennial streams in headwater areas and in diminished abundance along intermittent stream channels in the lower elevations within the watershed.

Fire and Fuels

Approximately 100 years of effective fire suppression have gradually shifted fire behavior and fuels composition. Frequent low to moderate severity fire historically occurred as a combined result of summer drought, winter precipitation and lightning. More recently in the Southern Cascades fire exclusion and land management practices (i.e. grazing and logging) have resulted in changes in forest structure and fuel loading that promote infrequent moderate to high severity fire (Skinner & Taylor(2006)).

Wildlife

The Edson watershed contains numerous habitats and diverse wildlife. This assessment focuses primarily on special interest species including federally listed as threatened or endangered [TES], forest service sensitive [FSSS], rare and game species. Special habitats include late successional and old growth, meadow, riparian, aspen and oak habitats. Old forest or late-successional species include wide-ranging carnivores, ungulates, riparian-associated and cavity dependent species.

Edson watershed contains limited habitat for the only TES wildlife species present, the northern spotted owl. Twelve FSSS are known to occur, or there is suitable habitat present, within the Edson watershed. This includes northern goshawk, willow flycatcher, bald eagle, California wolverine, Pacific fisher, American marten, pallid bat, Townsend's big-eared bat, western red bat, northwestern pond turtle, Cascades frog, and foothill yellow-legged frog. Several different bat species of interest have been observed within the watershed including two Forest Service sensitive bat species (pallid bat, western red bat) and NWFP-identified species (silver-haired bat, long-eared *myotis*)(NWFP Standards and Guidelines, 1994b)(Survey and Manage, 2001).[2] The watershed contains summer range for mule deer and elk, both of which are game species of interest.

[2] Ref (Survey and Manage, 2001)"Management Recommendations" and (NWFP Standards and Guidelines, 1994b)"protection buffer" species.

Fisheries

The watershed has three fish-bearing streams containing populations of McCloud redband. Unique to the Upper McCloud River basin, the McCloud redband is a forest service sensitive species. No TES fish species are found. Approximately 11.2 miles of perennial fish-bearing streams include a small reach of the upper McCloud River along with portions of Trout, Swamp and Edson Creeks. Several small, unnamed ponds occur within the watershed, mostly within the Swamp Creek drainage. Rainbow Lake, the only named pond, lies within Trout Creek drainage. Rainbow trout also live in the Edson watershed and are genetically indistinguishable from McCloud redband. Brown trout are found in Trout Creek and the Upper McCloud River. Brook trout are found in the Upper McCloud River.

Human Uses

The Edson watershed contains approximately 44,500 acres of private and approximately 36,200 acres of NFS lands managed by the Shasta-Trinity National Forest. Industrial forest lands owned by several timber companies comprise most of the private lands. A series of land exchanges have consolidated ownership to some degree, but a checkerboard ownership pattern resulting from railroad grants in the 1800s still exists over much of the northern watershed.

A large transportation network developed to support past and continuing vegetation management projects on both public and private lands. Timber harvest remains the predominant commercial land-use activity in the watershed. The Bartle and Toad Mountain cattle and McCloud-Hambone sheep grazing allotments are located partly within the watershed, although the sheep allotment has been vacant for several years.

Dispersed camping, hunting, and snowmobiling, along with firewood and mushroom gathering make up the primary recreational activities. Two Forest Service campgrounds, Cattle Camp and Trout Creek[3] provide developed camping opportunities. The Trout Creek Nature Trail in the Trout Creek campground is the only system trail in the watershed and is currently closed due to lack of maintenance. A portion of the Tri-Forest SnowmobileTrail crosses the watershed. A key access point at Pilgrim Creek Snowmobile Park lies just outside the watershed boundary on Pilgrim Creek road.

One national register eligible traditional cultural property exists within the watershed boundary and serves as the location for Native American cultural events.

Ecological Land Type Associations

The watershed consists of parts of two ecological subsections (Miles & Goudey (1997))[4]:

- M261Df: **High Cascades**

[3] Trout Creek campground is technically a dispersed campsite, as it does not provide designated spurs, fire-rings or picnic tables. However, it does provide vault toilets, unlike most dispersed sites.
[4] http://www.fs.fed.us/r5/projects/ecoregions/toc.htm

- M261Dg: **McCloud Flats**

The High Cascades subsection includes the southern end of the Cascades range. It is further subdivided into two Land Type Associations (LTAs) in the analysis area:

- The **Black Fox Upland** (M261Df (a)) is characterized as Tertiary volcanic upland, mixed conifer, gently sloping and consists of late-Tertiary basaltic andesites and andesitic tuffs. The terrain is broad, rounded volcanic buttes. It is mantled with volcanic ash. The predominant soil subgroup is Humic Haploxerands. Soil classification families include medial, medial-skeletal and medial over medial-skeletal, fine, mixed, mesic. Dominant vegetation is mixed conifer with black oak in the mesic temperature regime. Mountain tops are in the frigid temperature regime and support stands of mixed white fir and red fir. Slopes generally range from 15 to 30 percent. Soils are uniformly deep and productive. The erosion hazard rating is predominantly moderate.
- **Fisk Ridge** (M261Df (b)) is characterized as: Pliocene and Pleistocene volcanic buttes and ridges, white fir-red fir coniferous forests, steep and is a lateral extension of the High Cascades between Mt. Shasta and Medicine Lake(Anderson, 1941). It consists of Pliocene and Pleistocene volcanic buttes and ridges. The ridge tops were glaciated. The headwaters of the streams are cirque-like basins. Soils are mantled with volcanic ash and with as much as 12 inches of pumice on the east side of the mapping unit. The predominant soil subgroup is Typic Haploxerands. Soil classification families include medial-skeletal and cindery over medial-skeletal, mixed, frigid. The dominant forest type is white fir-red fir forest. North aspects on ridge tops are considered to be in the cryic temperature regime and support stands of mountain hemlock. Slopes range from 20 to 60 percent. Soils are generally moderately deep (20-40 inches) with frequent rock outcrops. Erosion hazard rating is considered moderate.

This McCloud Flats subsection includes the lava flows and outwash fans at the base of the High Cascades Subsection. In the watershed, it includes two LTAs: Ash Creek Sink and Rainbow Basin Lava Flows.

- **Ash Creek Sink** (M261Dg (a)) is characterized as: Holocene volcanic fans and terraces, ponderosa pine forest, nearly level and is a series of Holocene alluvial fans and terraces; much of the sediments are post-glacial outwash. The terrain is typified by a nearly level topography. Throughout this mapping unit remnants of older lava flows are exposed where they were only partially buried by more recent sediments. Soils are coarse-textured ashy sediments with a thin mantle of wind-laid volcanic ash. The predominant soil subgroups are Typic Vitrixerands and Andic Xerorthents. Soil classification families include: medial, ashy and coarse-loamy, mixed mesic. The dominant forest type is ponderosa pine forest. Coarse textured basins and frequently flooded areas support grass-bitterbrush communities. Slopes are generally nearly level. Erosion hazard is rated as low.
- **Rainbow Basin Lava Flows** (M261Dg (b)) are characterized as**:** Pleistocene lava flows, White fir-ponderosa pine mixed conifer forest, gently sloping and consist of a series of overlapping lava flows, late Pliocene and Pleistocene in age (Christianson, 1999) that emanated from Rainbow Basin as well as from Watakma and Kluntuchi Buttes. The topography is gently sloping lava flows interrupted by volcanic buttes and cones. Soils are weathered from basaltic lava flows and ash and tephra deposits. Pumice mantles range from scattered surface layers to overburdens that range up to 12 inches deep on the east side of the mapping unit. Soils are typically moderately deep (20-40 inches) over fractured basalt. The predominant soil subgroup is Typic Vitrixerands. Soil classification families include medial-

skeletal and cindery over medial-skeletal, mixed, and frigid. The dominant forest type is white fir-ponderosa pine mixed conifer. Erosion hazard rating is considered low.

Management Direction and Guidance

USDA Strategic Plan 2010-2015

The USDA Strategic Plan 2010-2015 [Strategic Plan] (Strategic Plan, 2010) provides general guidance in the form of four strategic goals articulating the Department's major programmatic policies and priorities along with objectives, strategies and means for achievement. Goals one and two pertain directly to the national forests and are listed in Table 1 along with the objectives, strategies and means most applicable to management activities within the Edson watershed. See the Strategic Plan for a full discussion of goals, objectives and performance measures.

The FLAME Act and the Cohesive Wildfire Management Strategy

The FLAME Act of 2009 calls for a Cohesive Wildfire Management Strategy to be developed by the departments of Agriculture and Interior. This strategy will build on the National Fire Plan and other documents, such as the 10-Year Comprehensive Strategy and Implementation Plan (USDA;USDI, 2002). The Cohesive Strategy focuses on three key areas to address wildlife problems across the nation:

- **Restore and Maintain Landscapes:** Landscapes across all jurisdictions are resilient to disturbances in accordance with management objectives;
- **Fire Adapted Communities:** Human populations and infrastructure can survive a wildland fire. Communities can assess the level of wildfire risk to their communities and share responsibility for mitigating both the threat and the consequences; and
- **Response to Fire:** All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildland fire management decisions.

Table 1 - USDA Strategic Plan 2010-2015 Pertinent Goals and Objectives

USDA Strategic Plan 2010-2015 Pertinent Goals and Objectives
Goal 1 - Assist rural communities to create prosperity so they are self-sustaining, re-populating, and economically thriving;
Objective 1.1 - Enhance Rural Prosperity • Facilitate Sustainable Renewable Energy Development. . . When compatible with other natural resource goals, USDA will facilitate the use of public lands in our National Forest System to support sustainable renewable energy development. • Generate and Retain Green Jobs and Economic Benefits Through Natural Resource and Recreation Programs. **Objective 1.2 - – Create Thriving Communities** • Collaboratively engage public lands communities in natural resource management.
Goal 2 - Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.
Objective 2.1 – Restore and Conserve the Nation's Forests, Farms, Ranches, and Grasslands • Develop collaborative strategies with landowners, State and local governments, other Federal agencies, tribes, and private sector organizations to address natural resource health and build community capacity to engage in natural resource work; • Ensure that National Forest System land management plans and projects are designed to restore degraded land and protect land that is healthy; • Strategically invest in conservation easements and land acquisitions to protect critical lands and leverage community investment in conservation practices. **Objective 2.2 – Lead Efforts to Mitigate and Adapt to Climate Change** • Plant trees, grasses, or other appropriate vegetative cover and maintain existing vegetative cover on . . . land that has been impacted by fire; • Incorporate climate change mitigation and adaptation strategies into management practices and utilize scientific findings for all restoration projects, planning, and prescriptions; • Include plans for protecting water quality and availability in climate change adaptation and mitigation strategies; • Develop renewable energy resources from sustainably managed . . . forests; **Objective 2.3 – Protect and Enhance America's Water Resources** • Strategically focus investments in watershed improvement projects and conservation practices that will have the highest impact based on specific conservation needs within a given landscape; • Increase watershed-based collaborative partnerships with tribes, States, communities, landowners, and other stakeholders to build community-planning capacity and effectively guide development, protect and restore open space, and improve watershed management that supports clean and abundant water resources; • Protect water resources on National Forest System lands by planning for watershed health and working to restore degraded watersheds, reduce erosion, reclaim and restore abandoned mine lands, reduce the threat of watershed damage from catastrophic wildfires, and reduce the impact of the road system on watershed health. **Objective 2.4 – Reduce the Risk from Catastrophic Wildfire and Restore Fire to its Appropriate Place on the Landscape** • Collaborate with public and private forest and rangeland owners to develop and implement hazardous fuels reduction and ecosystem restoration projects to reduce the risk of catastrophic fire and make lands more resilient; • Strategically and safely manage wildland fire and promote the appropriate use of prescribed fire to restore fire as a natural ecological process on the landscape, improve forest and habitat conditions, and reduce fuel loads and catastrophic fire risk; • Implement USDA's American Reinvestment and Recovery Act projects and biomass utilization activities.

Land and Resource Management Plan Allocations and Direction

Management direction for the Edson watershed is found in the Shasta-Trinity National Forest's Land and Resource Management Plan [Forest Plan] ((Forest Plan, 1995); the Forest Plan incorporates direction from the NWFP.

The NFS lands in the watershed are divided into three primary land allocations based on the NWFP. Approximately 20,900 acres are in Matrix lands, 13,515 acres in Late Successional Reserves [LSR], and approximately 3,400 acres are in Riparian Reserves.

Figure 3 displays the land allocations within NFS lands in the analysis area, as designated in the Forest Plan. Figure 4 and Table 2 display management areas and prescriptions as described in the Forest Plan.

Matrix

Three management prescriptions make up the Matrix land allocation. Approximately 900 acres are in the Roaded Recreation prescription, 2,000 in the Wildlife Habitat Prescription and 18,000 in the Commercial Wood Products Prescription as described in Table 2.

Late Successional Reserves

The NWFP established a network of LSRs accompanied by a set of management standards and guidelines(NWFP Standards and Guidelines, 1994b). The management objective within LSRs is to protect and enhance conditions of late-successional forest ecosystems, which serve as habitat for late-successional and old-growth related species including the NSO. The Forest Wide Late Successional Reserve Assessment [LSRA] (LSRA, 1999) provides management direction for LSRs on the Shasta-Trinity National Forest.

The reserves are intended to provide old-growth forest habitat, provide for populations of species that are associated with late-successional forests and to help ensure that late-successional species diversity will be conserved. Protection includes reducing the risk of large-scale disturbance, including stand-replacing fire, insect and disease epidemic, and major human caused impacts. The purpose of the LSRA was to develop management strategies for the LSRs, determine their sustainability, and provide information to decision makers for managing LSRs to meet Forest Plan goals and objectives.

Approximately 13,515 acres within the watershed are designated as LSR. The LSRs that lie at least partially within the boundaries of the Edson watershed are Mt Shasta, Elk Flat and Algoma plus Fons Managed Late Successional Area [MLSA]. This land allocation contains a single management prescription category as described in Table 2.

Riparian Reserves

The NWFP ACS was designed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them. The ACS directs the Forest Service to 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 ecosystems; serving for example, as dispersal habitat for certain terrestrial species (NWFP, 1994).

Riparian Reserves overlay all other land allocations. The Riparian Reserve widths prescribed in the ACS apply to all watersheds until watershed analysis is completed, a site-specific analysis is conducted and described, and the rationale for final Riparian Reserve boundaries is presented through the appropriate National Environmental Policy Act decision making process. Riparian Reserves in the watershed total approximately 3,400 acres and are displayed in Figure 5.

Standards and guidelines for Riparian Reserves prohibit or regulate activities that retard or prevent attainment of the ACS objectives. Specific standards and guidelines for Riparian Reserves are found in the Forest Plan on pages 4-53 through 4-60.

Management Prescription XI – Heritage Resources

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. Visual resources, water quality, wildlife habitat, and vegetation will be protected. Heritage resource sites occur as inclusions throughout the other land allocations on NFS lands.

Fire Management Plan

The Shasta-Trinity National Forest Fire Management Plan [FMP] (USDA, 2010). The FMP is not a decision document but is a decision support tool to help fire personnel and agency decision makers determine the appropriate suppression response to an unplanned ignition. The FMP provides a finer scale summarization of Forest Plan information organized by Fire Management Units [FMU]. Fire Management Units divide the landscape into smaller geographic areas in order to describe safety considerations, physical, biological, social characteristics and to frame associated Forest Plan guidance based on these characteristics. Fire Management Units within the Edson watershed include:

- Late Successional Reserve
- Interface and Private Lands FMU including Wildland Urban Interface [WUI] Zones further divided into WUI Zones 1-4 based on distance from improvements.
- General Forest

Table 2 - Management Prescriptions by Acres and Percent

Land Allocation or Management Prescription	Area	
	Acres	%
Matrix^		
III. Management Prescription – 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. Modifications are evident and may appear moderate to observers in the area but will be unnoticed or visually subordinate from sensitive travel routes. This prescription emphasizes recreational opportunities associated with developed road systems and dispersed and developed campsites. Fish and wildlife management, which supports the recreational use of wildlife species (hunting, fishing and viewing), is also emphasized. The emphasis of vegetation management activities will be to meet recreation, visual, and wildlife objectives while maintaining healthy and vigorous ecosystems.	900	2.5%
IV. Wildlife Habitat Emphasis: The primary purpose of this prescription is to maintain and enhance big game, small game, upland game bird and nongame habitat, thereby providing adequate hunting and viewing opportunities. Habitat management for species that are primarily dependent upon early and mid-seral stages is an important consideration. While this prescription does not emphasize those wildlife species dependent on late seral stages, habitat favorable to these species will occur within this prescription. Vegetation is manipulated to meet wildlife habitat management objectives and to maintain healthy, vigorous stands using such tools as silviculture and prescribed fire. Roaded natural recreation opportunities will be maintained.	2,000	5.5%
VIII. Commercial Wood Products: The purpose of this prescription is to obtain an optimum timber yield of wood fiber products from productive forest lands within the context of ecosystem management. Investments will be made in road construction, fuels management, reforestation, vegetation management, and timber stand improvement. Vegetative manipulation will provide habitat for those wildlife species primarily dependent on early and mid-seral stages.	18,000	49.7%
VII. Late-Successional Reserves* and Threatened, Endangered and Selected Sensitive Species: The purpose of this prescription is to provide special management for late- successional reserves and threatened and endangered species. It also includes special, selected sensitive wildlife species, which are primarily dependent on late-seral stage conditions. This prescription also emphasizes retention and enhancement of sensitive plant species, old-growth vegetation, and hardwoods. Sensitive fish and wildlife species, which are dependent on riparian areas, will be managed in accordance with the standards and guidelines in Riparian Reserves.	13,515	32.9%
IX. Riparian Reserves: Standards and guidelines for Riparian Reserves prohibit or regulate activities in Riparian Reserves that retard or prevent attainment of the ACS objectives. #	3,400	9.4%
Total of NFS Land in the watershed (some overlap so totals above exceed 36,200)	**36,200**	**100**
Total - All National Forest Land (% of watershed)	36,200	44.8%
Total - All Private Land	44,500	55.2%
Total - Watershed Area	**80,700**	**100%**

* See Forest Plan, p. 4-44. ^See Forest Plan on pages 4-64 through 4-67. #Specific standards and guidelines for Riparian Reserves are found in the Forest Plan on pages 4-53 through 4-60.

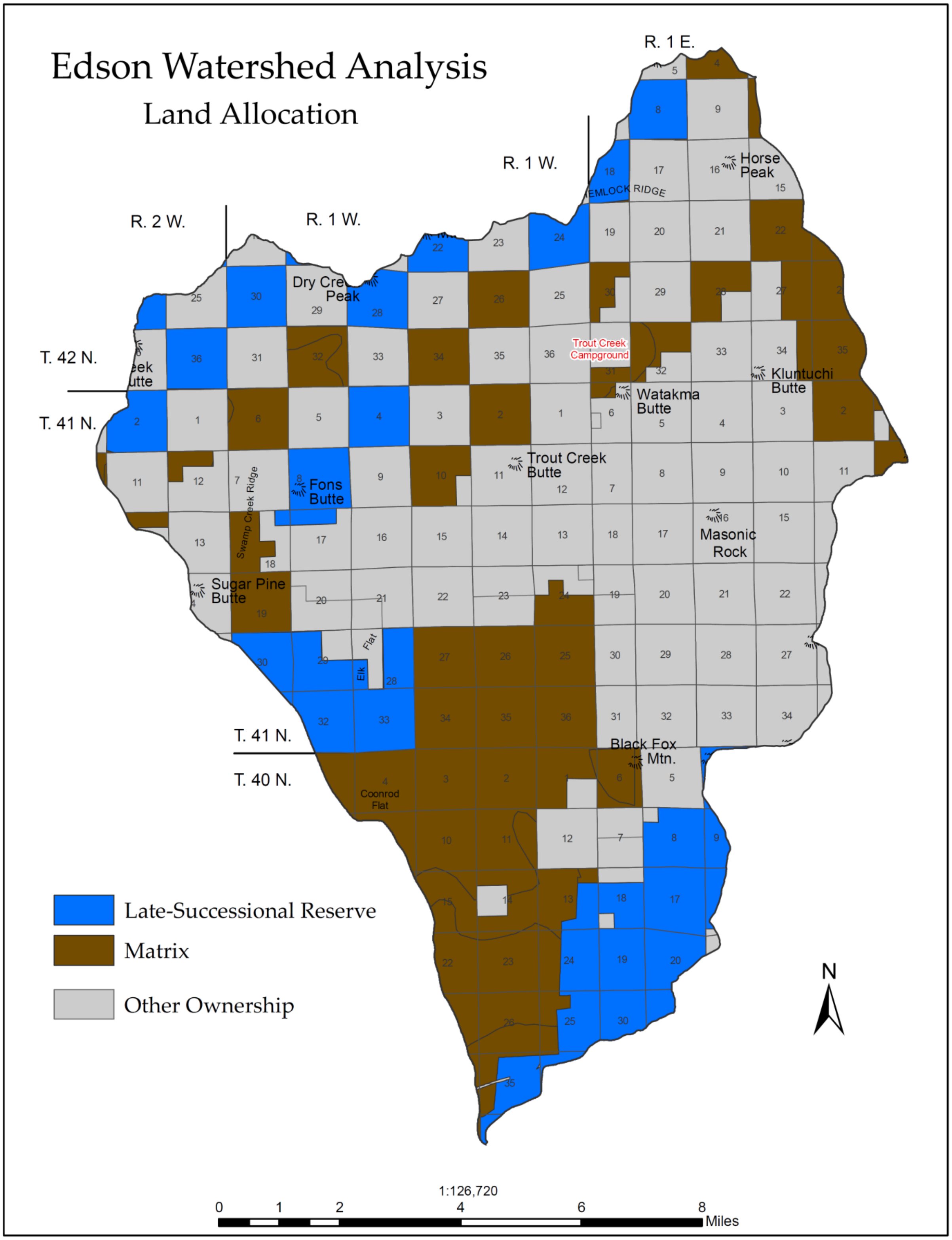

Figure 3 - Land Allocations

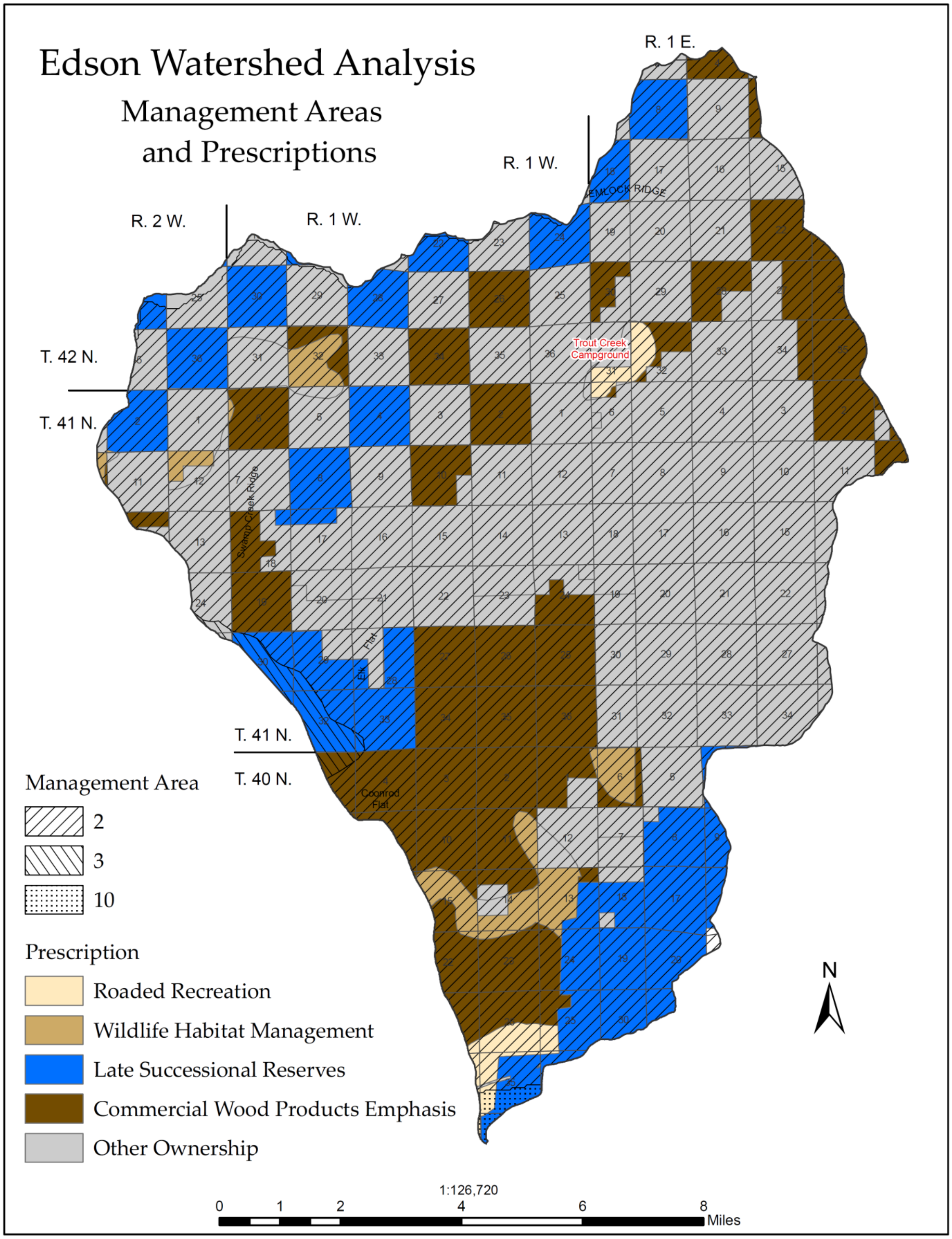

Figure 4 – Management Areas and Prescriptions

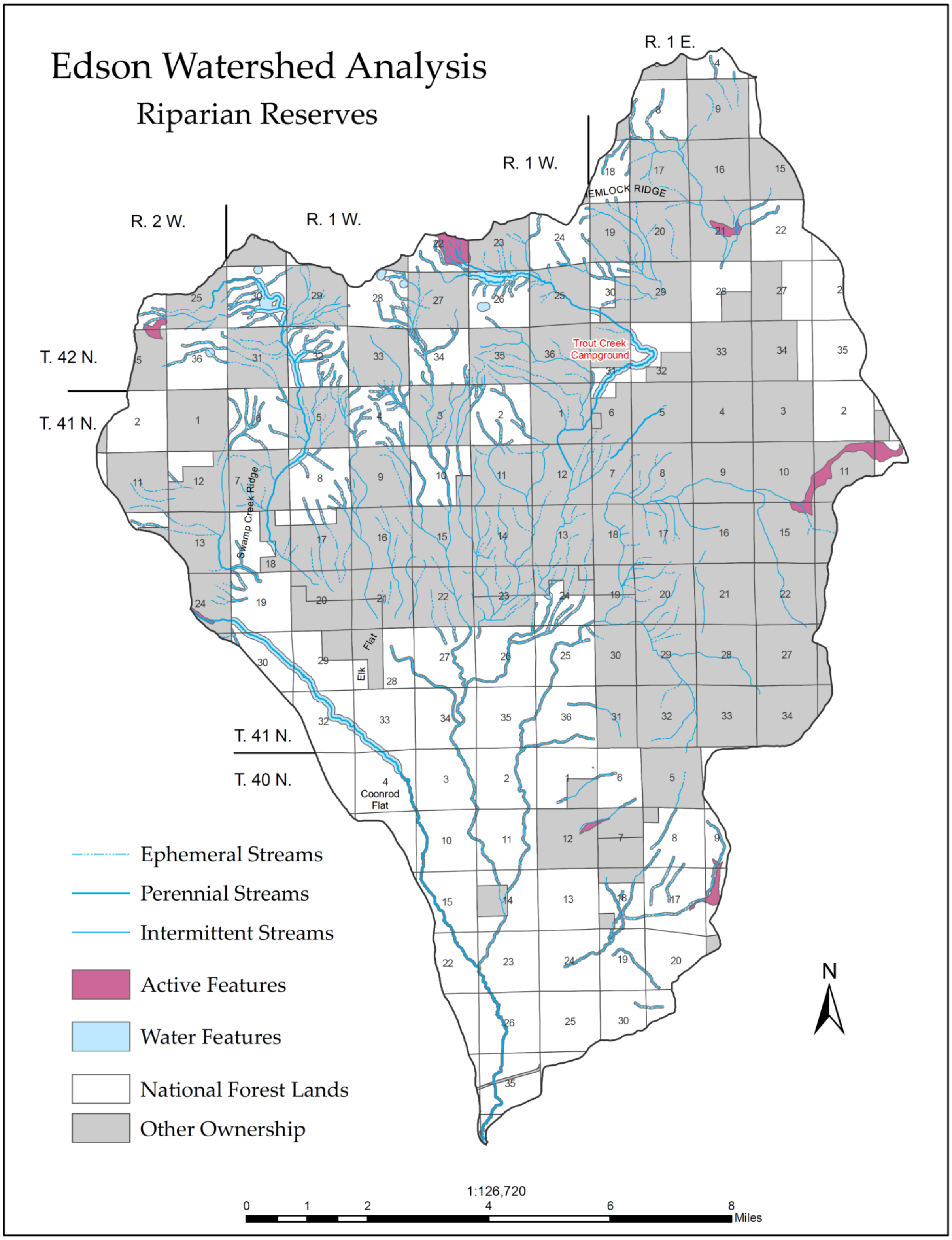

Figure 5 – Riparian Reserves

Other Direction and Guidance

Critical Habitat

The United States Fish and Wildlife Service [USFWS] has designated NSO Critical Habitat Units [CHU] including the 2008 Shasta-McCloud CHU (Unit 29) (USDI, 2008; USFWS, 2008) consisting of 9,080 acres and 1992 CA-2 consisting of 22,772 acres (USDI, 1992) within the Edson watershed boundary. Within the watershed boundary CHUs encompass portions of Elk Flat, Algoma and Mt. Shasta LSRs and Fons MLSA.

Redband Trout Conservation Agreement

The Shasta-Trinity National Forest entered into a Conservation Agreement in 1998 with the Redband Core Group [Core Group] for the Upper McCloud River Redband Trout [Conservation Agreement](RBT Agreement, 1998).[5] The Core Group is a collection of agency and private landowner representatives established in 1994 when the trout was recommended for elevated listing status, charged with the management and protection of the McCloud redband. The goal of the Core Group is to minimize or remove threats in order to promote the recovery of McCloud redband, and reduce the likelihood that it would require listing under the Endangered Species Act [ESA] through an adaptive management process of implementing, monitoring and adjusting conservation measures. The purpose of the agreement is to:

A. To maintain and enhance habitat for the McCloud redband

B. To maintain genetic viability of the McCloud redband

C. To provide specific direction for how each of the involved parties will contribute to the above

D. To gain the mutual cooperation and commitment of all parties involved for the protection and conservation of the McCloud redband

E. To minimize or remove threats in order to promote the recovery of McCloud redband and reduce the likelihood that McCloud redband would be listed under the Endangered Species Act of 1973, as amended

Caltrans Wetlands Mitigation Agreement for Trout Creek

The Trout Creek Stream Restoration Project implemented in 2006 consists of a 90-acre permanent wetland mitigation site for the Cayton Creek Bridge Replacement and Roadway Realignment project. Mitigation is described under the Caltrans Habitat Mitigation and Monitoring Plan (Caltrans, 2005) and is implemented under a United States Army Corps of Engineers nationwide permit.

[5] The Conservation Agreement is now expired; however, the Core Group is still active and is currently working on an update and a new agreement exists in draft form.

Step 2. Issues and Key Questions

The purpose of this chapter is to focus the analysis on the key elements of the ecosystem that are most relevant to the management questions and objectives, human values, or resource conditions in the watershed. Watershed concerns are identified and framed within the context of issues. The Edson Watershed Analysis Interdisciplinary Team formulated issues and key questions.

All information needed to address the issues and key questions is presented within the context of the core topics. The core topics, issues and key questions address the basic ecological conditions, processes, and interactions at work in the watershed. Core topics are presented in part 2 of the Guide.

Core topics that should be covered in all watershed analyses include:

1. Hydrology[6]
2. Vegetation
3. Species and habitats
4. Human uses

Identification of issues and key questions serves to focus the analysis on those key elements that are relevant to management objectives, human values and resource conditions within the watershed.

The following issues were identified for the Edson watershed Analysis:

1. Vegetation and Forest Resiliency
2. Habitat Quality and Distribution Through Time
3. Riparian Reserve Management

Chapter 6, "Opportunities", continues this format and further discusses management opportunities associated with each core topic.

Core Topic - Hydrology

Issue: Riparian Reserve Management

There is a need to restore the functions and processes associated with all types of Riparian Reserves within the watershed by identifying appropriate restorative measures and management practices for each Riparian Reserve type.

Riparian Reserves are relatively scarce in the watershed when compared to uplands. Terrestrial areas occur along aquatic boundaries. Riparian Reserves within the lower two-thirds of the

[6] Because hydrologic features are scarce within the watershed the core topics of erosion processes, hydrology, stream channel and water quality have been grouped into the topic of hydrology.

watershed are mostly ephemeral with intermittent stream channels, many of which only flow for several weeks or months each year. The few fish bearing streams (Figure 26) are located within the headwaters. Past management activities did not always recognize or protect intermittent and ephemeral drainages in the lower watershed. Some channels such as Ash Creek were routinely ditched in conjunction with timber harvest activity. A lack of vegetation management combined with 100 years of successful fire suppression has resulted in conifer encroaching into dry and wet meadows, increasing canopy cover and reducing sunlight, which has slowed riparian vegetation reproduction.

For the purpose of maintaining meadow values there is a need to restore the functions and processes associated with all types of Riparian Reserves within the watershed by identifying appropriate restorative measures and management practices for each Riparian Reserve type (e.g. intermittent streams, perennial streams, wet meadows, springs).

Key Questions - Riparian Reserve Management

Key Question 1: What future actions are needed to sustain or improve riparian plant communities and channel process function?

Key Question 2: What is the historic extent of both wet and dry meadows?

Core Topic - Vegetation

Issue: Vegetation and Forest Resiliency

The watershed is located in a region in which timber harvest is the main land-use activity. Vegetation is composed mainly of mixed conifer and ponderosa pine forests predominantly in an overly dense condition for the site. Thirty-five hundred acres of NFS lands consist of barren areas, grasses, brushfields and hardwoods that are not considered capable of sustaining late-successional forest. Of the 32,700 capable acres, approximately 40.3 percent or 14,600 acres currently have mature late-successional or older late-successional cover. Early to mid successional stages occupy the remaining 18,100 acres.[7] Compared to pre-Euro-American settlement, the watershed exhibits a surplus of mid-seral, a deficit of late, and early-seral habitats due to overly dense conditions.

Some stands have become vulnerable to disease and insect attack while under-intensive management over the past 100 years. The McCloud Flats area of the Edson watershed contains numerous infection centers of blackstain root disease, caused by *Leptographium wageneri.* This disease primarily affects hard pines in the flats area. *Annosus* root rot, caused by the fungus *Heterobasidium annosum*, is also present on the flats. This disease affects all conifers. The insects most likely to cause tree mortality on the flats are the mountain pine beetle, *Dendroctonus ponderosae*, and the western pine beetle, *Dendroctonus brevicomis*.

[7] Derived from Table 6

One hundred years of effective fire suppression has affected stand development and thus fire behavior and fuels composition. In many areas fire exclusion has resulted in the accumulation of dead and down fuels on the forest floor and encouraged the development of understory vegetation that has formed live fuel ladders that extend into the forest canopy. These conditions tend to make stands more vulnerable to disease and insect attacks.

Ongoing climate change research has concluded that on a global scale the climate is changing, that the change will accelerate, and that human greenhouse gas (GHG) emissions, primarily carbon dioxide emissions (CO2), are the main source of accelerated climate change (USDA, 2009). Climate change models and the predicted effects on different regions around the world show wide variation, with some greatly affected while other regions are going to be less affected. In general, the regions around the poles as well as inland from the oceans are going to see the greatest effects (Skinner, 2009).

California's climate is expected to become warmer during this century. During the next few decades, average temperatures are projected to rise between 1 and 2.3°F. Towards the end of the century statewide average temperatures are expected to rise between 3 and 10.5°F depending on various scenarios based on population growth, economic development, and control of heat-trapping emissions (CCCC, 2006);. On average, projections show little change in expected total annual precipitation or in seasonal precipitation patterns in California (CCCC, 2006).In a survey of models for California, 13 predicted higher precipitation, three showed no change and five predicted decreases (Butz, et al., 2011).. The most common prediction among the most recent models is precipitation remaining similar or slightly reduced compared to today(Butz, et al., 2011). Most models agreed that summers will be drier than they are currently, regardless of levels of annual precipitation (Christensen, et al., 2007)(Butz, et al., 2011).

With the projected rise in statewide average temperatures, more precipitation will fall as rain instead of snow and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent (CCCC, 2006). A hotter, drier climate could promote up to 90 percent more wildfires in northern California by the end of the century by drying out and increasing the flammability of forest vegetation (CCCC, 2006).

Published accounts of the last 25 years illustrate the increased intensity of fires (Miller, et al., 2009)(Spies, et al., 2006). Miller et al. (2009) noted a significant relationship between climate and forest fire activity from the early 20th century through 2006 in the Sierra Nevada and southern Cascades, with an increasing correlation between precipitation and temperature during the fire season itself. During the temporal span of the study, particularly over the last quarter century, the researchers noted a correlation between increased fire severity and increased annual precipitation. Precipitation accounted for all or most of the variance in the latest period models. The increased fire severity was attributed to increased fuel loadings, presumably from a combination of fire suppression and augmented vegetation growth due to increases in precipitation. Peak snowmelt is coming earlier, fire season lengthening, the summer drought deepening and forest fuels are possibly at all time highs (Miller, et al., 2009).

While no modeling specific to the Edson watershed area exists[8], a downscaling of three climate models for the Rogue River basin in southwest Oregon and the Klamath River Basin led to a similar projection for northwest California that precipitation may remain roughly similar to historical levels, but may shift in seasonality to occur predominantly in mid-winter months (Butz & Safford(2011)). Rising temperatures will increase the percentage of precipitation falling as rain and decrease snowpack considerably. Both wet and dry cycles are likely to last longer and be more extreme, leading to periods of deeper drought as well as periods of more extensive flooding(Butz, et al., 2011).

Although future statewide and local climate change is somewhat uncertain at this time, especially beyond a few decades, opportunities to promote forest conditions that are more resilient to potential future changes in local climate need to be considered.

There is a need to restore the resiliency of vegetation communities by identifying appropriate restorative measures and management practices for each vegetation type.

Key Questions - Vegetation and Forest Resiliency

Key Question 1: What are the current conditions and trends of the plant communities and seral stages in the watershed (riparian and non-riparian)?

Key Question 2: What actions are needed to maintain the resilience of forest stands with respect to fire, insects, disease and potential climate change?

Core Topic - Species and Habitats

Issue: Habitat quality, abundance, and distribution through time

Vegetation is continuously undergoing modification through management activities and natural processes. Timber harvest has had the greatest impact on the watershed historically; however, large changes have also occurred as a result of fire suppression, insect attack, disease and succession brought on by natural disturbance. There is a need to restore the quality, abundance, and distribution of important species' habitat through time by identifying appropriate restorative measures and management practices for each vegetation type, fuel hazard, or habitat type.

Key Question – Late Successional Habitat

Key Question 1: What actions are needed to improve the condition and increase the amount of late-successional and old-growth stands in the watershed, particularly within late-successional reserves?

The Edson watershed contains four McCloud River tributaries that provide varying amounts of habitat for McCloud River redband trout. McCloud redband are cooperatively managed under

[8] As of today, no published climate change or vegetation change modeling has been carried out for the Shasta-Trinity National Forest. Indeed, few future-climate modeling efforts have treated areas as restricted as the State of California. The principal limiting factor is the spatial scale of the General Circulation Models (GCMs) that are used to simulate future climate scenarios (Butz & Safford,(2011)).

a Conservation Agreement (RBT Agreement, 1998). Prior to the Conservation Agreement, the McCloud redband was recognized as a candidate species considered for listing under the U.S. Endangered Species Act. To date many actions have been implemented to protect and restore McCloud redband habitats. There is a need to evaluate the success of existing projects and identify other actions that will preserve, maintain or restore McCloud redband habitats.

Key Question – Redband Trout Habitat

Key Question 2: What management actions are needed to maintain habitat for the redband trout?

Core Topic – Human Uses

No issues or key questions were identified for human uses

Step 3. Current Conditions

The purpose of this chapter is to develop information relevant to the issues and key questions identified in Chapter 2. The current range, distribution, and condition of the relevant ecosystem elements are discussed.

Physical Features

Geology, Geomorphology and Erosion Processes

The watershed geology has been studied since the mid-nineteenth century (Newberry, 1856). Controversy has since persisted as to whether the area should be geologically identified with Cascade volcanics, the Basin and Range extensional tectonics, or both. The southern half of the watershed area is part of the Basin and Range province, while the northern half is most likely related to the Cascade volcanic province. Mount Shasta is one of many large composite or strato-volcanoes along the Cascade Range of North America composed of lava and fragmental (pyroclastic) deposits. The predominant volcanic rock type associated with this region is andesite.

In contrast, the Basin and Range is located inland from this volcanic arc and extends from northern Mexico to the state of Washington. The geomorphic character is generally that of linear mountain ranges (horsts) alternating with valleys (grabens). These features are the result of extensional faulting produced by plate tectonic interaction since the Miocene (26-7 m.y.b.p) geologic epoch(Atwater, 1970; Christiansen, 1972). The general strike of these faults is usually north-south to northwest-southeast. The predominant rock type within the western margins of this province is basalt. Silicic rocks such as rhyolite and dacite are also encountered, but in lesser quantities. Christiansen (1972) demonstrated how certain structural, geochemical, chronological and eruptive modes are typical of the Basin and Range province.

The block-faulting characteristic of the Modoc region extends into the northern Cascade portion of the study area and rocks characteristic of the two provinces are intermingled. Based upon geochemical studies, Baer (1973) discovered that percentages of certain chemical components of rocks found immediately southeast of the study area vary between those typical of the High Cascades and those of the Basin and Range. Some writers have referred to the area as the Modoc Plateau to distinguish its uniqueness from bordering regions (Peacock, 1931; Powers, 1932; Baer, 1973).

The geologic features of the watershed are characterized by a predominance of volcanic landforms and broad areas of nearly flat basalt plains. The presence of these plains led to the designation plateau. In its broad context the area consists of a series of northwest-to north-trending block-faulted ranges, with the intervening basins filled with broad-spreading plateau basalt flows, or with small shield volcanoes, steeper sided lava or composite cones, cinder cones, and lake deposits resulting from disruption of the drainage by faulting or volcanism.

The northern half of the watershed has been sculpted by glaciation at its northern reaches (around Dry Creek Peak and Rainbow Mountain). Below 7,000 feet, glacial landforms are predominantly depositional, including moraines, outwash plains and debris fans. Debris flows have occurred throughout the Holocene in response to rapid runoff from melting snow and ice, especially along streams that were fed by glaciers.

Most sediment moved from upper slopes is re-deposited on lower areas forming a debris fan of stacked flows and rapid aggradation of the fan surface. Both vertical and horizontal distinctions can be made regarding changes in size, sorting, and angularity.

Almost all faults align in a north-south to north-northeast direction within the study area. Their east-west separation can be as little as a hundred yards, for faults of short vertical displacement (less than 15 feet), but average about 1.5 miles for faults with larger throws. The north-south trace of some of these faults can be over fifty miles. Some faults, such as the Black fox-Buck Mountain system, are traceable across the hydrologic divide of Hemlock-Fisk Ridges continuing north into the Klamath National Forest. This so-called Cedar Mountain fault system is a complex association of normal faults along the boundary between the Cascade Ranges and the Modoc Plateau. The Stephens Pass fault was unmapped prior to the ML 4.6 Stephens Pass earthquake of August 1, 1978.

The zone of surface fractures resulting from the Stephens Pass earthquake sequence defines a linear, north-trending feature. The zone begins in section 32, T42, R1E about 260 meters south of the fault crossing of Stephens Pass Road, and extends north to the northern boundary of section 29, a total distance of about 2kilometers. The fracture zone then trends north toward a well-defined drainage feature on the south-facing slope of Hemlock Ridge, suggesting that the fault may extend at least another 0.6-0.8 kilometers to the north.

Another fracture trace is mapped about a half mile to the west. This trace cuts through section 32 and extends to the northwest paralleling Trout Creek. The upward displacement along this fault is believed responsible for the severe deflection of Trout Creek in section 32 by diverting the creek to the west and forming a new base level. Channel downcutting typical of such base level changes would be expected along this reach of the channel.

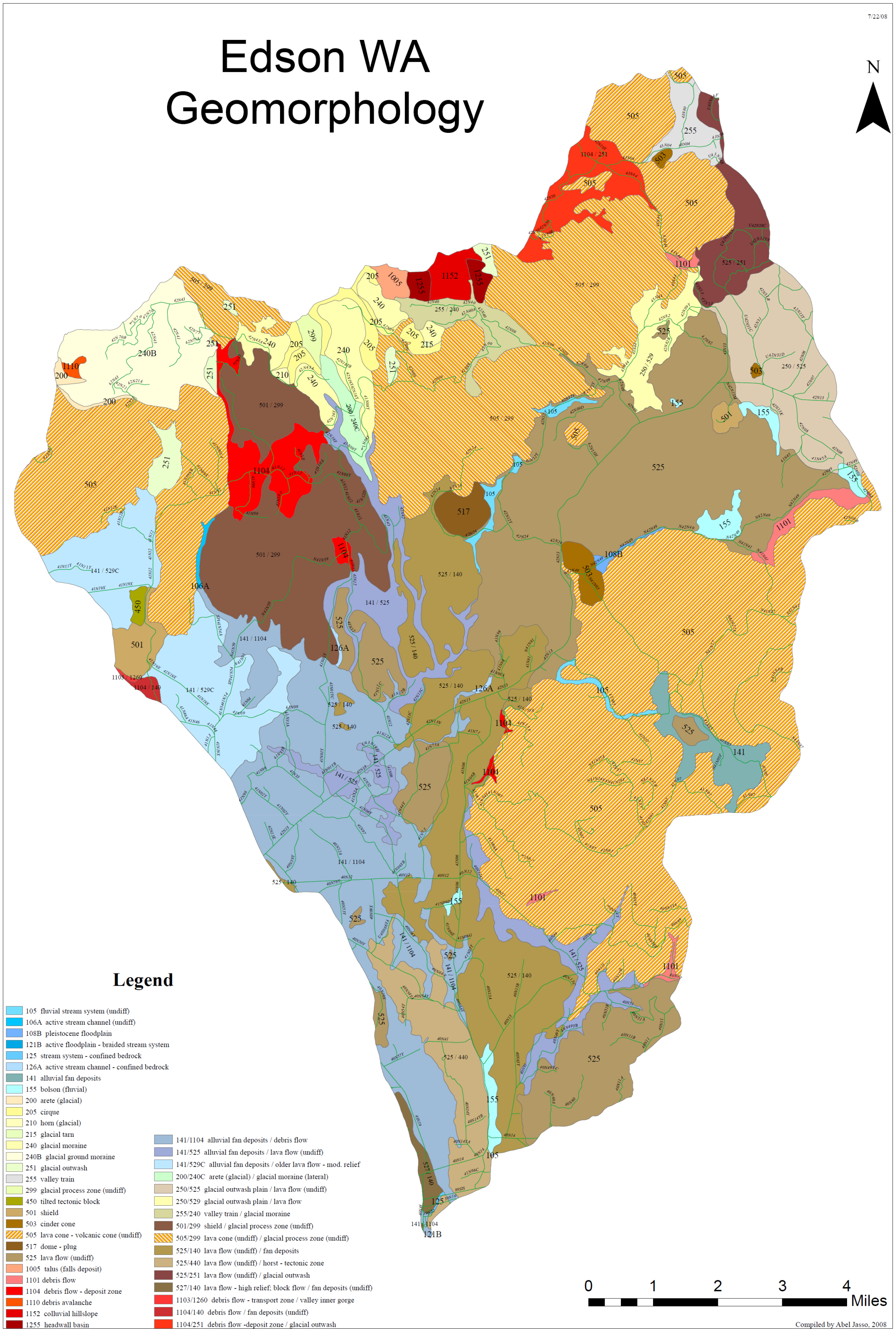

Figure 6 - Edson Watershed Geomorphology

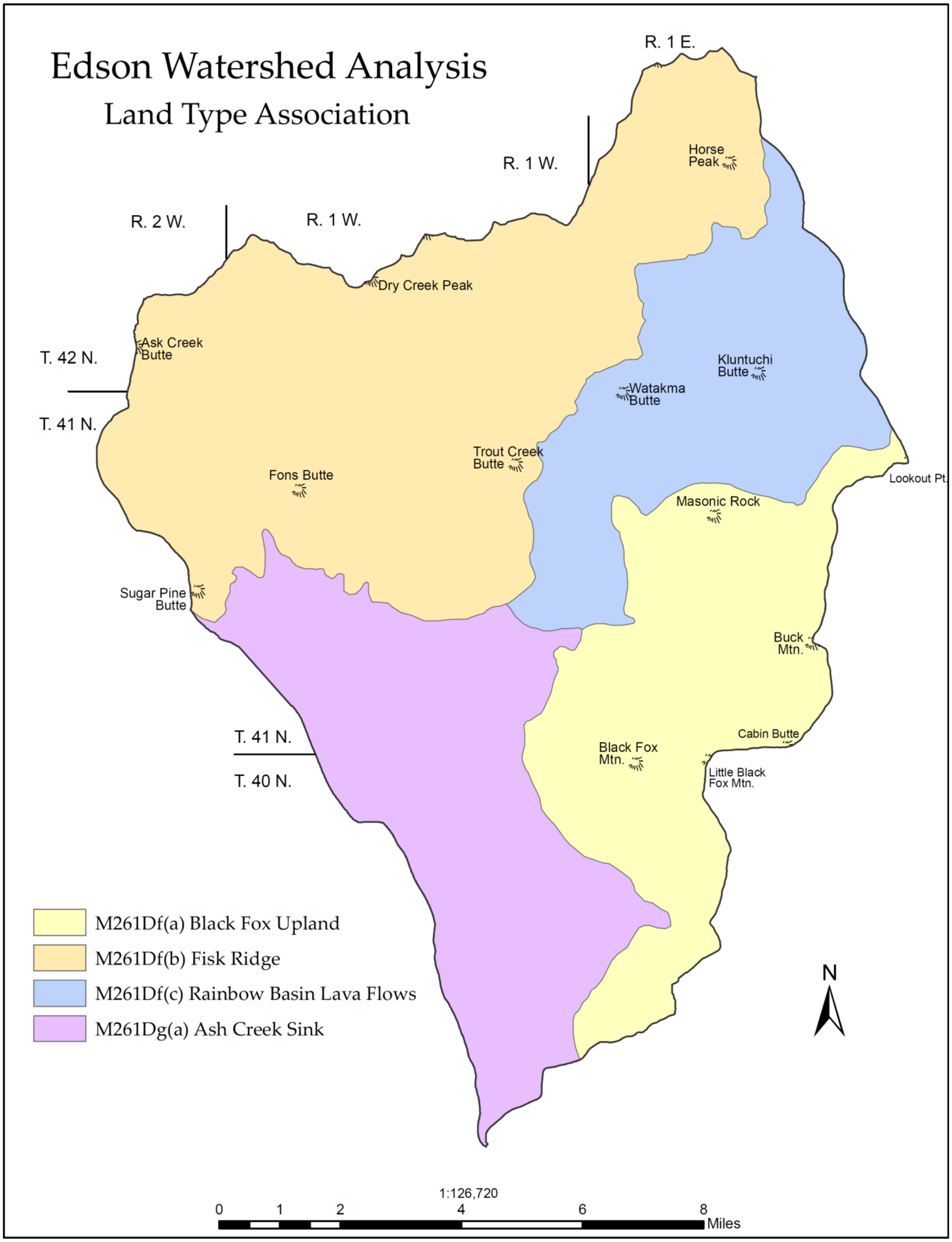

Figure 7 - Land Type Associations

Pleistocene and Holocene volcanoes tend to align along the traces of major faults such as the Black Fox-Little Black Fox Mountains along the Black Fox Fault. Many researchers have noticed the tectonic-eruptive relationship of faults within the area (Peacock, 1931; Powers, 1932; Anderson, 1941; Gardner, 1964; Baer, 1973). These cones are possibly the result of an underlying fissure-fault system.

Holocene basalts are very porous, and in some cases, their porosity is so great that the overlying areas are devoid of surface drainages. Such high water-holding capacities (a function of porosity) are partially a result of the vesicular nature of the rock.

Within the study area most creeks flowing south from Fisk Ridge or north, south or east from the Black Fox area infiltrate and disappear into alluvial fans (such as Ash Creek Sink). The exceptions being Edson and Trout Creeks which in wet years flow into the southern portion of the study area before fully infiltrating into the subsurface. Figure 6 displays Edson watershed geomorphology.

Soils

The Ecological Subsections that fall within the Edson watershed can be further subdivied into four Landtype Associations (LTAs) (Figure 7).

The McCloud Flat Subsection includes the lava flows and outwash fans at the base of the High Cascades Subsection and includes only the Ash Creek Sink LTA:

- **Ash Creek Sink** (M261Dg (a)) - Ash Creek Sink, dominated by ponderosa pine forest, is a series of Holocene alluvial fans and terraces; much of the sediments are post-glacial outwash. The terrain is typified by a nearly level topography. Throughout this mapping unit, remnants of older lava flows are exposed where they were only partially buried by more recent sediments. Soils are coarse-textured ashy sediments with a thin mantle of wind-laid volcanic ash. The soil subgroups include Andic Xerumbrepts, Humic Vitrixerands and Humic Haploxerands. Soil classification families include: medial, ashy and coarse-loamy, mixed, mesic. Slopes are generally nearly level and soils range from shallow to deep depending on their position relative to the underlying lava flows. Erosion hazard is rated low. While the area has been managed extensively, the coarse-textured soils are resilient and the level of compaction is low.

The High Cascades Subsection includes the southern end of the Cascades Range. It is further subdivided into three LTAs: the Black Fox Upland, Fisk Ridge and Rainbow Basin Lava Flows.

- **Black Fox Upland** (M261Df (a)): The Black Fox Upland is a Tertiary volcanic upland and consists of late-Tertiary basaltic andesites and andesitic tuffs with mixed conifer forest. The terrain is broad, rounded volcanic buttes. It is mantled with volcanic ash. The predominant soil subgroups are Typic or Humic Haploxerands. Soil classification families include medial, medial-skeletal and medial over medial-skeletal, mixed, and frigid. Slopes generally range from 15 to 50 percent, are deep or moderately deep, and productive. The erosion hazard rating is predominantly moderate and detrimental compaction is minimal.
- **Fisk Ridge** (M261Df (b)): Fisk Ridge consists of Pliocene and Pleistocene volcanic buttes and ridges, white fir-red fir coniferous forests, and is a lateral extension of the High Cascades between Mt. Shasta and Medicine Lake (Anderson, 1941). The ridge tops were glaciated; the headwaters of the streams are cirque-like basins. Soils are mantled with volcanic ash and

with as much as 12 inches of pumice on the east side of the mapping unit. The predominant soil subgroups are Typic Haploxerands and Typc Vitrixerands. Soil classification families include medial-skeletal and ashy over medial-skeletal, mixed, and frigid. North aspects on ridge tops are considered to be in the cryic temperature regime and support stands of mountain hemlock. Slopes range from 20 to 60 percent. Soils are generally moderately deep with frequent rock outcrops. Erosion hazard rating is considered moderate. The area is less intensively managed than other parts of the analysis area and the presence of the pumice overburden keeps the level of compaction minimal.

- **Rainbow Basin Lava Flows** (M261Df (c)): The Rainbow Basin Lava Flows are a series of overlapping lava flows, late Pliocene and Pleistocene in age (Christianson, unpublished) that emanated from Rainbow Basin as well as from Watakma and Kluntuchi Buttes. Dominated by White fir-ponderosa pine mixed conifer forest, the topography is gently sloping lava flows interrupted by volcanic buttes and cones. Soils are weathered from basaltic lava flows and ash and tephra deposits. Pumice mantles range from scattered surface layers to overburdens that range up to 12" deep on the east side of the mapping unit. Soils are typically moderately deep over fractured basalt. The predominant soil subgroups are Typic Vitrixerands and Vitric Haploxerands. Soil classification families include ashy-pumicious, ashy-skeletal and ashy over medial-skeletal, mixed, and frigid. Slopes are generally nearly level and erosion hazard rating is considered low. Though there is considerable management in the LTA, there is minimal detrimental compaction due to the coarse-textured soils and pumice overburden.

Overall, based on monitoring results using the Soil Disturbance Monitoring Protocol (Page-Dumroese, et al., 2009) and anecdotal evidence on pumice soils, Edson watershed soils show low levels with only one to four percent of the area with high levels of disturbance. Only relict converging main skid-trails on fine to medium fine-grained soils are over the soil quality standard threshold bulk density levels. With most soils being medium to coarse grained, soil compaction levels are low throughout the watershed along with soil disturbance.

Hydrology

This section describes the dominant hydrologic processes and their range of variability. In summary, due to the more abundant water in the upper portion of the watershed and the smaller basin areas, the streams and aquatic biota located in headwater areas such as Trout Creek, are more sensitive to activities than streams located at lower elevations such as Ash Creek.

Physical Processes affecting Hydrology

Physical processes are influenced by volcanism, tectonic extension and glaciation. The geology, geomorphology and the precipitation regime along with aspect, elevation and general position in the watershed are the dominant hydrologic controls in this system. Surface flow is generally greatest in volume and duration in the upper watershed basins and tends to diminish with increasing distance downstream in the lower watershed.

The watershed lies on the eastern flank of Mount Shasta, a strato-volcano, and incorporates features associated with volcanism, such as small cinder cones, domes and flows recognized as buttes and peaks. Some features such as Ash Creek Butte are pre-Shasta basalt shield volcanoes. These features influence cold air-drainage, precipitation, infiltration rates and drainage patterns by their composition, dominant relief and elevation. Infiltration rates vary with lithology; rates are very high where porous basalt occurs in the northeastern portion of the watershed. Surface features such as volcanic flows and uplifted blocks are strong influences on surface flow and can be physical barriers to channel migration.

Floodplain Processes

Flooding brings sediment to the floodplain and transfers energy in the form of woody debris, aquatic plant and animal species and nutrients, downstream. Floodplains are in a constant state of construction and flooding revitalizes many components of the near-stream ecosystem. Floods are controlled by how long and how much water floodplains can store, and how quickly water enters and exits the floodplain. How rapidly water infiltrates into the soil versus how quickly it runs off plays a large role in whether floodplains are functioning. Floodplain access by the stream is essential for floodplains to function.

In the upper watershed areas, channels are generally steeper, sediment is transported quickly through the system and floodplain extents are limited. In the lower watershed area, where channel gradients decrease, floodplains are more common. Channel incision into the floodplain occurs in some areas, which limits the ability of stream channels to disperse floodwaters and causes gullying.

Water Yield, Timing and Water Quality

Intermittent streams are the most common stream-type in the watershed as surface runoff is very limited in the watershed due to very high infiltration rates. Their intermittent character, both in spatial expression and duration of flow, is dependent on the water budget from past and current years, as well as local influences such as isolated precipitation events, infiltration rates, debris flows and channel migration. Ephemeral channels resulting from short duration rainfall events occur, but are not a common feature in the watershed.

Although some intermittent streams may flow very infrequently, once every 3-5 years, near-surface water is sometimes present and functions to support riparian vegetation and associated benefits to the surrounding landscape. Pockets of cooler air temperature from evaporation and increased humidity when water is present, or after surface water recedes or goes subterranean, are associated with intermittent channels.

Groundwater information is limited in the area; however, one well report published by the Department of Water Resources identifies a yield of 380 gallons per minute in the McCloud Flats area (DWR, 2003).[9] The USGS water atlas describes the general hydrogeologic character of northern California basin-fill and volcanic-rock aquifers, with yields from wells completed in basalt commonly producing from 100 to 1,000 gallons per minute. The volcanic-rock aquifers are generally quite variable in several ways; they are not distinct in their boundaries, as they are known to contain water in fractures, volcanic pipes, tuff beds, rubble zones, and interbedded sand layers, primarily in

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[9]link, California's Groundwater Update 2003, Bulletin 118, Sacramento River Hydrologic Region, p. 165

basalts of Miocene age or younger(USGS, 1995).[10] The extension tectonics, volcanics and basin fill in combination may result in zones that regulate ground-water input.

Stream Flow Processes

Perennial streams are maintained by base flow contributions from snow dominated precipitation and are limited in extent and duration attributed to the local geology and storage capacity. Stream flow is controlled by base flow contributions, the mass of the snowpack, its water content, and its rate of snowmelt. Occasional rain influences stream flow, especially if it rapidly melts the snowpack. Extensive flooding can occur depending on the snowpack character, temperature and moisture, rainfall, and infiltration rate. Infiltration rates vary in the watershed; high soil infiltration rates of snowmelt and rainfall are a dominant physical process active in the lower watershed where basins have filled with sediment and storage capacity is high. Antecedent soil moisture and available storage capacity affect infiltration rates and the amount of water available as surface runoff.

Surface runoff is more common in the upper watershed than in the lower watershed. The accumulation of sediment in the lower watershed allows for higher infiltration rates than what can support runoff. Upper watershed areas have smaller basins, higher snow packs, steeper slopes, more exposed bedrock and thinner soils than lower areas. These characteristics make streams in the upper watershed more responsive to snowmelt and rainfall input. , Unlike lower watershed reaches, upper streams maintain base flow throughout the year.

Streamflow in the lower and mid elevation areas of the watershed can exhibit diurnal fluctuations in response to daily evapotranspiration rates. Because surface flow diminishes with increasing distance, downstream evapotranspiration rates can strongly influence the linear extent of surface flow on streams like Trout and Ash Creeks.

Sediment Supply Processes

Ash, tephra and mudflows from volcanism as recent as 200 years ago, and glacial outwash, loess, moraine material and debris flows from recent glaciation provide abundant sediment sources. Colluvial material from eroding volcanic ridges, cones, alluvial fans and moraines provide coarse sediment sources in the upper watershed. This sediment supply along with its high infiltration rate dominates the physical processes on a landscape scale in the lower elevations.

Streamflow in headwater reaches of Cold, Ash, and Brewer Creeks is influenced by melt and sediment inputs from the Wintun Glacier located on the eastern flank of Mount Shasta. The Ash Creek gorge lying downstream of the Wintun Glacier is confined by a steeply sided lateral glacial moraine, and provides the bulk of the runoff and sediment available to Ash Creek. Debris flows occurring in the upper stream provide massive amounts of sediment released as pulses when large boulders and whole tree failure enters the channel and temporarily blocks the flow. Ash Creek receives additional runoff and sediment from all the streams within the watershed, primarily during the spring snowmelt period.

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[10]Link US Geological Survey, 1995. Water Atlas of the United States, HA 730-B.

Streamflow in all of the headwater perennial streams containing redband trout is primarily controlled by snowmelt. Snowmelt from Rainbow Ridge is the primary control of surface runoff for Swamp, Dry and Trout Creeks and snowmelt from Black Fox Mountain is the primary source of runoff for Edson Creek. Erosion of stream banks is accelerated in the gullied reaches of Trout Creek because the stream is confined at depth, and cannot disperse energy onto its floodplain. Instead of dispersing stream flow onto the floodplain during flood events, the erosive energy of the flood waters focus on the channel bed and gully walls. Composed of fine glacial outwash sediments and loess deposits forming the floodplain, gully walls are nearly vertical and mostly un-vegetated. These soils are very vulnerable to erosion and large quantities of floodplain soils are lost to the stream during flood events.

Sediment Transport Processes

Sediment transport within channel networks occurs primarily during spring runoff, and less frequently during summer and fall storms and winter rain-on-snow events that cause extensive flooding. Water quickly infiltrates into the ashy soil during the day and likewise quickly surfaces at night as diurnal variation from conifer respiration during evapotranspiration occurs. Perennial reaches of the intermittent streams are mostly limited to the upstream segments located well outside the analysis area. These streams become intermittent as they flow downstream on the alluvial fan. After seasonal flows diminish, surface water flow is more dependent on daily evapotranspiration rates. In this case, surface water flowing down the channel recedes in the upstream direction as diurnal changes in evapotranspiration rates occur. As the wetted front of the stream recedes, sediment falls out of suspension and is deposited in situ. The accumulation of sediment falling out of suspension as surface water infiltrates becomes a depositional form unique to the amount of sediment that was in transport at the time of flow recession. During the next occurrence of surface flow, the interception by these previously deposited forms, and other features, such as fallen trees or branches, directs the stream accordingly. In this area, channel migration is common, so much so that mature trees having established prior to channel migration are growing in the wetted channel, an unlikely location for conifer to establish or survive. The highly migratory character of the streams is a common feature in evolving channel networks.

The volume and concentration of sediment is variable and is dependent on the magnitude and duration of the event. Large events transport abundant sediment supply from the upper watershed to the lower watershed in pulses during floods and debris flows, the latter being common on the southeast slopes of Mount Shasta. Channel migration is a common process on the fans. The processes that control alluvial fan construction, sediment transport deposition and switching of channel location are common with Ash Creek. As gradient decreases, channels are defined by the most recent event, but can be overwhelmed by the next event and their definition erased from the last location as their channel switches with its sediment load. Sediments generated from the upper watershed are deposited in lower elevation reaches on the large alluvial fans that dominate the lower watershed area. The fans are very effective at storing all of the sediment generated from the upper watershed area; and consequently, very little sediment from the watershed ever reaches the McCloud River.

Biologic Processes

Biologic processes are more responsive to upper watershed hydrologic contributions, due to smaller basin size, in the upper watershed when compared to the lower watershed. All riparian areas, streams, wet meadows, springs and lakes provide habitat for species in otherwise dry terrain. These features support life-cycle fulfillment of many species. The roots of riparian vegetation are more influential in increasing soil strength along the stream bank. Riparian hardwoods provide near stream cover and moderate air and water temperature. Riparian plant communities function to provide soil strength to stream banks, provide near-stream cover, trap sediment, detain flow and maintain channel form. Riparian grasses and forbs are particularly important to reducing floodplain energy and bank erosion rates by slowing flooding and allowing sediment to deposit.

Conifers provide large wood recruitment for channel structure, and are perhaps the most influential in maintaining structure in the McCloud Flats area for all channel types. Large woody debris metered out over the course of time allows channels to regulate the wood more efficiently without building debris dams and causing large-scale failure. In the absence of fire, conifer encroachment of meadows has reduced meadow area. Some conifer stands are so dense they have out-competed riparian plant communities for sunlight.

Human Influences on Hydrology

The predominant land use in the watershed is timber harvest and associated plantation management, road maintenance, livestock grazing in the southeastern portion of the watershed and more recently meadow and stream restoration. Livestock frequent most riparian areas in the watershed. Overhead fills and surface water drafting locations for wildlife, grazing and dust abatement have been developed. All land use activities can affect hydrologic process and, in some cases, the condition of hydrologic features. For example, drafting from water developments can reduce surface flow availability, particularly during low flow periods. Timber harvest activities influence the amount of water available for surface runoff by altering the amount of water lost to evapotranspiration. In some cases past timber harvest activities impacted stream channels (e.g. historic ditching activity on lower Ash Creek). If not properly managed, cattle grazing can result in trampling of stream banks and riparian areas, overgrazing of riparian vegetation, bank erosion and channel sedimentation.

McCloud redband habitat restoration has occurred on Swamp, Edson and Trout Creeks. The largest of these projects on Trout Creek removed approximately 1.25 miles of gully and relocated the channel on the meadow surface. Approximately 90 acres of the restoration area is not managed as a mitigation site. Edson and Swamp Creek both have had restoration work completed on stream reaches to improve habitat and restore fish passage.

Biological Features

Vegetation

Discussion of current vegetation conditions in the Edson watershed is divided into the following sections:[11]

- **Vegetation types:** Vegetation types focuses on the species composition of the various vegetation types and describes the distribution and condition of each type within the watershed.
- **Seral stages:** Seral stages focuses on the size, density, and successional stage of vegetation rather than species. Seral stages are useful in describing the amount and distribution of various habitat types within the watershed.
- **Late-successional forest:** Late-successional forest is discussed separately because it includes additional attributes that cannot be identified solely by tree size and density classifications - such as age and decadence.

Vegetation Types

This section describes the major vegetation types and their general distribution within the Edson watershed. The current condition of each vegetation type is described in terms of forest health, the potential for catastrophic wildfire, and the potential for change due to natural succession.

Mixed conifer and ponderosa pine forest types dominate the Edson watershed. Dominant conifer species include ponderosa pine, white fir and red fir. Minor species include incense-cedar, sugar pine, Douglas-fir, lodgepole pine, and knobcone pine. Other forest types occurring in minor amounts are black oak, willows and aspen.

The amount of land in each vegetation type within the Edson watershed is displayed in Table 3-5. The current distribution of vegetation types is displayed in Figure 8 and vegetation density is depicted in Figure 9.

Non-Forested (un-vegetated lava and rock)

Description: This vegetation type is dominated by large areas of lava and barren rock where vegetation is absent or very sparse. This type also includes rock quarries, railroads, and powerlines.

Condition: Very little vegetation occurs on this vegetation type. Due to lack of fuels, there is no potential for catastrophic wildfire. No change is expected in the near future.

[11] Information of forest types, seral stages and late successional forests was derived from the 2003 air photography modeled by the Forest Service Remote Sensing Lab.

Table 3 - Summary of Major Vegetation Types within the Edson Watershed (NFS lands only)

Vegetation Types		Acres	% of NFSL
Non-forested (lava, rock, etc.)	- NB	200	0.5%
Mixed Conifer	- all mixed conifer types	3,000	8.3%
Red Fir	- all red fir types	3,800	10.5%
White Fir	- all white fir types	6,200	17.1%
Ponderosa Pine	- all PP types including plantations	18,000	49.8%
Lodgepole Pine	- LPX	900	2.5%
Knobcone Pine	- KPX	800	2.2%
Brush	- SX, SR	2,500	6.9%
Grasses	- GR	500	1.4%
Hardwoods	- HB	300	0.8%
	Totals	**36,200**	**100.0%**

Derived from the 2003 air photography modeled by the Forest Service Remote Sensing Lab

Mixed Conifer Forest

Description: Dominant conifer species in this forest type are ponderosa pine and true fir. Minor species include incense-cedar, sugar pine, Douglas-fir, lodgepole pine, and knobcone pine. Ponderosa pine tends to dominate the warmer, dryer sites while white fir tends to dominate the moister, cooler sites.

Condition: Many mixed conifer stands currently have very high stocking levels and tend to be susceptible to insect attack. White fir is especially susceptible to attack by the fir engraver beetle (*Scolytus ventralis*) when overstocked stands combine with drought conditions to increase tree stress. Frequent attacks by the red turpentine beetle (*Dendroctonus valens*) and the western pine beetle (*Dendroctonus brevicomis*) result in significant mortality in ponderosa pine in overstocked forest conditions.

Red Fir

Description: Red fir is the dominant species within the red fir forest type. White fir may make up a significant portion of this type, especially near the transition with the mixed conifer forest type. Minor species include lodgepole pine, sugar pine, and incense-cedar.

Condition: Some of the red fir stands are currently at high stocking levels. Some of these stands may also exhibit signs of storm damage along with heavy fuel loads on the forest floor. The stands also have varying degrees of dwarf mistletoe (*Arceuthobium abietunum*) infection as well as some signs of over maturity and decadence.

White Fir

Description: White fir is the dominant species within the white fir forest type. This type generally occurs between 5,000 and 6,000 feet in elevation. White fir can also occur above and below these elevations as well as on microclimate sites such as north facing slopes or sites that have more soil moisture holding capacity.

Condition: Many white fir stands are currently at high stocking levels. White fir is especially susceptible to attack by the fir engraver beetle (*Scolytus ventralis*) when overstocked stands combined with drought conditions help to increase the stress on the trees. Some of the white fir stands are also found to have dwarf mistletoe (*Arceuthobium abietunum*) as well as *annosus* root disease (*Heterobision Annosum*).

Ponderosa Pine

Description: The ponderosa pine forest type occurs in the southeastern portion of the watershed where annual precipitation is lowest. Much of the existing ponderosa pine forest type developed from ponderosa pine plantations that were established in the 1960's and 1970's. Many of these plantations have developed to size and density levels that reclassify them as a ponderosa pine forest type, rather than plantation.

Condition: Frequent attacks by the red turpentine beetle (*Dendroctonus valens*) and the western pine beetle (*Dendroctonus brevicomis*) result in significant mortality in overstocked ponderosa pine stands. Root disease is present throughout this type as described in the following section on forest health.

Lodgepole Pine

Description: The lodgepole pine forest type in the Edson watershed occurs in two distinct environmental situations:

- **Wet flats**: Lodgepole pine stands in the southern half of the watershed tend to occur in wet meadows and areas prone to seasonal flooding. Saturated soil conditions tend to favor lodgepole pine and exclude other conifer species.
- **Cold air basins:** Lodgepole pine stands at the higher elevations tend to develop in "frost-pockets" where cold air favors relatively frost-resistant lodgepole pine seedlings over other conifer species.

Condition: Most of these stands are in a mature condition and infected with western gall rust, (*Endocronartium harknessii*) and mistletoe.

Description: The knobcone pine forest type typically occurs as homogeneous, even-aged stands following fire and is a relatively short-lived species. Approximately 50 percent of trees in a stand are dead within 60 years. This high mortality within a short period of time results in areas of heavy fuel loads with large amounts of both standing snags and down logs.

Condition: Many knobcone pine stands within the watershed exhibit the high mortality and heavy fuel loads described above. The potential for catastrophic wildfire in this vegetation type is very high under certain conditions.

Plantations

Description: Plantations in the Edson watershed vary greatly in acreage and age.

- **Older plantations (greater than 25 years):** Large brush conversion projects in the 1960s and 1970s established extensive pine plantations. Dense brush understories are common in older plantations. Watershed NFS lands include approximately 5,500 acres of older plantation.
- **Younger plantations (less than 25 years):** Plantations established in the 1980s and 1990s tend to be smaller and more numerous. Although ponderosa pine was always the most

common species planted in the watershed, regeneration practices in the 1980s began to save residual small trees of other species and planted a mix of other species to promote species diversity. Younger plantations generally have very open understory conditions due to intense site preparation and plantation maintenance practices. Watershed NFS lands include approximately 500 acres of younger plantations.

Condition: Plantations in the watershed are generally highly successful. Gentle terrain and good soil conditions permit efficient use of mechanized site preparation and plantation maintenance methods, resulting in effective competing vegetation control with few plantation failures or health problems.

Brush

Description: general brush types occurring within the Edson watershed include:

- **Chaparral brush:** Chaparral consists mainly of bitterbrush and mountain-mahogany.
- **Montane brush:** Montane is mainly manzanita, snowbrush, and willow.

Condition: The chaparral brush type tends to be stable due to droughty soil conditions with a low potential for natural conifer encroachment. Dry soil conditions also make such areas unsuitable for conversion to conifer plantations.

In the absence of fire, the montane brush type is developing towards later seral stages due to conifer encroachment. There are very few opportunities to convert the montane brush type to conifer plantations because major type conversion activities occurred in the 1960's. Most remaining montane brush is on rocky terrain or in areas designated for management as wildlife habitat. Due to the dense brush conditions, the potential for high intensity wildfire in the montane brush type is high during certain months.

Forage value in both brush types is declining as brush becomes more decadent in the absence of fire.

Meadow (grass and forbs)

Description: general meadow types occurring within the Edson watershed include:

- **Wet Meadows:** Wet meadows such as those associated with portions of Trout Creek, Ash Creek and Swamp Creek, are associated with riparian areas of perennial streams, intermittent streams, or areas prone to seasonal flooding.
- **Dry Meadows:** Dry meadows are openings with meadow characteristics, such as Ash Sink, Coonrod Flat and Elk Flat have intermittent streams and may or may not have limited riparian areas.

Condition: In the absence of fire, wet meadows generally move towards later seral stages due to conifer encroachment. Periods of high precipitation and high water tables tend to halt or reverse conifer encroachment, at least temporarily; however, there has been a noticeable long-term decrease in wet meadow habitat for the last several decades. When wet meadows are in a moist condition, the potential for intense wildfire is low within the meadow itself. However, dry conditions in late summer can result in a rapid fire spread through dry grass vegetation. Encroaching conifers (typically lodgepole pine) around the meadow edge often provide vertical fuel-ladders that can create crown fires in the adjacent forest.

Dry meadows tend to be stable due to shallow soil conditions and have a low potential for natural conifer encroachment. Soil conditions also make such areas unsuitable for conversion to conifer plantations. Due to the sparse fuels, the potential for high intensity wildfire in dry meadows is low.

Hardwoods

Description: Quaking aspen and black oak occur throughout the watershed as a minor component of other vegetation types. Occasional stands of pure hardwood occur but are generally small and not mappable at the watershed scale. Both species are considered unique and valuable habitats within the watershed.

Distribution: Quaking aspen and black oak are uncommon components of conifer forests in the southern portions of the watershed. The frequency of hardwoods declines towards areas of higher elevation along the northern boundary of the watershed.

Condition: Hardwoods are trending in decline due to fire exclusion and recent management practices. Fire exclusion has allowed white fir understories to become established in many stands. As white fir develops, it eventually overtopped and shades out hardwoods.

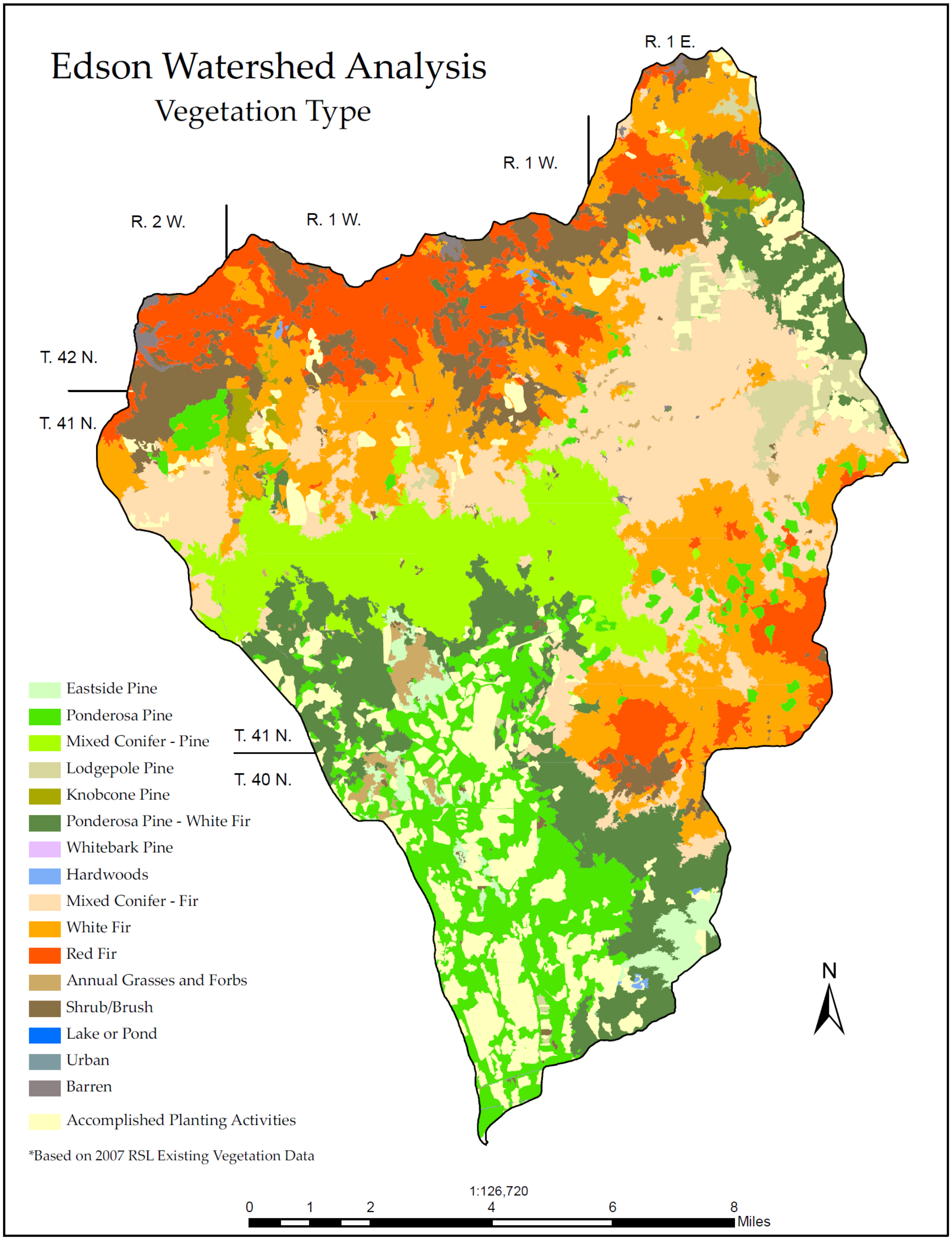

Figure 8 – Vegetation Types

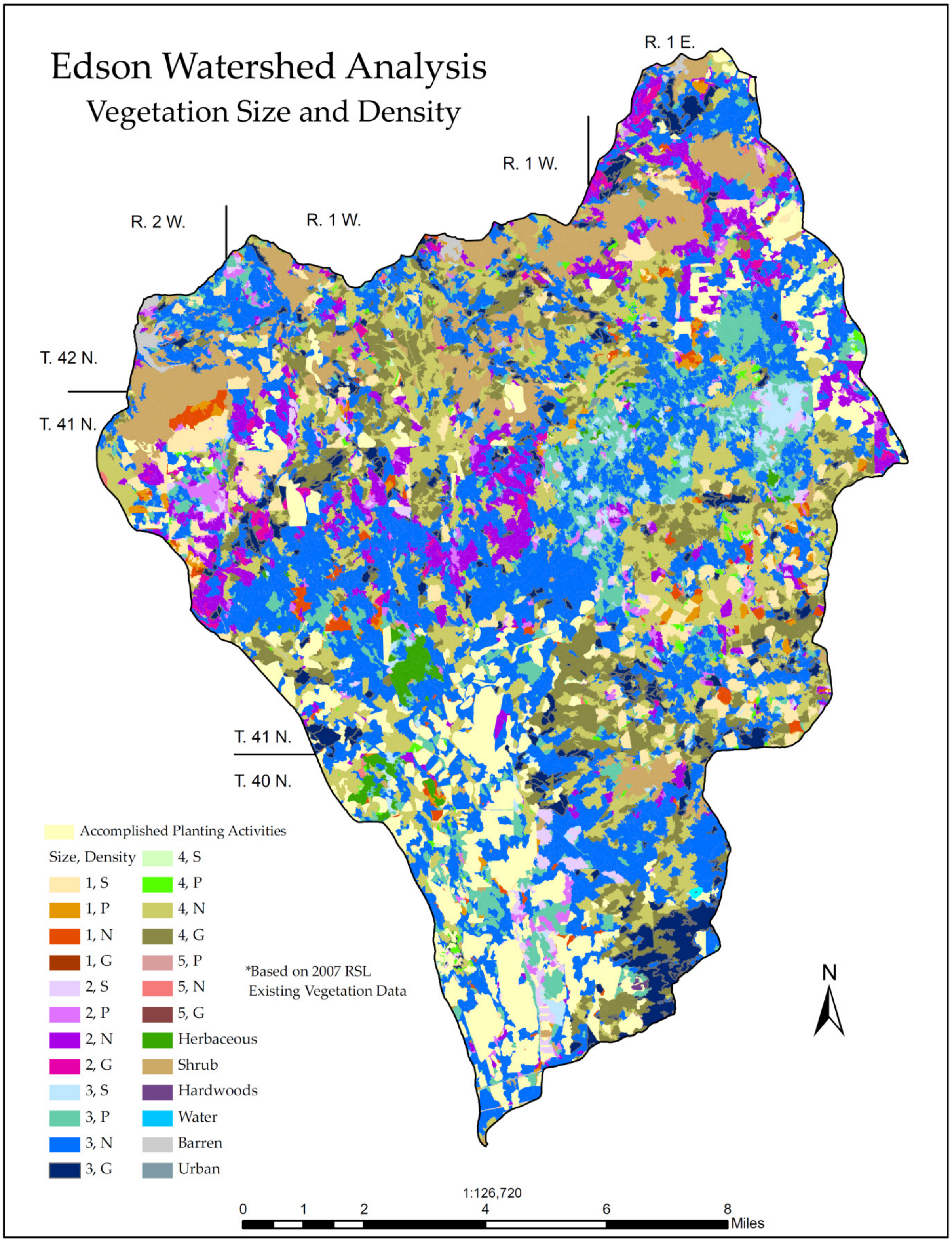

Figure 9 – Vegetation Density

Seral Stages

This section describes the current distribution of vegetation in the watershed by seral stages. Seral stages are generally described by the size and density of vegetation and the types of habitat they provide. Seral stages described in this section conform to the classification used in the Forest Plan (page 4-15).

The current seral stage distribution in the watershed developed from a combination of soil conditions, climate, fire history, and past management activities. Early seral stages generally tend to occur on lava flows, droughty soils, and areas with low annual precipitation or recently established plantations. Later seral stages tend to occur on productive soils and areas of higher annual precipitation. The amount of land in each major seral stage within the Edson watershed is displayed in Table 4.

- **Non-Forested (unvegetated lava and rock):** This area is stable with no potential for change in the near future.
- **Grass/forb (WHR 1):** The grass/forb seral stage is described as annual and perennial grasses and forbs with or without scattered shrubs and seedlings. In the Edson watershed this seral stage includes natural meadows, powerline corridors,
- **Shrub/seedling/sapling (WHR 2):** The shrub/seedling/sapling seral stage is described as mixed or pure stands of brush or conifers up to 20 feet in height. This seral stage also includes plantations 10 to 20 years old and is summarized in Table 5.
- **Pole/medium tree – open canopy (WHR 3a):** The "pole/medium tree – open canopy" seral stage is described as trees 20 to 50 feet in height and crown closure less than 40 percent. This seral stage includes all pole and small sawtimber conifer stands with crown closure less than 40 percent.
- **Pole/medium tree – closed canopy (WHR 3b, 3c):** The "pole/medium tree – closed canopy" seral stage is described as trees 20 to 50 feet in height and crown closure greater than 40 percent. This seral stage includes all pole and small sawtimber conifer stands with crown closure greater than 40 percent. It also includes lodgepole pine, knobcone pine, and plantations 20 to 30 years old.
- **Large tree – open canopy (WHR 4a):** The "large tree – open canopy" seral stage is described as trees generally over 50 feet in height and crown closure less than 40 percent. The average age of the stand is generally over 110 years and the stage corresponds roughly to a late-successional classification. This seral stage includes all conifer stands in the large tree size classes (4, 5, and 6) with crown closure less than 40 percent.
- **Large tree – closed canopy (WHR 4b, 4c, 4c-older):** The "large tree – closed canopy" seral stage is described as trees generally over 50 feet in height and crown closure greater than 40 percent. The average age of the stand is generally over 110 years (180 years and older for 4c-older) and the stage corresponds roughly to a late-successional classification. This seral stage includes all conifer stands in the large tree size classes (4, 5, and 6) with crown closure greater than 40 percent.

Table 4 - Summary of Current Seral Stage Distribution for the Edson Watershed

Seral Stage Description	Acres	% of NFSL
Non-forested (lava, rock, etc.)	200	0.6%
WHR 1,Grass/forb	500	1.4%
WHR 2, shrub/seedling/sapling	3300	9.1%
WHR 3a, Medium tree (5-21" DBH) - open canopy (<40%)	2,300	6.3%
WHR 3b-cMedium tree (5-21" DBH) - closed canopy (>40%)	15,300	42.3%
WHR 4a, Large tree (21"+ DBH) – open canopy (<40%)	300	0.8%
WHR 4b-c, Large tree (21"+ DBH) – closed canopy (>40%)	11,700	32.3%
WHR 4c-older, Large tree (21"+ DBH) – closed canopy (>40%) dominated trees are over 180 years of age	2,600	7.2%
Totals	**36,200**	**100.0%**

Derived from the 2003 air photography modeled by the Forest Service Remote Sensing Lab
DBH = Diameter Breast Height and is measured 4.5 feet off the ground

Table 5 - Summary of the Current Shrub/Seedling/Sapling Seral Stage in the Watershed

Vegetation Type	Strata Codes	NFSL	
		acres	%
Brush	BB,BS,BX,CM,CX	2500	83.3%
Plantations (10-20 years)	1S,P,N&G	500	16.7%
Totals		**3000**	**100.0%**

Derived from the 2003 air photography modeled by the Forest Service Remote Sensing Lab

Late-Successional Forest

While seral stage descriptions focus on the size and density of vegetation, descriptions of late-successional forest include additional forest attributes such as stand age, decadence, layering, large snags, and large down logs. Late-successional forests are those forest successional stages that include mature and old-growth age classes (NWFP Standards and Guidelines, 1994b). The structure and composition of these forests vary by forest type, site quality, and fire regime. Typically, such stands include live old-growth trees, standing dead trees (snags), and fallen trees or logs. In pine dominated forest, stands under normal conditions are more open with relatively fewer snags and logs. In wet climates, on productive sites, these old-growth characteristics can begin to develop as early as 150 years. On dry sites, stands may be well over 180 years before these characteristics develop. (LSRA, 1999)

Standards and guidelines for the retention of old-growth patches and late-successional forest are included in the Forest Plan (4-62). These guidelines include specific direction for fifth field watersheds in which federal forest lands are currently comprised of 15 percent or less late-successional forest. This section provides an assessment of the current condition of late-successional forest on NFS land within the Edson Creek watershed.

Overview

The current acreage and distribution of late-successional forest has developed from a combination of soil conditions, climate, fire history, and past management activities.

For purposes of this assessment, the determination of late-successional forest follows definitions used in the FEMAT report (FEMAT, 1993). Late-successional forest is subdivided into two subsets:

- **Mature forest:** In mature forest, the annual growth rate has peaked. Stands are generally greater than 80 years of age but do not meet the old-growth definition.
- **Old-growth forest:** Stands exhibit old-growth characteristics including: large trees, multi-layered canopies, decadence, large snags and down logs. Forest stands generally 180 years and older.

Table 6 - Summary of the Capability of the Edson Watershed to Support Late-Successional Forest and the Current Extent of Late-Successional Forest Within the Watershed.

Capability and Occupation of Late Successional Forest	Acres	% of NFS land in the watershed	% of capable NFS land in the watershed
Total National Forest land in Edson watershed	36,200	100.0	
Lands not capable of supporting late-successional forest (Barren areas, grasses, brushfields and hardwoods	3,500	9.7	
Lands capable of supporting late-successional forest.	32,700	90.3	100.0%
Not currently occupied by late-successional forest. seral stages 2 (seedlings), 3a and 3b-c	18,100	50.0	55.4%
Currently occupied by mature late-successional forest. Seral stages 4a and 4b-c	12,000	33.2	36.7%
Currently occupied by older late-successional forest. Seral stage 4c-older.	2,600	7.1	7.9%

Mature Forest

If left unmanaged, mature late-successional forest conditions within the watershed tend to develop dense, overstocked forest conditions with high fuel loads that make them increasingly susceptible to catastrophic events - such as wildfire and insect attack. Timber harvest is frequently used to reduce stand densities to healthy levels and to reduce fuel loads. As a result, most forest stands classified as mature late-successional forest have had some form of timber harvest in the past.

Old-Growth Forest

Due to the lack of past management activities, existing old-growth forest stands are typically overstocked with dense understory vegetation and heavy fuel loads. These stands are susceptible to catastrophic events - such as uncharacteristic wildfire and insect attack.

Late Successional Reserves

Approximately 13,515 acres within the watershed analysis area are designated as late-successional reserves. The reserves that lie at least partially within the boundaries of the Edson watershed are Mt Shasta, Elk Flat and Algoma LSRs plus Fons MLSA.

Table 7 - Late Successional Reserves

LSR	Designator	Total Acres	Acres within Edson Watershed	Portion within Edson Watershed	% of NFS Lands in Edson Watershed^	% of Capable NFS Lands in Edson Watershed*
Algoma	RC357	25,498	5,112	20.1%	14.1%	15.6%
Elk Flat	RC359	3,056	2,530	82.8%	7.0%	6.8%
Fons (MSLA)	DD72	1,448	1,448	100%	4.0%	4.4%
Mount Shasta	RC361	14,504	4,425	30.5%	12.2%	13.5%
	Total	**44,506**	**13,515**		**37.3%**	**40.3%**

^% of 36,200 acres, *% of 32,700 acres

Mt. Shasta LSR: Mount Shasta LSR ranges from 4800 feet up to 6600 feet. The LSR is dominated by white fir and red fir stands. Many of the stands are currently seeing diseased conditions. The disease that is predominantly found in these stands is dwarf mistletoe (*Arceuthobium abietunum*). Many of the stands are also seeing signs of old age and decadence.

Elk Flat LSR: The Elk Flat LSR ranges in elevation from 4040 feet up to 4320 feet. The stands within the LSR are primarily ponderosa pine stands at the lower elevations and transition more into mixed conifer stands at the higher elevations. Many of the stands are seeing substantial mortality in both the pine stands and the mixed conifer stands due to diseases such as annosus root disease (*Heterobasidion annosum*) in both the ponderosa pine and white fir. There is also black stain root disease (*Leptographium wageneri*) and insect attacks from the western pine beetle (*Dendroctonus brevicomis*) in many of the ponderosa pine trees.

Algoma LSR (Flemming, 2009): The Algoma LSR ranges in elevation from 3800 feet up to 4500 feet. The stands within the LSR are mostly mixed conifer with white fir as the dominant species on the higher terrain and ponderosa pine as the dominant species at the lower elevations. The overall stand densities are currently above desirable and healthy levels. A majority of the stands in the LSR have been experiencing bark beetle mortality from the western pine beetle

(*Dendroctonus brevicomis*) in the ponderosa pine component, along with root disease such as black stain (*Leptographium wageneri*) and annosus (*Heterobasidion annosum*).

Fons MLSA (LSRA, 1999)**:** This Managed Late Successional Area ranges in elevation from 4,920 feet at Swamp Creek, up to 5,660 in the northeast corner of the area. Late successional and mid successional conditions account for more than half of the land base within the MLSA. Ponderosa pine dominates Fons MLSA, followed by mixed conifer then white fir stands. Knobcone pine stands add to the species diversity. Observation flights (1996-97) found low rates of mortality in the mixed conifer stands with moderate rates in ponderosa pine. Current conditions remain unknown due to a lack of recently collected data. Subsequent projects level analysis will assess ongoing conditions.

Vegetation Management and Forest Resiliency

Current timber management has focused on commercial thinning of overly dense natural stands and plantations and regeneration harvest of areas with root disease and insect infestation problems. A total of approximately 14,460 acres (about 47 percent of the commercial forest lands in the watershed) of National Forest lands were commercially harvested between 1998 and 2008. The vast majority of this harvest has been commercial thinning (12,400 acres) that removed both sawlogs (trees 10 inches and greater in diameter) and biomass (trees 4 to 9.9 inches in diameter). Approximately 1580 acres have been salvage harvested to remove dead and dying trees. All of this salvage has been from areas of root disease and western pine beetle infestations. Approximately 480 acres of mature stands have been regenerated (85 percent of the mature trees removed) leaving reserve trees for a seed source and future snags.

Management of younger plantations has focused on control of brush competition and conifer tree stocking. Between 1998 and the present approximately 200 acres of young plantations have had brush removed either manually or by mechanical mastication. In the same period, approximately 570 acres of pre-commercial thinning in young plantations reduced stocking to levels prescribed by size class and anticipated future growth.

The McCloud Flats area of the Edson watershed contains numerous infection centers of blackstain root disease, caused by *Leptographium wageneri*. This disease affects primarily hard pines in the flats area. There are known to be three varieties of this fungus. A different variety infects Douglas-fir, a tree that is less common than other species on the flats. The disease is spread slowly through root contact from tree to tree. Rates of spread have been estimated from photo studies at one to seven meters per year. Infection of pines appears to be favored by wet, cool environments. Local tree-to-tree spread is via infection of small rootlets, following either root contact or short-distance growth of the through soil. The fungus is relatively non-persistent and cannot be isolated from previously infected wood much more than a year after the tree dies. The California Forest Insect and Disease Training Manual(USDA-CALFIRE, 2009) notes the fungus Infected trees usually die within a few years. Bark beetles, *Dendroctonus* or *Melanophila* species, are usually the immediate cause of mortality and new outbreaks are believed started by *Hylastes macer* beetles(USDA-CALFIRE, 2009).

The patterns of mortality and management activities that have been implemented to control blackstain disease have created several large openings. A 250-acre plantation in the Edson Creek area resulted from a blackstain infection with the prescribed treatment of logging all trees within 75 feet of an infected tree.

Blackstain occurs primarily on the better soils within the flats. Fine textured volcanic soils have been the site of most outbreaks. The better mudflow soils have also been subject to outbreaks where dense pine stands developed. There are few if any infection centers in the more open groups of pine on coarse textured mudflow (Delaney soil type) or in soil-rock outcrop associations (Ironwell and Lavacrack soil type). The disease occurs in stands that are predominantly ponderosa pine. The variety ponderosum occurs in other species such as Jeffrey pine, lodgepole pine and occasionally sugar pine and hemlock. Dense stands are more susceptible to the disease. However, thinning has not contained the disease in areas already affected.

Annosus root rot, caused by the fungus *Heterobasidium annosum,* is also present on the flats. This disease affects all conifers. It is spread by root contact. It is also spread by aerially borne spores from the fruiting body, which infect stumps and down logs. Some of the earlier outbreaks identified as blackstain probably included *Annosus* root disease. Borax powder applied to new stumps prevents the infection of these stumps.

The insects most likely to cause tree mortality on the flats are the mountain pine beetle, *Dendroctonus ponderosae*, and the western pine beetle, *Dendroctonus brevicomis. Ips Confusus*, the *ips* beetle, attacks younger trees or causes top kill in medium sized ponderosa pine. During normal precipitation years bark beetles typically attack trees weakened by root rots. During drought cycles these insects tend to attack more uninfected trees. Research is currently being conducted in the flats on the use of sex attractants or pheromones to disrupt the reproduction of these insects.

Pocket gophers frequently cause of heavy mortality in plantations. An estimated 800 acres of plantations have required replanting in the flats because of gophers. Between 1981 and 1988, strychnine bait was applied in underground burrows on an estimated 2,200 acres. Gophers tend to flourish in areas with a heavy cover of grass, forbs or rabbitbrush (*Chrysothamnus* and *Haplopappus* species). The worst problems have been in areas where plantations were established in dry meadows or rabbitbrush openings. Recent management has focused on reducing the grass-forb and rabbitbrush food base for the pocket gophers by rototilling or cultivating the plantations.

White fir mortality has been caused by engraver beetles, *Scolytus ventralis*. However, white fir mortality in the watershed has been relatively light and scattered, in contrast to the east side of the McCloud District, where white fir has died over extended areas.

Mortality and tree damage in the flats from other causes including snow, wind, dwarf mistletoe (both pine and fir species), heart rots and defoliating insects is generally well within the range of natural variation and the desired management range. These agents may cause localized problems but are not generally a forest health concern.

Although future climate change at the local level is uncertain, a shift towards a drier, or seasonally drier condition could result in an increasing risk over time of large-scale insect attack in the absence of management action to control stocking levels. Increased stand densities result in increased inter-tree competition for limited water and nutrients. Increased moisture stress reduces the natural defenses of the tree to repel insect attack and makes the forest susceptible to large-scale loss during periods of extended drought. This risk is amplified by the development of shade-tolerant species in the understory in the absence of fire or management activity. These shade-tolerant species (especially white fir) are less tolerant of prolonged drought and highly susceptible to insect attack.

Forest management improves the ability of the forest to withstand drier conditions by maintaining proper stand densities and potentially by favoring drought resistant species in the residual stands. Such measures would reduce the risk of insect attack during prolonged drought periods.

Sensitive, Watch List and California Native Plant Society [CNPS] Rare Plant Species

Pacific Fuzzwort - PTCA5 (*Ptilidium californicum*)

Status: Forest Service Sensitive

Presence in watershed: There are 18 known tree sites. Six sites are located in the Elk LSR and twelve sites are on the western flank of Black Fox Mountain.

Wilkin's Bellflower - CAWI (*Campanula wilkinsiana*)

Status: Forest Service Sensitive

Presence in watershed: Wilkin's Bellflower is found along stream banks at high elevations. There is one known population along Dry Creek, T42N, R1W, Section 34 in the Edson watershed. Several populations exist just outside the watershed.

Sugar Stick - ALVI (*Allotropa virgata*)

Status: Shasta-Trinity National Forest Watch List

Presence in watershed: Seven sites are known to occur at higher elevations. Surveys were required for this species prior to January 2001.

Salmon Mountains Wake Robin – TROVO (*Trillium ovatum ssp oettingeri*)

Status: Shasta-Trinity National Forest Watch List, CNPS List 4

Presence in watershed: Salmon Mountains wake robin was dropped from the Sensitive Plant list and added to the Shasta-Trinity National Forest National Forest Management Act or Watch List in 1998. One site is known to occur on private land in upper Trout Creek Meadow. This species is found in moist habitats near springs, seasonally wet areas and along stream banks.

Shasta Beardtongue - PEHES (*Penstemon heterodoxus var. shastensis*)

Status: Shasta- CNPS List 4

Presence in watershed: Shasta beardtongue is found in openings and light shade in more mesic habitats. This plant is known to occur in Trout Creek Meadows.

Noxious Weeds

Logging, recreation and grazing have introduced some undesirable plants into the watershed. Noxious weeds common throughout the watershed especially in disturbed sites such as landings, skid trails, plantations and along roads include: Bull thistle (*Circium vulgare*), Common mullein (*Verbascum thapsis*), and Klamath weed (*Hypericum perforatum*). Cheatgrass (*Bromus tectorum*) is known to occur in disturbed sites throughout the watershed. Cheatgrass is not mapped.

Landings used during more recent timber sale activity are heavily infested with bull thistle and common mullein. Some areas that were under-burned or piled and burned have healthy populations of bull thistle and common mullein. The Edson timber sale required more stringent noxious weed control measures during operations. It was observed during the 2008 field season that some of the landings used during the sale have fewer bull thistle and mullein plants. It was also observed that native plants claimed some of those landings very quickly, out-competing the weedy species. This was a casual observation and not all landings in the Edson sale area were surveyed.

A small population of musk thistle, a State of California A-listed weed species, occurs in a plantation just outside of the watershed's southern boundary and is checked and treated annually

Fire and Fuels

Current Conditions

Effective fire suppression efforts over the last 100 years have had a major effect on vegetation and as a result changed fire behavior and fire effects within the watershed. Forest density has increased with a shift from fire tolerant to fire intolerant species. These changes appear to be contributing to more severe wildfires, especially in low to mid-elevations (Skinner & Taylor (2006)). Increased fuel loading increases flame length that in turn, increases resistance to control. This can result in larger fire size and increased damage to values at risk from unwanted wildfire. Fire exclusion has promoted invasion of Jeffery pine, lodgepole pine and fir into meadows and aspen stands converting these areas to conifer forests (Skinner & Taylor (2006)).

In the absence of management, pine plantations are at risk of damage or loss from wildfire due to fuel conditions within and adjacent to the stands (Weatherspoon & Skinner(1996)). Fuel characteristics that affect fire behavior in plantations are low canopy base height and high canopy bulk density, which promote passive or active crown fire. Brush encroachment and dead woody surface fuels in the understory increase flame length, which aids in the initiation of crown fire and kills or damages trees by scorching crowns.

Vegetation types can be associated with a fire behavior fuel model that contains the numerical values needed to predict potential fire behavior in the fire spread model (Rothermel, 1983). These fuel models are combined with the weather variables that represent peak fire season conditions to predict rates of fire spread and intensity. Below are the vegetation types, associated fuel models and predicted flame lengths (a measure of fire intensity) for the Edson watershed (Table 9).

Table 8 - Fuel Models and Flame Lengths Associated with Vegetation Types

Vegetation Types	Fuel Models	Predicted Flame Lengths	Acres
Non-forested (lava, rock, etc.)	Unburnable	N/A	200
Mixed Conifer	Litter & Understory (TL5)	2-3 feet	3,000
	Moderate Litter (TL3)	1-2 feet	
Red Fir	Slash (SB2)	5-7 feet	3,800
	Shrubs (SH2)	4-5 feet	
	Timber Litter (TL1)	.5-1 foot	
White Fir	Slash (SB2)	5-7 feet	6,200
	Shrubs (SH2)	4-5 feet	
	Timber Litter (TL1)	.5-1 foot	
Ponderosa Pine (includes plantations)	**Wild stands**		18,000
	Pine Litter (TL9)	4 –6 feet	
	Grass & Overstory (GR2)	4–6 feet	
	Plantations		
	Shrub understory (SH2)	4-5 feet	
	Litter (TL1)	5 to 1 foot	
Lodgepole Pine	Timber Litter (TL1)	.5 -1 foot	900
Knobcone Pine	Timber/Shrub (SH5)	13-16 feet	800
Brush	Shrubs (SH3)	2-3 feet	2,500
Grasses	Grass & Overstory (GR2)	4–6 feet	500
Hardwoods	Timber Litter (TL1)	.5 -1 foot	300

Risk Hazard Rating

A Forest-wide analysis of fire occurrence, predicted fire behavior and potential for loss or damage to natural resources has been completed. Risk is the probability of a fire occurring within a given area based on the fire history for the previous 20 years. Hazard is measured by modeling potential fire behavior during fire weather conditions, which historically occur during peak fire season. Value has been determined based on urban development, commodities (e.g. saw timber), wildlife habitat and other natural resources that are at risk of damage from wildfire. The outputs from the individual ratings (risk, hazard and value) are combined to provide an adjective risk and hazard rating of high, moderate or low.

Table 10 displays of the amount of the watershed that is characterized by each adjective rating. Throughout the watershed, 24 percent of the area has a high likelihood of uncharacteristic wildfire potential. A moderate likelihood of uncharacteristic wildfire potential is found on 70 percent of the watershed. Figure 10 displays this information on a map in order to provide a general idea of where problems related to wildfire exist. This information can be used to determine where to prioritize fuel treatments, focus prevention efforts or increase suppression capability.

Table 9 - Risk Hazard Rating for Edson Watershed

Rating	Watershed Acres	Percent of Watershed
High	19368	24%
Moderate	56490	70%
Low	4842	6%
total acres	**80,700**	**100%**

Fire Return Interval Departure from Reference Conditions

Another way to look at wildland fire condition is through the evaluation of wildfire frequency, that is how similar or a dissimilar (departure) a landscape's fire regime is to its natural or historical state (reference conditions). The regional fire return interval departure [FRID] GIS layer was used to determine the fire regime departure of the Edson watershed from reference conditions. Reference minimum, maximum, and mean fire return intervals were determined (Table 11) by vegetation type. All three values were compared to the current fire return interval (Figure 11).

Table 10 - Current Fire Return Intervals (FRI)

	Mean FRI		Minimum FRI		Maximum FRI	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**
Low Departure	4860	6.15%	3	0.00%	7728	9.78%
Moderate Departure	11353	14.36%	2754	3.48%	9041	11.44%
High Departure	61374	77.65%	75144	95.07%	55960	70.80%
Fire More Frequent	314	0.40%	0	0.00%	5172	6.54%
Non Burnable	1140	1.44%	1140	1.44%	1140	1.44%

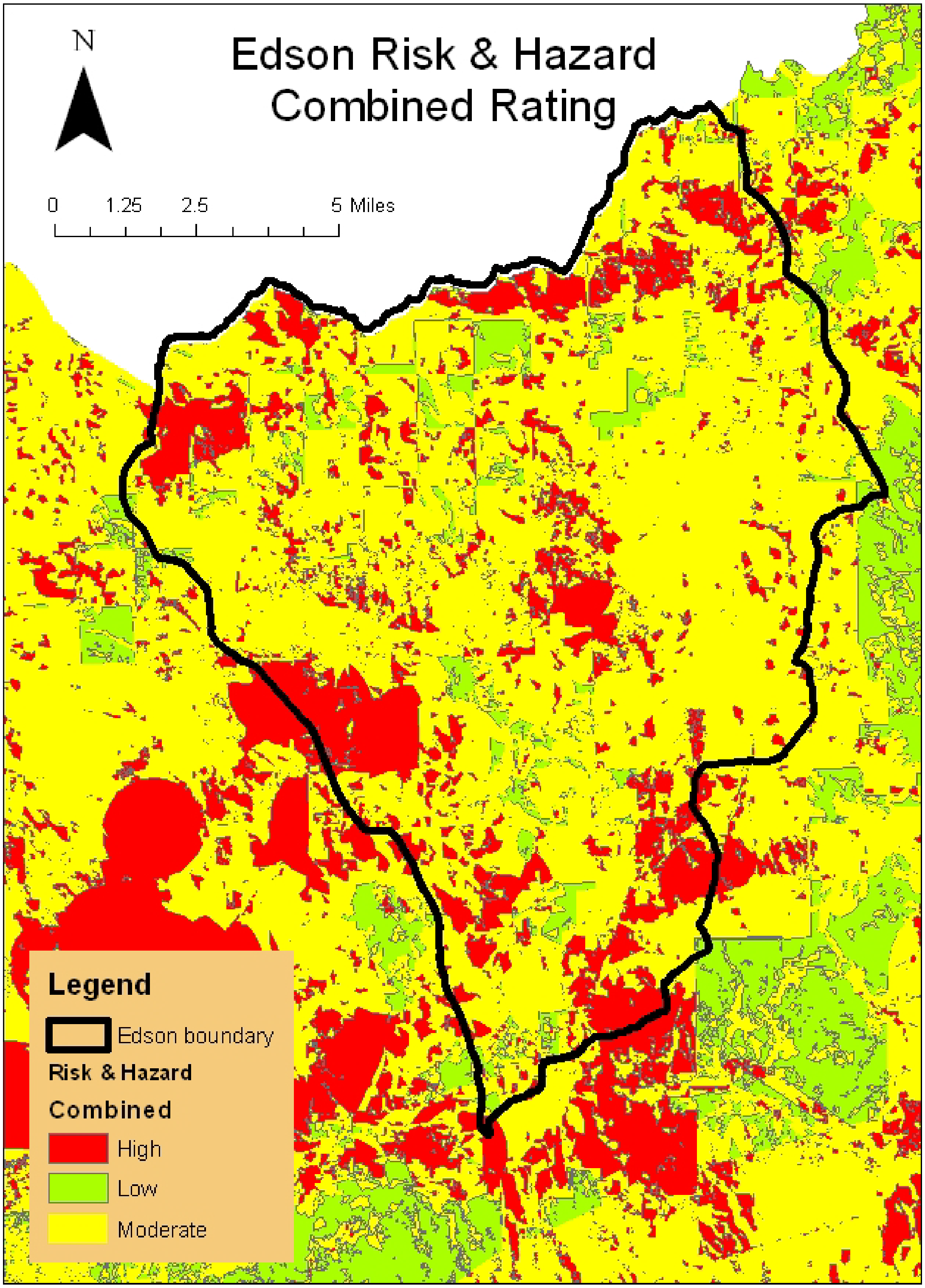

Figure 10- Edson Watershed Risk and Hazard Rating

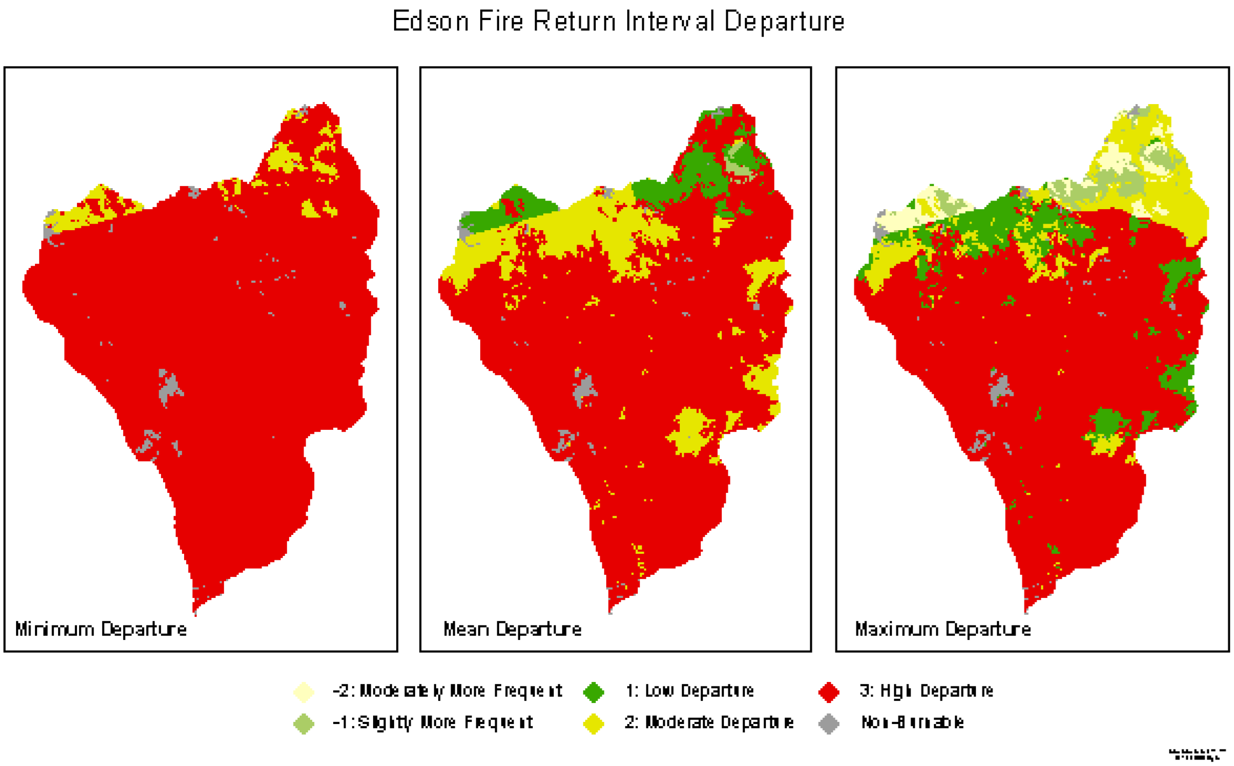

Figure 11 - Fire Return Internal Departure

Over the past 100 years, 13 percent of the watershed has burned at least once. This has resulted in a current fire return interval of 33 to 50 years depending on the number of fires burning that location. The remainder of the landscape has not burned during that time. When these current fire return intervals are compared to historic intervals, the results indicate high departure over 71 percent to 95 percent of the analysis area.

Wildland-Urban Interface

Edson watershed contains four Wildland-Urban Interface (WUI) areas and one Defense Zone.

- SMMU 2 WUI - 1,107 acres
- SMMU 3 WUI - 3,866 acres
- SMMU 3 Defense Zone - 126 acres
- SWOBE WUI - 4,393 acres
- BARTLE WUI - 69 acres

Figure 12 depicts the WUI locations, none of which is federally recognized. All of the WUI within the Edson watershed is characterized by private lands where structures or improvements are present, but are not federally listed as a community at risk. [12] Most of these acres fall within the threat zone of the WUIs (greater than 0.25 mile, up to 1.5 miles) from the structure as seen in Figure 13. The

[12] Federally recognized WUIs are listed in Federal Register V.66, No. 160, August 17, 2001. WUIs within Edson watershed are not listed.

goal within this threat zone is to achieve an environment where crown fires, headed towards communities, become surface fires within this zone before reaching the defense zone. The defense zone exists between 100 feet and ¼ mile from structures as seen in Figure 13. The wildfire behavior goal is to develop a fuels profile that will have moderate fire intensities, defined by flame lengths of four to eight feet or less, on a 90th percentile weather day (mid to late summer).

One hundred twenty acres of the WUI is within the Swobe defense zone. The target forest structure is characterized by stands that are somewhat open and dominated primarily by larger, fire tolerant trees. Surface and ladder fuel conditions are such that crown fire ignition is unlikely. The openness and discontinuity of crown fuels, both horizontally and vertically, result in very low probability of sustained crown fire. The wildfire behavior goal is to develop a fuels profile that will have low to moderate wildfire intensities determined by flame lengths of four feet or less, on a 90th percentile weather day throughout this zone. The goal is to establish an environment where firefighters can safely suppress wildfires. Specific direction related to fire in the WUIs is contained in the FMP (USDA, 2010).

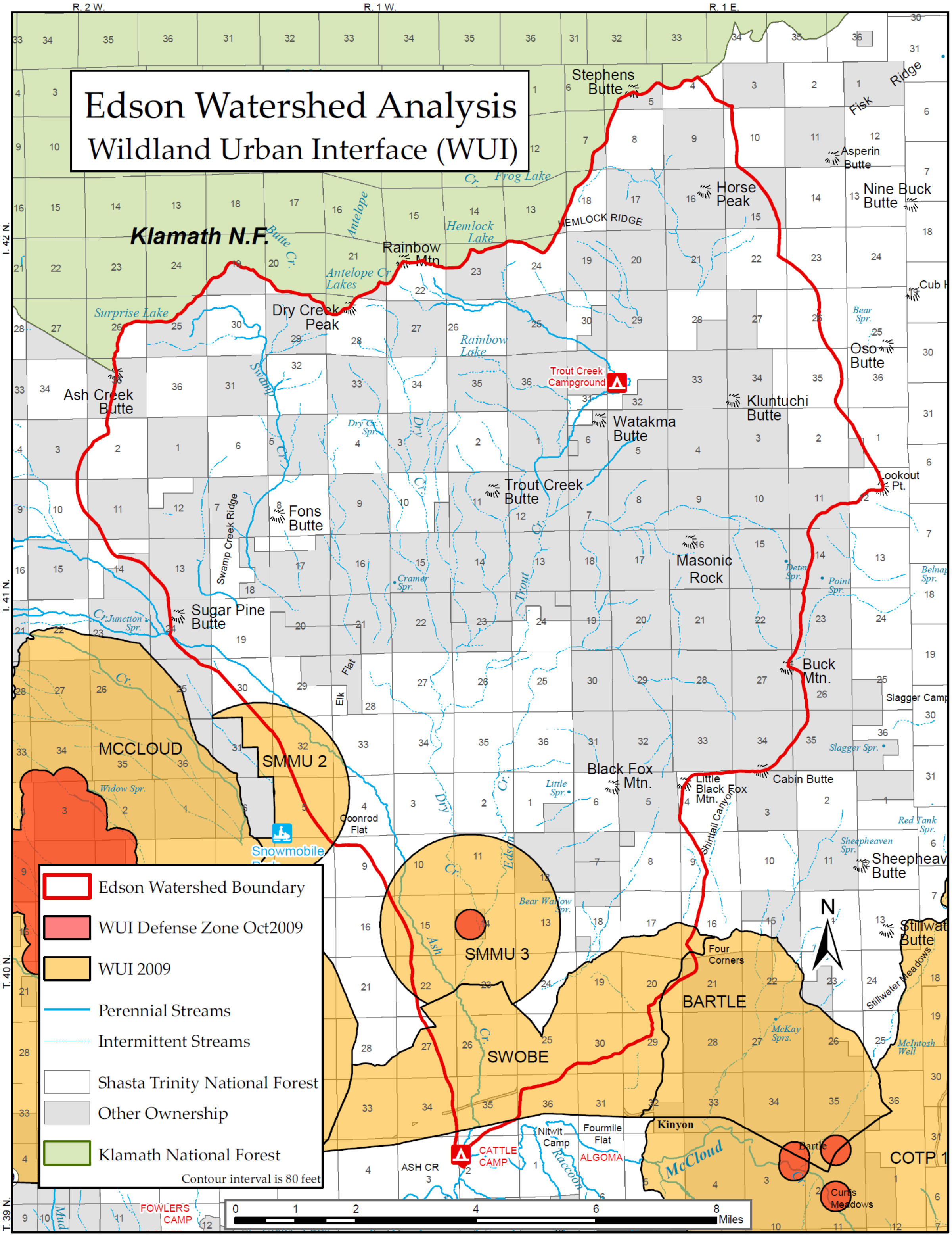

Figure 12 – Wildland-Urban Interface Zones

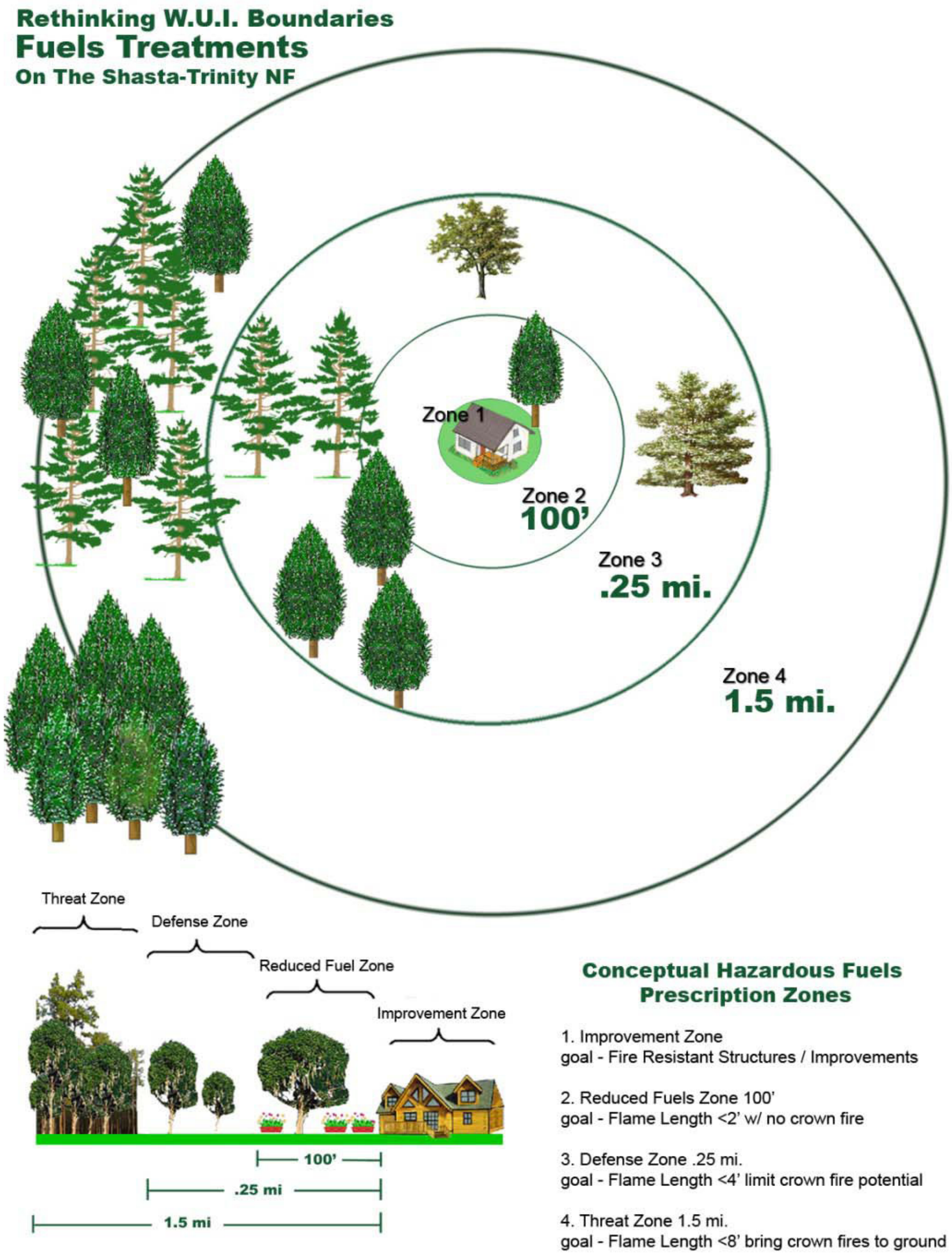

Figure 13 - Conceptual Hazardous Fuels Prescription Zones (USDA, 2010)

Species and Habitats

The Edson watershed contains habitat for 1 wildlife species listed as Federally Threatened, 12 Forest Service Sensitive Species, and 2 game species of concern. These species and their status are listed in Table 12 and discussed in the following sections. The watershed also includes habitats of importance to wildlife species and diverse and healthy landscapes, which are underrepresented within the watershed. These habitats are discussed following the species discussion.

Table 11 - Wildlife Species of Concern

Wildlife Species of Concern		Status
Northern Spotted Owl	-	Federally Threatened
Northern Goshawk	-	Forest Service Sensitive
Willow Flycatcher	-	Forest Service Sensitive
Bald Eagle	-	Forest Service Sensitive
California Wolverine	-	Forest Service Sensitive
Pacific Fisher	-	Forest Service Sensitive
American Marten	-	Forest Service Sensitive
Pallid Bat	-	Forest Service Sensitive
Townsend's Big Eared Bat	-	Forest Service Sensitive
Western Red Bat	-	Forest Service Sensitive
Northwestern Pond Turtle	-	Forest Service Sensitive
Cascades Frog	-	Forest Service Sensitive
Foothill Yellow-Legged Frog	-	Forest Service Sensitive
Mule Deer	-	Game
Elk	-	Game
Silver-haired bat	-	Species of Interest
Long-eared myotis	-	Species of Interest

Threatened and Endangered Wildlife Species of Concern

Northern Spotted Owl

Status: Federally Threatened

Presence in watershed: The Edson watershed is located near the southeast extent of the range of the NSO. There are five NSO activity centers within the watershed. Northern spotted owls were displaced or replaced at four of the five activity centers. Only the Shirttail Canyon site is currently occupied by spotted owls.

Table 12 - Status and Survey History of Spotted Owl Activity Centers within the Edson Watershed

Name	Owl ST#	Status
Kinyon	ST#203	1984(O), 1987(M), 1988(Y), 1989(O), 1990(P), 1991(Y), 1992(Y), 1993(U), 1994(O), 1995(N), 1996(Y), 1997(P, barred owl present), 1998(P), 1999(M), 2000(O), 2001(O), 2002(U), 2003(NR), 2004(O), 2005(O, barred owl present), 2006(barred owl only), 2007(barred owl only), 2008(X), 2009 ((M/F), 2010 (X)
Elk Flat	ST#215	1990(P), 1991(X), 1992(U), 1993(U), 1994(U), 1995(U), 1996(U), 1997(U), 1998(U), 1999(U), 2000(U), 2001(U), 2002(U), 2003(Y), 2004(X, barred owl present), 2005(X), 2006(U), 2007(X), 2008(U), 2009 (X), 2010 (X)
Fons	ST#221	1984(P), 1989(U), 1990(M), 1991(U), 1992(X), 1993(U), 1994(U), 1995(U), 1996(U), 1997(U), 1998(F), 1999(U), 2000(U), 2001(U), 2002(U), 2003(X, barred owl present), 2004(X, barred owl present), 2005(U), 2006(U), 2007(U), 2008(U), 2009 (X),2010 (X)
Edson	ST#223	2000(U), 2001(P), 2002(M), 2003(X), 2004(O, barred owl present), 2005(U), 2006(U), 2007(U), 2008(U),2009 (U), 2010 (U)
Shirttail Canyon	ST#225	2006(O), 2007(O), 2008(P), 2009 (O), 2010 (N,1Y)

(P) = Pair (TS) = Territorial Single (Y) = Young (S) = Single (M/F) = Male/Female - no pair (U) = Unknown (X) = No detection (O) = Occupied (N) = Nesting, Reproduction Unconfirmed.

Landscape overview: Northern spotted owl habitat is limited and isolated based on several factors. A relatively large proportion of the watershed is privately owned, and is composed primarily of industrial forest lands managed for timber production. The configuration of ownership results in a relatively large block of NFS land in the southern third of the watershed. Smaller blocks of contiguous national forest and a checkerboard pattern occur in the northern third, with the middle third primarily private.

Survey extents: Surveys have been conducted within the watershed since the early 1980's. A combination of opportunistic and protocol surveys have occurred. Monitoring of a subset of the occupied sites has occurred during most years. See Table 13.

Habitat description: Owls nest and roost within mature, relatively dense conifer forests with snags and multi-layered canopies. Foraging habitat varies, and is dependent on availability of prey species. Surface water is often present in the nest stand for local populations.

Habitat condition: The patchy and isolated habitat for owls limits population size within the watershed. Table 14 displays an analysis of the current forest conditions and habitat available for NSO. Figure 14 displays NSO habitat in Edson watershed.

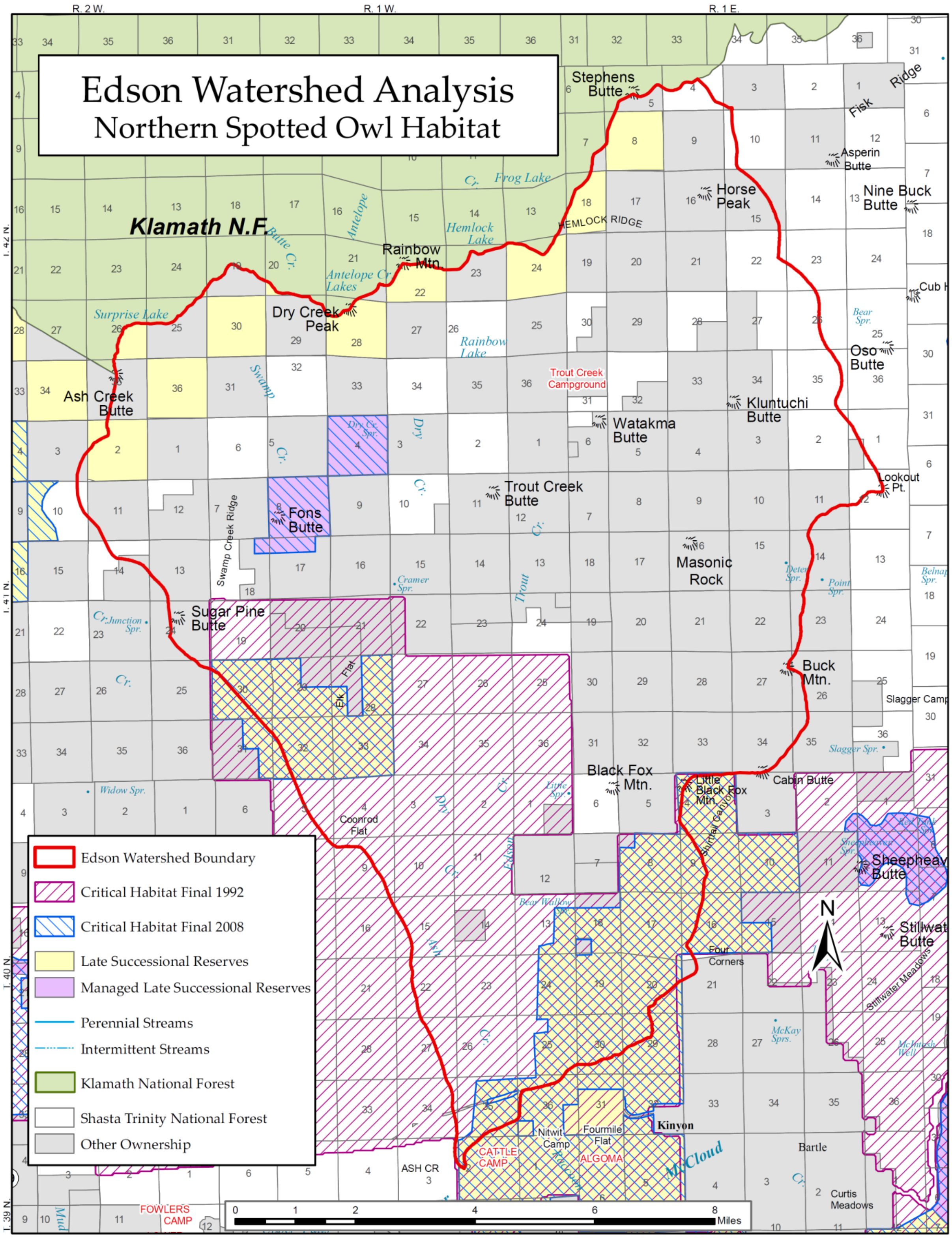

Figure 14 - Northern Spotted Owl Habitat

Table 13 – Acres of the Current Forest Conditions and Available Habitat for Northern Spotted Owl Within the Edson Watershed

Northern Spotted Owl Habitat	Acres
Nesting/Roosting Habitat	1368
Foraging Habitat	10666
Capable Habitat	1968
0-29 Year Old Plantations	9559
30+ Year Old Plantations	3255
No Trees, Capable of Trees (Not Capable of becoming NRF)	25
Trees (Not Capable of becoming NRF)	8453
Non-Forest	4018

Forest Service Sensitive Species of Concern

Northern Goshawk

Status: Forest Service Sensitive

Presence in watershed: There are eight goshawk territories within the watershed. Territories have been monitored since the early 1980's. Monitoring results from each territory are listed below.

Landscape overview: Local populations occupy suitable habitat, always near water.

Survey Extents: All moderate and high quality habitats have been surveyed. Survey intensity and area vary annually. Documented nest sites are checked periodically.

Habitat description: Mature dense conifer forests with openings, riparian preference.

Habitat condition: The patchy and isolated habitat limits goshawk habitat within the watershed.

Table 14 - Status and Survey History of Northern Goshawk Territories within the Edson Watershed

Name	ST #	Status
Fons	204	1981(O), 1984(O), 1986(O), 1987(O), 1988(3Y), 1989(1Y) 1990(P), 1991(X), 1992(X), 1993(U), 1994(P), 1995(X), 1996(O), 1997(X), 1998(X), 1999(X), 2000(Y), 2001(X), 2002(O), 2003(2Y), 2004(N), 2005(X), 2006(O), 2007(X), 2008(N), 2009 (N,3Y), 2010 (X)
Elk Flat	205	1985(4Y), 1988(O), 1989(O), 1990(1Y), 1991(O), 1992(2Y), 1993(1Y), 1994(1Y), 1995(2Y), 1996(X), 1997(X), 1998(2Y), 1999(X), 2000(O), 2001(O), 2002(2-3Y), 2003(X), 2004(1-2Y), 2005(X), 2006(X), 2007(2-3Y), 2008(2Y),2009 (X), 2010 (N,2Y)
Ash Creek Sink	206	1980-1989(O), 1990(2Y), 1991(1Y), 1992(X), 1993(U), 1994-1999(X), 2000-2008(U) ,2009 (U), 2010 (X)
Kinyon	223	1984(2Y), 1985-1986(O), 1987(2Y), 1988(Y), 1989(Y), 1990(N), 1991(U), 1992(O), 1993-1995(X), 1996(O), 1997(X), 1998(U), 1999(2Y), 2000(X), 2001(1Y), 2002-2008(X), 2009 (X), 2010 (X)
Slagger – Lookout Point	236	1991-1992(X), 1993-1998(U), 1999-2000(X), 2001(U), 2002(2Y), 2003(X), 2004(P), 2005(X), 2006(2-3Y), 2007-2008(X), 2009 (X), 2010 (X)
Coonrod (Middle Edson)	250	1991(1Y), 1992(X), 1993(U), 1994-2001(X), 2002(2Y), 2003(X), 2004(O), 2005(X), 2006(1Y), 2007(1+Y), 2008(X), 2009 (N,1Y), 2010 (X)
Rainbow Trout	251	1991(Y), 1992(X), 1993(X), 1994(2Y), 1995-1997(X), 1998(U), 1999-2001(X), 2002(U), 2003(X), 2004-2008(U), 2009 (X), 2010 (X)
Lower Edson	266	2001(1Y), 2002(2Y), 2003(X), 2004(N), 2005-2006(X), 2007(N), 2008(2Y), 2009 (U), 2010 (U)

(P) = Pair (Y) = Young (S) = Single (M/F) = Male/Female - no pair (U) = Unknown (X) = No detection (O) = Occupied (N) = Nesting, Reproduction Unconfirmed.

Willow Flycatcher

Status: Forest Service Sensitive

Presence in watershed: Willow flycatchers have not been confirmed within the watershed.

Landscape overview: Willow flycatchers occur east of the watershed at Bartle Creek and along the McCloud River.

Survey extents: Limited surveys have been conducted.

Habitat description: Nesting habitat consists of river corridors and moist or wet habitats interspersed with willow thickets.

Habitat condition: Potentially suitable habitat occurs within the watershed in riparian areas containing willow thickets.

Bald Eagle

Status: Forest Service Sensitive

Presence in watershed: Bald eagles are not known to nest within the watershed. A bald eagle was observed foraging along Trout Creek during June 2008.

Survey Extents: Limited surveys have been conducted specifically for bald eagles within the watershed.

Habitat description: Bald Eagles are generally found in coastal areas and around large bodies of water such as reservoirs, lakes, and rivers; which support their food sources, including fish, turtles, and waterfowl. Bald eagle nests are usually located in uneven-aged, multi-storied stands with old-growth components.

Habitat condition: While suitable nesting habitat occurs within the watershed, the lack of adequate foraging habitat is expected to be a limiting factor that would preclude bald eagles from nesting within the watershed.

Pacific Fisher

Status: Forest Service Sensitive

Presence in watershed: Fisher are not known to be present in the watershed.

Landscape overview: Pacific fisher have been documented in the Shasta-McCloud Management Unit and on private land in on the McCloud Flats and in the Sacramento River Canyon area. Fisher were documented at the lower elevations, less than 4,000 feet.

Survey extents: Remote camera surveys were conducted in 2002, within and adjacent to the western edge of the watershed. Additional surveys were conducted in winter and fall 2003, again near the western side of the watershed. One fisher was detected near 4,000 feet elevation.

Habitat description: Preferred habitat is characterized by dense (60-100 percent canopy), multi-storied, multi-species climax coniferous forests with a high number of large (greater than 30 inches DBH) snags and downed logs. These areas include close proximity to dense riparian corridors and saddles between major drainages used as travelways, and an interspersion of small (less than 2 acre) openings with good ground cover used for foraging. Preferred canopy closure in travel corridors is greater than 60 percent and is undesirable below 40 percent. Absence of roads is preferred. Within a given region, the distribution of fishers is likely limited by elevation and snow depth, and fisher are unlikely to occupy forest habitats in areas where elevation and snow depth act to limit their movements.

Habitat condition: Older forest habitats are limited. The Pacific fisher most often occurs between 2,000 - 5,000 feet in the Klamath Province. The majority of the watershed is above the altitudinal distribution of the Pacific fisher.

American Marten

Status: Forest Service Sensitive

Presence in watershed: Marten are present in the watershed.

Landscape overview: Marten have been documented in the Shasta-McCloud Management Unit and on private land in on the McCloud Flats and in the Sacramento River Canyon area. Marten are generally found at elevations over 4,000 feet.

Survey extents: Remote camera surveys were conducted in 2002, within and adjacent to the western edge of the watershed. Additional surveys were conducted in winter and fall 2003, again near the western side of the watershed. Marten were detected at various camera locations at the higher elevations (4,000-7,000 feet) during the three survey periods.

Habitat description: On the Shasta-Trinity National Forest, the American marten is associated with higher elevation (greater than 4,000 feet) late successional old growth true fir stands and to a lesser extent lower elevation conifer forest similar to fisher habitat. Suitable habitat consists of various mixed conifer types with at least 40 percent crown canopy closure with large trees and snags. Small clearings, meadows, and riparian areas provide foraging habitat. Absence of roads is preferred.

Habitat condition: Suitable habitat is available within the watershed.

Wolverine

Status: Wolverines found in the contiguous United States warrant protection under the Endangered Species Act, but a rulemaking to propose the species for protection is precluded by the need to address other higher priority species (USDI, 2010)[13]. The USFWS determination, also known as a 12-month finding, that sufficient scientific and commercial data exist to warrant protecting the wolverine in the contiguous United States as a Distinct Population Segment (DPS) under the ESA was made on December 14, 2010 after a comprehensive review of the best available scientific information concerning the wolverine and the threats it faces. This review found that the wolverine in the contiguous U.S. is primarily threatened by the impact of climate warming on its alpine habitat.

Presence in watershed: Unverified reports occur, species is likely not present.

Landscape overview: Scattered unconfirmed sightings throughout western forests occur. A confirmed detection on the Tahoe National Forest, and adjacent private lands in 2008 and 2009 was the first scientifically verifiable detection in California since the 1920's. Subsequent DNA testing of samples taken from the recently sighted individual determined that it is not a descendent of the last known California wolverine population, but was more genetically similar to wolverines found in the Rocky Mountains, Canada, and Alaska.

Survey extents: No wolverine have been detected in any of the ongoing furbearer surveys.

Habitat description: Wolverine require large areas of remote, undeveloped, high elevation habitat with large prey species available. Deep snow is required for successful wolverine reproduction because female wolverines dig elaborate dens in the snow for their offspring. These den structures are thought to protect wolverine kits from predators as well as harsh alpine winters. (USDI, 2010b)

Habitat condition: The necessary habitat requirements are likely not present.

Pallid Bat

Status: Forest Service Sensitive

Presence in watershed: Pallid bats are present within the watershed.

Landscape overview: Pallid bats are distributed through southern British Columbia, southern Montana, eastern Washington, Oregon, southern Idaho, Colorado, Wyoming, southwestern Kansas, western Oklahoma, western Texas, New Mexico, Utah, Arizona, Nevada, California, Baja, northern Mexico, and an isolated population on Cuba. In the Pacific Northwest, they are most

[13]Link: http://edocket.access.gpo.gov/2010/pdf/2010-30573.pdf

commonly found in oak savannah and mixed deciduous/coniferous forest (black oak and ponderosa pine habitat).

Survey extents: Bat surveys have been conducted within the Edson watershed at Trout Creek Meadow from 2005-2008. A combination of mist netting and acoustic methods are utilized. An individual pallid bat was captured during September 2005.

Habitat description: Pallid bats roost in rock crevices, tree hollows, caves, mines, and a variety of other anthropogenic structures, including buildings (vacant and occupied) and bridges. Pallid bats forage most frequently close to the ground in open meadows, savannahs, and open forest stands with minimal understory. They feed primarily on large ground-dwelling insects. Pallid bats are gregarious, and often roost in colonies of between 20 and several 100 individuals. The bats are relatively inactive during the winter. They are not known to migrate, and are believed to hibernate as solitary individuals or in small numbers.

Habitat condition: Areas within the watershed with open forested stands and forest openings are suitable foraging areas for pallid bats. Dense forest stands are not suitable foraging areas

Townsend's Big-eared Bat

Status: Forest Service Sensitive

Presence in watershed: Big-eared bats are suspected to occur, but have not been confirmed in this watershed.

Landscape overview: Big-ears are uncommon but have widespread colonies in the West. The Townsend's big-eared bat has been documented in the Sacramento River watershed. A Townsend's big-eared bat colony is known to exist in a cave located approximately 10 miles from the Edson watershed.

Survey extents: Bat surveys have been conducted within the Edson watershed at Trout Creek Meadow from 2005-2008 using a combination of mist netting and acoustic. Townsend's big-eared bats were not detected.

Habitat description: Townsend's big-eared bats make use of man-made structures such as abandoned buildings, water diversion tunnels, and bridges; its distribution is strongly correlated with the availability of caves and cave-like roosting habitat.

Habitat condition: Older forest habitats and caves are limited.

Western Red Bat

Status: Forest Service Sensitive

Presence in watershed: The Western red bat is known to occur within the watershed.

Landscape overview: The western red bat is locally common in some areas of California, occurring from Siskiyou County to the Mexican border, west of the Sierra Nevada/Cascade crest and deserts. Red bat winter range includes western lowlands and coastal regions south of San Francisco Bay. There are relatively short migrations in spring (March-May) and autumn (September-October) between summer and winter ranges in California.

Survey extents: Bat surveys were conducted within the Edson watershed at Trout Creek Meadow from 2005-2008 using a combination of mist netting and acoustic methods. An individual western red bat was captured in August 2007.

Habitat description: The western red bat is typically solitary, roosting primarily in the foliage of trees or shrubs. Western red bat day roosts are commonly in edge habitats adjacent to streams or open fields, in orchards, and sometimes in urban areas. There is an association with intact riparian habitat, particularly willows, cottonwoods, and sycamores

Habitat condition: Older forest habitats and caves are limited.

Northwestern Pond Turtle

Status: Forest Service Sensitive

Presence in watershed: The northwestern pond turtle has been reported within the watershed.

Landscape overview: Western pond turtle has been documented at scattered locations throughout the Forest.

Survey extents: Surveys have been conducted within the Edson watershed along Trout Creek since 1991, and annually from 1999-2008, and northwestern pond turtles have not been observed at Trout Creek. Limited surveys have been conducted in other areas of the watershed.

Habitat description: The northwestern pond turtle inhabits a wide range of fresh or brackish, permanent and intermittent water bodies from sea level to about 4,500 feet. It is the only freshwater turtle native to most of the west coast of temperate North America. Adult northwestern ponds turtles occur in a variety of habitat types associated with permanent or nearly permanent water, and they concentrate in low flow regions of rivers and creeks, such as side channels and backwater areas. They prefer creeks that have deep, still water and sunny banks. Northwestern pond turtles rely on basking to maintain their body temperatures during the active season. Potential basking sites include protruding or floating woody debris, protruding rocks, emergent vegetation, overhanging vegetation that touches the water, and banks.

Habitat condition: Habitat suitability is limited. Most of the watershed is above the elevation where pond turtles commonly occur. In addition, the general lack of aquatic habitats with permanent water within the watershed further limits the availability of pond turtle habitat.

Cascades Frog

Status: Forest Service Sensitive

Presence in watershed: The Cascades Frog has been reported within the watershed.

Landscape overview: The Cascades frog's distribution includes isolated populations in north-central California, along the Cascades mountain range to northern Washington, and on the Olympic peninsula. In California, Cascades frog is distributed from the Shasta-Trinity region eastward toward the Modoc Plateau and southward to the Lassen region and the upper Feather River system. The elevation range in California extends from 656 feet (Butte County) to 8,200 feet (Emerald Lake, Lassen National Park, Shasta County). California Department of Fish and Game field surveys during 1990 found that Cascades frog was moderately to extremely abundant in lake and ponded stream situations where few or no fish were present from the upper McCloud River system (Colby Meadows) westward into the Trinity Alps.

Survey extents: Surveys have been conducted within the Edson watershed along Trout Creek since 1991, and annually from 1999-2008, and Cascades frogs have not been observed during any surveys or other field work conducted at Trout Creek. Limited surveys have been conducted in other areas of the watershed.

Habitat description: The Cascades frog inhabits wet mountain meadows, ponds, lakes, and streams**.**

Habitat condition: While limited in area, suitable habitat occurs within the watershed.

Foothill Yellow-Legged Frog

Status: Forest Service Sensitive

Presence in watershed: The Foothill Yellow-Legged Frog is not known to occur within the watershed.

Landscape overview: They occur west of the Cascade crest, Sierra foothills, and coast range from Oregon to Baja California from sea level to approximately 7,000 feet, although they are rare over 4,800 feet.

Survey extents: Surveys have been conducted within the Edson watershed along Trout Creek since 1991, and annually from 1999-2008, and Foothill yellow-legged frogs have not been observed during any surveys or other field work conducted at Trout Creek. Limited surveys have been conducted in other areas of the watershed.

Habitat description: The foothill yellow-legged frog frequents the rocky, sunny banks of riffles along streams and rivers of all size in woodland, chaparral, and forest.

Habitat condition: The watershed is above the elevation where foothill yellow-legged frogs commonly occur. In addition, the general lack of aquatic habitats with permanent water within the watershed further limits the availability of yellow-legged frog habitat.

Game Species of Interest

Mule Deer

Status: None (game species of interest)

Presence in watershed: Mule deer are known within the watershed.

Landscape overview: The deer herd within and surrounding the watershed is generally considered migratory. The herd inhabits the watershed during the summer, and usually migrates out September through November. Migration is usually forced by snowfall in the higher elevations, and deer move south to lower elevations for the winter. The return migration generally occurs in May, and fawning takes place on the summer range.

Survey extents: Deer populations have declined from their peak in the 1950’s and 1960’s (Figure 15). Various reasons for the decline have been proposed including: increased hunting pressure, high road density, loss of forage, insufficient water, loss of cover, highway mortality, predation, disease, and other factors. The draft (SCDMTWG, 2008) attributes most of the deer decline in the County to reductions in early seral habitat.

Habitat description: Deer habitat concerns include the reduction of edible herbaceous and young shrub layers in forest or riparian understory and meadow and aspen encroachment by conifers. Fire exclusion has resulted in a shift from a mosaic of habitats to a more uniform densely forested habitat. Past practices such as plowing and rototilling activities used to control competition in plantations have removed edible forage species. Less desirable forage species such as goldenbush, needlegrass, squirreltail, and manzanita are prevalent in tilled plantations. In general, past fire and forest management has caused a reduction in sunlight reaching the ground, and consequently a reduction in nutritious forage available for deer.

Bitterbrush is a preferred browse for mule deer at all seasons except midwinter and before bud break. Deer arrival and departure coincides with this preferred season and hunter anecdotes testify to deer stomachs full of bitterbrush in September and October (Young &Clements (2002)). Signs of heavy grazing are unusual in this drainage, though bitterbrush is obviously used and important to the deer. Bitterbrush is abundant and widespread, so use is likely difficult to detect except on strategically located plants (e.g., in meadows, near water). Deer also eat a great variety of species, and the uncommon aspen, oak, other brush, and riparian habitats are important to forage diversity.

Habitat condition: Water availability is likely an important factor limiting deer population size and distribution in the watershed. Water is generally unevenly distributed and scarce and within the watershed. Recreational camping and other activities occur near many of the available water sources, which may reduce the availability of these sources for deer. Road densities and human activity limit deer use in the watershed.

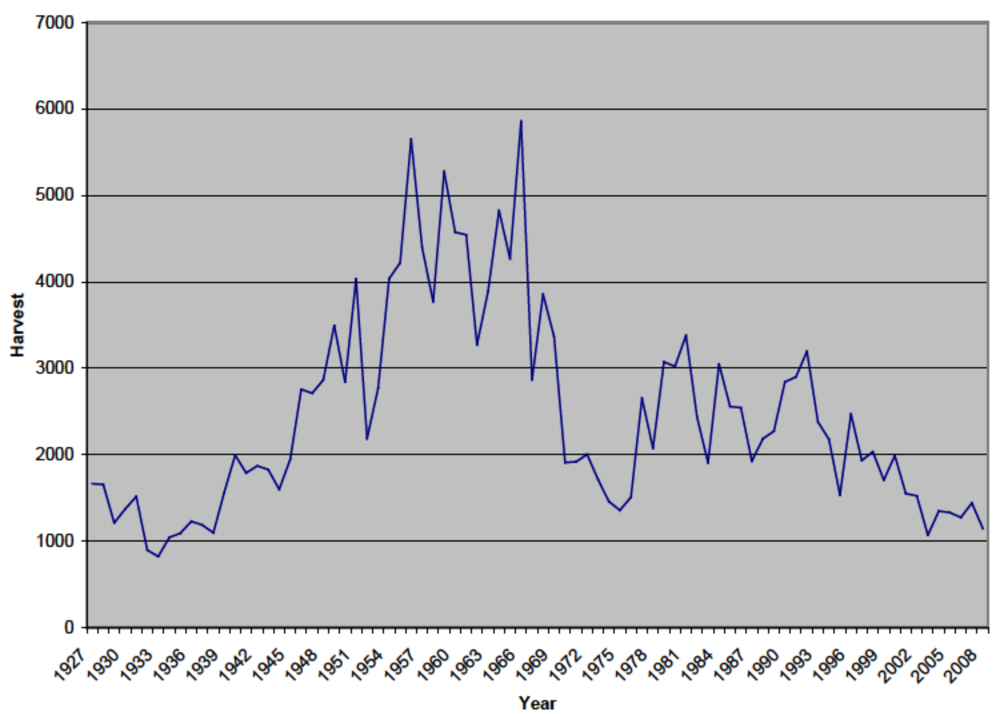

Figure 15 - Siskiyou County Buck Harvest

American Elk

Status: None (game species of interest)

Presence in watershed: Similar to the deer herd, elk migrate from lower elevation areas near Shasta Lake into the watershed for summer range. Elk utilize areas within the watershed, though currently elk densities are relatively low. Elk herds in northern California have been increasing over the past few decades, and it appears that they continue to increase. Despite less than ideal habitat conditions, elk herds may continue to increase.

Landscape overview: Elk occur west of the Cascade crest, Sierra foothills, and coast range from Oregon to Baja California from sea level to approximately 7,000 feet, although they are rare over 4,800 feet.

Survey extents: A Department of Fish and Game study indicates that concentrated elk use of some areas of the Edson watershed has been document (Shaefer, 2011).

Habitat description: Elk concentrate in riparian timber edge habitats near meadows.

Habitat condition: Many of the factors limiting deer herds, primarily declining habitat quality due to exclusion of fire and vegetation management practices, are also limiting elk.

Other Species of Interest

The presence of bats in the Trout Creek area of the watershed is being assessed as part of a study to monitor changes in occupancy, species presence and distribution, and detection probabilities. About two dozen different species of bats have been identified with the study since 2005. Two species are listed below as they overlap as species of interest[14] in the Northwest Forest Plan.

Silver-haired bat

Status: No Special Status - Bats are a study species within the watershed.

Presence in watershed: Silver-haired bat are known from surveys at Trout Creek.

Landscape overview: The distribution of the silver-haired bat includes coastal and montane forests from the Oregon border south along the coast to San Francisco Bay and along the Sierra Nevada and Great Basin region to Inyo County. During spring and fall migrations the silver-haired bat may be found anywhere in California. There may be some sexual segregation in the summer range, with females occurring further to the north. Silver-haired bats are common but erratic in abundance. Summer habitats include coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats. Summer range is generally below (9,000 feet) (Harris, 2005).

Survey extents: Bat surveys have been conducted within the Edson watershed at Trout Creek meadow from 2005-2008. A combination of mist netting and acoustic methods has been utilized. Silver-haired bats have been detected at Trout Creek every year since surveys began in 2005. The Silver-haired bat is the most abundant species identified during bat inventories (Derby, 2011).

Habitat description: Silver-haired bat is primarily a forest dweller, feeding over streams, ponds, and open brushy areas. Silver-haired bat roosts in hollow trees, snags, buildings, rock crevices, caves, and under bark (Harris, 2005).

Long-eared myotis

Status: No Special Status - Bats are a study species within the watershed.

[14] Provide additional protection for caves, mines, and abandoned wooden bridges and buildings that are used as roost sites for bats (USDA, USDI 1994; USDA, USDI 2001).

Presence in watershed: Long-eared myotis are known from surveys at Trout Creek.

Landscape overview: Long-eared myotis is widespread in California, but generally believed to be uncommon in most of its range. It avoids the arid Central Valley and hot deserts, occurring along the entire coast and in the Sierra Nevada, Cascades, and Great Basin from the Oregon border south through the Tehachapi Mts. to the Coast Ranges. This species has been found in nearly all brush, woodland, and forest habitats, from sea level to at least (9,000 feet), but coniferous woodlands and forests seem to be preferred (Harris, 2008 (edate)).

Survey extents: Bat surveys have been conducted within the Edson watershed at Trout Creek meadow from 2005-2008. A combination of mist netting and acoustic methods has been utilized. Long-eared myotis have been detected at Trout Creek in most years since surveys began (Derby, 2011). The long-eared myotis is one of three most abundant species identified during bat inventories.

Habitat description: This species roosts in buildings, crevices, spaces under bark, and snags. Caves are used primarily as night roosts. The long-eared myotis roosts singly, or is found in fairly small groups. Nursery colonies of 12to 30 individuals are found in buildings, crevices, snags, and behind bark. Long-eared myotis feeds along habitat edges, in open habitats, and over water (Harris, 2008 (edate)).

Special Habitats

Overview

Disturbance plays an important role in the natural function of an ecosystem. The ecosystem within the Edson watershed has been influenced in the past by natural disturbance events, such as volcanic activity or wind. Frequent low-intensity events such as natural fire and insects and disease played an important role in shaping and maintaining these ecosystems. Frequent, low-to-moderate intensity surface fires controlled the growth of plants not tolerant to fire, such as white fir. The departure from frequent wildfire has resulted in unnaturally high tree densities, vegetation that creates a ladder from the forest floor to the tree crowns, increase in disease and insect activity, and greater susceptibility of the stands to wide-scale disturbances in many areas of the watershed. In addition, the lack of fire -that once maintained habitat features such as meadows or aspen- has lead to habitat features being underrepresented (departed) compared to historic conditions.

Late-successional Forest

Late-successional forests are those forest seral stages that include mature and old-growth age classes (NWFP, 1994). Late-successional ecosystems perform several ecological functions that are lacking or less developed in younger stands. These functions include such processes as buffering microclimates, storing carbon, and providing nutrient and hydrological cycling. In addition, late-successional forests provide habitat characteristics important for species associated with late-successional forests such as large or old trees, decadence (e.g. in the form of snags, down logs, tree decay and deformity), and canopy gaps.

Numerous species are associated with late-successional forest; however NSO, northern goshawk, and American marten are notable species for more mesic sites. In the drier pine sites, species such as flammulated owl are notable in late-successional stands.

Preliminary Fire Regime Condition Class information (Creasy, 2006) indicates that in that late-successional habitats in certain vegetation types or density classes are only a percentage of what is to be expected. For example:

- **Upper Trout Creek subwatershed:**
  - Red fir-white fir type: late-open habitats are about 82 percent and late-dense habitats occupy about 13 percent of what can be expected.
  - White fir- mixed conifer type: late-dense habitats are about 0.5 percent of what is expected.
  - Ponderosa pine: late-open habitats are about 0 percent and late-dense habitats are about 0 percent of what can be expected.
- **Lower Trout Creek subwatershed:**
  - Red fir-White fir type: late-open habitats are about 70 percent and late-dense habitats are about 7 percent of what can be expected.
  - White fir- mixed conifer type: late-dense habitats are about 6 percent of what is expected.
  - Ponderosa pine: late-dense habitats are about zero percent of what can be expected.

Aspen

Aspen adds significantly to the richness of the wildlife in areas where it occurs (Verner, Undated). Insect production, together with a high rate of fungal infection of trees, is thought to account for the greater variety and abundance of birds in aspen habitats than in adjacent forests and shrublands. Aspen stands are habitats favored by a variety of cavity-nesting birds, such as bluebirds, sapsuckers, downy woodpeckers, and chickadees. Snags are important to cavity nesters in these stands, but live aspens are easily and therefore commonly drilled by excavating species. Aspen is considered a keystone species, vital to maintaining biodiversity. They conserve riparian soil moisture and provide habitat for obligate understory plants. Aspen are a common favorite browse by deer and elk (Howard, 1996). Some have said that aspen accounts for less than one percent of its historic extent.

Regular disturbance allows aspen to self-regenerate by cloning (Jones(2005); Bartos & Campbell (1998)). Full sunlight to the forest floor is best for reproducing aspen and as little as 20 square-feet per acre of conifer basal area will reduce understory growth production by 50 percent (Mueggler, 1989).

Hardwoods

Montane hardwood/conifer provides habitat for a variety of wildlife species. Mature forests are valuable to cavity nesting birds. Moreover, mast crops are an important food source for many birds as well as mammals. Canopy cover and understory vegetation are variable which makes the habitat suitable for numerous species. In mesic areas, many amphibians are found in the detrital layer (Anderson, Undated).

Meadows

Wet meadow in late summer, small mammals may visit wet meadows that have dried, however, the meadows are generally too wet to provide suitable habitat for small mammals. Mule deer and elk may feed in wet meadows, seeking especially forbs and palatable grasses. Waterfowl, especially mallard ducks, frequent streams flowing through wet meadows. Yellow-headed and red-winged blackbirds occasionally nest in Wet Meadows with tail vegetation and with adequate water to discourage predators. The striped racer is the common snake of wet meadows in the Sierra Nevada and Cascade Range. Various frog species are abundant in wet meadows throughout California (Ratliff, Undated).

Meadows in the watershed area and across the McCloud flats are a portion of what were historically maintained under natural disturbance regimes. For example, Mangels (Mangels, 2002) described, based on aerial photography analysis, that the extent of Elk Flat is less than 50 percent of its extent in 1944.

Fisheries

Within the Edson watershed Analysis Area there are approximately 11.2 miles of perennial fish-bearing streams. This includes a small reach of the upper McCloud River, and the perennial portions of Trout Creek, Swamp Creek, and Edson Creek. The latter three streams drain into the McCloud River, but very rarely have sufficient surface flows to reach the river. The perennial reaches of these three streams are located within larger drainages that are primarily ephemeral. These ephemeral reaches do not sustain any permanent aquatic fauna, but some sections do support fish on an intermittent basis depending on flow conditions. Ash Creek is an ephemeral stream that does not contain any fish. Edson Creek and Trout Creek are sub-basins within the Ash Creek drainage. The streams within the Edson watershed analysis area are part of the refugia for the upper McCloud River redband trout fisheries and land management objectives for this area are covered under the Upper McCloud River Redband Trout Conservation Agreement (RBT Agreement, 1998).

There are several small ponds within the analysis area. Most of these unnamed ponds lie within the Swamp Creek drainage. Rainbow Lake is the only one that is named and it lies within the trout Creek drainage. None of these ponds are known to contain any fish, however Rainbow Lake does provide habitat for the fairy shrimp (*Stretocephalus seali*). This species is rather common in the mountains of northern California and is not considered a species of concern. Tadpole shrimp are known to occur within Dry Lake, which lies to the east of the analysis area, but none have been found within any of these ponds or lakes. The species of tadpole shrimp within Dry Lake is not a species of concern.

Fish habitat conditions are dependent on stream size, stream flow, gradient, cover, pool habitat quality, and suitability of spawning gravels. Fish habitat condition within Trout and Swamp Creeks is considered fair to good. Flows are sufficient to maintain good water quality and temperature. Riffle and run habitat are the dominant habitats, but there are numerous pools with adequate cover and depth. Large deep pools and large woody debris is limited. Cover in the form of riparian vegetation and large rock is abundant. Spawning habitat is generally restricted to small pockets of gravel located behind boulders and debris. Sediment, including cinders from rocking roads, is prevented from entering streams by maintaining road runoff through road maintenance. Road maintenance prevents sediment from entering streams under most road runoff conditions. Some roads lie in old channels and these roads are difficult to drain. Some roads do contribute runoff to channels during precipitation events. In those cases where cinders make up the road sediment, cinders are delivered to streams. Channel substrate character has changed from andesite or basaltic native rock inputs to that contaminated with road cinders in the Trout Creek area.

The section of Trout Creek that was severely down cut has been rerouted into the historic stream channel and the old channel filled with a series of several plugs. As the restored channel is presently undergoing an adjustment period, habitat quality within this section is currently undergoing change. Fish habitat condition in Edson Creek is fair to poor. Stream flows during the summer are generally minimal, often resulting in stranded fish in shallow isolated pools. There are several large and deep pools that provide stable habitat with good cover, but in general, pool habitat is poor. The primary limiting factor within Edson Creek is the limited summer flow. Over the past 10 years actions have been implemented to protect and restore McCloud redband habitats in Edson, Trout and Swamp Creeks. There is a need to evaluate the success of existing projects and identify other actions that will preserve, maintain or restore McCloud redband habitats.

Table 15 - Fish-Bearing Streams

Stream	Miles Redband Trout Habitat (Normal Water Year)	Miles Redband Trout Habitat (Dry Year)	Fish Species
Trout Creek	9.6	3.5	Redband, Brown Trout
Swamp Creek	2.7	2.0	Redband
Edson Creek	1.1	0.3	Redband

McCloud redband/rainbow trout (*Onchorynchus mykiss var. stonei*) is the only species found in the Edson watershed. Brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*) occur in the Upper McCloud River however the watershed boundary just barely touches it. The Upper McCloud redband trout is a Forest Service Sensitive species. As a result of the conservation agreement, annual monitoring is conducted for McCloud redband in order to determine trends in habitat quality and relative fish abundance. No other fish species are known to inhabit the area. Table 1 is a list of fish bearing streams and the fish species found, as well as the miles of suitable habitat in most normal water years during summer flows.

Human Uses

Social and Economic Environment

Trout Creek Vegetation Restoration Project Economic Resource Report (Wilson, 2010) provides a description of the social and economic environment relating to the local population that relies on and utilizes the NFS lands on the McCloud Flats including the Edson watershed. The affected environment section presents a variety of demographic, social and economic variables that describe the current state of the economic environment for the local area. The Edson watershed is located in Siskiyou County. For the purpose of this assessment, residents and businesses of Siskiyou and Shasta Counties are considered local. Only a handful of permanent residents actually live within the Edson watershed.

Wilson (2010)[15] notes stable populations in both Counties with a slight decline experienced in 2008 and 2009. In prior years, the study area experienced amenity led growth in the form of retirees relocating from more metropolitan areas, and people searching for smaller communities to raise their family. However, that trend appears to have subsided due to national economic conditions. When conditions improve it is likely that Shasta and Siskiyou Counties will once again experience new population growth. Both counties have consistently maintained an unemployment rate near or greater than the state average in recent years. Siskiyou County has had the highest presence of unemployment, consistently experiencing rates above eight percent since 2001 (Wilson, 2010).[16] Both counties have lower per capita incomes and higher poverty rates than the state average. These poverty rates suggest that a substantial proportion of the existing population should be considered as a low income group. Therefore, decisions regarding future management actions should carefully assess the effects on low income populations in the study area (Wilson, 2010).[17]

The closest community is the town of McCloud, population 1582 (USCB, 2000), which until the last mill closed in 2002 was considered a timber dependent community (City-Data, 2010). Forty-Two percent of households in McCloud utilize wood as their primary source of home heating, and many local residents rely on the surrounding national forest system lands for firewood. The Edson watershed encompasses lands popular for firewood gathering. Load observations indicate lodgepole pine is the most popular firewood species.

Recreation and General Use

The Edson watershed experiences low levels of widely dispersed public use with limited exceptions. Deer hunting with associated dispersed camping and mushroom gathering are the two popular recreational activities undertaken by the public. Deer hunting occurs from mid-August to the end of October. This watershed is in the popular X-1 zone and permits and enforcement are the responsibility of the California Department of Fish and Game. Deer tags were limited to 2,370 in 2009 (CADFG, 2009).[18] Firewood gathering occurs throughout the summer.

Mushroom gathering occurs in both the spring and fall seasons. Mushroom hunting is a seasonal activity undertaken for recreational purposes. There is also some uncontrolled commercial picking. King bolete (*Boletus edulis*) and morels (*Morchella* spp.) are commonly collected in the spring. The area is considered one of the most popular spots in northern California; however, no data exists on participation levels or harvested quantities. Many pickers come from out of the area. Boletes are

[15] Table 1,

[16] Table 6)

[17] P# 6-7

[18] Link: http://www.dfg.ca.gov/wildlife/hunting/deer/docs/deerkill/2009DeerKillReport.pdf

usually found in mature pine and cedar stands. They come up in the same locations year after year. Morels are usually found in disturbed areas, are seldom abundant in the same place for more than two years. During the fall, a large number of commercial mushroom collectors come to the watershed in search of the matsutake mushroom. Approximately 400 personal use and 800 to 1000 commercial use mushroom permits are issued for mushroom collecting each year.

There are two developed recreation facilities in the watershed. The Cattle Camp Campground contains 27 units with piped water, picnic tables and vault toilets and receives moderate to heavy use during the summer season with a fee is $15 per night. The no fee Trout Creek dispersed campground offers vault toilets but no designated sites, picnic tables or water system. It is popular in the early summer and during hunting season. The campground serves as the venue for the Black Powder Rendezvous permitted recreation event that attracts between 200 and 300 visitors annually over a weekend in June. When Trout Creek campground is still under snow, the venue is Elk Flat, which is also within the Edson watershed.

The half mile Trout Creek Nature Trail (01E4) is the only system trail in the watershed. This interpretive trail begins at the main road through the campground, crosses Trout Creek on a foot bridge and then loops back to the main road. It was constructed by McCloud elementary and high school students, and the Youth Conservation Corps as part of the *Adopt-A-Watershed* program in 1994. The interpretive signs have been stored for the last several years and the trail effectively closed due to lack of maintenance.

There are several informal dispersed camps located throughout the watershed. Use at these locations occurs mainly during deer hunting and mushroom gathering season. Sites include well established undeveloped campsites located at the Ash Creek Mill site, and the Ash Creek – Pilgrim Creek Road crossing. Use at these two sites occurs primarily during deer hunting season but contractors have been known to occupy these locations also during the summer months. Three dispersed campsites are identified as “fire safe” sites where campfires are allowed during certain fire restrictions. No campsite inventory has been conducted to identify all the locations of obvious dispersed campsites.

Motorized recreation and driving for firewood and mushroom gathering and in conjunction with dispersed camping has often occurred cross country and on numerous unauthorized routes. Off-highway vehicle [OHV] recreation occurs in association with dispersed camping. Cross-country motorized travel is no longer allowed on most of the Shasta-Trinity National Forest including the Edson watershed. The Shasta-Trinity National Forest issued a Record of Decision [ROD] selecting modified alternative 2 of the Final Environmental Impact Statement [FEIS] for Motorized Travel Management [MTM] on the Shasta-Trinity National Forest on March 11, 2010 (MTM ROD, 2010). The decision addresses the 2005 Travel Management Rule[19]. The resulting Travel Management Plan

[19] 36 CFR Part 212, Subpart B - . This subpart provides for a system of National Forest System roads, National Forest System trails, and areas on National Forest System lands that are designated for motor vehicle use. After these roads, trails, and areas are designated, motor

lists roads included in the National Forest Transportation System [NFTS]. The ROD prohibits cross-country travel by motor vehicles within most of the Shasta-Trinity National Forest including motorized activities occurring on unauthorized routes within the watershed. Approximately 23.9 miles of roads in the watershed are not designated as system roads and are considered unauthorized. Even though these unauthorized roads and trails are officially closed to motorized travel, they continue to be used by OHVs for recreation due to lack of public education, signage and physical closures. Enforcement is scheduled to begin with publication of the Motor Vehicle Use Map alerting visitors to authorized routes.[20] The FEIS acknowledged a transitional period and a higher number of violations to the travel management rule during the first years of implementation.[21]

Winter recreation use consists primarily of snowmobiling. Approximately 49 miles of the 260 mile groomed snowmobile Tri-Forest trail system cross the Edson watershed. The trail system provides an extensive snowmobile trail network on the Shasta-Trinity, Klamath and Shasta-Trinity and Modoc National Forests. All snowmobile trails are located on forest system roads that do not have snow removal during the winter months. Elk Flat is a popular snow-play area for snowmobilers. The MTM decision does not restrict snowmobile use off system roads.

The snowmobile trail system is accessed from Pilgrim Creek Snowmobile Park located just outside of the Edson watershed at the junction of the Pilgrim Creek and Sugarpine Roads. The park is one of four trailheads that access the Tri-Forest trail system. The primary use season for this facility is between December 1 and April 15. The primary activity associated with this facility is snowmobile use and general snow play. There has been an increase over the past couple of years of both cross country and skate ski activities on the maintained trails. During the winter months, the only road that is plowed in the area is Pilgrim Creek Road up to the Snowmobile Park. From that point, both the Pilgrim Creek and Sugar Pine Butte Roads are seasonally converted to winter snow-trails. These are the main trails leaving the park. This trail system is the only one where routine surface maintenance occurs and novice winter recreational users can feel comfortable. Additionally, it offers local users a close location to ride and cross country ski on maintained trails.

Pilgrim Creek Snowmobile Park also serves as a checkpoint in the annual Siskiyou Sled Dog Races. All races start and end at the Deer Mountain/Chuck Best snowmobile park on the Klamath National Forest, however a segment of the course runs through the Edson watershed.

The Pilgrim Creek Snowmobile Park has a paved parking area, loading ramp, vault toilet, garbage service, bulletin board and four elevated fire rings. Although the primary use period is during the winter months, this facility remains open during the remainder of the year for forest visitors without any of the developed services available. Other use periods of this facility are mainly during the spring mushroom season and deer hunting season. There is also sporadic use of this facility during

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vehicle use, including the class of vehicle and time of year, not in accordance with these designations is prohibited by 36 CFR 261.13 Subpart A. Motor vehicle use off designated roads and trails and outside designated areas is prohibited by 36 CFR 261.13 Subpart A.

[20] As of the writing of this document the Motor Vehicle Use Maps were in draft form and not yet published.

[21] FEIS p. 73

the summer months. The main activity during these seasons is overnight camping. This use is incidental to the main purpose for this facility. Overnight use has not become popular at this site.

Over a mile of the McCloud River Railroad is located within the extreme southern end of the watershed just north of highway 89. The railroad line was abandoned in 2006 and the rails and ties have been removed. As of early 2011, efforts were underway to convert the railroad corridor to a trail and bridges and culverts remain intact pending the outcome of the rails-to-trails effort.

The McCloud River is located just to the south of the Edson watershed. Extensive recreation sites associated with the river and the Lower, Middle and Upper Falls are located along the river corridor. Popular activities include camping, picnicking, hiking, photography, sightseeing, swimming, fishing, and occasionally mountain biking.

Timber Harvest

Timber harvest continues to be the dominant land use activity occurring within the watershed. Refer to Vegetation Management and Forest Resiliency for discussion.

Transportation System

The current GIS transportation layer (4/09) shows the Edson watershed contains approximately 505 miles of road, including forest development roads, private timberland roads, and other unclassified roads. Approximately 212 miles of routes in the analysis area are designated for vehicle travel on national forest. Approximately 23.9 miles of unauthorized routes exist where motorized travel is prohibited. Figure 16 shows the transportation system in Edson watershed including these primary roads.

Most roads in the watershed were constructed in support of timber harvest activities; many road prisms lie on top of railroad grades originally developed for the same purpose.

Because of the mixed land ownership, there are more than 60 miles of cost-share road in the watershed, with both Sierra Pacific Industries and Champion Timberlands or their successors in interest or assignees as primary cooperators.

The heaviest travel on the road system occurs in the spring through fall season when public and commercial road use is at its peak. With the exception of FA13 Pilgrim Creek, which is plowed to the Pilgrim Creek Snowmobile Park, much of the road system is closed to conventional vehicle access in winter due to snow. Roads in this watershed access a variety of seasonal recreational uses including hunting, camping, mushroom and firewood gathering, fishing, and OHV use.

Traffic counters located on Pilgrim Creek Road (FA-13) and Sugar Pine Butte Road (FA-19) show that there is an average of 8,500 vehicles that travel through the area during the spring through fall seasons and 3,000 vehicles that travel to the Snowmobile Park during the winter (Hatakeda, 2005). These two paved roads are the primary travel routes for visitors going to the trail heads on the east side of the Mount Shasta Wilderness. They also access other dispersed recreation sites within and outside the Edson watershed located at Ash Creek Mill, Ash Creek, Trout Creek Meadows and Harris

Springs. Some incidental traffic occurs towards geologic features in the Medicine Lake Highlands and travel towards Tennant and Mt. Hebron, California. The other roads receive very little recreation traffic with the exception of deer hunting and mushroom gathering seasons. Most of the interior roads are traveled by hunters during deer hunting season. Upland game bird and squirrel hunting occurs throughout the area also. Within the analysis area, the activity is concentrated along Ash Creek and Trout Creek. Since this particular type of hunting is done primarily by walking, moving vehicles are not encountered as frequently.

Table 16 - Edson Watershed Road System

Arterial Roads	Collector Roads
FA13 Pilgrim Creek	41N06 Edson Creek
FA19 Military Pass	40N44 Middle Falls (Loop Road)
	43N19 Military Pass
	42N09 Trout Creek
	43N44 Stephens Pass
	43N04 Lost Spring
	40N12 Bear Wallow
	41N07 Black Fox
	41N12 Swamp Creek
	41N05 Buck Mountain
	42N49 Harris Rock

Current road density in the watershed is approximately 4 miles of road per square mile of land. Many roads are closed on private and public lands with gates and barricades; however, the current open-road density remains high at an estimated 3.8 miles of road per square mile. In addition to these authorized routes, unauthorized routes total another 23.9 miles within the Edson watershed. Unauthorized routes were created by past firefighting efforts, firewood gathering, recreation access, vegetation management projects and other access needs. Many of these routes have existed and have been in use for a long time.

Some formerly unauthorized routes were incorporated into the NFTS with MTM. The unauthorized routes not added to the NFTS in the ROD may be considered for removal from the landscape and restoration to the natural condition, conversion to foot or equestrian trails, or addition to the NFTS. Forest planning efforts under Travel Management continue to evaluate proposed projects on a site-specific basis for existing roads that can be used and for the possible decommissioning of roads that are no longer necessary. There may still be a need for temporary road construction and for the reconstruction of existing roads to allow for use of new equipment and for adjusting to specific logging systems required for steeper ground.

Permitted motorized access to private lands, communication sites and other special-use sites is exempt from travel management guidelines. These roads may not be included in the National Forest Transportation System. Those with a valid special use permit will be allowed to continue to access the property and sites. However, these roads may not be open to public access.

Water Sources

There are several existing traditionally used water sources (drafting sites) within the analysis area including:

- **Trout Creek overhead fill** at the junction of 42N09 Trout Creek and 43N44 Stephens Pass Roads in N ½ Sec.32, T42NR1E (Co-op with Forest Service and private).
- **Ash Creek crossing and drafting site** on FA13 Pilgrim Creek Road in SW Sec.33, T41NR1W (Forest Service).
- **Ash Creek crossing and drafting site** on 41N19X Sugar Pine Road in E ½ Sec.30, T41NR1W (Forest Service).
- **Edson Creek drafting site** off 42N13A Pilgrim Creek Road in SW Sec.19, T41NR1E (Private).
- **Swamp Creek drafting site off 41N12** Swamp Creek Road in SW Sec.5, T41NR1W (Private).

In addition two other nearby commonly-used water sources are the Ash Creek crossing on 41N16 Sugar Pine Butte Road in Sec.14, T41NR2W (Private) west of the analysis area and the Slagger overhead fill off FA15 Harris Springs Road in Sec.30, T41NR2E (Co-op) east of the analysis area.

Rock Sources

Several existing rock sources provide rock primarily used for road surfacing including:

- **Cinder pit off 41N12** Swamp Creek Road in W ½ Sec.7, T41NR1W (Private).
- **Rock pit off 43N44** Stephens Pass Road in N ½ Sec.17, T42NR1E (Private).
- **Cinder pit off FA13** Pilgrim Creek Road in Sec.18, T41NR1E (Private).

There is also a Forest Service rock pit east of the analysis area at Oso Butte off the Harris Springs Road (FA15) in Sec.36, T42NR1E.

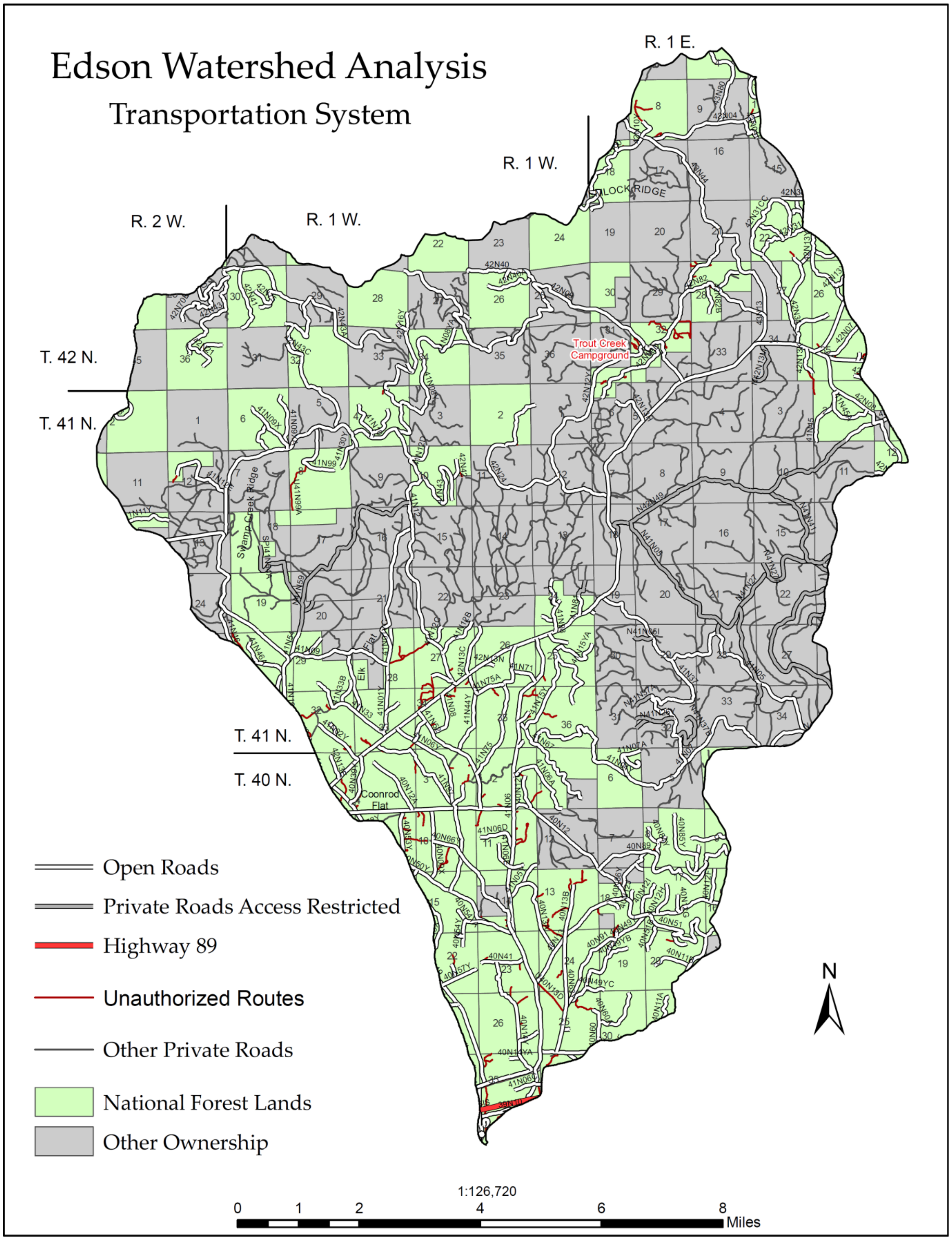

Figure 16 - Transportation System

Heritage Resources

Thirty-seven archaeological sites have been recorded within the Edson watershed boundary. Twenty-two prehistoric sites cluster around springs or creeks, although some sites appear to have no connections with water sources. An 1855 emigrant trail/wagon road (called the historic Military Pass Road or Lockhart wagon road) skirts the watershed boundary along its western portion. A 1940 historic lookout building sits on top of Black Fox Mountain, and is still in use for fire detection. Eleven recorded historic sites are largely associated with the activities of the McCloud River Lumber Company [MRLC] and their logging activities; this includes an early mill site and a railroad maintenance station. Several railroad spur grades enter the watershed, but are not yet recorded. Two areas in the watershed have been used or are used today as Native American ceremonial areas or important power spots. One of these been determined eligible to the National Register as a traditional cultural property.

Range

The Edson watershed analysis area is largely contiguous with the Bartle allotment and small portions overlap with the McCloud/Hambone allotment and the Toad Mountain allotment. The current Term Grazing Permit on the Bartle allotment authorizes 177 cow-calf pairs and eight bulls on National Forest System lands and 66 cow-calf pairs under an on and off provision on private lands intermingled and adjacent to the Bartle allotment from June 1 to October 31. The McCloud/Hambone allotment is currently vacant and was last grazed from May 1 to October 15, 2000 under a permit for 1,280 sheep. The current term Grazing permit on the Toad Mountain allotment authorizes 112 cow-calf pair and 3 bulls on National Forest System lands and 9 cow-calf pair and 1 bull under an on and off provision on private lands intermingled and adjacent to the Toad Mountain allotment from July 16 to October 30. The Toad Mountain allotment has been in non-use since 2005. The allotment, including private and public lands, is approximately 39,897 acres. Approximately one-third of the allotment is outside of the Edson watershed analysis area. Peak grazing since the Forest Service began managing the area occurred during World War I when records indicate that grazing by cow-calf pair was over 6,000 head-months for a single grazing season on the historic Ash Creek allotment, which was roughly contiguous with the watershed and the Bartle allotment. Figure 17 shows range allotments overlapping Edson watershed.

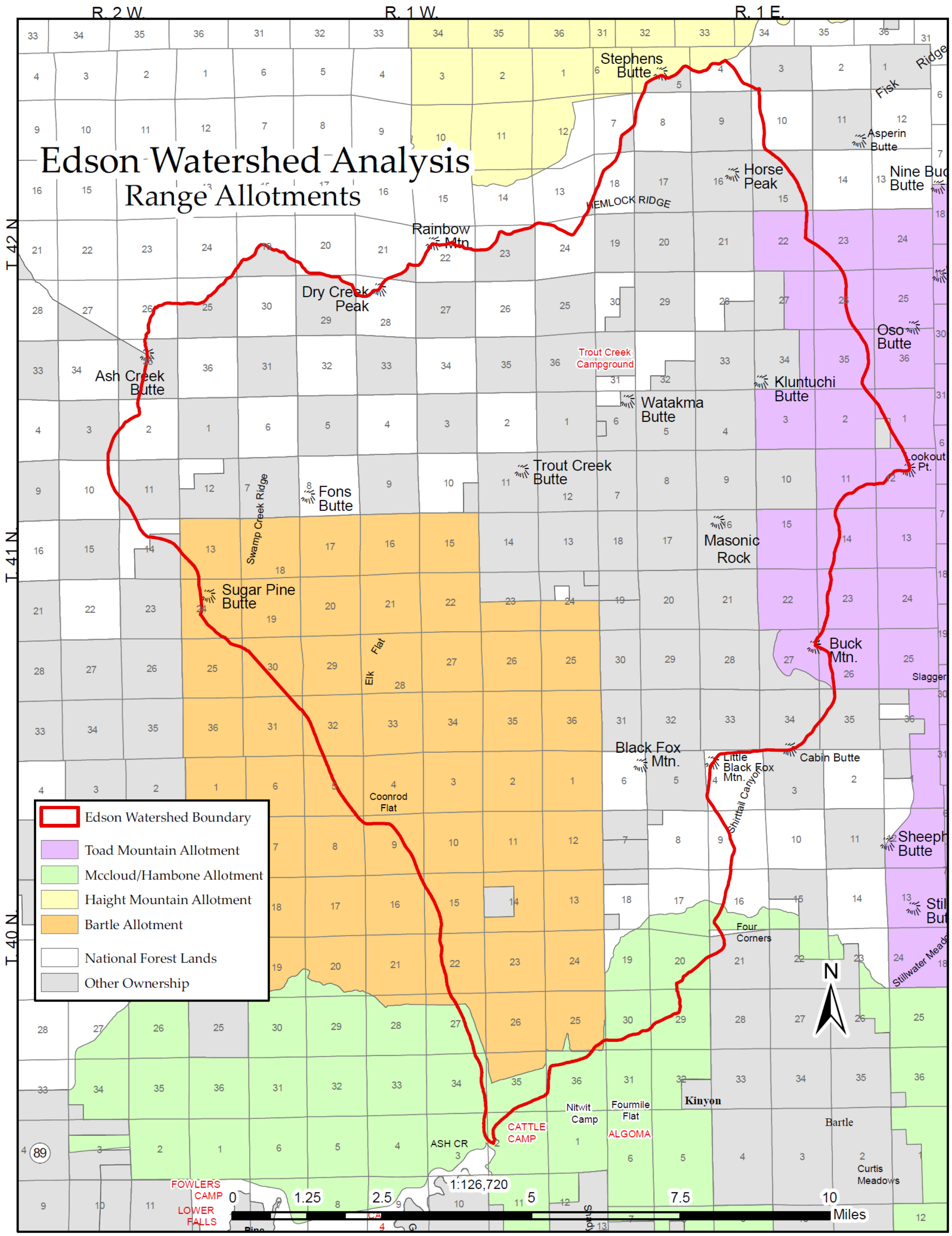

Figure 17 – Range Allotments in the Edson Watershed

Range Conditions

The watershed consists primarily of conifer stands with some dry meadows and limited riparian vegetation. The open conifer stands are the most important forage base for the grazing allotments, producing an understory of fescue, brome, sedge, and *ceanothus* species as preferred forage. Three large dry meadows are found within the watershed and allotment, Coonrod Flat, Elk Flat, and Military Pass Meadow. Other areas of interest are Ash Creek Sink, Ash Creek, Edson Creek and Bear Wallow Springs. Little Springs is also within the allotment. The latter is located on the western slope of Black Fox Mountain on the eastern edge of the watershed. There was no cattle sign when this spring was surveyed by botany crews for Survey and Manage fungi and bryophytes in 2001.

According to the 1995, McCloud Flats Watershed Analysis (USDA, 1995), measured transects in 1993 showed the allotment to be in very poor to fair forage condition utilizing the Parker 3-Step sampling protocol. This methodology is designed to assess forage value for livestock and does not assess ecological conditions. More recently, rooted frequency sampling was conducted in the Military Pass Meadow just outside the Edson watershed as a means to assess ecological condition. Sampling in 1999 and 2004 showed that Military Pass Meadow was in a high-seral vegetative state for both sampling years.

An important forage base within the Bartle allotment, grass and sedge, is suppressed as pine plantations grow and canopy cover exceeds 50 percent. Recent estimates of forage resources available for livestock have shown that current stocking rates are within the carrying capacity of the allotment. Annual forage utilization monitoring has shown that forage utilization does not exceed Forest standards and guidelines, confirming the finding that the Bartle allotment is stocked within its carrying capacity for livestock.

Step 4. Reference Conditions

The purpose of this chapter is to explain how ecological conditions have changed over time due to human influence and natural disturbances. A reference is developed for later comparison with the current conditions over the period that the system evolved and with key management objectives.

This chapter begins with a historic overview that summarizes the natural processes and land-use activities in the watershed. The remainder of the chapter follows the required six core topics (consolidated into four):

1. Hydrology[22]
2. Vegetation
3. Species and habitats
4. Human uses

Discussions of physical features, biological features and human uses can generally be segregated into two distinct periods, as follows:

Pre-European Settlement: During this period, significant Anglo-American influences were absent. Although native peoples used the area, the ecosystem was functioning under essentially natural conditions during this time.

Post-European Settlement: During this period, human influences began to affect natural processes in the watershed. The area began to experience increased effects from settlement, mining, wildfire suppression, timber harvest, and road construction activities.

Physical Features

Geology

Step 3 – Current Conditions provides a description of the geology of the Edson watershed area that includes reference conditions.

Climate

A summary of current trends in climate-driven processes for the Shasta-Trinity National Forests and surrounding lands was completed in 2011 (Butz & Safford(2011)). The summary noted no weather station data from elevations above 3,600 feet, but the highest station (Mt. Shasta) showed no change in mean annual temperature since 1949, although daily maxima are up slightly. Between 1911 and 2005 data collected at the McCloud weather station shows a significant increase in average temperature of about 1-2°F. These trends are being driven by highly significant increases in mean minimum (i.e. nighttime) temperatures of 2-3° F. The Shasta-Trinity summary also noted trends in historical annual precipitation appear to be positive at McCloud (approximately 15 more inches per year on average in 1987 than 1925). Analysis of regional hydrometeorlogical data from

[22] Because hydrologic features are scarce within the watershed the core topics of erosion processes, hydrology, stream channel and water quality have been grouped into the topic of hydrology.

the lower Klamath Basin show a decrease in the percentage of precipitation falling as snow and accelerated snowpack melt, resulting in earlier peak runoff and lower base flows (Butz & Safford(2011)).

Hydrology

Hydrologic Reference Conditions: Pre-Settlement

Hydrologic reference conditions are documented in historical accounts and descriptions of past activities in this watershed. Reference conditions are interpreted from physical relationships observed in the field by hydrology specialists. The hydrologic features and characteristics found within the Edson Creek watershed can largely be attributed to a combination of geologic and fluvial processes. Volcanic activity and erosion from Mount Shasta has exerted significant influence on the morphological characteristics of stream channels and drainage characteristics in the lower two-thirds of the watershed. While volcanic activity and debris flows occurred frequently with respect to geologic time, the general character of the landscape is not believed to have changed appreciably over the past 4,000 years.

Pyroclastic flows and mudflows were responsible for the creation of the flat landscape in the lower Ash Creek basin (Osterkamp, et al., 1986). Mount Shasta has been active in recent geologic time. At least seven eruptions are known to have occurred over the past 4000 years (USGS, Open File 94-585, 1994). Frequent mud flows originating mainly in Ash, Mud and Pilgrim Creeks played a major role in the development of the Ash Creek basin. Because of the flat topography much of the sediment carried off Mount Shasta by the mudflows was deposited over the lower western third of the watershed.

The location of stream channels within the lower elevations of the watershed and the extent of perennial, ephemeral and intermittent reaches has been highly variable over the past 4000 years. Numerous abandoned or remnant channels occur in the lower portion of the watershed. Many of these channels were likely abandoned due to debris flow activity originating on Mount Shasta, which resulted in channel migration.

Hydrologic Processes and Functions: Post Settlement

In the upper watershed areas, reference conditions have been altered by timber harvesting, plantation management and off-road vehicle use and influenced by water-road interactions. The higher watershed elevations are dominated by greater natural sediment input and snowpack. Water-road interactions were presumably not a large influence in the past, but are a dominant influence now. The upper watershed reference conditions can still be observed in areas that have not had disturbance activities.

In the lower watershed hydrologic processes and functions indicate that relatively rapid adjustment to elevation changes has and continues to occur. Abandoned channels, floodplains, meander cutoffs and incision indicate that surface hydrology was different than it is today and functioning at a higher position on the floodplains. The reasons for gully formation are not known, but it is believed that Trout Creek was destabilized in the late-1800s by a flood event possibly influenced by man-induced changes causing gully initiation. Although unconfirmed, what appear to be historical water diversions have been observed in the meadow. The meadow complex surrounding Trout Creek is also unique. Despite being dewatered for at least sixty years, the meadow complex still contains small populations of willow, aspen, and cottonwood trees. Facultative and obligate wetland species are believed to be remnants of much larger plant communities. Channel and floodplain interaction was probably more frequent than today, as evidenced by relict banks, well-sorted gravels, and greater sinuosity in the meadow areas. Along with these adjustments come changes in channel construction and habitat formation. Past channel and floodplain interaction would lead to lower width to depth ratios of channel form, producing narrow channels and presumably deeper water versus the higher ratios that lead to wide channels with shallow water.

Watershed response to changing anthropomorphic influence is readily seen where conifer encroach on meadows. Comparisons of 1944 with 1998 aerial photography indicate that extensive meadow encroachment by conifer has occurred and that meadow area is gradually reducing in size and being replaced. Soil and vegetation indicates that the seasonally wet floodplains have been replaced by dry meadow habitat as vegetation type conversion occurs due to gully incision, a lower water table in the meadows and fire suppression. Where gullying occurs, drier meadows retain little moisture due to efficient gully drainage, leaving the soils more vulnerable to further gullying. Dense conifer stands have formed in the meadows and along Riparian Reserves.

Biological Features

Vegetation

This section will discuss the changes to the vegetation type over time due to human manipulations and natural disturbance. It will also provide a reference to compare the current conditions as identified in Chapter 3 with those found in the past.

Vegetative Conditions: Pre-European Settlement

Fire and drought were the primary disturbances that influenced the vegetation in the Southern Cascade Province prior to pioneer settlement. These same disturbances influenced the Edson watershed much in the same way that it did the rest of the province.

Fire disturbance is thought to have been both human and lightening caused prior to pioneer settlement. The native people used fire as a tool to help drive big game and stimulate understory vegetation growth. The natural fire frequency for the Edson watershed is considered to have been a 2-29 year cycle for the lower elevation dry ponderosa pine sites and a 9-46 year cycle in the higher elevation true fir/lodgepole sites. The transition zone of pine/mixed conifer series makes up the majority of the Southern Cascades province. Prior to pioneer settlement, fire frequency was the primary influence that helped shape the species composition that existed at the time in the drier sites. The tree species composition that was adapted to frequent fire included species with relatively thick bark such as ponderosa pine, sugar pine, Douglas-fir and incense cedar. True firs existed in the stands, but occurred at relatively low levels especially on the drier sites. The fires that would burn through this area were typically low intensity ground fires. Tree species that were less tolerant of fire, such as true firs, were naturally managed at lower levels. Frequent fire would also keep surface fuel accumulations in check and naturally thin dense patches of regeneration. Drought is also thought to have played a role in the tree species composition prior to pioneer settlement. Much like recent history, drought helped to usher in insect attacks and disease especially on those species that have little drought tolerance such as true fir.

Both of these disturbances helped to maintain open areas and early successional stages of vegetation. Examples include Elk Flat and Coonrod Flat, both located on the western side of the Edson watershed. These two locations are examples of the grass and forb successional stage. Another example of early successional species is shrubs and brush, such as vegetation found in Trout Creek Meadow in the northwest portion of the watershed. Brush and shrubs tend to be located on south to east facing slopes, where conditions tend to be hotter and drier and where fires historically have burned with more frequency and intensity. Consequently, conditions on these sites tend to support only shrubs and brush.

Located in the southwestern end of the Edson watershed just northwest of the Ash Creek and Edson Creek confluence, Ash Creek Sink has early successional characteristics. Ash Creek Sind was documented by John Feilner, a Sergeant in the U.S. Army, in 1860 when he traveled the Military Pass Road from Fort Crook north to Yreka. In his diary he remarked that “After having left the station-house [located near where Bartle is today] about two or three miles behind, we suddenly struck a desert of about six miles in extent, entirely of sand, and not a particle of snow to be seen [since the rest of the area was nearly all covered in snow]. This sudden change from deep snow to a barren sand level, from cold to heat was very surprising.” The soils of Ash Creek Sink are very immature and undeveloped. Surface textures are loamy sands. According to the Shasta –Trinity Soil Survey the soils in the area are in the Ledmont Family and support brushland (BL). The natural predominant type of vegetation in this open expanse is bitterbrush.

Vegetative Conditions: Post - European Settlement

Human actions on the landscape from the 1850’s to present day have had noticeable effects on species composition across the watershed. Along with the suppression of fire, past logging practices and early grazing also helped to change the composition.

The watershed was subject to intensive logging at the turn of the century by the MRLC who logged large [old growth] trees such as sugar pine, ponderosa pine and some incense cedar. Between 1899 and 1903, their efforts were concentrated along the west boundary of the watershed near the Ash Creek mill in Section 30, Township 41 North, Range 1 West. The company moved to the southern portion of the watershed in 1907 and logged between Swobe and Edson Creek road and the area on the lower slopes of Black Fox Mountain until 1917. Concurrently, the Lumber Company logged the northeast portion of the watershed near Horse Peak in 1911.

The condition of the landscape after this intensive logging was described in a 1908 U.S. Forest Service field report (Smith, 1908). It states that the land logged prior to 1903 [probably in the vicinity of the Ash Creek mill and south of Highway 89 along the Elk Lawn Railroad Branch] “is in very bad condition and is practically worthless ... very few seed trees were left and frequent fires followed logging and the result is a vast chaparral covered tract with small scattered areas where knobcone pine is coming in." After 1908 the reports says that the land "is in good condition as operations have followed more or less closely a working plan prepared by the U.S, Forest Service. This area is well protected from fire, plenty of seed trees are left and slash is burned after logging."

It is harder to determine what effect cattle and sheep grazing had on the watershed with the absence of early historic documents.

Logging methods to bring timber to the branch line and railroad spurs used three technologies – horse and big-wheel logging, team powered tractor, and steam donkey yarders (Hoertling, 2010). The main Ash Creek branch line was also used by the MRLC and Southern Pacific to cut cord wood and bring it back to McCloud or to the Southern Pacific line in Mt. Shasta; Oak and other cord wood was cut in this county circa 1899-1903 for this purpose. The branch lines were then converted to logging spur grades or to roads within the watershed.

Congress established the Forest Service and the National Forest System in 1905. The Shasta National Forest was headquartered in Sisson (Mt. Shasta), with the McCloud Ranger District having its office in McCloud. The primary purposes of the Forest Service at that time on the McCloud Ranger District were fire suppression and conservation. Projects included the construction of lookouts, roads, nurseries and experiment stations. Telephone lines were built to connect the nurseries and experiment stations to the outside world.

Legislation allowing exchange of lands[23] opened the door for land-for-land and land for National Forest timber exchanges enabling consolidation and acquisition of additional lands. The Shasta National Forest acquired previously cutover private timber lands on the McCloud Flats in 1925, 1932, 1939 and 1988. Some of the acquired land is located within the watershed. The 1932 exchange represented a significant increase in the Forest land base through acquisition of about 60,500 acres of previously logged McCloud River Lumber lands in exchange for National Forest System timber. Despite the past acquisitions and consolidations much of the watershed still exists in a checkerboard land ownership pattern created by the railroad land grants of the late 1800s.

Changes over time

From the 1850's to present human manipulation of the vegetation helped to change the landscape from what it was to what it is today. Fire suppression aided conifer encroachment by reducing the fire return interval in natural features such as meadows that historically had frequent fire intervals, leading to a reduction in size (see Figure 18 through Figure 20). This shift from a grass/forb mix to a conifer stand is a shift from a Wildlife Habitat Relationship (WHR) 1 to a WHR 3a to 3c.

[23] Weeks Act of March 1, 1911 (36 Stat. 961 as amended; 16 U.S.C. 516).
General Exchange Act of March 20, 1922 (42 Stat. 465, as amended; 16 U.S.C. 485, 486).
Weeks Law Exchange Act of March 3, 1925. (43 Stat. 1215; 16 U.S.C. 516).

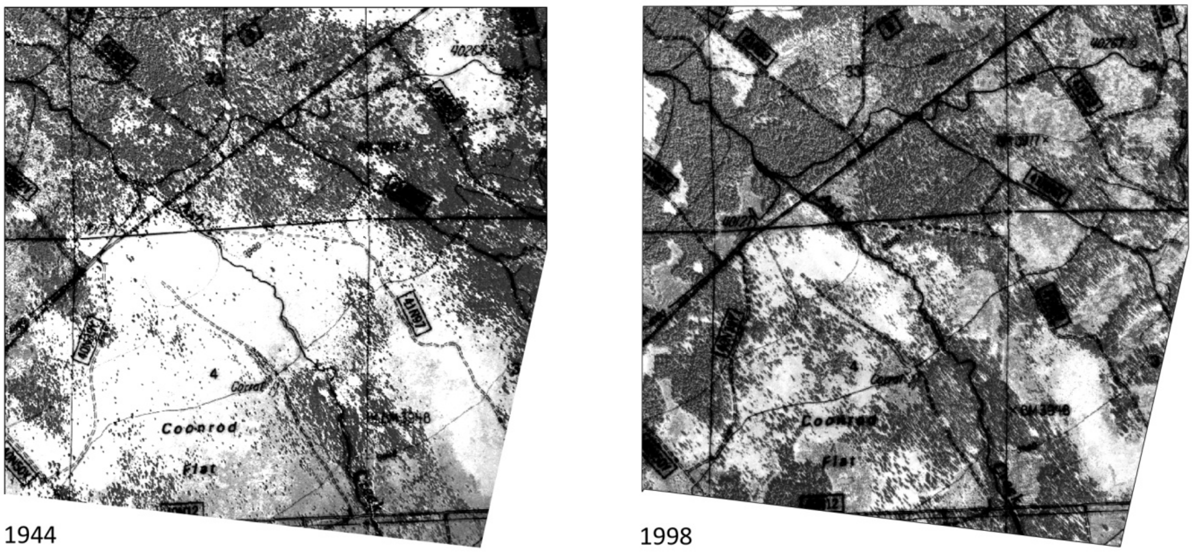

Figure 18 - Conifer Encroachment on Dry Meadow at Coonrod Flat Between 1944 and 1998.
(White areas indicate meadow while forest is represented by the darker tones.)

Figure 19 - Encroaching Conifer at Elk Flat

Figure 20 - Conifer Encroachment at Ash Sink

The suppression of fire has also contributed to an increase in stand densities across the watershed. Shade tolerant and fire sensitive species have been allowed to grow in the understory of stands and remain unchecked with the exclusion of fire. This increase in stand density has helped to decrease the health and vigor of the stand by allowing for greater competition for resources such as sunlight, water and soil nutrients. The decreased health and vigor has contributed to an increase in density dependent mortality as well as insect outbreaks, such as the fir engraver beetle and the western pine beetle.

Not only has fire played a big role in the current condition of the vegetation across the watershed, but also past practices from both private and public timber managers. Large logging companies such as the MRLC were known to cut the trees of greatest value and leave those of lesser value. This often resulted in the harvest of sugar pine, ponderosa pine and Douglas-fir, while leaving lesser desired species such as true fir and incense cedar. This practice is still evident today with the presence of old stumps. Over time, this had an effect on the species composition of these stands. With much of the seed source for the pine and Douglas-fir gone, these stands have transitioned into true fir stands. The shade tolerance of true fir coupled with fire exclusion has resulted in these large increases in density as well as a shift from natural species composition.

Figure 21 – Ponderosa Pine Stump in Predominantly While Fir Stand and Old Doublas-fir Stump in a Dense Mixed Conifer Stand

Some stands within the watershed have ongoing mortality, the majority evident in white fir and ponderosa pine. The existence of *Heterobasidion annosum* (annosus root disease) as well as *Scolytus ventralis* (fir engraver bark beetle) causes mortality in much of the white fir. Annosus is evidenced by areas of blow down where the trees are uprooted and the root systems are conspicuously thin or absent. Other identifiers are the delaminating characteristics of the wood below the root collar as well the conspicuous thinning and/or chlorosis of the crowns. Presence of the *H. annosum* fruiting bodies is a proven indicator of the disease in the stand. *Scolytus* historically has impacts the fir stands during drought years when the firs are most susceptible.

The mortality in ponderosa pine is mainly caused by two major factors: *Lepfographium wageneri var. ponderosum* (black stain root disease) and *Dendroctonus brevicomis* (western pine beetle). Western pine beetle attacks usually occur when a tree is stressed to the point of not being able to defend itself against successful beetle attacks. When one beetle is successful it sends out a chemical signal calling in other beetles. If the tree is healthy it is able to pitch-out the beetle preventing the chemical signal from being sent and reducing the severity of the local infestation. Another stress factor for the pine that can help initiate western pine beetle attacks is density. The ability of the pines to fight off beetle attacks when densities are high is greatly reduced.

Figure 22 – Annosus Root Disease in White Fir Stand and Pine Mortality with Western Pine Beetle Activity

Prior to European settlement of the general area, wildland fire was the primary factor that influences the vegetation patterns across the watershed. Fires started by lightning probably burned large areas during periodic droughts with mixed severity, perpetuated shrubs and very open conifer forest. Native American sites in the watershed indicate that some wildland fires were purposely started to maintain early seral vegetation that favored game species such as deer and elk.

Roads and railroad grades were constructed in the late 1800's to facilitate logging in the watershed. These roads and railroad grades were confined to the southern 1/3 of the watershed. Early logging removed most of the old-growth pine and Douglas-fir, leaving high concentrations of logging slash and less desirable species such as cedar and white fir.

With establishment of the Shasta National Forest in 1905 road construction and initial fire suppression actions were planned and initiated. As access to the watershed via roads improved, fire suppression began to limit the number of large wildland fires. The last large wildland fire to burn in the watershed was in 1928, burning about 9000 acres in the watershed. Fire suppression for the last 90 years has allowed dense conifer forests to become established on many shrubfields and otherwise open conifer stands.

An aggressive program to clear shrubfields and establish ponderosa pine plantations started in the 1960's and 70's. This action in combination with natural in-growth of conifer trees significantly increased the amount of mid and late seral dense forests and reduced the size of natural openings.

Fire and Fuels

Overview

Prior to organized fire suppression frequent low to moderate severity fire occurred as a combined result of summer drought, winter precipitation and lightning. More recently in the southern Cascades fire exclusion and land management practices (i.e. grazing and logging) have resulted in changes in forest structure and fuel loading that promote infrequent moderate to high severity fire (Skinner & Taylor (2006)).

Found in the lower elevations of the watershed, mid-montane forest consists of Jeffery pine, ponderosa pine, sugar pine, white fir and incense cedar. Hardwood and shrub species include black oak, aspen, bitter brush and mountain mahogany. Frequent low severity fire was the historic norm. Mature trees in this forest type are adapted to frequent surface fire. Historic fire return intervals in montane forests of the southern Cascades ranged from 2 to 29 years (Taylor, 2000).

Found in the higher elevations of the watershed, upper montane forest consists of white fir, red fir, lodgepole pine and Jeffery pine. Hardwood and shrub species include aspen, manzanita, chinquapin and ceanothus. Fire return intervals ranged from 9 to 46 years due to increased elevation combined with cool and moist conditions (Taylor, 2000). Fires that occurred historically in this area were mixed severity, with pockets of high severity stand replacing fire intermixed with areas of low to moderate severity fire.

Continuous stands of even age knobcone pine exist in the northwest corner of the watershed. Knobcone is a serotinous species and is adapted to high severity stand replacing fires. As these stands age mortality increases along with surface fuels creating conditions conducive to high severity fire.

Shrub species are fire adapted, reproducing through sprouting or germination of stored seeds. Fire return intervals in montane chaparral are longer than FRI's in adjacent stands as fuel structure, burning characteristics and fuel recovery rates in shrubs are different from surrounding forests (Skinner & Taylor (2006)). Frequent fire promoted aspen regeneration and limited tree encroachment in meadows.

Fire Regime: Pre-European Settlement

Pre-settlement fire rotation intervals ranged from 24 years in Jeffery Pine to 75 years in Red fir (Taylor, 2000).

Hot, dry summers combined with lightning and Native American burning for agricultural and other purposes promoted frequent low to moderate intensity surface fires. Fire frequency decreased with elevation and interruptions in the fuelbed in the form of lava and debris flows; a result of volcanic activity (Taylor, 2000).

Fire Regime: Post - European Settlement

A review of 94 years (1913-2007) of fire ignitions within the analysis area (Table 18) shows that 21 percent of fires are human caused and 79 percent were attributed to lightning. Eighty three of these were Class-A (less than .25 acres) and 24 were Class-B (.26 to 9.9 acres). The 1996 Horse fire in the area of Horse Peak was 95 acres and the largest fire in the watershed in the last 58 years. The annual expected ignition frequency is 1.12 fires per year for the Edson watershed.

Table 17 - Edson Watershed Ignitions 1913-2007

Edson Watershed Ignitions 1913-2007	
Statistical Cause	**Number of Ignitions**
Lightning	85
Equipment	3
Smoking	3
Campfire	4
Debris Burning	1
Arson	3
Miscellaneous	9
	Total 108

Table 18 - Edson Watershed Large Fires 1918-2008

Edson Watershed Large Fires 1918-2008		
Fire Year	**Reported Acres**	**Watershed Acres**
1924	2198	8
1949	122	122
1918	13174	1844
1928	33653	8977
Total Acres	**49147**	**10951**

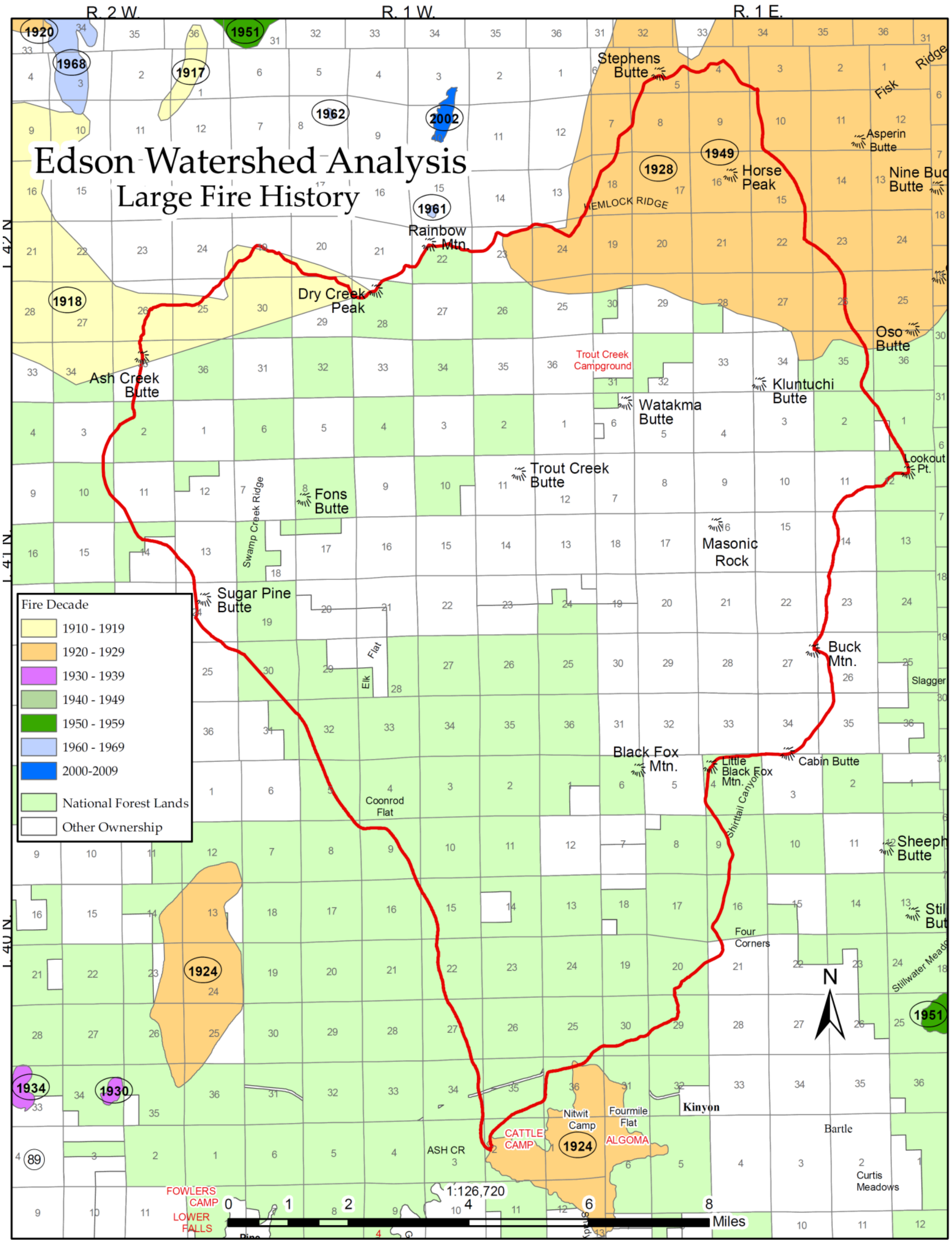

Figure 23- Large Fire History

Species and Habitats

Wildlife Species and Habitats: Pre - European Settlement

Little is known about the specific conditions of habitats or populations of wildlife species in the watershed prior to European settlement. Due to the lack of specific pre-historical wildlife and vegetation information the following information is somewhat speculative in nature. Based on research associated with current and historic vegetative conditions, geography, biophysical characteristics, succession stages, and natural disturbance regimes, wildlife habitats, and therefore species (based on habitat needs today) can be estimated.

Several wildlife species were present that have since been extirpated, such as grizzly bear, wolves, and bighorn sheep. Species that utilized special habitats such as cavity nesters and bats may have been more numerous. Habitat for late successional species was likely abundant, as large trees, snags and down logs were more available. Old growth forests were likely relatively open, due to the frequent low intensity fires that were allowed to burn through the area. Denser stands were probably limited to more mesic north facing slopes and areas with natural barriers to fire.

Vegetation conditions in the watershed were different from today and much of the Edson watershed did not contain habitats for the species that the Forest Service manages for today (e.g. NSO). The watershed was grazed by herds of deer and elk. Forage was also maintained by frequent, relatively low-intensity fires. Fires contributed to the maintenance of high quality forage by preventing conifer encroachment and maintaining natural openings.

Fisheries: Pre - European Settlement

Prior to the formation of the three falls (lower, middle and upper) and well before any written historic accounts, the upper McCloud River was probably accessible to salmon and steelhead. Genetic studies undertaken by Jennifer Nielson in the 1990s (Nielsen, et al., 1999; Nielsen, et al., 1996) show a link between the upper McCloud River redband trout and anadromous steelhead. This would indicate that at some point in prehistory, there was a hydrologic connection between the upper McCloud River and the south flowing tributaries such as Trout, Edson and Sheepheaven Creeks. A possible guess as to the period of connectivity would be during a warm climate approximately 1000 years ago. This hydrologic connection has long since disappeared and the trout remaining in these tributaries became genetically separated from those in the main McCloud River.

In addition to steelhead, coho salmon, and Chinook salmon, the lower and middle reaches of the McCloud River would also have been inhabited by white sturgeon, bull trout, hardhead minnow, Sacramento pike minnow, Sacramento sucker, and riffle sculpin. As the three falls developed over time, the upper reaches of the river would have become inaccessible to anadromous fish and the genetic isolation of the redband trout would take place. This occurrence probably took place long before the connection and subsequent separation of the south flowing tributaries from the main river. This genetic isolation would continue until the arrival of early fisheries managers.

Wildlife Species and Habitats: Post - European Settlement

After 1880 land-use activities introduced by European settlers began to change wildlife habitats in the watershed. Intense railroad logging occurring between 1910 and 1940 denuded large areas of the watershed. Aerial photos from 1944 show that sizeable portions were railroad logged. Railroad logging resulted in large concentrations of logging slash that fueled large high-intensity wildfires that burned the majority of the watershed. The 1944 photos indicate that both logging and fires removed old growth areas and likely reduced the species dependent upon them, but also created good early seral habitats for deer and elk.

The 1944 photos indicate that late-successional habitat was associated with major tributaries to the McCloud River and high elevation red fir zones. The remaining landscape consisted of open forested habitats (less than 60 percent canopy closure) primarily of ponderosa pine with shrub or herbaceous understories, with conifer, oak, aspen and chaparral habitats mixed in. Because of the open nature of most of the landscape, late successional species would have been restricted to unlogged mountains in this watershed. Most game concentrated along streams and in southern meadows, lake basins, and spring meadows where water was available.

Timber harvest increased in the watershed following the development of second growth stands. Developing late-successional habitat was fragmented by new entries in the watershed. Fragmentation of forest habitat would have affected late-successional species, but the effect is unknown as no surveys occurred before harvest activities. Despite the lack of surveys, the watershed had late-successional habitat adequate to maintain the presence of NSO and other late-successional species.

Harvest of second growth forests was often accomplished through clearcuts. These harvested areas, along with areas dominated by brush and generally lacking trees were site-prepped and planted, creating large openings of early seral habitat. Site preparation by windrowing and cultivating influenced soil structure in many areas. This reduced bioactivity and thus productivity, and removed many plants desirable to grazing animals. These activities likely affected the small mammal and bird prey base for predators.

The condition of riparian forage declined as a result of conifer encroachment, fire suppression and grazing. Heavy grazing removed ground cover and created areas favorable for the establishment of pine and fir seedlings. Cattle competed with wildlife for grazing of riparian forage. Populations of deer, elk and bear declined due to competition from cattle. Cattle continued to impact meadow and riparian habitats until effective grazing controls were initiated in the 1960s.

Fire suppression reduced populations of deer, snag-dependent, and other species that utilize early seral habitats (Smith & Murphy (Undated)). Fire suppression may have expanded distribution of a few late-successional species, but logging likely reduced it. Increased human activity through road construction and use, along with timber harvesting, reduced habitat use by some species (deer, elk, bear) due to disturbance and exposure (Smith & Murphy (Undated)). Many waterholes and springs were developed for sheep grazing. When the market collapsed they provided waterholes for wildlife and were instrumental in deer herd recovery from 1950 to 1970. Wildlife species that flourish in human altered environments (e.g., coyotes, raccoons) may be more common today.

Road building increased dramatically in the mid-1900s. Roads eventually provided vehicle access to nearly all water sources used by wildlife in the watershed. This contributes to stress on game, including poaching.

Four documents discuss historical wildlife population estimates, densities, distribution or presence within the watershed. One document, A Land-use History of the McCloud River Region, California, contained brief statements about the species present prior to the 1900's (Cranfield, 1984). The other documents, The Shasta Lake Elk Herd (Smith & Murphy (Undated)) and A Habitat Management Plan for the Shasta Lake Elk Herd (Dunaway, 1964) and its addenda, primarily discuss elk population levels and distribution from 1911 to 1980 with some mention of other game species. The McCloud Deer Herd Plan (CDFG, 1983) and associated studies contain some useful information. Information on wildlife not mentioned in the documents is projected based on the habitat regime, known European influences on the watershed, and wildlife sighting records from 1971 to 1995.

Professional judgment would indicate that many populations of species of concern declined due to logging. Riparian species declined due to habitat alterations as cattle grazing pressure increased. Goshawk populations increased until 1975 and declined in the 1990's.

Anecdotal history and records report elk and deer hunting was excellent around McCloud. Elk were exterminated by about 1880, but have repopulated the area at relatively low but increasing numbers. The deer herd continued to thrive until the 1960's. In the 1970's the deer population began a decline that has lasted to the present. The long term decline of deer in California has been attributed to the declining habitat quality and abundance (SCDMTWG, 2008). The State of California attributes most of this decline to reductions in early seral habitat, which have accompanied less timber harvest and increasingly more effective fire suppression throughout this period (Wolcott, 2009). Recommendations by the Siskiyou County Deer Management Technical Working Group [SCDMTWG] (SCDMTWG, 2008) include the following practices for population improvement in Siskiyou County (in an effort to create more early-successional habitat):

- Prescribed and natural fire
- Thinning and regeneration harvest
- Brush cutting
- Brush piling
- Pile burning
- Seeding

Fisheries: Post - European Settlement

When settlers arrived in the early to mid 1800s, the area was inhabited by indigenous peoples that relied on fish as a food source. The lower McCloud Falls was called the place where salmon stop by the original inhabitants. Fish would have been very plentiful and was an important food source for both the settlers and indigenous peoples. Due to the abundance of fish, the first federal egg taking station in the United States was established at Baird (near Greens Creek, formerly Crooks Creek) in 1879. Salmon and trout eggs were collected and shipped world-wide. Prior to the establishment of the Baird station, J. B. Cambell who settled on the river in 1855 was the first known person to collect and ship rainbow trout eggs from the McCloud River.

The river and its fishery remained largely unchanged as the early European settlers moved into and began to develop the area. The McCloud River became famous for its abundant and large trout and was a popular destination for tourists staying at the Soda Springs resort near the Sacramento River. Private fishing clubs purchased large sections of the rivers shore and adjacent property around 1900.

The stocking of the McCloud River with non-native fish species began in the late 1800s. These fish came from the Sisson fish hatchery. In an effort to improve the angling experience, brown trout, other stains of rainbow trout, and brook trout were stocked throughout the river. At the time little was known about the effects these non-native fish would have on the native fish fauna. These fish were competitors and predators that served to suppress the native fish populations, and in the case of the redband trout, the introduction of other rainbow trout resulted in the hybridization and contamination of the redband trout gene pool. This hybridization continued for about 100 years until the development of the Upper McCloud River Redband Trout Conservation Agreement. The interagency agreement limits the stocking above Middle Falls to species other than rainbow trout.

The native redband trout in the upper McCloud drainage are thought to be a relict subspecies of non-anadromous rainbow trout adapted to harsh, fragmented environments. Within the upper McCloud drainage, populations in Sheepheaven, Trout, Edson and Swamp Creeks are isolated from the mainstem McCloud River. Trout Creek had been stocked with hatchery trout prior to a rotenone treatment in 1977 but has not been stocked with hatchery trout since the post treatment reintroduction of redband trout from Sheepheaven Creek. Swamp Creek was believed to be fishless prior to the introduction of redband trout in 1973.

The completion of Shasta Dam in 1942 had a major effect on the McCloud, Pit, and Sacramento Rivers. Approximately 110 miles of spawning habitat for salmon and steelhead was no longer accessible. Within the McCloud River, the elimination of the anadromous fish runs had a serious effect on the highly piscivorous bull trout. The juvenile salmon and steelhead, a major food source, were no longer available. The dam also resulted in the flooding of about 16 miles of bull trout habitat. McCloud Dam, completed in 1965 was the final blow to the bull trout. The dam flooded five miles of prime bull trout habitat. It blocked the migration of adults to their spawning habitat, and finally it altered river flow patterns and water temperatures. The affects of these two dams on the McCloud redband were probably minimal. Most of the McCloud redband were already isolated from much of the river and most of the tributaries, and fish stocking over several decades had already extracted its toll on the redband gene pool. Figure 26 shows the fish-bearing streams in the Edson watershed.

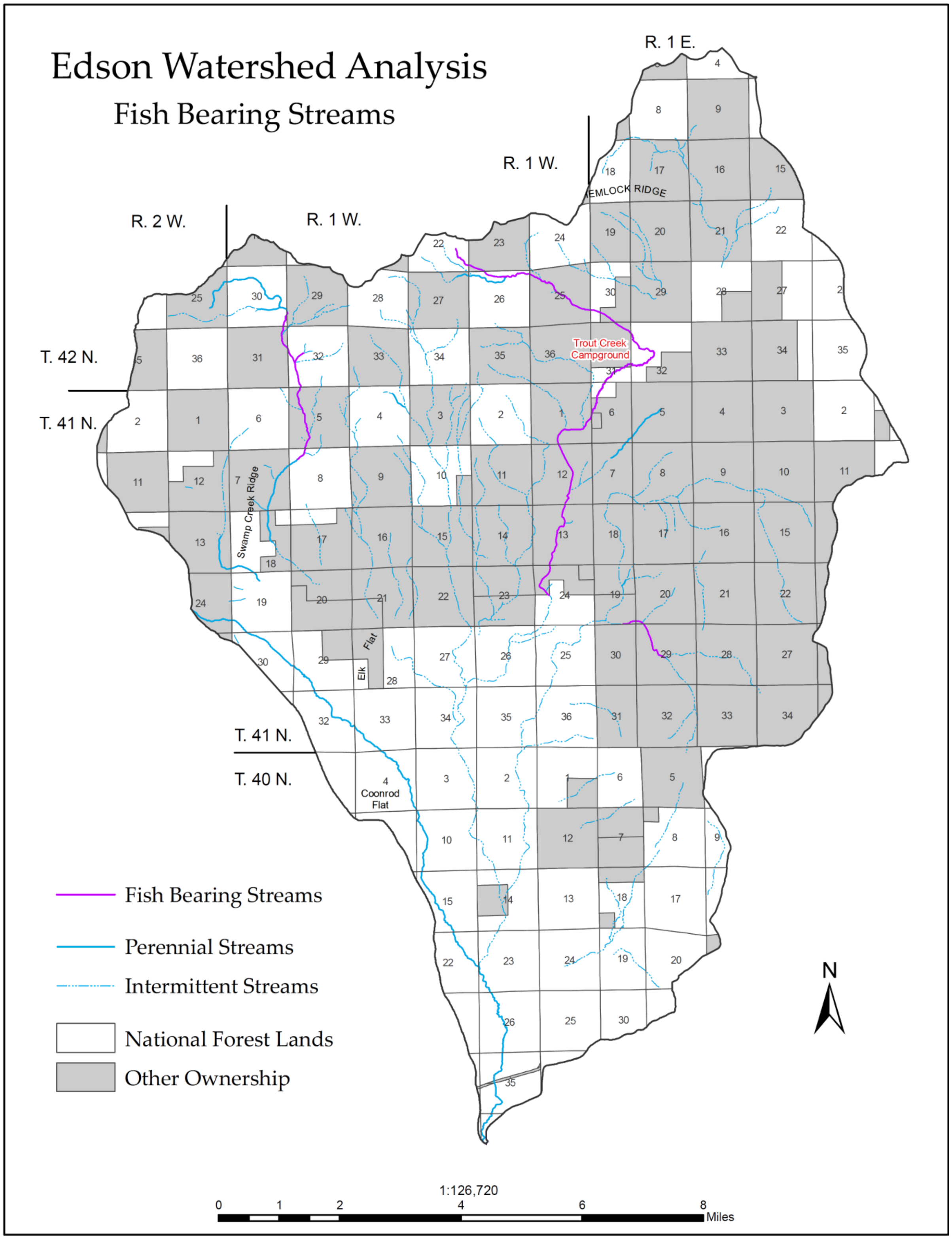

Figure 24 - Fish-Bearing Streams

Human Uses

Prehistoric Use: Pre - European Settlement

Prehistoric human activity in the watershed is known from surveys conducted and prehistoric sites recorded. However, since no archaeological research has been done in the watershed, it is not known how far back in time these sites represent.

Late prehistoric use by Native Americans is documented in the watershed from linguistic evidence. There is an overlap of place-names between two tribes, the Pit River Tribe and the Winnemem Wintu Tribe. The names for landscape features are indicative of a physical knowledge of an area. Both tribes had a name for Ash Creek (Theodoratus, 1985).[24] Additional linguistic place-name data include: 1) a Wintu word for Black Fox, 2) a Pit River word for Elk Flat, 3) a Wintu word for Coonrod Flat, and 4) Wintu names (not completely verified) for buttes near Trout Creek called Watakma and Kluntuchi Buttes.

Data collected by J.P. Harrington summarized in Theodoratus (1985) demonstrates late prehistoric use can be traced back to the 1700's. More recent research of the early Native American use of specific locations such as Black Fox Mountain and Coonrod Flat (Cassidy, 2008; 2005) supports Native American use of the watershed at least from the 1880's.

Historic Uses: Post - European Settlement

Early Travel and Homesteads

Early travel through the watershed along its western edge was via an old emigrant trail and wagon road that was pioneered in 1855. The wagon road was called by various names: Military Pass Road (for the military who protected the emigrants), the road from Yreka to Fort Crook, the Fall City to Yreka Road, The Shasta Valley Road, Sheep Rock-Pilgrim Camp Road, and the Lockhart Wagon Road (named after the Lockhart brothers who helped build the road).

In 1855 Judge Roseborough in partnership with Sam Lockhart laid out the road. Apparently the first to test the road with wagons was Sam Lockhart who took an emigrant party of twenty-five wagons in July of 1855 from Yreka to Red Bluff. "They started out from Yreka and set out southward to Red Bluff with a party of 75 men, 25 families, 2,500 head of cattle, 3,000 sheep and 75 horses. They seceded from the Mormon faith and were headed down to the southern part of California. The company wintered at Salt Lake, and started with the intention of coming through Nobel's Pass, but by some accident got off on the Yreka Trail" (Yreka Union, 1855).

One traveler's diary from 1860 describes an area along the Military Pass road in the Ash Sink vicinity (Feilner, 1864). Sergeant Feilner took a furlough from the army in 1860 for scientific purposes and started his explorations along the Military Pass Road from Fort Crook. On May 14, 1860 he encountered a desert between a station-house on McCloud River [Bartle stage stop est. 1857] and

[24] The Wintu name for Ash Creek is 'bubhulwaqat', translated "Dust Creek". The Pit River name for Ash Creek is 'tahha 'alussa', translated "Dirt Creek"

Pilgrim's camp. In his words: "After having left the station-house about two or three miles behind, we suddenly struck a desert of about six miles in extent, entirely of sand, and not a particle of snow to be seen. This sudden change from deep snow to a barren sand level, from cold to heat was very surprising."

Another observation along the Military Pass road was from 1863 by William H. Brewer (Farquhar, 1949). William H Brewer wrote a journal entry where he talked about Elk Flat that he passed through on October 7, 1863. He was on horseback or mule and he wrote:

"One plain, Elk Valley, three or four miles in width, is without trees, and the views of Mount Shasta rising in its single cone, very sharp, eleven thousand feet above us, its top covered with snow, would delight the painter and enchant the lover of the grand".

Other roads and trails in the watershed lead from the Military Pass Road to other destinations. The GLO survey maps of 1879 and 1882 show:

6. **Road to Stewarts Ranch:** An old road that split off from the Military Pass road south of Coonrod and Elk Flat, with the approximate footprint of the Pilgrim Creek Road, was called "Road to Stewart's Ranch"(GLO, 1882);
7. **Stewarts to Flats Trail:** A trail led from "Stewarts to Flats" in Sections 9 and 10, Township 41 North, Range 1 East.
8. A connector road led from the Road to Stewart's Ranch eastward to Stagers Camp (Slagger today) (GLO, 1879).
9. **Road to Fioks:** A road starting in Section 26, Township 40 North, Range 1 West connected the Military Pass Road to Cattle Camp and was called the "Road to Fiocks." The roads served as transportation routes to early activities within the watershed, most likely related to early livestock grazing.

Government Land Office surveys were conducted in the late 1870s and land began to be claimed into private ownership under various acts. Historic information about early homesteaders in the watershed is scarce. Jos Cavanaugh is mentioned as homesteading Elk Flat (Conner, 1941).

Grazing History

The history of the cattle and sheep grazing in the watershed is pieced together from a number of varied sources such as old maps, Forest Service range documents, and early newspapers. The watershed encompasses the old Mud Flats allotment (1918-1950), the McCloud Flats allotment and the Bartle allotment.

A few sources suggest that cattle and sheep men had farms and home ranches in the surrounding lower elevation lands such as Squaw Valley Creek (south of McCloud), Fall River Valley, Redding, Red Bluff and the Big Shasta and Little Shasta Valleys (Conner, 1941).[25] They would use the watershed for their summer grazing. The earliest evidence of this activity comes from an 1879 Government Land Office (GLO) survey in the Trout Creek vicinity. The GLO maps and survey notes depict

[25] Letter from Fiock 2002

Stewart's field, a fence line, and roads or trails leading to and away from the field. It is not known if Mr. Stewart was grazing sheep, horses, or cows, but a 'Mr. Stewart' is mentioned in an 1889 newspaper article (Pioneer, 1889). This article placed his ranch between Bear Creek and Bartle and it was called the "Pole Bridge Ranch". It is not known if this is the same Stewart from the GLO maps. Stewart's field and associated fences, roads and trails remained on maps for almost 30 years, as depicted on the 1907 Shasta National Forest Map.

Cattle grazing in the watershed is documented in 1888 when George Fiock purchased 160 acres from the Federal Government bordering the McCloud River; the old settlers referred to the property as "George Fiock's Cattle Camp," now known today simply as Cattle Camp, a Forest Service campground. The Fiock family had their home ranch in the Shasta Valley and in a letter to the Forest Service they suggest that the early settlers in Shasta Valley were looking for summer grazing land and drove their cattle to McCloud Flats area using the Military Pass Road (Fiock, 2002).

Steward, Fiock and presumably other stockman were grazing in the watershed before these lands were National Forest.[26] In 1906 the Shasta Forest Reserve began to regulate grazing in a limited way (Headlight, 1906). At a meeting of the Shasta Forest Reserve and Stockmen in Weed, California provisions were made to allow grazing during 1906 of all cattle, horses, sheep and goats, which had regularly used this range. The requirement was that the owners apply for permits and pay the grazing fee (25 cents a head). The summer grazing season for cattle and horses was set from May 1-October 31. The summer grazing season for sheep and goats was set from June 1 through October 15 at 6 cents a head. That same year, the Forest planned to make a careful study of the ranges in order to determine to what extent that they may be overstocked. Several other meetings and grazing regulations for the Shasta National Forest appear in the local newspapers in 1908. In 1908 the Forest was divided into grazing Districts; District 1 and 2 encompassed all forest land east of the McCloud River (Headlight, 1908).

Once these regulations came into play, various Shasta National Forest Maps show sheep camps on the 1911 and 1916 Shasta National Forest maps. A 'Haugedorn Sheep Camp' is depicted in the vicinity of Coonrod Flat in 1911(Meekham & Show (1911)). This section was fenced on its south, east and west boundaries. By 1916, Hagadorne [spelled differently] may have moved up to the Trout Creek area in the vicinity of today's campground, as depicted on the 1916 Shasta National Forest Map. Another Sheep Camp in Section 6, Township 40N, 1 West [just outside the watershed boundaries] shows a "Mac 01 Sheep" camp with a fence line enclosing the south ½ of section 6. A phone line is also on the map that went from Pilgrim Creek Nursery to this sheep camp.

Another historic primary reference notes that the McCloud Flats allotment was a sheep allotment from 1928 to 1944 (Sullaway, 1947). The allotment boundaries took in portions of what were later the Trout Creek allotment and the Bartle Flat allotment. Ranger Sullaway notes that 7,818 head of sheep were permitted, of which 2,524 of which were "on" and 5,292 "off". He notes that there were four permittees on this allotment and they owned a large ranch south of the town of McCloud. They

[26] The Shasta Forest Reserve was established in 1905 (the name was changed to the Shasta National Forest in 1907).

used their ranch as summer pasture. Most likely the "four" permittees represented the three Johnson brothers and their father who bought a ranch now known as the Cooley Ranch in 1929 (Cooley, 1997).[27] The ranch was purchased in 1929 by Andrew Johnson from the MRLC and then inherited at his death by his four sons in 1935, two of which were Silas Senior. and Malen Senior (Cooley, 1997).[28] Eventually in 1961 the Cooley's became the ranch owners.

Cattle grazing are also documented in the watershed in the early 1900's. A 1966 Range Management Plan for the Bartle allotment describes that the MRLC ran cattle from 1910-1921 on this allotment (it is unclear whether they had a permit on public lands) "Their policy was to have the cattle eat the feed down to the ground to reduce the fire hazard" (USDA, 1966).

In 1943 the Johnson brothers gave up their Bartle sheep allotment to Bruce McIntosh. Mr. McIntosh gradually acquired the Johnson Brothers leases from the MRLC and ran cattle only in the allotment (USDA, 1966). In 1962 the allotment was extended to include the Coonrod feed area and in 1965 northward to include the Trout Creek area. It was recognized in 1966 that:

> "Water is the big problem in the Coonrod, Black Fox, Elk Flat and Bartle units. The water lies in the outer fringe of the feed areas and is temporary in nature, drying up generally by the middle of the season".

Lumber Industry

A mill called the Holbrook mill was started on Ash Creek in 1891 within the watershed (Pioneer, 1891a). The newspapers suggest that the milled lumber was transported via wagon road from the site, along the slope of Mt. Shasta and from there to the Mott/Sisson road. In 1891, Holbrook and others sold their interests in timber lands to the Siskiyou Lumber Company [the precursor of the MRLC] (Pioneer, 1891b).

In 1898, the MRLC eventually starting overhauling the Holbrook Mill (Dunsmuir News, 1898a) and started grading a railroad branch north from McCloud to the mill that same year (Dunsmuir News, 1898b). They completed a branch line (called the Ash Creek branch) in 1899 and started adding spurs and logging until at least 1903 when the Ash Creek mill burned down (Mirror, 1903). The branch lines were then converted to logging spur grades or to roads within the watershed.

The 1908 U.S. Forest Service field report (Smith, 1908) describes the timber holdings of the MRLC as "an open stand of nearly pure yellow pine with white fir, red fir, sugar pine, cedar, and knobcone pine in the mixture." The report comments on the cutover condition of the lands both prior to and after 1903.

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[27] Signs on a barn on the Squaw Valley Creek Road still say Cooley Ranch.

[28] Additional information about the Johnson brothers comes from a 1945 Grazing map showing sections within the watershed that were grazed by the Johnson Brothers. A 1954 memo and inspection from Andrew R. Schmidt, Forester, also mention the Johnson brothers in relationship to the sheep allotment. Malen and Silas Johnson ran sheep on the McCloud Allotment and apparently leased private land from the MRLC as well.

As the mainline railroad expanded eastward to Bartle, other spur branches were built northward from the mainline into the watershed sometime prior to 1907. The area between Swobe and Edson Creek road (which was once a railroad grade) was heavily logged as evidenced by the density of spur grades in the area. Logging continued until approximately 1917 in this area. The lower slopes of Black Fox Mountain were logged in 1911 when the company purchased the geared Shay locomotives. The MRLC reached Slagger in 1907 (Herald, 1907) with their Bartle branch line and then came off that line to log the Horsepeak area sometime after 1911.

Forest Service Activities

Forest Service administrative activities were consolidated in the watershed between 1907 and 1908 when the Ash Creek Ranger Station [which no longer exists].was built. A 1907 map shows the ranger station located on the east side of Ash Creek in Section 10, Township 40 North, Range 1 West (Meekham, 1907). A 1908 a newspaper article (Herald, 1908) discusses the new station:

> "Supervisor W.B. Rider and Rangers Richardson and Ruggles went over to Ash Creek near Black Fox Mountain, . . . on business connected with the establishment of the new Rangers quarters at that place. A pasture of 160 acres is being fenced off and a three room house and a barn will be built thereon. Mr. Richardson has been assigned this section"

In 1910 the Forest Service established a tree nursery, called the Pilgrim Creek Nursery just west of the watershed. The nursery was in existence until at least the 1930's.[29] Tree plantations were planted in Section 8, Township 40 North, 1 West, and west of the nursery in 1919. In a letter from S.B. Show (Show, 1919) the "original cover was bitterbrush – rabbit brush burned off with quick hot fire just before planting, with a heavy north wind."

The Shasta National Forest built a lookout on Blackfox Mountain to aid in fire detection circa 1922 (Herald, 1922). A winter storm in 1939 destroyed the tower and it was rebuilt sometime between 1939 and 1941.[30]

During the Great Depression some of the private land within the watershed transferred to national forest through land-for-timber exchanges. Prior to public ownership, much of the private lands were owned by the MRLC that logged all of the large, high value ponderosa and sugar pine, leaving the small trees. Early logging left many areas with so few conifers that they were converted to brush fields. Starting in the early to mid 1960's a program of brushfield conversions to pine plantations was started on the public lands.

One of the oldest plantations in California is located in this watershed, the Show Plantation, was created in 1920 and has been commercially thinned several times over the past 90 years.

With the advent of tractor logging, motorized firefighting techniques, and World War II, the access gradually changed from railroad to a truck-based system; many roads used the same corridors as earlier wagon roads and railroad grades.

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[29] See Archaeological Site Record 05-14-61-122.

[30] See Archaeological Site Record 05-14-61-429

After World War II the demand for timber products and outdoor recreation opportunities grew and access to areas of the watershed increased. Initially most of this activity was on private timberlands but by the late 1960s more public lands were included in this growth. Many key roads such as FA13 Pilgrim Creek Road, 41N06 Edson Creek Road, and others were improved to provide better access for commercial logging and recreation traffic. Tractor logging enabled greater access to steeper slopes of the watershed than was the case during railroad logging. Logging activity on NFS lands increased in the 1950's. Timber harvest quantity on the McCloud District increased from 10 million board feet per year in the 1950's to 60 million board feet per year between 1975 and 1990 (USDA, 1995).

Step 5. Synthesis and Interpretation

The purpose of this chapter is to compare existing and reference conditions of specific ecosystem elements and to explain significant differences, similarities, or trends and their causes. The interaction of physical, biological, and social processes is identified. The capability of the system to achieve key management plan objectives is also evaluated.

This step discusses each issue within the context of each applicable core topic. Additional issues and topics are also addressed here if they are deemed important for guiding future management direction for the watershed, or will result in a management opportunity. Conversely, some topics addressed in Chapters 3 and 4, for example geology, are not addressed in Chapter 5 because they are not related to the issues and are not currently important for the development of management opportunities. Conclusions are only provided if they address a management concern identified by the ID team that will lead to a management opportunity in Chapter 6. Table 20 through Table 23 display the discussion organized by core topic.

Core topics and issues from Chapter 2:

1. **Hydrology (also includes Erosion Process, Stream Channels Water, Quality)**

   Issue: Riparian Reserve Management - There is a need to restore the functions and processes associated with all types of Riparian Reserves within the watershed by identifying appropriate restorative measures and management practices for each Riparian Reserve type.

   Vegetation

   Issue: Vegetation and Forest Resiliency - There is a need to restore the resiliency of vegetation communities by identifying appropriate restorative measures and management practices for each vegetation type.

2. **Species and Habitats**

   Issue: There is a need to restore the quality, abundance, and distribution of important species' habitat through time within the watershed by identifying appropriate restorative measures and management practices for each vegetation type.

Issue: There is a need to evaluate the success of existing projects and identify other actions that will preserve, maintain or restore redband trout habitats.

3. **Human Uses** (No issues pertaining to human uses were identified)

Core Topic: Hydrology

Table 19 – HYDROLOGY – RIPARIAN RESERVES - Synthesis and Interpretation

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Diminished Riparian Reserves: The presence and extent of Riparian Reserves (and hydrologic features) is greatly diminished in the lower two-thirds of the watershed. Isolated remnants of riparian vegetation still occur along intermittent and perennial streams.	• Distribution of hydrologic features is governed by high infiltration and climate. • Annual antecedent soil moisture is a factor in determining spacial and temporal runoff distribution. • Past channel alteration (ditching) of some channels including Ash Creek. • Channels enclosed beneath a dense overstory reducing sunlight resulting in a decline in riparian plant communities. • Historic debris flow activity originating on the upper slopes of Mount Shasta resulting in channel migration and riparian vegetation impacts in Ash Creek.	Climate change has the potential to alter the timing, duration and extent of runoff in the stream channel networks.	**H.1** - Increase resiliency of riparian habitats in response to potential changes in climate.
Meadow Habitats Decline: Stream channels have incised deep gullies in some meadow areas. Conifer encroachment is slowly decreasing the extent of existing meadow habitat.	• Gullying caused by local uplift and rapid erosion. • Historic land-use practices related to grazing (ditching and diversion). • Fire suppression contributing to conifer encroachment	Restoration in some areas (e.g. Trout Creek). Static conditions for gullies in unrestored areas (e.g. Swamp Creek in Elk Flat).	**H.2a** - Continue restoration of degraded meadow systems. **H.2b** - Evaluate costs-benefits of floodplain restoration and gully obliteration.

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Degraded intermittent/perennial stream channels and associated Riparian Reserves: Lower elevation banks have high width to depth form and limited riparian vegetation. Channels draining the Mount Shasta highlands (e.g. Ash Creek) are susceptible to large scale natural disturbances. Swamp Creek has become incised within a gully in Elk Flat.	• Natural processes (e.g. floods and debris flows) influence drainage patterns and channel form. • Past activities (e.g. timber harvest, roads, grazing and diversion) altered physical characteristics. • Ash Creek was ditched over the past 100 years. • Riparian plant communities are not reproducing sufficiently along some perennial stream banks to trap sediment to build banks and reduce erosion. • Riparian vegetation is limited by shade and lack of bank strength.	Condition trending towards improvement with management strategies emphasizing restoration. Channels within the influence zone of Mount Shasta will continue responding to large scale natural disturbance. Sediment trapping and bank-building processes occur sporadically resulting in a static condition of high width to depth channel form. Riparian plants are present but are not forming plant communities or functioning to anchor sediment or increase bank strength.	**H.3a** - Survey and classify condition and restoration potential for intermittent and perennial streams. **H.3b** - Restore functions and processes of intermittent and perennial streams including floodplain interaction. **H.3c** – Where hydrologic conditions allow maintain sufficient height and density of riparian plants adjacent to stream channels to trap sediment and buffer stream energy during spring runoff.
Surface flow is scarce in the lower two-thirds of the watershed: Water availability is limited in late summer for wildlife and fish as well as human uses (e.g. fire suppression, dust abatement, grazing).	• Underlying Geology. • Climate change may also affect the timing, duration and extent of surface water availability.	Trend is unknown however it is likely that competition for limited water sources will increase over time.	**H.4** - Employ management strategies that maintain or restore the natural timing, duration and extent of surface water availability in the watershed.

Core Topic: Vegetation

Table 20 – VEGETATION - Synthesis and Interpretation

Present Condition	Causal Mechanisms		Trends	Conclusions *there is a need to:*
Overly Dense Ponderosa Pine Stands (50% of NFS): Ponderosa pine stands have overly dense stocking levels and experiencing mortality due to insect attacks and root disease.	• Lack of management activities designed to control spacing. • Fire exclusion creating high stand densities.	• Lack of vegetative species diversity. • *D.valens, D.brevicomis* in P.P. • fir engraver beetle in white fir. • Annosus root disease and black stain.	Continued mortality in Ponderosa pine stands and plantations under no action scenarios.	**V.1a** - Control density levels and reduce the amount of disease vectors in infected stands. **V.1b** - Increase species diversity.
Overly Dense Mixed Conifer Stands (8% of NFS): Many mixed conifer stands have high stocking levels and tend to be susceptible to insect attack, particularly in the white fir component during periods of below average precipitation.			Short term trends indicate increased overly dense stands on NFS lands.	**V.2** - Manage mixed conifer stands for density levels and species composition as appropriate for local site conditions (annual rainfall, soils, etc.).
Overly Dense True Fir Stands (28% of NFS): Variable stocking levels and varying degrees of mistletoe, annosus, storm damage and heavy fuel loads exist in red and white fir stands.		• Mistletoe • Annosus root disease	Short term trend toward increased fuel accumulations in overly dense stands and continued spread of mistletoe and annosus disease.	**V.3** - Control density levels in true fir stands to promote healthy populations.
Overly Dense and Diseased Lodgepole Stands (2.5% of NFS): Many lodgepole pine stands have high stocking levels and infected by gall rust and dwarf mistletoe.		• Gall rust	Trending static to slight increase in numbers of lodgepole pine and increasing fuel loads in lodgepole pine stands over time in the absence of management or natural disturbance.	**V.4** - Manage lodgepole to insure healthy stands that exhibit multiple age classes and fuel loads that approximate those of a natural fire regime.

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
High Mortality and High Fuel Loading Knobcone pine (2.2% of NFS): Many knobcone pine stands have high mortality and high fuel loads.	• short life expectancy of knobcone pine (~80 years)	The trend is increasing fuel loads as older knobcone stands deteriorate and are replaced by younger stands in the absence of management or natural disturbance.	**V.5a** - Control fuel loads and density. **V.5b** - Retain other species to increase diversity. **V.5c** - Where late seral knobcone occupies large continuous areas increase seral stage diversity within stands and convert some areas into other vegetation types.
Diminished Species Diversity: The southern two-thirds of the watershed is predominantly composed of second growth mixed conifer and pine stands.	• Past timber harvest activity on public and private lands. Reforestation activities over the past 100 years have mostly emphasized planting of single species (i.e. Ponderosa pine). Over 50 percent of public lands are vegetated almost exclusively with pure Ponderosa pine • Fire suppression.	Trend towards increased species diversity on public and private lands. Recent management practices have emphasized increased species diversity.	**V.6** - Increase species diversity throughout the watershed.
Hardwoods Decline (aspen, cottonwood and black oak <1% of NFS):	• Fire exclusion and conifer encroachment. • Past management practices emphasized removal of the hardwood component.	Continued decline in hardwood stands in the watershed in the absence of fire or management actions.	**V.7** - Expand on management practices that retain, conserve or restore hardwood stands.
Brush Habitat Decline: (7% of NFS): Many brushfields are old and the quality of forage is declining.	• Fire exclusion	Continuing decline in forage suitability and decadence in the absence of fire or management activities.	**V.8** - Evaluate brushfield for potential rejuvenation and/or conversion at the project level.
Poor Diversity in Plantations: Vegetation diversity is poor in older and younger plantations, which occupy approximately 50 percent of public lands in the watershed.	• Past planting and harvesting practices	Gradual increase in diversity as plantations age and additional species establish.	**V.9** - Consider the role of plantations in maintaining openings and providing early seral habitat in the watershed. Plantations on private lands should also be considered.

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Increased Fuel Loading: can lead to increased flame length, reduced fireline construction capabilities, larger fire size and increased damage to values at risk from unwanted/uncharacteristic wildfire.	• Fire Suppression • Past Land Management Practices	Increased forest density with a shift from fire tolerant to fire intolerant species. Increased fuel loading, lower canopy base height, higher canopy bulk density	**V.10a** - Re-introduce fire back into a fire dependant ecosystem. Reduce fuel loads and vegetation density. Reduce ladder fuels.

Core Topic: Species and Habitats

Table 21 – SPECIES AND HABITATS - Synthesis and interpretation

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Homogenous Ponderosa Pine Stands: Many Ponderosa pine stands, particularly younger plantations, exhibit homogenous characteristics (e.g. single species, single age class) and lack species, structural and seral stage diversity. Older stands (>50 years) exhibit more diversity (e.g. white fir) due to natural reintroduction.	• Historic and recent timber harvest. • Plantation management emphasizing single species. • Past site conversion to plantations. • Natural reintroduction of white fir in the absence of fire at higher elevation.	Species diversity is increasing due to changes in vegetation management practices where suitable site conditions exist. Site conditions are variable in the watershed.	**S-H.1** - Increase diversity in Ponderosa pine stands and plantations where suitable. Control density for long term resiliency and sustainability of both pure and mixed stands.
Stands exhibiting old growth characteristics are uncommon:	• Past management activities which removed late-successional habitat. • Fire history and fire suppression.	Stands in the watershed are gradually trending towards later successional stages. Recent management activities including thinning from below emphasize retention of larger trees.	**S-H.2** - Continue to develop late-successional habitat within the Edson watershed through management actions.
Late-successional habitats are deteriorating in the Elk Flat LSR: Large stands of Ponderosa are experiencing extensive mortality due to bark beetle attacks.	• Overstocked stands. • Historic vegetation management practices. • Fire suppression. • Bark beetles.	Late –successional habitat will continue to decline in the Elk Flat LSR.	**S-H.3** - Implement actions to reverse the trend and maintain/restore late-successional habitat and associated foraging habitat in the Elk Flat LSR.

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Low Resiliency in Mt. Shasta LSR: Mistletoe, and decadence along with higher than desired fuel loadings exist in many stands.	• Historic management. • Fire suppression.	Trend is to see continued spread of mistletoe as well as an increase in fuel loading over time.	**S-H.4** - Treat stands to decrease the spread of mistletoe and to reduce the fuel loads to levels that are desirable in the Mt. Shasta LSR.
Late-successional habitats are deteriorating in the Algoma LSR: Late-successional habitat is declining in portions of the LSR. Ponderosa pine trees are experiencing heavy mortality due to insect attacks and root disease. If no action is taken these trends will continue and result in a continued decrease of late-successional habitat and an increase in fuel loads in the Algoma LSR.	• Management activities in recent decades along with fire suppression.	Trend is variable in watershed. Conditions are expected to improve in portions of LSR with implementation of future projects designed to improve late-successional habitat.	**S-H.5** – Plan and implement vegetation management projects designed to restore and conserve late-successional habitats in the Algoma LSR.
Mortality in Fons MLSA: Stands are see mortality in the ponderosa pine stands as well as in the mixed conifer stands.	• Management activities in recent decades along with fire suppression.	Continued spread of mortality pockets with increased concentrations of fuel loads if untreated.	**S-H.6** - There is a need to treat diseased areas as well as control stocking levels to promote health and vigor.
Riparian Reserve Stand Condition: Riparian Reserve stands are not optimal for many wildlife species of concern.	• Historic vegetation management practices. • Historic grazing practices. • Roads (particularly increased road densities within scarcely distributed Riparian Reserves. • Fire suppression.	Stand conditions will improve in areas where active management is occurring to restore habitat (i.e. Trout, Ash, Edson, Dry Creeks). Stand conditions will continue to deteriorate in some areas in the absence of management.	**S-H.7** - Evaluate the condition of Riparian Reserves with respect to habitat for wildlife species of concern and implement management actions to improve habitat. Consider how actions will benefit other wildlife (game) species.

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Game Species: Deer populations have declined from peak levels.	• Loss of forage (including site conversion of brush and open areas to plantations). • Loss of cover. • Increased predation. • Lack of water availability • Increased hunting pressure. • Highway mortality. • High road densities (habitat fragmentation) • Disease.	Recent trend has been a decline in deer populations. Vegetation management projects occurring in the watershed should improve habitat conditions for game species but the future trend remains unknown.	**S-H.8** - Improve habitat conditions for deer and other game species.
Redband Trout Habitat: Over the past 10 years actions have been implemented to protect and restore redband trout habitats in Edson, Trout and Swamp Creeks.	• Restoration activities designed to improve redband habitat through, gully obliteration, fish passage improvement, and project that enhance pool habitat and bank stability.	Redband trout habitat should continue to improve however the magnitude of this trend in unknown.	**S-H.9** - There is a need to evaluate the success of existing projects and identify other actions that will preserve, maintain or restore redband trout habitats.
Brush Habitat Decline (7% of NFS). Many brushfields are old and the quality of forage is declining.	• Fire exclusion	Continuing decline in forage suitability and decadence in the absence of fire or management activities.	**S-H.10** - Evaluate brushfield for potential rejuvenation and/or conversion at the project level.

Core Topic: Human Uses

Table 22 – HUMAN USES - Synthesis and Interpretation

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Diminished Rural Community Development and Economic Sustainability: McCloud has higher unemployment and poverty rates than the State average. McCloud evolved as a timber dependent community and declines in timber harvest have resulted in mill closures and decreased opportunities.	• Decreased NFS timber availability and broader economic conditions. • Changes in timber management goals and objectives over time. • Closure of mills.	Timber harvest activities have declined in the past decade and that trend is expected to continue.	**HU.1a** –Encourage and support alternative forest product utilization in support of local economic diversification. **HU.1b** –Encourage and support special land uses in support of local economic diversification.
Declining Firewood Availability: Wood remains the primary heating fuel for McCloud residents and much of the firewood utilized by the community is gathered in the surrounding National Forest. Access to firewood is becoming more limited.	• MTM closure of cross-country travel and unauthorized routes. • Changes in timber management practices are limiting availability from timber harvest operations. • Limitations in open fuelwood gathering areas due to management actions. • Lack of commercial fuelwood opportunities.	Continued decline in availability and access	**HU.2a** – Implement management actions designed to increase fuelwood availability for both commercial and personal use, particularly in lodgepole and knobcone areas. **HU.2b** – Assure access to fuelwood gathering areas when possible.
Dispersed camp condition and inventory: Numerous traditionally used dispersed campsites occur within the watershed. Condition and inventory data is lacking to effectively manage this use and associated impacts.	• Non system routes created by users and past management activities expanded the non-system transportation system and development of dispersed camping areas.	MTM restricts cross-country travel including travel on unauthorized routes. This may potentially decrease use of some dispersed camp areas.	**HU.3** – Inventory and assess dispersed camp locations and condition. Develop management actions as needed to protect resources and provide adequate dispersed camping opportunity.
Lack of Developed Recreation Opportunities: Recreation activities are relatively limited within the Edson Creek watershed and include mostly dispersed uses.	• Scarcity of significant recreational features (e.g. lakes, rivers) in the watershed.	Recreation use in the watershed is expected to increase slightly for most uses over the next 25 years.	**HU.4** - Evaluate and identify developed recreation potential including motorized and non-motorized trails.

Present Condition	Causal Mechanisms	Trends	Conclusions *there is a need to:*
Fragmented Land Ownership: Much of the watershed exists in a checkerboard land ownership pattern resulting in management limitations and inefficiencies.	• Late 1800s railroad grants • Private land holdings pre-dating creation of the National Forest.	Several key consolidations have taken place through land for land and land for timber exchanges. The trend at this time is status quo unless further opportunity presents itself. Accords such as the Redband Trout Conservation agreement help mitigate ownership patterns for resource management and protection.	**HU.6a** – Consolidate land ownership. **HU.6b** – Work cooperatively with adjoining landowners at the watershed scale to more effectively manage resources and habitats across ownerships.
Protection of Traditional Cultural Property: Occasional user group conflict exists between recreationists, Native Americans utilizing the site for traditional purposes and cattle grazing have been documented.	• Overlapping uses between recreation, range, and traditional Native American activities at the identified TCP.	Unknown. Implementation of MTM should restrict OHV use thus decreasing group conflict.	**HU.5** – Consider opportunities to decrease user group conflict and grazing impacts on the TCPs.
McCloud River Lumber Co. Historic District: Determined eligible in 1988 and has undergone changes in condition to sites and some sites related to the District were not included in the original study.	• Deteriorating sites • Site vulnerable to wildfire • Post-determination discovery of additional sites	Continuing deterioration from natural processes.	**HU.6a** – Update historic district information. **HU.6b** – Protect sites from fire
Prehistoric Sites at Dispersed Recreation Facilities: There have been effects to sites from recreation use.	• Limited control of dispersed recreation use	Loss of sites constituents from long term modern camping	**HU.7** – Protect archaeological sites to prevent continued loss
Military Pass Emigrant Trail: Emigrant trail has been identified where it still exists, but is returning to native forest by encroaching vegetation.	• Previous logging disturbance • Natural vegetation growth • Lack of use • Road building	Continued encroachment by forest brush	**HU.8** – Protect and enhance the Military Pass emigrant trail

Step 6. Opportunities

This step discusses management opportunities within the context of each applicable core topic, issue, key question and the conclusions generated in Step 5. Although presented within the context of the primary topic, many opportunities respond to multiple core topics. Table 24 through Table 27 display the management opportunities organized by core topic.

Core Topic – Hydrology

Issue: Riparian Reserve Management[31]

Table 23 - HYDROLOGY - Opportunities

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Key Question 1 – Sustainability of Riparian Plant Communities *What future management actions are needed to sustain or improve riparian plant communities within the watershed?* **Key Question 2 – Reference Conditions for Meadows** What is the historic extent of meadows, both wet and dry, within the watershed? (What are the historic and active processes that maintain meadows?)		

[31] The specific proposed actions, project design and methods to achieve Riparian Reserve opportunities are evaluated in project specific National Environmental Policy Act analyses. It is recognized that various tools will be considered in riparian reserve projects, including mechanical and manual vegetation management methods.

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
H.1 - Increase resiliency of riparian habitats in response to potential changes in climate.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.2 and 2.3. (Strategic Plan, 2010) and Meet or maintain ACS objectives Stream banks are known to receive up to 80% of their soil strength from riparian root systems. Riparian vegetation has the most extensive root systems of vegetation known to occur along streams increasing bank strength essential for maintaining channel form and function. While conifer root systems may contribute to bank strength, and are essential for woody debris recruitment that is essential for bank building processes, without neighboring riparian vegetation, conifer root structure may cause bank failure in ash and glacial loess deposits. The weight of a mature conifer may be greater than the resisting forces of the bank's soil strength; whole tree bank failure often occurs as conifer rotate out of the banks, form obstructions that block channels and expose ash and glacial loess deposits to the forces of stream flow subsequently widening the channel.	**Restore Riparian Plant Communities**: **H.1.1 -** Identify opportunities for restoration of riparian plant communities where suitable hydrologic conditions exist. **H.1.2**- Maintain riparian vegetation at sites where it currently exists. **H.1.3** - Management activities should increase sunlight for riparian vegetation by removing very dense conifer overstory. **H.1.4 –** Identify where riparian vegetation exists and what, if any, limits its ability to reproduce and form species diversity and complexity, in both the overstory and understory.

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
H.2a - Continue restoration of degraded meadow systems.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.2, 2.3.and 2.4 (Strategic Plan, 2010) and Meet or maintain ACS objectives Restoration to reference conditions. Meadows, wet and dry, are a very scarce resource on the McCloud Flats. Vegetation data from the nearby Porcupine watershed indicate that meadows currently occupy less than 1 percent of the watershed area (USDA, 2004)[32]. The distribution of meadows within the Edson 5th Order watershed is believed to be similar to that of the Porcupine watershed Analysis area. Nineteenth-century historical anecdotes indicate that the central McCloud Flats area was composed of very open grasslands that were from three to six miles wide (USDA, 1995)[33]. These open grassland areas have been greatly diminished due to conifer encroachment of the meadows during a period of tree plantation and active fire suppression management. [34]	**H.2a.1 - Meadow Restoration:** Continue to evaluate opportunities to restore the distribution, size and functions associated with meadows (both wet and dry) in the Edson Creek watershed. Areas that should be assessed for restoration and continued maintenance of meadow habitats include but are not limited to meadows associated with Trout Creek, Elk Flat and Coonrod Flat. Evaluate potential for maintaining meadows through reintroduction of fire and vegetation management activities. **H.2a.2 - Managed Wildland Fire for Meadow Restoration and in Riparian Reserves:** When appropriate, use fire from naturally occurring ignitions as a resource management tool where it can be used effectively to accomplish resource objectives.
H.2b - Evaluate costs-benefits of floodplain restoration and gully obliteration.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.3. (Strategic Plan, 2010)	**H.2.b.1 - Channel and Floodplain Restoration:** Evaluate opportunities for channel restoration of gullied and ditched reaches of Ash, Trout, Edson and Swamp Creek and other channels where appropriate.

[32] Porcupine Watershed Analysis 2003

[33] McCloud Flats Ecosystem Analysis 1995

[34] R. Posey, botanist, USDA Forest Service, Shasta-Trinity National Forest, personal communication August 30, 2005.

<table>
<tr><th>Conclusions from Step 5
there is a need to:</th><th>Rationale or Objective</th><th>Management Opportunity</th></tr>
<tr><td>H.3a - Survey and classify condition and restoration potential for intermittent and perennial streams.

H.3b - Restore functions and processes of intermittent and perennial streams including floodplain interaction.

H.3c – Maintain and restore sufficient height and density of riparian plants along stream channels to trap sediment and buffer stream energy during spring runoff where hydrologic conditions allow.</td><td>Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.3 (Strategic Plan, 2010)

Meet or maintain ACS objectives,

Streams are considered a part of the purpose and need if associated with a given project as they are analyzed within the project boundary instead of outside of the project.</td><td>Restoration of Intermittent and Perennial Streams:
H.3a. 1 - Survey condition of intermittent and perennial stream channels. Identify and prioritize opportunities for restoration.

Examples of areas with known restoration potential include:
Swamp Creek in Elk Flat – Past meadow damage from gullying due to improper road drainage.
Ash Creek – Stream channelization from past stream ditching. Opportunities exist to improve riparian vegetative condition.
Edson Creek – Dense conifer overstory creating poor growing conditions for riparian vegetation along some reaches.
Trout Creek – Continue restoration activities to address conifer encroachment and floodplain interaction.
H.3b .1 - Plan and implement restoration projects that restore functions and processes associated with intermittent and perennial streams.

H.3c. 1 – Identify opportunities for restoration of riparian vegetation. Plan and implement restoration activities.</td></tr>
<tr><td>H.4 - Employ management strategies that maintain or restore the natural timing, duration and extent of surface water availability in the watershed.</td><td>Achieve objective of the Redband Trout Conservation Agreement (RBT Agreement, 1998).

Reducing water withdrawals from streams containing redband habitat for dust abatement is needed to maintain habitat.</td><td>Alternative Water Sources:
H.4.1 – Explore opportunities to develop wells to replace stream withdrawal as water sources for overhead fills.

H.4.2 - Maintain dust abatement infrastructure. Prevent leakage of overflow, storage tanks and overhead-fill valves to reduce the need to draft.

Reducing the Need for Water Withdrawals:
H.4.3 - Rock or pave the surface of most if not all, primary and secondary roads to reduce the need to draft water from streams and springs.</td></tr>
</table>

Core Topic - Vegetation

Issue: Vegetation and Forest Resiliency

Table 24 – VEGETATION - Opportunities

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Key Question 1 - Conditions and trends What are the current conditions and trends of the plant communities and seral stages in the watershed (riparian and non-riparian)?		
Key Question 2 - Forest Resiliency What actions are needed to maintain the resiliency of forest stands with respect to fire, insects, disease and potential climate change?		
Ponderosa Pine: **V.1a** - Control density levels in ponderosa pine and reduce the amount of disease vectors in infected stands. **V.1b** - Increase species diversity in Ponderosa pine stands.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Prevent spread of *annosus* root disease. Stands composed predominantly of Ponderosa pine are vulnerable to insects and disease. Increasing species diversity within Ponderosa pine stands could reduce the likelihood of complete stand mortality in response to insects and diseases that target Ponderosa pine and increase resiliency to these disturbances.	**V.1a.1 - Prevent the Spread of *Annosus* Root Disease:** When implementing vegetation management practices treat all cut stumps greater than 14 inches with Borax unless specific management objectives preclude treatment. **V.1b.1 - Increase Species Diversity in Ponderosa Pine stands:** When developing proposed actions for vegetation management projects identify opportunities for increasing species diversity. [also see V.9.1.1]

<table>
<tr><th>Conclusions from Step 5
there is a need to:</th><th colspan="2">Rationale or Objective</th><th>Management Opportunity</th></tr>
<tr><td>Mixed Conifer:
V.2 - Manage mixed conifer stands for density levels and species composition as appropriate for local site conditions (annual rainfall, soils, etc.).</td><td rowspan="2">Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010)

High stocking levels increase susceptibility to insect and disease attacks. Activities that control stocking levels will increase resiliency, health and vigor.</td><td>Susceptibility increases where white fir or Ponderosa pine is the dominant stand components.</td><td>V.2.1 - Mixed Conifer Stand Resiliency: Proposed actions for mixed conifer stands should include activities that will increase stand resiliency to disturbance. Possible practices include control stocking levels, small group selections to increase stand diversity with respect to species mix and age, and increase stand health and vigor.</td></tr>
<tr><td>True Fir:
V.3 - Control density levels in true fir stands to promote healthy populations.</td><td>Many true fir stands are located in the Mount Shasta Late-Successional Reserve.</td><td>V.3.1 - True Fir Stand Resiliency: Management actions in true fir stands should focus on maintaining appropriate stocking levels and controlling diseases including mistletoe and annosus. In the event that reforestation activities are required in areas once occupied by true fir stands plant with appropriate species mixes that will limit the spread of annosus and result in healthier stand conditions.</td></tr>
<tr><td>Lodgepole:
V.4 - Manage lodgepole to insure healthy stands that exhibit multiple age classes and fuel loads that approximate those of a natural fire regime.</td><td colspan="2">Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010)

Gall rust and mistletoe will continue to spread within lodgepole pine stands without management action.</td><td>V.4.1 - Lodgepole Pine Stand Resiliency: Manage lodgepole pine stand for a mosaic of seral stages while controlling stocking levels and fuel loads.</td></tr>
<tr><td>Knobcone :
V.5a - Control fuel loads and density in knobcone stands.

V.5b - Retain other species to increase diversity in knobcone stands.

V.5c - Where late seral knobcone occupies large continuous areas increase seral stage diversity within stands and convert some areas into other vegetation types.</td><td colspan="2">Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2.and 2.4 (Strategic Plan, 2010)

Without treatment conditions will continue to deteriorate in these stands. Fuel loads will continue to increase resulting in elevated fire risk.</td><td>Knobcone Pine Stand Resiliency:
V.5a.1 - Manage knobcone stands for a mosaic of seral stages while controlling stocking levels and fuel loads.

V.5b.1 - When treating knobcone retain other species to increase stand diversity and resiliency.

V.5c.1 – Thin knobcone stands to control stocking in younger stands and more aggressive treatments such as clearcutting or green tree retention cuts in older, decadent stands to increase the proportion of early seral stages in the watershed.</td></tr>
</table>

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Vegetative Diversity: **V.6** - Increase species diversity throughout the watershed.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Less represented species need to be retained for vegetation diversity.	**Vegetative Diversity at Watershed Scale:** **V.6.1** - Retain vegetative diversity in stand types at watershed scale to insure that less represented species (i.e. brush, grasses, knobcone, lodgepole, hardwoods) continue to be present in the watershed. Future projects should be designed to manage for retention of these vegetation types where suitable site conditions exist. Also See V.1b.1, V.2.1,V.5b.1, and V.7.1
Hardwoods: **V.7 -** Expand on management practices that retain, conserve or restore hardwood stands.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Aspen and black oak populations can be restored through careful implementation of vegetation management practices that remove competing conifers and increase sunlight to the understory, which encourages reproduction.	**V.7.1 - Hardwood Management:** Continue to pursue opportunities that promote hardwoods in the watershed. Expand on existing aspen and black oak restoration activities (e.g. Trout Creek, Algoma project). Potential actions could include fencing, prescribed fire, and vegetation management designed to reduce competition between hardwoods and conifers.
Brushfields: **V.8** - Evaluate brushfields for potential rejuvenation and/or conversion at the project level.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. and 2.4 (Strategic Plan, 2010)	**V.8.1 –** Plan and implement conversion and rejuvenation projects. Consider use prescribed fire, managed wildland fire, mechanical treatments and planting with conifers.
Plantations **V.9** - Consider the role of plantations in maintaining openings and providing early seral habitat in the watershed. Plantations on private lands should also be considered.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Introducing vegetative diversity in age, species and structure would improve habitat conditions for many wildlife species and increase resiliency in stands that are prone to or currently experience mortality due to insects and disease.	**Vegetative Diversity in Ponderosa Pine Plantations:** **V.9.1** - Introduce vegetative diversity into monoculture Ponderosa pine plantations by implementing management practices that emphasize introduction of additional species, diversification of seral stages and structural complexity. Examples of possible management practices would include creation of small openings in plantations, inter-planting with mix of species including hardwoods and variable thinning prescriptions to increase structural complexity.

Conclusions from Step 5 *there is a need to:*	Rationale or Objective	Management Opportunity
Prescribed and Managed Natural Fire: **V.10** - Re-introduce fire back into a fire dependant ecosystem. Reduce fuel loads and vegetation density. Reduce ladder fuels.	Implement USDA Strategic Goal 2, Objective 2.4 (Strategic Plan, 2010). A forest that is fire resilient has characteristics that limit fire intensity and increase the resistance of the forest to mortality (Brown, et al., 2004). Thinning from below especially when combined with surface fuel treatments has proven to reduce fire severity and increase fire resiliency in timber stands (Agee & Skinner (2005); Vailliant, et. al, (2009)). Fuel treatment prescriptions should focus on raising canopy base height and reducing canopy bulk density and surface fuels. This will result in lower flame lengths, reduce the probability of torching and lower resistance to control (Agee & Skinner(2005)).	**Fuel Loading:** **V.10.1** - Develop prescriptions to reduce excess surface and aerial fuel loading to decrease unwanted high severity fire effects. **V.10.2** - Restore and maintain riparian plant communities with mechanical or hand thinning and prescribed fire using best management practices. **V.10.3** - Develop prescriptions that create and maintain forest structure and fuel loadings that reduce the probability of high severity fire and resultant negative effects. **V.10.4** - Thin from below. **V.10.5** - Raise the canopy base height and reduce canopy bulk density and surface fuels. **V.10.6** - Where possible use prescribed fire and/or managed wildland fire for restoration and maintenance of desired forest structure and fuel profiles. **V.10.7** - Develop landscape prescriptions that benefit the wide range of vegetation types that exist (e.g. Mixed Conifer, True Fir, Aspen, Knobcone, meadows, chaparral). **V.10.8** - Consider the effects of climate change and increasing fire season length when developing prescriptions and monitoring results.

Core Topic - Species and Habitats

Issue: Habitat quality, abundance, and distribution through time

Table 25 – SPECIES AND HABITATS - Opportunities

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Key Question 1 - Percentage of Late-Successional and Old Growth: What actions are needed to improve the percentage of late-successional and old-growth stands in the watershed, particularly within late-successional reserves?		
Resiliency in Ponderosa Pine Stands **S-H.1** - Increase diversity in Ponderosa pine stands and plantations where suitable. Control density for long term resiliency and sustainability of both pure and mixed stands.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Vegetation diversity is poor in older and younger plantations, which occupy approximately 50 percent of public lands in the watershed. Introducing vegetative diversity in age, species and structure would improve habitat conditions for many wildlife species and increase resiliency in stands that are prone to or currently experience mortality due to insects and disease.	See **V.9.1**
Late Successional Habitat Development: **S-H.2** - Continue to develop late-successional habitat within the Edson watershed through management actions.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) The Late Successional Areas in the watershed currently have less than half the acres capable of supporting late successional forests in late successional condition. Historic vegetation management practices did not emphasize retention of important habitat features (e.g. snags, large down logs, large trees, etc.). Over 50 percent of public lands in the watershed are vegetated almost exclusively with ponderosa pine, and could benefit from increased habitat diversity.	**Increase Late Successional Forested Area:** **S-H.2.1** - Thinning from below in combination with surface fuel treatments will accelerate the development of dense mid-successional stands to late successional conditions within LSRs in the watershed. **Retain Late Successional Habitat Features:** **S-H.2.2** - When implementing management practices retain important habitat features (i.e. snags, large down logs. Retain large trees and damaged/deformed trees.

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Elk Flat LSR: **S-H.3** - Implement actions to reverse the trend and maintain/restore late-successional habitat and associated foraging habitat in the Elk Flat LSR.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Late-successional habitat is declining in portions of the Elk Flat LSR. Ponderosa pine stands are experiencing heavy mortality due to insect attacks. Younger pine stands in the Elk Flat LSR are also being affected by insects. If no action is taken these trends will continue and result in a continued decrease of late-successional habitat in Elk Flat LSR.	**Elk Flat Late Successional Reserve:** **S-H.3.1** - Implement projects to improve and conserve existing late-successional attributes in the Elk Flat LSR. Reintroduce species diversity in mixed conifer stands and Ponderosa pine stands. Implement group selection treatments to increase diversity in plantations. Salvage and replant dead and dying stands of Ponderosa pine. **RS-H.3.2** - Restore dry meadows associated with Elk Flat and Swamp Creek.
Mt. Shasta LSR: **S-H.4** - Treat stands to decrease the spread of mistletoe and to reduce the fuel loads to levels that are desirable in the Mt. Shasta LSR.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) More information is needed on current conditions in the Mount Shasta LSR before opportunities are developed. Initial surveys indicate that there may be opportunities for vegetation management associated with mistletoe problems in true fir stands.	**Mount Shasta Late Successional Reserve:** **S-H.4.1** - Continue to evaluate habitat conditions within the Mount Shasta LSR. Implement projects to improve and conserve existing late-successional attributes where necessary.
Algoma LSR: **S-H.5** – Plan and implement vegetation management projects designed to restore and conserve late-successional habitats in the Algoma LSR.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Late-successional habitat is declining in portions of the Algoma LSR. Ponderosa pine trees are experiencing heavy mortality due to insect attacks and root disease. If no action is taken these trends will continue and result in a continued decrease of late-successional habitat and an increase in fuel loads in the Algoma LSR.	**Algoma Late Successional Reserve:** **S-H.4a1**- Implement projects to improve and conserve existing late-successional attributes in the Algoma LSR. **S-H.4a2** - Manage stocking levels in the stands to help promote health and vigor. **S-H.4a3** - Sanitation of dead and dying pine trees will be implemented with planting occurring in areas that are one acre or larger in size.
Fons MSLA: **S.H.6** - There is a need to treat diseased areas as well as control stocking levels to promote health and vigor.	Achieve USDA Strategic Plan 2010-2015 Goal 2, Objective 2.1 and 2.2. (Strategic Plan, 2010) Little data exists about the current condition of the Fons MLSA. Data from the mid '1990's shows that mortality was occurring in the ponderosa pine stands as well as in the mixed conifer stands. Specific treatments will be determined on a project by project analysis basis.	**S.H.5-1** - Implement projects to improve and conserve existing late-successional attributes in the Fons MLSA. **S.H.5-2** - Manage stocking levels in the stands to help promote health and vigor. Specific needs for treatment will be identified at the project level.

<table>
<tr><th>Conclusions from Step 5
there is a need to:</th><th>Rationale or Objective</th><th>Management Opportunity</th></tr>
<tr><td>Wildlife Habitat in Riparian Reserves:
S-H.7 - Evaluate the condition of Riparian Reserves with respect to habitat for wildlife species of concern and implement management actions to improve habitat. Consider how actions will benefit other wildlife (game) species.</td><td>Conifer encroachment in the meadows has reduced habitat for species that rely on meadows and riparian areas.

Overly dense conifer stands along Riparian Reserves increase the chance of catastrophic fire along the Reserve, increasing the chance of losing the habitat.

Decline in vegetation species diversity is decreasing habitat quality.</td><td>Riparian Reserve Habitat Improvement
S-H.6-1 - Develop vegetation management strategies designed to improve stand condition and reduce fuel loading.

S-H.6-2 - Pursue opportunities to reduce road density in Riparian Reserves with emphasis on roads located in close proximity to riparian and aquatic habitats.

S-H.6-3 - Utilize grazing management strategies and monitor result to reduce grazing impacts to Riparian Reserves.</td></tr>
<tr><td>Game Species Habitat:
S-H.8 - Improve habitat conditions for deer and other game species.</td><td>Habitat for mule deer and elk has declined due to a loss of forage. Re-establishing and enhancing forage will benefit game and other wildlife species.

Existing water sources are scarce particularly in the lower 2/3 of the watershed.</td><td>Game Species Habitat Improvement:
S-H.6.1 - Design projects to maintain and improve forage condition for game species. Possible management practices include prescribed fire, creation of openings, roads management (closures), and thinning projects that increase forage.

S-H.6.2 - Evaluate opportunities to improve water distribution for the benefit of wildlife (e.g. guzzlers, troughs).</td></tr>
<tr><td colspan="3">Key Question 2 – Habitat for Red Band Trout
What actions are needed to maintain habitat for Red Band Trout?</td></tr>
<tr><td>Redband Trout Habitat:
S-H.9 There is a need to evaluate the success of existing projects and identify other actions that will preserve, maintain or restore redband trout habitats.</td><td>Achieve goal 2, objective 2.1 of USDA Strategic Plan (Strategic Plan, 2010).

Achieve objective of the Redband Trout Conservation Agreement (RBT Agreement, 1998).

The status of certain stream reaches is unknown. In addition to the known habitat in Swamp and Trout Creek there are reaches identified as “Unknown (further study needed).” These reaches identified as “Unknown extend into upper reaches of Swamp Creek: T42N, R1W Section 30 and Trout Creek tributaries in section 26.

Observations of cinder fines embedding native streambed gravels have been made.</td><td>Red Band Trout Habitat Assessment and Improvement:
S-H.9.1 - Pursue opportunities to survey unknown status reaches in cooperation with private landowners to assess habitat and determine redband trout presence or absence.

S-H.9.2 - Avoid rocking roads with cinders that are located in close proximity to redband trout habitat. Where cinders are present near redband habitat pursue opportunities replace the surface with other aggregate.</td></tr>
</table>

Core Topic – Human Uses

Table 26 – HUMAN USES - Opportunities

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Economic Diversification: **HU.1a** –Encourage and support alternative forest product utilization in support of local economic diversification. **HU.1b** –Encourage and support special land uses in support of local economic diversification.	Achieve USDA Strategic Plan Goal 1, Objective 1.1 and 1.2 (Strategic Plan, 2010) McCloud and Siskiyou County as a whole have a higher than average poverty rate and lower than average per capita and family income. McCloud evolved as a timber dependent community and the surrounding NFS lands have played a key role in support of the local economy. A need exists to support local economic diversification in light of the mill closures and general decline in the timber industry.	**Alternative Forest Products:** **HU.1a.1** – Foster opportunities for alternative forest product industry development (e.g. Manzanita burl, boughs, cones, Christmas trees, commercial fuelwood, mushrooms). Identify suitable areas during project level NEPA review for integrated vegetation management. **Special Uses:** **HU.1b.1** – Foster opportunities for recreation and special land uses that directly or indirectly benefit the local community.
Fuelwood: **HU.2a** – Implement management actions designed to increase fuelwood availability for both commercial and personal use, particularly in lodgepole and knobcone areas. **HU.2b** – Assure access to fuelwood gathering areas.	Achieve USDA Strategic Plan Goal 1, Objective 1.1 (Strategic Plan, 2010) 42% of homes in McCloud rely on firewood as the primary source of heat. The McCloud Flats area, including the Edson watershed is an important and popular firewood gathering area. Lodgepole pine is the most popular firewood species. Changes in commercial timber harvesting, firewood gathering restrictions and Motorized Travel Management have contributed to a decline in available fuelwood gathering areas accessible by motor vehicle. Forest health and resiliency including lodgepole pine stands benefit from thinning that can be accomplished in conjunction with fuelwood production.	**Personal Use and Commercial Fuelwood :** **HU.2a.1** - Evaluate stands, particularly lodgepole and knobcone, for personal and commercial fuelwood areas. **HU.2a.2** - Create opportunities for commercial firewood sales in conjunction with sanitation and forest health projects. **HU.2b.1** – Consider NFTS decisions at the project level to increase and maintain fuelwood gathering opportunity. **HU.2b.2** - Consider temporary or permanent adjustments to the NFTS on a project basis and personal use wood permit restrictions in areas targeted for fuelwood gathering to facilitate access to and improvement of lodgepole and knobcone stands.

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
Dispersed Camping Areas: **HU.3 –** Inventory and assess dispersed camp locations and condition. Develop management actions as needed to protect resources and provide adequate dispersed camping opportunity.	Achieve t USDA Strategic Plan Goal 1, Objective 1.1 and 1.2 (Strategic Plan, 2010) Internal roads in Trout Creek Campground are unauthorized. Dispersed camping is an important recreational activity and contributes to the local economy. Locations, access and conditions of dispersed camping areas are largely undocumented.	**Dispersed Camping Areas:** **HU.3.1 -** Inventory and assess dispersed camping opportunities and traditionally used areas and develop appropriate management actions to assure motorized access to those areas considered desirable to retain for recreation access and protect resource conditions. **HU.3.2 –** Evaluate internal unauthorized routes within Trout Creek campground and adjust NFTS to provide desirable access.
Developed Recreation: **HU.4 -** Evaluate and identify developed recreation potential including motorized and non-motorized trails.	Achieve USDA Strategic Plan Goal 1, Objective 1.1 and 1.2 (Strategic Plan, 2010) The Trout Creek Nature Trail is currently the only system trail in the watershed. Construction of this trail was achieved through partnerships with local students through the Adopt-A-Watershed program. It is important to maintain this educational and recreational opportunity. The watershed in general is lacking non-motorized trail opportunities. The Rails-to-Trails project constitutes a significant recreational link between the communities of McCloud and Burney and can potentially present a regional draw in recreation related tourism.	**Trails:** **HU.4.1 -** Re-open the Trout Creek Nature Trail and continue to work with partners in Rails-to-Trails as the McCloud River Railroad abandonment proceeds. **HU.4.2 -** Continue to evaluate other potential trail routes such as the proposed rails to trails on the McCloud River Railroad Right-of-Way.
Land Ownership Fragmentation: **HU.6a –** Consolidate land ownership. **HU.6b –** Work cooperatively with adjoining landowners at the watershed scale.	Achieve USDA Strategic Plan Goal 2, Objectives 2.1 and 2.3 (Strategic Plan, 2010) Much of the watershed exists in a checkerboard land ownership pattern resulting in management limitations and inefficiencies.	**Land Ownership Consolidation:** **HU.6a.1 –** Pursue land exchange opportunities with private landholders to consolidate ownership particularly regarding checkerboard sections. **Cooperative Management:** **HU.6b.1 –** Pursue agreements such as CRMPs and conservation agreements with adjoining land owners to work towards watershed scale ecosystem management.
Protection of TCP: **HU.5 –** Consider opportunities to decrease user group conflict and grazing impacts on the TCPs.	Fulfill requirements of National Historic Preservation Act (NHPA) Achieve USDA Strategic Plan Goal 1, Objective 1.2 (Strategic Plan, 2010)	**Manage and Protect TCP:** **HU.5-1 -** Develop Historic Property Management Plan **HU.5-2 –** Protect property from cattle damage. *Evaluate protective measures in upcoming Bartle grazing allotment planning process.*

Conclusions from Step 5 *there is a need to:*	**Rationale or Objective**	**Management Opportunity**
MRLC Historic District : **HU.6a –** Update historic district information. **HU.6b –** Protect sites from fire	Fulfill the Supplemental Management Direction for Managements Area 2 in the Forest Plan. A Answer research questions posed in the Determination of Eligibility of the MLCHD	**MRLC Historic District Management:** **U.6a-1** - Develop a thematic study of the archaeological sites representing the MRLC operations. **MRLC Historic Site Fire Protection:** **HU.6b-1 –** Develop fire protection projects for MRLC sites as appropriate.

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Appendix A – Fire Behavior Potential

Appendix
Fire Behavior Potential Edson Watershed Analysis

Fire behavior was modeled using Behave Plus a software program that computes potential fire behavior characteristics (e.g. spread rate, flame length, fireline intensity) under constant weather and fuel moisture conditions. The 90th percentile weather and fuel moisture values used were derived from a Special Interest Group (SIG) using the Ash Creek and Round Mountain Lookout Remote Automated Weather Stations (RAWS). These values represent those that would occur during peak fire season conditions (Table1).

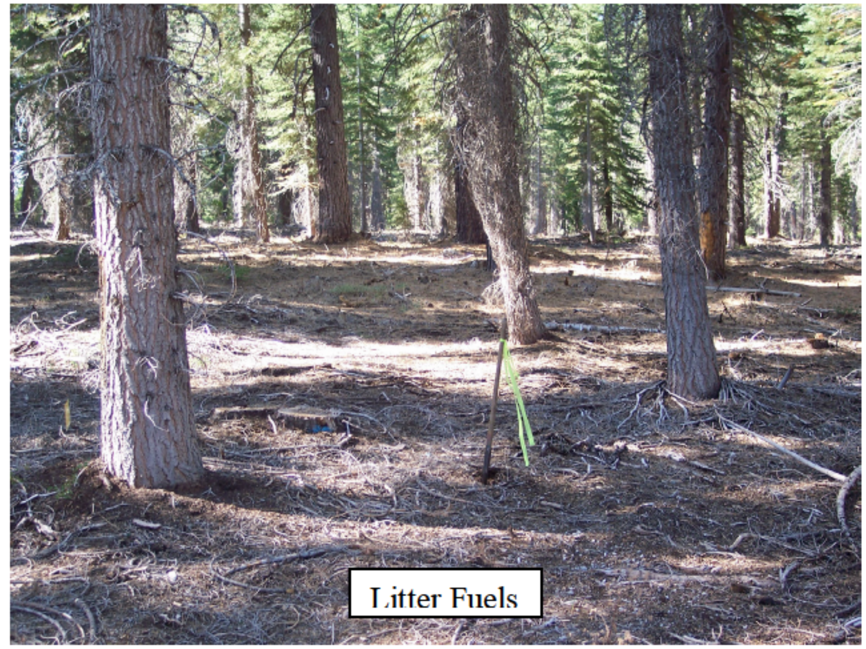
90th Percentile Weather Ash Creek & Round Mountain Significant Interest Group (SIG)								
Temperature (F^0)	Relative Humidity (%)	20' Wind Speed (mph)	1 hour moisture (%)	10 hour moisture (%)	100 hour moisture (%)	1000 hour moisture (%)	Herb (%)	Woody (%)
88	14	8	2	4	8	9	30	66

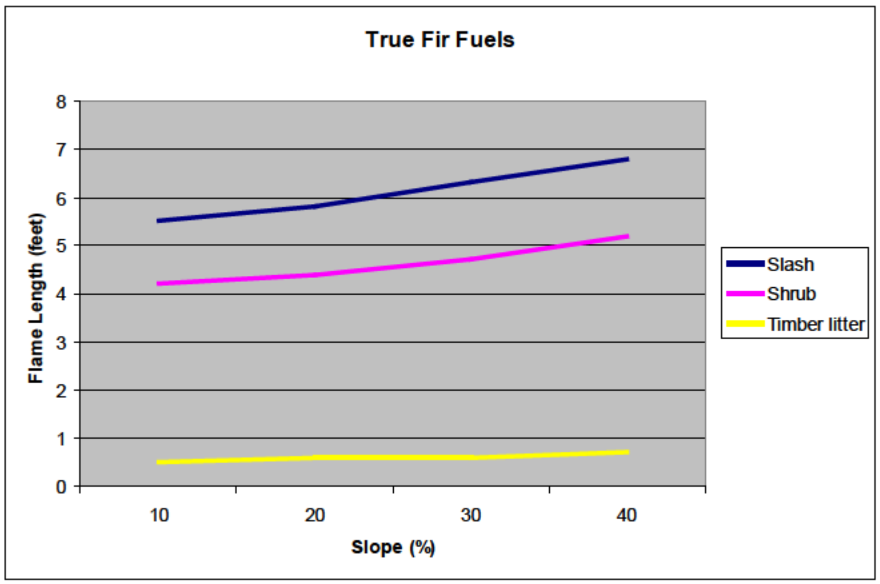
Table 1

Flame length is the variable used to show differences in fire behavior by fuel model for each vegetation type. Flame length is an indicator of resistance to control i.e. the ability to suppress wildfire (Table 1). It is also useful in determining crown fire potential and tree mortality.

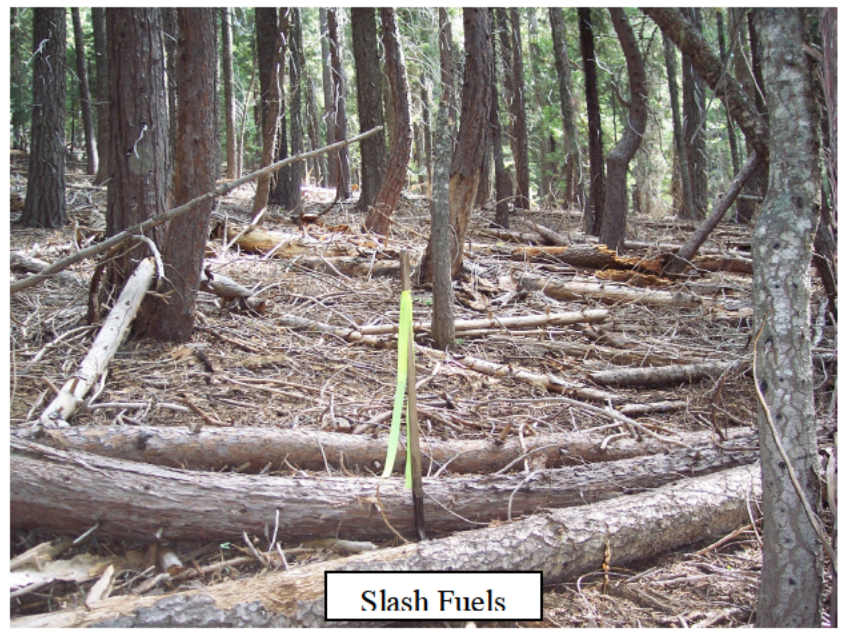
Hauling Categories	
Flame Length	**Control Issues**
0-4	Persons using handtools can generally attack fires at the head or flanks. Handline should hold the fire.
4-8	Fires are too intense for direct attack on the head by persons using handtools. Handline can not be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft can be effective.
8-11	Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the head of the fire will probably be ineffective
11+	Crowning, spotting, and major runs are common, control efforts at the head of the fire are ineffective

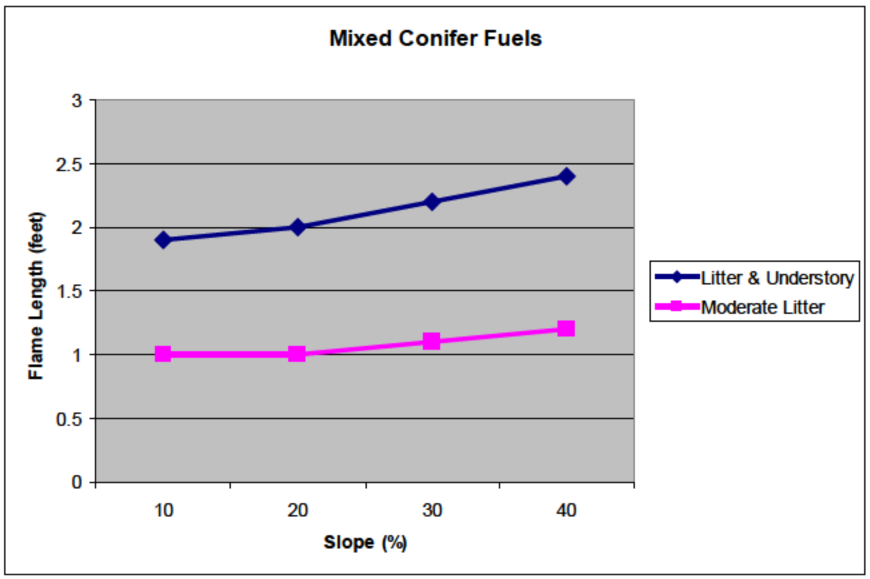
Table 2





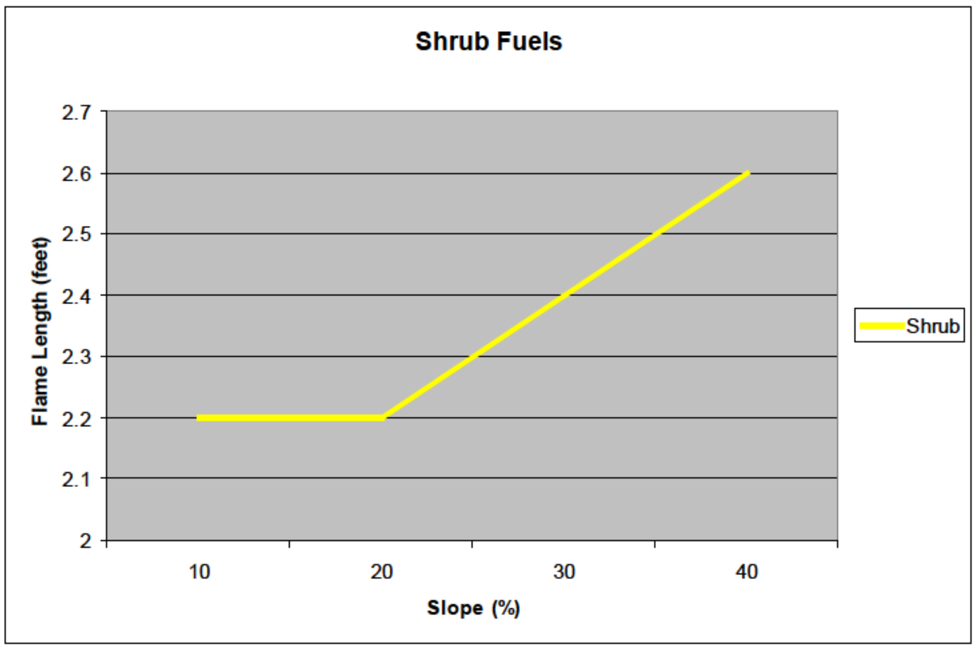
Mid and Upper Montane Vegetation – White fir, Red Fir
Fire effects: low tree mortality in litter fuels. Potential exists for torching (passive crown fire) in shrub and slash fuels along with high tree mortality and resistance to control.



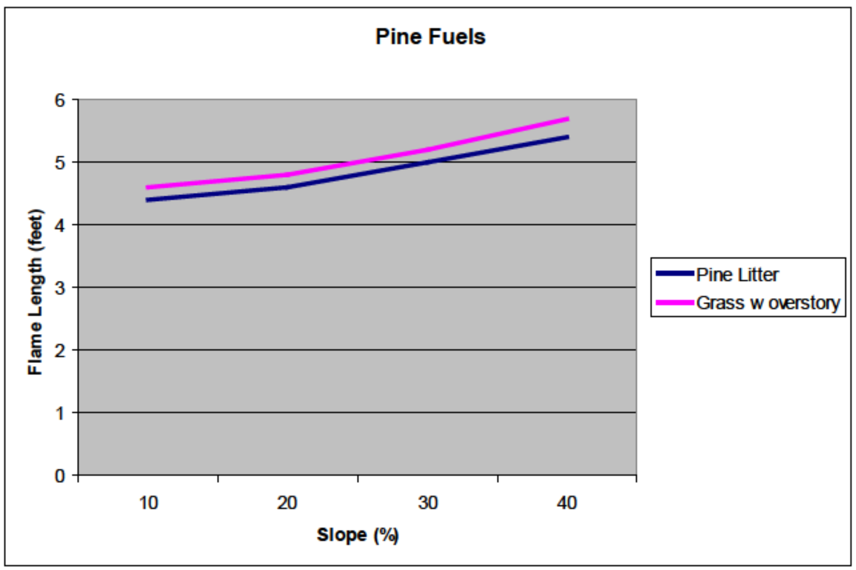


Mid-Montane Vegetation – Mixed conifer: Jeffery & Ponderosa pine, White fir, Incense cedar, Sugar pine

Fire Effects: Potential exists for torching (passive crown fire) where ladder fuels are present. Moderate resistance to control. Tree mortality will vary by species and age.

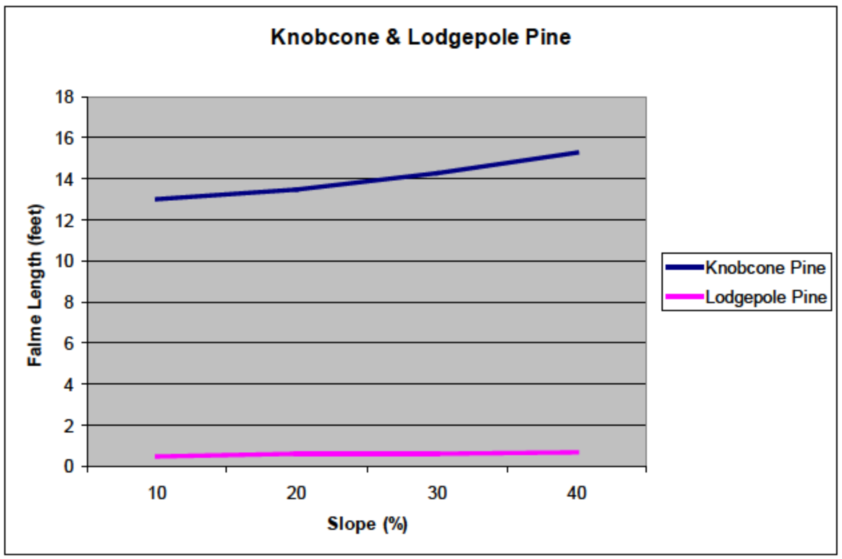


Shrubs – bitterbrush, mountain mahogany, manzanita, ceanothus
Fire effects: Moderate resistance to control where cover is greater then 50 to 60%. Will initiate torching (passive crown fire) where there is an overstory of trees. Species are fire adapted, reproduce through sprouting and stored seeds.

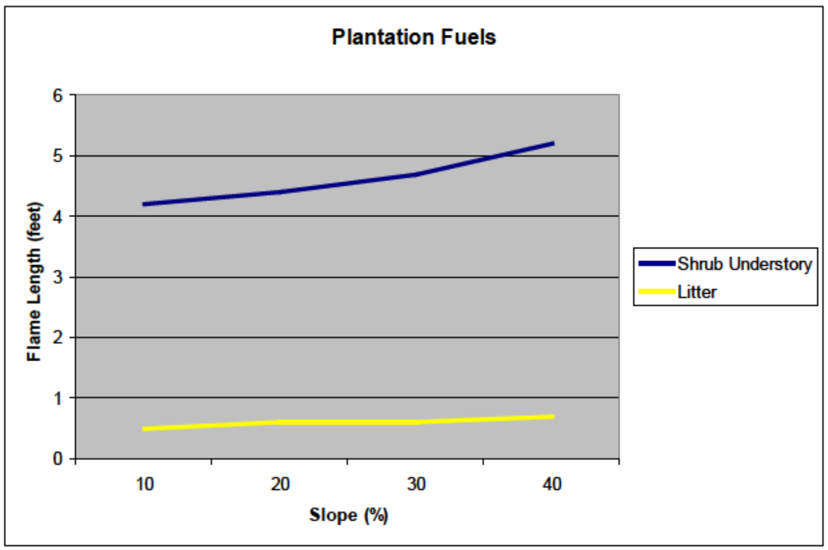


Mid-Montane Vegetation- Ponderosa and Jeffery pine

Fire effects: Open stands with light to moderate surface fuels, primarily surface fire due to limited ladder fuels. Larger trees are fire resistant.



Mid and Upper Montane Vegetation- Knobcone and Lodgepole Pine Fire effects: These pines are serotinous species that require high severity stand replacing fire to reproduce. Older stands with high surface fuel loading and standing dead are set for high severity fire.



Pine Plantations

Fire effects: Young trees lack resistance to effects of moderate severity fire. Pruned stands with light litter fuels are more resistant. Where brush creates ladder fuels torching (passive crown fire) and high mortality will occur.