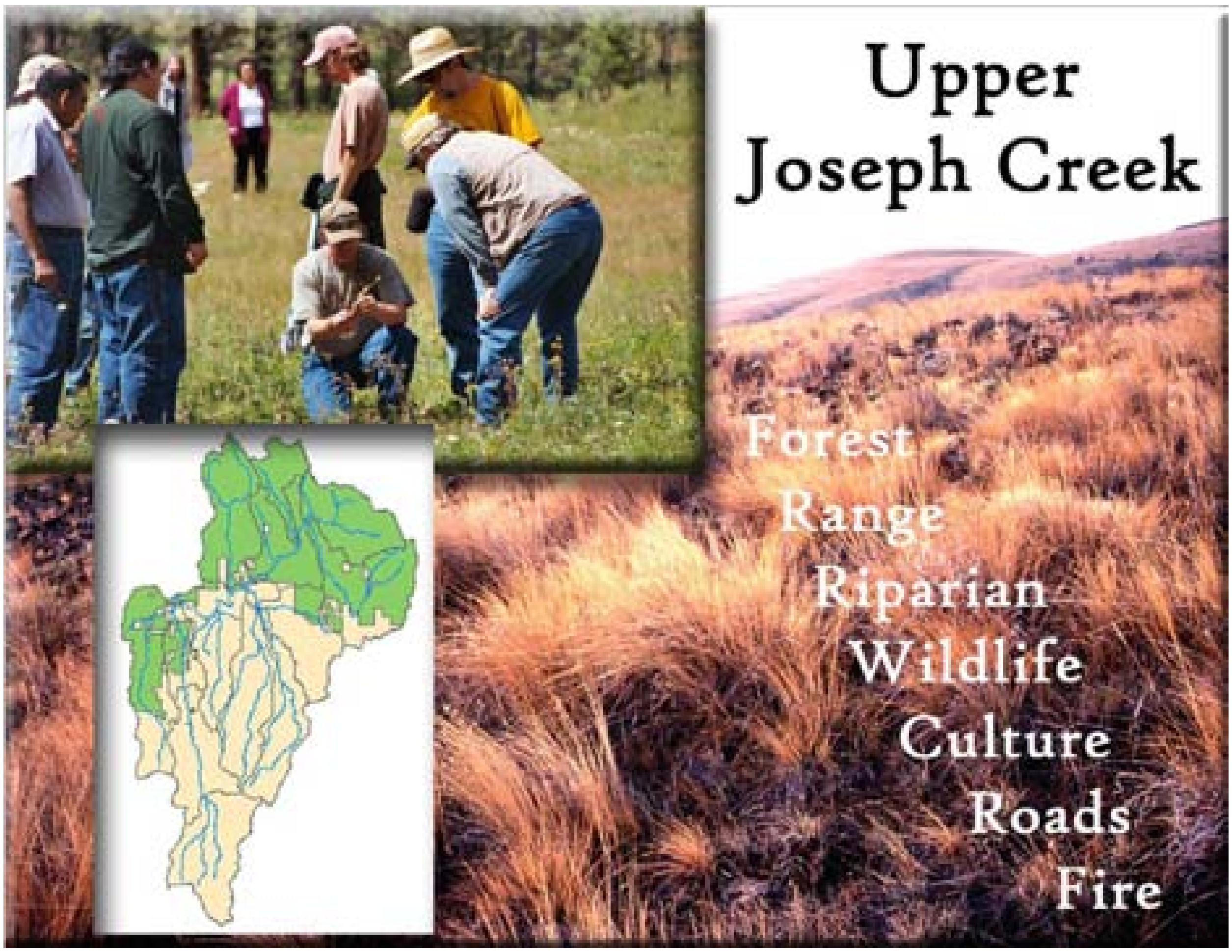
Upper Joseph Creek Watershed Assessment



Wallowa County Community Planning Process Group

September 2005

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Stewardship Principles

At the beginning of the Upper Joseph Creek Watershed assessment, the Wallowa County Natural Resources advisory committee developed the following principles to guide the collaborative planning process. With time and experience, it is anticipated that agreement will be reached on principles to guide management across the watershed.

The ecological systems in the Upper Joseph Creek Watershed are disturbance-adapted systems. Competition within and between species, and natural disturbance regimes of fire, insects, disease, wind, flood, and herbivory, create mosaics of vegetation cover and structure that change over time and space. The native biological diversity of the landscape is adapted to these dynamics.

In this context, habitat diversity is important. The alteration of disturbance regimes (through the control of disturbance or resource use) can lead to a simplification of vegetation patterns and riparian systems, which may impair watershed functions and jeopardize the persistence of many native species. Processes that lead to simplification increase the risks for larger scale disturbances (such as uncontrolled fire, insects, and disease occurrences).

These principles provide a framework to exercise continuing responsibility for maintaining and enhancing watershed conditions. In some areas, restoration is needed to reestablish both structure and function within the watershed. These principles guide the development of specific management recommendations, and facilitate the collaborative efforts already taking place in the community.

Stewardship efforts should:

- Begin with analysis of the current and historic ecological conditions at the watershed level – ridgetop to ridgetop.
- Incorporate the social, cultural, and economic dynamics of the community;
- Maintain spatial and temporal patterns of species composition, structure, and seral stages that are within a resilient range for the landscape;
- Address not only symptoms, but also the causes of habitat loss and modification which exceed normal ranges and cycles for these disturbance-adapted systems;
- Avoid strategies likely to entail recurring high maintenance costs;
- Define clear, achievable and measurable management objectives;
- Use adaptive and flexible management, supported or modified by feedback from monitoring – with multi-party monitoring being an important tool for collaborative processes on public lands.

Stewardship should draw from passive and active management strategies that address specific issues and conditions within the watershed. A broad range of resource management tools needs to be available, including but not limited to: prescribed burning; pre-commercial and commercial logging; revegetation using both native and non-native plant species; managed grazing, restoring channel morphology and structure, use of herbicides and pesticides; riparian and rare plant community protection; as well as permanent and temporary road closures.

Table of Contents

I. Introduction ……………………………………………………………... Tab I, pg. 1-10

Purpose and Organization of this Document ……………………………………... 1
Environmental Setting …………………………………………………………...1
Existing Condition of Wallowa County …………………………………………5
Community Collaboration ……………………………………………………… 7
Acknowledgements ……………………………………………………….……10

II. Integrated Issues and Recommendations …………………………….. Tab II, pg. 1-37

Purpose of this Section ……………………………………………………….…. 1
Organization of this Section …………………………………………………….…. 1
Integrated Issues ……………………………………………………………………2
Riparian Vegetation, Stream Temperatures, and Large Woody Material …… 2
Large Trees, Wildlife Habitat and Fire ………………………...……….…..7
Wildfire and Economic Opportunities ……………………………….…...14
Roads and Recreation ……………………………………………………. 15
Rangeland Health ……………………………………………………..…. 19
Cultural Resources …………………………………………………...….. 33
Additional Recommendations ………………………………………………….35
Monitoring and Evaluation ………………………………………………………36

III. Forest Condition Assessment ………………………………………… Tab III, pg. 1-11

Forest Assessment Methodology ………………………………….……………… 1
Overview of Conditions ………………………………………………………...…… 1
Silvicultural/ Fuels Management Overlook ………………………………………. 5
Warm Dry Management Options …………………………………………… 6
Cool Dry Management Options ………………………………………………7
Forest Conditions and Wildlife Habitat ……………………………………….... 9

IV. Fire and Fuel Analysis ……………………………………………... Tab IV, pg. 1-18

Fire & Fuel Overview ……………………………………………………………. 1
Analysis of Fire Occurrence ……………………………………………………… 5
Fuel Models ……………………………………………………………………… 9
Fire and Air Quality ……………………………………………………………... 12
Fire and Fuels Recommendations ………………………………………………… 13

V. Rangeland Condition Assessment …………………………………….. Tab V, pg. 1-16
Introduction ………………………………………………………………………. 1
Results ……………………………………………………………………………. 2
Vegetation Classification …………………………………………………. 2
Range Mapping Research ………………………………………………… 2
Permittee/Private Landowner Input ……………………………………… 4
Recommendations …………………………………………………………………5
General recommendations ……………………………………………….... 5
Projects ……………………………………………………………………12

VI. Riparian Condition Assessment ……………………………………… Tab VI, pg. 1-40
Introduction ……………………………………………………………………... 1
Conditions and Analysis ………………………………………………………... 2
Riparian Vegetation ………………………………………………………...2
Pools ……………………………………………………………………….6
Temperature ………………………………………………………………...8
Large Woody Material ……………………………………………………19
Bank Stability ……………………………………………………………...21
Width to Depth Ratio ……………………………………………………...22
Projects ……………………………………………………………………………24
Recommendations ………………………………………………………………33

VII. Roads and Recreation Assessment ………………………………….. Tab VII, pg. 1-10
Executive Summary …………………………………………………………….. 1
Current Situation ……………………………………………………………….. 2
The Assessment Process………………………………………………………… 2
The Rating Process ………………………………………………………… 3
The Weighting Process ……………………………………………………. 4
Total Scores and Assignment of Matrix Positions …………………………4
Final Recommendations ……………………………………………………5
Project Work Sites ………………………………………………………… 8
Bridge Related Project Work …………………………………………………… 8
OHV Trail Network …………………………………………………………….. 9
Recreation Considerations ……………………………………………………… 9

VIII. Wildlife Issues …………………………………………………… Tab VIII, pg. 1-7
Goals ……………………………………………………………………… 1
Community Planning Process……………………………………………… 1
Review of Salmon Plan……………………………………………………… 2
1995 Analysis……………………………………………………………… 2
Review of Key ESA Issues and Guidelines ……………………………… 3
Open Discussion …………………………………………………………... 4
Positive Highlights ………………………………………………………… 6
Issues to Follow Up ……………………………………………………….. 7

IX. Cultural Assessment ……………………………………………... Tab IX, pg. 1-19
Introduction ………………………………………………………………...1
Ethnohistory ………………………………………………………………..1
Settlement and Subsistence ………………………………………………...4
Introduction of the Horse …………………………………………………13
Aboriginal Use of Fire ……………………………………………………14
Prehistory and Archaeology ………………………………………………16
Summary and Conclusions ………………………………………………..17

X. Bibliography

XI. Appendices
1. Acronym List
2. Participants

Forest Condition Assessment:
3. Forest Condition Assessment Description
4. EVG Data Entry Form Definitions
5. Biophysical Environments
6. Structural Stages of Stand Development
7. Forest Stand Historic Range of Variation

Rangeland Condition Assessment
8. Rangeland Relationships in the Upper Joseph Creek Watershed

Roads and Recreation Assessment
9. Forest Service Roads Data
10. Segment Rating Criteria
11. Segment Benefit Scores
12. Segment Cost Scores
13. Results
14. Category Matrix
15. Scatter Plot of Cost and Benefit Scores
16. Percentile Arrays

Introduction

Purpose and Organization of This Document

This document is a comprehensive assessment of the Upper Joseph Creek Watershed (UJCW)[1], prepared through a collaborative process by the Upper Joseph Creek Community Planning Group. The document begins with introductory and background information about the watershed and the process used to complete the assessment. The next section integrates individual assessments to summarize current watershed conditions and desired future conditions as well as recommendations for activities that promote the desired conditions. Following this section are individual assessments for Forest Condition, Fire and Fuels, Rangeland Condition, Riparian Condition and Roads and Recreation, Wildlife, and Culture.

Environmental Setting[2]

The UJCW is a relatively large watershed (174,674 acres) with slightly more private ownership than public ownership (44% federal and 56% private). The Wallowa-Whitman National Forest manages virtually all of the public land. The private land is primarily grassland and includes all of the southern headwaters of this watershed. Private ownership is divided among 55 landowners with almost two-thirds of the private land held by 10 landowners. The watershed is bounded on the east and north by the Hells Canyon National Recreation Area. The Hells Canyon Wilderness is approximately 2 miles from the watershed boundary.

The National Forest portion of this watershed has been managed more intensively than most other watersheds within the northern portion of the Wallowa-Whitman National Forest. Almost all portions of the watershed are accessible by vehicle due to gentle terrain and regularly spaced roads. Stands of conifers have been managed over the last 50 to 60 years, and range vegetation has long supported cattle and sheep grazing. Since less than 5 percent of the private land is forested, timber harvest is a minor component of management activities on private land.

Contrary to its name, the UJCW does not actually contain Joseph Creek. Rather it contains all of the drainages that contribute to Joseph Creek where it begins at the mouth of Chesnimnus Creek. The watershed contains 13 subwatersheds. Components of the UJCW are described in greater detail below.

<u>Subwatershed Descriptions</u>

The UJCW consists of thirteen National Forest System subwatersheds, ranging in size from 6,000 to 19,000 acres.

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[1] An Acronym Key is provided for this document in Appendix 1
[2] From Upper Joseph Creek Watershed Analysis Report, USDA FS (1995)

Lower Crow subwatershed is the smallest of the thirteen subwatersheds, containing less than 6,300 acres. County Road 765 and Forest Road 4620 run along the portion of Crow Creek within this subwatershed. The area provides a transition between grasslands to the south and more heavily forested areas to the north, Johnson Canyon and Doe Gulch are tributaries to Crow Creek within this subwatershed.

Elk Creek subwatershed ranges from an elevation of 5122 at Elk Mountain to 3260 at the mouth of Elk Creek. Forest Road 46 runs along portions of Elk Creek. Most of Elk Creek has received restoration treatments such as exclosure fencing, in-stream woody debris placement, and streamside planting. In addition to Elk Creek, this subwatershed contains Little Elk Creek and Gould Gulch. Similar to the Lower Crow subwatershed, this subwatershed provides a transition between grasslands to the south and more heavily forested areas to the north.

Middle Crow subwatershed is entirely within private ownership, except for a small parcel managed by the Bureau of Land Management. County Road 765 runs along the portion of Crow Creek within this subwatershed. Virtually this entire subwatershed is grassland.

Upper Crow subwatershed also contains a small parcel managed by the Bureau of Land Management, but otherwise is privately owned. The subwatershed is entirely rangeland and agricultural land. A former volcanic vent is located in the northeast corner of the subwatershed.

Lower Chesnimnus subwatershed contains a portion of Chesnimnus Creek in addition to tributaries such as Calf Creek, Butte Creek, Corral Creek, and Gooseberry Creek. Portions of the floodplain of Chesnimnus Creek have been cultivated and grazed. The southern and central portion is grassland and becomes more forested toward the north.

Pine Creek subwatershed is privately owned except for a small Bureau of Land Management parcel. The subwatershed is entirely non-forested. It contains Pine Creek and its various unnamed tributaries.

Alder Creek subwatershed is primarily privately owned with a portion of National Forest in the northeast corner. In addition to Alder Creek, the subwatershed contains Sterling Gulch. Forest Road 4600-990 runs along the main stem of Alder Creek. Almost 5,000 acres of grasslands and open timberland (most of it privately owned) burned in 1994 during the Thomason Complex fires.

Salmon Creek subwatershed includes Salmon Creek, Dry Fork Salmon Creek, and Deadman Gulch. The subwatershed is non-forested and except for a small Bureau of Land Management parcel is privately owned.

Middle Chesnimnus subwatershed is mostly forested and except for a few privately owned parcels, is managed by the Forest Service. The subwatershed contains a portion of Chesnimnus Creek, Romane Gulch, Doe Creek, Hilton Gulch, and Ellis Canyon. Portions of the 1994 Thomason Complex of wildfires is within this subwatershed. Vigne Campground is located along the portion of Chesnimnus Creek in this subwatershed.

Upper Chesnimnus subwatershed is the largest of the thirteen subwatersheds containing almost 19,000 acres. The southern portion is privately owned and the National Forest is to the north. The Thomason Meadows Guard Station is in the center of the subwatershed. Besides the headwaters of Chesnimnus Creek, the subwatershed contains drainages such as Tamarack Gulch, Dry Fork Creek, and Vance Gulch. The Vance Knoll Research Natural Area is located in this subwatershed. The subwatershed is a transition zone for grasslands to the south and forested land to the north.

Devils Run subwatershed is mostly forested and except for a five-acre parcel, is managed by the Forest Service. Drainages within this subwatershed include Summit Creek, Poison Creek, and Devils Run Creek. This subwatershed contains a particularly high density of roads, although many of the roads have been closed to vehicles over the last five years.

Billy Creek subwatershed is a relatively small subwatershed (6,500 acres) that is entirely within National Forest jurisdiction. It contains the Billy Meadows Guard Station. Billy Meadows is known for the elk fence installed early in the century to protect the first reintroduced Rocky Mountain Elk herd. Daugherty Campground along Road 46 is in this subwatershed. The subwatershed contains Billy Creek and its forks. Most of the subwatershed is forested, and forested portions are some of the densest in the watershed.

Peavine subwatershed contains private land in the south and National Forest System Lands in the central and northern portions. Roads line the East Fork, West Fork, and Main Stem Peavine Creek. Coyote Campground and Red Hill Lookout are located in this subwatershed. The road along main stem Peavine Creek is currently closed to standard width vehicles. The subwatershed is primarily forested.

<u>Geology and Landforms</u>

The UJCW is a gently sloping dissected plateau. The Columbia River Basalt that forms this plateau is generally thick bedded, fine-grained, hard and massive. Locally, the plateau contains some interbeds of ash, old soil profiles, and sedimentary rocks; it makes up about 95 percent of the watershed. The basalt plateau slopes from the highest points on the rim on its northeast side into a "bottleneck, on the northwest where Elk, Crow, and Chesnimnus Creek meet to form Joseph Creek. Here, Joseph Creek empties into its deeply incised canyon. The watershed is bounded by the break-lands of the Snake River on the northeast and those of Joseph Creek Canyon on the northwest. The northern half of the watershed is a mix of forest and grassland and is dissected by Chesnimnus, Crow, Elk, Peavine, and Devils Run Creeks. These are fairly incised drainages; their flow is generally to the west. The southern half of the watershed (mostly private land) is flatter and is drained by Crow and Alder Creeks, flowing to the north and west.

Broad alluvial deposits are present along Chesnimnus Creek and at the confluence of Elk, Crow and Chesnimnus Creeks into Joseph Canyon. These valley floors make up less than 1 percent of the watershed.

Volcanic vents, which were intruded through the plateau basalt, now exist as buttes. They make up about 4 percent of the watershed, including Elk Mountain, Roberts Butte, Greenwood and

Haskin Buttes, and the Findley Buttes. North and northwest trending faults border the watershed.

Soils

Soils in UJCW are related to landform, vegetation, and temperature moisture group. Higher elevations along the northeast rim as well as north facing slopes are some of the cooler sites.

North Half - Dominant soil series in the rolling mountain slopes include Fivebit, Deadend, and Kamela. Fivebit is a shallow gravelly silty lam on forested plateaus and back slopes. It is present in warm/dry areas and is forested by ponderosa pine or Douglas fir. The Deadend series is a very shallow loamy skeletal soil, present on mountainside slopes in opening with a sage bluegrass plan association. It is a warm/dry temperature moisture regime. The Kamela series is present under a more closed canopy of Douglas fir on mountain toes slopes on cool/dry sites. It is a moderately deep gravelly loam and is a mixture of ash, loess, and colluvium from basalt. These soils are present in the Peavine, Billy, and Devils Run subwatersheds.

Dominant soil series on the northern plateau include Syrupcreek and Downey Gulch. Syrupcreek soils are moderately deep, cool, loamy-skeletal, and occur on forested sites. Downey Gulch soils are moderately deep and loamy with less ash and also occur on forested sites. Openings may be moist meadows with dark, loamy soils such as Albee or Parsnip. Swales may have soils high in clay such as Zumwalt or Harlow.

Steep canyon walls occur along incised drainages. Upper slopes of these canyon walls are erosional (soil detachment and transport) and transition to depositional on toe slope positions. On north facing slopes, Limberjim soils are associated with grand fir forests. Limberjim soils are very deep and ashy. Tamarack soils are also found on north slopes with grand fir and are very deep. Klicker soils, which are moderately deep and loamy-skeletal, occur on drier forested sites and are associated with ponderosa pine and Douglas fir. Anatone, a shallow, loamy-skeletal soil, and the very shallow, skeletal Bocker soil, occur on south aspects.

South Half - Snell and Harlow soils occur on north and south side slopes of the southern plateau. They are shallow to moderately deep, skeletal loams over clays. Plateau tops are dominated by mound-intermound microrelief. The very shallow Bocker soil occurs in intermound positions. Anatone soils are shallow, loamy-skeletal soils found in mounds. Wallowa soils are moderately deep silt loams with thick dark surfaces. They are found in grasslands on the plateau. Albee soils are similar but are found in areas of higher precipitation. Harlow soils are shallow, clayey-skeletal, and found on ridge tops. Zumwalt soils are moderately deep, fine textured soils found in swales. Hurwal soils are deep and are the most productive agricultural soils within the UJCW. They are usually found in association with Topper and Tippet soils, which occur, adjacent to and in swales.

The stream break lands and north slopes off the plateau are almost always influenced by volcanic ash. The soils are mapped as Getaway-Tolo complex. Getaway is a deep non-ash soil, while Tolo is a very deep ash soil. This complex supports productive stands of ponderosa pine and Douglas fir. Klicker soils are found on south slopes and support ponderosa pine and Douglas fir.

Existing Condition of Wallowa County

This section not only describes the general physical characteristics of forestlands and rangelands, but also the socio-economic conditions that exist within the county. The UJCW is one of 20 watersheds that fall within or partially within Wallowa County; however, countywide conditions are well represented within the UJCW. Figure I-1 shows the location of the UJCW within Wallowa County.

Figure I-1. Upper Joseph Creek Watershed vicinity within Wallowa County.

Physical Conditions
The poor ecological health of the forested ecosystem in Wallowa County and the greater Blue Mountains area is well documented in federal and scientific reports. Forest ecosystems are considered "unhealthy" because of widespread conifer die-off due to insect and disease epidemics, as well as periods of low precipitation. Assessments of the area typically highlight "natural process imbalances" attributed to the history of fire exclusion, extensive livestock grazing and past timber management techniques. This history has driven a colonization of the forested lands by more shade tolerant Douglas-fir and true firs, and a build-up of fuels to a level much greater than that historically found in this area. These conditions have lead to increases in the size and occurrence of disturbance events, as currently seen throughout the inland west. There is broad agreement that a course of non-intervention would result in unacceptable consequences to the forest ecosystem.

Rangeland areas are in better condition at the start of the 21st century than at any time during the previous century. However, the spread of noxious weeds and alien invasive species continues to threaten native grasslands, and the management of isolated riparian areas requires attention.

Riparian areas are a concern due to the decline in anadromous salmonid populations, and attention is being given to forestry, farming and livestock practices that affect riparian vegetation, stream sedimentation, and water temperature. However, several factors outside of Wallowa County affect these fish populations, including ocean fishery harvest and hydropower dams. While improvements in riparian management are being pursued in Wallowa County, it is unlikely that these improvements alone will result in the desired increase in threatened salmonid populations.

Because of the varied natural environment of Wallowa County (from alpine mountains to North America's deepest canyon), a great diversity of wildlife species exists in Wallowa County. While settlement and excessive hunting did result in decreased numbers of most of the larger mammals by the early 1900's, subsequent regulation and management have resulted in a significant increase in populations of all the larger mammals but the bighorn sheep. The importance of many other species is now being addressed in management plans due to their status as threatened or endangered, and because of increased interest in maintaining resource diversity.

Socio-economic Condition

In a recent statewide assessment (2003), the Oregon Progress Board ranked Wallowa County's economy as 30th out of 36 counties in the state. Since 1995, the number of residents with incomes below the federal poverty level increased due to the loss of manufacturing jobs and their partial replacement with service jobs. Persistent poverty continues to be a problem for many residents. Per-capita incomes are among the lowest in Oregon, as is the net job growth per 1,000 population.

The per-capita income conditions are actually worse than the weak figures indicate, as Wallowa County's income figures have among the highest contribution from dividends, interest and rent of any in the State. This is believed to reflect the increasing retiree and second homeowner segment of the population. The economic data supporting this assessment highlights the significant loss of jobs from the wood products manufacturing sector over the past 10 years, a sector with above average wages in the County, as a key contributor to the depressed economic conditions.

State of Oregon, Employment Department figures from January 2004 indicate that Wallowa County was among the lower counties in the state for average pay per job in 2002. The average annual pay in Wallowa County of $25,669 is only 76 percent of the state average and 70 percent of the national average. The unemployment rate for November 2003 in Wallowa County was 8.5 percent as compared to a statewide rate of 7.3 percent. In January 2004, Oregon moved from the 50th to the 49th highest unemployment rate in the nation.

In 1992, a reduction in timber harvest from public lands, along with a downturn in the market price for lumber, contributed to a severe shock in Wallowa County's economy. The three remaining mills closed by 1995 – including the large Boise Cascade mill in Joseph, which had the highest lumber industry wage jobs. While one mill remains in the county, supply to this mill remains tenuous.

Recognizing the importance of the forest products sector of the economy, the impact of the job loss comes as no surprise. A broad range of federal and state public assistance claims have skyrocketed since 1991 including food stamps, employment related day-care, temporary assistance to needy families, and aid to dependent children. Staff at the Enterprise Employment Department also indicated that the loss of forest industry jobs contributed to a breakdown in families. Data shows a significant increase in public assistance to single parent families. The three Wallowa County School Districts have also been hit hard with a cumulative decrease in enrollment. This decline in enrollment severely affects state financial allocations to rural schools already strapped for funds.

The shifting demographics and employment trends in the County are fueling increased real estate sales and home construction. With the passage of Measure 37[3] in Oregon, the restrictions on sub-division of agricultural and forestry properties under state and county land-use laws are being challenged. Several Measure 37 claims have been filed in Wallowa County.

Community Collaboration

On several occasions between October and December, 2000, County Commissioners, the Forest Service, Wallowa Resources, several State agencies, tribal representatives, environmental group members and representatives on the local Natural Resource Advisory Council (NRAC) discussed ways we could "fit together" and enhance our collective influence over local Natural Resource issues. All parties noted the good communication; coordination or collaboration once private landowners or stewardship agencies initiate management projects. However, all were concerned that we lack a ***shared vision of land stewardship or restoration priorities*** across the landscape. There was also a sense of urgency based on various needs for forest-rangeland restoration or health and the employment opportunities that such projects could generate in a county with one of the highest unemployment rates in Oregon.

We decided that a collaborative and interdisciplinary approach to establishing restoration project priorities and developing initial project proposals would enhance the present level of collaboration between citizens, local government, tribes, state and federal agencies. Calling the effort the Community Planning Process, we want to generate agreement around the most important places to initiate further restoration and land stewardship in Wallowa County. In addition, we are exploring efficiencies in the NEPA, federal planning process, as well as implementation and monitoring that involves citizens in the management of their public lands by using a variety of contracting methods and agreements.

Although the initial idea was to identify priorities across the County, ultimately the community decided to focus on the Upper Joseph Watershed (5^{th} order). This watershed was chosen because it ranks high in the Wallowa-Whitman Watershed Restoration ranking process and because there was a high degree of community interest and readiness to do work in this particular part of the landscape, including the private landowners who own most of the southern headwaters.

[3] The constitutionality of this measure is being tested in the courts.

The Planning Group

The Upper Joseph Creek Community Planning Group is a collection of individuals who represent local government, tribal, public agencies, and private organizations. This group was formed by the Wallowa County Natural Resources Advisory Committee based on its common interest in developing a shared vision of land stewardship and restoration priorities across the landscape. The UJCW was the group's first attempt at applying this collaborative process, and they are currently initiating the process on a neighboring watershed. During the Upper Joseph Creek Watershed process, the group initiated four working groups[4] around four pressing natural resource issues (1) forest vegetation conditions, (2) rangeland vegetation conditions, (3) riparian conditions, and (4) roads and recreation access. Each of the sub-committees gathered field information to assess the current situation, reviewed the resulting information, and generated project proposal priorities. Each of these sub-committees is formed from a diverse group of citizens and agency representatives under the invitation of Wallowa County. These sub-committees reported their findings to the Wallowa County Natural Resource Advisory Committee, a diverse group, appointed by the Wallowa County Commissioners, representing various stakeholders.

The sub-committees soon recognized the need for further information about wildlife habitat related to the desire to manage for the full range of species within the watershed. The subcommittees jointly conferred with a variety of wildlife specialists and wildlife-based interest groups, including the Nez Perce Tribe. Along with subcommittee representatives, this conference included representatives of the US Fish and Wildlife Service, National Oceanic and Atmospheric Administration – Fisheries, Oregon Department of Fish and Wildlife, and US Forest Service; representatives from Wallowa Resources, Wallowa County Soil and Water Conservation District, Hells Canyon Preservation Council, The Nature Conservancy, and Defenders of Wildlife; and a representative from the Nez Perce Tribe.

Organization

The four working groups initiated fieldwork to assess the current situation, reviewed the resulting information, and generated project proposal priorities for consideration across all ownerships.

The working groups were formed from a diverse group of citizens and agency representatives under the invitation of Wallowa County. These sub-committees reported out to the County's Natural Resource Advisory Committee a diverse group representing various stakeholders. The smaller groups sub-committees more efficiently gathered and analyzed information while making recommendations to the larger and more diverse representation of stakeholders.

Data Gathering and Use

Recommendations in this assessment are based on existing records and on data gathered specifically for this effort. At the beginning of the assessment process, each of the four sub-

[4] *Appendix 2: Participants* contains a full list of participants in each working group.

committees determined what level of additional information was necessary, both from the public land and private land portion of the watershed.

The *forest vegetation subcommittee* built a methodology for assessing forest conditions based on the existing Forest Service vegetation database. Collaborators included the Forest Service, Wallowa Resources, The Nature Conservancy, Joseph Timber Company, Wallowa Forest Products, RY Timber, Oregon Dept of Forestry, Hells Canyon Preservation Council, and a few private landowners. The methodology focused on gathering information regarding stand structure, function, composition, and disturbance agents. Camp II Forest Management was contracted to conduct the forest assessment on the 76,159 acres of public land in the watershed from September to December 2001. Data maintained by Oregon Department of Forestry was used for private forestlands. This data had been obtained by classifying pixels from a 1997 satellite image to existing vegetative cover on a five-acre or greater basis.

The *rangeland vegetation subcommittee* initiated inventories in the summer of 2002, to create a baseline inventory of important biological components, including plant species, plant associations, terrain, and soil types. Plant community vegetation was sampled on grass and forest steppe rangeland within and adjoining the UJCW. Collaborators included The Nature Conservancy, the Forest Service, Wallowa Resources, the Nez Perce Tribe, Oregon State University Extension Service, and private landowners with land in the UJCW. Dennis Sheehy and Mike Hale of the International Center for the Advancement of Pastoral Systems (ICAPS) were contracted to conduct field studies followed by a written report. Information collected during field investigation was used to classify vegetation into plant community and seral stage to develop a watershed vegetation map using “Quickbird” imagery. During the second field season, preliminary vegetation mapping units defined by correlating field measurements with remotely sensed “Quickbird” imagery were ground-truthed and validated. A vegetation map defining watershed vegetation by plant communities and seral stage accompanied by descriptive and quantitative information will be developed from this information.

The *riparian subcommittee* compiled existing information and completed additional riparian condition surveys with assistance from the Grande Ronde Model Watershed, the US Forest Service, Wallowa Resources, Oregon Department of Fish and Wildlife, and the Nez Perce Tribe. This information covered both publicly managed and some privately owned stream reaches. Landowner permission had been granted for access to collect information on private stream reaches.

The *road and recreation subcommittee* updated existing road records to represent the current road system on public lands and the County Road system on private lands. Collaborators included: Wallowa Resources, US Forest Service, Nez Perce Tribe, Wallowa Valley Trail Riders Association, Grande Ronde Model Watershed and Oregon State OHV Advisors. They then completed an interdisciplinary roads analysis that identified the costs and benefits of each road, essential roads for various needs and their maintenance needs, and roads that can be closed. Other than county roads, roads on private land were not addressed.

In September 2002, a workshop on wildlife and wildlife habitat of the UJCW was held to review known information about wildlife species and habitat in the UJCW, and identify key wildlife issues pertinent to this analysis. Participants included US Forest Service, NOAA Fisheries, US Fish and Wildlife Service, Oregon Department of Fish and Wildlife, Wallowa Resources, Wallowa County Soil and Water Conservation District, Hells Canyon Preservation Council, The Nature Conservancy, Nez Perce Tribe, and Defenders of Wildlife. Recommendations resulting from the workshop are incorporated into relevant integrated issues.

Acknowledgements

The Wallowa County Commissioners and the Standing Committee of its Natural Resource Advisory Committee provided critical leadership throughout the course of this assessment. The Commissioners also provided funding to the project that supported specific analytical components and contributed to the participation by the Nez Perce Tribe.

The Wallowa Mountain Office of the Wallowa-Whitman National Forest supported the process, including invaluable contributions of technical data, guidance on NEPA, NFMA and the WWNF Forest Plan, as well as in-kind staff commitments to the various meetings, workshops, field trips and data analysis sessions. The USFS provided the initial funding to get this project started through a grant under the Blue Mountain Demonstration Area.

The Nature Conservancy provided substantial additional funding to this project, which was critical to the Range Assessment component. Additional funding for the full watershed assessment came from the Ford Foundation, Weyerhaeuser Family Foundation, Oregon Community Foundation, and private donations.

The Birkmaier, Buckhorn (Goertzen's), Tippett, B&H (McDaniel's), McClaran, Lewis and Yost ranches and families deserve thanks for agreeing to include their properties in this assessment; allowing our range assessment crews to undertake assessments on their land; and, contributing their time to add to our knowledge and understanding of the area. Oregon State University assisted in the coordination of the range assessment component, and provided research protocols to protect the private landowners involved.

The Oregon Department of Forestry provided summaries of the forest conditions on private lands, and the Oregon Department of Fish and Wildlife provided important information on wildlife populations, critical habitat areas, and wildlife management goals.

All of members to the NRAC, as well as regional partners such as Hells Canyon Preservation Council, Sustainable Northwest, and many local citizens devoted innumerable hours, and demonstrated tremendous commitment and patience with this process. To everyone involved, we are committed to seeing the resulting recommendations implemented.

Integrated Issues and Recommendations

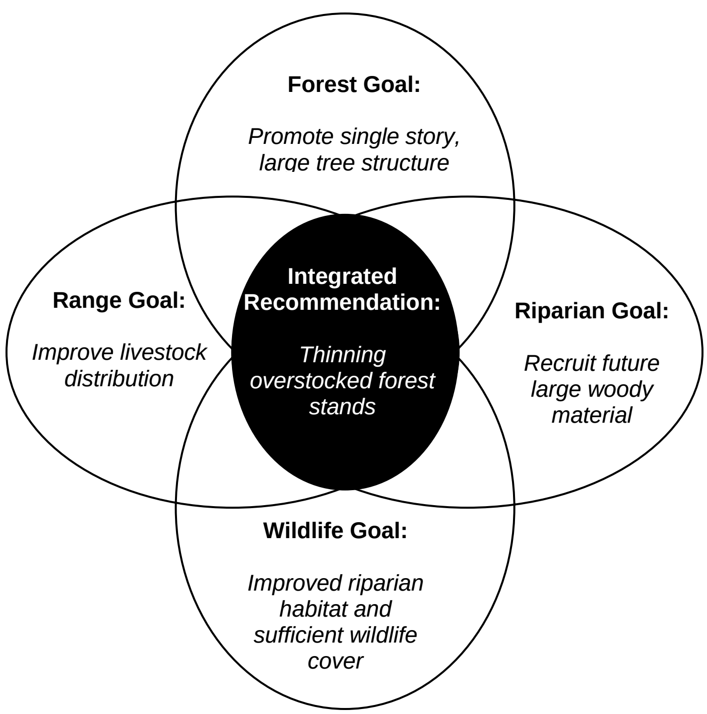
Purpose of This Section

Integrated Issues and Recommendations summarizes the existing and desired future conditions for the Upper Joseph Creek Watershed (UJCW) along with recommendations for activities that promote those conditions. These recommendations are based on the best available knowledge of the watershed ecology, interest in managing habitat for the full range of species within the watershed, and interest in bringing socio-economic benefits to the community. This section also summarizes the monitoring prescribed as a basis for community-wide evaluation of progress and to guide adaptive management.

Organization of This Section

This section emphasizes the recommendations of the four working groups, particularly where their recommendations could be integrated. These recommendations respond to issues that identify a difference between the current condition of the UJCW and the desired condition. Desired conditions are based on current understanding of the conditions that should exist and the processes that should function to sustain healthy forestlands and rangelands in the UJCW. Therefore, the substance of these efforts is documented in the section entitled "integrated recommendations" and "additional recommendations". The diagram below shows how the goals identified by the four subgroups were used to identify an integrated recommendation.

Illustration of Integration Process



Recommendations that address integrated issues are particularly important because funding of restoration efforts is scarce, and any amount spent on restoring the UJCW should achieve multiple goals. Also, a wider arena of support was found among committee members for recommendations that address integrated ecologically-based issues. Any recommendations in this assessment will be re-evaluated on a site-specific basis prior to implementation.

A monitoring and evaluation section follows the issues section of this document. Collaborative data gathering efforts undertaken as part of this planning process emphasized how much more can be learned about the UJCW. A strong feedback loop from further monitoring and evaluation will adjust approaches to restoration and stewardship of the UJCW over time.

Integrated Issues

Six integrated issues were identified to provide the framework for the management recommendations. These integrated recommendations are particularly important because they address multiple goals and provide a cost-effective investment of restoration expenditures.

1. Riparian Vegetation, Stream Temperatures, and Large Woody Material

Decreases in riparian vegetation have resulted in decreased streamside shade, thereby raising summer water temperatures above normal. In contrast, in some locations, dense stands of streamside conifers are providing some stream shade, but are impairing the re-establishment of deciduous shrubs, which are a key component in healthy riparian vegetation. These dense trees are also growing too slowly to provide the large trees needed for instream large woody material.

Riparian vegetation functions to maintain the physical integrity of stream and river channels over a wide range of environmental conditions. The quantity and quality of energy inputs, large woody material, nutrient regulation, algal and macrophytic production, structure and function of biotic communities, and channel morphology are largely controlled by streamside vegetation. Streamside vegetation allows stream ecosystems to function in ways that structural additions alone to channels cannot replicate.

Once damaged or destroyed, riparian vegetation can be difficult to re-establish because of increased grass and/or noxious weed competition and increased livestock and wildlife use. This is particularly true for young shrubs that could ultimately provide shade for streams and habitat for wildlife.

Temperature is just one environmental factor that can affect distribution and abundance of juvenile and adult salmonids within a stream. Salmonids are coldwater fish. Water temperatures influence every phase of salmonid life histories including: growth, development, feeding behavior, time of spawning, susceptibility to disease, and competitive advantage over non-salmonid species (squaw fish, shiners, and dace, of the cyprinid family), all of which are known to inhabit the UJCW. Water temperature also affects the amount of dissolved oxygen in water, biological oxygen demand, and quantity and quality of aquatic invertebrate life forms. Upper lethal temperatures for steelhead are about 75°F, and the preferred temperature range is 50-55°F.

Large woody material plays an important role in stream morphology and the function of aquatic ecosystems. Large wood is a primary influence on pool development and maintenance, and it plays a key role in stabilizing sediment transport through the system. LWM is also fundamental to healthy streams as hiding cover for fish, its contribution to water chemistry, and as habitat for numerous smaller organisms, particularly aquatic insects.

Existing Conditions

Stream Temperature

Stream cooling processes in the UJCW have been altered from natural conditions. As a result, several streams have been listed by the Oregon Department of Environmental Quality as Water Quality Limited for temperature. These streams are Chesnimnus Creek, Crow Creek, Elk Creek, Peavine Creek, and Salmon Creek.

As noted in the Wallowa County-Nez Perce Tribe Salmon Habitat Recovery Plan (SRP), "temperature is a high priority on Joseph Creek. Stream temperature recorders consistently show readings over 80°F ... (t)he area's headwaters are at a lower elevation than other major streams in Wallowa County and naturally more prone to high temperatures. Loss of riparian vegetation and shade has also allowed heating of water to take place on some reaches of Joseph Creek and its tributaries."

Streams in the UJCW commonly exceed the preferred temperature ranges in the area for fish habitat. Temperature violations often first occur in early June and can last well into September. Elevated temperatures are most likely a cumulative result of created openings within riparian reserves, advanced seasonal timing of flows and generally low elevation of the watershed.

Riparian Vegetation

Because of the generally small nature of most streams within this watershed, both reduction of ambient air temperature and prevention of direct exposure to sunlight on the streams are important functions of riparian vegetation. Fire suppression, road construction, logging, grazing and browsing by livestock, elk and deer, and introduction of non-native plant species have contributed to a loss of species diversity, increased stream temperatures, downcutting of streams and banks, and loss of large trees available for future large woody material. Early seral riparian vegetation species such as cottonwood, willow, and aspen are virtually nonexistent. This change is significant because deciduous trees also annually supply extensive litter fall into streams, which is an important factor controlling local aquatic nutrient levels.

A key problem within forested portions of the UJCW is that canopy cover in some areas is too dense, while other areas are understocked. Fire suppression, for example, has left excessively dense, grand fir dominated stands, which effectively shade out other vegetation. This can result in bare soils that are very susceptible to hoof action by larger animals and subsequent erosion. Examples of this are found in the upper portions of East Fork Peavine Creek and the northeastern tributaries of East Fork Billy Creek. Areas with low canopy cover, which can directly affect stream temperature, are those that have experienced logging and road construction. Middle and Upper Chesnimnus creeks are particularly noted as riparian areas with low canopy cover.

Dense conifer stands near water attract large herbivores, particularly livestock, during the heat of mid to late summer. Due to a lack of sunlight reaching the forest floor, herbaceous vegetation does not establish adequately to hold or maintain soils. As animals seek shade within riparian areas, trampling often breaks down streambanks and adds detrimental quantities of fine sediments to the channel. Although these dense stands are not a dominant riparian feature of riparian areas at the watershed scale, they occur often enough to effect biotic and abiotic riparian attributes.

At the other end of the spectrum, conifer vegetation has been removed from the primary and secondary riparian areas to a level that negatively influences stream temperatures. Reestablishment of conifers (primarily for shade/winter thermal cover) is a primary effort in current restoration activities, although it must be recognized that direct benefits of these efforts are not fully realized for 15-25 years. Hardwood plantings in the riparian areas provide short-term (less than 15 years) cover and shade. Relevance of this work to the UJCW is that shrub growth potential is likely very high, as would also be suggested from observations within many riparian exclosures.

In some areas, unstable banks are the result of past management practices, and stream downcutting and entrenchment caused by confining the channel to a smaller floodplain (i.e. road building). Portions of Crow, Elk, and Alder creeks are examples of this. Restoration of these sections would most likely be expensive with uncertain results. In other areas, large animals, particularly livestock, annually disturb streambanks and reduce rhizomatous forbs and shrubs, decrease species diversity, and increase bare and exposed soils. Portions of East Fork Peavine, East Fork Billy, Alder and Upper Elk creeks are examples of this.

Channel morphology in certain streams of the UJCW has been altered, and one of the natural restorative processes is inhibited through reductions in beaver populations due to a lack of riparian vegetation as a food source. Timing of water release may be off by one month from historic conditions, and part of this could be attributed to lack of beavers building instream dams.

Large Woody Material

Due to the increase in small diameter conifers suppressed by more shade tolerant species, large diameter trees are developing at a much slower rate than naturally occurred. These dense stands with an abundance of ladder fuels are susceptible to consumption by high-intensity wildfire. These conditions are most noticeable in portions of East Fork and West Fork Peavine, East Fork Billy (and tributaries), Summit, Poison, Upper Devils Run, Upper Elk and South Fork Chesnimnus creeks.

Private landowners and public land managers have long recognized that channels in the UJCW are deficient in large woody material. The Riparian Team Report includes a comprehensive list of riparian improvement projects that placed large woody material in streams. Despite these efforts, some stream reaches remain deficient in large woody material. Surveys conducted between 1990 and 1998 in the UJCW document a range of 3 to 69 pieces of large woody material per mile of stream surveyed, with an average of 22 pieces per mile of stream surveyed.

Desired Conditions

Stream Temperature

Wallowa-Whitman Forest Plan standards and guidelines and recommendations of the SRP (shade greater than 80 percent; and 60 percent and above on a site specific basis, respectively) are expected to help facilitate the return of riparian vegetation characteristics to their natural range of variability. Since the effects of conifer reestablishment are realized in the long term, short-term management considerations for increasing stream shade may need to focus more on reestablishment and enhancement of shrub communities where appropriate. Botanists have done much work in the UJCW to reestablish native vegetation. Seed from the same or similar areas has been collected and propagated. Vegetation within exclosures that have been established for ten plus years is approaching climax condition.

The desired condition is for stream temperatures to remain below 64^{o} F for the seven-day moving average of the daily maximum temperature[1]. This condition may be difficult to reach in the UJCW, but is an accepted parameter by which fisheries are protected in the watershed. The 64^{o}F criterion will be used as a management reference by which conservation projects in the watershed are implemented, including riparian vegetation management to produce adequate stream shade, bank stability and channel morphology; and projects intended to reduce stream width and increase stream depth, and upland vegetation management that may over time return stream flow regimes to a normal distribution.

Riparian Vegetation

Within this watershed, both conifer and deciduous vegetation are important components of many riparian areas. As described above, in some areas, increases in riparian vegetation is needed, while in others, decreases in suppressed small-diameter conifers is needed to allow for the recovery of riparian vegetation. It has not yet been determined to what extent shrubs were historically found in this area. In the forested portion of this watershed, where fire has been excluded and large herbivores have played a dominant role in modifying riparian vegetation, shrubs seem to be lacking. This is based not only on casual observations comparing vegetation within exclosures to that outside exclosures, but also results from management studies on the Wallowa Valley Ranger District over the past 20-25 years, which demonstrate riparian planting protected within the exclosures respond more favorably than those without protection. Once deciduous vegetation has reestablished, it is anticipated that beavers will return to selected streams.

[1] The State of Oregon standards for water temperatures are based on the seven-day averages of the daily maximum water temperature: 55°F for steelhead and spring/summer chinook spawning through emergence; 64°F for all waters that support rearing steelhead and spring/summer chinook; and 50°F for bull trout throughout the year. The criterion in the stream temperature standard for general salmon and trout use of 64^{o}F was established to protect general salmon and trout use during the warm summer months. The average of the daily maximum stream temperatures for 7 consecutive days is calculated and compared to the applicable criterion. If the criterion is exceeded a management plan is required.

Large Woody Material

Most large woody material currently tends to be of smaller size classes, although greater representation of larger size classes is desirable. Due to increasing awareness of the important role large woody material plays within riparian systems, the trend is toward leaving larger trees/snags for future recruitment. However, where stands are dense, tree growth rates are suppressed, and the large tree component develops slowly. With thinning in selected areas, tree growth rates will increase and large trees will develop more quickly for future large woody material recruitment. Desired conditions for large woody material are based on levels needed for fish habitat. At least 20 pieces of large wood per mile of stream is the goal for maintaining fish habitat within all stream reaches of the UJCW.

Recommendations

Recommendations focus on enhancing processes that cool stream temperature. When applied in appropriate locations, it is anticipated that the following projects would lower stream temperatures. Refer to Issue 5, Rangeland Health, for additional recommendations to restore riparian "hot spots" and enhance and improve water sources.

- Planting and preserving trees where streamside vegetation is understocked
- Enhancing riparian vegetation
- Protecting springs
- Providing cool spring water input to streams
- Stabilizing streambanks and fencing them from livestock access
- Piling and rearranging fuels to reduce consumption of streamside deciduous shrubs
- Closing roads that interfere with the establishment and maintenance of riparian canopies along Chesnimnus, East Fork Peavine, West Fork Peavine, mainstem Peavine, and Devils Run creeks

In some stream reaches, existing riparian vegetation is dominated by overstocked stands of small diameter, late seral conifers. Current riparian vegetation management practices of implementing "no cut" buffers would perpetuate this condition. Stand density reduction measures are recommended to facilitate the attainment of large-diameter recruits for shade and future large woody material. Such treatments should be modest in design and maintain optimal shade from the existing canopy.

To address stream segments where dense conifers are impairing the re-establishment of large trees and deciduous shrubs, the following activities are recommended:

- Implement prescribed burns to stimulate growth of riparian shrubs.
- Thin the upper portions of East Fork Peavine Creek and northeastern tributaries of East Fork Billy Creek.
- Thin streamside stands of conifers to stimulate tree growth rates. Priority treatment areas are in portions of East Fork and West Fork Peavine, East Fork Billy (and tributaries), Summit, Poison, Upper Devils Run, Upper Elk and South Fork Chesnimnus creeks.

To address streams lacking deciduous and other vegetation, or large woody material, the following activities are recommended in the following locations: fencing, caging, planting, placement of instream structures or large woody material, or a combination of all:

- Alder Creek - approximately two miles on the National Forest

- Sterling Gulch – approximately 1.5 miles below Davis Spring Reservoir
- Tamarack Gulch - approximately one mile
- TNT Gulch - approximately one mile of both the upper and lower portions
- Crow Creek - approximately one mile between Roads 4620-110 and 4620-115
- Elk Creek – approximately one mile above Wellamotkin Drive
- Vance Gulch – approximately ¾ mile in Section 29 of T3N, R47E
- Place large woody material in streams currently deficit in large woody material Priority streams are Chesnimnus Creek (1/2-mile segment), TNT Gulch (1/2-mile segment), and East Fork Peavine Creek

2. Large Trees, Wildlife Habitat and Fire

Fire suppression, timber harvest and natural disturbances (insects and disease) have resulted in a more homogenous landscape with larger and fewer "patches" of timber, in simplified, more heavily stocked stands. Dense stands of conifers are impeding tree growth rates and reducing the ability to achieve large trees that contribute to old growth characteristics and provide wildlife habitat. Homogenous forested vegetation, elevated fuel loads and increased fire ladders to the overstory may provide immediate hiding cover, but can contribute to larger and more intense wildfires that could consume large blocks of hiding cover.

Changes in the structure and composition of forest vegetation are caused by succession and disturbance. Succession is the orderly process of plant community development that involves changes in species composition, structure, and community processes with time. Disturbances can occur from natural or human causes (e.g. fire, insect infestation, timber harvest, grazing). These changes affect ecosystem function, as well as the value humans place upon ecosystems for commodity production and amenities. Vegetation changes through succession in the absence of disturbance. Planned (e.g. timber harvest, prescribed fire, domestic livestock grazing) and unplanned disturbance (e.g. insect and disease, wildfire, wildlife herbivory, flood, winds) cause transitions to different successional classes or hold back such changes.

Landscape dynamics in the interior west are controlled by a combination of site conditions (e.g. soils, elevation, and aspect) and the timing and severity of disturbance. Fire was the dominant disturbance controlling the structure of forests of the interior west before the settlement era (Agee,1993, 1994; Smith, 1983) and numerous studies have examined the effects of fire on stand composition and structure (reviewed by Keane et al. 1990). Fire's effects can be integrated into land management planning through an understanding of how fire affects the site and the landscape (Agee, 1993).

Existing Condition

Forest vegetation of the UJCW is characterized by a wide variety of vegetation types. Existing stand structures and associated species composition vary with landform, elevation, aspect, soil condition, and precipitation gradients.

The integrity of forest ecosystems within the UJCW has been compromised to various degrees by:

- The removal of large, early seral over-story trees (especially ponderosa pine, Douglas-fir, and western larch).
- The departure from native disturbances (e.g. active fire suppression, and periods of increased grazing), and,
- Successional processes influenced by human management over the last century, including the abrupt decline in management activity on public forest land since the early 1990's.

The recurring droughts (1986-1994, and 1999-2003) affecting Northeast Oregon exacerbate the impact of these factors on forest ecosystem functioning. The recent long-term drought appears to be the most severe since the dust bowl years of the 1930's.

As a result of the human and natural influences mentioned above, the landscape has become more homogenous, patch sizes have become larger, and patches are fewer. Forest stands have been simplified, and more heavily stocked. The potential for drastically different conditions exists due to the increase in insect and disease hosts and forest fuel continuity. The area could quickly change due to widespread insect and disease outbreaks, and large-scale stand replacement wildfires—unlike any that are believed to have occurred in pre-settlement time.

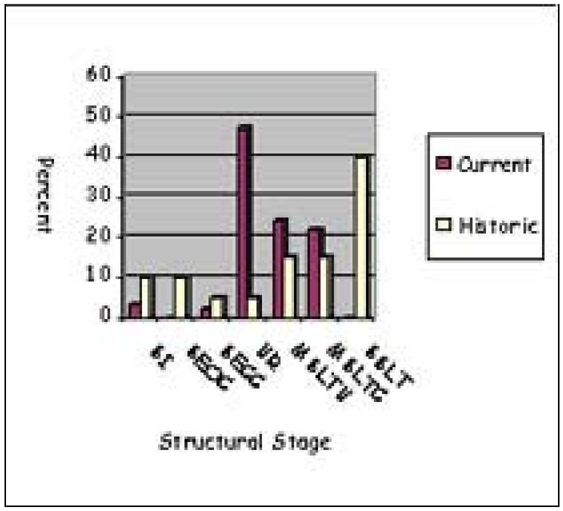
Due to increased fire suppression and increased fuel loads, 68 percent (51,670 acres) of public lands within the UJCW have been *significantly* altered from their typical fire regimes (condition class 3). Considering both condition classes 2 (*moderately* altered from historical range) and 3 (*significantly* altered from historical range), ninety-one percent of the public lands (68,082 acres) have been moderately or significantly altered, resulting in far greater fuel loads than historically occurred in the watershed.

From the large percentage of the UJCW area currently in fire condition class 3, it is assumed that hiding cover for big-game is at levels higher than historic levels within the UJCW. Particularly where interruptions in fire return interval occur in ponderosa pine stands, shade-tolerant seedlings and sapling-sized trees have established themselves. Hunting activity in this area may warrant increased hiding cover, but current forest conditions increase the risk of a stand-replacing crown fire. Under certain circumstances, large blocks of hiding cover could be lost. Temporary and permanent road closures should be considered to improve elk security.

The consequence to wildlife from this departure from historic conditions is that habitat for a variety of species associated with late and old structure is deficient. Functional old growth and late old structure abundance is of primary concern. This structure is deficit in comparison to the historic range of variability for both warm/dry and cool/dry environments. A review of existing designated old growth found that only about 40% of the 3,028 acres met the USFS Region 6 old growth criteria. The same review found a number of late old structure stands that did meet the criteria. A review these findings and role of late old structure stands in promoting and supporting wildlife and other biological diversity is needed. Outputs from such a review would include recommendations on broader landscape management to promote and enhance late old structure stands, and the possibility of revising the designated old growth matrix to improve the representation protecting by this status.

<u>*Warm/Dry Environment*</u>
The warm/dry biophysical environment constitutes 32 percent of the watershed, and is dominated by two stand types -- Understory Reinitiation (UR) and Multi-story Large Trees Uncommon (MSLTU), primarily Douglas-fir and ponderosa pine (Fig. II - 2).

Figure II - 2. Comparison of current and historic distributions of structural stage classes on warm/dry sites in the Upper Joseph Creek Watershed.

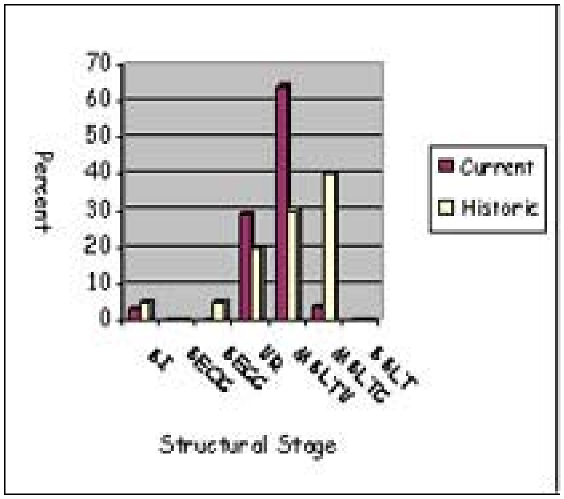


Stands in the UJCW are deficient in trees 21 inches in diameter and greater (the "Late and Old Structure" forest component). The forested portion of the watershed is currently dominated by 9 inch to 20 inch diameter trees.

Fire History
Wildfires in this environment were cyclic, but generally consisted of low-intensity surface fires with predictable return intervals of 20-30 years. Periodic, low-intensity fires functioned to eliminate the development of a floor level of conifers and maintained open, park-like structures of ponderosa pine and Douglas-fir. However, even in low-severity fire regimes, intense fires sometimes occurred in discrete areas of fuel buildup (possibly due to bark beetle mortality patterns, longer than normal fire-return intervals, or unusual fire weather events). Shade-intolerant ponderosa pine regeneration could become established in the gaps created following the death of the overstory. The resultant stand structure appeared as a mosaic of younger ponderosa pine age classes nested within a matrix of single-storied overstory ponderosa pine and Douglas-fir. Relatively uniform, open spacing was maintained within the clumps of advanced regeneration with the return of frequent, low-intensity fires.

<u>*Cool/Dry Environment*</u>
The coo/dry biophysical environment constitutes 27 percent of the watershed. The dominant forest structures today are Understory Re-initiation (UR) and Multistory Large Tree Uncommon (MSLTU). These two stand types exceed their historic occurrence, with the extent of Multistory Large Tree Uncommon stands far exceeding the historic pattern (Fig. II - 3). The cool/dry sites are particularly deficient in Multistory Large Tree Common stands. Douglas-fir and western larch ranging from 9 to 20 inches in diameter dominate the overstory of the cool dry sites.

Figure II - 3. Comparison of current and historic distributions of structural stage classes on cool/dry sites in the Upper Joseph Creek Watershed.



Fire History

Fire regimes operating within this biophysical environment ranged from frequent, light surface fires, to long return interval crown fires, and all combinations in between.

Fire was a frequent visitor to a large extent of this environment as evidenced by the existence of residual overstory ponderosa pine, western larch and Douglas-fir. These early seral species, especially ponderosa pine and western larch, are extremely intolerant of shade and root competition. Consequently, frequent low intensity surface fires favored canopy dominance, and gave rise to a mosaic pattern of stand structures.

In the absence of frequent fires, Grand fir begins to dominate, because it is more tolerant of understory competition than ponderosa pine, Douglas-fir, and western larch. This results in a change in stand conditions to a dense multi-layered stand with a higher accumulation of down fuels.

Wildlife Habitat and Hiding Cover

The decline in deciduous vegetation in riparian areas and deficiencies in large snags and late old structure are critical issues pertinent to terrestrial wildlife in the UJCW. Elk are a good indicator for adequate cover and security areas for large game animals in the watershed.

Elk use a mixture of habitat types in all successional stages in both forest and grassland vegetation. The elk use of these habitats changes in both a daily and seasonal pattern. One key to successful elk habitat management is to provide a variety of successional stages across the landscapes.

One measure for providing security to elk is to have hiding cover and security areas. Providing hiding cover and security areas is essential to elk habitat management, especially during the fall hunting seasons. Many studies over the last three decades have shown that elk will leave an area with insufficient hiding cover when disturbed by humans (Hillis et. al., 1991). Forest stands with

70% or more canopy closure provide good thermal cover, which is shelter from wind, and extremes of heat and cold.

These areas also provide hiding cover and security areas where animals can escape hunters and predators. These dense forest stands also serve as habitat and connective corridors for species preferring late and old forest structure. Although current levels of hiding cover may be greater than historically occurred for big game, past management activities such as harvest and road construction have broken up continuity of some corridors, and the cover is at risk for depletion by stand-replacement fire.

Desired Condition

Warm/dry and Cool/dry Biophysical Environments

Healthy ecosystems, with high integrity, exhibit the ability to absorb and recover from disturbances without losing their inherent function. Natural fire regimes and common (endemic) insect and disease activity play a significant role in the cultivation of vegetative integrity within the UJCW.

A return to historic structural stages in the UJCW would create a more heterogeneous, “patchy” landscape, with an increase of large diameter trees in single-storied stands. Low-severity fires would occur more frequently, lowering fuel loads and maintaining stands for fire resiliency, allowing trees to grow, thrive and survive natural disturbances.

Silviculture prescriptions designed to increase the representation of “Single Storied Large Tree” structures within the warm/dry biophysical environment, and “Multi Storied with Large Tree” stands within the cool/dry environment would be desirable. However, the developmental history of the multi-layered, small diameter stands precludes many treatment options. The overstocked understory has developed poor crown ratios and has been subjected to “climax site” maladies (i.e. high incidence of insects and disease). Douglas-fir dwarf mistletoe is of special concern since it can be expected to cause catastrophic losses in infected stands that are incorrectly managed. Consideration also needs to be given to silviculture prescriptions that reduce the risk of fire to existing multi-storied structures and designated old growth areas.

Wildlife Habitat

The importance of forested areas for a wide range of wildlife in UJCW was recognized throughout the assessment process. Critical issues pertinent to terrestrial wildlife and forest management included the decline in deciduous vegetation in riparian areas, and the deficit in large snags and late old structure. With specific reference to game species (especially elk and deer), the importance of maintaining hiding and thermal cover, was acknowledged – as was the potential impact of road closures (permanent and seasonal) on the overall status of these populations.

Within the forested zone, the US Forest service is mandated to meet a number of standards on behalf of wildlife, wildlife habitat, access and usability. One of those considerations is adequate representative units of mature and old large tree forest patches, and contiguity of access for big game, raptors, woodpeckers and others that may have limited ability to easily cross large stretches of non-habitat. Old growth and late and old structure stands that meet regional old growth standards and provide quality wildlife habitat and corridors should be identified and designated as old growth.

Recommendations
The following forest management recommendations emerged from the analysis of wildlife issues in this watershed:

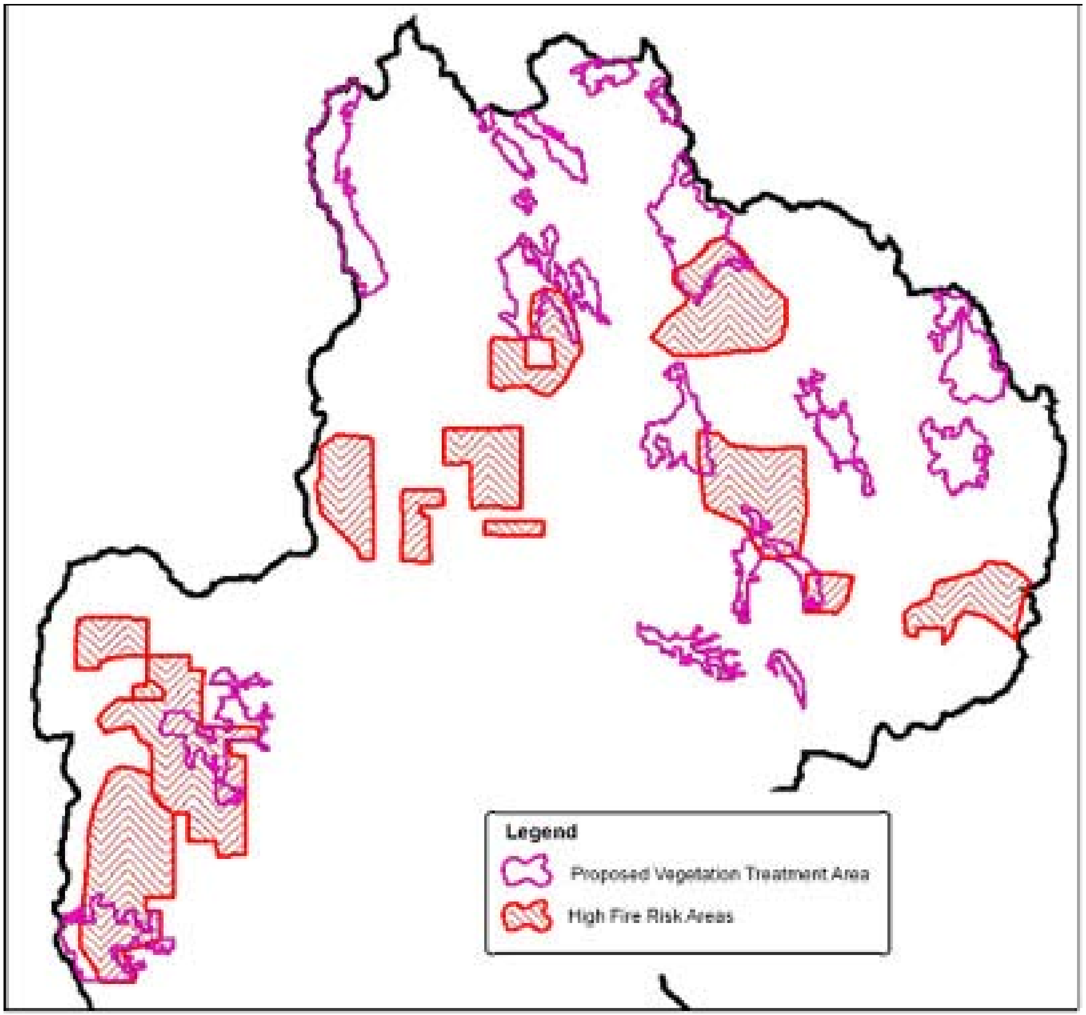
- Secure and promote the "heritage elements" of the habitat, consisting of mature and old timber stands, large old live and dead trees and large woody material which are the most limited on this landscape, and the hardest to re-construct (at least over time).
    - Retain heritage forest elements where they remain in the landscape; large/old live trees, large old dead trees, logs and stumps.
    - Reduce the risk of wildfire to these remaining elements through fuel reduction activities (understory thinning, slash and down fine fuel treatment, raking duff accumulations away from base of trees, and prescribed burns) to preserve big-game hiding cover over the long term.
    - Prescribe silvicultural (including fuels) treatments to accelerate the return of forest stands to the historic range of variability both temporally and spatially by "habitat type and structural stage".
    - Target 40-80 acre blocks of late old structure distributed proportionally across the landscape and the various biophysical environments.
    - Review the old growth survey findings and role of late old structure stands in promoting and supporting wildlife and other biological diversity and generate recommendations to promote and enhance late old structure stands, and revise the designated old growth matrix to improve the representation protecting by this status
    - Map wildlife travelways and corridors in GIS from recently updated vegetative data.
- Minimize reliance on "corridor/travelways" to connect highly fragmented habitats while restoring historic "continuity and connectivity",
- Promote connecting corridors adjacent to open roads to facilitate movement and access to hiding cover to improve big game survival during hunting season
- When allocating new uses across the landscape of this watershed (ATV's) consider temporal and spatial impacts and possible mitigative factors (screening via vegetation and/or topography, seasonal scheduling, etc.)
- Restore relict and remnant habitats as freestanding elements on the landscape towards suspected historic range of variability including; western yew, aspen clones, cottonwood galleries, willow carrs, hawthorne shrub-lands, alder stands, talus garlands, etc. These features are disproportionately important for the biodiversity they represent and the habitat options they provide.

Prescribed fire treatments recommended for protection of private property and preservation of economic opportunities in Issue 3 would also work towards achieving the desired conditions for wildlife habitat. Road closures recommended to increase security for big game and other wildlife species are included in the Issue 4.

In concert with the above recommendations to improve wildlife habitat, a combination of commercial and noncommercial thinning, mechanical fuels reduction and prescribed burning are recommended to reduce stand densities in selected locations. These treatments are a refined tool for reducing density in specific locations without the risk of damaging non-target trees or consuming downed woody material associated with underburning.

Refer to the following map (Fig. II - 4) for opportunity areas related to these recommendations.

Figure II - 4. Proposed vegetation treatment and high fire risk areas in the Upper Joseph Creek Watershed.



3. Wildfire and Economic Opportunities

> *Dense stands of conifers in a homogenous pattern increase the risk of large high-intensity wildfires that threaten private property and consume resources on public lands that forego economic opportunities for the community.*

Existing Versus Desired Conditions

Refer to Issue 2, for a discussion of existing versus desired fuel loadings. Also, refer to the introductory section, existing condition of Wallowa County for a description of how the current economic condition of Wallowa County departs from the desired condition.

Recommendations

Treatments to reduce fuel loads are recommended to reduce the risk of large stand-replacement wildfires, and sustain the resource upon which economic conditions for Wallowa County depend. Recommendations listed in Issue 2 also address this issue.

- Reduce fuels around private property interfaces.
- Utilize prescribed fire and/or mechanical treatment on a landscape scale in areas identified as high fire risk due to fuel loading and history of fire starts.
- For late seral stands that are fire dependent, establish a plan for periodic maintenance burns to keep fuels from re-accumulating to unnaturally high levels. When fuel loads exceed the ability to safely apply prescribed fire, first reduce fuel loads mechanically.
- Prescribed fire and mechanical treatment should be used to reduce fuel levels, and thereby reduce the likelihood of future natural fires opening up large areas of potential seedbeds for non-native species.
- Use of prescribed fire in unique habitats should be considered as long as mitigation against increasing noxious weeds can be effective.
- Use of prescribed fire should be considered in designated old growth where stands historically supported fire tolerant species and are fire dependent to maintain their old growth structure. This would also benefit hiding cover as described in Issue 2.
- In stands that are overstocked and support heavy ladder fuels, consider mechanical treatment to reduce the potential of entire stand loss.
- Wildfire suppression strategies should recognize the role of fire in the ecosystem and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function. However, for the time being, fire will continue to be aggressively suppressed to avoid loss of timber, old growth, wildlife and fish habitat and late successional forests.

4. Roads and Recreation

> *Current motorized vehicle access does not maximize protection of habitat for elk and other wildlife species. Use of some roads is contributing to rutting and soil disturbance, which can lead to surface water channeling and delivery of sediment to streams. In contrast, recreationists have expressed interest in continued access to existing roads and trails within the UJCW for motorized forms of recreation, particularly all-terrain vehicle (ATV) use.*

Existing Conditions

Roads

Approximately 815 miles of open and closed roads occur throughout the UJCW in county, private and Forest Service ownership. At the time of the 1995 UJCW assessment, approximately 640 miles of open roads occurred on the National Forest portion of the basin. Since that time, approximately 305 miles of road have been selected for closure by NEPA-based analysis. The open road density is currently 2.83 miles per square mile in the Forest Service portion of the watershed.

Since the 1995 assessment, the situation regarding transportation system objectives has remained essentially unchanged. Although many miles of road have been closed, road densities are still in excess of Forest Plan guidelines in many of the subwatersheds. Wet-weather use of native surface roads continues to cause rutting, surface water channeling, and subsequent delivery of sediment to streams. Of the eight bridges occurring within the UJCW, several are greater than 50 years old, are deteriorating, and require maintenance or replacement.

Deterioration of the surfacing on Road 4625 along lower Chesnimnus is a continual safety and maintenance problem. Budgetary constraints continue to hamper the implementation of needed maintenance. Many of the roads that have been closed to traffic have not had the culverts removed, nor has there been a widespread program of annual culvert maintenance developed and implemented for the closed roads.

Elk Security

Elk are important economically and culturally (more tribal hunting occurs in the UJCW area than any other area in Wallowa County), and maintaining their habitat is a concern. Annual elk trend data has been collected since 1969. Currently, calf mortality rates are high and have been since passage of state law banning hunting cougar and bear with dogs (also affecting mule and whitetail deer). Thus, the Oregon Department of Fish and Wildlife is managing for reducing the number of those large predators. Changes in elk distribution (more time spent in the flatter uplands vs. lower canyons) could be related to predator pressure (visibility) or grazing (seeking succulent regrowth).

Open road densities have a key role in determining whether elk will remain on site after hunting seasons have started. If road density is high and hiding cover is low, elk will move until secure areas are found. Open road densities are often the easiest and most effective habitat attribute to manage since cover and forage criteria may take many years to meet the desired future condition.

Recreation

Recreation use in the area includes hunting, driving for pleasure, dispersed camping, OHV riding, biking, firewood gathering and mushrooming.

Additionally, ATV use is increasing in this area because of its existing extensive road system and accessibility. Currently, ATV riders can legally ride anywhere, including closed and off-road situations, when green-dot closures aren't in effect. However, the local ATV club understands that changes in off-road travel policies on the National Forest are imminent, and may exclude any off-road travel on forest land.

Desired Conditions

Desired conditions for the UJCW include open road densities within Forest Plan guidelines of 2.5 miles per square mile; a transportation system compatible with big game habitat; and adequately maintained culverts, open roads, and bridges to correct or prevent safety and resource concerns.

The local ATV club has identified all of the routes they would like to see in a possible trail system that would maximize their riding opportunities while utilizing existing roads as much as possible. Their interest is in maximizing riding opportunities where loops occur and views are available. They are also exploring other opportunities for trail systems in adjacent watersheds. Concerns for disturbance to elk from motorized use on roads in elk habitat would be considered when designing or designating any ATV trail system in the UJCW.

Tribal interests have expressed their desire for continued motorized access for hunting, and gathering traditional plants from relic grass communities.

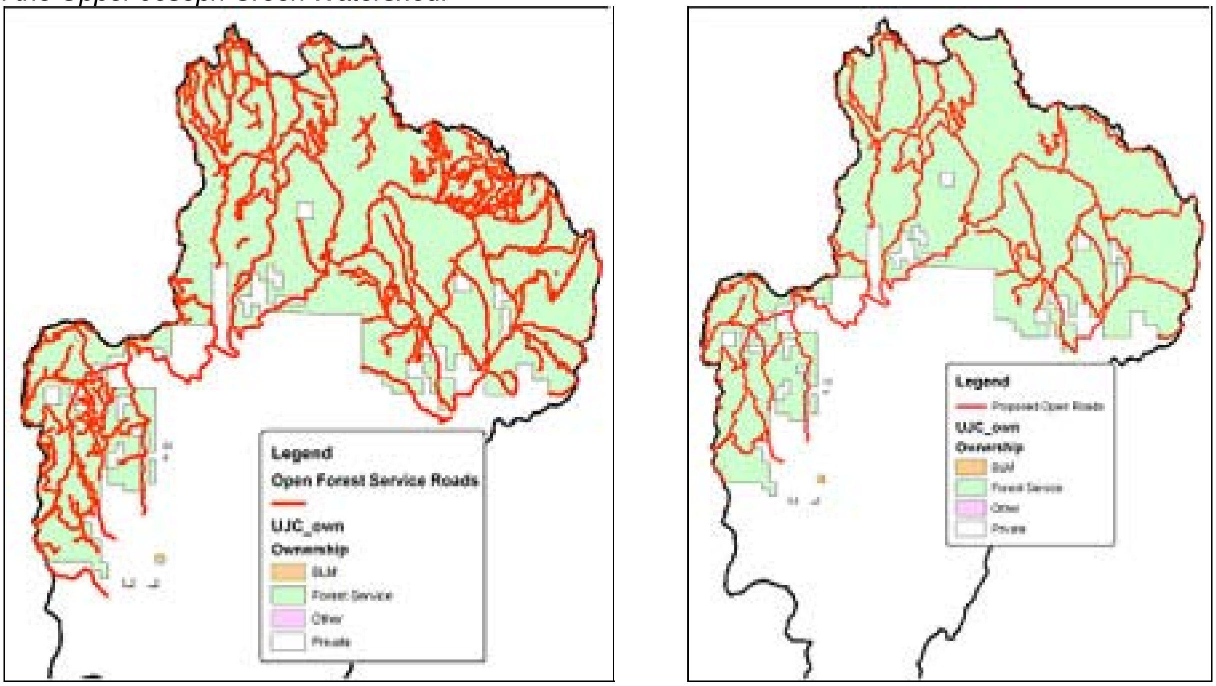
Recommendations

An integrated roads analysis was completed for this assessment and includes all road management recommendations.

The following recommendations bridge the gap between existing and desired conditions by 1) closing or decommissioning roads that will not be part of the designated open road system, 2) designating which roads will be made available for motorized vehicle use, and 3) improving designated open roads to provide the access needed with a minimum of rutting and stream sedimentation.

It is recommended that some roads previously closed or scheduled for closure by previous NEPA decisions be re-evaluated for open roads to provide access to specific areas. These roads are displayed on the map (Fig. II - 5) and listed in the Team Recommendation Column of *Appendix 13*.

Figure II - 5. Comparison of current open (left) and recommended open (right) US Forest Service roads in the Upper Joseph Creek Watershed.



When implemented, these recommendations will result in an open road density on National Forest system lands within the UJCW of 1.46 miles per square mile. This is in contrast to the current level of 2.83 per square mile, and is well with in the current Forest Plan guideline of 2.5 miles per square mile in most management areas.

The schedule and specific methods for road closure will be determined by future project level planning. Specifics, such as culvert removal versus establishment of a maintenance plan, gates versus physical barriers, and reshaping versus simple scarification and revegetation of the road prism will be decided at that time.

The following measures are recommended to establish a motorized transportation system that is compatible with big game habitat and other natural resource values:

- Keep any all-terrain vehicle trail use as close as possible to existing main roads.
- When considering all-terrain vehicle use, maintain the largest possible non-roaded areas.
- Extend the green dot system to the entire hunting season (use Boise Cascade road-closure system as a model).
- Install gates to assist in enforcement of seasonal road closures.
- Close 122 miles of road to motorized vehicles access on a seasonal or permanent basis.
- Leave open 187 miles of road to motorized travel.
- Maintain access to important plant gathering sites.

The following measures are recommended to maintain, repair or replace bridges with UJCW:

- Implement periodic deck cleaning and brush removal from the channel and road approaches to all bridges.
- Grade aggregate surfaces on bridge approaches, patch asphalt; replace or repair object markers, decks, rails or curbs; and place riprap on footings when needed to protect them from scour.
- Completely replace the Peavine Creek Bridge on Road 4625 as soon as possible.
- Replace the deck and superstructure of the Peavine #2 Bridge on Road 4665 within the next ten years.
- Conduct special fracture critical inspections of the superstructures on the Howard O'Brien Bridge once every 10 years.

To address the issue of sediment delivery from roads to streams, maintenance of culverts and road drainage features are recommended. Specific recommendations for individual roads that may be contributing sediment to streams are contained in the following table.

Table II – 1. Potential projects for reducing sediment input to streams along roads in Upper Joseph Creek.

Stream Name or Road Number	Recommendation
Chesnimnus Creek	Upper Chesnimnus Creek: Reduce road densities. Road maintenance needed in the upper reach.
Peavine Creek	Peavine Creek: Remove culverts on closed road and repair instream structures
Devils Run	Repair Road 550 where it meets Devils Run Creek.
Elk Creek	Replace culvert in Elk Creek with hardened ford (bottom of Road 500)
Elk Creek	Close and hydrologically stabilize Road 959 on Elk Creek
Elk Creek	Remove trash rack at intersection of Gould and Elk creeks
Gould Gulch	Remove trash rack at Gould Gulch
TNT Gulch	Harden ford across TNT gulch
Elk Creek	Fix road crossing on Elk Creek
Elk Creek	Fish Passage Red culverts (as noted on map)
4620-110	Hydrologically stabilize
978	Decommission
975	Hydrologically stabilize, change gate for admin use only
4600-932	Harden ford across stream
4665-200	Hydrologically stabilize
4625 (segment 102, 227)	Hydrologically stabilize
4625-800	Hydrologically stabilize (portion recommended for closure)
4600-475	Hydrologically stabilize
4600-109	Hydrologically stabilize

Decommission treatments may include removing culverts, removing fills encroaching on stream channels or floodplains, installing frequent waterbars, seeding disturbed areas, and removing the road number marker and permanently removing the road from the Forest Service database. Subsoiling, scarification, recontouring slopes in designated areas, and placing large woody material on the roadbed may also take place. Decommissioned roads would not be opened for future public or administrative use.

Hydrologic stabilization can occur on roads proposed for closure, as well as previously-closed roads that have been identified as high risk to water quality due to their proximity to streams, number of stream crossings, and side slope steepness and location. Treatment for road closures may include constructing earth berms, placing large woody material at the junction, recontouring the slopes within sight distance, or simply obscuring the junction. The road number marker would be set back from the junction facing the roadbed. Stabilization activities would include removal of culverts, installing frequent waterbars, and seeding. Hydrologically stabilized roads would remain in the Forest Service database as closed roads.

5. Rangeland Health

Selected rangelands of the UJCW have been altered from historic conditions by ungulate grazing resulting in an increase in early seral plant communities that are more susceptible to invasion by non-native plant species, in particular noxious weeds. Noxious weeds change habitat by decreasing plant community diversity, lowering forage production, and changing vegetative structure and cover. In addition, some riparian areas have been negatively impacted by ungulate use causing localized stream bank degradation.

Existing Condition

All of the Forest Service and most of the private rangeland in the UJCW is actively managed for livestock grazing. Today, producers and permittees are challenged by increasing regulations, fence maintenance and lack of management flexibility. In general, upland water sources are of inadequate quantity and quality, a situation that decreases animal production and influences animal distribution. Overstocked forest stands, as discussed in Issue 2, decrease forage quality and quantity. Given the high level of noxious weed infestations in other watersheds in Wallowa County, the UJCW remains relatively weed free. Sulfur cinquefoil, meadow hawkweed and spotted knapweed, however, are of particular concern.

Most of the grassland in the UJCW is in the Idaho Fescue plant community series. These communities are valuable as high forage producers in the watershed. Kentucky bluegrass is the most widely distributed perennial increaser encountered in the UJCW. It can replace some native perennial bunchgrass species; however it is highly palatable, nutritious and can withstand intense grazing.

Over the last decade or more many miles of streams have been fenced to protect banks and riparian vegetation. Currently work is being done to maintain these structures and to monitor their success. Localized hotspots still exist as a result of poor livestock distribution and timing restrictions based on a perception of steelhead spawning and livestock interactions.

Desired Condition

Desired conditions are for productive and resilient rangelands in the UJCW, managed to maintain and enhance native or desirable plant communities, threatened and endangered plant species, and soil stability. Rangelands in the UJCW should also provide social and economic opportunities for traditional and emerging cultural uses.

Across the landscape, noxious weeds should be very limited in their distribution and impact; and diverse, adequate and clean water sources should function to their full ecological potential.

Recommendations

A. General recommendations

1. *Management considerations*

   The following are intended as general goals and tools to use for future management of public and private land in the UJCW:

Goals and Rationale:

- Maintain the social economic, and cultural values of livestock production –
  The rangeland group recognizes the economic, social, and cultural value associated with livestock production. Long-term stewardship by people with a vested interest in the ecological health and productivity of a place is essential.

- Control noxious weeds –
  Noxious weeds compete with and can dominate previously healthy landscapes degrading their productivity, diversity, and viability. Integrated management should work to prevent, control, eradicate and reduce the potential spread of weeds.

- Revegetation of early seral areas –
  These sites are particularly susceptible to noxious weed invasion and can be subject to higher rates of erosion than later seral stages. However, there is a normal and natural presence of very early and early seral stages that is within HRV and the resilient range for the landscape. Some of early seral sites may, by nature, have low potential for revegetation. Where very early seral stages are the result of past and/or present management, or they are in areas subject to high risk of weed invasion, they should be revegetated with appropriate perennial vegetation for current management objectives. Sites should be evaluated on a site-by-site basis for causal factors, weed risk and appropriate revegetation species and potential. All early and very early seral sites should be closely monitored for noxious weed presence and treated accordingly.

- Improve vegetative cover/condition of riparian area hot spots –
  In riparian areas that have been identified as having been degraded of their ecological function by historic uses, utilization should be limited (by herding, barriers – Large Woody Material, or fencing, change in the time of use, etc.) Condition could be enhanced by revegetation (e.g. grasses or shrubs) if appropriate. Sites should be evaluated on a site-by-site basis for causal factors and appropriate actions.

- Upland water development and enhancement –
  Water sources are essential to dispersing livestock use patterns. Clean water sources also can improve wildlife habitat. Where possible, water sources should be developed in a manner that protects the sources and the associated vegetation. Sites should be evaluated considering cost, maintenance requirements, and use potential.

- Maintain and/or enhance native plant communities, T&E and S plant habitat –
  Grazing practices should, at minimum, maintain these goals and improve them where practical.

- Improve productivity of old-field sites –
  Old-field sites within the watershed are often weedy and/or dominated by single species of non-native grasses. These areas could be improved by the addition of other grasses and forbs to improve forage production and weed resistance. Old-fields have the potential to be used for intensive grazing areas that may allow for relieving grazing pressure from sensitive areas. These sites could also serve as areas to investigate methods of reestablishing native species.

- Improve and diversify forage opportunities –
  Management that expands current forage opportunities (e.g., thinning of overstocked forest stands) is encouraged because it provides livestock with a greater variety of options and can disperse usage. Potentially, increasing forage opportunities could allow for an increase in livestock numbers.

- Improve livestock distribution –
  The UJCW provides ample forage for wildlife species and domestic livestock. It is recognized that in specific areas/times livestock can cause damage to riparian and rangeland resources. These "hot spots" will be addressed by improving spatial and temporal distribution of cattle, fencing, or placement of woody material, etc.

Tools:

- Weed treatment (including inventory, control, revegetation, and monitoring)
- Prescription fire
- Thinning in the timber zone
- Fencing and/or barriers (riparian and allotment)
- Off-stream water development
- Prescription grazing
- Revegetation
- Improved co-management of allotments (explore vacant allotment uses i.e., grass banks, reissuance of allotments)
- Alternatives to traditional management (e.g., pastoral grazing systems, altering season of use)
- Increase herding (riders)
- Livestock herding and behavioral conditioning
- Multi-species grazing
- Incidental take permits (allows grazing along riparian areas during spawning)

Table II - 2. Partial list of potential rangeland improvements in the Upper Joseph Creek Watershed.

Improvement Type	Improvement Category	Potential Project Implementation	Implementation Factors
Physical	Water Development	1. Spring and tank development and rehabilitation. 2. Riparian zone exclusion fencing. 3. Change stream dynamics in the riparian zone.	1. Implement during summer and fall seasons; periodic maintenance required. 2. Implement during summer and fall seasons; annual maintenance and periodic replacement of materials needed; costly; needs to address large wild herbivore use as well as livestock; creation of riparian pastures may be more cost and management efficient. 3. Implement during summer and fall seasons; stream placement of materials or planting of vegetation costly; periodic maintenance required;
	Fencing	1. Grazing management fencing including perimeter, cross fencing, and grazing system. 2. Exclosure & protection fencing.	1. Implement conceivably within a season but more likely implementation will extend over several years due to cost and time factors; annual maintenance needed. 2. Implement as needed prior to implementation of the project; costly; annual maintenance as needed.
	Seeding	1. Mechanical seeding degraded native range. 2. Mechanical reseeding depleted Oldfields and older rangeland seedings. 3. Site specific seedings (seed production exclosures, seed dispersal stations, experimental plots, broadcast seeding, etc.). 4. Mechanical interseeding.	1. Two-year exclusion from grazing to ensure stand establishment required; periodic reseeding required depending on seeded species and site; more intensive management required. 2. Two-year exclusion from grazing to ensure stand establishment required; periodic reseeding required depending on seeded species and site; protection required. 3. Exclusion from grazing needed; protection related to seeding objectives. 4. One year exclusion from grazing required; protection not required.
	Control of invasive species.	1. Herbicide & pesticide control of herbivore competitors and invasive species.	1. Expensive; control of invasive species requires multi-year application.
	Burning	1. Large-scale burning to increase forage quality and reduce potential for wildfire. 2. Small-scale burning at specific sites for specific purposes	1. Periodic application of treatment required; inherent danger of loosing control of fire; costly; negative and positive impacts not fully understood for grass steppe communities; grazing may achieve the same objectives. 2. Periodic application of treatment required; inherent danger of loosing control of fire; costly; negative and positive impacts not fully understood for grass steppe communities; grazing may achieve the same objectives.
Animal Management	Grazing management.	1. Herding & pastoral grazing strategies for direct control of livestock grazing. 2. Mixed species grazing for effective weed control. 3. Forage backgrounding to improve nutrient content for other species and during other	1. Implementation is seasonal and annual; higher costs of production should be expected. 2. Herding and some pastoral strategies needed required; constraints on using some livestock breeds probable. 3. Herding and some pastoral strategies needed required; constraints on using some livestock breeds probable.

		seasons. 4. Implement grazing systems such as rest-rotation, deferred, and intensive.	4. Requires increased knowledge of plant-animal relationships; may require increased inputs of materials and/or labor; increased cost because of greater inputs of labor, materials and management.
	Change herbivore numbers	1. Ensure proper herbivore stocking rates. 2. Adjust herbivore stocking rates to fit seasonal and annual forage production. 3. Reduce, restrict, or eliminate herbivore grazers.	1. Both private and public rangeland in the UJCW are grazed relative to overt or implicit stocking rates; changing stocking rates can be difficult unless "slack" has been previously introduced to the livestock production system, i.e., forage banks, allotments grazed in alternate years, etc. The ability to graze CRP may offer slack (flexibility). 2. Difficult to accomplish for the same reasons as above, also because of contractual obligations and economic hardships to the producer. 3. Many non-livestock herbivores use both forest and grass steppe rangeland; reducing or eliminating livestock only may not facilitate rangeland improvement; may upset predator-prey relations or interfere with mutually beneficial interactions between animal and plant resources; should only be used in situations where the need is obvious to all stakeholders.
Indirect Enhancement	Rest	1. Seasonal and annual rest periods may enhance over-utilized rangeland. 2. Forage banks and alternate seasonal and annual use of pastures.	1. Requires increased management of large herbivores; knowledge of plant-animal relationships. 2. Requires creation of "slack" in the system; non-use of some pastures may concentrate use by all herbivores on used pastures by diminishing nutrient availability on rested pastures, i.e., elk may follow cattle because of forage backgrounding.
	Tree Harvest	1. Release of herbaceous understory vegetation providing forage enhanced by removing tree overstory.	1. High potential in forest steppe; sequential, planned tree harvest throughout the forest needed to ensure availability of herbaceous vegetation; should be used as a grazing management tool only in forest communities that have potential for significantly increasing growth of herbaceous understory vegetation.
	Grass banks	1. Grass banks can be used as alternate pastures to reduce grazing pressure during adverse environmental conditions or to allow improvements to be implemented on other rangeland pastures	1. Difficult to reduce stocking rate to create enough slack to permit grass banks unless created outside the current livestock production system; in the UJCW vacant allotments or TNC rangeland have potential to be used as grass banks.
	Fertilization	1. Fertilization of high yielding sites to increase forage production.	1. Requires a cost/benefit analysis; previous research indicates fertilization of native rangeland is not cost efficient; should be tested during Oldfield rehabilitation.
	Nutritional Balance	1. Develop nutrient based stocking rates.	1. Change emphasis from stocking rate based on volume to nutrient based stocking rate will promote improved control of animals; improvement of ecological condition expected because of correlation between nutrients and preferred species; require greater knowledge of animal-plant/community relationships.

2. *USFS GIS*

   UJCW allotment/pasture maps need to be field verified and updated. For example, several ponds and springs are mapped in the wrong place, missing from the map, or show up when they no longer exist.

Table II - 3. Mapping recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Priority	Description
2	Cougar	Muddy	T3N R46E NW1/4 Sec07	3	remove spring from map
4	Cougar	Muddy	T3N R46E SE1/4 Sec07	3	remove trough from map
5	Cougar	Muddy	T3N R46E NW1/4 Sec18	3	remove trough from map
7	Cougar	Muddy	T3N R46E NW1/4 SE1/4 Sec07	3	remove pond from map
32	Swamp	Davis Creek	T3N R45E SE1/4 Sec13	3	remove pond from map
48	Swamp	Elk Creek	T2N R45E N1/2 Sec3	3	Elk/Dorrance pasture fence needs remapped
51	Swamp	Upper Swamp	T2N R45E SW1/4 NE1/4 Sec9	3	remove pond from map
52	Swamp	Upper Swamp	T2N R45E NW1/4 NE1/4 Sec9	3	remove pond from map
53	Swamp	Upper Swamp	T2N R45E NW1/4 NW1/4 Sec9	3	remove pond from map
54	Swamp	Upper Swamp	T3N R45E SE1/4 NW1/4 Sec31	3	remove pond from map
57	Chesnimnus			3	several ponds not shown on the map - many need cleaned
64	Chesnimnus	Poison	T3N R47E W1/2 NE1/4 Sec5	3	two ponds not shown end of Mitchell Ridge to ponds across creek off of Road

3. *Research/Analysis*
   - Analyze current satellite image to determine acres of each community type in the mapped area
   - Obtain satellite coverage (scale to be determined) of the west portion of the watershed, cross walk current reflectance values/communities to new the image and analyze for acreage across the watershed
   - Develop confidence levels for different scales of the vegetation map
   - Study the relationship of soil turnover by small rodents and community stability of Idaho Fescue mounds and communities in the Bluebunch Wheatgrass series
   - Consideration should be given to applied research initiatives to track succession of Oldfields towards native communities to determine potential for successfully restoring native communities.
   - Designing and implementing an improvement treatment should be considered with regard to potential impacts throughout the watershed, not just for the site at which the treatment will be implemented

4. *Proposed future consideration/emphasis area (to be field verified & defined)*

Table II - 4. Policy recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Project Type	Priority	Description	Notes
13	Vigne	Peavine	Policy	1	Policy change to allow Peavine pasture early grazing every 2nd year if possible - at least every third year	Right now not allowed in before July 1
68	Chesnimnus		Policy	3	New grazing plan: Poison to Sterling/Cayuse/Berland to Devils Run to S. Fork	Poison is better pasture for spring or fall grazing (fish issues) June or September; Cayuse/Sterling may not need reseeding if change rotation; cattle would utilize grass better in North Poison if it was spring pasture
72	Chesnimnus		Policy	3	Please close the gate signs	

- Implement improvements and management activities that maintain and improve the condition of meadow/riparian habitats. Creation of riparian pastures rather than riparian exclosures should be considered, and if exclusion fencing is selected, fence structure should consider exclusion of large wild herbivores as well as domestic livestock.

5. *Plant community improvements*

- Idaho Fescue-Prairie Junegrass (ridgetop)
  - Plant communities in very early and early seral stages unless dominated by Kentucky bluegrass should be considered for mechanical seeding of native bunchgrass plants.
  - As part of an UJCW management plan, deferment of livestock grazing to fall season grazing in alternate years should be considered.
  - Degraded sites should be identified and treated through grazing modification and seeding.

- Idaho Fescue-Prairie Junegrass (mounds)
  - Grazing mound communities before soil stabilizes should be avoided because of unstable soil stability characteristics.
  - Mounds are highly susceptible to churning caused by frost heaving and hoof action and grazing should be avoided during this period.

- Idaho Fescue-Prairie Junegrass (mounds-Kentucky Bluegrass disclimax)
  - Manage with other communities forming the Mound-Intermound complex.
  - Mounds dominated by Kentucky bluegrass can be grazed heavier than mounds dominated by native perennial grasses.

- Idaho Fescue-Prairie Junegrass (mounds-Wyeth's Buckwheat disclimax)
  - Manage with other communities forming the Mound-Intermound complex.

- Idaho Fescue-Prairie Junegrass (high elevation)
  - Manage this community similar to and with other steep sloped Idaho Fescue communities.

- Idaho Fescue-Bluebunch Wheatgrass (ridgetop)
  - Early season use by large herbivores should be avoided.
  - The community can be easily degraded by overgrazing.
  - Difficult to use fire in this community because of low vegetation cover.

- Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine
  - Community is suitable for livestock use but best for domestic sheep use.
  - Winter grazing by multiple large herbivores can damage plant community and promote weedy forbs.
  - Fire can damage perennial bunchgrasses and promote weedy forbs.

- Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox
  - Manage community in coordination with other steep sloped Idaho fescue communities in the Idaho fescue series.

- Common Snowberry/Idaho Fescue-Prairie Junegrass
  - Manage with Idaho Fescue-Prairie Junegrass (high elevation) steppe community

- Idaho Fescue-Timber Oatgrass-Sedge
  - Community should be managed in conjunction with dominate adjacent communities in the Idaho fescue series.

- Bluebunch Wheatgrass/Wyeth's Buckwheat
  - Manage to maintain Bluebunch Wheatgrass on the site.
  - Reduction of early season use may improve Bluebunch Wheatgrass and onion grass.

- Bluebunch Wheatgrass-Onespike Oatgrass
  - Management of the community should focus on importance of the community to large wild herbivores in spring because of southerly aspect.
  - Manage the community to maintain Bluebunch Wheatgrass.
  - Large herbivore use should be initiated after soils dry to avoid creating terracettes.
  - Use of the community by large herbivores should follow seed set.

- Bluebunch Wheatgrass-Sandberg's Bluegrass (basalt)
  - Management of the community should focus on proper grazing to sustain Bluebunch Wheatgrass.
  - Large herbivore grazing should end before boot stage and not resume until after flowering.

- Bluebunch Wheatgrass-Sandberg's Bluegrass (scabland)
  - Manage as a community associated with Idaho Fescue-Prairie Junegrass communities, especially the mound community.
  - Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.

- Stiff Sagebrush/Sandberg's Bluegrass
  - Manage as a community associated with Idaho Fescue-Prairie Junegrass communities, especially the Mound and Ridgetop communities.
  - Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.
  - Maintain Stiff Sagebrush as a component of the community because of the high value diversity potential of the shrub within the prairie habitat.

- Sandberg's Bluegrass-Onespike Oatgrass (scabland)
  - Manage as a community associated with Idaho Fescue-Prairie Junegrass communities, especially the Mound and Ridgetop communities.
  - Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.

- Douglas' Buckwheat/Sandberg's Bluegrass
  - Manage similar to other scabland communities.
  - Domestic livestock use should be timed to occur when soils are dry and flowering/seed set of Sandberg's bluegrass has occurred.

- Common Snowberry-Rose
  - Manage to maintain shrub stands but monitor (especially the Rose component) to prevent invasive tendencies of the shrubs.

- Mountain Snowberry
  - Manage to maintain current stands of mountain snowberry where they occur.
  - Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as "elk calving."
  - Manage to maintain the diversity offered by mountain snowberry.
  - Promote natural reseeding with existing vegetation.

- Ninebark-Common Snowberry
  - Manage to maintain current stands of Ninebark-Common snowberry where they occur.
  - Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as "elk calving."

- Oldfields
  - Reseeding Oldfields to best adapted introduced or native forage species should be part of a management plan for the UJCW.
  - Highly productive Oldfields should be used to reduce grazing pressure on native communities during implementation of native community improvement alternatives.

- Meadow/Riparian
  - Meadows and Riparian areas require coordinated management with upland grass steppe.
  - Management focus should be not only on protection/exclusion but also on shifting timing and density of large herbivore use.
  - Trials to establish deciduous woody growth forms to stabilize riparian areas and diversify habitat should be initiated.

- Annual Grass
  - Manage to increase establishment potential and sustainability of caespitose bunchgrasses in stands with high density of Cheatgrass and Ventenata.
  - Initiate applied research initiatives to study Ventenata to increase information about invasive potential and habit requirements.

B. Projects

1. *Proposed future projects (to be field verified & defined)*

- In forested areas of the watershed, developing a sequential programs to open forest overstory canopies to allow optimal response of herbaceous understory vegetation should be considered
- Weeds: prioritize and perform weed inventories and follow-up treatment
- Improve capacity of Oldfields to produce forage. The rationale for this conclusion is: (1) Oldfields are, and will remain in a very early seral stage for an indefinite time period because of the past severe disturbance to soils and native vegetation; (2) insufficient information on methods and the time required to restore Oldfields to native bunchgrass communities currently exists, and (3) developing the capacity of Oldfields to produce quality forage for livestock and large wild herbivores can induce flexibility in livestock management and be used to reduce grazing pressure on native bunchgrass communities.

2. *Site specific*

Table II - 5. Fence project recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Priority	Description	Notes
12	Cougar	Muddy	T3N R46E Sec 7 & 18	1	fence on east side of Muddy Pasture needs rebuilt	Kooch Boundary Fence
24	Swamp	Snake Canyon/ Barney Flat	T3N R45E E1/2 E1/2 Sec 5& 8	1	new fence	Witch's Tit to Baker Knob and Ton Ridge to Rims (T-shape)
47	Swamp	Elk Creek	T2N R45E NW1/4 NE1/4 Sec3	3	fence off pond in Dorrance Pasture and gate so that it can be used in Elk as well	improve utilization in north end of Elk Pasture
61	Chesnimnus	Berland	T3N R47E SW1/4 NW1/4 Sec14, NW to NW1/4 SE1/4 Sec3, SW to NE1/4 NE1/4 Sec9	3	extend Berland fence to 4690 rd	Sterling/Cayuse/Berland is a spring pasture and too little for the same number of cattle that go into larger pasture later
62	Chesnimnus	Sterling/ Vance	T3N R47E eastern edge of sec29; from SW corner sec29 east 1/2 mile, north on 1/2	3	extend Vance Knoll fence down to Cayuiuse and take corner between Sterling and	

			section line through section center 2/3 mile		Vance	
63	Chesnimnus	Cayuse/ Berland	T3N R47E NE1/4 SE1/4 Sec17; SE1/4 NW1/4 Sec21	3	gate water gaps to allow complete seperation of Cayuse and Berland	
67	Chesnimnus	Poison	T4N R46E from SE1/4 SE1/4 Sec26 northeast to T4N R47E SW1/4 NE1/4 Sec20	3	Hollow Log to Poison Point Fence needs rebuilt	Mark suggests potentially changing fence location, and trading for grass elsewhere
69	Chesnimnus	Poison/ Devils Run	T4N R47E SW1/4 SE1/4 Sec33 north to SE1/4 NE1/4 Sec21	3	New fence from mouth of Summit Creek to 46 road	right now, just drift fences
90	Chesnimnus	Poison			add riparian pasture fence	site to be announced

Table II - 6. Pond project recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Site Name	Priority	Description	Notes
6	Cougar	Muddy	T3N R46E SE1/4 NE1/4 Sec07		3	fix and fence dike, clean	
9	Cougar	Muddy	T3N R46E SE1/4 Sec07		3	clean	
11	Cougar	Muddy	T3N R45E SE1/4 SE1/4Sec13		3	need pond built	
15	Vigne		T3N R46E NE1/4 Sec 17		3	Pond on private ground	follow up with Doug for clarification
16	Vigne		T3N R46E NE1/4 Sec20		3	Pond on private ground	follow up with Doug for clarification
22	Swamp	Lower Swamp	T4N R45E NE1/4 SE1/4 Sec 32	Rachel Pond	1	build pond	
23	Swamp	Baker Gulch	T4N R45E SE1/4 SE1/4 Sec29	Rachel Pond	1	build pond	very close to fence
25	Swamp	Barney Flat	T4N R45E SE1/4 SE1/4 Sec32		1	clean	possibly move if install fence between Snake

							Canyon and Barney Flat (Project ID #24)
26	Swamp	Lower Davis	T3N R45E NW1/4 SE1/4 Sec7		3	clean	on top of Starvation
27	Swamp	Lower Davis	T3N R45E SE1/4 NW1/4 Sec18		3	clean	on top of Starvation
28	Swamp	Lower Davis	T3N R45E NE1/4 Sec1		3	clean	
29	Swamp	Lower Davis	T3N R45E SW1/4 Sec12		3	clean	
30	Swamp	Lower Davis	T3N R45E SW1/4 Sec1		3	clean	
31	Swamp	Lower Davis	T3N R45E NW1/4 Sec13		3	clean	
33	Swamp	Davis Creek	T3N R45E NW1/4 Sec25	Chico Pond	3	clean	
34	Swamp	Davis Creek	T3N R45E SW1/4 Sec30		3	clean	
35	Swamp	Miller	T3N R45E NE1/4 NE1/4 Sec16	Trump Pond	3	develop new site	
36	Swamp	Beef	T3N R45E NW1/4 SE1/4 Sec29		3	clean	on fence between Beef and Little Elk Creek pastures
37	Swamp	Little Elk Creek	T3N R45E SW1/4 SW1/4 Sec28		3	clean	not shown on the map
38	Swamp	Little Elk Creek	T3N R45E NW1/4 SW1/4 Sec28	Frog Pond	3	clean	
39	Swamp	Little Elk Creek	T3N R45E NE1/4 SW1/4 Sec27		3	clean	
40	Swamp	Little Elk Creek	T3N R45E NW1/4 Sec34		3	fix breach	
41	Swamp	Elk Creek	T3N R45E NE1/4 NE1/4 Sec21	Two Track	1	clean	at Baker Corner; other ponds in area may need cleaned that aren't on map
42	Swamp	Little Elk Creek	T2N R45E		1	clean	clean ponds

			S1/2 Sec4				in potholes
43	Swamp	Dorrance	T2N R45E NW1/4 SW1/4 Sec14		3	clean	
44	Swamp	Bennett	T2N R45E E1/2 SW1/4 Sec7		3	clean	
45	Swamp	Bennett	T2N R45E SE1/4 NW1/4 Sec7		3	clean	wet spot, possibly a spring development
46	Swamp	Elk Creek	T2N R45E N1/2 SW1/4 Sec10	Black Snag Pond	1	clean	draw across from black snag
49	Swamp	Little Elk Creek	T3N R45E NW1/4 SW1/4 Sec33		1	clean	
50	Swamp	Red Fir	T4N R45E E1/2 NW1/4 Sec31		3	clean	
55	Swamp	Upper Swamp	T2N R45E NW1/4 SW1/4 Sec9	Moonshine Pond	3	clean	
58	Chesnimnus	Berland/ Poison	T3N R47E SE1/4 NW1/4 Sec9	Berland Reservoir	3	clean	
59	Chesnimnus	Cayuse	T3N R47E NW1/4 NW1/4 Sec28	Hilton Ridge	3	clean	
60	Chesnimnus	Cayuse	T3N R47E NE1/4 NE1/4 Sec29	Hilton Ridge	3	clean	
65	Chesnimnus	Poison	T3N R47E W1/2 NE1/4 Sec5		3	clean	
77	Cougar	Baldwin	T4N R46E NW1/4 NW1/4 Sec8		3	new pond or spring development	
78	Cougar	Baldwin	T4N R46E SE1/4 NW1/4 Sec7		3	enlarge and clean	include fence that would allow access from Huntng Camp & Baldwin Pasture
79	Cougar	Peavine	T4N R46E NW1/4 NE1/4 Sec20	S. Getchel Ridge Pond	3	clean and enlarge	
80	Cougar	Peavine	T4N R46E SW1/4 SE1/4 Sec17	N. Getchel Ridge Pond	3	clean and enlarge	
82	Cougar	Peavine	T4N R46E		3	need pond	

			SE1/4 SE1/4 Sec17			1/4 mile southeast of Quirk Spring	
83	Cougar	Peavine	T4N R46E SE1/4 SE1/4 Sec20	Rock Pit Pond	1	clean out to make usable	
84	Cougar	Boner	T3N R46E NE1/4 NW1/4 Sec25		3	enlarge and clean	
86	Cougar	Cougar	T4N R46E SW1/4 NW1/4 Sec30		3	build new pond	

Table II - 7. Spring and trough project recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Site Name	Priority	Description	Notes
1	Cougar	Muddy	T3N R45E SE1/4 Sec01		3	rehab spring	
3	Cougar	Muddy	T3N R46E SW1/4 Sec07	Joe Platz Springs	3	develop spring with trough	
8	Cougar	Muddy	T3N R45E SE1/4 Sec12		2	need water source found	
10	Cougar	Muddy	T3N R46E NE1/4 Sec07		2	need water source found	
17	Swamp	Buck	T4N R45E NE1/4 Sec19		3	develop spring with trough	
18	Swamp	Buck	T4N R45E NW1/4 Sec19		3	develop spring with trough	
19	Swamp	Buck	T4N R45E SE1/4 Sec19		3	develop spring with trough	on the line between Sec 19 & 30
20	Swamp	Buck	T4N R45E SE1/4 NW1/4 Sec30		3	develop spring with trough	
21	Swamp	Lower Swamp	T4N R45E SW1/4 SE1/4 Sec20		1	needs reconstruction	
66	Chesnimnus	Poison	T3N		3	west side of	

			R47E SE 1/4 NW1/4 Sec4			Mitchell	
70	Chesnimnus	Devils Run/South Fork			3	spring work in Devils Run/South Fork Chesnimnus (late grazing)	
75	Chesnimnus	Devils Run		Burnt Springs	3	rehab spring	
76	Chesnimnus	Devils Run			3	rehab spring at head of devils run	
81	Cougar	Peavine	T4N R46E NE1/4 SE1/4 Sec17	Quirk Spring	1	reconstruct	
85	Cougar	Boner	T3N R46E SE1/4 SE1/4 Sec24	Boner Spring	3	fenced off area needs to be cleaned of cattails	
87	Cougar	Cougar	T4N R46E		3	rehab spring	east of pond under Lone Spring Saddle
88	Swamp	Little Elk Creek	T3N R45E NW1/4 Sec5		1	find water sources & develop trough	new site
89	Swamp	Little Elk Creek	T3N R45E NW1/4 Sec32		2	find water sources & develop trough	new site

6. Cultural Resources

Prehistory and History of the Nez Perce Tribe in UJCW

Historically, the Joseph, Imnaha and Wallowa bands of the Nez Perce Tribe probably interacted the most intensively with the UJCW. At the time of white encroachment into the Wallowa country, ca. 1860, the Nez Perce may have already played a significant role in shaping the physical environment of the watershed. With thousands of head of horses and cattle, rangelands were already being managed and or impacted by livestock. Recognizing the aboriginal use of fire and harvest of plant resources over thousands of acres, it is clear that the UJCW has been a culturally-managed landscape for thousands of years.

Archaeological investigations, conducted within and adjacent to the UJCW, place people within the watershed for the last 8,000 years and possibly longer. There are hundreds of significant cultural resource sites within the watershed. Most, if not all of these sites (lithic scatters, cambium peeled trees, etc.) can be attributed to hunter-gatherer bands operating out of winter villages and seasonal camps located within the northern portion of UJCW and immediately adjacent to it.

The location of seasonal camp sites, lithic (stone tool) workshops and cambium peeled trees (CPTs) are determined by the availability and or location of specific resources; water, food, tool stone and ponderosa pine trees. Campsites are almost always found adjacent to surface water, springs or streams, however numerous other factors, such as proximity to food resources, slope and aspect also play a role in site selection. One thing that all campsites share in common is that they all seem to be located within or adjacent to ecotones or edges, most commonly the forest grassland ecotone.

The most significant campsites located within or adjacent to the UJCW are three sites in the southern portion of the watershed. They have contributed significantly to the understanding of the development of lithic procurement and reduction strategies in the Joseph uplands, and probably hold the key to understanding ethnographic Nez Perce settlement and subsistence strategies within the watershed.

Hundreds of peeled ponderosa pine trees ("cambium peeled trees" or CPTs) occur within and adjacent to the UJCW, primarily within the northeast portion of the watershed near Thomason Meadows. Although the purpose for peeling these trees remains unclear (possible food or medicinal purposes), the extensive groves of CPTs within the watershed, probably peeled from the mid 1700s through the late 1800s, are living examples of Nez Perce interaction with the watershed.

The remaining CPTs in the watershed are a relatively fragile and finite resource. Within a few generations, a significant number of these trees will succumb to old age, insects and fire, and will eventually disappear. A well thought out management plan, developed in conjunction with the Nez Perce Tribe, is desired for this resource.

Edible plant resources important to the Nez Perce occur in significant quantities through out the watershed. Approximately 20 edible plants have been identified within the UJCW. Among them are camas and cous, both mainstays of the Nez Perce diet at the time they would have occupied the watershed as hunters and gatherers. Forest Service land management activities do not appear to have significantly degraded this resource, particularly camas and cous. The grassland and grassland shrub and ponderosa pine communities contain the bulk of the plant resources, the same communities where the archaeological resources are concentrated.

Stone tools were primarily made from black andesite, and workshops (lithic resource sites) are found along and near ridgetops. Given the extent and distribution of black andesite resource sites within the UJCW, the watershed most likely played a significant role in the distribution of black andesite tool stone across much of eastern Oregon. Unlike the CPTs, the lithic sites are in no immediate danger of disappearing. The majority of these sites possess limited data potential beyond defining or refining the lithic technology of the Joseph uplands. Forest Service land management activities are not likely to significantly degrade the data potential of these sites.

Recommendations
The intrinsic value placed on the resource by the American Indian community, in this case the Nez Perce, should be considered. These intrinsic values should be woven into Forest Service decisions with intensive, ongoing, person-to-person, Nez Perce involvement in the planning process, particularly at the watershed level.

The greatest gap in understanding the cultural history and archaeology of the UJCW is the un-surveyed Zumwalt Prairie, which constitutes over half of the UJCW. Based on the bedrock geology and the presence of several Joseph volcanoes, archaeological site density is anticipated to be much greater than the National Forest portion. Archaeological survey of the Zumwalt Prairie would contribute to a greater understanding of the cultural history of the watershed.

Recommendations include archaeological research and management priorities (in order of priority) as follows:

- Significantly increase the involvement of the Nez Perce, including the Joseph Band, in the management of archaeological resources, CPTs and culturally significant plants.

- Develop a management/research plan for the Thomason Meadows and Indian Village groves of CPTs.

- Develop a management plan for the Starvation Springs site. This plan should include direction for reducing fuel loads within the most significant portions of the site as defined by Jaehnig, 1992. This could be accomplished by a combination of a low ground pressure thinning system such as a forwarder and hand piling and mechanical chipping. The site/spring also functions as a major, stock water development. The current stock tank is located within the boundaries of the site and should be relocated outside the site.

- Conduct archaeological survey and testing of the Indian Village (immediately adjacent to UJCW) and Steen ranch sites.

- Conduct a stratified, archaeological survey of the private portions of the Zumwalt Prairie.

Additional Recommendations

The following recommendations were raised during the planning process, but weren't reviewed or discussed by the entire planning group. These recommendations will be considered and discussed in further detail in the future to determine if and how they respond to the issues and move the watershed towards desired conditions.

- Horse and cattle allotments on national forest land should remain active, and vacant allotments should be utilized by existing permittees, or managed as collaborative Grass Banks, to provide additional management flexibility.

- No active domestic sheep or goat allotments should occur on national forest land.

- Establish an active carnivore management program by placing priority on expanding public hunting opportunity, and utilizing Wildlife Services to keep carnivores at set population levels if hunter quotas are not met.

- Consider use of chemical control methods in the management of noxious weeds.

- Continue restoration efforts of native wildlife including Columbian Sharp-tailed grouse, Mountain quail and Rocky Mountain bighorn sheep in suitable habitat. Consider establishing a small self-sustaining population of pronghorn antelope.

- Restore wetlands to reclaim the fullest possible functioning of hydrological regimes.

Monitoring and Evaluation

A list of monitoring and evaluations needs was developed throughout the UJCW analysis process. First, a list of additional data needs was identified, followed by a list of monitoring items helpful in verifying assumptions made and to evaluate how well the recommendations served at bridging the gap between existing and desired conditions.

Data Needs

- Analyze Forest Service rangeland data and make results accessible in a user -friendly format.

- Inventory noxious weed sites

- Inventory upland water sources

- Inventory gaps between riparian exclosures

- Inventory distribution of T&E/sensitive plants

- Inventory wildlife presence and use of designated old growth and late old structure stands, and their movement between such stands.

- Inventory the presence and condition of upland deciduous plants (i.e., native hardwoods)

- Perform a statistical analysis of the historic and ongoing temperature data that has been presented in this document and that will continue to be compiled. Answer the question "What does all of this temperature information mean?"

- Perform an aerial photo analysis of the 1938, 1988 and 1997 photos in the UJCW. A review and comparison of aerial photographs taken in 1938 and again in 1988 was completed, but the analysis should include the 1997 photos.

Monitoring Items

- To determine trends in juvenile salmonid populations, stream attributes specified by Forest Plan standards and guidelines, or important stream/riparian health indicators, Level III monitoring stations should be established in various locations on National Forest System lands. Level III measurements should focus on width to depth ratios, channel substrates, channel entrenchment ratios, streambank stability, water temperature, fish population estimates, and riparian vegetation. This information is especially important to determine appropriate restoration objectives and progress toward those objectives.

- To determine seasonal flow and runoff patterns, a stream flow gauging station should be reestablished on Joseph Creek. During the mid-1930's a gauging station was established near Sumac Creek, and records were kept for three years. A site near this location is preferred.

- To determine site-specific potential for growth and species diversity of deciduous vegetation, compare conditions within and outside of existing riparian exclosures.

- Monitor the timing of seasonal grazing by cattle and elk to understand its effects on restoration efforts.

Forest Condition Assessment

Forest Condition Assessment Methodology

Under Wallowa County's Upper Joseph Creek Watershed Assessment process, the Forest Condition Working Group[1] devised a revised forest condition assessment methodology, which builds on the existing USFS system. The assessment focused on structure, function, composition and disturbance agents. Camp II Forest Management conducted the forest assessment on the 76,159 acres of public land in the Watershed from September to December 2001.

Canopy cover was used to designate stand boundaries. Stand stratification used canopy cover classes of 0-10% (non-forested), 10-40%, 40-70%, and 70%+. Of the total public acreage, 53,968 acres (71% of the area) were designated as forested (i.e. > 10% canopy cover). Forested lands were divided into 650 stand polygons averaging 83 acres in size. Non-forested land accounted for 22,121 acres broken into 560 polygons averaging 40 acres in size.

Field assessment took place in each of the forested stand polygons. Transects of at least 660 horizontal feet were established in all plots less than 40 acres. Stands larger than 40 acres were assessed along transects of at least 1320 feet. On each transect, a minimum of five observation points were established, marked and labeled. At each observation point, tree layer information and relative species cover by layer was obtained with a variable plot. Trees per acre and snag densities were measured with a fixed radius plot. Fuel loads were summarized following the walk-through, with a comparison to a USFS photo series. Damage, growth assessment, crown ratios, forest health evaluations, and wildlife habitat analysis were recorded in a written summary prior to exiting the stand. USFS and Wallowa Resources staff performed periodic quality control in the field, conducting assessment protocol in randomly selected plots and comparing the data with that secured by Camp II Forest Management. This random re-sampling confirmed the high quality of the data, with one exception – snags were undercounted in the initial plots. Additional details of the assessment methodology and data captured are provided in *Appendix 3: Forest Condition Assessment Description* and *Appendix 4: EVG Data Entry Form Definitions*.

Overview of Conditions

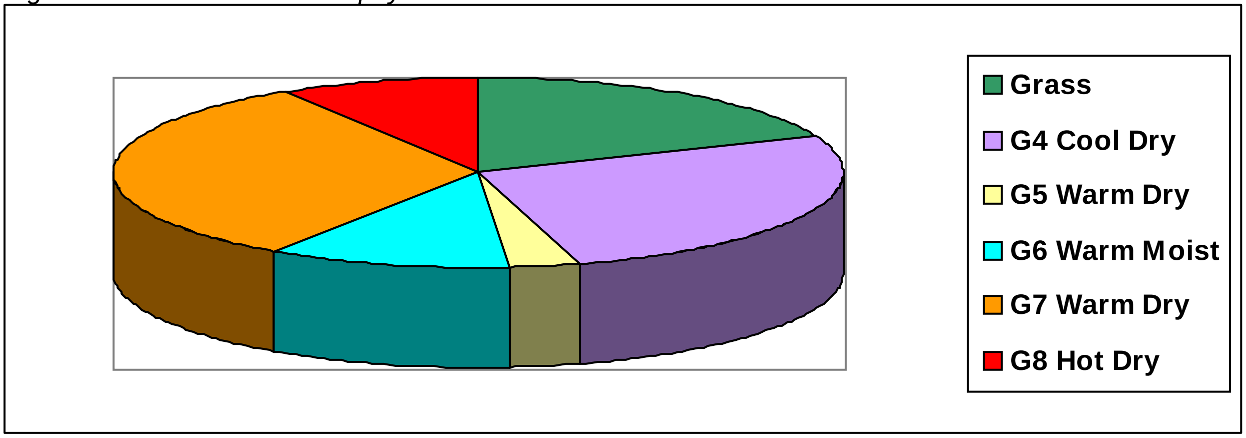
Forest vegetation of the UJC Watershed is characterized by a wide variety of vegetation types. A description of these vegetation types by biophysical environment is provided in *Appendix 5: Biophysical Environments*. Existing stand structures and associated species composition vary with landform, elevation, aspect, soil condition, and precipitation gradients.

The forested lands are dominated by warm dry Ponderosa pine – Douglas fir stands (G7) in the south and cool dry Grand fir (G4) stands in the north. Together these two forest types comprise 59% of the forested land base within federal ownership. Cold dry (G1) and cool moist (G2)

[1] Participants in the working group are identified in *Appendix 2: Participants.*

forests represent less than 0.25% of the area, and are not included in the pie chart below. Grasslands constitute 19% of the federal ownership. Forest types were assigned according to the biophysical environment classification adopted by the Interior Columbia Basin Ecosystem Management Project (ICBEMP)[2].

Figure III-1. Distribution of Biophysical Environments within the watershed



Changes in the structure and composition of forest vegetation are caused by succession and disturbance. These changes affect ecosystem function, as well as the value humans place upon ecosystems for commodity production and amenities. Vegetation changes through succession in the absence of disturbance. Planned (e.g. timber harvest, prescribed fire, domestic livestock grazing) and unplanned disturbance (e.g. insect and disease, wildfire, wildlife herbivory, flood, winds) cause transitions to different successional classes or hold back such changes.

Forested vegetation changes with succession, typically toward dominance by the most shade tolerant tree species that can occur. In the absence of subsequent disturbance events, succession after a stand-replacing event generally follows a sequence of structural stages:

1) A non-forested condition dominated by shrubs or grasses and herbaceous or exotic plants,
2) Stand Initiation (SI),
3) Stem Exclusion stage with open canopy (SEOC) – additional trees limited by moisture,
4) Stem Exclusion stage with closed canopy (SECC) – additional stems limited by moisture and available sunlight; trees compete for site.
5) Understory Reinitiation (UR) – competition induces mortality, a new age group establishes in the openings of the older overstory.
6) Multistory Stands (MS) – several age groups of trees are established,
    a. Without significant large trees (MSLTU)
    b. With large trees present (MSLTC)
7) Single Story Large Tree (SSLT) – Understory trees generally absent; large trees are present and significant in the overstory (e.g. Park-like Pine stands)

[2] Descriptions of the dominant plant associations within these biophysical environments are in *Appendix 5: Biophysical Environments*.

In the absence of disturbance, older forests will perpetuate the Multistory Stands with Large Trees (MSLTC) or Single Story Large Tree (SSLT) with the later prevailing in the warmer, dryer Ponderosa Pine sites with frequent ground fires. Where exotics dominate in a non-forested condition, it takes longer for the succession to Stand Initiation. In Stand Initiation, tree seedlings and saplings reach more than 50% canopy cover, usually distributed in clumps. In the Stem Exclusion Closed Canopy (SECC) structural stage, tree saplings and poles are dense, and the understory shrubs, grasses and forbs are the least abundant compared with other stages. Once some of the trees die, others regenerate to create the Understory Reinitiation (UR) structural stage. In UR stands, there is a separation between the overstory trees and establishing understory trees in the mortality induced gaps. Eventually, in the absence of disturbance a Multistory Stand develops with large trees unless these have been removed by timber harvest or killed by insect or disease.[3] *(Appendix 6: Structural Stages of Stand Development* contains definitions and photographs of various stand stages in UJCW.*)*

Analysis of the 2001 assessment results reconfirmed the principal finding of the 1995 Upper Joseph Creek Watershed Analysis Report prepared by the Wallowa Whitman National Forest, USFS. The integrity of forest ecosystems within the UJCW has been compromised to various degrees due to:

- The removal of large, early seral over-story trees (especially Ponderosa pine, Douglas fir, and Western tamarack)
- The departure from native disturbances (e.g. active fire suppression, and periods of increased grazing), and,
- Successional processes influenced by human management over the last century, including the abrupt decline in management activity on public forest land since the early 1990's.

The recurring droughts (1986-1994, and 1999-2005) affecting Northeast Oregon exacerbate the impact of these factors on forest ecosystem functioning (*see Palmer Drought Index for Northeast Oregon on following page*). The current long-term drought (1999-2005) is the most severe since the dust bowl years of the 1930's.

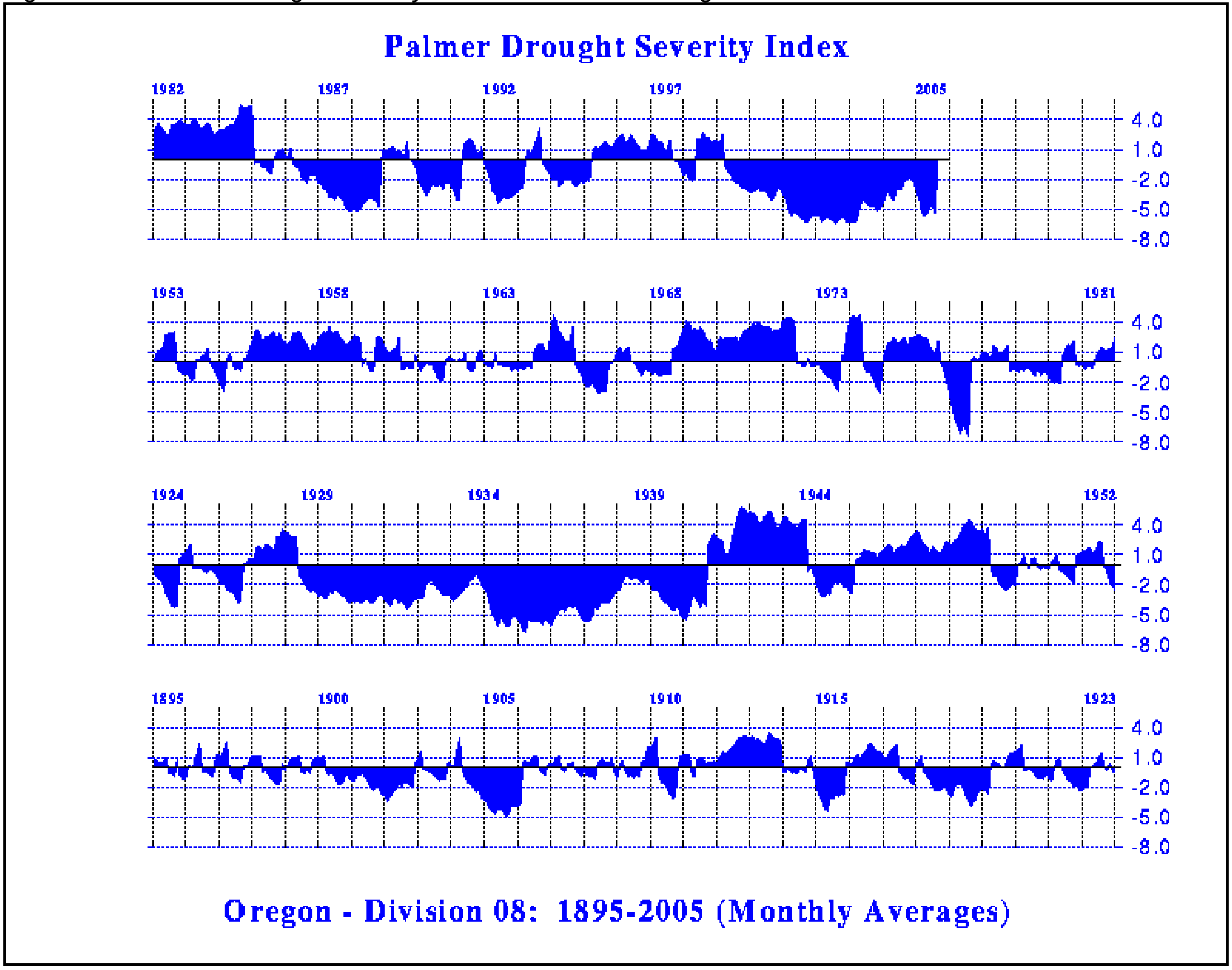
Healthy ecosystems, with high integrity, exhibit the ability to absorb and recover from disturbances without losing their inherent function. Natural fire regimes and common (endemic) insect and disease activity play a significant role in the cultivation of vegetative integrity within the Upper Joseph Watershed. Landscape patterns across any area and over time are shaped by the inherent dominant disturbance events associated with the site. In eastern Oregon, natural disturbance regimes functioned to create a variety of structural patterns across the landscape.

As a result of the human influence mentioned above, the landscape has become more homogeneous, patch sizes have become larger, and patches are fewer. Forest stands have been simplified, and are more heavily stocked. Insect and disease hosts and forest fuel continuity has been increased in the process. The results are significant—widespread insect and disease

[3] Description from "Development of Management Scenarios for Modeling Disturbance Regimes and Succession in the Interior Columbia River Basin", Donald G Long, et. al. Jan 1998 Revised Draft. USDA Forest Service. USDI Bureau of Land Management. Administrative Report.

outbreaks, and large-scale stand replacement wildfires—unlike any that are believed to have occurred in pre-settlement time.

Figure III-2. Palmer Drought Severity Index for Northeast Oregon 1895-2005[4]



Examples of recent disturbance events exceeding historic norms within the Upper Joseph Watershed are numerous. In 1972, the Devil's Run subwatershed experienced an epidemic infestation of Douglas-fir tussock moth and during the period of 1990-1994, the Douglas-fir bark beetle virtually eliminated the large tree Douglas-fir component of thousands of acres of stands in the vicinity of the TeePee Butte Fire.

Aggressive suppression facilitated by the extensive road system has prevented the outbreak of any large-scale fires within the watershed in recent history. More than 100,000 acres have burned in surrounding watersheds (Lower Joseph, Snake River / Rogersburg, and Lower Imnaha)

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[4] The Palmer Drought Severity Index provides measurements of moisture conditions that are standardized so that comparisons using the index can be made between locations and between months (Palmer 1965). It is a meteorological drought index. It responds to weather conditions that have been abnormally dry or abnormally wet.

since 1986. The 2002 Wallowa Whitman Fire Management Plan notes that the ecological conditions within the watershed are outside of the historical range[5] and the risk of losing key ecosystem components to fire is high.

Silvicultural/ Fuels Management Outlook

The integrity of the forested ecosystems in the UJCW has been compromised to various degrees by past management practices and climate change, which have altered native disturbance regimes and successional processes.

The principal areas of concern are:

- Lack of stand structure diversity
- Reduction in early seral species across forest types
- High stand densities in a majority of stands, and
- High volume of dead standing and down fuel loads

These factors influence the ability of the forested ecosystems to absorb and recover from disturbances without losing their inherent function. All four areas of concern increase the risk of fire, insect and disease occurrences exceeding common (endemic) levels.

The watershed is deficient across all biophysical environments in size classes 5 & 6 (21"-31" and 32+" diameters, respectively) and the "Late and Old Structure" forest component. The cool dry Grand fir environment is deficit in early seral species (Lodgepole pine, Ponderosa pine, Douglas fir, and Western larch).

In addition, the decline in the deciduous component of the forested landscape is a concern. In particular, the decline in deciduous shrubs in the riparian area and hardwood stands impacts wildlife use and distribution in the UJC Watershed. Fire suppression, long-term drought, herbivory (by wildlife and domestic livestock) and conifer competition are agents that prejudice deciduous shrubs and trees across the watershed.

High forest stand densities also affect water tables and stream flow. The increase in stand density is largely a byproduct of historic overstory removal and fire management within the watershed. As forest vegetation increases, it slows or inhibits the flow of water from precipitation toward aquatic systems. The significance of this relationship is enhanced by the current cycle of drought, and the resulting concerns over water flow and temperature with respect to native fish populations and other aquatic life.

Various options exist to improve forest conditions within each biophysical environment. The Forest Conditions Working Group envisages an 80-100 year restoration plan with management activities in various parts of the forest every 5-10 years. This selective, incremental and

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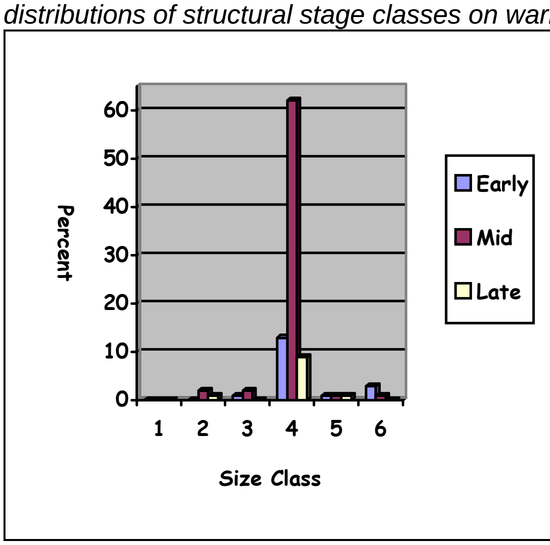
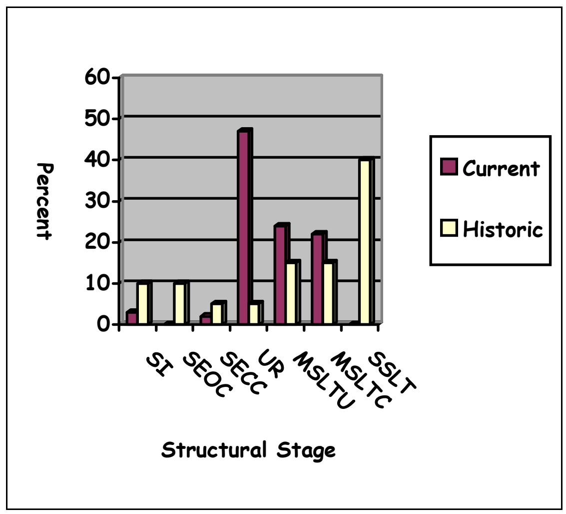
[5] A discussion on historic range of variation is included in *Appendix 7: Forest Stand Historic Range of Variation.*

relatively slow approach to restoration allows for continued learning and economic benefits, and responds to the uncertainty in our knowledge of these systems.
In the course of this assessment, particular attention was devoted to the two main habitat types in the watershed – the cool dry Grand fir habitat, and the warm dry Ponderosa pine – Douglas fir habitat.

Warm Dry Management Options
The Warm Dry Biophysical Environment (G7) constitutes 32% of the watershed. The dominant forest structures today are Understory Reinitiation (UR) and Multistory Large Tree Uncommon (MSLTU), and Multistory Large Tree Common (MSLTC). These three stand types exceed their historic occurrence, with the extent of Understory Reinitiation stands far exceeding the historic pattern. The warm dry pine sites are particularly deficient in Single Story Large Tree (SSLT) stands. 9"-20" diameter trees (size class 4) and mid seral species (Douglas fir and Ponderosa pine) dominate the warm dry sites.

Figures III-3 and 4. First graph: Current distribution of size class and seral stage of warm/dry forest stands in the Upper Joseph Creek Watershed. Second graph: comparison of current and historic distributions of structural stage classes on warm/dry sites in the Upper Joseph Creek Watershed.





<u>Warm/Dry environment</u>. To be classified as "early seral"; ponderosa pine would constitute 70+% (by basal area) of the species composition of the dominant canopy layer. This early seral species would constitute 30-70% of mid seral stands and less than 30% of late seral stands.

Silvicultural prescriptions designed to increase the representation of "Single Storied Large Tree" structures within the biophysical environment would be desirable. However, the developmental history of the two layered, small diameter stands precludes many treatment options. The overstocked understory has developed poor crown ratios and has been subjected to "climax site" maladies (i.e. high incidence of insects and disease). Douglas-fir dwarf mistletoe is of special concern since it can be expected to cause catastrophic losses in infected stands that are incorrectly managed. Consideration also needs to be given to silvicultural prescriptions that reduce the risk of fire to existing multistoried structures and designated old growth areas.

Natural Disturbance Patterns. Disturbance events in this environment were cyclic, but generally consisted of low intensity surface fires with predictable return intervals of 20-30 years. Periodic, low intensity fire regimes functioned to eliminate the development of a floor stratum of conifers and maintained open, park-like structures of ponderosa pine and Douglas-fir. However, even in low severity fire regimes, intense fires sometimes occurred in discrete areas of fuel buildup (possibly due to bark beetle mortality patterns, longer than normal fire-return intervals, or unusual fire weather events). Shade intolerant ponderosa pine regeneration could become established in the gaps created following the death of the overstory. The resultant stand structure appeared as a mosaic of younger ponderosa pine age classes nested within a matrix of single storied overstory Ponderosa pine and Douglas fir. Relatively uniform, open spacing was maintained within the clumps of advanced regeneration with the return of frequent, low-intensity fire regime.

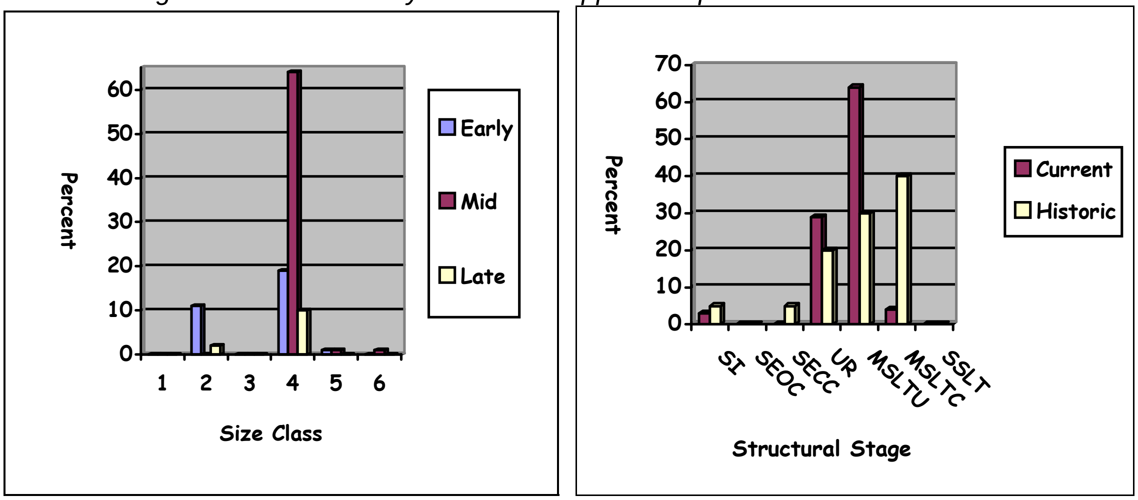
Silvicultural/ Fuels Treatment Opportunities. The Forest Condition Working Group identified the following opportunities. These opportunities are consistent with the management alternatives established in the Wallowa County – Nez Perce Tribe Salmon Rehabilitation Plan, Appendix O: Management Alternatives for Producing Various Stand Structures (1999).

- Intermediate thinning opportunities within single storied late seral structures provided stands are healthy and vigorous.
- Intermediate thinning opportunities within single storied early-mid seral structures designed to reduce inter-tree competition and fire risk, maintain the health and vigor of the residual stand, preserve future treatment options, and to accelerate the development of large diameter trees.
- Individual tree selection regimes designed to maintain and improve the health and vigor of existing multi-layered structures of diverse species composition, age and size classes. Such stands within the warm/dry environment would have a substantial existing component of early-mid seral species represented in all crown strata. (Would include stewardship opportunities with limited merchantable volume recovery).

Cool Dry Management Options

The Cool Dry Biophysical Environment (G4) constitutes 27% of the watershed. The dominant forest structures today are Understory Reinitiation (UR) and Multistory Large Tree Uncommon (MSLTU). These three stand types exceed their historic occurrence, with the extent of Multistory Large Tree Uncommon stands far exceeding the historic pattern. The cool dry sites are particularly deficient in Multistory Large Tree Common stands. 9”-20” diameter trees (size class 4) and mid seral species (Douglas fir, and Western larch) dominate the overstory of the cool dry sites.

Figures III-5 and 6. First graph: Current distribution of size class and seral stage of cool/dry forest stands in the Upper Joseph Creek Watershed. Second graph: comparison of current and historic distributions of structural stage classes on cool/dry sites in the Upper Joseph Creek Watershed.



<u>Cool/Dry environment</u>. To be classified as “early seral”; ponderosa pine, western larch, Douglas-fir or lodgepole pine would constitute 70+% (by basal area) of the species composition of the dominant canopy layer. These early seral species would constitute 30-70% of mid seral stands and less than 30% of late seral stands.

Silvicultural prescriptions designed to increase the representation of “multi-layered with large tree” stands within the biophysical environment would be desirable. However, the developmental history of the layered, small diameter stands precludes many treatment options. The remnant, early seral component of these structures has been previously removed and the understory stocking levels were never managed to optimize development. Consequently, the overstocked understory has developed poor crown ratios and has been subjected to “climax site” maladies (i.e. high incidence of insects and disease). Douglas fir and Western larch dwarf mistletoe is of special concern since it can be expected to cause catastrophic losses in infected stands that are incorrectly managed.

<u>Natural Disturbance Patterns.</u> Natural disturbance events within the cool dry environment were cyclic, variable in intensity and gave rise to the mosaic pattern of stand structures historically encountered on a landscape scale within this biophysical environment.

The fire regimes operating within this biophysical environment ranged from frequent, light surface fires to long return interval crown fires and all combinations in between.

Fire was a frequent visitor to a large extent of this environment as evidenced by the existence of residual overstory Ponderosa pine, Western larch and Douglas fir. These early seral species, especially ponderosa pine and western larch, are extremely intolerant of shade and root competition. Consequently, frequent low intensity surface fires favored canopy dominance.

In the absence of frequent fires, Grand fir becomes begins to dominate, because it is more tolerant of understory competition than Ponderosa pine, Douglas fir, and Western larch. This results in a change in stand conditions to a dense multi-layered stand with a higher accumulation of down fuels.

<u>Silvicultural/ Fuels Treatment Opportunities.</u> The Forest Condition Working Group identified the following opportunities. These opportunities are consistent with the management alternatives established in the Wallowa County – Nez Perce Tribe Salmon Rehabilitation Plan, Appendix O: Management Alternatives for Producing Various Stand Structures (1999).

- Intermediate thinning opportunities within single storied early-mid seral structures designed to reduce inter-tree competition and fire risk, maintain the health and vigor of the residual stand, preserve future treatment options, and accelerate the development of large diameter trees.
- Individual tree selection regimes designed to maintain and improve the health of existing multi-layered structures of diverse specie composition, age and size classes. Such stands within the cool dry environment would have a substantial existing component of early-mid seral species represented in all crown strata. (Would include stewardship opportunities with limited merchantable volume recovery).
- Group selection variant of uneven-aged management designed to reintroduce horizontal patchiness, species, and size class diversity within homogeneous, late seral structures. Spatial and temporal distribution would be patterned to replicate naturally occurring disturbance regimes typical of cool dry sites.

Forest Conditions and Wildlife Habitat

The importance of forested areas for a wide range of wildlife in Upper Joseph Creek was recognized throughout the assessment process. Critical issues pertinent to terrestrial wildlife and forest management included the decline in deciduous vegetation in riparian areas, and the deficit in large snags and late old structure. With specific reference to game species (especially elk and deer), the importance of maintaining hiding and thermal cover was acknowledged – as was the potential impact of road closures (permanent and seasonal) on the overall status of these populations.

There are 3 significant divisions of habitat in the UJCW. The southernmost 56% (98,278 acres) is predominantly native grassland/prairie bisected by streams, riparian zones and patterned with a variety of brush lands. About ½ of the remaining 75,892 acres is predominantly ponderosa pine forest and prairie grasslands or a relatively dry ecotonal zone. The balance is moister upland forest of mixed conifer to true fir.

Wildlife use is largely describable by these distinctions with a tremendous amount of big-game (deer and elk) use in and adjacent to the ecotonal zones. It is also in this zone that the most capable streamside and riparian zones exist. These zones bear the evidence of ungulate use both domestic and wild.

Within the forested zone the US Forest service is mandated to meet a number of standards on behalf of wildlife, wildlife habitat, access and usability. One of those considerations is about representative units of mature and old large tree forest patches and about some contiguity of access for big game, raptors, woodpeckers and others that may have limited ability to easily cross large stretches of non-habitat. Travelways have been mapped via GIS, largely along riparian zones that tie most units of Late Old Structure, Multistory Large Tree Common and designated old-growth (MA 15) units together. These are not acres removed from timber management or other use, but zones where some standards of canopy cover and visibility are directed that protect many species from isolation in islands of habitat.

The following forest management recommendations emerged from the analysis of wildlife issues in this watershed:

- Secure and promote the “heritage elements” of the habitat, consisting of mature and old timber stands, large old live and dead trees and large woody debris (logs) which are the most limited on this landscape, and the hardest to re-construct (at least over time).
    - Retain heritage forest elements where they remain in the landscape; large/old live trees, large old dead trees, logs and stumps.
    - Reduce the risk of wildfire to these remaining elements through fuel reduction activities (understory thinning, slash and down fine fuel treatment, raking duff accumulations away from base of trees, and prescribed burns).
    - Prescribe silvicultural (including fuels) treatments to accelerate the return of forest stands to the historic range of variability both temporally and spatially by “habitat type and structural stage”.
    - Target 30-80 acre blocks of late old structure distributed proportionally across the landscape and the various biophysical environments.
- Minimize reliance on “corridor/travelways” to connect highly fragmented habitats while restoring historic “continuity and connectivity”.
- When allocating new uses across the landscape of this watershed (OHV’s) consider temporal and spatial impacts and possible mitigative factors (screening via vegetation and/or topography, seasonal scheduling, etc.)
- Restore relict and remnant habitats as freestanding elements on the landscape towards suspected Historic Range of Variability including; Western yew, aspen clones, cottonwood galleries, willow carrs, hawthorn shrub-lands, alder stands, talus garlands, etc. These features are disproportionately important for the biodiversity they represent and the habitat options they provide.

A key element about which much less is known quantitatively is the presence of vigorous and abundant deciduous understory in mature to old open (ponderosa pine and dry mixed conifer) stands and in the riparian zone. The first euro-immigrant accounts of this area spoke of open park-like stands with abundant willow and serviceberry, and patches of currents (*Ribes* and *Rubus* species) where walking grouse (blue grouse) and brush pheasants (ruffed grouse) were abundant. The history of timber harvest and fire suppression, and the on-going competition for forage by domestic and wild ungulates, has reduced this component to remnants of what it may once have been. Restoration of the deciduous understory would require understory tree removal with harvest and prescribed fire, followed by planting and protection until successful establishment of willows (at least 5 species), serviceberry, elderberry, *Ribes* species, *Rubus* species, etc.

Monitoring of wildlife species and groups for habitat restoration purposes. In 1983 the Wallowa Valley Ranger District instituted a system of bird species monitoring intended to show changes in species composition and abundance along Elk Creek, Peavine Creek and Chesnimnus Creek where significant investments in habitat restoration had been and were continuing to be made. Monitoring was conducted to a systematically reproducible protocol with highly qualified local volunteers (Frank and Sue Conley). This monitoring continued through 2002, and the data is being entered on publicly accessible databases (http://birdnotes.net/census) and Cornell Laboratory of Ornithology and National Audubon 2003 http://www.ebird.org/MyEBird).

Fire and Fuels Assessment[1]

Fire and Fuels Overview

Disturbance is an integral process in natural ecosystems, and management of forest ecosystems must take into account the chance of natural disturbance by a variety of agents. Fire is an ever-present disturbance factor in both space and time, and it cannot be ignored in long-term planning. Its effects can be integrated into land management planning through an understanding of how fire affects the site and the landscape (Agee, 1993).

Ecosystems frequented by fire almost always contain species that adapt and take advantage of the disturbance. Adaptation occurs in many ways such as: thick bark, ability to sprout from rootstock or stem following a burn, serotinous cones, to name just a few. Climate also has a direct impact on vegetation and will influence the likelihood of that vegetation burning.

Fire Regimes

Fire regimes are identified by fire's interaction with the environment, the number of fire occurrences and the frequency at which these occurrences take place. The fire regime indicates the frequency or fire return interval and the type of fire severity that is considered *typical*. Fire regimes within Forest Service lands in the UJCW are represented primarily by three different regimes. There is a representation of fire regimes 1 thru 5, with fire regimes 1-3 accounting for 97% of the watershed's public lands. The public lands account for approximately 75,985 acres of the watershed. The entire watershed encompasses approximately 174,719 acres. The private lands in the watershed fall within fire regime I and fire regime II.

Dominant Fire Regimes in public lands of the Upper Joseph Creek Watershed

Fire Regime	**Acreage**	**Percent of Public Lands**
Fire Regime 1	33,094 acres	44%
Fire Regime 2	13,790 acres	19%
Fire Regime 3	25,276 acres	34%
Fire Regimes 1-3	72,160 acres	97%

Fire Regime Frequency and Severity

Fire Regime Group	Frequency (Fire return Interval) FRI	Fire Severity (Fire effects on the dominate vegetation)
I	0 – 35 year FRI	Low severity
II	0 – 35 year FRI	Stand replacement severity
III	35 – 100 + year FRI	Mixed severity
IV	35 – 100 + year FRI	Stand replacement severity
V	> 200 year FRI	Stand replacement severity

[1] This section prepared by Jenny Reinheardt, USFS Natural Fuels Specialist; edited by Nils Christoffersen, Wallowa Resources.

Each fire regime has three condition classes that have been developed to categorize the current ecological condition as defined in terms of departure from the historic fire regime. As the condition class number increases a greater deviation is indicated with the associated greater risk of the loss of key biological elements found within the system (Wallowa-Whitman Fire Management Plan, 2002).

When the condition class is combined with the fire regime it provides an indication of the current conditions across the watershed. 68% (51,670 acres) of the public lands within the watershed have been *significantly* altered from their typical fire regimes (condition class 3). 91% (68,082 acres) have been moderately or significantly altered (condition classes 2 and 3).

The fire regime and condition class for the UJCW were derived from field evaluations. Based on the down fuels and stand condition the information was then compared to the representative data describing each condition class listed in the Fire Management Plan for the Wallowa Whitman National Forest. The most common regime and condition class is fire regime 1 and condition class 3 (33% of public lands). This indicates that the frequency (fire return interval) is thought to be between 0-35 years with a low fire severity. The condition class is considered to be outside of the historical range and the risk of losing key ecosystem components is high (Wallowa-Whitman Fire Management Plan, 2002).

Condition Class and Fire Regime Relationships

Condition Class	Fire Regime
CC1	Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning with an historical range.
CC2	Fire Regime have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
CC3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

Fire Regimes and Condition Classes in Upper Joseph Creek Watershed

Regime and Condition Class	% of Public Lands
1-1	1%
1-2	11%
1-3	**33%**
2-1	6%
2-2	7%
2-3	**5%**
3-2	5%
3-3	**29%**
4-3	**1%**
5-1	2%

Disturbance Process

Forested Vegetation

Landscape dynamics in the interior west are controlled by a combination of site conditions (soils, elevation, aspect) and the timing and severity of disturbance. Fire was the dominant disturbance controlling the structure of forests of the interior west before the settlement era (Agee 1993, 1994; Smith 1983) and numerous studies have examined the effects of fire on stand composition and structure (reviewed by Keane et al. 1990)

Disturbance by fire within the Upper Joseph Watershed occurred at all elevations and in all stand types. Lightning was and still is the primary ignition source for fire disturbance (see fire history). In order for lightning to start a fire there must be adequate ground and standing fuels available for fire spread. When the fire burns it does so based on the several conditions, fuels being one of them. The impacts of the disturbance often varied depending on down fuel loadings, stand densities, slope, aspect, elevation, wind, and drought conditions for that particular time.

The disturbance process for the vegetation within the UJCW varies depending on the site conditions. Fire often maintained the mid-elevation mixed conifer stands by periodically consuming the understory and ground fuels. Under typical fire regimes, these stands would be dominated by more fire resistant species such as ponderosa pine, Douglas fir, and western larch. Fire severity would be mixed across these stands – with small openings of high mortality and larger areas of lower mortality. Fire often burned on the ground until contacting pockets of heavy down fuels and torching out pockets of trees. When fire did pass through these stands a mosaic frequently occurred on the landscape. Moderate severity fires typically contained the most diverse plant species.

Areas that experienced low severity ground fires were often the open stands of ponderosa pine or ponderosa pine & associate type stands. The result of low severity burning was a more open park like stand with the least amount of understory due to the frequent fires and limited seedling establishment.

Grasslands

Grasslands and large meadows are classed in fire regime 2. These areas experience fire every 0-35 years, and fire events are considered as stand replacement. Grassland areas and meadows often burned in conjunction with forest stands. Fires in these areas help maintain the meadows. Fire suppression is contributing to a transition of meadows to forested areas. Tree encroachment on meadows is impacting some meadow moisture tables. Shrublands and grasslands do experience all severity of burns.

Riparian areas

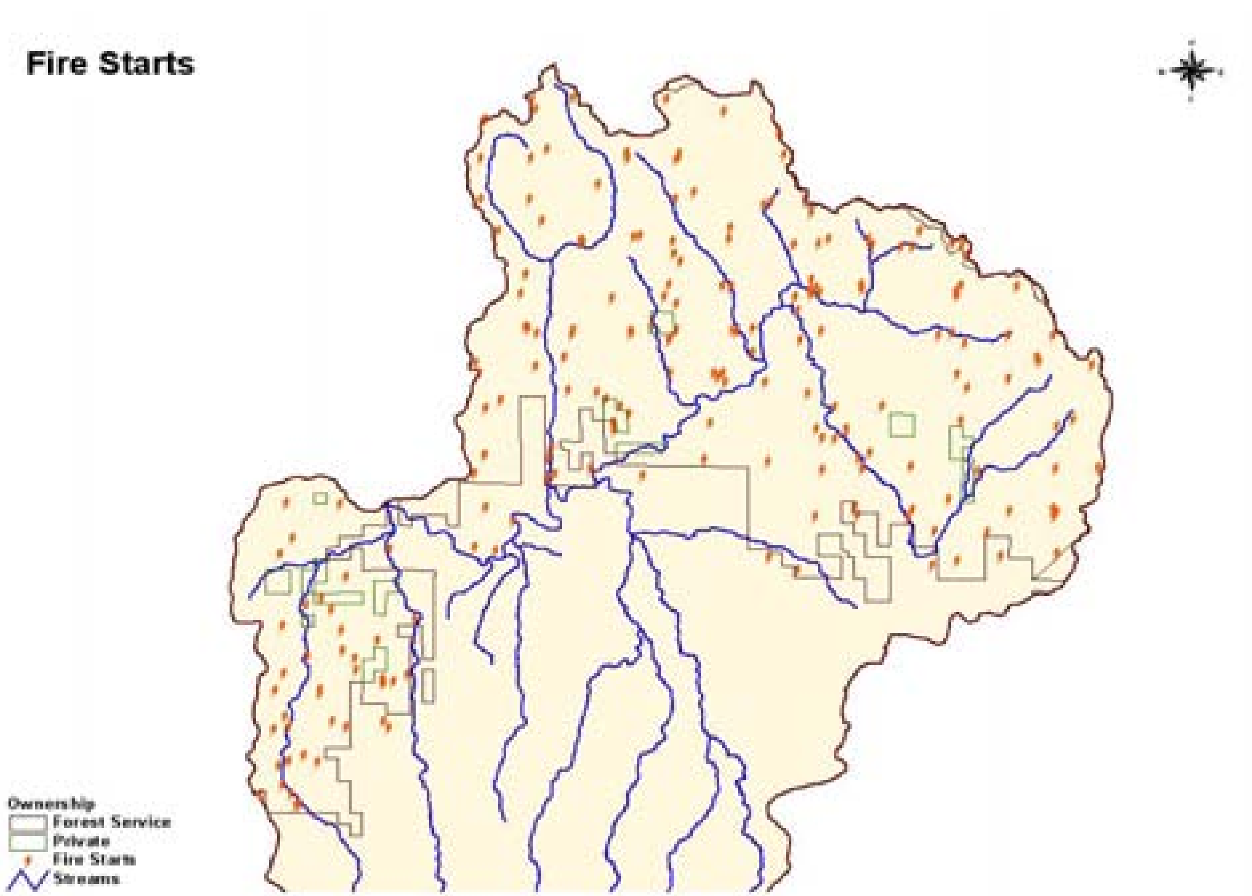
In the year 2000 Diana Olson completed her master thesis on *Fire in riparian zones: a comparison of historical fire occurrence in riparian and upslope forests in the Blue Mountains and southern Cascades of Oregon.* One of her study areas was on the Wallowa Whitman National Forest approximately 3 miles west of Baker City, Oregon. It is located on the northeast slope of the Elkhorn Mountains and it encompasses the lower portions of the Marble Creek watershed, extending northwest to the Mill Creek drainage and southeast to the Elk Creek drainage. (Diana L. Olson, 2000) This study is currently the closest study that has been done to compare upland and riparian forests.

Olson's study was separated into the following three different categories: stream size comparisons, forest type, and slope aspect comparison.

The study showed that overall the riparian fire return intervals in the Baker study area are longer than upslope fire return intervals. The variation in return intervals depended on the size of the riparian area. When both large and small streams are combined, the fire return intervals were 15 years for riparian and 11 years for upslope. The variation was smaller when large streams were isolated - their corresponding upslope fire return interval were 13 years in the riparian and 10 years upslope. Smaller stream riparian results showed higher variation - 17-year intervals for riparian areas in comparison to 10-year intervals for upslope.

Fire Starts

Fires within the Upper Joseph Watershed are quite frequent. The following map demonstrates the distribution of starts throughout the watershed. Fire starts are fairly evenly distributed with a few areas of minor concentrations. However, all areas of the watershed have experienced fire starts at some time. The points identified are those recorded with the Wallowa Whitman National Forest. They do not include any starts that may have occurred on private or state lands.



Between the years 1970 to 1999 the UJCW experienced a total of 209 fires, the largest being the Alder fire in 1994 reaching 5,700 acres. This equates to 7.2 fires per year over the 29 year period. Fires are a common occurrence in the watershed and will continue to be in the future.

Watershed Fire Statistics 1970-1999

Fire Size (acres)	Number of Starts
0 - 0.24	144
0.25 - 0.99	14
1 - 9.9	35
10 – 99.9	10
100 – 999.9	4
1000+	2

It is important to remember these fire sizes are not typical; aggressive fire suppression aided by the extensive road system in the watershed has minimized the size that fires would have reached.

Summary

Disturbance has played an important part in the ecological development within the Upper Joseph Watershed. Fire's interaction with the watershed is primarily influenced by the elevation, slope, aspect, and seasonal weather conditions at the time. Fire severity was apparent at all levels from low, moderate and high. Conditions within the watershed have changed since the aggressive suppression of wildfires.

Analysis of Fire Occurrence

Overview

The fire frequency for the Wallowa Fire Zone (Wallowa Ranger District, Eagle Cap Ranger District, and Hells Canyon National Recreation Area) and the UJCW is based on the fire occurrence records from 1970-1999. The Wallowa Fire Zone over the past 30 years experienced 1860 fires or an average of 62 fires per year.

In comparison, the UJCW recorded 209 fires over the same time period for an average of 7.2 fires per year. The watershed receives 11 % of the districts fires and encompasses only 5 percent of the districts land mass.

The present day fire occurrence rate (FOR) would be:

Wallowa Fire Zone

1860 fires / 30 years = 62 fires per year

62 fires per year / 1403(000) acre district = .044 fires per 1000 acres per year

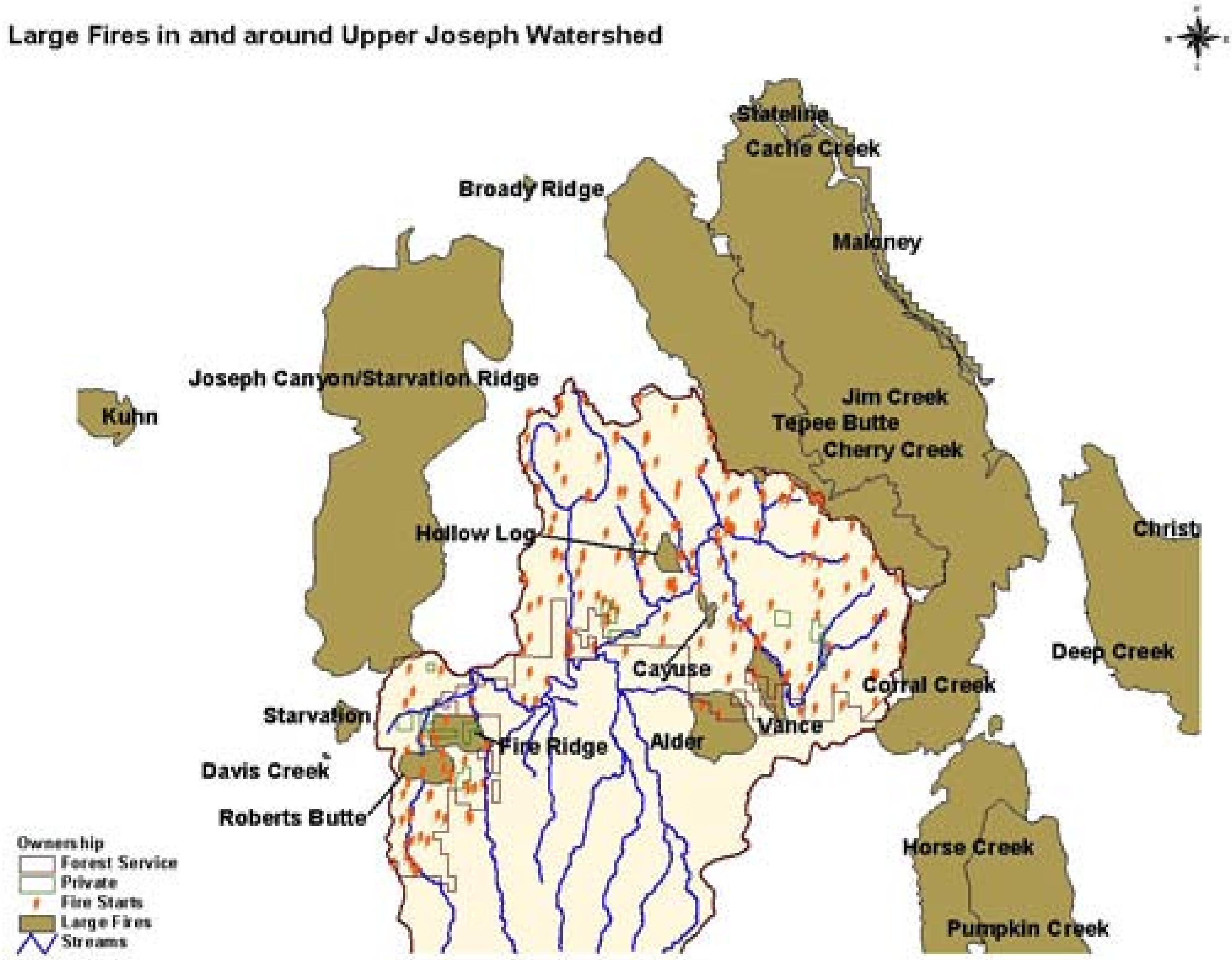
Upper Joseph Creek Watershed

209 fires / 30 years = 7.2 fires per year

7.2 fires per year / 74.5(000) acre watershed = .096 fires per 1000 acres per year

The fire occurrence rate for the Upper Joseph Creek is equivalent to a fire occurring on each 1000-acre block over an 11-year period. The probability of all fires remaining small (<1000 acres) in this 11-year time frame is very low. There is a 33% chance that at least one fire and a 25% chance that two fires in this time frame will exceed 1000 acres (PROBACRE computer program).

Large fires occurring in the vicinity of the UJCW have reached up to 59,860 acres (Teepee Butte Fire, 1988) and 40,163 acres (Joseph Canyon/Starvation Ridge Fire, 1986). Large fires within the UJCW have remained relatively small over the last 30 years, with the exception of the Alder Fire (5,700 acres) and the Roberts Butte Fire (1,040 acres). Other fires between 100 and 1000 acres have also occurred within the watershed. The following map shows the large fires in and near the Upper Joseph Watershed as well as all starts that were suppressed.



A significant area adjacent to and surrounding the watershed has experienced fire disturbance over the past 29 years, some areas being disturbed more than once. Large portions of the surrounding fires are in roadless areas or areas of limited access. The UJCW currently has a high level of access, however, with increased road closure fire size will likely increase. Some areas within the watershed have already received prescribed burning treatments in an effort to mimic natural disturbance.

Probability Analysis

The fire occurrence records for the 1970-1999 time period provided input data for the PROBACRE: A Model for Computing Aggregate Burned Acreage Probabilities for Wildfire Risk Analysis. The data is based on the current number of fire starts and acreage over a specific time period. The significance of the data is the outcomes are based on input data obtained while utilizing suppression techniques on most starts. PROBACRE takes into account the actual frequency of fires over a given period. The outputs then distribute a 100% probability of a fire in a given size class over 6 ranges of fire counts. The ranges of fire counts are: No fires, 1 fire, 2 fires, 3 fires, 4 fires, >4 fires. When the >4 fires has a probability of 80% it can be assumed that the remaining 20% is distributed amongst the other ranges. That is not to say that the other ranges have less than an 80% chance of occurring, when in fact the lower ranges have a higher than 80% chance of fires occurring because there are fewer fires in the range.

Key data input include frequency at which fires in various size classes occurred. This information is used to obtain the output of the probability of a fire occurring over a specified period of time. The size classes were based on fire sizes that occurred since 1970 in the Upper Joseph Watershed.

Watershed Fire Statistics 1970-1999

Fire Size (acres)	Number of Starts
0 - 0.24	144
0.25 - 0.99	14
1 - 9.9	35
10 – 99.9	10
100 – 999.9	4
1000+	2

Fire records shows that over the past 30 years four fires burned between 100 and 999 acres and two fires burned more than 1000 acres. According to PROBACRE outputs there is a 76% probability of at least two "100 to 999 acre" fires occurring over a 20-year period.

The fire statistics used are based on years in which fire suppression has been the primary fire policy; suppression is successful on 98% of all fires. This results in a lower probability outcome prediction due to the lower frequency of large fires. If fire suppression response was relaxed through a change in policy, the frequency of large fire sizes would likely be higher, and there would be a higher probability of more acres burning.

PROBACRE RESULTS FOR SMALL FIRES

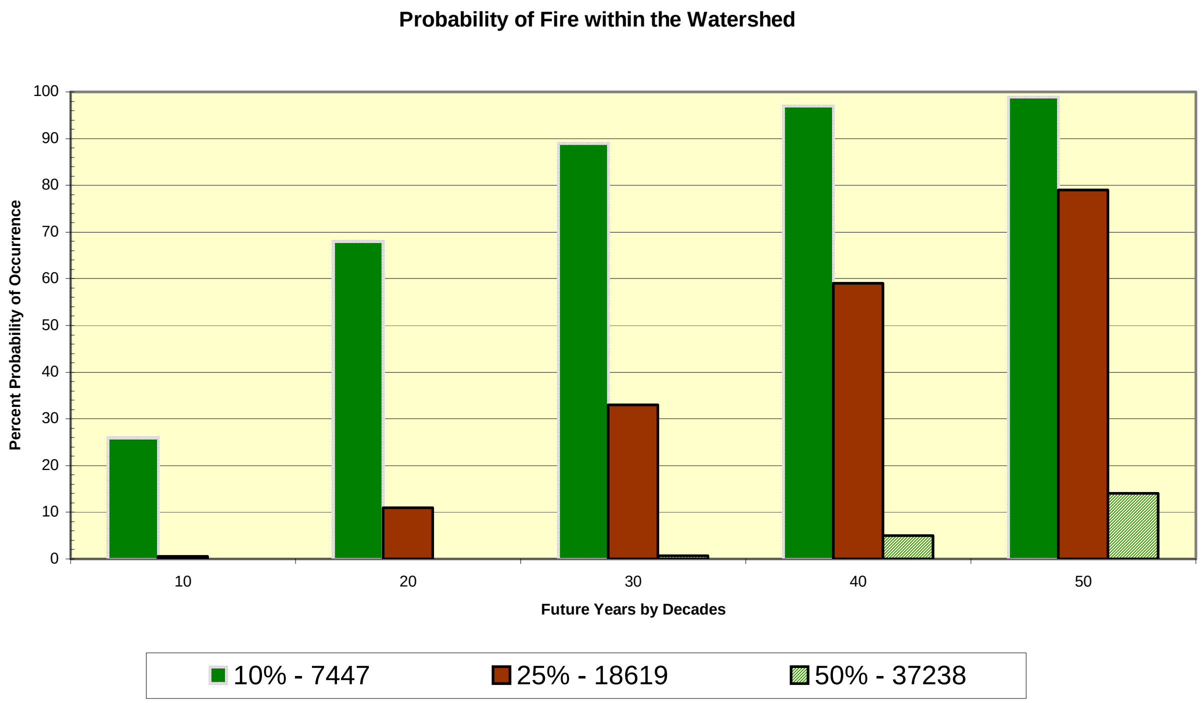
Size Class In acres	10 Years		20 Years		30 Years		40 Years		50 Years	
	>2 fires	>4 fires	>2 fires	>4 fires	>2 fires	>4 fires	>2 fires	>4 fires	>2 fires	>4fires
1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1-9.99	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
10-99.9	76%	26%	98%	81%	100%	98%	100%	100%	100%	100%
100-999.9	35%	1%	76%	14%	93%	40%	98%	65%	100%	88%
1000 **+**	15%	.07%	40%	1%	62%	6%	76%	15%	86%	26%

The PROBACRE output indicates that in a ten year period there is a 35% probability that *two* fires between 100 and 1000 acres will occur somewhere within the watershed boundary. In the next 40 years there is a 65% probability that *four* fires between 100 and 1000 acres will occur. Fires within the watershed will occur with or without fire suppression; acres burned are limited due to suppression. The probability of a large fire increases with time.

Long range probabilities were derived using the same prediction model. Predictions were based on a percentage of the watershed burning within a given time period. Period of years were calculated at intervals of 10 or on a decade basis. The following table displays long range burned acreage thresholds used as inputs for large fires.

PERCENT OF WATERSHED BURNED	PERCENT CONVERTED TO ACRES
10%	7,447
25%	18,619
50%	37,238

The probability of these percentages burning on a per decade basis is displayed in the graph below.



The total acres are an aggregate over a given length of time. The probability that 10 percent of the watershed will burn within 50 years is 99%. This number is significant in that there has not been an aggregate of acres burned within the watershed at this proportion in the past 50 years. The probability of 25% of the watershed burning over a 30-year period is 33%.

The probability analysis is based entirely on number of fire start over a period of time. It is important to remember that it does not take into consideration at what intensity these fires have burned.

Important considerations not taken into account in the prediction model are:

1) The intensity at which each fire burns.
2) The current fuels and stand conditions.

3) The watershed analysis area has already missed one or more fire intervals.

Fires in the UJCW have and will continue to occur. Size of fires will be dependent on the conditions on the ground, weather and the availability of initial attack resources. Probability estimates and existing conditions within the watershed make it likely that a large fire will occur in the near future. Identifying areas of concern and recognizing the potential for those areas will be important in making management decisions.

Fuel Models

Overview
Fuel model descriptions are based on Anderson's *Aids to Determining Fuel Models For Estimating Fire Behavior.* These fuel models are broken into four distinct fuel groups. They consist of grass and grass-dominated, chaparral and shrub field, timber litter, and slash. Each of these fuel groups are subdivided into three or four fuels descriptions.

Reference Condition Fuel Models
Information for the reference condition fuel models is limited. Some assumptions can be made based on historical types of fire regimes and condition classes that existed in the watershed.

The assumptions are:
1) Based on historical photography and documentation, fires burned at random throughout the watershed, therefore maintaining fuels loadings consistent with a condition class 1.
2) South and west aspects were drier and generally had a lower fuel accumulation than north and east aspects.
3) Fire regimes I and II have a fire return interval of 0 – 35 years preventing increases in fuel loadings.
4) Fire regime III had a slightly higher fuel load and occasional concentrations of heavy fuels.
5) Fuel models 1 were open grass meadows.
6) Fuel model 2 was primarily the low and mid elevation ponderosa pine grass stands.
7) Late and mid seral stands were comprised of fuel models 2, 8 or 10.

Fuel models for the reference period consisted primarily of fuel models 1, 2, 8 and 10 which fall into the grass and timber fuel models.

Fuel Model Descriptions
The following fuel model descriptions are relevant to both current and historic fuel models.

Fuel model 1 often burned with high intensities however the residence time of the flame was short through the grass. This fuel model is comprised of grasslands and savannas along with stubble, grass-tundra, and grass-shrub combinations. Fires in fuel model 1 are surface fires, spread rapidly and are the primary carrier for fire spread from stand to stand where meadows existed.

Fuel model 2 is primarily made up of fine herbaceous fuels, litter, and dead downed wood from the shrub and timber overstory. This fuel model can often be found in the open ponderosa pine stands that support a brush and grass component on the ground. Fires in this fuel model will have lower spread rates than in fuel model 1 and have a low residence time for fires. Fires often travel through the brush and grass under the pine stands leaving the stands intact. Where concentrations of down fuels occur higher intensities may be generated.

Fuel model 5 is made up of litter cast by shrubs, forbs and grasses. Surface fuel loads are light and fires are generally not very intense as a result. The shrubs in fuel model 5 are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Because of the amount of live fuels and low down fuel loadings, fire spread in this brush fuel model is the lowest of all the brush models. This fuel model is not identified under the current conditions although there may be small patches that exist within the watershed.

Fuel model 8 fuel loading is low in all size class material. Fire behavior within the fuel model 8 for the reference condition was slow burning ground fires with low flame lengths (low intensity). The fire may encounter an occasional “jackpot” of heavy fuel contributing to a periodic flare up and torching of a single or an individual clump of trees. The fuels in the less than 3” size class were light in tons per acre and played a significant role in providing a low intensity burn. Fuel model 8 was most predominant in areas that supported frequent fires. Fuels accumulation was kept in check by periodic fire disturbance. This is not to say that a fire burned through all fuel model 8’s with every occurrence. Once the fuel levels reach a loading to support fire spread, the fire would creep through the ground litter. Fire spread occurred until the fuel loading became too light to sustain fire or the fire would burn into a fuel model 10 causing increased fire spread and intensity.

Fuel model 10 commonly burned in the surface and ground fuels with greater fire intensity than the other timber litter models. The dead-down fuels include greater quantities of 0 to 3” and greater than 3-inch material. Larger limb wood resulted from over maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees is more frequent. Once these areas burned, one of two trends would occur depending on the severity. High intensity burns would convert stands to an early seral stage, where low-moderate intensity burns changed to meet fuel model 8 specifications due to a reduction in fuel loading.

It is important to remember that fuel models do not cover the entire area in a huge continuous block. These fuel models were often intertwined throughout the watershed allowing for natural broken burn patterns.

Current Condition Fuel Models

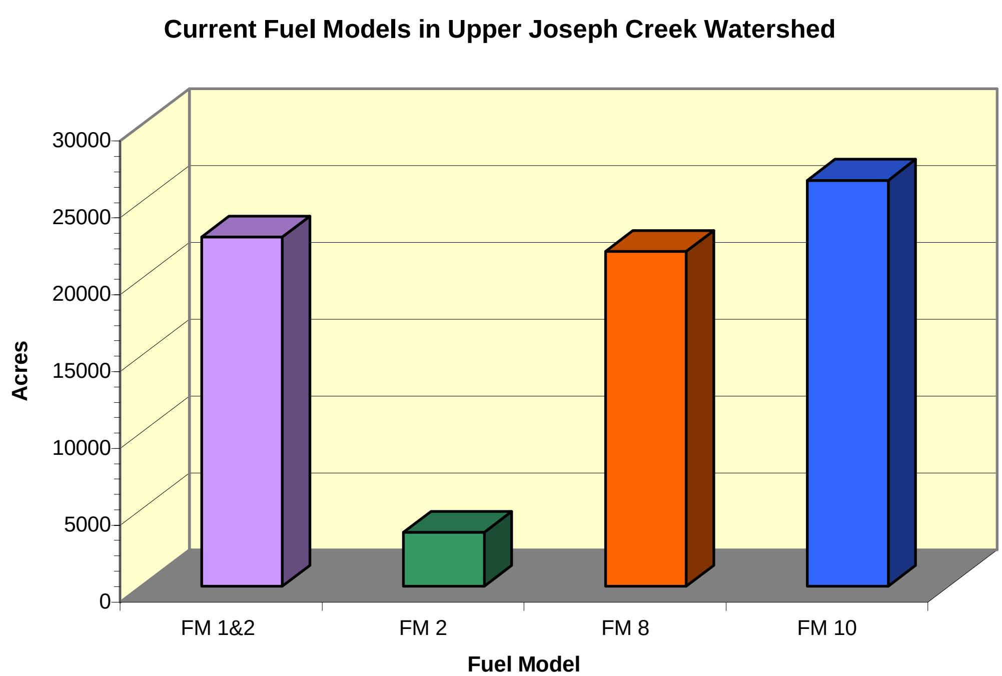
Fuel models present in the watershed today are primarily due to some harvest activity and a long history of successful fire suppression.

Fuel model 1 has decreased in upper elevation sites where suppression has allowed stands to encroach on upland meadows and grasslands.

Many areas that historically supported fuel model 8 have either been converted to a fuel model 1 through timber harvest or they have taken on the characteristics of fuel model 10 due to fire exclusion and accumulation of additional fuels. Fuel model 8 was commonly found on sites where fires frequently occurred and where grass was present to carry fire under the canopies. The significance of this is:

1) Fuel model 8 is the primary supporter of the low intensity fires that existed in the reference condition.
2) Plant and stand composition has been altered with this reduction.
3) Plant and stand structure have a direct effect on wildlife.

Fire suppression has allowed fuel model 10 to continually increase in areas where historically a fuel model 8 existed. Fuel model 10 stands have also changed geographically from the reference condition. Fuel model 10's where present during the reference period, and still found today, have been compounded by additional fuels accumulation in all size classes. This is significant in that reference fuel model 10 would burn with a combination of low to high intensity. Today's fuel model 10 exhibits complete high-intensity type fires because of the continuous fuel bed and dense stands that was often broken in the past from small patches of fires on the landscape.



The above graph shows the current fuel models identified in the UJCW.
Based on the fire regimes and current condition classes it can be assumed that historically there were *more acres* of fuel models 2, 8, 9 and *less acres* of fuel model 10. Fuel model 1 and 2 are combined here due to the sparse timber stringers within the watershed that were calculated within the grass component.

Fuel model 2 and 8 historically covered more area. Currently mixed conifer and ponderosa pine stands support a dense understory and have had fire exclusion for more than one return interval resulting in heavier fuel loadings converting many of these stands to a fuel model 10.

Fire and Air Quality

Air Quality - Emission And Visibility

The Forest Service is required to comply with the provisions of the Clean Air Act as well as standards set by the Environmental Protection Agency and the Oregon State Smoke Management Plan. These policies are designed to maintain or improve air quality. A critical objective is the prevention of smoke accumulation in designated areas or areas sensitive to smoke.

When proposing prescribed burning at the project level it is important to address Air Quality issues. Numerous programs are available to identify potential impacts and expected levels of particulate matter to be release based on the type of treatment. In December 2001 the new edition of Smoke Management Guide for Prescribed and Wildland Fire was released. This is an excellent reference for addressing smoke management issues.

As of July 1997 the Environmental Protection Agency (EPA) revised the particulate matter standards. Particulate matter (PM) has been identified as an air pollutant. Particulate matter will be measured at PM-10 and PM-2.5 micron levels. The PM-10 and PM-2.5 health standards established by the EPA target small sized particulate matter (10 micrometers or smaller) that penetrates deep into the lungs.

Residual smoke from prescribed fire is a related concern. Large volumes of this smoke may drift downwind and into communities. Generally, residual smoke from prescribed fire has not been an issue to lower elevation communities. Nighttime down canyon winds are normally light, but may cause some smoke to settle in adjacent valleys. Tools are now available for managers to evaluate the emissions tradeoffs in respect to seasonality of the burn, expected tons per acre to be consumed, and emissions risks for a wildfire. Furthermore, the direction of smoke plume disbursement can be managed under controlled conditions. This is important for both the special protection zone and the designated areas.

In January 1992, Roger Ottmar a Pacific Northwest researcher, released a Fire and Environmental Research Application paper titled Immediate Fire Effects and Air Quality Tradeoffs. This study compares fuel consumption, site severity, and smoke pollutant production from various treatment types.

Visibility

Visibility relates to human perception of the environment and includes color, the contrast of viewed objects against the background sky, the clarity of the atmosphere, and psychological interpretation of the person viewing the scene. Visibility impairment is caused by the presence of particles and gases in the air that either absorb or scatter light. Even under the best conditions, there is some “natural” light scattering that occurs that limits visibility (Visibility Protection Plan for Class I Areas, OAR 340-200-0040, Section 5.2).

Sections 169A and 169B of the Clean Air Act contain requirements for states to protect and improve visibility in national parks and wilderness areas in the country. In 1977 Congress designated certain national parks and wilderness areas as "mandatory Class I federal areas", where visibility was identified as an important value. Currently in the United States there are 156 of these Class I areas, including 47 national parks, 108 wilderness areas, and one international park.
Oregon has 12 Class I areas, including the Eagle Cap Wilderness and the Hells Canyon National Recreation Area. The importance and value of Oregon's Class I areas lie not only in the intrinsic value of their beauty but also in their importance to tourism in Oregon. They are also valuable as a recreational resource for Oregon residents (Visibility Protection Plan for Class I Areas).

The Oregon Visibility Protection Plan provides guidance on times of year when burning should be prohibited to maintain the integrity of our area. Smoke management issues are important to address with the continued increase in prescribed and natural fires. It is recommended that smoke issues are addressed when planning at the project level.

The Oregon Visibility Protection Plan restricts prescribed burning from July 1 to September 15, that may impact Class I air sheds (Eagle Cap Wilderness and the Hells Canyon National Recreation Area). There has not been an intrusion into the Eagle Caps Wilderness or Hells Canyon National Recreation Area class I area due to prescribed fire activities since the class I areas were designated.

The closest areas of concern for smoke intrusions and effects are:

Class I
Eagle Cap Wilderness
Hells Canyon National Recreation Area

Special Protection Zone
La Grande 60 miles to the west.

Fire and Fuels Recommendations

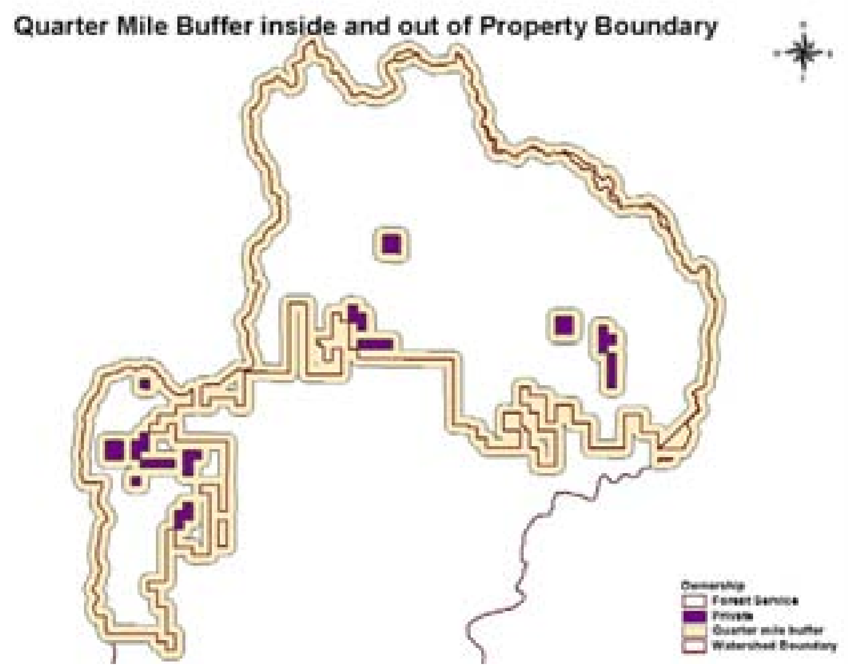
Key Considerations
Fire is an important regulatory tool in the forest communities of the UJCW. The suppression of fire has changed forests that were previously dominated by ponderosa pine, western larch, and Douglas fir. Surface fires selectively eliminated species such a grand fir because of their heat-sensitive bark. Thus, surface fires produced open stands, and served as a stocking regulator. Due to fire suppression, many forested areas have more trees per acre, more ground and ladder fuels, and an increased representation of fire-sensitive species. These conditions increase the risk of insect and disease-caused mortality and stand-replacing fire (Blue Mountains Forest Health Report, 1991).

Fire can be reintroduced to the ecosystem through both management-ignited fire and wildland fire use (prescribed natural ignitions). Today the wildland fire policy direction for the UJCW area is complete suppression. A wildland fire use plan, a revision of the Forest Land Management Plan (FMP), updates within the Fire Management Plan, and a complete burn plan will need to be accomplished prior to allowing wildland fire use. The Eagle Cap Wilderness and Hells Canyon Wilderness are the two areas that have current wildland fire use plans in place. Any wildfire will require an appropriate suppression response to minimize suppression costs and protect resources from damage, while ensuring public and firefighter safety. No wildland fires will be managed for resource benefits in the suppression zone until revision of the FMP for inclusion of a Fire Management Unit (Wallowa-Whitman National Forest Fire Management Plan, Chapter 37.00, January 1, 2002).

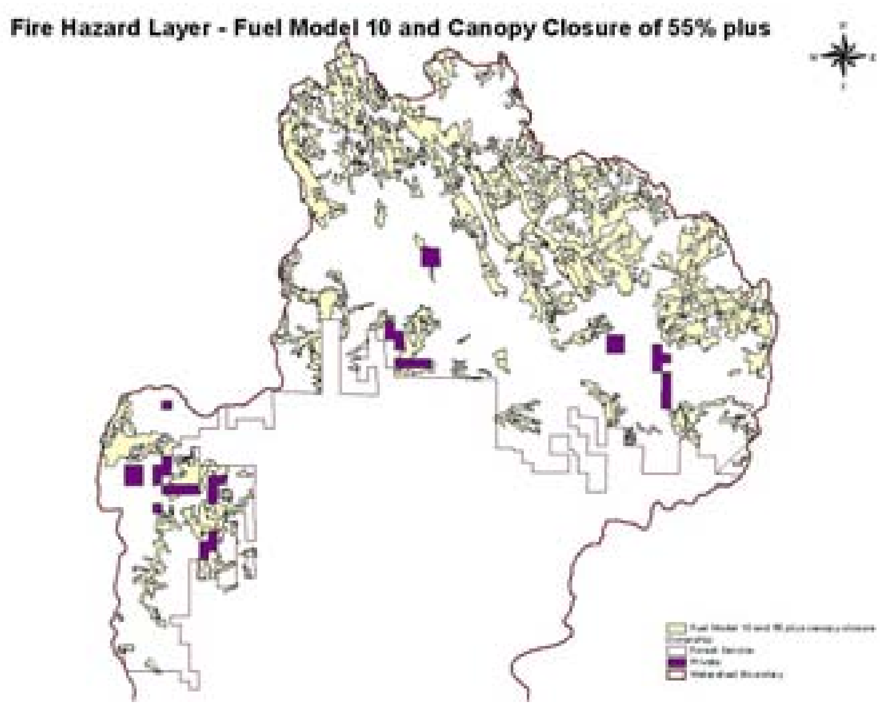
Management-ignited fires can occur in specific areas at specific times when conditions allow for some control over the intensity of the burn. Management-ignited fire can perform more characteristically as an underburn or a partial stand replacement burn depending on what is desired. The reintroduction of fire could help to stimulate fire-resistant plant species, selectively thin stands, reduce fuel loadings, and reduce the risk of large, extensive stand replacement fires (Blue Mountain Forest Health Report). These activities can provide benefits such as: an increase in biological diversity; improved vigor and vitality of plants and plant communities; and an increase in the early and mid seral plant species.

Prioritization of Areas
Although the entire UJCW merits attention from a fuels and fire perspective, identification of priority areas was established through a multi layered process. The determination of priority areas within the watershed was done with several criteria in mind. The following maps provide a sequence used to identify the *priority high-risk* areas.

The fire zone map displays the concentrations of fire starts that have occurred over the last 29 years. Each sphere is 1000 acres. Sphere colors represent number of starts within each 1000-acre zone, with yellow spheres representing one start in the 29 year time period, and red spheres representing five or more starts. The map provides a visual of how the fires were distributed throughout the watershed over time.

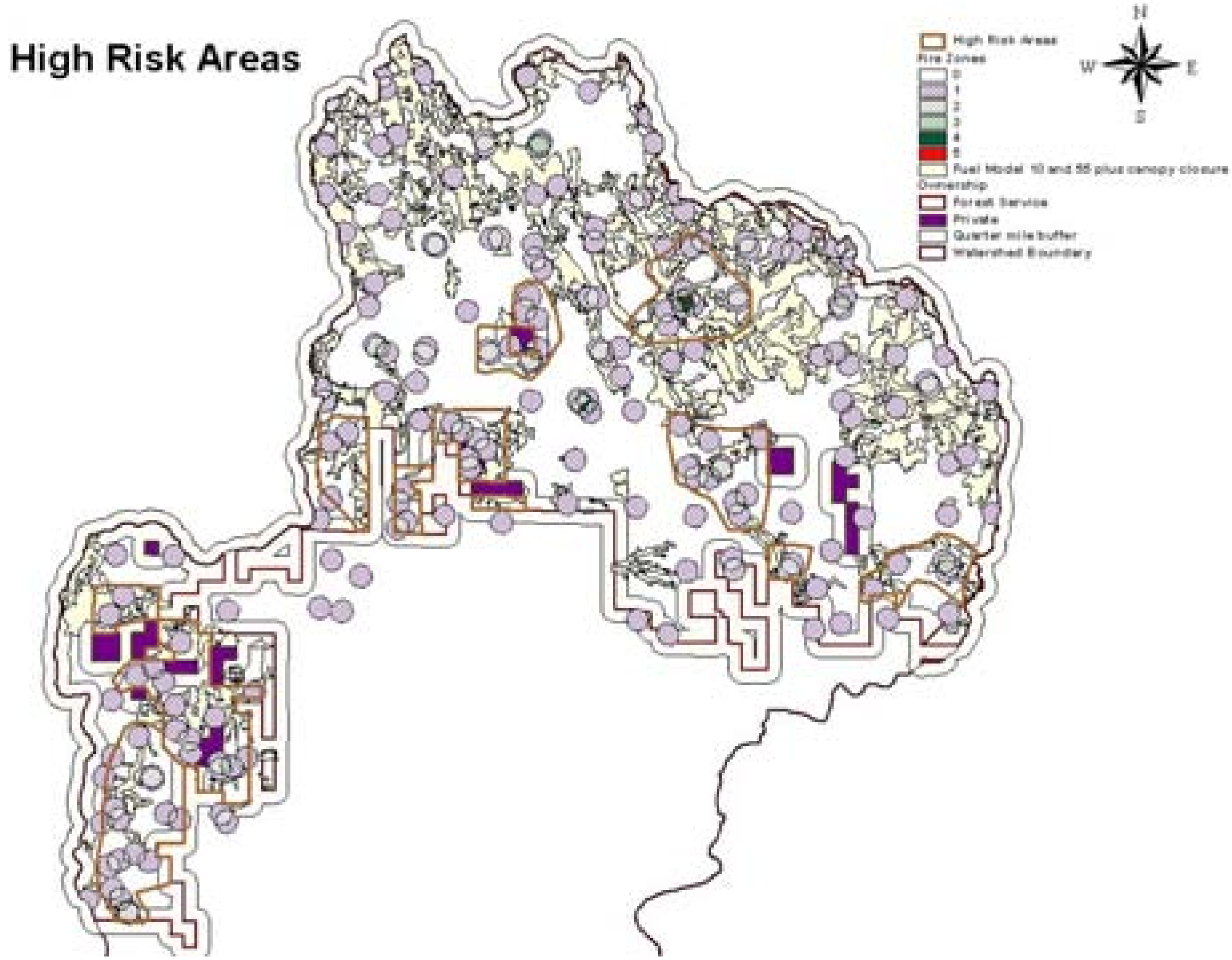


The Upper Joseph watershed is comprised of 98,734 acres of private properties of which 1,889 acres are distributed within larger public land blocks. The quarter mile buffer map above, highlights critical areas to protect private property or adjoining watersheds. The response time of suppression forces, fuel model fire behavior rates of spread, and typical late July early August weather were taken into account to determine the needed buffer distance.



The fire hazard map identifies areas with heavy fuel loadings (fuel model 10) and stands with canopy closure of greater than 55%. These areas have the greatest potential for high severity fires.

The *priority high-risk* fire areas were determined through a synthesis of all the previous maps. Priority Areas include areas with a history of numerous fire starts in close proximity to private land regardless of fuel loads, as well as areas with heavy fuel loads and high fire starts far from private properties. When all were taken into account the following map was developed showing the priority areas.



Recommendations
Many of the late seral and mature stands in the drier land areas tend towards a more even-aged structure and appearance. Stands in slightly moister areas will typically develop more complex structure. The following recommendations apply:

- Reduce fuels around private property interfaces.
- Utilize prescribed fire and/or mechanical treatment on a landscape scale in areas identified as high fire risk due to fuel loading and history of fire starts.
- For late seral stands that are fire dependent, establish a plan for periodic maintenance burns to keep fuels from re-accumulating to unnaturally high levels. When fuel loads exceed the ability to safely apply prescribed fire, first reduce fuel loads mechanically. Where logistically appropriate, include late seral stands that support fuel model 8 but are in a high fire frequency area.
- Prescribed fire and mechanical treatment should be used to reduce fuel levels, and thereby reduce the likelihood of future natural fires opening up large areas of potential seedbeds for non-native species.
- Use of prescribed fire in unique habitats should be considered as long as mitigation against increasing noxious weeds can be effective.
- Use of prescribed fire should be considered in designated old growth where stands historically supported fire tolerant species and are fire dependent to maintain their old growth structure.
- In stands that are overstocked and support heavy ladder fuels consider mechanical treatment to reduce the potential of entire stand loss.

Fire Suppression
Wildfire suppression strategies should recognize the role of fire in the ecosystem and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function. However, for the time being, fire will continue to be aggressively suppressed to avoid loss of timber, old growth, wildlife and fish habitat and late successional forests. Important components of suppression strategies will be to:

- Limit wildfire size and continue to minimize impact of suppression tactics according to the Wallowa-Whitman Forest Land and Resource Management Plan.
- Design suppression strategies, practices and activities to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in the ecosystem and identify instances where suppression activities could cause more damage than the fire itself. Utilize existing breaks and natural barriers.
- Locate incident bases, fire camps, helicopter-bases, staging areas, and other facilities outside of riparian reserves, moist meadows and unique habitats.
- Develop mechanized equipment guidelines. This would involve mapping sensitive areas such as steep ground, high geo-hazard areas, and riparian reserves. Include alternative line construction methods in these guidelines.

- Include 1/8" mesh for pump intake, absorbent kits, and spill containment materials in district pump kits and initial attack engines.
- Identify least toxic water additives for utilization and minimize delivery of chemical retardants to surface waters. An exception would be situations where overriding and immediate human life safety concerns exist.
- Utilize existing roads and facilities to support fire suppression activities. (e.g. helicopter spots, sumps)
- Include a qualified Resource Advisor as a position filled when initial attack block cards dictate the need, or fire location is threatening resource habitat or site. This person should be familiar with the area, its resource values, and have a thorough knowledge of the standards and guidelines in the Forest Land Management Plan.
- Develop monitoring protocol and attempt to establish monitoring on a minimum of 3 to 5 percent of units or treatment areas within a project. Monitoring should be based on both present and long term needs. Multi-discipline monitor sites are encouraged in meeting cost effectiveness and interdisciplinary goals.
- Implementation of suppression strategies should follow the Fire Suppression Direction located in the Wallowa-Whitman National Forest Fire Management Plan – Chapter 43.01 and 43.01.02.

Regardless of whether fire activities are undertaken for wildfire suppression, wildfire hazard reduction, or for prescribed fire applications, it is critical that the safety of fire fighting personnel and the public are not compromised.

Rangeland Condition Assessment

Introduction

This assessment of rangeland vegetation and condition was part of the multi-party collaboration that occurred through the Wallowa County Community Planning Process to assess watershed condition in the Upper Joseph Creek Watershed (UJCW). Representatives[1] from Wallowa Resources, US Forest Service, The Nature Conservancy, Nez Perce Tribe, OSU Extension, the International Center for the Advancement of Pastoral Systems, Natural Resources Conservation Service and local landowners directed the assessment to include:

A. *Vegetation Classification*
Classified vegetation to plant community and seral stage by sampling and analyzing grass and forest steppe rangeland on private and USFS ground in the UJCW and on similar rangeland in an adjacent watershed.[2]

B. *Range Mapping Research*
Historical methods of range mapping were very accurate but, most often, time consuming and limited in scale. We evaluated the efficacy of using high-resolution satellite imagery and statistical analysis in combination with range inventory data and local knowledge to create a watershed scale range map for identifying plant community and seral stage. We hope that this process will be a learning tool or potential model for other rangeland mapping efforts.

C. *Input from Permittees/Private Landowners*
Sought input from private landowners and permittees in the UJCW to capture local knowledge and management experience.

The above activities will aid in developing recommendations for sustaining and/or improving biological, ecological, economic, and land-use values of the UJCW; improving the capacity of cooperators to identify pertinent issues affecting the watershed; and to implement improvements, manage, and monitor the UJCW in the future.

[1] Participants in the Rangeland Working Group are listed in *Appendix 2: Participants.*

[2] For detailed information, see *Appendix 8: Rangeland Relationships in the Upper Joseph Creek Watershed (Sheehy & Hale, 2004).*

Results[3]

A. Vegetation Classification

Evaluation of field site measurements obtained during the summer of 2002 indicated that most grass steppe plant communities in the UJCW were represented by multiple seral stages (Johnson and Simon, 1987) (Table V-1).

Table VI-1. Seral stage of vegetation in the Upper Joseph Creek Watershed as indicated by field site evaluation (% of total).

	Idaho Fescue Series	Bluebunch Wheatgrass Series	Scabland Series	Shrub Series	Oldfield Communities	Meadow Communities	Annual Grass Communities
V. Early	23	0	4.2	10	100	0	100
Early	18.2	14.3	44.6	40	0	88.9	0
Mid	40.5	71.4	37.5	50	0	11.1	0
Late	18.2	14.3	13.4	0	0	0	0

Idaho Fescue and Bluebunch Wheatgrass series dominate rangeland in the UJCW. Observations include:

- Vegetation in the majority of field sites in these plant communities was in mid or late seral stages.
- The majority of sites in the Idaho Fescue series in the very early seral stage are Kentucky Bluegrass or Wyeth's Buckwheat disclimax communities.
- Nearly 45% of the Scabland series sites were early seral, however, the mid and late seral stages together exceed 50%.
- Among sites measured in shrub communities, the majority of sites had vegetation in early and mid seral stages.

B. Range Mapping Research

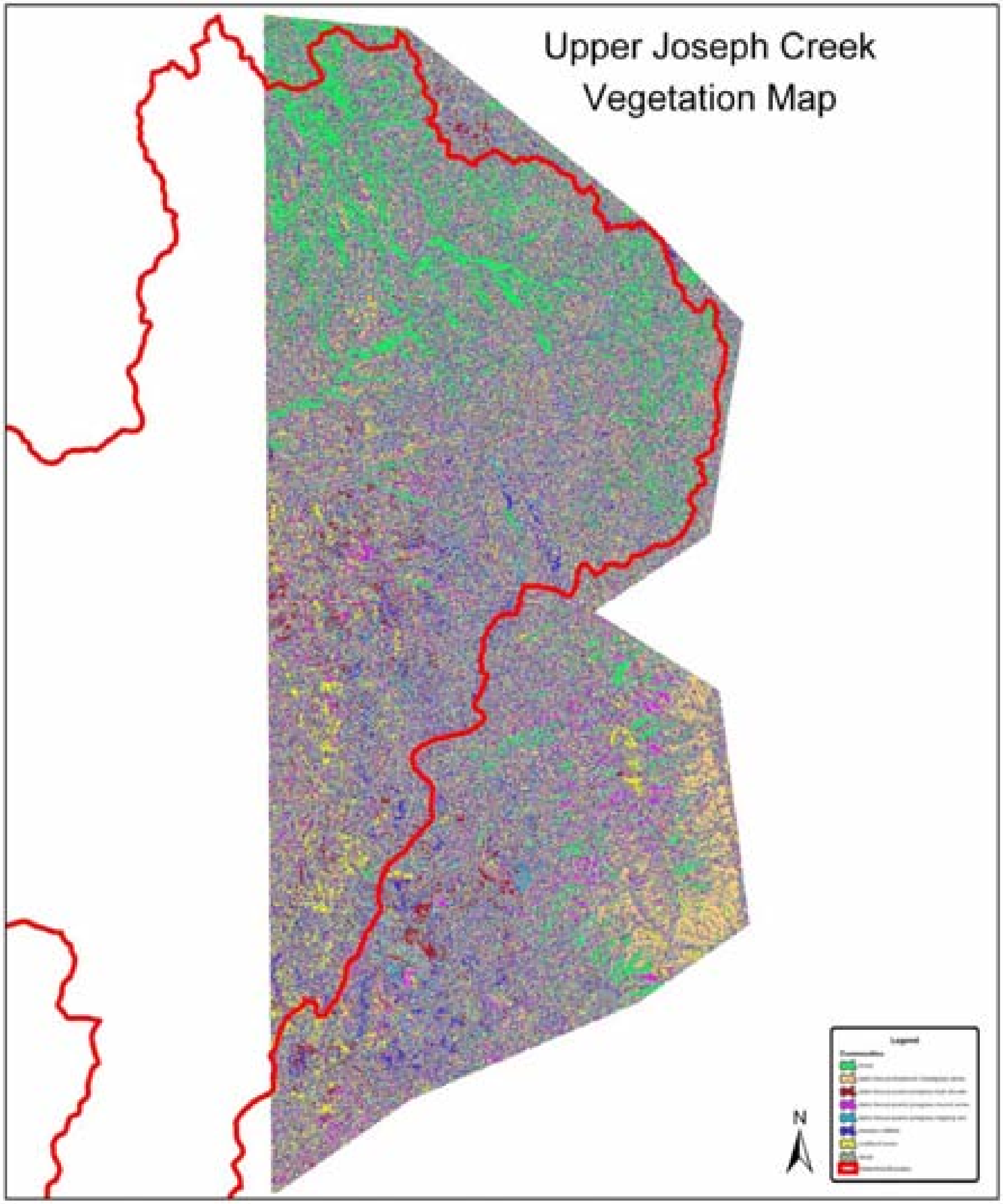
The final output from spatial classification of vegetation and ground surface attributes of the UJCW will be a vegetation map at 1:100,000 scale resolution (Figure V- 1). Mapping units of the vegetation maps will be plant communities (Level II) and seral stages (Level I). The Level II vegetation map output will only spatially define plant communities and will be accessible to the general public. The Level I vegetation map output will spatially define plant communities and seral stages within plant communities. Level I vegetation maps of privately owned rangeland in the UJCW will only be available to the landowner.

To assess initial mapping unit accuracy, a ground-truth survey to validate the computer map was conducted during late summer, 2003. Field data from ground-truthing were related to the mapping units from the satellite image and a table of comparison values was created. Generally, it appeared that the mapping units correlate with what was found on the ground. While a more thorough accuracy assessment and further field verification will need to be completed in the future, the range group generally agreed that with on the ground interpretation by knowledgeable range professionals, the map can be used to identify open water, forests/shrubs/grass, landscape level vegetation patterns, moisture/soil gradients, areas of very high annual grass cover, and plant community/seral

[3] See Appendix 8 (Sheehy & Hale, 2004) for methodology and specific results.

stage. The map maybe useful to identify old fields and deep soil areas, predict plant cover and erodability, or combine with other information/analyses (e.g., trend). The map cannot be used to identify vegetation at a small scale or noxious species at a fine scale.

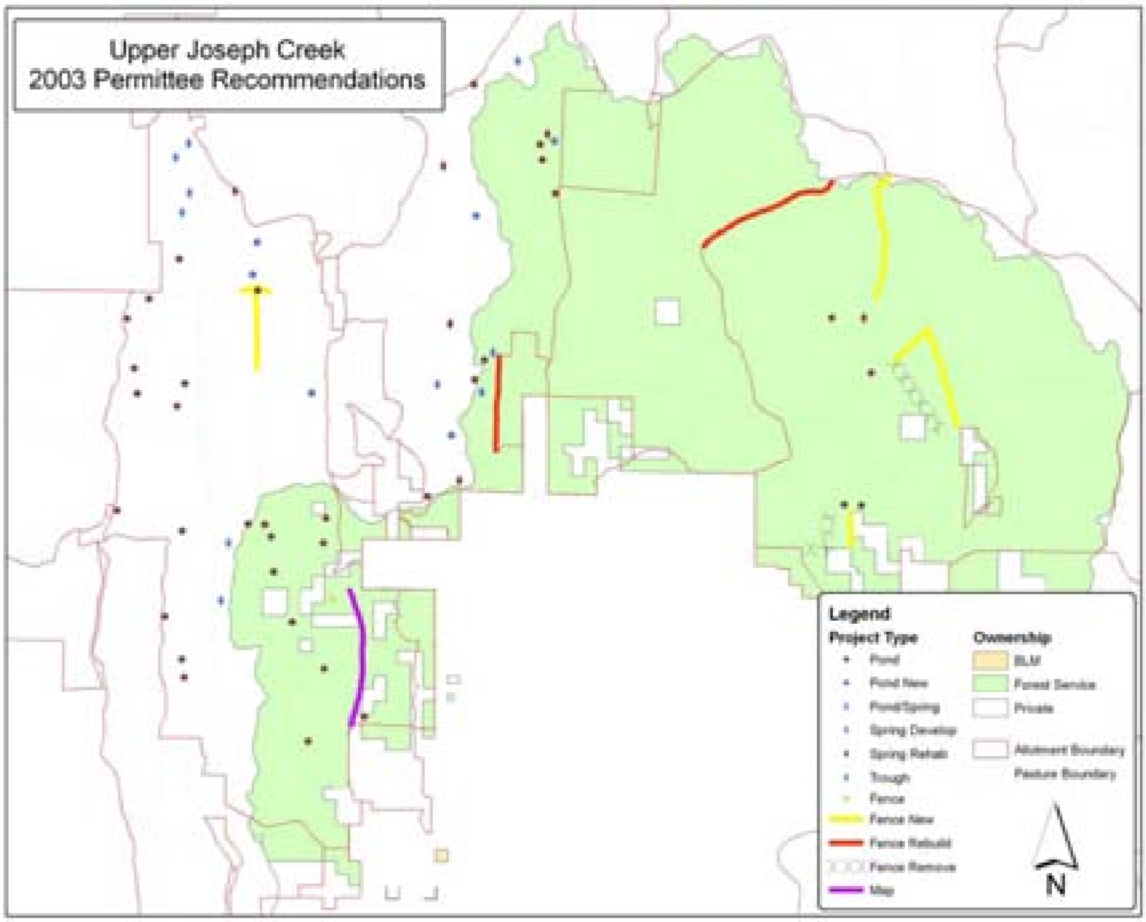
Figure V- 1. Illustration of Upper Joseph Creek Watershed Plant Communities (Level II) map



C. Permittee/Private Landowner Input

USFS allotment permittees[4] met in December 2003 to develop recommendations for range restoration improvements that would facilitate animal distribution, improve the availability of clean water, and improve rangeland conditions in the UJCW. Locations for those recommendations are illustrated in Figure V - 2. The recommendations are addressed specifically in the recommendations section with priority ratings 1-3, 1 being the most urgent.

Figure V - 2. Illustration of Upper Joseph Creek Watershed Permittee recommendations map.



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[4] Permittees/Allotments: Doug McDaniel (Cougar and Vigne), Rod Childers (Swamp), Tom Birkmaier (Cougar and Swamp), Scott McClaren (Swamp, Doe Creek, and Chesnimnus), Paul Yost (Cougar), Charles Bornstedt (Chesnimnus), and King Williams (Chesnimnus).

Recommendations

A. General recommendations

1. *Management considerations*

   The following are intended as general goals and tools to use for future management of public and private land in the UJCW:

   Goals and Rationale:

   - Maintain the social, economic and cultural values of livestock production –

     The rangeland group recognizes the economic, social, and cultural value associated with livestock production. Long-term stewardship by people with a vested interest in the ecological health and productivity of a place is essential.

   - Control noxious weeds –

     Noxious weeds compete with and can dominate previously healthy landscapes degrading their productivity, diversity, and viability. Integrated management should work to prevent, control, eradicate and reduce the potential spread of weeds.

   - Revegetation of early seral areas –

     These sites are particularly susceptible to noxious weed invasion and can be subject to higher rates of erosion than later seral stages. However, there is a normal and natural presence of very early and early seral stages that is within HRV and the resilient range for the landscape. Some early seral sites may, by nature, have low potential for revegetation. Where very early seral stages are the result of past and/or present management, or they are in areas subject to high risk of weed invasion, they should be revegetated with appropriate perennial vegetation for current management objectives. Sites should be evaluated on a site-by-site basis for causal factors, weed risk and appropriate revegetation species and potential. All early and very early seral sites should be closely monitored for noxious weed presence and treated accordingly.

   - Improve vegetative cover/condition of riparian area hot spots –

     In riparian areas identified as having been degraded of their ecological function by historic uses, utilization should be limited (by herding, barriers – Large Woody Debris, or fencing, change in the time of use, etc.) Condition could be enhanced by revegetation (e.g. grasses or shrubs) if appropriate. Sites should be evaluated on a site-by-site basis for causal factors and appropriate actions.

   - Upland water development and enhancement –

     Water sources are essential to dispersing livestock use patterns. Clean water sources also can improve wildlife habitat. Where possible, water sources should be developed in a manner that protects the sources and the associated vegetation. Sites should be evaluated considering cost, maintenance requirements, and use potential.

- Maintain and/or enhance native plant communities, T&E and S plant habitat –
  Grazing practices should, at minimum, maintain these goals and improve them where practical.

- Improve productivity of old-field sites –
  Old-field sites within the watershed are often weedy and/or dominated by single species of non-native grasses. These areas could be improved by the addition of other grasses and forbs to improve forage production and weed resistance. Old-fields have the potential to be used for intensive grazing areas that may allow for relieving grazing pressure from sensitive areas. These sites could also serve as areas to investigate methods of reestablishing native species.

- Improve and diversify forage opportunities –
  Management that expands current forage opportunities (e.g., thinning of overstocked forest stands) is encouraged because it provides livestock with a greater variety of options and can disperse usage. Potentially, increasing forage opportunities could allow for an increase in livestock numbers.

- Improve livestock distribution –
  The UJCW provides ample forage for wildlife species and domestic livestock. It is recognized that in specific areas/times livestock can cause damage to riparian and rangeland resources. These “hot spots” will be addressed by improving spatial and temporal distribution of cattle, fencing, or placement of woody debris, etc.

Tools:

- Weed treatment (including inventory, control, revegetation, and monitoring)
- Prescription fire
- Thinning in the timber zone
- Fencing and/or barriers (riparian and allotment)
- Off-stream water development
- Prescription grazing
- Revegetation
- Improved co-management of allotments (explore vacant allotment uses i.e., grass banks, reissuance of allotments)
- Alternatives to traditional management (e.g., pastoral grazing systems, altering season of use)
- Increase herding (riders)
- Livestock herding and behavioral conditioning
- Multi-species grazing
- Incidental take permits (allows grazing along riparian areas during spawning)

Table V - 2. Partial list of potential rangeland management tools in the Upper Joseph Creek Watershed.

Improvement Type	**Improvement Category**	**Potential Project Implementation**	**Implementation Factors**
Physical	Water Development	1. Spring and tank development and rehabilitation. 2. Riparian zone exclusion fencing. 3. Change stream dynamics in the riparian zone.	1. Implement during summer and fall seasons; periodic maintenance required. 2. Implement during summer and fall seasons; annual maintenance and periodic replacement of materials needed; costly; needs to address large wild herbivore use as well as livestock; creation of riparian pastures may be more cost and management efficient. 3. Implement during summer and fall seasons; stream placement of materials or planting of vegetation costly; periodic maintenance required;
	Fencing	1. Grazing management fencing including perimeter, cross fencing, and grazing system. 2. Exclosure & protection fencing.	1. Implement conceivably within a season but more likely implementation will extend over several years due to cost and time factors; annual maintenance needed. 2. Implement as needed prior to implementation of the project; costly; annual maintenance as needed.
	Seeding	1. Mechanical seeding degraded native range. 2. Mechanical reseeding depleted Oldfields and older rangeland seedings. 3. Site specific seedings (seed production exclosures, seed dispersal stations, experimental plots, broadcast seeding, etc.). 4. Mechanical interseeding.	1. Two-year exclusion from grazing to ensure stand establishment required; periodic reseeding required depending on seeded species and site; more intensive management required. 2. Two-year exclusion from grazing to ensure stand establishment required; periodic reseeding required depending on seeded species and site; protection required. 3. Exclusion from grazing needed; protection related to seeding objectives. 4. One year exclusion from grazing required; protection not required.
	Control of invasive species.	1. Herbicide & pesticide control of herbivore competitors and invasive species.	1. Expensive; control of invasive species requires multi-year application.
	Burning	1. Large-scale burning to increase forage quality and reduce potential for wildfire. 2. Small-scale burning at specific sites for specific purposes	1. Periodic application of treatment required; inherent danger of loosing control of fire; costly; negative and positive impacts not fully understood for grass steppe communities; grazing may achieve the same objectives. 2. Periodic application of treatment required; inherent danger of loosing control of fire; costly; negative and positive impacts not fully understood for grass steppe communities; grazing may achieve the same objectives.
Animal Management	Grazing management.	1. Herding & pastoral grazing strategies for direct control of livestock grazing. 2. Mixed species grazing for effective weed control. 3. Forage backgrounding to improve nutrient content for	1. Implementation is seasonal and annual; higher costs of production should be expected. 2. Herding and some pastoral strategies needed required; constraints on using some livestock breeds probable. 3. Herding and some pastoral strategies needed required; constraints on using some

Improvement Type	**Improvement Category**	**Potential Project Implementation**	**Implementation Factors**
		other species and during other seasons. 4. Implement grazing systems such as rest-rotation, deferred, and intensive.	livestock breeds probable. 4. Requires increased knowledge of plant-animal relationships; may require increased inputs of materials and/or labor; increased cost because of greater inputs of labor, materials and management.
	Change herbivore numbers	1. Ensure proper herbivore stocking rates. 2. Adjust herbivore stocking rates to fit seasonal and annual forage production. 3. Reduce, restrict, or eliminate herbivore grazers.	1. Both private and public rangeland in the UJCW are grazed relative to overt or implicit stocking rates; changing stocking rates can be difficult unless "slack" has been previously introduced to the livestock production system, i.e., forage banks, allotments grazed in alternate years, etc. The ability to graze CRP may offer slack (flexibility). 2. Difficult to accomplish for the same reasons as above, also because of contractual obligations and economic hardships to the producer. 3. Many non-livestock herbivores use both forest and grass steppe rangeland; reducing or eliminating livestock only may not facilitate rangeland improvement; may upset predator-prey relations or interfere with mutually beneficial interactions between animal and plant resources; should only be used in situations where the need is obvious to all stakeholders.
Indirect Enhancement	Rest	1. Seasonal and annual rest periods may enhance over-utilized rangeland. 2. Forage banks and alternate seasonal and annual use of pastures.	1. Requires increased management of large herbivores; knowledge of plant-animal relationships. 2. Requires creation of "slack" in the system; non-use of some pastures may concentrate use by all herbivores on used pastures by diminishing nutrient availability on rested pastures, i.e., elk may follow cattle because of forage backgrounding.
	Tree Harvest	1. Release of herbaceous understory vegetation providing forage enhanced by removing tree overstory.	1. High potential in forest steppe; sequential, planned tree harvest throughout the forest needed to ensure availability of herbaceous vegetation; should be used as a grazing management tool only in forest communities that have potential for significantly increasing growth of herbaceous understory vegetation.
	Grass banks	1. Grass banks can be used as alternate pastures to reduce grazing pressure during adverse environmental conditions or to allow improvements to be implemented on other rangeland pastures	1. Difficult to reduce stocking rate to create enough slack to permit grass banks unless created outside the current livestock production system; in the UJCW vacant allotments or TNC rangeland have potential to be used as grass banks.
	Fertilization	1. Fertilization of high yielding sites to increase forage production.	1. Requires a cost/benefit analysis; previous research indicates fertilization of native rangeland is not cost efficient; should be tested during Oldfield rehabilitation.

2. *USFS Mapping*

Upper Joseph Creek allotment/pasture maps need to be field verified and updated. For example, several ponds and springs are mapped in the wrong place, missing from the map, or show up when they no longer exist.

Table V - 3. Mapping recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Priority	Description
2	Cougar	Muddy	T3N R46E NW1/4 Sec07	3	remove spring from map
4	Cougar	Muddy	T3N R46E SE1/4 Sec07	3	remove trough from map
5	Cougar	Muddy	T3N R46E NW1/4 Sec18	3	remove trough from map
7	Cougar	Muddy	T3N R46E NW1/4 SE1/4 Sec07	3	remove pond from map
32	Swamp	Davis Creek	T3N R45E SE1/4 Sec13	3	remove pond from map
48	Swamp	Elk Creek	T2N R45E N1/2 Sec3	3	Elk/Dorrance pasture fence needs remapped
51	Swamp	Upper Swamp	T2N R45E SW1/4 NE1/4 Sec9	3	remove pond from map
52	Swamp	Upper Swamp	T2N R45E NW1/4 NE1/4 Sec9	3	remove pond from map
53	Swamp	Upper Swamp	T2N R45E NW1/4 NW1/4 Sec9	3	remove pond from map
54	Swamp	Upper Swamp	T3N R45E SE1/4 NW1/4 Sec31	3	remove pond from map
57	Chesnimnus			3	several ponds not shown on the map - many need cleaned
64	Chesnimnus	Poison	T3N R47E W1/2 NE1/4 Sec5	3	two ponds not shown end of Mitchell Ridge to ponds across creek off of Road

3. *Research/Analysis*
   - Analyze current satellite image to determine acres of each community type in the mapped area
   - Obtain satellite coverage (scale to be determined) of the west portion of the watershed, cross walk current reflectance values/communities to new the image and analyze for acreage across the watershed
   - Develop confidence levels for different scales of the vegetation map
   - Study the relationship of soil turnover by small rodents and community stability of Idaho Fescue mounds and communities in the Bluebunch Wheatgrass series
   - Consideration should be given to applied research initiatives to track succession of Oldfields towards native communities to determine potential for successfully restoring native communities.
   - Designing and implementing an improvement treatment should be considered with regard to potential impacts throughout the watershed, not just for the site at which the treatment will be implemented.
   - Research efficacy and economics of reseeding Oldfields with native grasses.
   - Work with the National Riparian Team to develop appropriate management and restoration goals and objectives with monitoring protocols.

4. *Proposed future consideration/emphasis area (to be field verified & defined)*

Table V- 4. Policy recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Project Type	Priority	Description	Notes
13	Vigne	Peavine	Policy	1	Policy change to allow Peavine pasture early grazing every 2nd year if possible - at least every third year	Right now not allowed in before July 1
68	Chesnimnus		Policy	3	New grazing plan: Poison to Sterling/Cayuse/Berland to Devils Run to S. Fork	Poison is better pasture for spring or fall grazing (fish issues) June or September; Cayuse/Sterling may not need reseeding if change rotation; cattle would utilize grass better in North Poison if it was spring pasture
72	Chesnimnus		Policy	3	Please close the gate signs	

- Implement improvements and management activities that maintain and improve the condition of meadow/riparian habitats. Creation of riparian pastures rather than riparian exclosures should be considered, and if exclusion fencing is selected, fence structure should consider exclusion of large wild herbivores as well as domestic livestock.

5. *Plant community improvements*

- Idaho Fescue-Prairie Junegrass (ridgetop)
  - Plant communities in very early and early seral stages unless dominated by Kentucky bluegrass should be considered for mechanical seeding of native bunchgrass plants.
  - As part of an UJCW management plan, deferment of livestock grazing to fall season grazing in alternate years should be considered.
  - Degraded sites should be identified and treated through grazing modification and seeding.

- Idaho Fescue-Prairie Junegrass (mounds)
  - Grazing mound communities before soil stabilizes should be avoided because of unstable soil stability characteristics.
  - Mounds are highly susceptible to churning caused by frost heaving and hoof action and grazing should be avoided during this period.

- Idaho Fescue-Prairie Junegrass (mounds-Kentucky Bluegrass disclimax)
  - Manage with other communities forming the Mound-Intermound complex.
  - Mounds dominated by Kentucky bluegrass can be grazed heavier than mounds dominated by native perennial grasses.

- Idaho Fescue-Prairie Junegrass (mounds-Wyeth's Buckwheat disclimax)
  - Manage with other communities forming the Mound-Intermound complex.

- Idaho Fescue-Prairie Junegrass (high elevation)
  - Manage this community similar to and with other steep sloped Idaho Fescue communities.

- Idaho Fescue-Bluebunch Wheatgrass (ridgetop)
  - Early season use by large herbivores should be avoided.
  - The community can be easily degraded by overgrazing.
  - Difficult to use fire in this community because of low vegetation cover.

- Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine
  - Community is suitable for livestock use but best for domestic sheep use.
  - Winter grazing by multiple large herbivores can damage plant community and promote weedy forbs.
  - Fire can damage perennial bunchgrasses and promote weedy forbs.

- Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox
  - Manage community in coordination with other steep sloped Idaho fescue communities in the Idaho fescue series.

- Common Snowberry/Idaho Fescue-Prairie Junegrass
  - Manage with Idaho Fescue-Prairie Junegrass (high elevation) steppe community

- Idaho Fescue-Timber Oatgrass-Sedge
  - Community should be managed in conjunction with dominate adjacent communities in the Idaho fescue series.

- Bluebunch Wheatgrass/Wyeth's Buckwheat
  - Manage to maintain Bluebunch Wheatgrass on the site.
  - Reduction of early season use may improve Bluebunch Wheatgrass and onion grass.

- Bluebunch Wheatgrass-Onespike Oatgrass
  - Management of the community should focus on importance of the community to large wild herbivores in spring because of southerly aspect.
  - Manage the community to maintain Bluebunch Wheatgrass.
  - Large herbivore use should be initiated after soils dry to avoid creating terracettes.
  - Use of the community by large herbivores should follow seed set.

- Bluebunch Wheatgrass-Sandberg's Bluegrass (basalt)
  - Management of the community should focus on proper grazing to sustain Bluebunch Wheatgrass.
  - Large herbivore grazing should end before boot stage and not resume until after flowering.

- Bluebunch Wheatgrass-Sandberg's Bluegrass (scabland)
  - Manage as a community associated with Idaho Fescue-Prairie Junegrass communities, especially the mound community.
  - Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.

- Stiff Sagebrush/Sandberg's Bluegrass
  - Manage as a community associated with Idaho Fescue-Prairie Junegrass communities, especially the Mound and Ridgetop communities.
  - Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.
  - Maintain Stiff Sagebrush as a component of the community because of the high value diversity potential of the shrub within the prairie habitat.

- Sandberg's Bluegrass-Onespike Oatgrass (scabland)
  - Manage as a community associated with Idaho Fescue-Prairie Junegrass communities, especially the Mound and Ridgetop communities.
  - Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.

- Douglas' Buckwheat/Sandberg's Bluegrass
  - Manage similar to other scabland communities.
  - Domestic livestock use should be timed to occur when soils are dry and flowering/seed set of Sandberg's bluegrass has occurred.

- Common Snowberry-Rose
  - Manage to maintain shrub stands but monitor (especially the Rose component) to prevent invasive tendencies of the shrubs.

- Mountain Snowberry
  - Manage to maintain current stands of mountain snowberry where they occur.
  - Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as "elk calving."
  - Manage to maintain the diversity offered by mountain snowberry.
  - Promote natural reseeding with existing vegetation.

- Ninebark-Common Snowberry
  - Manage to maintain current stands of Ninebark-Common snowberry where they occur.
  - Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as "elk calving."

- Oldfields
  - Reseeding Oldfields to best adapted introduced or native forage species should be part of a management plan for the UJCW.
  - Highly productive Oldfields should be used to reduce grazing pressure on native communities during implementation of native community improvement alternatives.

- Meadow/Riparian
  - Meadows and Riparian areas require coordinated management with upland grass steppe.
  - Management focus should be not only on protection/exclusion but also on shifting timing and density of large herbivore use.
  - Trials to establish deciduous woody growth forms to stabilize riparian areas and diversify habitat should be initiated.

- Annual Grass
  - Manage to increase establishment potential and sustainability of caespitose bunchgrasses in stands with high density of Cheatgrass and Ventenata.
  - Initiate applied research initiatives to study Ventenata to increase information about invasive potential and habit requirements.

B. Projects

1. *Proposed future projects (to be field verified & defined)*

- In forested areas of the watershed, developing a sequential program to open forest overstory canopies to allow optimal response of herbaceous understory vegetation should be considered.

- Weeds: prioritize and perform weed inventories and follow-up treatment.
- Improve capacity of Oldfields to produce forage. The rationale for this conclusion is: (1) Oldfields are, and will remain in a very early seral stage for an indefinite time period because of the past severe disturbance to soils and native vegetation; (2) insufficient information on methods and the time required to restore Oldfields to native bunchgrass communities currently exists, and (3) developing the capacity of Oldfields to produce quality forage for livestock and large wild herbivores can induce flexibility in livestock management and be used to reduce grazing pressure on native bunchgrass communities.

2. *Site specific*

Table V - 5. Fence project recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Priority	Description	Notes
12	Cougar	Muddy	T3N R46E Sec 7 & 18	1	fence on east side of Muddy Pasture needs rebuilt	Kooch Boundary Fence
24	Swamp	Snake Canyon/ Barney Flat	T3N R45E E1/2 E1/2 Sec 5& 8	1	new fence	Witch's Tit to Baker Knob and Ton Ridge to Rims (T-shape)
47	Swamp	Elk Creek	T2N R45E NW1/4 NE1/4 Sec3	3	fence off pond in Dorrance Pasture and gate so that it can be used in Elk as well	improve utilization in north end of Elk Pasture
61	Chesnimnus	Berland	T3N R47E SW1/4 NW1/4 Sec14, NW to NW1/4 SE1/4 Sec3, SW to NE1/4 NE1/4 Sec9	3	extend Berland fence to 4690 rd	Sterling/Cayuse/Berland is a spring pasture and too little for the same number of cattle that go into larger pasture later
62	Chesnimnus	Sterling/ Vance	T3N R47E eastern edge of sec29; from SW corner sec29 east 1/2 mile, north on 1/2 section line through section center 2/3 mile	3	extend Vance Knoll fence to Cayuse; remove corner between Sterling and Vance	
63	Chesnimnus	Cayuse/ Berland	T3N R47E NE1/4 SE1/4 Sec17; SE1/4 NW1/4 Sec21	3	gate water gaps to allow complete separation of Cayuse and Berland	
67	Chesnimnus	Poison	T4N R46E from SE1/4 SE1/4 Sec26 northeast to T4N R47E SW1/4 NE1/4 Sec20	3	Hollow Log to Poison Point Fence needs rebuilt	Mark suggests potentially changing fence location, and trading for grass elsewhere
69	Chesnimnus	Poison/ Devils Run	T4N R47E SW1/4 SE1/4 Sec33 north to SE1/4 NE1/4 Sec21	3	New fence from mouth of Summit Creek to 46 road	right now, just drift fences
90	Chesnimnus	Poison			add riparian pasture fence	site to be announced

Table V- 6. Pond project recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Site Name	Priority	Description	Notes
6	Cougar	Muddy	T3N R46E SE1/4 NE1/4 Sec07		3	fix and fence dike, clean	
9	Cougar	Muddy	T3N R46E SE1/4 Sec07		3	clean	
11	Cougar	Muddy	T3N R45E SE1/4 SE1/4Sec13		3	need pond built	
15	Vigne		T3N R46E NE1/4 Sec 17		3	Pond on private ground	follow up with Doug for clarification
16	Vigne		T3N R46E NE1/4 Sec20		3	Pond on private ground	follow up with Doug for clarification
22	Swamp	Lower Swamp	T4N R45E NE1/4 SE1/4 Sec 32	Rachel Pond	1	build pond	
23	Swamp	Baker Gulch	T4N R45E SE1/4 SE1/4 Sec29	Rachel Pond	1	build pond	very close to fence
25	Swamp	Barney Flat	T4N R45E SE1/4 SE1/4 Sec32		1	clean	possibly move if install fence between Snake Canyon and Barney Flat (Project ID #24)
26	Swamp	Lower Davis	T3N R45E NW1/4 SE1/4 Sec7		3	clean	on top of Starvation
27	Swamp	Lower Davis	T3N R45E SE1/4 NW1/4 Sec18		3	clean	on top of Starvation
28	Swamp	Lower Davis	T3N R45E NE1/4 Sec1		3	clean	
29	Swamp	Lower Davis	T3N R45E SW1/4 Sec12		3	clean	
30	Swamp	Lower Davis	T3N R45E SW1/4 Sec1		3	clean	
31	Swamp	Lower Davis	T3N R45E NW1/4 Sec13		3	clean	
33	Swamp	Davis Creek	T3N R45E NW1/4 Sec25	Chico Pond	3	clean	
34	Swamp	Davis Creek	T3N R45E SW1/4 Sec30		3	clean	
35	Swamp	Miller	T3N R45E NE1/4 NE1/4 Sec16	Trump Pond	3	develop new site	
36	Swamp	Beef	T3N R45E NW1/4 SE1/4 Sec29		3	clean	on fence between Beef and Little Elk Creek pastures
37	Swamp	Little Elk Creek	T3N R45E SW1/4 SW1/4 Sec28		3	clean	not shown on the map
38	Swamp	Little Elk Creek	T3N R45E NW1/4 SW1/4 Sec28	Frog Pond	3	clean	
39	Swamp	Little Elk Creek	T3N R45E NE1/4 SW1/4 Sec27		3	clean	
40	Swamp	Little Elk Creek	T3N R45E NW1/4 Sec34		3	fix breach	
41	Swamp	Elk Creek	T3N R45E NE1/4 NE1/4 Sec21	Two Track	1	clean	at Baker Corner; other ponds in

Project ID #	Allotment	Pasture	Location	Site Name	Priority	Description	Notes
							area may need cleaned that aren't on map
42	Swamp	Little Elk Creek	T2N R45E S1/2 Sec4		1	clean	clean ponds in potholes
43	Swamp	Dorrance	T2N R45E NW1/4 SW1/4 Sec14		3	clean	
44	Swamp	Bennett	T2N R45E E1/2 SW1/4 Sec7		3	clean	
45	Swamp	Bennett	T2N R45E SE1/4 NW1/4 Sec7		3	clean	wet spot, possibly a spring development
46	Swamp	Elk Creek	T2N R45E N1/2 SW1/4 Sec10	Black Snag Pond	1	clean	draw across from black snag
49	Swamp	Little Elk Creek	T3N R45E NW1/4 SW1/4 Sec33		1	clean	
50	Swamp	Red Fir	T4N R45E E1/2 NW1/4 Sec31		3	clean	
55	Swamp	Upper Swamp	T2N R45E NW1/4 SW1/4 Sec9	Moonshine Pond	3	clean	
58	Chesnimnus	Berland/ Poison	T3N R47E SE1/4 NW1/4 Sec9	Berland Reservoir	3	clean	
59	Chesnimnus	Cayuse	T3N R47E NW1/4 NW1/4 Sec28	Hilton Ridge	3	clean	
60	Chesnimnus	Cayuse	T3N R47E NE1/4 NE1/4 Sec29	Hilton Ridge	3	clean	
65	Chesnimnus	Poison	T3N R47E W1/2 NE1/4 Sec5		3	clean	
77	Cougar	Baldwin	T4N R46E NW1/4 NW1/4 Sec8		3	new pond or spring development	
78	Cougar	Baldwin	T4N R46E SE1/4 NW1/4 Sec7		3	enlarge and clean	include fence that would allow access from Hunting Camp & Baldwin Pasture
79	Cougar	Peavine	T4N R46E NW1/4 NE1/4 Sec20	S. Getchel Ridge Pond	3	clean and enlarge	
80	Cougar	Peavine	T4N R46E SW1/4 SE1/4 Sec17	N. Getchel Ridge Pond	3	clean and enlarge	
82	Cougar	Peavine	T4N R46E SE1/4 SE1/4 Sec17		3	need pond 1/4 mile southeast of Quirk Spring	
83	Cougar	Peavine	T4N R46E SE1/4 SE1/4 Sec20	Rock Pit Pond	1	clean out to make usable	
84	Cougar	Boner	T3N R46E NE1/4 NW1/4 Sec25		3	enlarge and clean	
86	Cougar	Cougar	T4N R46E SW1/4 NW1/4 Sec30		3	build new pond	

Table V- 7. Spring and trough project recommendations from Upper Joseph Creek Watershed permittees.

Project ID #	Allotment	Pasture	Location	Site Name	Priority	Description	Notes
1	Cougar	Muddy	T3N R45E SE1/4 Sec01		3	rehab spring	
3	Cougar	Muddy	T3N R46E SW1/4 Sec07	Joe Platz Springs	3	develop spring with trough	
8	Cougar	Muddy	T3N R45E SE1/4 Sec12		2	need water source found	
10	Cougar	Muddy	T3N R46E NE1/4 Sec07		2	need water source found	
17	Swamp	Buck	T4N R45E NE1/4 Sec19		3	develop spring with trough	
18	Swamp	Buck	T4N R45E NW1/4 Sec19		3	develop spring with trough	
19	Swamp	Buck	T4N R45E SE1/4 Sec19		3	develop spring with trough	on the line between Sec 19 & 30
20	Swamp	Buck	T4N R45E SE1/4 NW1/4 Sec30		3	develop spring with trough	
21	Swamp	Lower Swamp	T4N R45E SW1/4 SE1/4 Sec20		1	needs reconstruction	
66	Chesnimnus	Poison	T3N R47E SE 1/4 NW1/4 Sec4		3	west side of Mitchell	
70	Chesnimnus	Devils Run/South Fork			3	spring work in Devils Run/South Fork Chesnimnus (late grazing)	
75	Chesnimnus	Devils Run		Burnt Springs	3	rehab spring	
76	Chesnimnus	Devils Run			3	rehab spring at head of devils run	
81	Cougar	Peavine	T4N R46E NE1/4 SE1/4 Sec17	Quirk Spring	1	reconstruct	
85	Cougar	Boner	T3N R46E SE1/4 SE1/4 Sec24	Boner Spring	3	fenced off area needs to be cleaned of cattails	
87	Cougar	Cougar	T4N R46E		3	rehab spring	east of pond under Lone Spring Saddle
88	Swamp	Little Elk Creek	T3N R45E NW1/4 Sec5		1	find water sources & develop trough	new site
89	Swamp	Little Elk Creek	T3N R45E NW1/4 Sec32		2	find water sources & develop trough	new site

Riparian Condition Assessment

Introduction

This assessment is intended to be a compilation of issues and parameters that affect the riparian corridor in the Upper Joseph Creek Watershed (UJCW). Discussion topics include riparian characteristics, instream parameters, projects, monitoring and data needs. Characteristics are those physical features that define the riparian corridor and the water column and include vegetation, pools, large woody material, bank stability and width-to-depth ratios. Instream parameters are directly affected by characteristics and include temperature, habitat modification and sedimentation. Projects are actions taken to fix adversely affected characteristics with the goal of removing the symptoms exhibited by the instream parameters. Monitoring and data needs refer to actions taken to document whether our conservation projects are producing intended results or to information that may be lacking.

As stated above, there is a clear relationship between riparian characteristics and instream parameters. Elevated stream temperatures can be explained by a lack of shade-producing riparian vegetation that blocks solar radiation from the stream surface. Increased width-to-depth ratios, due to unstable streambanks resulting from lack of vegetation, expose more stream surface area to direct sunlight increasing stream temperature. Stream habitat modification can be attributed to a lack of riparian vegetation by decreased bank stability that produces increased width-to-depth ratios, or if large wood has been removed from the riparian forest then the opportunity for large wood recruitment to the stream is limited and channel complexity is decreased. Vegetation also has the ability to affect another parameter: sedimentation in the stream channel. Without healthy riparian plant communities, streambanks are unstable, easily eroded, and yield sediment to the stream channel. Riparian roads are an extreme example of vegetation removal that deliver sediment to the stream from overland runoff, direct input from drainage structures, or in some cases, mass wasting.

Several management approaches can be taken to restore riparian and water function in the UJCW including passive and active restoration. Passive restoration in a pure form is to remove the cause of degradation and let restoration happen naturally. Best Management Practices can be a form of passive restoration where the cause is removed from the area of concern but is still present in the watershed. An example of this is fencing riparian areas to remove livestock, yet livestock are still present in the watershed; restoration is fostered by the fence, and economic gains are realized through cattle production. Conservation programs in the UJCW that have utilized Best Management Practice principles are the ODFW *Grande Ronde Basin Fish Habitat Enhancement Project* and the NRCS *Conservation Reserve Enhancement Program*. Active restoration is implemented when natural processes are not left to their own end and anthropogenic changes are made to the watershed. These actions can include road obliteration, stream channel morphology manipulation or large wood placement in the stream channel. Active restoration actions are generally reserved for those areas severely altered or when our management objectives do not match a passive restoration time frame.

Dozens of passive and active conservation projects have been implemented in the UJCW with several intentions, including riparian vegetation enhancement, improving channel morphology and complexity, improving fisheries habitat and reducing adverse water quality conditions. While a majority of these projects have produced their intended results, many have also produced unintended changes. Examples of this are the wood structures built in many watershed creeks in the 1970's. The intent was to create pools for fisheries habitat. While pools were created below the structures, the channel above many of the structures developed increased width-to-depth ratios resulting in wider, shallower streams and potentially warmer stream temperatures. Thorough project planning, including results analysis based on current knowledge, must be implemented during project development.

There is concern that management practices have altered stream conditions in the UJCW and that restoration is needed to provide suitable riparian habitats and quality water for fisheries and other riparian dependent species. Through this assessment, an attempt has been made to identify regions of concern, potential conservation project locations and actions to mitigate adverse effects to riparian and water quality conditions.

Conditions and Analysis

Riparian Vegetation
Because of the generally small nature of most streams within this watershed, both reduction of ambient air temperature and prevention of direct exposure to sunlight on the streams are important functions of riparian vegetation. Modification is primarily due to fire suppression, road construction, logging, grazing and browsing by livestock, elk and deer and introduction of non-native plant species. Downcutting of streams has lowered water tables, in some cases fundamentally changing riparian plant communities.

Riparian vegetation functions to maintain the physical integrity of stream and river channels over a wide range of environmental conditions. The quantity and quality of energy inputs, large woody material, nutrient regulation, algal and macrophytic production, structure and function of biotic communities, and channel morphology are largely controlled by streamside vegetation. Streamside vegetation allows stream ecosystems to function in ways that structural additions alone to channels cannot replicate.

Once damaged or destroyed, riparian vegetation can be difficult to re-establish because of increased grass and/or noxious weed competition and increased livestock and wildlife use. This is particularly true for young shrubs that could ultimately provide shade for streams. The current condition includes many areas showing notable improving trends, however much of the watershed may be considered in fair, and sometimes poor condition.

Management Objectives for riparian vegetation within the UJCW can be found in the following documents: Forest Plan Standards and Guidelines (1991); "Mid-Montane Wetlands Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forest" (1997); Riparian Area Management, Process for Assessing Proper Functioning Condition: (USDI-BLM, 1998);

"PACFISH" (1995); "INFISH" (1995); and, "Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan and Multi-species Strategy" (1999).

As noted in the Wallowa County-Nez Perce Tribe Salmon Recovery Plan (SRP, 1999), a key problem within forested portions of this watershed is that canopy cover in some areas is too dense, while other areas are understocked. Fire suppression, for example, has left excessively dense, grand fir dominated stands, which effectively shade out other vegetation. This can result in bare soils that are very susceptible to hoof action by larger animals and subsequent erosion. Examples of this are found in the upper portions of East Fork Peavine Creek and the northeastern tributaries of East Fork Billy Creek. Areas with low canopy cover, which can directly affect stream temperature, are those that have experienced logging and road construction. Middle and Upper Chesnimnus creeks are particularly noted here.

A review and comparison of aerial photographs taken in 1938 and again in 1988 representing riparian locations within forested portions of this watershed indicate the following:

- Roads, particularly along portions of Peavine, Chesnimnus, and Devils Run creeks have significantly opened up primary and/or secondary riparian canopies.

- Where roads have not been built within riparian areas, the overall canopy closure appeared to be equal, although trees in the 1988 photographs seemed to be smaller and more numerous.

- In the 1988 photos, there were more, yet smaller trees noted throughout the entire watershed. Encroachment into open areas was evident.

These aerial photograph observations were consistent with on-site observations. Riparian canopies are multi-layered, with younger and denser stands blocking out most sunlight to the riparian floor.

Dense conifer stands near water attract large herbivores, particularly livestock, during the heat of mid- to late summer. Because of a lack of sunlight reaching the forest floor, herbaceous vegetation does not establish adequately to hold or maintain soils. As animals seek shade within riparian areas, trampling often breaks down streambanks and adds detrimental quantities of fine sediments to the channel. Although these dense stands are not a dominant riparian feature of riparian areas at the watershed scale, they occur often enough to effect biotic and abiotic riparian attributes.

At the other end of the spectrum, conifer vegetation has been removed from the primary and secondary riparian areas to a level that negatively influences stream temperatures. Reestablishment of conifers (primarily for shade/winter thermal cover) is a primary effort in current restoration activities, although it must be recognized that direct benefits of these efforts are not fully realized for 15-25 years. Hardwood plantings in the riparian areas provide short-term (less than 15 years) cover and shade.

Upland timber management has also influenced riparian areas and stream morphologies by affecting peak flows and flow duration. Although no flow gages have been established in this watershed, a USGS gauging station was in operation at Chico (two miles downstream of Crow Creek confluence) from July 1931 to September 1933. From this limited data, a snowmelt and spring rain hydrograph was developed. Peak flows generally occurred in March, April, or May with low flows from June through February. Fire suppression has produced forests with denser canopies that intercept precipitation. Less precipitation reaches the forest floor, and therefore less is stored and available for late summer flows. Increased canopy coverage, although it provides shade and lower stream temperatures, also results in increased transpiration and less water available for stream flow. Presently it appears that due to past management activities, the peak in the streamflow hydrograph has been shortened in duration, increased in amplitude, and occurs earlier in time.

Within this watershed, both conifer and deciduous vegetation are important components of many riparian areas. It has not yet been determined to what extent shrubs were historically found in this area. In the forested portion of this watershed, where fire has been excluded and large herbivores have played a dominant role in modifying riparian vegetation, shrubs seem to be lacking. This is based not only on casual observations comparing vegetation within exclosures to that outside exclosures, but also results from management studies on the Wallowa Valley Ranger District over the past 20-25 years, which demonstrate riparian planting protected within the exclosures respond more favorably than those without protection.

In a more intensive study concerning shrub growth on Meadow Creek, at the Starkey Experimental Station, Case et al. (1994) analyzed 265 permanently tagged shrubs to quantify regrowth and biomass accumulation. Livestock were removed completely from the study area and elk fences were constructed for comparisons. Due to the general similarity of environments between the study area and UJCW, results of this study may be important in making management decisions:

- After two years, shrub crown volume increased 47 – 1046 percent.
- Although 76 percent of shrubs outside exclosures were browsed (by wild herbivores) to some degree, crown volume of alder increased 200 percent and cottonwood increased 800 percent, with no significant differences inside or outside the exclosure.
- Highly palatable willows were impacted by wild herbivores. Crown volumes increased 550 percent inside elk exclosures, compared to 195 percent outside the exclosure.
- Overall density of all shrubs combined increased 50 percent in the two seasons of livestock removal, or one new shrub per nine meters of streambank.
- In all cases, willows were the preferred forage species.

Relevance of this work to the UJCW is that shrub growth potential is likely very high, as would also be suggested from observations within many riparian exclosures.

Forest Plan Standards and Guidelines and recommendations of the SRP (shade greater than 80 percent; and 60 percent and above on a site specific basis, respectively) are expected to help facilitate the return of riparian vegetation characteristics to their natural range of variability. Since the effects of conifer reestablishment are realized in the long term, short term management considerations for increasing stream shade may need to focus more on reestablishment and enhancement of shrub communities where appropriate. Botanists have done much work in the UJCW to reestablish native vegetation. Seed from the same or similar areas has been collected and propagated. Vegetation within exclosures that have been established for ten plus years is approaching climax condition.

To determine the site-specific natural riparian vegetation, including vegetation component and structure, we recommend following the guide: *Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forests* by Elizabeth A. Crow and Rodrick R. Clausnitzer. This guide presents a classification of wetland plant associations, community types and communities occurring within the three National Forests. This guide provides a key to major vegetative lifeforms including forested plant, shrubby plant and herbaceous plant associations to identify potential site-specific plant communities. In the event that insufficient natural vegetation is available to key out a site based on major lifeforms, a landform key is provided. The landform key allows the user to narrow down the number of possible plant associations within a given location, provide the user with possible plant associations that may occur on a site that has been so altered from the potential late seral vegetation that use of the vegetative key is impossible, and prompt the user to search for remnant vegetation if previously stumped by the vegetative key and/or to look in the upland plant association guides for the Blue Mountains Ecoregion if necessary. Although untested at the time of publishing the landform key provides a logical method of identifying natural riparian plant communities. The objectives of this guide are to provide information to allow users to be able to identify potential natural vegetation types in wetlands (and transitional riparian areas) and to provide information pertinent to the use and management of these areas.

The UJCW fits the description of a mesic forest zone 2 that encompasses the northern Blue Mountains and the Wallowa Mountains. This zone is characterized by broad or moderately broad valleys with low gradients (1% or less), narrow to moderately wide V- or trough-shaped valleys with moderate gradients (2-4%), or narrow V-shaped valleys with high gradients (4% or higher). The utilization of the *Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forests* guide and the subsequent discussion in this assessment provides the background for riparian vegetation management goals. Figure VI-19 depicts degraded stream conditions including primary restoration areas identified in the 1995 assessment and deficient width-to-depth, large woody material, pools per mile and DEQ 303(d) listed streams. All of these conditions are symptoms of degraded riparian vegetation.

Under natural conditions, riparian plant communities display a high degree of structural and compositional diversity, reflecting the history of past disturbances such as floods, fire, windthrow, grazing, and insects and disease outbreaks. Existing riparian vegetation conditions within the UJCW exhibit a profound loss in species diversity as a direct result of past harvesting practices and the exclusion of fire. Early seral riparian vegetation species such as cottonwood, willow, and aspen are virtually nonexistent. This change is significant because deciduous trees also annually supply extensive litter fall into streams, which is an important factor controlling local aquatic nutrient levels.

Existing riparian vegetation is dominated by overstocked stands of small diameter, late seral conifers. In general, large diameter residuals necessary for providing long-term input into stream structure are lacking. Current riparian vegetation management practices of implementing “no cut” buffers would perpetuate this condition. Stand density reduction measures would be necessary to facilitate the attainment of large diameter recruits. In addition, the overstocked conifer riparian vegetation is susceptible to catastrophic damage, which would exceed historic disturbance patterns. In the likely event of major disturbance, the integrity of ecological processes in many riparian areas would be severely compromised.

Pools

Region 6 stream survey protocol recognizes a pool when hydrologic control extends across the full width of the channel on the down stream end. Forest Plan guidelines recognize an inverse relationship between the number of pools per mile and the width of the wetted channel. With a greater stream width, fewer pools per mile are expected.

Specific values for desired pool frequency have been assigned for all stream widths throughout the Pacific Northwest. Given existing guidelines, there are no streams within this watershed that contain an adequate number of pools per mile. It has been determined that pool frequencies described in PACFISH are not appropriate for the streams in the UJCW. However, new guidelines have not been established for eastside streams.

Studies of the Upper Grand Ronde system have shown a significant decrease in pools per mile since the early 1940’s (Wissmar, et al. 1994 and MacIntosh, et al. 1994). Eight streams were shown to have a 20-87 percent reduction in pools (65 percent average) over the last fifty years. As similar management activities have occurred within the UJCW, it is likely these streams have similar reductions in pool habitat.

Primary conditions that lead to loss of pool habitat have been: removal of larger trees from areas near or within riparian zones, channelization of streams, and increased sediment loads filling pools. The loss of pool habitat, as noted by Wissmar et al. (1994), “indicates fewer rearing areas for juvenile fish, and resting habitat for adults prior to spawning, indicates minimal refugia in which to avoid catastrophic events (floods, ice flow, drought, fire) and tends to make fish crowd into smaller spaces making them increasingly vulnerable to disease, competition, and predation”.

Many pools have been formed through stream restoration activities, although it is not known what the current trend is in “natural” pool development. For many streams within this watershed, large wood plays a key role in pool development and maintenance. Large wood (those pieces larger than 12 inches diameter and 35 feet length) seems to be available, but an abundance of quality pool habitat is lacking, most notably in smaller streams. It is possible that:

1. Region 6 stream survey protocol does not provide adequate resolution to pick up all pools within a surveyed stream,

2. High flow water energies are not enough to create and maintain larger pools within this watershed,

3. Many pools within the smaller streams (e.g., Crow, Billy, or East Fork Peavine creeks) have sand/silt noted as being either the dominant or subdominant substrate type, indicating pools may be filled with sediment.

It should be noted that the Region 6 stream survey protocol used to determine pools per mile does not recognize smaller "pocket pools", which contribute to a stream's habitat complexity. Pocket pools are common features found within riffle sections of this watershed, particularly in Rosgen (1996) B-Type and some C-Type channels (e.g., Summit, Poison and portions of the Chesnimnus creeks). Within this watershed, these features are most important to salmonids during high flows in spring and as refugia through out summer, but due to their shallowness (most pools within the watershed are less than two feet deep), probably are not key habitat features when streams freeze in winter.

Table VI-1. Upper Joseph Creek Watershed Stream Survey Data: Pools per Mile

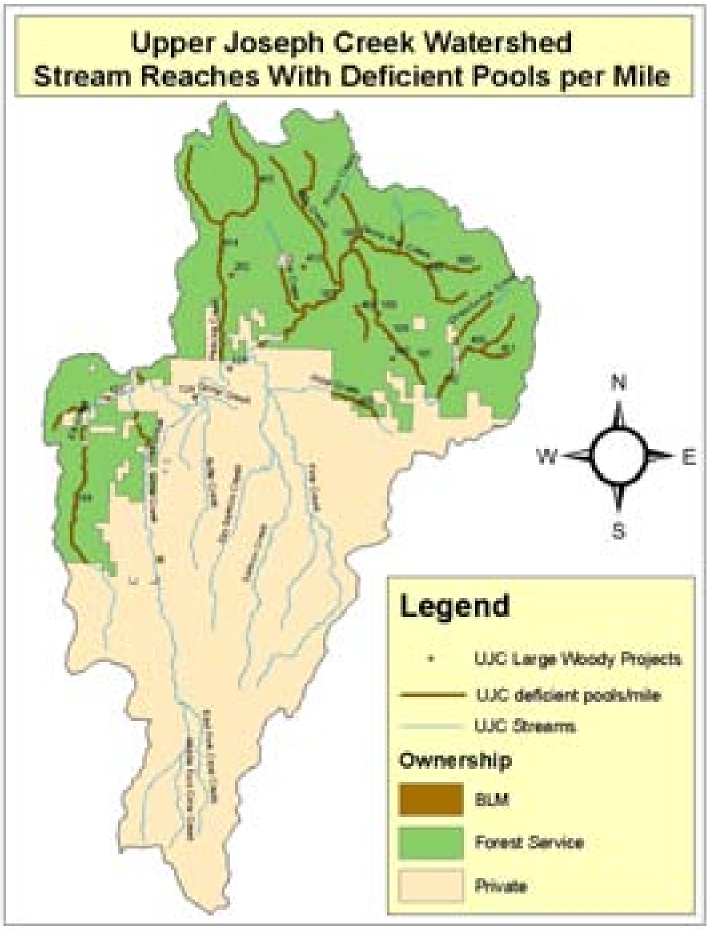
Stream	Sub Watershed	Wetted width (feet)	Pools/Mile	Meets Steelhead Matrix	Meets PACFISH	Year Surveyed
Crow	26A	15	17	N	N	1991
Elk	26B	15.4	22	N	N	1998
Little Elk	26B	3.1	31	N	N	1991
Alder	26G	4.5	4	N	N	1995
Chesnimnus	26I	21.2	19	N	N	1997
Hilton Gulch	26I	4.7	25	N	N	1991
Doe	26I	4.1	32	N	N	1992
Chesnimnus	26J	10.3	27	N	N	1997
South Fork Chesnimnus	26J	9.8	5	N	N	1990
South of South Fork Chesnimnus	26J	7.8	4	N	N	1990
Devil's Run	26K	10.6	12	N	N	1990
TNT Gulch	26K	5.2	7	N	N	1991
Poison	26K	6.4	16	N	N	1990
Summit	26K	4.4	47	N	N	1991
Billy	26L	6.8	15	N	N	1992
East Fork Billy	26L	7.1	6	N	N	1992
Peavine	26M	10.5	30	N	N	1998
East Fork Peavine	26M	7.9	11	N	N	1992
West Fork Peavine	26M	4.5	6	N	N	1992
McCarty Gulch	26M	5.3	21	N	N	1990

Steelhead Matrix

Wetted width (feet)	Pools/Mi
5	184
10	96
15	70
20	56
25	47
50	26

National Oceanic and Atmospheric Administation, Environmental and Technical Service Division, Habitat Conservation Branch. 1996. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale (Matrix).

Figure VI-1. Upper Joseph Creek Watershed Stream Reaches with Deficient Pools per Mile
(Refer to project table in project section for project descriptions)



Temperature
Temperature is just one environmental factor that can affect distribution and abundance of juvenile and adult salmonids within a stream. Salmonids are cold water fish. Water temperatures influence every phase of salmonid life histories including: growth and incubation of embryos, development times, feeding behavior, time of spawning, susceptibility to disease, and competitive advantage over non-salmonid species (squaw fish, shiners, and dace, of the cyprinid family, all of which are known to inhabit the UJCW). Water temperature also affects the amount of dissolved oxygen in water, biological oxygen demand, and quantity and quality of aquatic invertebrate life forms. Upper lethal temperatures for steelhead are about 75^{o}F, and preferred temperature range is 50-55^{o}F.

State of Oregon Department of Environmental Quality (DEQ) Water Quality Standards state there shall be no measurable increase in maximum water temperature: less than 64^{o}F for migration and rearing habitat and less than 60^{o}F in spawning habitat.

The criterion in the stream temperature standard for general salmon and trout use of 64^{o}F was established to protect general salmon and trout use during the warm summer months. This criterion applies where those uses occur or are designated beneficial uses for the stream segment.

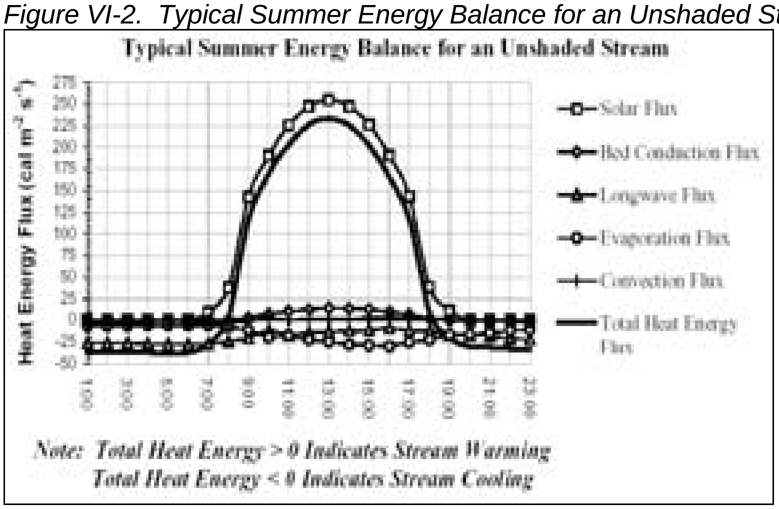
The unit for all the criteria in the standard is the 7-day moving average of the daily maximum temperatures. This means that the average of the daily maximum stream temperatures for 7 consecutive days is calculated and compared to the applicable criterion. If the criterion is exceeded a management plan is required.

At 64°F, temperatures are less than optimal but not yet at levels where growth ceases or direct mortality occurs. In selecting the criteria, this information was balanced with the fact that the unit is a maximum temperature and that if the criteria is met, the fish will be exposed to temperatures above 60°F for only part of the day during a few of the warmest weeks of the summer. The intent is that while this criterion does not eliminate any risk to the fish whatsoever, it keeps the risk to a minimum level.

The DEQ recognizes that not only summer maximum temperatures are of importance to aquatic biota. The intent is to protect the temperature regime through the year. Built into the standard is the assumption that if stream and riparian conditions are managed such that they meet the summer maximum criteria, those same conditions will protect the temperature regime of the stream through the year.

There are six processes that allow heat energy exchange between a stream and its environment: solar energy, longwave radiation, evaporation, convection, streambed conduction and groundwater inflow/outflow. It is important to note that with the exception of solar energy, which can only deliver heat energy, the other energy processes are capable of both introducing, or removing heat energy from the stream system.

Figure VI-2. Typical Summer Energy Balance for an Unshaded Stream (Boyd 1996)



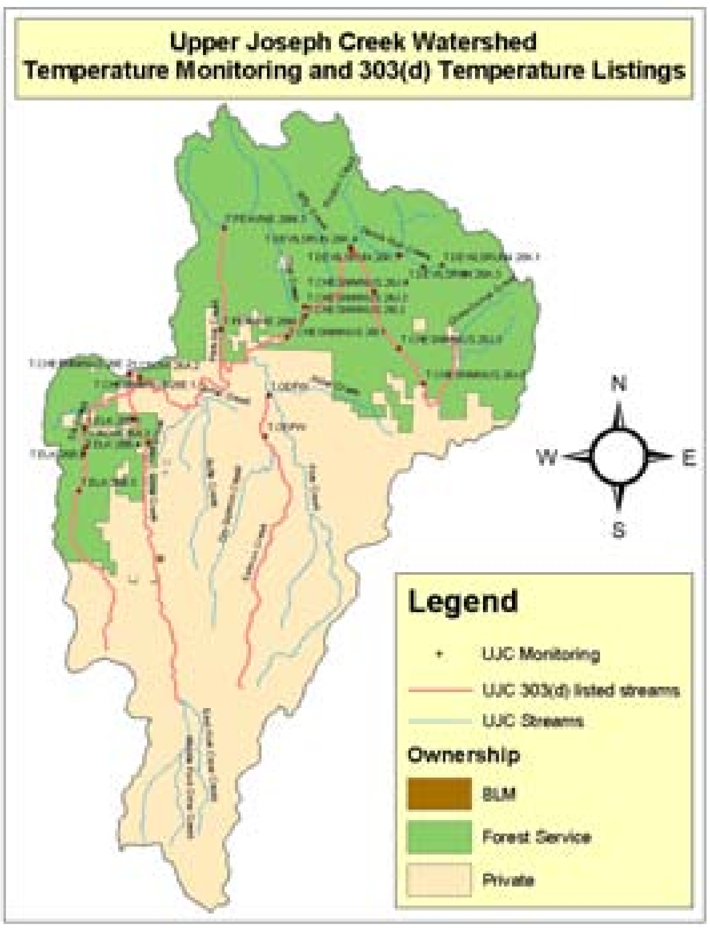
As illustrated in the chart above, the ultimate source of heat energy to a stream is solar radiation, while longwave radiation, streambed conduction, convection and groundwater exchange play a secondary role. Evaporation and back radiation dissipate energy from the stream at the air-water interface. If the effect of the six energy processes results in reducing the total heat energy of the stream, the stream temperature will decrease. Stream temperature will increase if the six processes result in adding total heat energy to the stream.

Table VI-2. Oregon's Final 1998 Water Quality Limited Streams - 303(d) List for streams in the Upper Joseph Creek Watershed (rows highlighted are temperature listings).

Name	Boundaries	Parameter	Criteria	Season	Status
Chesnimnus Cr.	Mouth to Headwaters	Habitat Modification			303(d) List
Chesnimnus Cr.	Mouth to Headwaters	Sedimentation			303(d) List
Chesnimnus Cr.	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer	303(d) List
Crow Cr.	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer	303(d) List
Elk Cr.	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer	303(d) List
Elk Cr.	Mouth to Headwaters	Habitat Modification			303(d) List
Elk Cr.	Mouth to Headwaters	Sedimentation			303(d) List
Peavine Cr.	Mouth to East/West Fork	Temperature	Rearing 64 F (17.8 C)	Summer	303(d) List
Peavine Cr.	Mouth to East/West Fork	Habitat Modification			303(d) List
Salmon Cr.	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer	303(d) List

As noted in the SRP, "temperature is a high priority on Joseph Creek. Stream temperature recorders consistently show readings over 80^{o}F ... (t)he area's headwaters are at a lower elevation than other major streams in Wallowa County and naturally more prone to high temperatures. Loss of riparian vegetation and shade has also allowed heating of water to take place on some reaches of Joseph Creek and its tributaries."

Figure VI-3. Upper Joseph Creek Watershed Temperature Monitoring and 303(d) Temperature Listings



The following tables are an analysis of the 7-day moving average of the daily maximum temperatures (7-day avg max) of each water temperature data collection site in the UJCW from 1980 to 2001. The first two columns identify the stream and the year that the data set was produced. The next three columns describe the timing of the temperature data as compared to the 64^{o}F temperature criterion; the “1st Date >” column identifies the first day the 7-day avg max was greater than 64^{o}F, the “Days >” column shows how many days in the data set were above the criterion, and the “Last >” column identifies the last day the 64^{o}F criterion was surpassed. The “Percent >” column tells what percent of the 7-day avg max calculation were above the 64^{o}F criterion between the “1st date > and “Last >”, the “Date at Max” column gives the date on which the greatest 7-day avg max was calculated, and the “Max Temp” column identifies the temperature calculated for that date.

It must be noted that the data in these tables are only a mathematical query in response to 64^{o}F temperature standard for the UJCW. These tables are in no way meant to be a statistical analysis indicating trend or cumulative effects response to conservation projects in the UJCW. It must also be noted that much of the data in these datasets may have not gone through appropriate quality assurance/quality control (QA/QC) procedures including accuracy checks or appropriate field auditing techniques. The metadata documents for each dataset that would identify QA/QC procedures are not available except for the 1999-2002 data collection seasons.

Tables VI-3-19. Upper Joseph Creek Watershed 7-day Moving Average Temperature Reports 1980-2001

Temperature Report for Site T.CHESNIMNUS.26E.1

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Chesnimnus	1991	07/01/1991	50	08/19/1991	100.0	08/03/1991	80.37
Chesnimnus	1993	05/26/1993	133	10/05/1993	88.7	08/10/1993	80.53
Chesnimnus	1994	05/08/1994	6	05/13/1994	100.0	05/12/1994	70.89
Chesnimnus	1995	08/06/1995	2	08/07/1995	100.0	08/06/1995	64.70
Chesnimnus	1997	06/05/1997	115	09/27/1997	93.9	08/08/1997	80.84

Temperature Report for Site T.CHESNIMNUS.26I.2

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Chesnimnus	1989	07/21/1989	30	08/19/1989	100.0	07/26/1989	74.94
Chesnimnus	1993	07/02/1993	31	08/01/1993	61.3	07/18/1993	68.74
Chesnimnus	1994	06/22/1994	80	09/09/1994	100.0	08/01/1994	79.57
Chesnimnus	1995	07/10/1995	59	09/06/1995	74.6	08/07/1995	68.64
Chesnimnus	1997	07/08/1997	67	09/12/1997	86.6	08/08/1997	71.73
Chesnimnus	2000	06/14/2000	99	09/20/2000	82.8	08/01/2000	86.21
Chesnimnus	2001	06/21/2001	74	09/02/2001	100.0	07/12/2001	76.03

Temperature Report for Site T.CHESNIMNUS.26J.2

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Chesnimnus	1989	07/20/1989	30	08/18/1989	100.0	07/24/1989	73.85
Chesnimnus	1998	07/03/1998	13	07/15/1998	100.0	07/12/1998	68.46

Temperature Report for Site T.CHESNIMNUS.26J.3

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Chesnimnus	1991	07/03/1991	67	09/07/1991	95.5	07/08/1991	73.18
Chesnimnus	2001	06/20/2001	112	10/09/2001	97.3	09/23/2001	99.37

Temperature Report for Site T.CHESNIMNUS.26J.4

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Chesnimnus	1990	06/28/1990	91	09/26/1990	95.6	08/13/1990	80.15

Temperature Report for Site T.CHESNIMNUS.26J.5

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Chesnimnus	1991	07/03/1991	69	09/09/1991	42.0	09/04/1991	75.20

Temperature Report for Site T.CROW.26A.1

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Crow	1992	06/21/1992	64	08/23/1992	95.3	06/27/1992	73.91
Crow	1996	07/03/1996	49	08/20/1996	89.8	08/01/1996	69.74

Temperature Report for Site T.DEVILSRUN.26K.1

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Devils Run	2000	06/14/2000	62	08/14/2000	69.4	06/14/2000	70.72
Devils Run	2001	06/22/2001	77	09/06/2001	85.7	08/12/2001	72.54

Temperature Report for Site T.DEVILSRUN.26K.2

		Thermograph Data Summary					
	Data	Temperature Comparison Standard			64		
Stream	**Year**	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Devils Run	1980	07/20/1980	30	08/18/1980	100.0	07/28/1980	73.18
Devils Run	1981	06/30/1981	58	08/26/1981	39.7	07/22/1981	69.80
Devils Run	1982	07/13/1982	47	08/28/1982	97.9	07/31/1982	70.70
Devils Run	1990	06/29/1990	53	08/20/1990	90.6	08/10/1990	75.37
Devils Run	1994	06/22/1994	95	09/24/1994	90.5	07/22/1994	78.96
Devils Run	1995	06/28/1995	85	09/20/1995	97.6	08/06/1995	75.00
Devils Run	1997	07/08/1997	44	08/20/1997	72.7	07/26/1997	66.64

Temperature Report for Site T.DEVILSRUN.26K.3

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
Stream	Year	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Devils Run	1990	07/14/1990	36	08/18/1990	72.2	08/11/1990	70.77
Devils Run	1994	06/24/1994	68	08/30/1994	83.8	07/31/1994	72.63
Devils Run	1997	07/24/1997	20	08/12/1997	70.0	08/08/1997	66.74

Temperature Report for Site T.DEVILSRUN4.26K.1

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
Stream	Year	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Devils Run	1980	07/13/1980	19	07/31/1980	36.8	07/29/1980	74.30
Devils Run	1981	08/10/1981	17	08/26/1981	100.0	08/13/1981	73.18
Devils Run	1982	06/20/1982	51	08/09/1982	68.6	08/01/1982	73.63
Devils Run	1983	07/22/1983	41	08/31/1983	78.0	08/09/1983	73.40
Devils Run	1984	06/30/1984	17	07/16/1984	100.0	07/12/1984	70.57

Temperature Report for Site T.DEVILSRUN5.26K.1

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
Stream	Year	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Devils Run	1980	07/28/1980	1	07/28/1980	100.0	07/28/1980	64.18
Devils Run	1981	N/A	0	N/A	N/A	07/05/1981	63.28
Devils Run	1982	N/A	0	N/A	N/A	08/23/1982	62.60
Devils Run	1983	08/06/1983	4	08/09/1983	100.0	08/08/1983	65.08

Temperature Report for Site T.ELK.26B.1

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
Stream	Year	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Elk	1991	07/02/1991	68	09/07/1991	100.0	07/08/1991	72.24

Temperature Report for Site T.ELK.26B.2

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
Stream	Year	1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Elk	1983	06/22/1983	76	09/05/1983	97.4	08/08/1983	77.22
Elk	1990	N/A	0	N/A	N/A	10/02/1990	54.21
Elk	1991	07/03/1991	57	08/28/1991	100.0	07/08/1991	69.73
Elk	1993	08/04/1993	7	08/10/1993	100.0	08/08/1993	64.99
Elk	1993	N/A	0	N/A	N/A	10/17/1993	49.71
Elk	1994	N/A	0	N/A	N/A	09/30/1994	53.64
Elk	1997	07/08/1997	36	08/12/1997	63.9	08/08/1997	66.60
Elk	1998	07/04/1998	67	09/08/1998	73.1	07/28/1998	69.99

Temperature Report for Site T.ELK.26B.3

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
		1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Elk	1983	06/21/1983	73	09/01/1983	71.2	08/09/1983	77.90
Elk	1990	06/22/1990	69	08/29/1990	89.9	07/16/1990	74.99
Elk	1990	N/A	0	N/A	N/A	10/03/1990	57.09
Elk	1991	06/11/1991	91	09/09/1991	85.7	07/08/1991	72.79
Elk	1992	06/04/1992	91	09/02/1992	84.6	06/25/1992	74.29
Elk	1992	N/A	0	N/A	N/A	10/06/1992	58.34
Elk	1993	05/19/1993	98	08/24/1993	46.9	08/09/1993	69.36
Elk	1994	05/11/1994	2	05/12/1994	100.0	05/12/1994	66.56
Elk	1994	06/22/1994	75	09/04/1994	100.0	08/01/1994	73.03
Elk	1994	N/A	0	N/A	N/A	09/28/1994	60.31
Elk	1995	05/31/1995	73	08/11/1995	71.2	07/22/1995	69.64
Elk	1997	07/07/1997	69	09/13/1997	94.2	08/08/1997	72.26
Elk	1998	07/02/1998	77	09/16/1998	100.0	07/21/1998	74.89

Temperature Report for Site T.PEAVINE.26M.2

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
		1st Date >	Days>	Last >	Percent>	Date at Max	Max Temp
Peavine	1980	08/04/1980	2	08/05/1980	100.0	08/04/1980	72.24
Peavine	1981	07/22/1981	23	08/13/1981	100.0	08/13/1981	77.00
Peavine	1982	06/18/1982	85	09/10/1982	100.0	07/31/1982	78.35
Peavine	1990	06/24/1990	67	08/29/1990	95.5	08/10/1990	78.80
Peavine	1990	N/A	0	N/A	N/A	10/03/1990	58.11
Peavine	1993	05/29/1993	108	09/13/1993	48.1	08/10/1993	72.30
Peavine	1994	06/12/1994	102	09/21/1994	93.1	07/22/1994	83.14
Peavine	1995	06/13/1995	87	09/07/1995	85.1	08/06/1995	73.56
Peavine	1996	06/09/1996	88	09/04/1996	86.4	07/29/1996	74.23
Peavine	1997	06/28/1997	76	09/11/1997	93.4	08/08/1997	71.70
Peavine	1998	07/03/1998	76	09/16/1998	100.0	07/22/1998	73.97

Temperature Report for Site T.PEAVINE.26M.3

Stream	Data Year	Thermograph Data Summary					
		Temperature Comparison Standard			64		
		1st Date >	Days >	Last >	Percent >	Date at Max.	Max Temp
Peavine	1990	07/01/1990	49	08/18/1990	71.4	07/16/1990	69.76
Peavine	1990	N/A	0	N/A	N/A	10/03/1990	52.61
Peavine	1993	08/05/1993	9	08/13/1993	100.0	08/09/1993	65.83
Peavine	1994	06/22/1994	65	08/25/1994	98.5	08/05/1994	74.97
Peavine	1995	07/09/1995	32	08/09/1995	100.0	07/22/1995	68.14
Peavine	1996	07/04/1996	50	08/22/1996	76.0	07/29/1996	68.51
Peavine	1997	N/A	0	N/A	N/A	08/08/1997	63.44
Peavine	1998	07/16/1998	55	09/08/1998	61.8	07/30/1998	67.16
Peavine	1999	07/31/1999	31	08/30/1999	58.1	08/06/1999	66.55

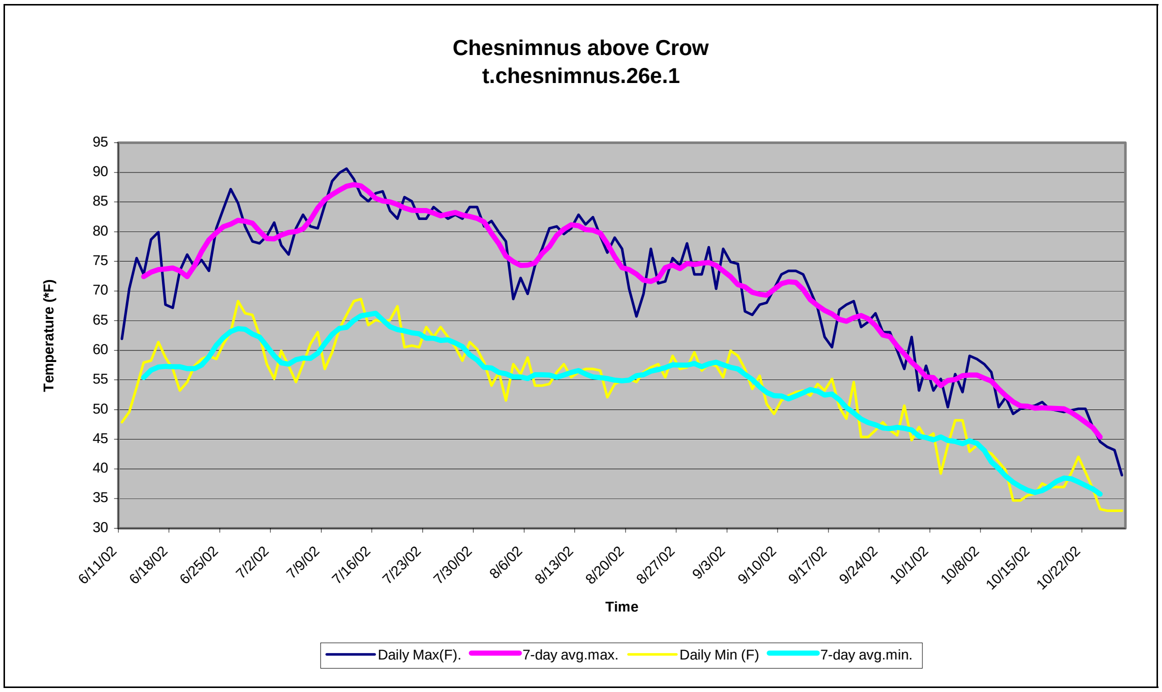
2002 Temperature Data

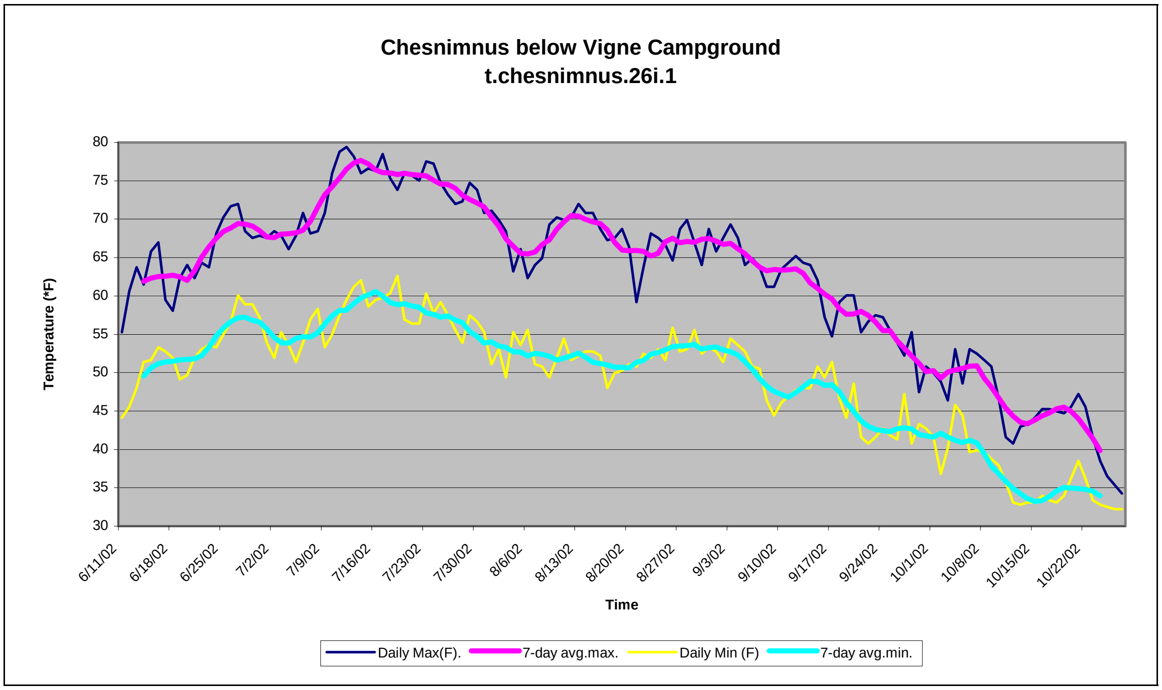
The 2002 field season included the collection of water temperature data from June 10th through October 28th. Seven temperature loggers were deployed and intended to represent both public and private land temperature regimes in the UJCW. Temperature loggers were accuracy checked before and after deployment and audited monthly during the data collection period as per "Oregon Plan for Salmon and Watersheds" technical guidebook guidelines. All field notes, accuracy checks and pertinent metadata are available on request. After the data collection season, each data set was analyzed for believability and accuracy then descriptive graphs were produced depicting 7-day moving average of the daily maximum and minimum temperatures. Included in each graph are recorded daily maximum and minimum temperature lines and calculated moving averages. The following table lists 2002 temperature collection sites by name and code and locations are plotted on the map at the beginning of the temperature section.

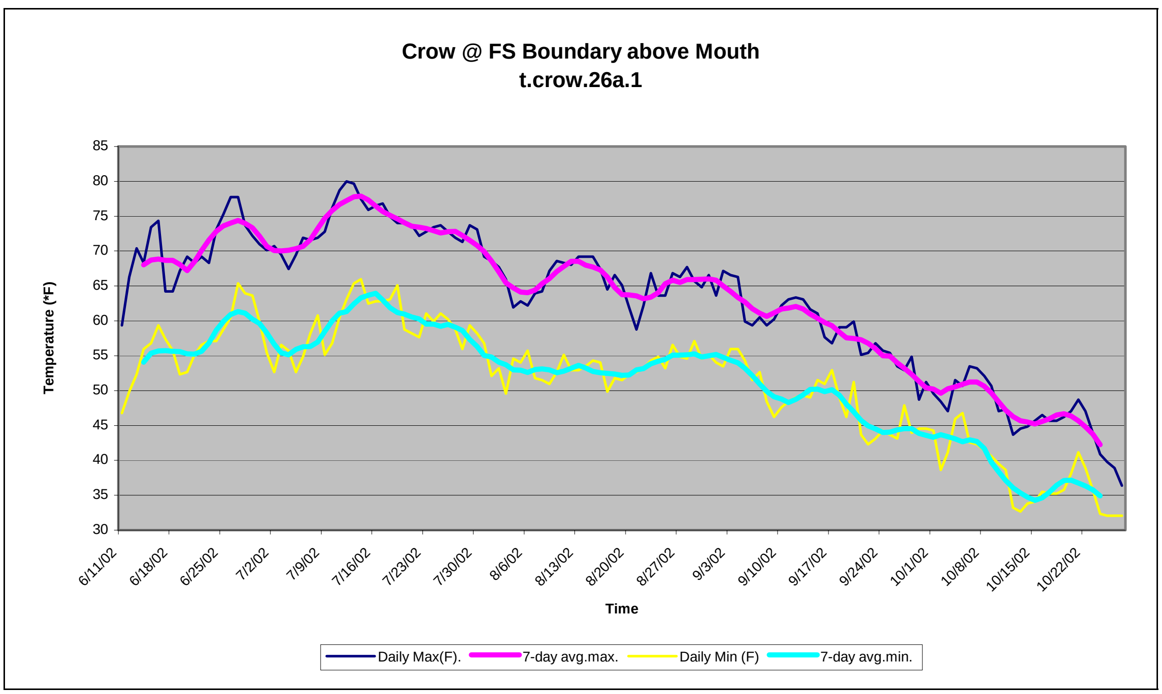
Table VI-20. 2002 Temperature Collection Sites

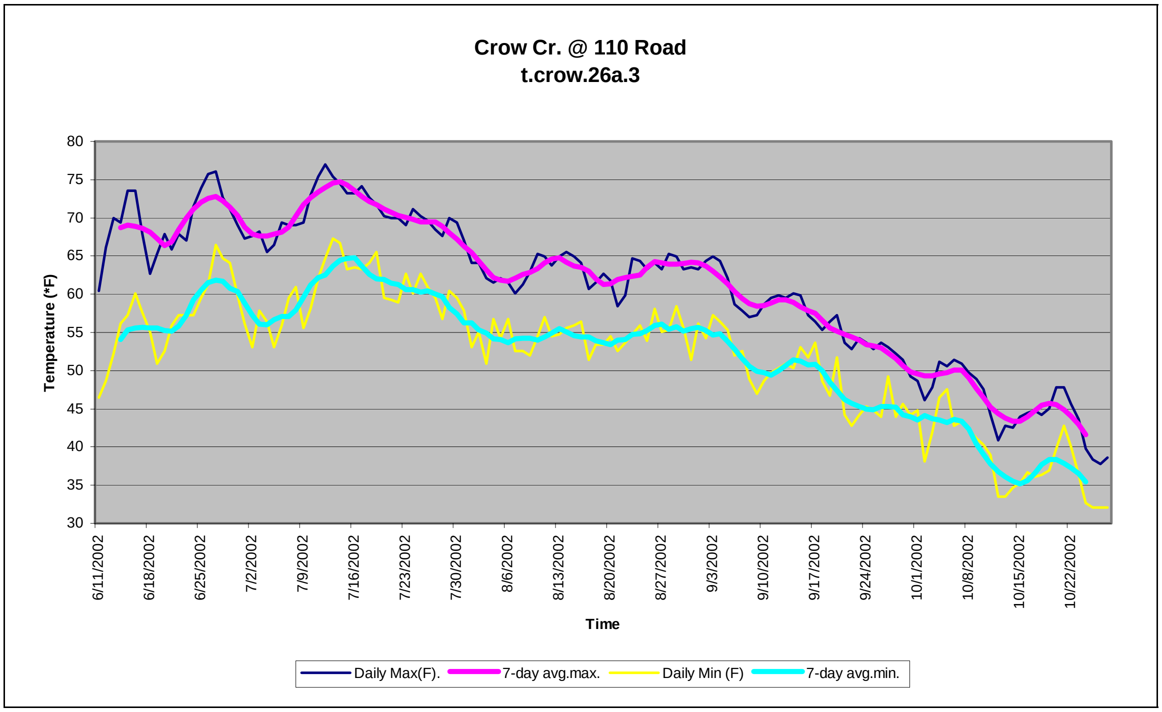
Site Name	Site Code
Chesnimnus above Crow Creek	t.chesnimnus.26e.1
Chesnimnus below Vigne Campground	t.chesnimnus.26i.2
Crow @ FS Boundary above Mouth	t.crow.26a.1
Crow @ 110 Road	t.crow.26a.3
Elk Below Gould Gulch	t.elk.26b.4
Peavine above McCarty	t.peavine.26m.2
Devils Run above Mouth	t.devilsrun.26k.1

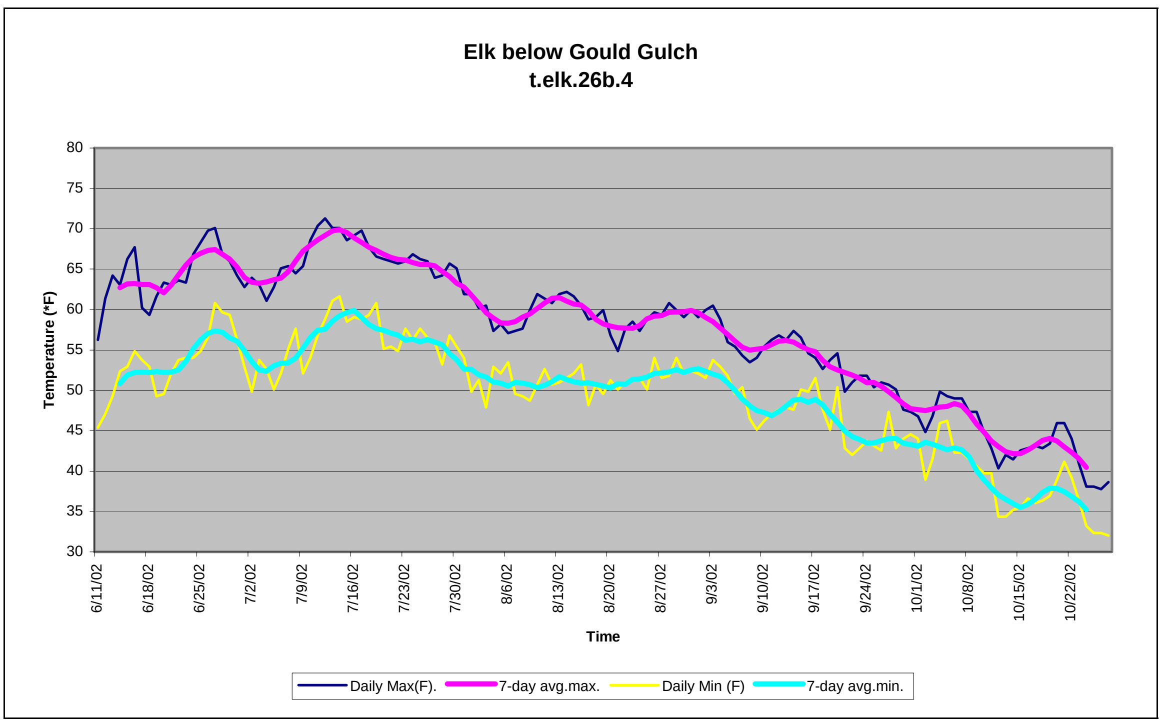
Figures VI-4-10. 2002 Temperature Monitoring Graphs

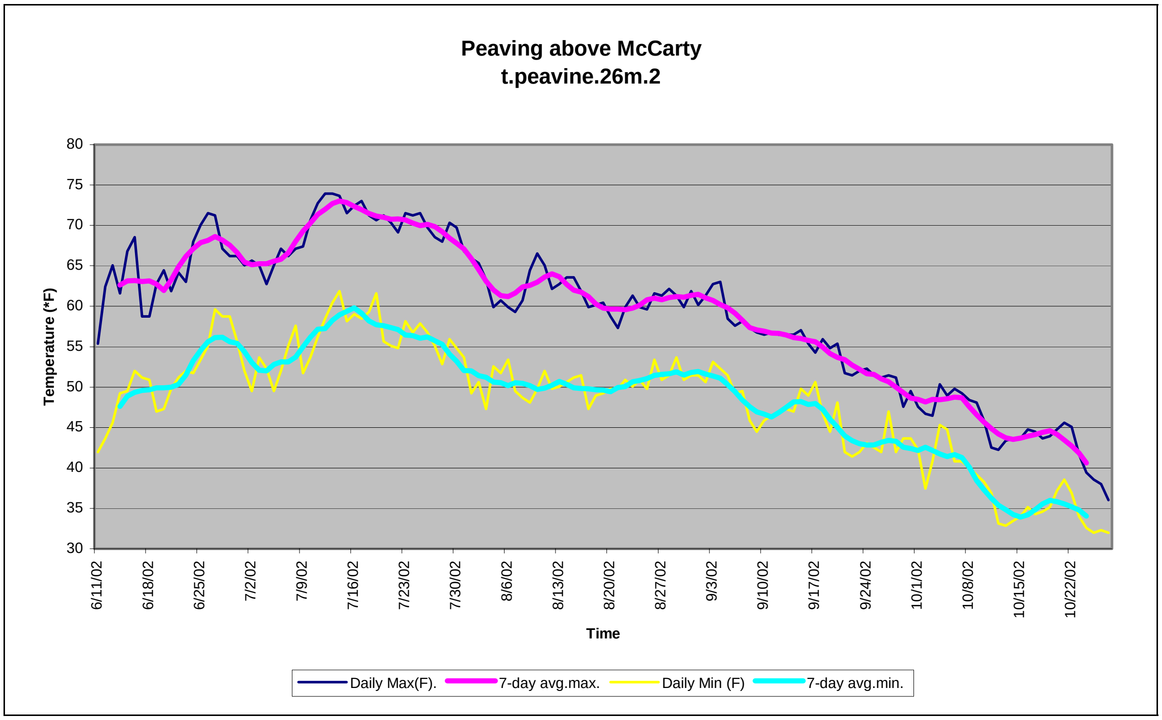


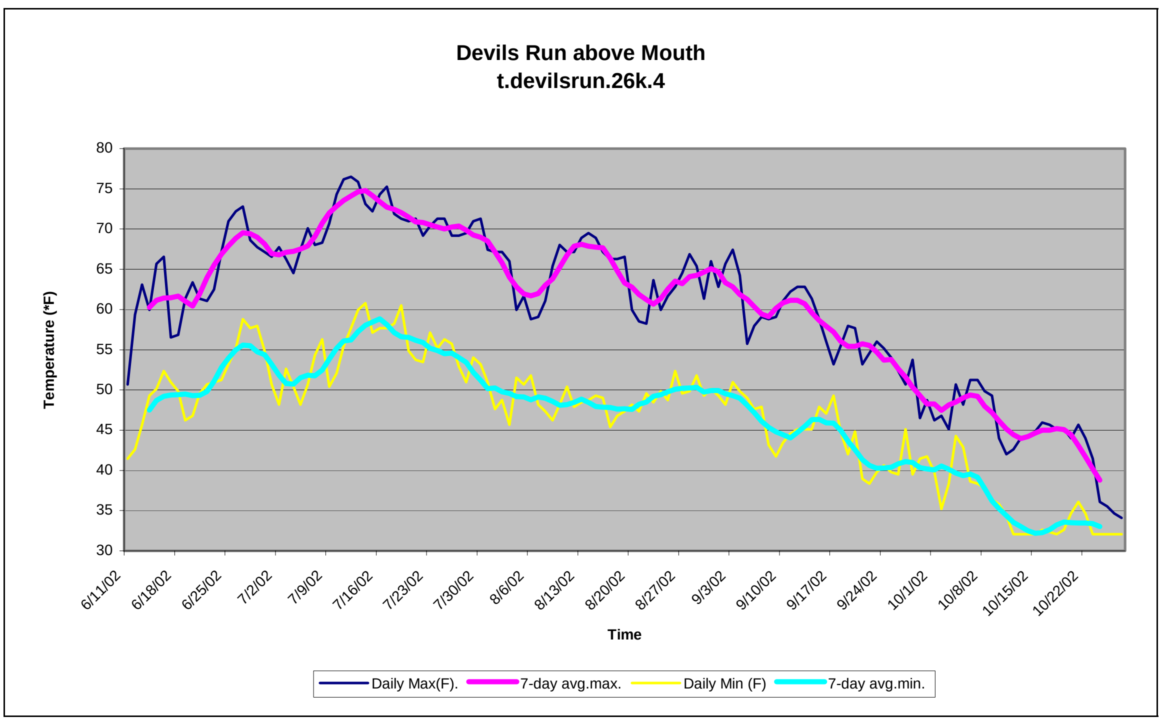

Chesnimnus below Vigne Campground
t.chesnimnus.26i.1
Temperature (*F)
80
75
70
65
60
55
50
45
40
35
30
6/11/02
6/18/02
6/25/02
7/2/02
7/9/02
7/16/02
7/23/02
7/30/02
8/6/02
8/13/02
8/20/02
8/27/02
9/3/02
9/10/02
9/17/02
9/24/02
10/1/02
10/8/02
10/15/02
10/22/02
Time
Daily Max(F).
7-day avg.max.
Daily Min (F)
7-day avg.min.


Crow @ FS Boundary above Mouth
t.crow.26a.1
Temperature (*F)
85
80
75
70
65
60
55
50
45
40
35
30
6/11/02
6/18/02
6/25/02
7/2/02
7/9/02
7/16/02
7/23/02
7/30/02
8/6/02
8/13/02
8/20/02
8/27/02
9/3/02
9/10/02
9/17/02
9/24/02
10/1/02
10/8/02
10/15/02
10/22/02
Time
Daily Max(F).
7-day avg.max.
Daily Min (F)
7-day avg.min.


Crow Cr. @ 110 Road
t.crow.26a.3
80
75
70
65
60
55
50
45
40
35
30
Temperature (*F)
6/11/2002
6/18/2002
6/25/2002
7/2/2002
7/9/2002
7/16/2002
7/23/2002
7/30/2002
8/6/2002
8/13/2002
8/20/2002
8/27/2002
9/3/2002
9/10/2002
9/17/2002
9/24/2002
10/1/2002
10/8/2002
10/15/2002
10/22/2002
Time
Daily Max(F).
7-day avg.max.
Daily Min (F)
7-day avg.min.


Elk below Gould Gulch
t.elk.26b.4
80
75
70
65
60
55
50
45
40
35
30
Temperature (*F)
6/11/02
6/18/02
6/25/02
7/2/02
7/9/02
7/16/02
7/23/02
7/30/02
8/6/02
8/13/02
8/20/02
8/27/02
9/3/02
9/10/02
9/17/02
9/24/02
10/1/02
10/8/02
10/15/02
10/22/02
Time
Daily Max(F).
7-day avg.max.
Daily Min (F)
7-day avg.min.





It is obvious from the preceding tables and graphs that streams in the UJCW commonly surpass the 64°F 7-day moving average of the daily maximum temperature criterion. Temperature violations often first occur in early June and can last well into September. The intent of this assessment is not to question the validity of the 64°F criterion but rather to use the criterion as an accepted parameter by which the most sensitive beneficial use (fisheries) is protected in the watershed. The 64°F criterion will be used as a management reference by which we implement conservation projects in the watershed, including riparian vegetation management to produce adequate stream shade, bank stability and channel morphology projects intended to reduce stream width and increase stream depth, and upland vegetation management that may over time return stream flow regimes to a normal distribution.

Temperatures that exceed Forest Plan standards and guidelines are most likely a cumulative result of created openings within riparian reserves, advanced seasonal timing of flows and generally lower elevation of the watershed. Caution should be used when suggesting lower elevation of this watershed as a reason for highly elevated stream temperatures. Rather, elevation may be a factor that indicates the sensitivity of these streams to management practices that influence stream temperatures.

If over time we can demonstrate that streams in the UJCW are approaching their site potential for temperature, that our conservation efforts are producing their intended results, and that mitigation against adverse effects is taking place then the 64°F criterion will remain the reference by which improvements are judged. Given current management direction within the Riparian Habitat Conservation Areas, stream temperatures within the National Forest System lands should return to more natural levels.

Large Woody Material

Large woody material (LWM) plays an important role in stream morphology and the function of aquatic ecosystems. Large wood is one of the primary influences on pool development and maintenance, and it plays a key role in stabilizing sediment transport through the system. LWM is also fundamental to healthy streams as hiding cover for fish, its contribution to water chemistry, and as habitat for numerous smaller organisms, particularly aquatic insects.

Table VI-21 lists the number of sections of each stream that meet Forest Plan standards and guidelines for LWM. This information was collected through the USFS Stream Survey program for 1990-1993. Large wood is counted when it lies primarily within the bankfull channel (defined by 1.5-2.0 year high flow event), is greater than 12 inches diameter, and greater than 35 feet length. Twenty pieces per mile are required through Forest Plan direction.

Table VI-21. Upper Joseph Creek Watershed Stream Survey Data: Large Woody Material

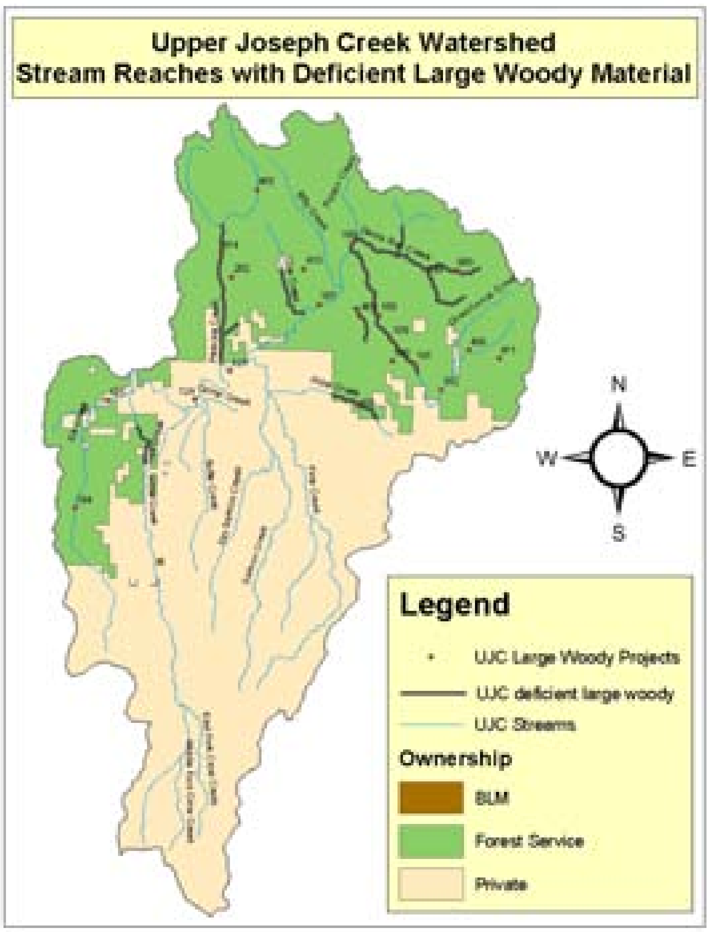
Stream	Sub Watershed	Large Woody Material (pieces/mi)	Meets Steelhead Matrix	Meets Pacfish	Year Surveyed
Crow Creek	26A	3	N	N	1991
Elk Creek	26B	40	Y	Y	1998
Little Elk Creek	26B	23	Y	Y	1991
Alder Creek	26G	4	N	N	1995
Chesnimnus Creek	26I	26	Y	Y	1997
Hilton Gulch	26I	19	N	N	1991
Doe Creek	26I	11	N	N	1992
Chesnimnus Creek	26J	7	N	N	1997
South Fork Chesnimnus	26J	46	Y	Y	1990
South of South Fork Chesnimnus	26J	69	Y	Y	1990

Devil's Run Creek	26K	19	N	N	1990
TNT Gulch	26K	11	N	N	1991
Poison Creek	26K	25	Y	Y	1990
Summit Creek	26K	15	N	N	1991
Billy Creek	26L	36	Y	Y	1992
East Fork Billy Creek	26L	22	Y	Y	1992
Peavine Creek	26M	6	N	N	1998
East Fork Peavine	26M	21	Y	Y	1992
West Fork Peavine	26M	20	Y	Y	1992
McCarty Gulch	26M	17	N	N	1990

Standards and Guides and Matrix - >20 pieces/mile of large wood (length 35 feet and diameter 12 inches)

Specific stream sections deficient in LWM are indicated in Figure VI-11.

Figure VI-11. Upper Joseph Creek Watershed Stream Reaches with Deficient Large Woody Material (refer to project table in project section for project descriptions).



Current Forest Plan direction within Riparian Habitat Conservation Areas should provide for recruitment of large wood in the future. Most wood currently tends to be of smaller size classes, although greater representation of larger size classes is desirable. Due to increasing awareness of the important role LWM plays within riparian systems, the trend is toward leaving larger trees/snags for future recruitment. Only seven areas along surveyed streams are noted for decreased LWM. Although these areas are considered below Forest Plan standards and guidelines, it has never been established as to what resolution within the watershed these guidelines apply. With possible exception of Peavine Creek, all fish-bearing streams that have been surveyed are within Forest Plan direction.

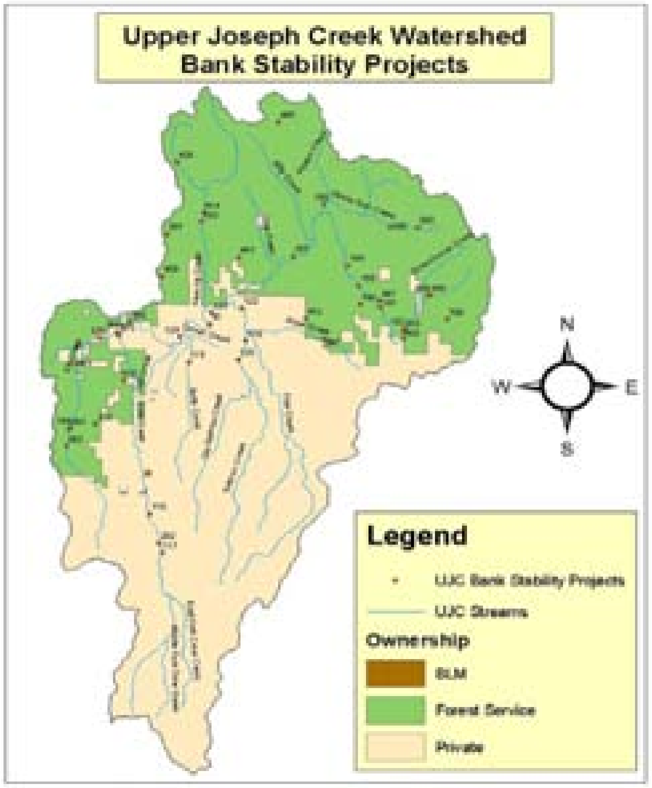
Bank Stability

Bank stability is the measure of lineal distance of actively eroding bank along both sides of the active channel. Forest Plan guidelines require greater than 80 percent bank stability overall.

The primary result of unstable banks is increased sediment delivered to the stream. It has long been established that sediment is a detriment to water quality and salmonid habitat. As noted in the document, “Restoring Ecosystems in the Blue Mountains” (USFS, July 1992), the current range of variability for bank stabilities within the Lower Grande Ronde River Basin is well below the range of natural variability. Poor bank stability has resulted from past timber harvest, channelization, livestock and elk grazing/browsing, and increased peak flows which have modified stream channels.

It is generally accepted by fisheries and hydrology resource specialists that localized problems exist throughout the watershed. In some areas, unstable banks are the result of past management practices, and stream downcutting and entrenchment. Portions of Crow, Elk, and Alder creeks are examples of this. Restoration of these sections would most likely be expensive with uncertain results. In other areas, large animals, particularly livestock, annually disturb streambanks and reduce rhizomatous forbs and shrubs, decrease species diversity, and increase bare and exposed soils. Portions of East Fork Peavine, East Fork Billy, Alder and Upper Elk creeks are examples of this.

Figure VI-12. Upper Joseph Creek Watershed Bank Stability Projects



Although bank stabilities have not been measured across the UJCW, it is likely most subwatersheds are within Forest Plan standards and guidelines. However, it is important to consider that even small areas of bank disturbances can contribute to downstream sedimentation. It seems likely that large animal grazing within riparian areas will continue to affect bank stabilities in localized areas, which in turn will affect salmonid spawning gravels and rearing habitat.

Width-to-depth Ratio

The ratio between width and depth at bankfull flow is an indicator of a streams ability to move sediment and maintain channel form based on the distribution of water energy. Wide, shallow channels indicate poor fish habitat and water quality. Generally, the following impacts occur within the UJCW as a result of high width-to-depth ratios:

- Elevated low flow water temperatures,
- Increases in sediment and turbidity during high flow events,
- Decreases in spawning habitat due to increased sedimentation of spawning beds
- Filling of pools with sediment, and
- Increased streambank angle with corresponding decrease of under-cut banks and loss of fish habitat.

Forest Plan standards and guidelines advocate a width-to-depth ratio of less than 10, regardless of stream type. It is generally agreed by most fisheries and hydrology specialists that this ratio is difficult to achieve for all stream types. Rosgen (1996) C-Type channels can naturally have width-to-depth ratios of 15, and possibly 20.

Figure VI-13. Rosgen Table

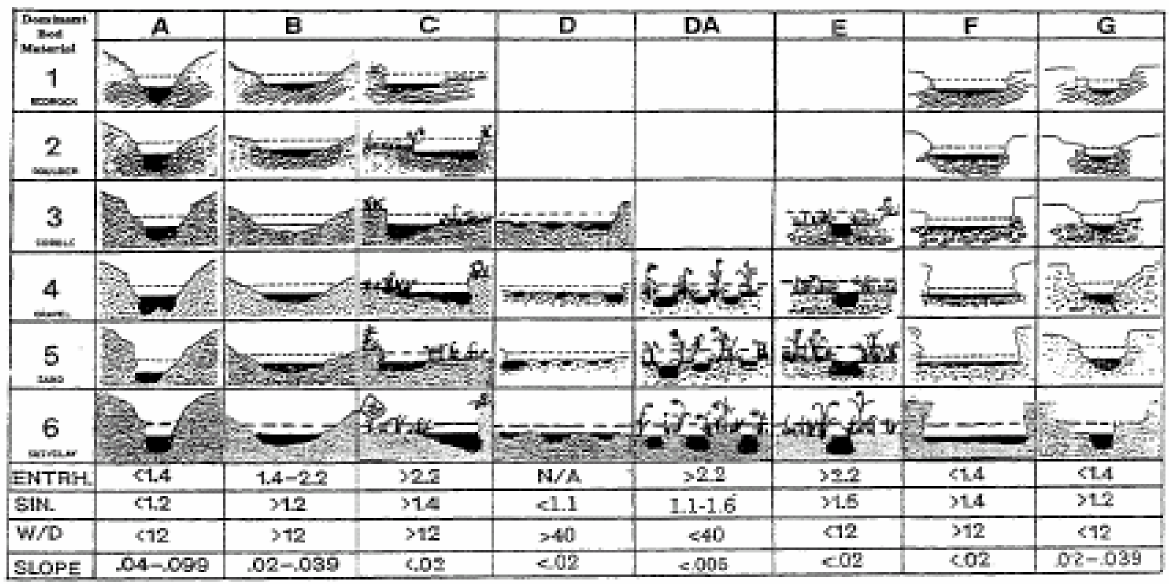


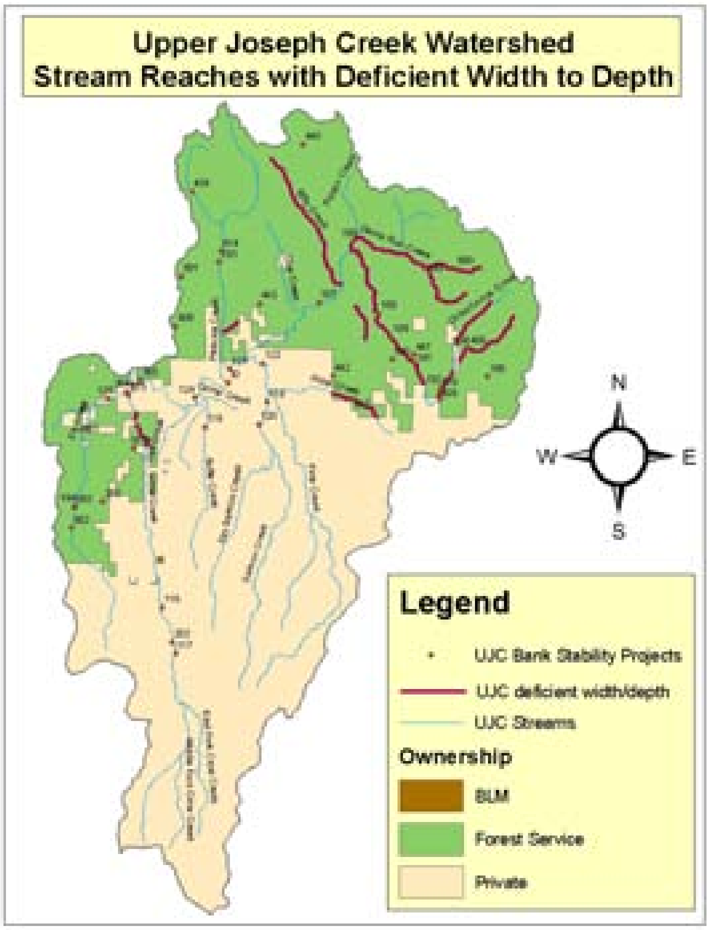
Table VI-22. Upper Joseph Creek Watershed Stream Survey Data: Width-to-depth Ratio

Stream	**Sub watershed**	**Bankfull Width/Depth Ratio**	**Wetted Width/Depth Ratio**	**Rosgen**	**Meets Steelhead Matrix**	**Meets Pacfish**	**Year Surveyed**
Crow Creek	26A	12	16.1	C3/4	N	N	1991
Elk Creek	26B	16.7	8.2	C3/4	Y	Y	1998
Little Elk Creek	26B	5.4	6.8	A4	Y	Y	1991
Alder Creek	26G	4.1	13	B3	N	N	1995
Chesnimnus Creek	26I	24.2	14.9	C4	Y	N	1997
Hilton Gulch	26I	11.9	12.6	A4	N	N	1991
Doe Creek	26I	18	13.6	B3	Y	N	1992
Chesnimnus Creek	26J	10.8	9.7	C4	N	Y	1997
South Fork Chesnimnus	26J	6.7	11.8	B3/4	N	N	1990
South of South Fork Chesnimnus	26J	5.7	10.7	B4	N	N	1990
Devil's Run Creek	26K	12.1	23.2	B3/4	N	N	1990
TNT Gulch	26K	10	15.3	B4	N	N	1991
Poison Creek	26K	8	13.9	A4	Y	N	1990
Summit Creek	26K	10.7	19.8	A4	Y	N	1991
Billy Creek	26L	33	19.4	B3	N	N	1992
East Fork Billy Creek	26L	22.0	13.4	B3	Y	N	1992
Peavine Creek	26M	15.8	11.4	B4	Y	N	1998
East Fork Peavine	26M	21.1	19.5	B3	Y	N	1992
West Fork Peavine	26M	20.2	14.9	B3	Y	N	1992
McCarty Gulch	26M	6.3	13.1	B4	N	N	1990

PACFISH – less than 10 wetted width-to-depth ratio Matrix – Rosgen criteria

Figure VI-14 indicates those areas where width-to-depth ratios are outside Forest Plan standards and guidelines.

Figure VI-14. Upper Joseph Creek Watershed Stream Reaches with Deficient Width-to-depth (refer to project table in project section for project descriptions).



Riparian exclosures located throughout forested portions of the watershed indicate that, as vegetation is allowed to stabilize streambanks and floodplains, water velocities are slowed and banks are sufficiently armored with vegetation to prevent continued deterioration and widening.

Projects

The mission of the Grande Ronde Model Watershed Program (GRMWP) is to develop and oversee the implementation, maintenance, and monitoring of coordinated resource management that will enhance the natural resources of the Grande Ronde River Basin. The following figure and Table describe projects within the UJCW.

Figure VI-15. Upper Joseph Creek Watershed Project Locations as per GRMWP Database

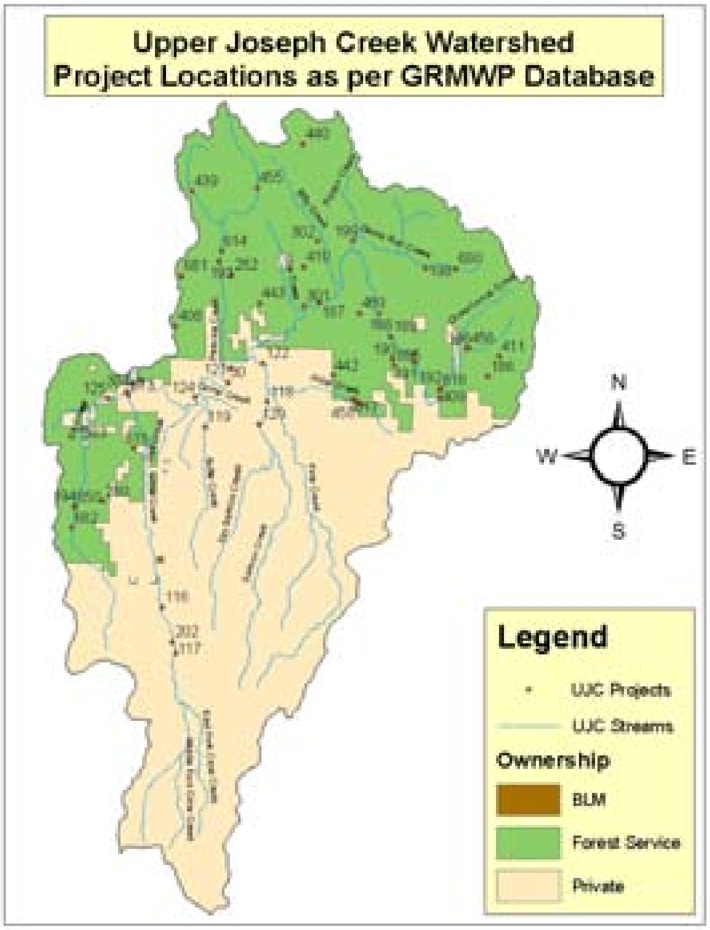


Table VI-23. Upper Joseph Creek Watershed GRMWP Database Project Descriptions

Point ID	Project Name	Project Description	Stream miles treated	Stream miles affected	Acres treated	Acres affected	Road miles treated
30	B & H Ranch Riparian Revegetation Workshop	Streambank bioengineering, riparian zone vegetation planting, education/workshop	3	3	11	11	
116	Crow Creek - ODFW/BPA Fish Habitat/Buhler	Land/stream lease, riparian exclosure fencing & planting, juniper riprap	0.8	0.8	7.4	7.4	
117	Crow Creek - ODFW/BPA Fish Habitat/Fleshman	Land/stream lease, riparian exclosure fencing & planting, log sills, water developments	1.2	1.2	10.5	10.5	
118	Salmon Creek - ODFW/BPA - Fish Habitat/McClaran	Land/stream lease, riparian exclosure fence & plantings, juniper riprap	0.7	0.7	7	7	
119	Butte Creek - ODFW/BPA Fish Habitat/McDaniels	Land/stream lease & riparian exclosure fencing, juniper riprap	2.7	2.7	29.2	29.2	
120	Salmon Creek - ODFW/BPA Fish Habitat/McDaniels	Land/stream lease, riparian exclosure fence & planting, juniper riprap	1.6	1.6	45.5	45.5	

Point ID	Project Name	Project Description	Stream miles treated	Stream miles affected	Acres treated	Acres affected	Road miles treated
121	Chesnimnus - ODFW/BPA Fish Habitat/McDaniels	Land/stream lease, riparian exclosure fencing & planting, boulders, jetties, log & rock weirs, large organic material	3.8	3.8	130.1	130.1	
122	Pine Creek - ODFW/BPA Fish Habitat/McDaniels	Land/stream lease, riparian exclosure fence & planting, boulder placement & juniper riprap	1.5	1.5	43.5	43.5	
124	Chesnimnus - ODFW/BPA Fish Habitat/Yost	Land/stream lease, riparian exclosure fence & planting, boulders, jetties, log & rock weirs, large woody material, juniper riprap	3	3	41.8	41.8	
125	Elk Creek - ODFW/BPA Fish Habitat/Birkmaier	Land/stream lease, riparian exclosure fencing & planting, boulders, jetty, log weirs, large woody material	0.6	0.6	7.7	7.7	
186	Dry Fork/Chesnimnus Riparian Enhancement – USFS	Riparian exclosures & planting	0.5	0.5	14.7	14.7	
187	Chesnimnus Creek (Vigne-Big Canyon) Riparian Enhancement - USFS/BPA	Riparian exclosures & planting, log weirs, large woody material	4.5	4.5	132	132	
188	Chesnimnus Creek (Poison-Cayuse) Riparian Enhancement - USFS/BPA	Riparian exclosures & planting, large woody material	2	2	24	24	
189	Chesnimnus Creek (Upper & Lower Vance Draw) Riparian Enhancement – USFS/BPA	Riparian exclosures & planting, log weirs, large woody material	1.7	1.7	36	36	
190	Vance Gulch & Chesnimnus Tributary Riparian Enhancement – USFS	Riparian exclosures & planting, large woody material	1.65	1.65	29	29	
191	Chesnimnus Creek (Cow Camp) Riparian Enhancement - USFS/BPA	Riparian exclosures & planting, large woody material	3	3	36	36	
192	Chesnimnus Creek (Tree Plantation +) Riparian Enhancement - USFS	Riparian exclosure & planting, large woody material	1.8	1.8	6	6	
193	Peavine & E.F. Peavine Creek Riparian Enhancement - USFS/BPA	Riparian exclosures & planting, log weirs	4.1	4.1	41	41	
194	Elk Creek Riparian Enhancement - USFS/BPA	Riparian exclosures, planting, log structures, large woody material	5.1	5.1	48	48	
196	South Fork Chesnimnus Creek - Riparian Enhancement - USFS	Riparian exclosure & planting	0.15	0.15	2	2	
198	Devils Run (Upper) & TNT Gulch Riparian Enhancement - USFS/BPA	Riparian exclosures, planting, large woody material	2.5	2.5	40	40	

Point ID	Project Name	Project Description	Stream miles treated	Stream miles affected	Acres treated	Acres affected	Road miles treated
199	Devils Run (Lower) Riparian Enhancement – USFS/BPA	Riparian exclosures & planting, large woody material	0.75	0.75	9	9	
202	Crow Creek Riparian Fence - NRCS/Fleshman	Riparian exclosure fence	0.85	0.85	10	10	
266	Birkmaier Streambank Protection	Streambank riprap & gravel bar removal	0.09	0.09			
280	Gould Gulch Riparian Planting – USFS	Riparian planting of conifer seedlings	1.5	1.5	18	18	
282	Peavine Creek Tributaries Large Woody Material Placement – USFS	Large woody material placement in intermittent draws	3.25	3.25			
299	Alder Creek Exclosures – USFS	Riparian exclosures	0.5	0.5	2	2	
301	Greenwood Pasture Fence – USFS	Pasture division fence		3		3800	
302	Chesnimnus Ponds - USFS	Livestock ponds		3.5			
383	Elk Creek Road Repair I - Riparian Enhancement - Road 4600 – USFS	Stabilize slopes/streambank & revegetate bare/unstable surfaces	0.06	0.06			0.06
384	Elk Creek Road Repair II - Riparian Enhancement - Road 4600 & 4620 - USFS	Stabilize & plant slopes/streambank, stabilize around arch pipe culvert	0.12	0.12			0.12
385	Chico Road Flood Repair - Riparian Enhancement - Road 4600185 - USFS	Repair road surface, stabilize slopes/streambank, instream barbs	0.03	0.03			0.03
408	Muddy Pond Exclusion Riparian Enhancement	Pond/riparian planting		0.5	1	1	
409	Tamarack Gulch Riparian Enhancement - USFS	Riparian planting, large woody material	1	1	3	3	
410	Doe Creek Riparian Enhancement - USFS	Large woody material in ephemeral draws	1.5	1.5			
411	Dry Forks Riparian Enhancement - USFS	Large woody material	1.5	1.5			
437	Joseph Creek Watershed Improvement Project	Riparian exclosure fencing, livestock water developments, instream placement of large woody material	77	77	14	14	
439	Joseph Creek Watershed Improvement Project	Riparian exclosure fencing, livestock water developments, instream placement of large woody material	77	77	14	14	
440	Joseph Creek Watershed Improvement Project	Riparian exclosure fencing, livestock water developments, instream placement of large woody material	77	77	14	14	
441	Joseph Creek Watershed Improvement Project	Riparian exclosure fencing, livestock water developments, instream placement of large woody material	77	77	14	14	
442	Joseph Creek Watershed Improvement Project	Riparian exclosure fencing, livestock water developments, instream placement of large woody material	77	77	14	14	

Point ID	Project Name	Project Description	Stream miles treated	Stream miles affected	Acres treated	Acres affected	Road miles treated
443	Joseph Creek Watershed Improvement Project	Riparian exclosure fencing, livestock water developments, instream placement of large woody material	77	77	14	14	
455	East Fork Peavine Large Woody Material Placement – USFS	Instream placement of large woody material	4.5	4.5	18	18	
456	South Fork Chesnimnus Creek Exclosure and Large Woody Material Placement – USFS	Riparian exclosure fence and instream placement of large woody material	0.3	0.3	2	2	
458	Alder Creek Large Woody Material Placement - USFS	Instream placement of large woody material	4	4			
460	Hilton Gulch Large Woody Material Placement - USFS	Instream placement of large woody material	3	3	12	12	
518	Crow Creek Star Thistle Containment and Riparian & Spaldings Catchfly Enhancement Project	Noxious weed control & riparian pasture fence		0.9	40	150	
573	Crow Creek Enhancement - NRCS/Birkmaier	Riparian exclosure fence & livestock water development	0.34	0.34	4	4	
614	USFS Upper Wildcat & Joseph Creek Watershed Improvement Project	Riparian exclosure fence and plantings, livestock/wildlife spring development and protection, instream placement of large woody material	9.75	9.75	99	99	
616	USFS Upper Wildcat & Joseph Creek Watershed Improvement Project	Riparian exclosure fence and plantings, livestock/wildlife spring development and protection, instream placement of large woody material	9.75	9.75	99	99	
617	USFS Upper Wildcat & Joseph Creek Watershed Improvement Project	Riparian exclosure fence and plantings, livestock/wildlife spring development and protection, instream placement of large woody material	9.75	9.75	99	99	
650	Elk Creek Riparian Fence Reconstruction - USFS	Reconstruct riparian exclosure fence	0.31	0.31	10	10	
655	Chesnimnus Watershed Road Obliteration - USFS	Obliterate roads	0.25	1.6			1.6
680	Muddy Elk Hunter Riparian & Watershed Improvement Project	Instream large woody material placement, riparian exclosure & pasture fencing, riparian planting, livestock water developments	6.88	9.88	82.5	2082.5	
681	Muddy Elk Hunter Riparian & Watershed Improvement Project	Instream large woody material placement, riparian exclosure & pasture fencing, riparian planting, livestock water developments	6.88	9.88	82.5	2082.5	
682	Muddy Elk Hunter Riparian & Watershed Improvement Project	Instream large woody material placement, riparian exclosure & pasture fencing, riparian planting, livestock water developments	6.88	9.88	82.5	2082.5	

The following section describes an example of a project on private ground and is in this document as a case example. An excerpt from the ODFW 2001 annual report:

ODFW project background in the UJCW.
Grande Ronde Basin Fish Habitat Enhancement Project:
2001 Annual Report
Project No. 198402500.

This project calls for passive regeneration of habitat, using riparian exclosure fencing as the primary method to restore degraded streams to a normative condition. Active remediation techniques using planting, off-site water developments, site-specific instream structures, or whole channel alterations are also utilized where applicable. Individual projects contribute to and complement ecosystem and basin-wide watershed restoration efforts that are underway by state, federal, and tribal agencies, and local watershed councils.

Historically the Joseph Creek Subbasin has been an excellent producer of summer steelhead, and continues to be managed as a wild fishery. Wild summer steelhead spawning ground counts on ODFW index streams (stream reaches that were selected for consistent annual monitoring) began in the 1960's. Redds/mile in this Subbasin from 1970 through 1984 indicated severe reductions of returning spawning adults. This downward trend showed signs of improvement from 1985 to 1989, and have fluctuated at lower levels since then.

The Grande Ronde Basin Fish Habitat Enhancement Project is a logical and integral part of the species recovery process by implementing projects that establish long term riparian and instream habitat protection, and tributary passage improvement on private lands through riparian lease agreements. Planning for implementation of these projects includes the participation and involvement of private landowners, state and federal agencies, tribes, model watersheds, and watershed councils. Individual projects contribute to ecosystem and basin-wide watershed restoration and management efforts that are underway by these groups.

Drake (1999) concluded that seasonal maximum temperatures and variables related to it explained the distribution and abundance of salmonids in Upper Grande Ronde streams, and that management and restoration activities should focus on reducing stream temperatures. Streams in the John Day basin with greater than 75% shade maintained acceptable stream temperatures for rainbow trout and chinook salmon (Maloney and others, 1999), and the lowest temperatures were observed in streams from ungrazed watersheds. This program primarily relies on restoring natural riparian vegetative recovery, floodplain connectivity and groundwater interactions, using riparian fencing in streams that have been impacted by livestock grazing. This method has proven to be effective in protecting and restoring streams (Beschta and others, 1991; Chaney and others, 1993; Owens and others, 1996).

The Joseph Creek Subbasin (part of Federal Hydrologic Unit Number 17060106) constitutes a major drainage within the Grande Ronde Basin of northeast Oregon. It drains approximately 635 square miles of the 5,229 square mile Grande Ronde Basin. It contains an estimated 225 miles of anadromous fish habitat, and is managed for wild summer steelhead. It empties into the Grande Ronde 4.3 miles above the confluence of the Grande Ronde and Snake Rivers. Approximately 75 percent of the Joseph Creek Subbasin is within the project area. Not included in the project area are lower Joseph Creek in Washington State, and the Cottonwood Creek drainage, which enters Joseph Creek 4.4 miles above Joseph Creek's confluence with the Grande Ronde River.

Within the project area 120.5 miles of stream were identified as in need of habitat enhancement; 75 miles on private land and 45.5 miles on public lands.

Table VI-24. Summary of Projects Completed or in progress by the ODFW/BPA Grande Ronde Basin Fish Habitat Enhancement Project, 1985-2001.

Upper Joseph Creek Subbasin:							
Stream	*Landowner*	*GRMWP Project #*	*Year Built*	*Stream miles*	*Acres Protected*	*Fence Miles*	*Spring Devel.*
Butte Cr.	*McDaniel*	*1128*	*1990-91*	*2.7*	*29.7*	*5.3*	*1*
Chesnimnus Cr.	*McDaniel*	*1130*	*1992*	*3.8*	*130.1*	*8.1*	*0*
Chesnimnus Cr.	*Yost*	*1133*	*1986-87*	*3.0*	*41.8*	*5.6*	*0*
Crow Cr.	*Buhler*	*1125*	*1989*	*0.8*	*7.4*	*1.5*	*0*
Crow Cr.	*Fleshman*	*1126*	*1988*	*1.2*	*10.5*	*2.4*	*2*
Elk Cr.	*Birkmaier*	*1134*	*1986*	*0.6*	*7.7*	*1.4*	*0*
Pine Cr.	*McDaniel*	*1131*	*1991*	*1.5*	*43.5*	*3.2*	*0*
Salmon Cr.	*McClaran*	*1127*	*1989*	*0.7*	*7.0*	*1.4*	*0*
Salmon Cr.	*McDaniel*	*1129*	*1990*	*1.6*	*45.5*	*3.2*	*0*
			Subtotals:	*15.9*	*323.2*	*32.1*	*3*

Salmon Creek

Thermographs were installed at two sites in 1991. The upper site is located at the upstream end of the McDaniel property at RM 2.4. The lower site is near the mouth at RM 0.1, on the McClaran property. Riparian fencing at the upper site was completed in 1990; the lower site was fenced in 1989.

Salmon Creek has consistently shown cooling of stream temperatures as water travels downstream through the riparian corridor. In 1992, comparison of upper and lower summer mean weekly maximum temperatures showed an average cooling of 1.69 degrees C at the lower (downstream) thermograph. In the summer of 2001 the average was 2.72 degrees C cooler at the lower end. Over the last ten years of data collection lower Salmon Creek has averaged 2.5 degrees C cooler. Temperature fluctuations from 1992-2001 averaged 6.4 C at the lower site compared to 9.4 C at the upper site, indicating cooler, stable, and more favorable conditions in the lower reaches. Salmon Creek is a small mid-elevation stream, and despite some large floods in 1996 and 1997, the vegetation is now in better condition to prevent damage from high flows, and there has been a considerable increase in the amount of shade along this reach. The steam channel has narrowed and deepened, reducing the stream water surface area and amount of solar radiation reaching the creek. There are also inputs of ground water from some springs that were also fenced off in 1990, which are also becoming more shaded.

Figure VI-16. Mean weekly summer temperature on Salmon Creek in 2001, RM 2.4 (upper) and RM 0.1 (lower).

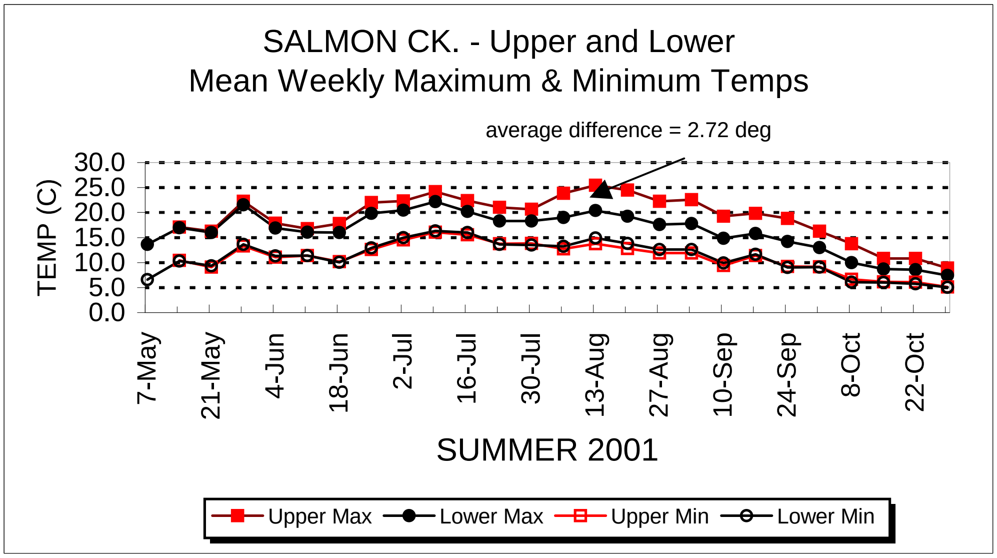
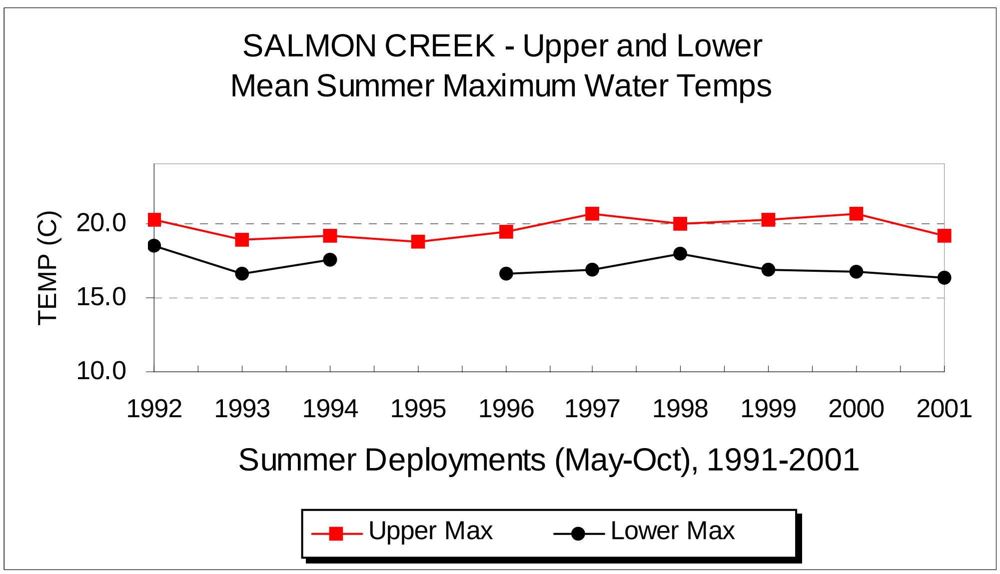


Figure VI-17. Mean summer maximum temperatures on Salmon Creek, 1992-2001, RM 2.4 (upper) and RM 0.1 (lower).



Oregon Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) is a joint federal and state conservation program that targets significant environmental effects related to agriculture. It is a voluntary program that uses financial incentives to encourage farmers and ranchers to enroll in the Conservation Reserve Program in contracts of 10 to 15 years duration to remove lands from agricultural production.

The Oregon CREP, developed to assist in the restoration of habitats for salmon and trout listed under the Federal Endangered Species Act, will restore freshwater riparian habitat along as many as 4,000 miles of streams throughout the state. Goals of the Oregon CREP include:

1. Reducing water temperature to natural ambient conditions,
2. Reducing sediment and nutrient pollution from agricultural lands adjacent to streams by more than 50 percent,
3. Stabilizing streambanks along critical salmon and trout streams, and
4. Restoring stream hydraulic and geomorphic conditions.

Specific conservation practices including filter strips, riparian buffers, and wetland restoration have been identified for inclusion in the CREP program. Both cropland and pastureland are eligible for enrollment in the program. The federal Government will pay applicable land rental costs and 50 percent of the cost of installing conservation practices, the state will pay 25 percent of the cost of conservation practices, and the landowner or another non-federal entity will pay the remaining 25 percent.

In the UJCW several CREP projects have been planned and implemented. The following table describes planned or implemented CREP projects in the UJCW.

Table VI-25. CREP Projects in the Upper Joseph Creek Watershed

Stream	Riparian Buffer (Acres)	Length of Riparian Areas Enrolled (Feet)	Length of Fencing (Feet)	Conservation Plans Written	Projects Implemented
Chesnimnus	50	15,745	13,900	Yes	
Chesnimnus	36.8	4,972	10,130	Yes	
Gooseberry	32	4,500	3,884	Yes	
Pine	90.3	19,470	33,678	Yes	
Pine	86	10,540	18,500	Yes	Yes
Butte	11	6,700	13,681	Yes	Yes
Butte	29	3,600	7,743	Yes	
Crow	42.9	10,200	6,600	Yes	Yes
Peavine	37	4,900	9,280	Yes	
Total	415 Ac.	80,627 Ft.	117,396 Ft.		

The current planned or implemented CREP projects in the UJCW will treat approximately 15 miles of stream. In the coming year, it is expected that another 8 miles of stream will come into the program in the UJCW.

Figure VI-18. Upper Joseph Creek Watershed CREP

Recommendations
Joseph Creek and Tributaries
Wallowa County/Nez Perce Tribe
Salmon Habitat Recovery Plan
August 1993

Joseph Creek, and its tributaries including Cottonwood Creek, Crow Creek, Swamp Creek, and Chesnimnus Creek, were considered in one reach.

The Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan recognizes water quantity, water quality, stream structure and habitat requirements as elements of concern in the UJCW. Water quantity issues include tree density and compaction both viewed as low priority issues. Water quality concerns are temperature (high priority), excess fine sediment (high priority), and fuel density (low priority). Channelization (low priority) has been identified as a stream structure concern and riparian vegetation (high priority) is a concern for habitat requirements.

Table VI-26. Water quantity projects concerning tree density and compaction include:

Tree Density:	Compaction:
• Planting and preserving trees where trees are understocked. • Thinning where trees are overstocked.	• Road use reduction and relocation. • Seasonal road use limitation. • Utilization of light logging equipment. • Road maintenance. • Reduce road runoff. • Limit recreational and livestock trail use in riparian areas.

Table VI-27. Water quality projects to mitigate water temperatures, excess fine sediment and fuel density include:

Temperature:	Excess fine Sediment:	Fuel Density:
• Enhance riparian vegetation. • Spring protection. • Provide cool spring water input to streams. • Bank stabilization and fencing.	• Limit recreational and livestock trail use in riparian areas. • Bank stabilization and fencing. • Provide off stream watering. • Wetlands and filter strips. • Road maintenance. • Road use reduction and relocation. • Seasonal road use limitation. • Utilization of light logging equipment.	• Prescribed burns. • Commercial thinning. • Precommercial thinning. • Fuel piling and rearrangement • Grazing.

Stream structure projects to address channelization include:

- Avoid building in the floodplains.
- Develop mitigation strategies for necessary channelization and bank protection.

Actions to enhance habitat requirements are:

- Protect existing vegetation.
- Conifer and deciduous tree and shrub planting in riparian areas.
- Fencing and banks stabilization activities.
- Provide off stream watering facilities.
- Add and/or preserve large woody material.

The SRP recognizes that sediment is being delivered to portions of the UJCW through road use, logging, recreational activities, and livestock grazing. This plan advocates that streambank destruction and erosion by livestock be prevented through fencing of specific affected riparian areas. The SRP also recognizes riparian vegetation is in poor condition on some tributaries of Joseph Creek.

Additional recommendations from the SRP include:

- Educate landowners about beneficial and detrimental effects of land use on salmonids (and water quality).
- Provide information about government and private funding sources to help correct habitat problems.
- Direct limited funds first towards correcting high priority problems.
- Provide cost share incentives to landowners who maintain and enhance salmonid habitat and overall environmental quality.

Potential Projects
Potential thinning project areas include, but are not limited to, portions of East Fork and West Fork Peavine, East Fork Billy (and tributaries), Summit, Poison, Upper Devils Run, Upper Elk and South Fork Chesnimnus creeks. These projects are expected to improve cover and soil stability in riparian areas and to enhance the hardwood shrub component.

Beaver populations are recognized as a key attribute of riparian health in many watersheds. Managing towards enhancement of beaver habitat is strongly encouraged as a primary tool in bringing riparian areas, in suitable locations, back to historic range of variability. Reestablishment of beaver populations can be a major undertaking, and will need to be carefully coordinated with appropriate State and Tribal agencies as well as private landowners.

During site-specific project design, shrub occurrence should be noted. Silviculture prescriptions and allotment management plans should promote shrub enhancement, particularly those in younger age classes, which tend to be more heavily impacted by grazing and other management activities.

Use of fire within riparian communities should be encouraged to help stimulate shrub growth and to provide open canopies within dense stands of young conifers. Relatively cool burns have little impact on erosion and sedimentation.

Riparian thinning for fire prevention and stand release is encouraged although it should not occur over large areas. A mosaic of stand ages and structures is desired.

Snags and larger trees should be retained for future LWM recruitment within both primary and secondary riparian areas.

Roads have opened riparian canopies along Chesnimnus, East Fork Peavine, West Fork Peavine, mainstem Peavine and Devils Run creeks. Road closures will have a long-term beneficial effect on overall riparian health including temperature, sedimentation and habitat modification.

As noted above, pools are an important component of fish habitat. When passive restoration techniques prove inappropriate, instream restoration projects should emphasize placement of large pieces of wood in streams for pool development and reduction of sediment movement through the stream.

From a perspective of stream morphology and water quality, spring grazing is generally preferred over late summer and fall grazing. Grazing early usually results in better distribution of use between riparian areas and adjacent uplands. Grazing riparian areas during summer should be limited or highly controlled because of the strong tendency for cattle to use these areas disproportionately. Utilization standards have been established to control grazing in riparian areas and should be utilized.

Water gaps between riparian exclosures should be monitored for potential streambank erosion. If significant erosion is occurring, harden the water gap with gravel, or consider providing a source of off stream water.

Table VI-28. Upper Joseph Creek Watershed Assessment Potential Projects

	Stream name	Project
1		Spring development condition assessment on all springs in the UJCW. Bear Paw spring and others as noted on the map need maintenance/repair. The condition of the spring developments may speak to spring conditions in the whole subwatershed.
2	Devils Run	Fix Devils run exclosure as noted on map. right now it seems to be trapping cows instead of keeping them out.
3	TNT Gulch	TNT Gulch: Wide open, no shade, no protection from cattle. Continue fencing down the TNT Gulch.
4	Chesnimnus	Upper Chesnimnus Creek: Address road density problem. Road maintenance needed on roads in the upper reach.
5	Chesnimnus	Upper Chesnimnus: Potential planting in existing exclosures.
6	Peavine	Peavine Creek: Remove culverts on closed road and repair instream structures
7	Chesnimnus	Lower Chesnimnus on Dawson's: Improve livestock control along the creek.
8	Crow Creek	Crow Creek: Private and FS land could use increased livestock control, fencing, and possibly planting
9	Devils Run	Fix 550 road where it meets Devils Run.
10	Elk	Replace culvert in Elk Creek with hardened ford (b0tt0m of 500 rd)
11	Chesnimnus, Peavine Elk, Devils Run	Concerning old instream structures on FS ground in the watershed: Do work on those that are definitely passage barriers or causing water quality problems. Otherwise some of them are providing descent fish habitat. (Peavine, Chesnimnus, Elk, Devils Run)
12	Summit	Summit Creek protection
13	Elk	Close and hydrologically stabilize 959 road on Elk Creek
14	Elk	Planting within exclosure of Elk Creek
15	Elk	Remove trash rack at intersection of Gould and Elk
16	Gould Gulch	Remove trash rack at Gould
17	McCarty	Potential fencing at McCarty Creek
18	Vance Gulch	Vance Gulch potential planting area below and within existing exclosure; additional exclosure?
19		McCarty and Dog Fight Ponds, fencing and planting
20	TNT	Harden ford across TNT gulch
21	Elk	Fix road crossing on Elk – Birkmier has OK'd
22	Peavine	East and West Fork Peavine RHCA thinning
23	Poison	Poison RHCA thinning
24	Alder	Alder RHCA thinning
25	Billy	East Fork Billy RHCA thinning
26	Summit	Summit RHCA thinning
27	Devils	Upper Devil's Run RHCA thinning
28	Elk	Upper Elk Creek RHCA thinning
29		*Road restoration/hydrologic stabilization projects
30		Fish Passage Red culverts (as noted on map)

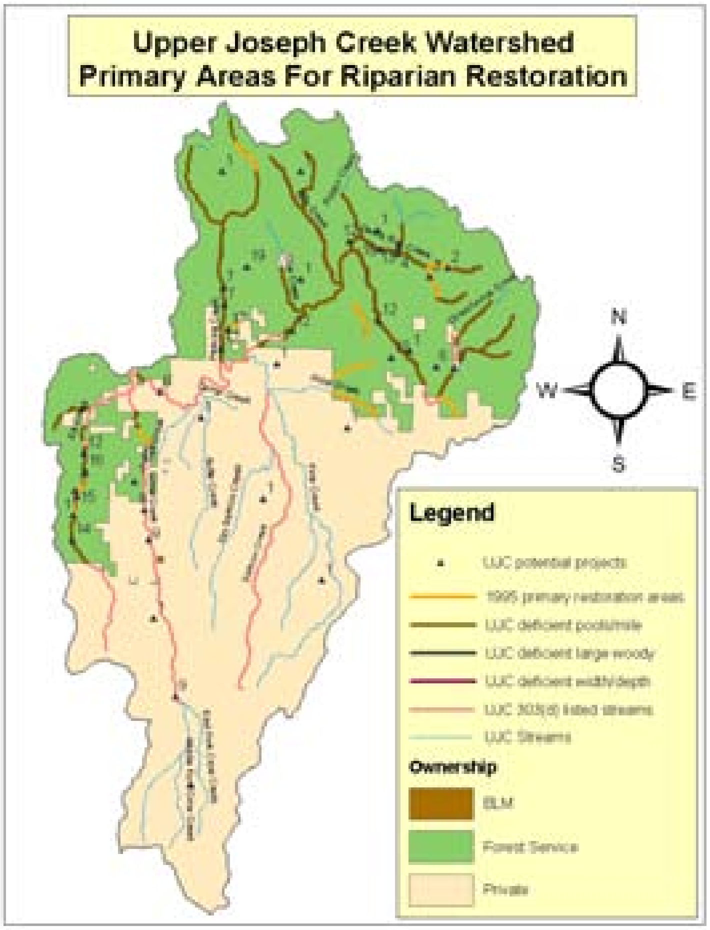
Table VI-29. Upper Joseph Creek Watershed Potential Road Projects

Road Number	Project
4620-110	hydrologically stabilize
4630-300	hydrologically stabilize
978	Decommission
975	Hydrologically stabilize, change gate for admin use only
4600-932	Hardened ford across stream
4665-200	Hydrologically stabilize
4680	Hydrologically stabilize
4625 (segment 102, 227)	Hydrologically stabilize
4600-450	Hydrologically stabilize
4625-800	Hydrologically stabilize
4600-475	Hydrologically stabilize
4690-135	Hydrologically stabilize
4670	Hydrologically stabilize
4690	Hydrologically stabilize
4600-930	Hydrologically stabilize
4605	Hydrologically stabilize
4600-109	Hydrologically stabilize
4620	Hydrologically stabilize
4610	Hydrologically stabilize

Table VI-30. Upper Joseph Creek Watershed Assessment Potential Range Projects

	Project	Sub watershed	Location	Problem	Treatment
1	Vance Knoll NRA	26J	T3N, R47E, Sec. 28, 29, 33	Need to exclose cattle from NRA, separate pastures, and fence Fleenor Springs	3.5 miles fence around NRA, ½ mile fence to separating pastures, ¼ mile plus around Fleenor Springs
2	Devil's Run	26K	T3N, R47E, Sec. 3	Streambanks breaking down, channel widening	Fence meadow
3	Devil's Run	26K	T4N, R47E, Sec. 31, 32 Poison Unit		Add ¾ mile fence to backside
4	Chesnimnus Creek	26J	T3N, R47E, Sec. 8		Add fence to backside
5	Chesnimnus Creek	26J	T4N, R47E, Sec. 31, 32		Add wood material ½ mile to cement bridge
6	TNT Gulch	26K	T3N, R47E, Sec. 10	Streambanks breaking down, channel widening	Add wood material to channel, wood will have to be brought in from other location. Approximately 1/2 mile.
7	TNT Gulch	26K	T3N, R47E, Sec.	cattle gap widening channel	Harden cattle gap and reform channel to match upstream channel width, harden around culvert where road fill is eroding.
8	Vance Gulch	26J	T3N, R47E, Sec. 29	Streambanks breaking down, no streamside vegetation	¾ mile fence exclosure and possible deciduous planting
9	East Fork Peavine	26M		Trailing along stream and streambank breaking down	LWM placement

Figure VI-19. Upper Joseph Creek Watershed Primary Areas for Riparian Restoration



Guidelines for Projects within RHCAs

Prescribed burns within riparian areas may need to be conducted independently of other prescribed burns in order to better control fire behavior and intensity. Use of prescribed fire within riparian areas should be done carefully and should consider slope, erosion hazard, fuel loading, and potential to negatively affect stream shade.

Canopy openings along stream reaches should range between 10 to 40 percent (as recommended through the SRP). This will provide enough light to the forest floor to encourage shrub and forb growth, but not enough to increase stream temperatures. Emphasize selection system silviculture practices, scattered small group removal (1/4 – 2 acre sizes) and orientation of created openings according to aspect, slope, alignment, and shape to maximize shaded snow pack.

To help ensure greater potential for project success, deciduous planting should generally be associated within riparian exclosures. Traditional use and ease of access to an area by large herbivores should be a primary consideration in determining the need of future riparian exclosures.

The following projects were identified as potential restoration areas in the 1995 assessment. Restoration projects identified may include fencing, planting, instream structures, or a combination of all. Projects include the following areas:

- Alder Creek (on National Forest land), approximately two miles;
- Sterling Gulch (below Davis Spring Reservoir), approximately 1.5 miles;
- Tamarack Gulch, approximately one mile;
- TNT Gulch (both upper and lower portions of), approximately one mile;
- Crow Creek (between roads 110-115), approximately one mile;
- Elk Creek (above Wellamotkin Drive), approximately one mile.

Monitoring and Data Needs
To determine trends in juvenile salmonid populations, stream attributes specified by Forest Plan standards and guidelines, or important stream/riparian health indicators, Level III monitoring stations should be established in various locations on National Forest System lands. Level III measurements should focus on width-to-depth ratios, channel substrates, channel entrenchment ratios, streambank stability, water temperature, fish population estimates, and riparian vegetation. Attributes such as pools per mile, large woody material, sinuosity and others can be accomplished using existing Level I protocol in adjacent, localized areas. Cooperative arrangements with appropriate State agencies to determine base line information on private lands is important to evaluate the watershed overall. This information is especially important to determine appropriate restoration objectives, where needed.

To determine seasonal flow and runoff patterns, a stream flow gauging station should be reestablished on Joseph Creek. During the mid-1930's a gauging station was established near Sumac Creek, and records were kept for three years. A site near this location is preferred. Currently, most of the equipment required to operate this facility is available. Tentative agreements with cooperating agencies have been initiated.

To determine site-specific potential for growth and species diversity of deciduous vegetation, comparison within and outside of existing riparian exclosures is needed.

Perform a statistical analysis of the historic and ongoing temperature data that has been presented in this document and that will no doubt continue to be compiled. A statistical analysis will assist in answering the question "What does all of this temperature information mean?" We have the ability to present data on an annual basis but when an answer to what does all of the compiled data over time mean, the services of a statistician are required.

Perform an aerial photo analysis of the 1938, 1988 and 1997 photos in the UJCW. A review and comparison of aerial photographs taken in 1938 and again in 1988 representing riparian locations within forested portions of this watershed, indicate the following:

- Roads, particularly along portions of Peavine, Chesnimnus, and Devils Run creeks have significantly opened up primary and/or secondary riparian canopies.

- Where roads have not been built within riparian areas, the overall canopy closure appeared to be equal, although trees in the 1988 photographs seemed to be smaller and more numerous.
- In the 1988 photos, there were more, yet smaller trees noted throughout the entire watershed. Encroachment into open areas was evident.

This analysis needs to be performed including the 1997 photos.

Roads and Recreation Assessment

Executive Summary

This document describes the analysis used within the Community Planning Process to assess and evaluate the road network in the UJCW. Recommendations have been developed with regard to which roads should remain open to public highway vehicle use and which roads should be closed to public use. These recommendations worked out by the Roads and Recreation Working Group[1] have been reviewed by others involved in the Community Planning process, and will be further reviewed by the public in conjunction with the public review process carried out in the UJC Community Planning process.

This road analysis process applies the USDA Roads Analysis Guide (1999). As outlined in that guide, the environmental costs are balanced against the benefits and uses of the roads. The result is a recommended approach to road management within the basin that meets Forest Plan objectives. The recommendations will be blended with other aspects of management to create project specific proposals carried out under the NEPA process.

The centerpiece of the analysis is an approach developed and applied on the Umpqua NF by an interdisciplinary team of resource specialists on the North Umpqua Ranger District. A spreadsheet is used to perform analysis operations on NF system roads. The USFS roads database for UJC contains 574 roads totaling 815 miles, and comprised of 811 road segments which were subdivisions of individual roads made to facilitate analysis. The database divides roads into three broad groups: USFS, County, and private roads. This analysis dealt only with USFS roads relative to consideration of whether roads should be closed to public use.

At the time of the 1995 UJCW Analysis, there were approximately 640 miles of USFS roads on the NF lands in the basin. Since that time, project-level NEPA analysis has resulted in decision by the District Ranger to close approximately 305 miles of road. Those roads were not re-evaluated; regardless of whether they had been physically closed or were just on the project list to be closed.

All USFS roads not included in previous NEPA decision for closure were evaluated by this process. Resource specialists on the IDT evaluated 287 segments of road making up 309 miles. Each road segment was rated according to 12 beneficial use questions and 13 environmental cost questions. The individual ratings were then weighted according to weighting factors discussed and agreed to by the IDT to reflect the relative importance of each cost and benefit evaluation question. The resulting weighted cost and benefit scores were then arrayed in a way to allow a ranking of high, medium and low to be applied to each segment relative to cost and benefit.

[1] Participants in the working group are identified in *Appendix 2: Participants.*

Road segments were then evaluated using the spreadsheet based matrix and assigned a recommended status as to whether to leave open or close, and if left open whether to accelerate maintenance. The recommendations derived by the spreadsheet based analysis were then evaluated by the IDT and revised into final recommendations.

Final recommendation of the roads analysis process for the UJCW Assessment, after consideration of the combined benefits and costs, resulted in 122 miles of currently open road to be closed on a seasonal or permanent basis, 187 miles to be left open. When the closures recommended in this analysis have been accomplished, the open road density per square mile on the NF land will be approximately 1.58 miles per square mile, well within the Forest Plan guidelines.

Specific road related projects to correct drainage and water quality problems as well as future bridge work are proposed. A possible OHV trail network was developed and assessment of future recreation related needs is discussed.

Current Situation

There are 815 miles of road in the UJC Watershed including all open and closed roads in County, private and USFS ownership. At the time of the 1995 analysis, there were approximately 640 miles of open road on the NF portion of the watershed. Since then, approximately 305 miles of those have been selected for closure by NEPA based analysis. Some of these are still on the project list for physical closure.

Since the 1995 UJCW Analysis, the situation regarding transportation system objectives has remained essentially unchanged. Although many miles of road have been closed, road densities are still in excess of the LMP guidelines in many of the subwatersheds. Wet weather use of native surface roads continues to causing rutting, surface water channeling and subsequent delivery of sediment to streams. Surface deterioration of road 4625 along Lower Chesnimnus Creek continues to be a problem. Several bridges in the basin are approaching their realistic length of service. Budgetary constraints continue to hamper the implementation of needed maintenance. Many of the roads that have been closed to traffic have not had the culverts removed nor has there been a wide-spread program of culvert maintenance developed and implemented for the closed roads.

The Assessment Process

The UJCW Roads and Recreation Assessment is the portion of the UJC Community Planning Process that provides information relative to the maintenance levels of open roads and provides a basis for deciding which roads should be left open to public travel. The analysis has been carried out using Miscellaneous Report FS-693 (August 1999) as the guiding document. Specifically, the analysis was conducted using a process developed by the Umpqua NF for the Steamboat Watershed and adapted for use in UJC. The analysis is a spreadsheet-based operation working with environmental costs and user benefits of individual road segments coupled with an evaluation matrix. The results of the spreadsheet process are then reviewed by the USFS IDT and the District Ranger before being brought to public review.

The objective of this analysis is to provide the critical information to be used within the planning process to develop recommendations for decisions that will tailor the existing road system in the UJCW into one that is safe, responsive to public needs and desires, minimally impacting ecologically, and in balance with available funding and management needs.

This analysis was under the direction of the Wallowa Valley District Ranger by a working group made up of USFS personnel and members of the community cooperating in a larger Community Planning Process on the UJCW.

The analysis process utilized the USFS roads database which contains all USFS, County, and private roads in the basin. Many of the roads have been broken into segments (average length 1.0 mi) and identified by a segment number. The segments are the basic unit evaluated in the analysis as described below.

All of the County roads, and all of the open USFS roads (Objective Level 2 and above, explained below) were inspected and evaluated for work needed to correct potential water quality problems. This information is shown in the **Project Work Sites** section of this analysis.

There has been a substantial amount of project-level planning in NF portion of the watershed over the last several years. A number of road closure decisions have been made, but not all have been implemented. USFS roads are designated according to their Operational Maintenance level and their Objective Maintenance level. All road segments designated Objective Maintenance Level 1 are road segments for which previous NEPA decisions have been made to close. Only road segments that are Objective Maintenance 2 or greater were analyzed in the process. *Appendix 9: Forest Service Roads Data* contains the roads and road segments evaluated in the process, and shows the ratings applied to each as described below.

In addition, the UJC Community Planning Process has served as a forum to discuss a potential OHV trail network (described below).

The Rating Process

Each road segment listed in *Appendix 9* was evaluated by resource specialists and rated according to the evaluation factors shown in *Appendix 10: Segment Rating Criteria*. All open road segments in the watershed were visited during the rating process. In conjunction with this effort, all dispersed campsites, water developments, salt grounds and fences visible from the road were located by GPS coordinates. This information was placed in the GIS database and used in addition to the other GIS data and the local knowledge of the IDT in evaluating the spreadsheet output and making final recommendations.

This portion of the analysis is a key part of the process as outlined in the Roads Analysis Guidelines (FS-643 (1999)). Key questions relative to the Benefits and Environmental Costs are selected from the guideline by the IDT and the line officer working together. The factors in *Appendix 10* reflect the questions/issues considered in rating each road segment.

Benefit factors include four factors under transportation system, four under public access, and one under special uses, two under administrative uses (fire and fuels needs, and one under forest management. The environmental cost factors include six specifically related to riparian and aquatic habitat, and seven for terrestrial species of plants and animals.

The rating applied to each segment for each cost or benefit factor are shown in *Appendix 9*. The column headings: TS1, TS2, etc. refer to the questions contained in the evaluation criteria *(Appendix 10)*, and the numbers ranging from 1 to 3 are the raw scores assigned to each segment for each cost and benefit factor. Blanks indicate a zero rating.

The Weighting Process

As described above, twenty-five questions (twelve benefit and thirteen cost) were selected to represent the important issues relative to roads in UJC. The score assigned to each segment for each question is then weighted by the factors in the fifth row of *Appendix 11: Segment Benefit Scores and Appendix 12: Segment Cost Scores*. These factors reflect the relative importance of each of the twenty-five questions as seen by the IDT and the line officer. The appendices show the Benefit (*Appendix 11*) and Cost (*Appendix 12*) scores and display the issues and questions (TS-1 etc.) as well as the weighting factors.

Total Scores and Assignment of Matrix Positions

The spreadsheet was used to produce total weighted benefit and cost scores for each segment evaluated. These scores are contained in *Appendix 13: Results*.

Since the aim of the spreadsheet analysis was to assist in highlighting road segments that might be closed with minimum impact on benefits and to identify road segments that carried with them high environmental cost, the weighted cost and benefit scores were arrayed in a 3x3 matrix of high, medium, and low benefit against high, medium, and low cost (*Appendix 14: Category Matrix*). The appendix shows the action assigned to each matrix position as well as the number of segments that fell in each portion of the matrix as a result of the breakpoint assignments. The spreadsheet process is designed to do this using the values shown in *Appendix 13* in the top row, labeled Benefit Break Points and Cost Break Points.

The break point values were established by arranging the weighted benefit and cost scores into separate percentile arrays and selecting the values that represented the 33.33 percentile and 66.66 percentile values for each to represent the low and medium break points. The diagram, shown in *Appendix 15: Scatter Plot of Costs and Benefits*, indicates the relative balance within and between the matrix cells. Since there are multiple points represented by many of the points on the scatter diagram, the number of segments falling within each matrix cell is also shown on *Appendix 14*.

The spreadsheet program then assigns the segment to a treatment category based on the pairing of its cost to benefit ratio as shown in the Table VII-1 and *Appendix 14*. Treatment categories based on segment cost/benefit ratings are described in Table VII-2.

Table VII-1. Treatment category for road segments based on pairing of relative cost and benefit scores.

Cost	Benefit	Treatment Category
H	L	Close
M	L	Close
L	L	Leave
H	M	Close
M	M	Quandary
L	M	Leave A
H	H	Quandary
M	H	Leave B
L	H	Leave A

Table VII-2. Treatment category descriptions.

Treatment Category	Description
Close	Close the road to public vehicular access. Road may be used as an ATV trail, blocked and appropriately maintained, gated and used for administrative purposes only, or taken off the system and the right of way profile restored. The specific future management will be a project level decision.
Leave	Leave the road open to public vehicular traffic with the current level of road maintenance.
Leave A	Leave the road open to public vehicular traffic with an accelerated level of maintenance to reduce the environmental cost associated with the road being left open.
Leave B	Leave the road open to public vehicular traffic with a significantly accelerated level of maintenance and possibly reconstruction to reduce the environmental costs associated with the road being left open.
Quandary	IDT and Line Officer specifically reconsider the segment and decide which treatment category the segment should be placed in

The category placement by the spreadsheet analysis process is shown for each road segment in the Matrix Category column of *Appendix 13: Results*.

Final Recommendations

Following field evaluation, rating, and spreadsheet analysis of 287 segments of open roads on NF land, totaling 309 miles in the UJC watershed, the Working Group made the recommendations shown in the “Team Recommendations" column of *Appendix 13* and displayed in Figure VII-1. It is noted here that the team has recommended that some roads previously closed, or scheduled for closure by previous NEPA decisions, be reevaluated to provide access to specific areas.

When implemented, these recommendations will result in an open road density of 1.58 miles per square mile on NF lands in the watershed. This is in contrast to the current level of 2.58 miles per square mile, and well with in the current Land Management Plan guideline.

The schedule for and specific method of road closure will be determined by future project-level planning. Issues relative to specifics such as culvert removal versus establishment of a maintenance plan, gates versus physical barriers, and reshaping versus simple scarification and revegetation of the road prism will be dealt with at that time.

Figure VII-1. Final working group recommendations for USFS roads in Upper Joseph Creek.

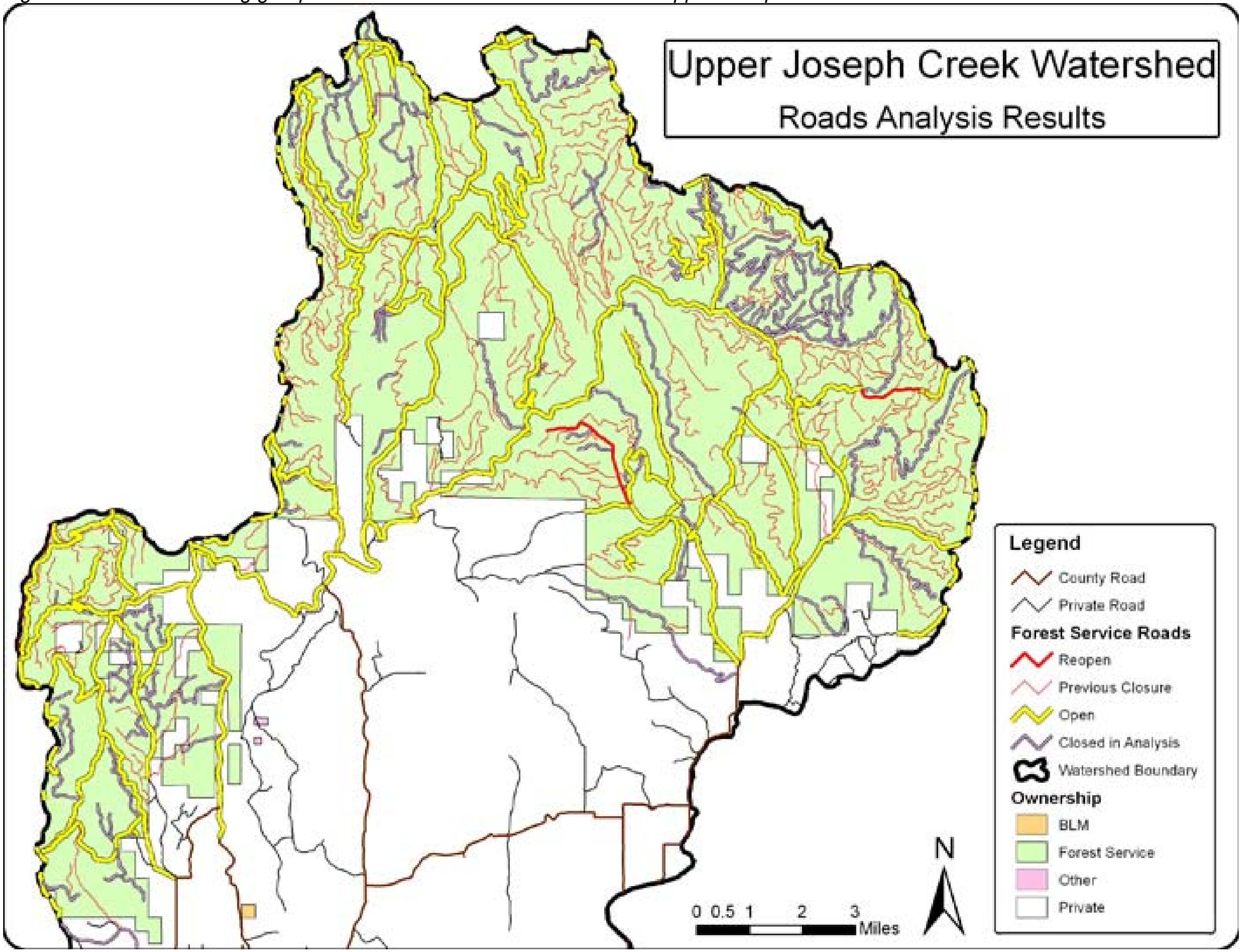
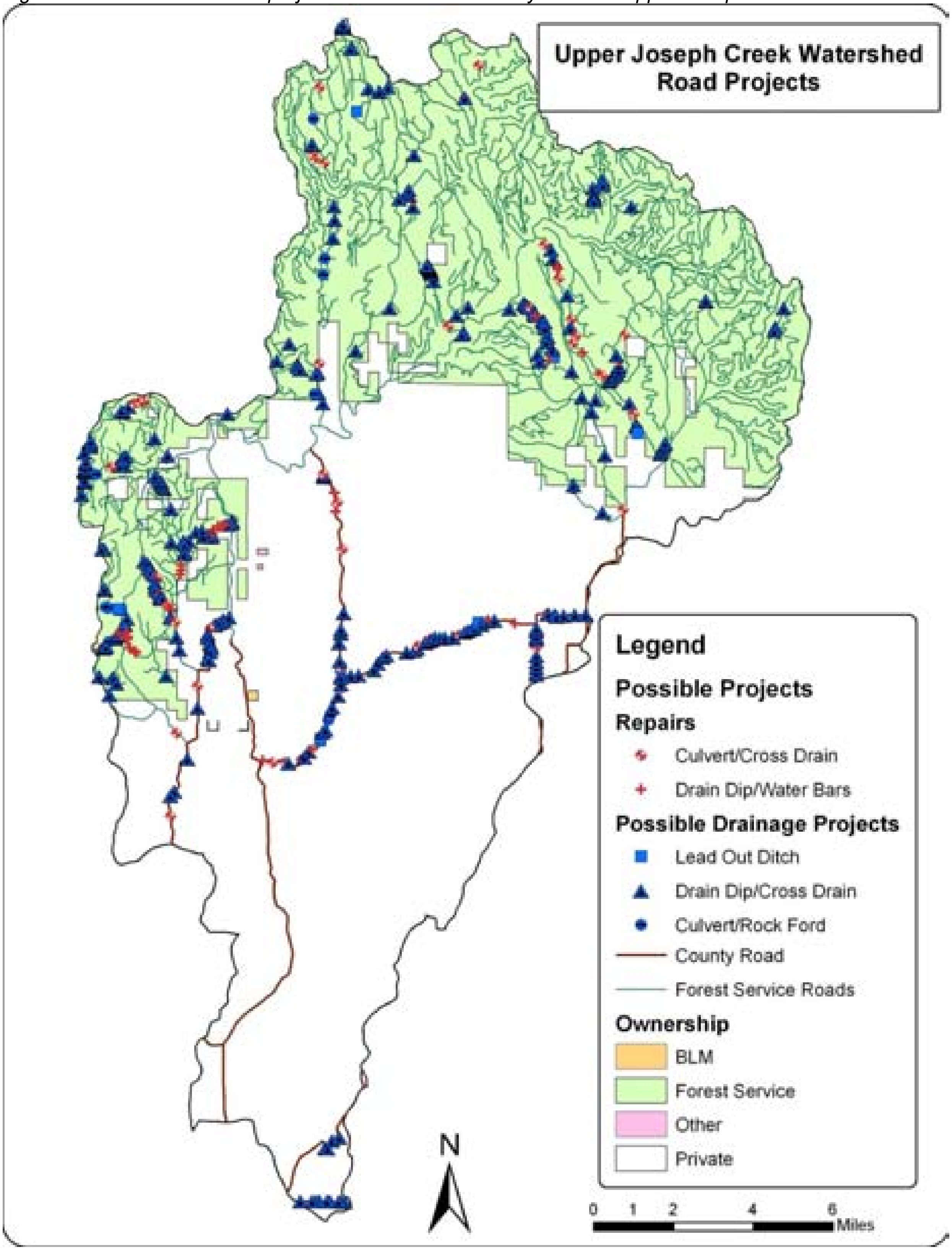


Figure VII-2. Potential roads projects on USFS and County roads in Upper Joseph Creek.



Project Work Sites
In addition to the roads analysis, the specialists' team identified specific sites on County and USFS roads where road surface drainage, surface shaping and cross drains should either be repaired or developed. The inventory includes repair work to 50 culverts/crossdrains and 40 drain dips/waterbars. New projects include 10 lead-out ditches, 277 drain dips/cross drains, and 13 culverts/rock fords. Figure VII-2 illustrates the location of these projects in the watershed.

Bridge Related Project Work[2]

There are eight bridges on USFS roads in UJC. See Table VII-3 for a summary listing of these bridges. They range in age from 5 to 55 years of age, and from 16 to 90 feet in length.

Table VII-3. Bridges on Forest Service Roads in Upper Joseph Creek.

Road Number	Milepost	Name	Year Built	Total Length	Total Deck Width	Number of Lanes	Number of Spans	Superstructure Material
4600000	9.29	Elk Creek	1961	24	15.7	1	1	sawn, treated timber
4600000	12.972	Crow Creek	1998	51	16.5	1	1	prestressed concrete
4600000	13.824	Chesnimnus Creek	1998	90	22.8	2	1	prestressed concrete
4620110	0.1	Long Draw	1966	32	16	1	1	treated glulam timber
4625000	6.679	Peavine Creek	1947	46	18	1	3	sawn, treated timber
4665000	5.482	Peavine #2	1952	15.7	15.6	1	1	sawn, treated timber
4695000	8.7	Howard O'Brien	1959	54.5	20.3	1	3	continuous steel
4695140	4.8	Hilton Bridge	1964	32	16.1	1	1	sawn, treated timber

All of the bridges require periodic deck cleaning and brush removal from the channel and the road approaches. Approaches on bridges with aggregate surfaces often need grading, and those with asphalt sometimes need patching. The object markers often need to be replaced or repaired. Occasionally riprap needs to be placed to protect footings from scour, or deck, rail, or curb repairs are needed.

Two of the bridges in this watershed are over 50 years old (see Table 4), have treated timber stringers, and should be scheduled for replacement.

The Peavine Creek Bridge on the 4625 road is the priority bridge for replacement. It has the following problems:

- The curb is rotten, is missing some pieces, and needs to be replaced.

[2] (from R. Nielsen, Jan 2003)

- The Bridge Railing Hazard Analysis shows that this bridge should have railing but it doesn't.
- The superstructure and substructure are beginning to show some areas of rot.

Rather than repair these items on this old structure, this bridge should be scheduled for replacement.

The Peavine #2 Bridge on the 4665 road will probably need to be scheduled within the next ten years or so for a deck and superstructure replacement. The substructure is concrete and is in good condition except for some minor scouring.

The Howard O'Brien Bridge is fracture critical. This means that there are only two supporting superstructure members, and that if either of them were to fail, it would result in a total failure of the bridge. Special fracture critical inspections are required on this bridge once every 10 years.

OHV Trail Network

In connection with the community planning effort in UJC, the local OHV Club did substantial work to prepare options for a designated OHV trail system within the watershed. This work was reviewed by a sub-group consisting of diverse stakeholders and expertise including wildlife specialists (USFS, ODF&W), Nez Perce Tribe, Oregon Parks and Recreation Department OHV advisors, USFS Recreation specialists, as well as community and environmental group representatives.

This effort sought to balance the OHV desire for a designated trail system offering diversity - one that caters to various rider skill levels and provides trail variation over the course of a three day weekend; with wildlife habitat and other ecological issues, as well as the future network of the road system - recognizing that some roads would be closed due to reduced operational budgets within the USFS and a desire to reduce the amount of roaded habitat.

Despite considerable effort by all parties, agreement could not be reached for a designated system within UJC, and user groups shifted their attention to adjacent watersheds and the Salt Creek Summit area.

Recreation Considerations

The current situation is fairly well described by the 1995 watershed analysis. The basic use priorities remain similar. Use by hunters remains the heaviest use with driving for pleasure, dispersed camping, OHV riding, biking, mushrooming etc. all likely to increase.

Things that may need consideration and generate changes in emphasis include proposals for a fairly widespread OHV trail system using primarily closed roads, draft proposals for developing a self-guided auto tour along the Wellamotkin Road (4600 road) and a recognition of the need to provide more potable and non-potable water sources.

Inventories of range-related spring developments and dispersed campsites were conducted in connection with the road analysis process. Many dispersed camps are close to these water sources and a high percentage of the springs and troughs were in need of maintenance.

Projections of population growth in the region within driving distance may warrant increased promotion and development of recreation opportunities in the basin. The 1995 UJCW Analysis recommends a recreation corridor management plan if this occurs.

Wildlife Issues[1]

Workshop on Wildlife and Wildlife Habitat
September 11, 2002[2]

Goals

1. Secure the engagement of wildlife/habitat managers, agencies, representatives and advocates in Upper Joseph Creek Community Planning effort.
2. Review the state of knowledge concerning wildlife species, habitats and conditions relevant to the Upper Joseph Creek watershed.
3. Identify key issues pertinent to the watershed analysis, and the formulation of recommendations for restoration and management action.

Community Planning Process

Background

The Upper Joseph Creek Watershed Assessment is taking place by mandate of the Wallowa County Board of Commissioners. The Steering Body is the Natural Resources Advisory Council, with Wallowa Resources appointed to coordinate and facilitate the working groups in the assessment of: (i) forest condition; (ii) range condition; (iii) riparian condition; and, (iv) road and recreation use analysis.

Progress to Date

- Forest Condition: data collection is finished; completing map generation; continuing analysis
- Range Condition: data collection is finished, working on summary set to tie to satellite imagery and analysis
- Riparian Condition: collected flow and temperature data this season; updating 1995 analysis with temperature trend data, developed database of riparian restoration projects in the watershed and new maps
- Road & Rec Analysis: using the North Umpqua roads analysis spreadsheet (cost vs. benefit), will look for possible road closures in the watershed; field work finished; next step is analyzing the evaluation criteria

[1] A separate wildlife working group was not formed. Instead, a workshop was convened to identify major wildlife issues. This section contains the minutes from that workshop.
[2] A list of participants in this workshop can be found in *Appendix 2: Participants.*

Review of Salmon Plan

Nils reviewed issues listed in the Wallowa County-Nez Perce Tribe Salmon Habitat Recovery Plan analysis for Joseph Creek:

High Priority	Low Priority
Water temperature	Tree density
Excess fine sediment	Compaction
Herbicide/pesticide use	Fuel density
Riparian vegetation	Channelization

1995 Analysis

Ralph Anderson reviewed the 12 issues outlined in the Upper Joseph Creek Watershed Analysis Report (1995) in relation to wildlife concerns (handout). Since that analysis, new analysis has been gathered from project driven surveys, database compilation, and systematic bird and bat monitoring.
From Ralph's discussion:

Issue	Discussion
1. Structural Stages	Wildlife habitat in forested land falls into three main categories: Coniferous forest - mid and low elevation Deciduous forest - cottonwood, aspen, & willow carrs Brushlands – alder, hawthorne, talus garlands Concern: the deciduous forest (all native hardwoods including willow carrs) have become almost nonexistent as habitat.
2. Insects and Disease	From a wildlife standpoint, insects and disease are not necessarily bad as they can be habitat producing and prey bases. Concerns: epidemic infestations, introduced and exotic species.
3. Fire and Fuels	For wildlife habitat, all fire is not good, and all fire is not bad. There are differences in prehistoric, historic and current fire periodicity. Concerns for reducing fuels are: striking a balance between hazard and risk, natural fuels vs. harvest fuels
4. Rangeland Vegetation	Three important references for wildlife habitat are: Existing conditions Reference conditions Desired future conditions Concern: may be missing information about historic conditions
5. Stream Conditions	Key characteristics identified: Vegetative conditions Channel morphology (pools, bank stability, width to depth ratio) Temperature

	Large woody material Restoration efforts could include beavers vegetation, and large woody material.
6. Riparian Dependent Species	Three groups: Aquatic species Emergent (invertebrates) Terrestrial vertebrates (beavers, water voles, water shrews, veerys, red-eyed vireos, yellow-bellied chats, catbirds, yellow-billed cuckoo) Concern: the most challenged bird species seem to be those that depend on riparian habitat
7. Old Growth	Functional old growth abundance is of primary concern. This structure is deficit in comparison to HRV for both warm/dry and cold/dry environments. A range of species key into this habitat.
8. Big Game	Specifically, deer, elk, bighorn sheep, and antelope. Most of the antelope habitat within the UJCW watershed is on private land – a reintroduction concern.
9. Grassland Habitat	Issues: Distribution Species of concern (including Native American gathering species: camas, wild onion, and wild carrot) Condition and trend Invasive species Concern: need more data and a good definition for desired future condition
10. Scenery	Wildlife and wildlife habitat contribute to overall sense of place an inherent scenic attractiveness. Concerns: increasing diversity (seems to be suffering), and minimizing management impact
11. Recreation	A few activities that can impact wildlife and their habitat are: camping, viewing, forest product gathering, and hunting.
12. Access and Travel Management	In addition to prehistoric, historic, and current access and travel within the UJCW watershed, desired future condition should also consider buffers, open road densities, ATV's, and snowmobiles.

Review of Key ESA Issues and Guidelines

Catherine Broyles (NMFS) described the ESA Consultation Process for proposed projects (handout). For projects proposed in the UJCW Assessment, consultation will proceed easier with NMFS early involvement in the planning process and keeping in mind guidelines found in the 1998 Steelhead and Critical Habitat EO and the 2001 BO.

Key issues from *Biological Opinion: Land and Resource Management Plans for National Forests and Bureau of Land Management Resource Areas in the Upper Columbia River Basin and Snake River Basin Evolutionarily Significant Units* (2001):

> Section 7 (a) (2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that any action it authorizes, funds, or carries out, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat.
>
> Within the Wallowa-Whitman National Forest, those species are Snake River salmon and Snake River steelhead.
>
> Listed salmon and steelhead and their habitat may be adversely affected when project design does not adhere to the protective criteria in PACFISH and the 1995 LRMP Opinion.
>
> NMFS considers six key aspects of plan level or related direction where improvements are proposed or already underway which should result in projects more consistently compatible with the survival and recovery of the listed anadromous fish species. These are considered key outstanding items needed to ensure that PACFISH-amended LRMPs sufficiently protect the listed species and designated critical habitat during the extended period for which PACFISH would apply:
>
> a) Prioritization of subbasins for special management;
> b) Accelerating restoration of anadromous fish habitat;
> c) Increased implementation of watershed analysis;
> d) Grouping projects by watershed;
> e) Unroaded area;
> f) And subbasin review/assessment.

Open Discussion

Terrestrial species

Vic Coggins began our discussion, stating that since 1965, he has seen conditions improve tremendously in both range and riparian areas of the UJCWW. Some of the first riparian exclosures in Northeast Oregon were along Elk, Chesnimnus, and Peavine creeks.

Elk are important economically and culturally (more tribal hunting is done here than any other unit in Wallowa County), and maintaining their habitat is a concern. Annual elk trend data has been collected since 1969. Currently, calf mortality rates are high and have been since passage of state law banning hunting cougar and bear with dogs. (Also affecting mule and whitetail deer). Thus, ODFW is managing for reducing the number of those large predators. Changes in elk distribution (more time spent in the flatter uplands vs. lower canyons) could be related to predator pressure (visibility) or grazing (seeking succulent regrowth). Additionally, ATV use is increasing in this area because of its existing extensive road system and accessibility. Designing and designating an ATV trail system should be done carefully because of the potential for elk displacement.

Restoration efforts for bighorn sheep continue and UJCWW watershed can be a migratory area for those animals as they move between Imnaha and Lower Joseph Creek watersheds. ODFW would also like to establish a small self-sustaining population of pronghorn antelope in the Zumwalt area.

The UJCW is good habitat for upland birds. ODFW is working on restoring Columbian Sharp-tailed grouse and those efforts may extend to the Zumwalt prairie. To succeed, they must have excellent range condition for hiding cover as the prairie also has a large concentration of raptors.

Mountain quail has been petitioned for listing as a threatened species. These birds require complex contiguous deciduous vegetation (riparian shrubs). The habitat concern here is the loss of cover, contiguity between patches of cover, and the intrusion of grass – 30-50 meters constitutes an interruption.

A few other species discussed:

Lynx – elevation too low

Reptiles and Amphibians – loss of toads (reasons not clear) and lizards (cheat grass)

Bobcat – good habitat, doing well

Otter – seem to be coming back

Beaver – recognizing that they probably played a much larger historical role in the watershed, the problem with reintroducing them is food. Major vegetative restoration must occur before beaver will be successful.

Whiteheaded woodpecker – trend probably down

Aquatics

Major concerns are temperature, road density, and sedimentation. Several miles of exclosures exist in riparian pastures, and provisions should be made for their continued maintenance. At the same time, those exclosures have concentrated large herbivores in smaller areas for watering. With that increased pressure, the water gaps have become sources of sedimentation from hoof action on the streambank.

The major species of concern is steelhead (redband lumped here and bull trout not a concern). In a recent culvert survey, it was found that 80% do not pass fish.

A lot of work has gone into improving in-stream structure in the UJCW, and trying to achieve criteria developed on the West side may not be attainable. However, the Forest Service does have the ability to tweak the matrix to better reflect conditions here, and this community planning process may provide the best opportunity for adjustment.

Key factors in temperature and sedimentation improvement: riparian vegetation, bank protection, in-stream structures, road closures, road maintenance, and map updates.

Weeds

Upper Joseph Creek is in relatively fair health but threatened. Maintenance is critical. Weeds of primary concern: sulfur cinquefoil, yellow starthistle, and rush skeletonweed. The range inventory group has a record of the weeds they encountered (however, not recorded in the forest analysis).

ATV's

Right now, ATV riders can legally ride anywhere, including closed and off-road situations, when green-dot closures aren't in effect. The local ATV club has identified all of the routes they would like to see in a possible trail system. There is an opportunity to work with them in this process– they understand that all of the routes may not be possible due to several concerns (wildlife, tribal rites, etc.), and in exchange for a trail system, the ATV clubs could possibly help maintain roads and be the "eyes and ears" for possible weed situations. A few concerns expressed specific to roads and ATV's:

- Keep any designated trail system as close as possible to existing main roads.
- Make the largest possible non-roaded areas.
- Extend the green dot system to the entire hunting season (use Boise Cascade road-closure system as a model)
- Possible locked gate system

Slash Burning

ODFW would like to see controlled burns in spring or late fall (not during hunting season) – difficult to spot/glass for game in haze. Also concerned about the overall effect of slash burning reducing shrub cover.

Tribal Rights

Relic grass communities, traditional gathering species and areas, and access for hunting are important. Don't lose sight of cultural interest species in focus on habitat types/typing or T&E species.

Land Ownership

The possibility of increased fragmentation of land ownership (new law allowing splits if 160+ acres) has the potential to also fragment habitat.

Restoration Investment

How many years of riparian investment do we do until we can just back off and let heal on its own? For example, restoration work has been done in Peavine Creek since 1965 and in Elk Creek since 1974, and might be at that point.

Positive Highlights

- 30+ years of improving riparian habitat
- Collaborative, creative, candid discussion of ATV's and their use
- Opportunity for private/public interaction and collaboration, including tribal participation

Issues to Follow Up

- Opportunities within this assessment:
    - Showcase restoration successes (i.e., Elk Creek, other upland habitats)
    - Tribal rights – tell the story for increased public awareness
- Riparian condition – temperature, localized sedimentation, bank stability, lack of beavers, restoring native vegetation in headwater areas
- Roads/ATVs affects on: riparian areas, sedimentation, treaty rights, habitat
- Inventories:
    - Data gaps and funding sources to accomplish
    - Upland water sources
    - Gaps between riparian exclosures
    - Distribution of T&E/sensitive plants
    - Old growth dependent species
    - Upland deciduous plants (i.e., native hardwoods)
    - Areas subject to subdivision and possible effects
    - Historic beaver occurrence/effects
- Gaps between riparian exclosures – documentation of role and amount in sedimentation and possible remedies (i.e., hardening, fencing, developing alternative, off-channel water)
- Impacts of prescribed burning – opportunity to look at the ecological effects
- Timing of water release may be off by one month from historic conditions – verify this and possible causes (up-stream storage, stand density management, lack of beavers?)
- Wildlife corridors/linkage zones – monitor and assess their utility (what species use them, when are they used, and how important are they?)
- Culverts and road drainage maintenance
- Weed strategy development (public meetings emphasizing prevention, protection, and treatment options)– addressing now is the most effective
- Better match of plants to site for revegetation in future restoration efforts
- Range
    - Understanding the affects of timing of seasonal grazing by cattle and elk on restoration efforts
    - Interpreting C&T and I plot data for trend
    - Conditions on private ground may be better than anticipated, but there are hot spots
    - Range condition for sharp-tailed grouse habitat
    - Basin wild rye re-establishment
- Restoring stand resiliency to fire – old growth systems in particular
- Bats – what have we learned, what does it mean – interpretation for general consumption
- Monitoring for neotropical migratory birds, rare fur bearers (i.e., wolves, wolverine, fisher, lynx), and old-growth Ponderosa pine dependent species

Cultural Assessment[1]

Introduction

The ethno historic and ethnographic data presented below have a degree of application far greater than the Upper Joseph Creek Watershed (UJCW), which is but a tiny fraction of territory occupied by the Nez Perce Indians. Although rather general, this information sets the stage and or provides a backdrop for the late prehistoric and early historic Nez Perce occupation of the Joseph Uplands and Wallowa County in general. Where possible, this information will be focused at the watershed level. The discussion of the archaeological resources will be more specific, and will be based on previous archaeological investigations within and adjacent to UJCW. In order to understand the prehistory and archaeology at the watershed level, it will be necessary to look at broader, regional patterns. For this reason, adjacent archaeological resources may refer to sites twenty-five miles distant, particularly those located within Hells Canyon. Wherever possible and or appropriate the ethno historic, ethnographic and archaeological data will be brought to bear on the future management of significant cultural resources located within UJCW. Much of the discussion which will follow, will be based in part, on over twenty years of archaeological field experience, by the author, within and adjacent to the UJCW.

Ethnohistory

In the summer of 1806, on their return trip east, the Lewis and Clark expedition would spend more than a month with a group of American Indians near what is now Lewiston, Idaho. Referring to this group as the Chopunnish or Nez Perce, the expedition interviewed a number of Indian informants. From these interviews Lewis and Clark identified seven bands or divisions of the Nez Perce, one of which was referred to as (5) Wil-le-wah Band on the Wallowa River in Oregon, population 500, (Thwaites, Reuben Gold, ed., 1905: Vol.8). Based this information, the expedition developed a crude map displaying the general locations of the various Nez Perce bands. The Wil-le-wah band is depicted as being located on a long, straight river flowing directly northeast into the Snake River. Per Chalfant (1974:6), this may be either the Imnaha or Grande Ronde River. Spinden (1908:174) identifies over forty divisions or bands of Nez Perce. Those most germane to the UJCW include those bands at the Imnaha River; Wallowa Valley; mouth of the Grande River; near Zindels, on the Grande Ronde River; mouth of Joseph Creek; and, above Joseph Creek on the north side of the Grande Ronde.

In the winter of 1834, the expedition led by Captain Benjamin Bonneville reached the breaks of the upper Imnaha River. Based on information gained from previous contacts with The Upper Nez Perce, Bonneville was aware of the existence of the Indian group known as the Joseph

1 The Cultural Assessment was prepared by Bruce R. Womack, retired USDA Forest Service Archaeologist, Wallowa Whitman National Forest. The Assessment is titled "The Culture, History, and Archaeology of Upper Joseph Creek Watershed."

Band, also referred to as the Wallowa or Imnaha Band. Proceeding down stream, the expedition finally encountered the Joseph Band occupying a winter village on the Lower Imnaha River. Referred to by Ray (1974:5) as the most isolated of the subdivisions of the Nez Perce, Bonneville's encounter would be the first meeting between whites and the Wallowa Nez Perce to occur on the Indian's home ground. Already conversant to some degree in the Shahaptia dialect, Bonneville was able to converse freely with members of the band. Per Ray (1974:6):

> Among the early explorers Bonneville was one of the better ethnographers and in the present instance he was to record data of great value about the band now known as the Joseph's during the many days he was to spend with them. Particularly, he noted the range of territory they occupied, the economic pattern with summer use of the uplands, winter occupation of the wooded lower valleys, and the location of the villages and the nature of band leadership.

With Joseph/Wallowa/Imnaha Band Nez Perce as his guides, the Bonneville expedition reached Fort Walla Walla on March 4th 1834. The ethnographic data collected by the Lewis and Clark expedition, 1805-6 and that of Captain Benjamin Bonneville, 1834 would come to have a profound impact in delineating the aboriginal territory of the Nez Perce Indians, in which the study area lies, and serve as the base line, ethnographic data for future Nez Perce ethnographers and ethno historians.

By 1850, white migration into Nez Perce territory had increased dramatically and trouble was on the horizon. In 1855, a treaty was concluded between the Nez Perce, including the Joseph Band. Negotiated by Issac I. Stevens, Governor of the Washington Territory and Joe Palmer, Superintendent of Indian Affairs for the Oregon Territory. The Treaty of 1855 reduced the aboriginal territory of the Nez Perce by almost fifty percent. However, due to the persuasiveness and insistence on the part of Old Joseph all of the aboriginal territory of the Joseph band was retained. This included all of the Imnaha, Grande Ronde and Wallowa River basins. Other than Indian Agency personnel, all non-Indians were excluded from Joseph band territory. The treaty was ratified in 1859 and in 1860, gold was discovered on the Clearwater River.

By 1861, a tent city with over a mile of streets had sprung up in what is now Lewiston, Idaho. As occupation of reservation lands continued unabated, white miners and settlers began to pressure public officials for the removal of the Indians. The results would be the Treaty of 1863. Negotiated by Superintendent Calvin H. Hale and S.D. Howe and Charles Hutchins representing the United States, the territory controlled by the Nez Perce would be reduced dramatically. Indian participation in the negotiating process was led primarily by Chief Lawyer of the Northern Nez Perce. The Treaty of 1863, concluded on June 9th, 1863 would reduce the size of the Nez Perce Reservation created under the 1855 treaty by approximately ninety percent or over 90,000 square miles. The majority of the ceded lands constituted the aboriginal territory of the Joseph band. When all was said and done, there were fifty-one Indian signatures to the 1863 treaty. Vehemently opposed to the treaty, not a single one of the fifty-one signers was a Joseph Band member. Old Joseph tore a copy of the treaty to shreds and destroyed his long-treasured New Testament, and departed for the Wallowa (Ray, 1974:21-23)

At the time of the 1863 treaty, white encroachment was limited primarily to the Clearwater basin in the northern portion of the reservation. The Wallowa country was for the most part untouched by white settlement, but this was soon to change. Within a few years, white settlers began to make inroads into Joseph Band territory. Although relatively few in number, hostile contacts between whites and Indians did occur and were reported to Indian agents in Idaho. The growing tension between Indians and whites led to the appointment of an investigation commission consisting of Agent Monteith and Oregon Indian Superintendent T.B. Odoneal. In March 1873, Monteith and Odoneal held a joint meeting with white settlers and members of the Joseph Band. The original intent of the meeting was to bring about removal of Joseph and his people from the Wallowa Valley to the reservation at Lapwai. It quickly became apparent to Monteith and Odoneal that such a move would be both impractical and undesirable (Ray 1974:30). This observation was based on a series of factors, the most important of which was that neither believed that the 1863 Treaty was binding on Joseph, since he was not a party to it. Further, the white bureaucrats could not help but notice that:

> While Joseph, and most of his people seem very friendly, and well disposed, they manifest a very strong determination to hold the valley...The Band is composed mainly of young men, who are well armed, and mounted, and whose bravery is unquestionable. It would require a strong force to remove them. We did not feel authorized to say to the Indians that they must do anything in particular, so we confined our efforts to ascertaining their views, and, wishes, and facts upon which their claims are based. (Ray, 1974:33)

The investigation findings, along with a recommendation that the Joseph Band be allowed to remain in the Wallowa Valley and that whites be prohibited entering or settling therein, was submitted to Secretary of the Interior Delano. Further, that an Executive Order be requested, setting apart the Wallowa valley for the exclusive use of the Joseph Band. The submission also included a proposed reservation with meets and bounds. On June 11th 1873, Secretary Delano presented these recommendations to President Grant, and on June 16th, the President set aside the Wallowa Reservation for the roaming Nez Perce Indians and supposedly withholding these lands from entry or settlement by whites. The Reservation would consist of approximately half of the aboriginal territory of the Joseph Band. In essence, the new reservation included the rugged, deeply dissected Grande Ronde and Imnaha River basins and excluded the Wallowa Valley, opening the heart of Joseph Band territory to white settlement. In the end, it would not matter. The prohibition against white settlement of the new reservation would not be enforced and due political pressure, the Wallowa Reservation would be withdrawn in 1875, only two years later. By 1877, the Joseph Band would be at war with the United States. While they would put up a valiant effort, fighting a running battle that would last for months and inflicting heavy losses on the US Army. Finally, the Nez Perce were forced to surrender on October 5th 1877, at what would become the Bear Paw Battlefield in Montana. Approximately 400 Nez Perce, including the Joseph Band, surrendered and would be sent to the Indian Territory in what is now Oklahoma. More than one fourth of those Nez Perce would die either en route to or within Indian Territory. Only women and children and those deemed to pose no future threat would ever return to Idaho. The political, most of the Joseph band including Joseph would eventually be sent to the Colville Reservation in Washington. The now famous Chief Joseph died at Nesplem, Washington on September 21, 1904.

<u>The Indian Claims Commission/Aboriginal Territory of the Nez Perce Indians</u>

On August 13th 1946, Congress created the Indian Claims Commission, (60 Stat. 1049; 25 U.S.C. 70 et seq.):

> By the1946 Act, Congress created a special judicial tribunal to hear and determine claims by Indian tribes in an effort to settle once and for all, the claims of the Indians.... The Congress imposed one important limitation: The Commission could render only a money judgment in favor of the tribes. It could not return any land to them, which might have been taken wrongfully, nor could it give them any land to supply a land base. (*Ralph A. Barney*: preface to Chalfant and Ray 1974)
>
> Occupancy necessary to establish aboriginal possession is a question of fact to be determined as any other question of fact. If it were established as a fact that the lands in question were, or included in, the ancestral home of the Walapais in the sense that they constituted a definable territory occupied exclusively by the Walapais (as distinguished from lands wandered over by Many tribes), then the Walapais had "Indian title." (United States v. Santa Fe Pacific R. Co., 314 U. S. 339 345,1941)

The primary purpose of the Indian Claims Commission was to determine the value of monetary awards owed to the Indian tribes in question. A key to settlement of most Indian claims would be the determination of the extent of the ancestral homeland of the tribes in question. A crucial test would be the best approximation of the areas occupied by the various tribes aboriginally or "for a long time". Further, there was a distinction between lands occupied exclusively by a particular tribe as opposed to lands occupied jointly, by two or more tribes. There would be no monetary remuneration for losses involving jointly occupied territory. In the case of the Nez Perce, Spinden (1908:173):

> *There are no traditions of migration, and so far as can be determined, the tribe has dwelt within these boundaries from time beyond memory. The meaning of most of the place names has been forgotten.*

Based on the ethnographic information collected by Lewis and Clark (1805-06), Bonneville (1834), Spinden (1908) and the ethnographic data provided by Stuart Chalfant (1974), Verne Ray (1939), Joel Berreman (1937) and others, the aboriginal territory, the lands occupied by the Nez Perce Indians would be defined and accepted by the Indian Claims Commission, Defendant's Exhibit 24-A, Docket No. 175 (Map). The UJCW lies wholly within those lands occupied exclusively by Nez Perce Indians.

Settlement and Subsistence

The UJCW lies within the aboriginal territory of the Joseph Band of the Nez Perce (Chalfant and Ray, 197; Ray, 1938; Spinden, 1908). While there are no documented, ethnographic, Nez Perce sites with the watershed, there are numerous, documented, ethnographic Nez Perce camps and villages within close proximity to the study area (Chalfant and Ray, 1974:Exhibit 24-A (map);

Fletcher, 1892:35-38; Schwede, 1966; 42-44).

Schwede (1966): recognizes two types of Nez Perce settlements, the village and the camp. The village is defined as the smallest group of people that live on a seasonal basis in a given named geographical area they are thought to own. A camp is defined as the smallest group of people that live on a seasonal basis in a given named geographical area they are thought to own by use right only. They only own it when they are in the area. Marshall (1977: 159) notes that villages are found primarily at or near salmon fishing stations. Further, he indicates that the smallest residential groups were found on hunting grounds and small root grounds, which would correspond with a camp, rather than a village. Schwede's (1966:9) analyses were based on the location of 295 settlements, 132 villages and 26 settlements, which are probably camps. Villages occur at lower elevations than camps. Schwede's analysis found that 98% of all villages were located below 2500 ft, and that the majority of camps occurred between 2500 and 6500 feet in elevation. Within the UJCW, elevation ranges from 3250 at the confluence of Crow and Chesnimnus Creeks to 5200 feet near the northern boundary of the study area. Of the two settlement types, the camp and/or sites associated with camps are most likely to be represented within the UJCW. Both Marshall (1977:139) and Schwede (1966:3) indicate that the locations of camps and or villages are determined by biophysical factors, primarily the availability of resources, i.e. energy necessary to sustain the group. Both agree that the primary sources of the energy would be fish, roots, game and water.

Both Marshall (1977), and Schwede (1966), recognize only two settlement types, the Village and the Camp. There is a minor problem with applying this model too tightly to the study area, because in this case, that would leave out the majority of the black andesite, lithic resource procurement areas which make up about 90% of the sites within the watershed. Binford, 1980: 9-11 recognizes five settlement types rather than two. Benford recognizes the residential bases (villages) and field camps of Marshall and Schwade, but includes **Caches, Locations** and **Stations.**

Caches as the term implies, refers to the storage or concealment of goods, valuables, e.g. excess supplies of fish, meat, roots, tool-stone etc. for latter use. Caches generally occur near camps or stations. **Locations** are sites at which extractive activities such as collection of lithic raw material are the focus of the subsistence activity. In the case of the UJCW, most locations would occupy waterless, exposed, near ridge top positions in open scabs, not a particularly suitable location for extended or even short term camping. Locations represent the bulk of the sites within the watershed. In some unique situations such as that which exists at the Starvation Springs, a site where water, tool stone and some protection from prevailing winds occur in unison. It is important to note, that the small and large ridge top scabs, which contain lithic raw material, also contain some amounts of culturally significant plants, particularly, lomatium coos. **Stations** are sites at which special purpose task groups gather information, such as monitoring the movement of game or other humans. The physical manifestation of a station could include a hunting blind or an observation post, usually located on a prominence such as Findley Buttes. Neither Marshall, Schwade, nor Binford include a category for religious or spiritual sites (vision quest). Like stations, religious or vision quest sites would likely be located on landforms offering panoramic views, such as Buckhorn Lookout, Poison Point, Red Hill, and of course, the Findley Buttes.

The periodicity, length of availability and extent of resource would have a significant bearing on the overall size and importance of the village or camp and therefore the importance of the people occupying it. Villages in the lower end of river systems like the Snake or Columbia would have access to more and better fish. These villages could and did support larger numbers of individuals and often had higher status as a result. It would be extremely important for villages located further up the system to maintain strong trade ties and or trading partners within the lower, or more well off villages. Per Marshall (1977:37), the food resources most important to the Nez Perce were fish, a wide variety of plants and large game mammals. Anadromous fish are thought to have comprised 50 % of the Nez Perce diet prehistorically 25-40% of the diet was derived from plant resources and the remaining 10-25% from big game.

Fishing

The fisheries most important to the Nez Perce were the anadromous salmonids, Chinnook, silver and blue back salmon and steelhead. These were followed by the non-anadromous fish, whitefish, chiselmouth, suckers and trout. Both anadromous and non-anadromous fish were targeted when they were most vulnerable, during spawning season. Of the three anadromous fish species, Chinook were the most important, spawning in August and early September. Hewes (1947; 1973) estimates that as much as 330 pounds of salmon was consumed by every person, every year. Based on Nez Perce population densities thought to exist in pre-contact times, Hewes believes that the Nez Perce may have caught upwards of 1,200,000 pounds of salmon per year.

Edible Plant Resources

Per Marshall (1977:46) plant resources were the second mainstay of the Nez Perce diet and made up approximately 25-40% of the Nez Perce diet. Plants were collected for both medicinal and industrial purposes, but edible plants were by far the most important. Marshall (1977:47) identifies 34 plant species consumed by the Nez Perce. Marshall's list of plant resources was reviewed by Jerold Hustafa, USDA FS, North Zone Botanist, for fit with the UJCW. Hustafa identified twenty plants from Marshall's list as having a high probability of occurring within or adjacent to the watershed. Those plants will be shown in bold. They are as follows:

The plants will be identified by common English name and scientific name. Plant names follow Hitchcock and Cronquist (1973). Voucher specimens for many have been deposited in the Marion B. Ownbey Herbarium at Washington State University and were identified by Joy Mastrogiuseppe (personal communication 12 II 1974).

Lomatium dissectum--refers to the ultimate potato shaped root of this plant. The upper root of the plant is very oily and consequently not eaten. It is abundant on the slopes of the major river canyons where fine textured soils are well drained. It was not a preferred food because of its poor texture and bad taste. Moreover, the root is difficult to gather: each sample I attempted to collect was over 2 feet deep. My informants called it starvation food, and said that it was gathered in January and February. It was difficult to locate because the above ground parts were deteriorated, leaving only a small dry stock.

Lomatium salmoniflorum--is the earliest blooming food plant in the region. It first appears in late January to late February in the Lewiston area, growing in very rocky soils, inactive talus slopes, and in shallow soils. Both the herbaceous above ground parts and the stout root were eaten. The leaves served "as a kind of garnish" while the roots, though not tasty, were fresh food in the spring. They were especially prized when stores were depleted.

Lomatium canbyi--this was the most valued spring plant. It is especially common in "lithosolic" habitat types as discussed by Daubenmire (1970:39). Relatively dense stands occur on the gentle slopes of ridge tops, which are most common in the Lapwai-Lewiston area. They ripen latest and in least profusion towards Kamiah. The Kamiah area residents rarely stored them but the downstream groups did dry them for winter use. It tastes like kerosene to many people, but this seems to be an attribute of *Lomatium gormanii*, a plant very similar in appearance and habitat. The root of *L. canbyi*, unlike *L. gormanii*, is bald.

L. gormanii is distinguished from *L. canbyi* by the presence of many fine rootlets on the bulb. Both plants apparently occur in the same habitat. In my experience, one dominates the other. What leads to this dominance is unknown, but it seems related to the intensity of soil disturbance.

Yellowbell (*FritilIaria pudica*)--blooms shortly after *Lomatium canbyi*, but at lower elevations. It is common on steep slopes where the soil is relatively deep, moist, and stable. It was primarily a supplementary food plant because its bulb is small.

Lomatium grayi--unlike other *Lomatium* species, which were prized for their roots, the stems were eaten in March or April since, after blooming, the plants become hard and woody. It is very abundant in some limited areas, and grows singly throughout the canyons.

Balsamroot sunflower *(Balsamorhiza sagittata*)--balsamroot sunflower was collected from April to May. The root was baked and the stems were eaten fresh. It is sometimes profuse on relatively high ridges within the canyons; in such cases, it borders a plant community rich in *Lomatium grayi*, which generally grows just downslope. This was primarily a seasonal food.

Hackberry (*Celtis douglasii*)--is especially abundant on the low alluvial fans of the primary streams. It is a primary floristic feature of a distinct habitat type (Daubenmire, 1970:73). The large seeded fruit was crushed and dried for winter use. It was collected in late April or May.

Serviceberry (*Amelanchier alnifolia*)--grows throughout the region, but it is best known from the canyons. It was not preferred to *A. utahensis*, which is generally found at higher altitudes. Serviceberry blooms in March to April, and matures in May or June.

Golden currant *(Ribes aureum*)--is also known as a canyon plant. It bloomed in late March or April, and its fruits were available from May to June. It was less preferred than serviceberry.

Wild hyacinth (*Brodiaea douglasii*)--is a common, though not abundant, plant. It grows in moist, deep soils in both the canyons and plateaus; consequently, the bulb was gathered over a long period. Partly because it does not grow closely bunched together, and partly because it has a relatively small bulb, it was primarily a supplement to other plant foods. It was nevertheless highly valued.

Elderberry (*Sarnbucus cerulea*)--is a common shrub, which carries great numbers of flowers and berries. This lowland elderberry produces as many as three generations of flowers between June and September. Presently shrubs are found in well watered, generally protected spots in the canyons and plateaus of the region. In the Clearwater area elderberries were commonly stored for winter use.

Biscuitroot (*Lomatium coos*)--was one of the most intensively gathered food plants. It is found on well-drained soil, generally ridge tops. It grows in great profusion in the canyons, on the plateaus, and in restricted areas of the Clearwater River bottoms. On the river bottoms it blooms earliest, but does not produce large roots. May and early June is the main collection season, after the seed had matured. This root, along with camas, formed the bulk of the plant foods stored for winter use. A good digger gathered 50-75 pounds of bisquitroot in a single day. As the specific epithet implies, Whites commonly call it coos.

Wild onion (*Allium spp*.)--blooms from May through June. They are found in shallow rocky soils or soils subject to frost heaving. It was not generally collected for winter storage, but was a supplement during their season. Spinden (1908) reports that some Nez Perce cooked it like camas.

Lomatium triternatum var. triternatum--also was a supplementary source of vegetable food. It, too, grows in rocky soils, which are well drained or subject to frost heaving. It grows at roughly the same elevations as *L. coos* and seems to have been collected at the same time.

Frasera (*Frasera fastigiata*)--grows both in the lower ponderosa pine forests and in wet meadows within the pine forest. My informants say it also grew in wet prairie meadows, which are now farmed. It was thus a plateau resource. It was collected as a supplementary plant food in late June and early July while the Nez Perce were at the great root grounds of Camas prairie.

Gooseberry *(Ribes spp.)*--were plateau and foothills resources. They were collected while still green in late June and early July as well as when ripe in August. They were eaten fresh and dried and stored for winter use.

Chokecherry (*Prunus virginiana var. melanocarpa*)--is found both in the canyons and plateaus. They bloom from May through June, and have an equally long period during which the fruits are ripe. They were eaten fresh, and ground, including the stone, for drying and storage.

Elk thistle (*Cirsium scariosum*), a 3 to 4 foot high thistle, is solitary, and grows throughout the area's plateaus and mountain meadows. Both the stalk and root were eaten, but the root was especially favored. They were gathered before the flower had set seed in late July or early August. It was a seasonal supplement, and the roots were not generally stored for winter use.

Sego lily; mariposa lily *(Calochortus eurycarpus; C. nitidus;* probably others)--is found in seasonally dry marshes and flood plains from the canyons into the mountains. However, it is known primarily as a prairie and mountain plant. In the mountains it is found mostly on the terraces of rivers, especially near McCall, Idaho. It was collected from late June through August as a seasonal supplement.

(*Lomatium spp.*)-- is found on dry open slopes in the lower portion of the ponderosa pine zone. This plant, though often abundant, was not preferred and was rarely stored. The root is slightly smaller than a pencil and is somewhat bitter. It was collected in June.

Spring beauty *(Claytonia lanceolata*)--is now confined to open ponderosa pine forests and mountain stream terraces. Formerly it grew on the prairies near Craigmont, Idaho. There the roots of this perennial were an inch or more in diameter. These were dug in late June or early July, and formed a supplementary part of the diet.

Camas *(Camassia spp.,* especially *Camassia quamash var. quamash*)'--is the best known of the roots used by the Nez Perce. Their territory was especially well known for the vigor and abundance of the camas growing there, and-numerous other groups came to exploit these grounds. The most famous of the camas meadows was at Weippe, Idaho. The Camas Prairie, too, was well-known, and even today small "lakes" of camas bloom near Grangeville. Less well-known were the small "holes" of the mountains and the large, well-used grounds near Moscow, Idaho and Pullman, Washington. These different locations had camas marshes, which matured at different times; the lowest, warmest ones were exploited in early to mid-June; the highest, coolest ones could be worked until September. As Daubenmire noted (1970:78) the disturbance caused by digging may have aided the establishment of seedlings. Further, he felt there was no evidence to indicate "overexploitation" of these grounds.

Camas was, along with biscuitroot, the primary root stored for winter use. A winter supply could be gathered in 4 to 5 days. A good digger could gather 80-90 pounds per day of hard labor, while less intensive work would yield 40-50 pounds easily. A week of hard, undivided labor would produce about 500 pounds of cooked roots suitable for winter use. Many other activities were undertaken when people were living at these main grounds. My informants estimate that women gathered camas for two to three weeks.

Sunflower (*Balsamorhiza incana*)--this plant is found in dry soils during middle and late July, especially in the plateaus. Its root was not favored, and though some may have stored it, it was primarily a supplementary food at the time it was collected

Wild carrot (*Perideridia gairdneri*)--was a highly favored food plant. The roots, which have the size, texture, and flavor of young carrots, were gathered in July before they set seed. Afterwards, the root becomes hard and flavorless. These grow over the prairies and in open pine forests. It is not, at least, abundant. It was stored for winter use

Rose hip (*Rosa nutkana var. hispida; R. woodsii* and other species)--was not a favored food. Fertile plants producing rose hips grew in thickets throughout the moist grasslands of the area, but they were especially abundant south of the Snake and Clearwater Rivers. Rose hips were collected as a supplement, except in years when other fruits were in short supply. Then it was gathered and dried in quantity for winter use. Late July and early August was the collection time.

Thimbleberry (*Rubus parviflorus*)--grows throughout Nez Perce territory. Those found in the mountains, however, were favored. It is particularly abundant in the early stage of post-fire forest succession. They apparently were not gathered in quantity by many people, though some were dried and stored for winter use.

Serviceberry (*Arnelanchier utahensis*)--is common throughout the Nez Perce region. Again, those that grew in the mountains were most favored, and great quantities were gathered and stored for winter food. They ripen first in the canyons, about late June, and are ready at their highest elevations during August and early September. Like other berries found in the forest, it is favored by fire and becomes most productive 10 to 15 years after a burn.

Mountain elderberry (*Sambucus racemosa var. melanocarpa; S. cerulea* ?)--was also favored over elderberries found in the canyons and plateau. However, it was rarer. This food was collected in August and September in the foothills of the Bitterroot Range. This plant is also favored by fire: those I have seen were all in small openings of the forest.

Huckleberry (*Vaccinum globulare*)'--was the only huckleberry species I collected, although others are found in the area (e.g. *V. membraneceum*). These berries were collected in the *Abies lasiocarpa* zone. They were picked in August and September. Along with *Amelanchier utahensis,* huckleberry was the major berry collected by the Nez Perce and was highly valued. The huckleberry's productivity increases as a result of fire.

Little fire; fireberry; Grouseberry (*Vaccinium scoparium*) --was another valued high altitude plant. It is found in secondary growth timber stands or in openings on high mountain ridge tops. Its production from year to year seems more variable than other berry crops, however. In years of high production the berry patch is bright red, hence the Nez Perce name. The berries are small, and the Nez Perce made wooden combs to rake the berries from the plants into baskets. These berries were dried for winter use when abundant. Fire favors the growth of *V. scoparium* through the removal of taller plants, which suppress its growth.

Pine moss (*Alectoria jubata*)--lichen, is found throughout the forests of the Nez Perce area. The preferred plants are found in the high mountains. "Pine moss" grows on a variety of tree species, but those found on larch were especially favored. Those of pine are also edible; on the other hand, lichens growing on fir trees are considered inedible. It has been called famine food (Spinden, 1908:205; Haines, 1955:14). Both sources cite Lewis and Clark's journals that report the Nez Perce using lichens from pine trees during famine. The identification of the lichen is uncertain, however, since they were gathered in the winter at relatively low elevations. Given the amount of labor required in obtaining pine moss, and the fact that it is gathered in summer at high altitudes, and requires considerable effort to prepare, it seems unreasonable to assume that it was a famine food.

Hawthorn (*Crataegus columbiana*)'--and (*C. uvuglasii*)'--were collected late in the summer in the canyons and plateaus. As noted in the previous section, hawthorns are so abundant along streams that they form their own peculiar habitat type. Hawthorn fruits were ground and dried for winter use. Marshall (1977:48-59).

Citing Skirmisher's (1967:64-69) data, Marshall notes that some of the plant foods collected by the Nez Perce had higher nutritional values than fish. Of the two primary root crops, camas had the highest nutritional values, possessing 5.4 ounces of protein, or 1695 calories per pound.

Steelhead trout possesses only 3.4 ounces of protein, or 885 calories per pound. It is estimated that a Nez Perce family would require approximately 450 pounds of stored camas per year, assuming it was the only source of plant food (Marshall, 1977:62-63).

Intentional or not, while collecting plant resources, the Nez Perce were manipulating the environment. Most roots, particularly camas and coos were not collected in quantity until their seeds had ripened. In the process of digging roots, soil disturbance would be extensive. Most of the above mentioned plants thrive in disturbed soils. By digging roots after the seeds had ripened, the Nez Perce insured that plant seeds would be distributed in prepared seedbeds, therefore furthering the survival and/or propagation of culturally significant plants (Marshall, 1977:61).

Since the Nez Perce villages were located with respect to primary salmon fishing sites, movement away from the village was in response to the maturation of the above plants, through spring and summer. If the village represents the smallest group that live on a seasonal basis at a given geographical location, then movement to a primary root ground such as Weippe Prairie would constitute one of the largest aggregations of the Nez Perce. Per Chalfant (1974:100) the Joseph band often traveled to Weippe for the purpose of digging camas.

Chalfant (1977:99) notes that the inner bark of the lodgepole pine was sometimes used as an emergency food. There are hundreds of peeled ponderosa pine trees (cambium peeled trees CPTs) within and adjacent to the UJCW, primarily within the northeast portion of the study area near Thomason Meadows. Marshall (1977) makes no reference to the use of inner bark and the purpose for peeling these trees remains unclear. Based on the age class of the trees and the tree ring dates obtained from a few of the trees, ca. 1850, it is highly likely that they were peeled by none other than the Nez Perce. This resource will be discussed in more detail below.

<u>A Cultural Ecoclass Perspective on plants and archaeological resources significant to the Nez Perce</u>

The National Forest portion of the watershed has been subdivided into 25 ecoclasses or plant associations that contain the bulk of the edible plants identified by Hustafa. Fifteen ecoclasses, dominated by grass associations contain the majority of the root resources, particularly camas and cous (biscuit root). Included are biscuit scabs. Four ponderosa pine ecoclasses, consisting of the pine and grass associations and particularly the ponderosa snowberry ecoclass contain the majority of the cambium peeled trees. The Thomason Meadows and Indian Village groves of CPT lie predominantly within the ponderosa pine, snowberry association. Per Hustafa (personal communication) the level of ecoclass mapping currently available may be too coarse to identify narrow grassland stringers, which are known to contain culturally significant plants, particularly roots.

The ability to predict archaeological site location based on ecoclass mapping is similar to that of the twenty culturally significant plants identified by Hustafa. Most sites within the UJCW are found on or near ridge tops, which are characterized by grassland and ponderosa pine, plant associations. The majority of the black andesite, lithic resource sites occupy these same near ridge top settings. The Wallowa-Whitman National Forest (WWNF) cultural resource inventory program is based on a survey design known as S.I.P.S, or Stratified Inventory Probability Sample. This survey design is based on over twenty-five years of cultural resource survey within the forest, the ethnographic pattern and the geomorphology, geography and geology of the WWNF. The survey design stratifies the Forest into High, Medium and Low potential areas based on the probability of discovering prehistoric and historic cultural resources. S.I.P.S. generally works better for prehistoric than historic cultural resources and tends to fit the north end of the Forest better than the south. It is no accident that the bulk of the black andesite lithic scatters, campsites and now, culturally significant plants occur within the High probability stratum, Major Ridge Systems, Water Courses and Springs.

Game Resources

Approximately 15-30% of the Nez Perce diet was obtained through hunting. They categorized game species into three sub-classes, hoofed animals, pawed furry animals and flying animals. Only hoofed animals were hunted extensively. The other animals constituted a much smaller portion of the subsistence economy and when they were collected, it was often due to serendipity (they were caught or killed in hunting activities in which hoofed animals were the primary target, or for ritual purposes). Pawed animals were occasionally eaten, but were not usually hunted for food. Per (Marshall 1977:63), the major food animals of the Nez Perce consisted of six species, elk (*Cervus canadensis*), whitetailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), mountain sheep (*Ovis canadensis*), mountain goat (*Oreamnos americanus*), and moose (*Alces alces*). Two additional species, bison (*Bison bison*) and antelope (*Antilocapra americana*) are referenced as being hunted on the Great Plains, however, both appear to have been present within the study area. All of the above species were hunted either by ambush or driven into traps.

Marshall (1977:67) places considerable emphasis on elk as a primary prey species and down plays the importance of mountain sheep in the subsistence economy. Within and adjacent to the Joseph Creek Watershed, the opposite appears to have been the case. The faunal assemblages obtained from archaeological excavations in Hells Canyon, located only a few airline miles from the northern portion of the watershed, contain significant quantities of mountain sheep bone and are notable for their lack rather than the presence elk remains. In many of the sites in Hells Canyon, particularly the southern portions of the canyon, mountain sheep appear to be the predominate prey species. As one moves north towards Pittsburg Landing, deer takes the lead, but mountain sheep runs a close second. Within the faunal assemblage obtained from Downey Lake, bighorn sheep and pronghorn antelope represent 80% of the identifiable elements (Reid, 1988:60).

The occurrence of bighorn sheep within or adjacent to the study area is not surprising given the name of Big Sheep Creek. According to Horner, (Bartlett, N.D.), this creek was named in the early 1880's for the many mountain sheep that roamed on its breaks. In the winter these sheep would come in droves out on the high point between Imnaha and Big Sheep Creek.

The excavations at Downey Lake also yielded a large molar, which may be that of a bison. According to Fern Warnock, several bison skulls were found along the upper Imnaha River. These skulls were unearthed during a bridge construction project (Gildemeister, 1992). Gildemiester also refers to several undocumented bison finds in Union county. In 1985, one these sites near the town of Union, Oregon was surveyed for the presence of prehistoric cultural materials. An extensive bone bed, entrapment area and drive lanes were identified. The bone bed is contained within a semicircle of stones, which may have once been a stone fence. The bone bed and enclosure lie at the base of a cliff. A stone fence, or drive lane extends away from the top of the basalt cliff. Bone specimens collected from the bone bed were collected and submitted to the University of Washington for analysis. They were positively identified as bison, or modern bison (Womack And Francy, 1985). Temporally diagnostic artifacts recovered from the site suggest that the kill occurred between two and three thousand years ago, about the same time that the Downey Gulch site was occupied.

By the mid 1870's, the Joseph Band of the Nez Perce had also acquired extensive cattle herds. Per 1876 US Census data, the treaty Nez Perce possessed 9,000 head of cattle in 1876, or 3.2 cattle/person. Applying this same value to the Joseph Band, they would have possessed approximately 1,600 head of cattle. The degree to which domestic livestock (cattle) contributed to the historic Nez Perce diet and therefore hunting and gathering activities is unknown. However, if the 1876 US Census estimates for cattle herds among the treaty Nez Perce is correct, and can be extrapolated to the Joseph Band, the impacts would have been significant.

Introduction of the Horse

Acquisition of the horse by the Nez Perce ca. 1730 (Haines, 1938:429-436) had a profound impact on Nez Perce socio-political organization and other cultural systems. Within a few generations, the Nez Perce had become horse pastoralists. According to Chalfant (1974:110), in post horse times, the Nez Perce traveled extensively outside their aboriginal range. The horse increased the range of the Nez Perce and other Plateau groups to the maximum. Trade networks were increased by hundreds of miles, and, by hunter-gatherer standards, huge quantities of goods could be transported with relative ease.

At the time of the Nez Perce War in 1877, each family was thought to possess between 50 and 100 horses. U.S. census figures for the year 1876 indicate that the treaty Nez Perce in Idaho maintained 14,000 head of horses and 9,000 head of cattle. This equates to a horse, person ratio of 5:1. At the time of their surrender at Bear Paw in Montana in 1877, the Joseph band numbered approximately 450 individuals. If one allows for approximately 50+ casualties resulting from the various battles leading up to the Bear Paw Battle, the numbers would have been around 500 individuals in the pre-war setting. Given 5.0 horses/person per the above model, the Joseph Band of the Nez Perce would have had approximately 2500 head of horses.

Maintenance or reliance on large herds of horses probably had a significant impact on prehistoric settlement and subsistence patterns. Many Nez Perce village sites, particularly those within the more rugged portions of the Hells Canyon, which contains numerous village sites, appear to have been abandoned around the time of acquisition of the horse. These areas were simply too rugged and precipitous to be accessible to horses without a heavily constructed trail system which did not exist prior to Euro-American settlement. This tends to be substantiated by the almost total lack of European trade items or artifacts (coppers, gun flints, trade beads etc.) in archaeological assemblages recovered from numerous Hells Canyon sites. The few items that have been found are associated with sites in the lower portion of the canyon, such as the Pittsburg Landing area, which would have been accessible to horses, as well as providing forage for horse herds.

The mobility afforded by the horse had brought the Nez Perce into more intimate relationships with Plains cultures, stimulating trade. Initially, the prolonged trips to the plains were for the purpose of buffalo hunting. Eventually the Nez Perce would return with more than buffalo robes and meat. Repeated contacts with Plains Indian groups resulted in the adoption of plains cultural traits, clothing, house style, and plains tribal structure, which was much more centralized. Per Chalfant (1974:34), tribal Organization in the eastern Plateau, which includes the area occupied by the Nez Perce is not of great age and is largely a result of plains contacts made possible by the horse. Prior to these contacts and or acquisition of the horse, the Nez Perce social structure operated at the band level, rather than the tribe. Per Chalfant (1974:37):

> ...Nez Perce history exhibits a change from an earlier, plateau-type political organization comprising loosely associated bands, each with its own chief, and functioning more or less independently; to a late Plains-like tribal organization characterized by the uniting of geographically grouped bands into larger, tribe-like entities, each coming under more and more control from a prominent band or war chiefs...

Per Marshall (1977:112), groups much larger than the village or band had little more than a vague reality to most Nez Perce. Larger, regional groupings may have been recognized, but consisted of other, distant peoples such as the Shoshoni or Piaute or simply the downstream or upstream people.

Aboriginal Use of Fire

Most Indian groups are thought to have used fire to manipulate the environment for various reasons. Those most likely to have been employed by the Nez Perce are as follows:

- **Hunting**: Burning of large areas to drive big game into smaller unburned areas.
- **Crop Management**: The Nez Perce relied heavily on various root crops, the majority of which grow in wet meadow or scab environments. Burning would retain or enhance both the extent and condition of open areas.
- **Fireproof Areas**: The Nez Perce may have burned around winter villages and seasonal camps to help reduce threat from wildfires.
- **Improve Growth and Yields:** Fire may have been used to improve forage for big game (deer, elk, antelope, bison and eventually horses), root crop production seed plants, berry plants, (especially huckleberries).
- **Clearing Areas for Travel**: Fires may have been started to clear trails for travel through areas that were overgrown with grass or brush.
-

In 1979 a cooperative study was initiated between the USDA Forest Service's Inter-Mountain Forest and Range Experiment Station and the University of Montana. The purpose of this study was to determine the relationship of Indian caused fires to the ecology of western Montana forests (Barrett, 1981). More specifically, the study focused on forests characterized by the presence of ponderosa pine, Douglas fir and grand fir. The researchers utilized fire scar data to determine fire frequency for selected stands. Stands were selected based on proximity to major, Indian travel routes and zones of occupation. Control stands were identified in areas of similar habitat type, but located away from high use zones. Not surprisingly, the researchers found that fire frequencies were much higher in areas adjacent to major travel routes and zones of occupation. They also found that fire frequencies were much higher prior to 1860, the approximate time after which Indian life-ways were interrupted by white settlement.

Specific reference to the use of fire by the Nez Perce is lacking within the ethnographic literature. However, historic accounts of Indian use of fire, e.g. those of Lewis and Clark, Peter Skene Ogden and others are abundant. One such account by a pioneer on Smith Mountain, northwest of the town of Wallowa notes as follows:

> In the late 1800's and early 1900's, much wild hay was cut. The Indians had been hunting and berry-picking the mountain for ages. Every fall when they left they'd set everything afire that would burn, then hunt on that ground next year. There was a heavy growth of pine timber all over, but they kept it burned. There was no brush of any kind. You could take a mower and mow for days among the trees. (Riggle, 1983:37)

Given the location within Wallowa County, it is highly likely that the "Indians" referred to in Riggle's account were Nez Perce.

The purpose of the above discussion involving Native American livestock and burning is to elucidate the often-held misconception that Euro-American settlers encountered a pristine landscape unaffected by other humans. Scientists are beginning to understand that the opposite is more likely the case. At the time of entry of the first white settlers, the grassland forest mosaic of the Blue Mountains and more specifically, the Wallowa country, was in large part a managed landscape. The Indians, or first Americans as they are often called, were the managers. They were an integral part of the ecosystem and to some degree this has probably been the case for the last 8-10,000 years. According to Shinn (1980:415):

Broadcast burning by the peoples of the inland Pacific Northwest was widespread and persisted over an extended period primevally. It may have dominated, perhaps largely pre-empted, natural burning in shaping aboriginal environments. The entry of European culture to the region interrupted native traditions in the use of fire, altered their role in nature, and distorted their prior relation to grazing phenomena, causing fundamental shifts in nature, which continue to this day.

European settlers entered the Wallowa country in the 1860's. By 1870, their numbers had increased to the point that conflict developed between homesteaders and the Indians. By 1877, any meaningful interaction between the Indian community and the forest grassland ecosystems of Wallowa County had ended. From this point on, the dominant cultural force on the landscape would be that of white homesteaders.

Prehistory and Archaeology

The UJCW consists of 75,892 acres of National Forest (NF) land, 504 acres of Bureau of Land

Management lands and 98,278 acres of private holdings, for a total of 174,647 acres of watershed. Largely as a result of the USDA Forest timber sale program, the NF lands have been intensively surveyed for heritage/cultural resources. As a result of these surveys, over 143 archaeological sites have been identified within or immediately adjacent to the NF segment of the watershed to archaeological testing and evaluation and only one of these sites yielded a radiocarbon age estimate. If the archaeology and prehistory of study area are to be understood and or discussed within the framework of the regional prehistory, the watershed cannot be viewed in isolation.

As noted in the in the description of the Environmental Setting, the UJCW can be characterized as a gently dissected basalt plateau. However, to the north and east of the study area lie the Imnaha and Snake River Canyons. They are anything but gently dissected, and represent some of the most rugged topography in western North America. Nonetheless, they contain some of the most significant archaeological resources in Eastern Oregon. The Hells Canyon Archaeological District contains well over 600 prehistoric archaeological sites. As the crow flies, most of these sites are less than twenty-five miles from the UJCW. They have contributed significantly to our understanding of the regional archaeological patterns. It is quite possible, even probable, that the occupants of some of these sites may have visited the study area. For this reason, they will be discussed below.

Since stone tools and the transport and trade of tool stone is a facet of every site discussed below, it is therefore necessary to discuss the bedrock geology of the areas in and around UJCW. The bedrock geology of the Joseph Uplands is dominated by the Miocene, Columbia River Basalts to the extent that no other pre-quaternary geological formations are present. The basalt flows are poorly expressed within most of the watershed. The rock types associated with the basalt flows, primarily basalts and andesite/basalts are exposed as outcrops on steeper slopes or as jointed bedrock in ridge top scabs. Sub-angular basalt/andesite cobbles and boulders can be found in low energy alluvial environments along Elk Creek and its tributaries.

The basalts flows in and around the watershed are noted for the occurrence of extremely fine-grained glassy materials often referred to as glassy basalts. Although jet black, these materials are in fact andesite/basalts. They occur primarily as cobble sized nodules and are most often found in ridge top scab environments. Although bedrock exposures of this material are unusual, it does outcrop on the ridge immediately south of Forest Rd. 46 near Starvation Springs.

The source of the glassy andesites is probably Elk Mountain, which lays approximately four miles southeast Starvation Springs. Elk Mountain is the largest of eighteen Pliocene shield volcanoes collectively referred to as the Joseph Volcanoes (Kleck, 1976:35). To most people, they are simply known as The Buttes. Beyond Elk Mountain, notable volcanoes within or adjacent to UJCW, (north to south), are Roberts Butte, Haskins Butte, Greenwood Butte, Brumback Butte and Findley Buttes. The above volcanoes cut diagonally through the heart of the watershed. Other buttes include Nedham, Harl, Morgan and Miller Buttes located southeast of Wallowa Lake, in the Upper Imnaha Watershed. Elk Mtn, and Roberts Butte located within or immediately adjacent to UJCW, and Harl Butte located approximately eight miles southeast of Enterprise, are the buttes best known for their association with fine grained, andesite tool stone. The material associated with Elk Mtn. and Roberts Butte is jet black while those from Harl Butte consist of reddish orange andesite. While the black andesites predominate, the reddish orange material is present in most excavated sites.

The glassy andesite/basalt deposits were a major source of lithic raw materials for prehistoric hunters and gatherers. Consequently, the area in and around the UJCW area contains one of the highest densities of lithic scatter sites on the Wallowa-Whitman National Forest.

Summary and Conclusions

The UJCW lies within the aboriginal territory of the Nez Perce Indians, more specifically, lands exploited exclusively by the Nez Perce. Prehistorically, the Nez Perce consisted of a loose confederation of independent bands. The band, consisting of several or more extended families was the key to Nez Perce social structure. Historically, the Joseph, Imnaha and Wallowa bands probably interacted the most intensively with the UJCW.

At the time of white encroachment into the Wallowa country, ca. 1860, the Nez Perce may have already played a significant role in shaping the physical environment of the watershed. With thousands of head of horses and cattle, the range was already being managed and or impacted by livestock. Add to the mix the aboriginal use of fire and the mechanics of harvesting plant resources over thousands of acres, the UJCW and surrounding area, has been a culturally managed landscape for thousands of years.

Archaeological investigations conducted within and adjacent to the study area place people within the watershed for the last 8,000 years and possibly longer. There are hundreds of significant cultural resource sites within the watershed. Most if not all of these sites, lithic scatters, cambium peeled trees etc., can be attributed to hunter-gatherer bands operating out of winter villages and seasonal camps located within the northern portion of UJCW and adjacent to it.

The location of seasonal camp sites, lithic workshops and cambium peeled trees are determined by the availability and or location of specific resources, water, food resources, tool stone and in the case of the cambium peeled tree groves, ponderosa pine trees. Campsites are almost always found adjacent to surface water, springs or streams, however numerous other factors, such as proximity to food resources, slope and aspect also play a role in site selection. One thing that all campsites share in common is that they all seem to be located within or adjacent to ecotones or edges. This is most commonly the forest grassland ecotone. Probably 99% of all the prehistoric sites within the UJCW are located accordingly.

The most significant campsites located within or adjacent to the UJCW are three sites in the southern portion of the watershed. They have contributed significantly to our understanding of the development of lithic procurement and reduction strategies in the Joseph Uplands, and probably hold the key to understanding ethnographic Nez Perce settlement and subsistence strategies within the watershed.

The groves of CPTs in the watershed were no doubt peeled by the ancestors of today's Nez Perce Indians. While we know that the UJCW was occupied seasonally by hunter gatherer populations for the last 8000 years and that they were probably the early ancestors of the Nez Perce, the extensive groves of CPTs, probably peeled from the mid 1700s through the late 1800s are living examples of Nez Perce interaction with the watershed. If the USDA FS interpretive sign located at the Indian Village grove of CPTs is accurate, and it probably is, the Nez Perce were busily peeling trees right up until they were evicted from the Wallowa Country by the US Army.

The CPTs within and adjacent to the UJCW are an incredible resource, both from an aesthetic and scientific perspective. There is yet much that can be learned from these trees. While there are hundreds of them, they are a relatively fragile and finite resource. Within a few generations, Indian or White, a significant number of these trees will succumb to old age, insects and fire and will eventually disappear. That is the eventual future for all of the CPTs. The forest needs a well thought out management plan for this resource, developed in conjunction with the Nez Perce Tribe

Edible plant resources important to the Nez Perce occur in significant quantities through out the watershed. Hustafa (2003), identified 20 edible plants that occur within the UJCW. Among them are camas and cous, both mainstays of the Nez Perce diet at the time they would have occupied the watershed as hunters and gatherers. For the majority of these plants, and particularly camas and coos, Forest Service land management activities do not appear to have significantly degraded this resource. In an attempt to better understand the distribution and condition of the edible plant resource, the national Forest portion of the watershed was subdivided on the basis of ecoclass. Twenty-five ecotypes were identified. In short, the grassland and grassland shrub and ponderosa pine communities contain the bulk of the plant resources and are also where the archaeological resources are concentrated.

Lithic resource sites and workshops are all found in near ridge top settings where tool stone is present, and as far as the UJCW is concerned, that tool stone is black andesite. Given the extent and distribution of black andesite resource sites within the UJCW, together, they must have played a significant role in the distribution of black andesite tool stone across the North Zone of the WWNF and probably much of eastern Oregon. Unlike the CPTs, the lithic scatters are in no immediate danger of disappearing. As noted above, all lithic scatters are not created equal. The majority of these sites possess limited data potential beyond defining or refining the lithic technology of the Joseph Uplands. Forest Service land management activities are not likely to significantly degrade the data potential of these sites.

There is however, another type of significance, which does not always mesh well with scientific values and USDA Forest Manuals and Handbooks, PMOAs etc. That would be the intrinsic value placed on the resource by the American Indian community, in this case the Nez Perce. They do seem to believe that all sites are created equal and that all have a value greater than that which can be measured, weighed, dated etc. Just how intrinsic values can be woven into USDA FS land/resource management decisions is beyond the scope of this report. There is one thing for certain; it can not happen without intensive, ongoing, person to person, American Indian involvement in the planning process, especially planning at the watershed level.

The greatest gap in our understanding of the culture, history and archaeology of the UJCW is the un-surveyed Zumwalt Prairie, which constitutes approximately 60% of the UJCW. Based on the bedrock geology and the presence of several Joseph volcanoes, there is no reason to believe that site density would be much different than the NF portion. The Zumwalt Prairie desperately needs some level of archaeological survey before the culture history of the watershed can be truly understood.

As for the most pressing archaeological research and management priorities, in the author's opinion, they are as follows. They are presented in order of priority:

1. Significantly increase the involvement of the Nez Perce, including the Joseph Band in the management of archaeological resources, CPTs and culturally significant plants.

2. Develop a management/research plan for the Thomason Meadows and Indian Village groves of CPTs.

3. Develop a management plan for the Starvation Springs site. This plan should include direction for reducing fuel loads within the most significant portions of the site as defined by Jaehnig (1992). This could be accomplished by a combination of a low ground pressure thinning system such as a forwarder and hand piling and mechanical chipping. The site/spring also functions as a major, stock water development. The current stock tank is located within the boundaries of the site and should be relocated outside the site.

4. Conduct archaeological survey and testing of the Indian Village and Steen ranch sites.

5. Conduct a stratified, archaeological survey of the private portions of the watershed, namely, the Zumwalt Prairie.

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Appendix 1: Acronym Key

Abbreviation	Description
ATV	all-terrain vehicle
BLM	Bureau of Land Management
C&T	Condition and Trend
CPT	cambium peeled tree
CREP	Conservation Reserve Enhancement Program
DEQ	Department of Environmental Quality
DOQ	Digital Orthoquad
ELU	Ecological Land Unit
EPA	Environmental Protection Agency
EVG	Existing Vegetation
FMP	Forest Land Management Plan
FOR	fire occurrence rate
GIS	Geographic Information System
GPS	Geographic Positioning System
HCPC	Hells Canyon Preservation Council
HRV	historic range of variation
ICAPS	International Center for the Advancement of Pastoral Systems
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IDT	Interdiciplinary Team
INFISH	Inland Native Fish Strategy
IP	introduced perennial
LMP	Land Management Plan
LRMP	Land and Resource Management Plan
LWM	large woody material
MS	Multistory Stands
MSLTC	Multistory Large Trees Common
MSLTU	Multi-story Large Trees Uncommon
NEPA	National Environmental Policy Act
NF	National Forest
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OHV	off-highway vehicle
ONHP	Oregon Natural Heritage Program
OSU	Oregon State University
OWEB	Oregon Watershed Enhancement Board
P/T	precipitation/temperature ratio
PACFISH	Implementation of Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California
PM	particulate matter
PMOA	Programmatic Memorandum of Agreement
PMU	Preliminary Mapping Unit

QA/QC	quality assurance/quality control
RHCA	riparian habitat conservation area
S	sensitive
S.I.P.S.	Stratified Inventory Probability Sample
SECC	Stem Exclusion stage with closed canopy
SEOC	Stem Exclusion stage with open canopy
SI	Stand Initiation
SRP	Salmon Habitat Recovery Plan
SSLT	Single Story Large Trees
SWCD	Soil and Water Conservation District
T & E	Threatened and Endangered
TNC	The Nature Conservancy
UJC	Upper Joseph Creek
UJCW	Upper Joseph Creek Watershed
UR	Understory Reinitiation
USDA FS	United States Department of Agriculture Forest Service
USDI	United States Department of the Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
WWNF	Wallowa-Whitman National Forest

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Appendix 3: Forest Condition Assessment Description

1990 Digital Orthoquads (DOQ's) of the Upper Joseph Creek Watershed were used as the image theme in ForestView™, an extension of ArcView. The 1988 EVG Stand Tag Layer was the attribute theme for delineating stand boundaries under a different set of criteria from that used to generate the EVG in '88. The 1988 criteria were significantly driven by species, overstory structure, and density changes, while the current criteria will be driven primarily by density and structural stage. 1997, 1:12000 color photography were used to perceive obvious management changes, aided by a map or theme of timber management activities from 1990 to 1997. Polygons will be combined or split to reflect management treatments interpreted from the photos.

Once the management changes were delineated, a "heads-up" map of the EVG polygons was created from the DOQ image, to conform to the density criteria (0-40%, 40-70%, and 70+%) on the forested land base. Obvious, major structural stage changes were discernable in mono. The majority of polygon changes merged two or more polygons, which may have previously been delineated based on species changes.

Detailed lists of merged polygon numbers were kept in hardcopy as the mapper proceeded, in order to rectify the attribute tables. The outcome of this process was a modified EVG Stand Tag Layer, with polygons delineated by density and gross structural stage, with acreage determined by density stratification.

Designating one mapper to perform the heads-up mapping, for consistency, enhanced quality control. Weekly inspections of the reviewers were conducted initially from Wallowa Resources and the Forest Service in order to ensure compliance with the intent of the project. The heads-up mapping was completed by November 1, 2001.

Following approval of the first completed DOQ, the 9x9 aerial photos were prepared for the field. A clear overlay was attached to alternating photos, the effective areas drawn in permanent black ink, and the EVG polygons and numbers drawn onto the overlay in blue. The data source was a hardcopy of the modified EVG layer superimposed on the DOQ.

The "Modified EVG Data Entry Sheet" contained most of the pertinent data fields to describe the stand. A field for *Structural Stage* was added and used to describe the area following the walk-through. The walk-through was accomplished by pre-planning the route through the stand to cover at least 660 horizontal feet. Stands larger than 40 acres had at least 1320 horizontal feet of coverage. The entry point, route, and exit point were noted on the overlay in red. A minimum of five observation points were established, marked and labeled by flagging, and noted on the overlay in red. At each observation point, tree layer information and relative species cover by layer was obtained with a variable plot. Trees per acre and snag densities were taken with a fixed radius plot. Fuel loads will be summarized following the walk-through, with a comparison to the photo series. Damages, growth assessment, crown ratios, forest health evaluations, and wildlife habitat analysis were recorded in summary prior to exiting the stand.

<u>Production Schedule.</u> The EVG modification process began October 1, 2001, with the first DOQ inspected and ready for transfer to the 9x9's by October 15. The EVG modification was finished by December 1, 2001. Four foresters conducted the field assessment process.

Appendix 4: EVG Data Entry Form Definitions

Initials: _____
Date: _______

Stand Tag: e.g. 2IH16N980001 (2: denotes Wallowa Valley District, IH16: denotes quad designation, N: denotes quad half, 980001: denotes unique stand number. Acceptable tag identifier must be 12 characters in length.)

Data Source Code: CP (denotes walk thru exam was completed in 2001 as part of the "Community Planning" assessment.)

Ecoclass Information: derived from Charlie Johnson's "Plant Associations of the Wallowa-Snake Province… copies provided.

Tree Layer Information:

* Age Class Layer

Code	Definition
R:	Residual component: 200+ years in age
1:	stratum consisting of trees: 150-199 years in age
2:	stratum consisting of trees: 120-149 years in age
3:	stratum consisting of trees: 70-119 years in age
4:	stratum consisting of trees: 40-69 years in age
8	stratum consisting of trees: 0-39 years in age

* Basal Area per acre

Inventory basal area with 20 BAF and record density by layer (trees greater or equal to 5 inches DBH- size classes 4-11).

* Seedlings/saplings per acre

Inventory trees less than or equal to 4.9 inches (size classes (size classes 1,2,3) with a 100th acre plot (11.8' plot radius).

* Clumpiness

Code	Definition
1	Uniform: Trees generally even-spaced; not many holes present in the canopy
2	Clumped: Trees tend to be found in clumps giving stand a patchy character with trees in group, along with unstocked openings. Unstocked openings are a function of past harvesting activities. Stands with past HPR activity (partial removal) have this characteristic
3	Scattered: Trees sparsely distributed throughout the stand
4	Non-forest inclusions: Stand displays inclusions of non-forested openings within forested matrix.

Non-forested inclusions were never forested.

* Size Class

Code	Definition
1	Seedlings less than 1 inch in diameter
2	Seedlings/saplings mixed
3	Saplings: 1”-4.9” in diameter
4	Saplings/poles mixed
5	Poles: 5.0”-8.9” in diameter
6	Poles/small saw mixed
7	Small saw: 9.0”-20.9” in diameter
8	Small saw/medium saw mixed
9	Medium saw: 21.0”-31.9” in diameter
10	Medium saw/Large saw mixed
11	Large saw: 32” + in diameter

<u>Relative Species Coverage by Layer:</u>

* Species composition prioritized by relative dominance by basal area

Code	Definition
PSME	Douglas-fir (<u>Pseudotsuga menziesii)</u>
PIPO	Ponderosa pine (<u>Pinus ponderosae)</u>
PICO	Lodgepole pine (<u>Pinus contorta)</u>
LAOC	Western larch (<u>Larix occidentalis)</u>
PIEN	Englemann spruce (<u>Picea engelmannii)</u>
ABGR	Grand fir (<u>Abies grandis)</u>
ABLA2	Subalpine fir (<u>Abies lasiocarpa</u>)

<u>Snag Densities per Acre:</u> Swing 10 BAF prisim from plot centers… tally snags by diameter, condition class, and species. (Diagrams provided)

Diameter Classes

Code	Definition
1_ _	10”-20” DBH at least 10’ in height
2_ _	20”+ DBH at least 10’ in height

Condition Classes

Code	Definition
_1_	Hard snag: bark intact, branches/fine twigs present
_2_	Hard snag: bark loose, some branches remain- no fine twigs
_3_	Soft snag: no bark, sapwood deteriorated, no branches remain

Species

Code	Definition
_ _1	PIPO (ponderosa pine)
_ _2	LAOC (western larch)
_ _3	PSME (Douglas-fir)
_ _4	PICO (lodgepole pine)
_ _5	ABGR (grand fir)
_ _6	PIEN (Englemann spruce)
_ _7	ABLA2 (subalpine fir)

E.G. A 24" soft ABGR snag would be coded: 235

Fuel loads:

* Photo Series: Indicate representative "Photo series for quantifying forest residues" (twelve most common series provided)

* Height to live fuel crown:

Code	Definition
1	General height from fuel bed to lower live crown: 0-10 feet on at least 25 percent of forested stand
2	General height from fuel bed to lower live crown: 11-20 feet on at least 25 percent of forested stand
3	General height from fuel bed to lower live crown: 21+ feet.

Code stand to most restrictive (lowest value numeral) i.e. if 30% of the stand indicated fuel heights of 0-10 feet and 70% indicated 11-20 feet- code stand as 1.

Stand Exam Summary

* Crown Density: total stand crown closure as derived with a densiometer (or some similar crown density measuring device)

* Layers: total number of existing stand layers

* BA/AC: total basal area per acre (summation of basal areas by layer)

* Snags per Acre: Snag densities by diameter/condition class/ species summarized per acre

Narrative (General Observations):

Hiding Cover: Y or N

Vegetation capable of hiding 90% of a standing adult deer or elk from the view of a human at a distance of 200 feet. Classify the stand as providing hiding cover if 50% or more of the plots or transect meets definition.

Damaging Agents and Severity

Bark beetles

Code	Agent	Severity
_1_	Bark beetles (unknown	_ _1 unsuccessful current attack
_2_	Mountain pine beetle	
_3_	Douglas-fir beetle	
_4_	Spruce beetle	_ _2 successful current attack
_5_	Western pine beetle	
_6_	Pine engraver	_ _3 last years

_7_	Fir engraver	successful
_8_	Red turpentine beetle	attack

Defoliators

Code	Agent
_9_	Defoliators (unknown)
10_	Western spruce budworm
11_	Douglas-fir tussock moth

Code	(Severity: defoliation/top-kill) Defoliation	Top-kill
__1	light	no top kill
__2	defoliation	1-10% dead crown
__3	(1-25%)	11%+ dead crown
__4	moderate	no top kill
__5	defoliation	1-10% dead crown
__6	(26-75%)	11%+ dead crown
__7	heavy	no top kill
__8	defoliation	1-10% dead crown
__9	(76-100%)	11%+ dead crown

Dwarf Mistletoe: The 6-class Dwarf mistletoe rating system by Hawksworth (GTR RM-48) is used to code severity of infection. Code general incidence of mistletoe within stand. Host species of dwarf mistletoe consist of Douglas-fir and western larch within the analysis area.

Code	Definition
1	Light infections (general ratings of 1-2)
2	Moderate infections (general ratings of 3-4)
3	Severe infections (general ratings of 5-6)

Stem Decays: Note incidence within stand with following codes:

Code	Pathogen
47	Red ring rot (Phellinus pini)
48	Indian paint fungus (Echinodontium tinctorium)

Root Diseases: Note incidence within stand (i.e. rot centers visible; crowns of host species deteriorating adjacent to centers) with following codes:

Code	Pathogen
60	Root Diseases (unknown)
61	Annosus root rot (Heterobasidion annosum)
62	Shoestring root rot (Armilaria ostoyea)

63	Black stain (Ceratocystis wageneri)
64	Brown cubical rot (Phaeolus schweinitzii)
65	Laminated root rot (Phellinus weirii)

Silvicultural Opportunities: Identify potential treatment opportunities given existing stand conditions:

Code	Definition	Description
HRG	regen cut	Desireable/acceptable trees (relatively vigorous; i.e. free of insect and disease infestations, crown ratios in excess of 30%, distinct whorls, pointed top, strong excurrent growth form) below minimums for a given site. (Refer to attached photos for examples of desireable vs. undesireable phenotypes…) Assume the following minimum basal areas of desireable/acceptable trees in recommending a HRG prescription: CP associations: 30 BA CD associations: 40 BA CW, CE associations: 50 BA
HSC	selection cut/uneven aged mgmt.	Two to three+ storied structures with multiple age and size classes represented. Trees developing in lower canopy layers capable of release (i.e. possess desireable/acceptable tree characteristics- see above). Existing BA's exceed HRG minimums.

Desireable 4" diameter, "C" stratum Douglas-fir. Note pointed top, strong excurrent growth form, upturned branch angle, distinct whorls

Undesireable 4" diameter, "B" stratum grand fir. Note rounded top, poor crown ratio, indistinct whorls, horizontal to drooping branch angle

HSA	sanitation	Stand contains a salable quantity of dead, damaged, or undesireable trees. Remaining stocking of desireable, acceptable trees exceeds minimum levels. Generally, undesireable nature of excess trees due to insects/disease or damage. Sanitation cut also referred to as "cleaning and weeding"
HTH	commercial thinning	Single cohort structure (may have multiple crown classes represented) of immature or younger (120

		years and less) pole to medium saw timber at densities exceeding the lower limits of full site occupancy. Assume the following basal areas by plant association types as minimum levels of full site occupancy: CP: 60 BA CD: 70 BA CW,CE: 80 BA
HXX	non-commercial thinning	Existing stocking of desirable/acceptable sapling to pole stocking exceeds maximums for the given associations: CP: 250 TPA CD: 250 TPA CW, CE: 300 TPA
HNT	no treatment	Stands do not meet any of the above criteria. Stand density, condition appears adequate for site.

Damage Agents/Severity Indicators

Record the following damaging agents when observed:

- **Bark Beetles**

  Mountain Pine beetle *(Dendroctonus ponderosae)*
  Douglas-fir beetle *(Dendroctonus pseudotsugae)*
  Western pine beetle *(Dendroctonus brevicomis*
  Red Turpentine beetle *(Dendroctonus valens)*
  Spruce beetle *(Dendroctonus rufipennis)*
  Pine engraver beetle *Ips Pini)*
  Fir engraver *(Scolytus ventralis)*

  Note in narrative: Successful current attacks, unsuccessful current attacks, or last years successful attack.

- **Defoliators**

  Western spruce budworm *(Choristoneura occidentalis)*
  Douglas-fir tussock moth *(Orgyia pseudotsugata)*

  Note in narrative: general incidence of crown loss and topkill: light defoliation (1-25% total complement of foliage- new and old- missing), moderate defoliation (25-75%), and heavy defoliation (76-100%).

Topkill categories: no top kill, 1-10 percent dead crown, 10 percent plus dead crown.

- **Dwarf Mistletoe**

The 6-class Dwarf Mistletoe Rating System by Hawksworth (GTR RM-48) is used to code severity of infection. (Live crown is divided into thirds and each third is assigned a numerical score of 0-3). The scores for each third of the crown are totaled to give a severity rating of 1 through 6.

Note in narrative: general incidence of mistletoe within stand… light infections (general ratings of 1-2), moderate infections (ratings of 3-4), and severe infections (ratings of 5-6)

- **Stem Decays**

Red Ring Rot *(Phellinus pini)*
Indian Paint Fungus *(Echinodontium tinctorium)*
Brown cubical butt rot *(Phaeolus schweinitzii)*

Note in narrative: general incidence of above pathogens

- **Root Diseases**

Annosus root rot *(Heterobasidion annosum)*
Shoestring root rot *(Armilaria ostoyae)*
Brown cubical rot *(Phaeolus schweinitzii)*
Laminated root rot *(Phellinus weirii)*

Note in narrative: general incidence within stand.

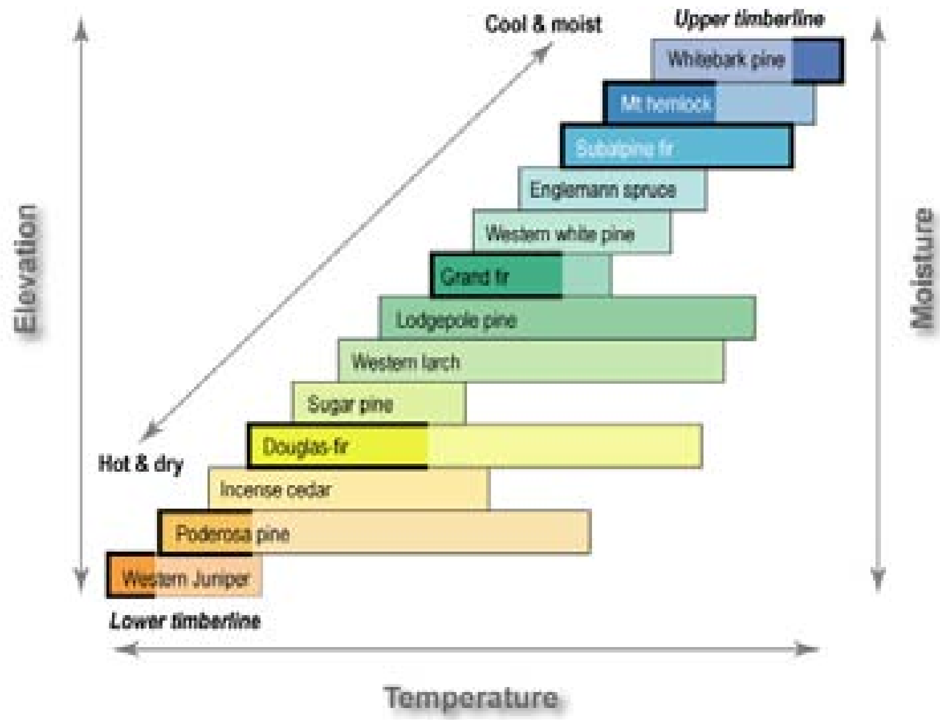
Appendix 5: Biophysical Environments

Biophysical environments provide a system to group plant communities and environmental conditions based upon plant associations, temperature and moisture. Biophysical environments are sites with similar characteristics and responses in relation to disturbance events. They provide the foundation for deriving the historic range of variability for vegetation within a watershed.

Within eastern Oregon, plant associations are based on "Plant Associations of the Wallowa-Snake Province" (Johnson and Simon, 1987) using potential plant associations as a basis. Forest types are assigned according to the biophysical environment classification adopted by the Interior Columbia Basin Ecosystem Management Project (ICBEMP).

Temperature and moisture groups are a relative indicator of the climatic conditions of a given site. Temperature classifications are described as hot, warm, cool, and cold; indicating the relative temperature characteristics of a site. Moisture classifications range from dry to wet indicating the relative moisture of a given site.

This system categorizes the biophysical environments of an ecosystem into a scale ranging from G1 (group 1) through G9 transitioning from cold and wet high elevation environments to hot and dry low elevation environments. The figure below produced by OSU Extension Service (Emmingham, 2005) illustrates this concept with reference to tree species occurring in Eastern Oregon.



Each of these biophysical environments has certain characteristics such as soil content, aspect, moisture, and temperature that are historically adapted to supporting a certain continuum of plants. This continuum is not static or homogenous. It fluctuates within the biophysical environment based on the frequency and severity of disturbance events and through the natural succession of plants.

The forested lands within the Upper Joseph Creek Watershed are dominated by warm dry Ponderosa pine – Douglas fir stands (G7) in the south and cool dry Grand fir (G4) stands in the north. Together these two forest types comprise 59% of the forested land base within federal ownership.

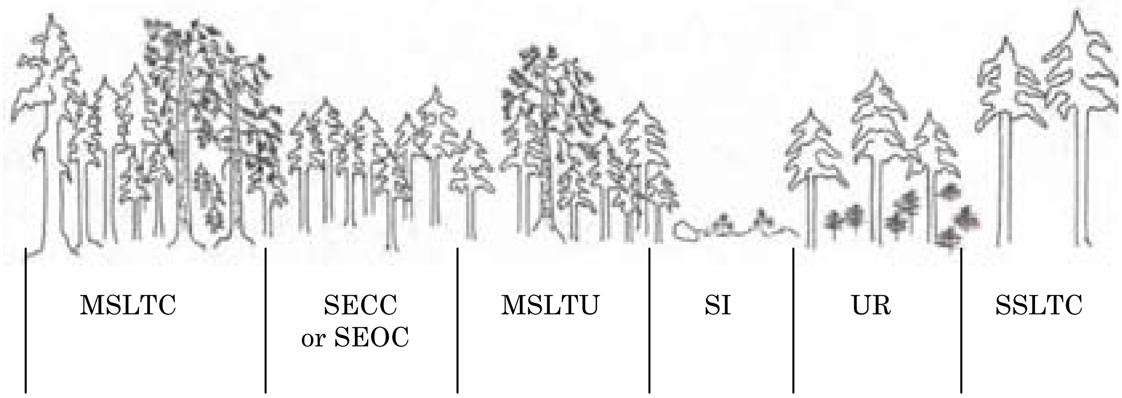
Management prescriptions should respond to the specific biophysical attributes of each site, as well as the legacy of past management action which was fairly uniform across biophysical environments (e.g. overstory removal and fire suppression).

Forest Cover Types by Biophysical Group and Seral Stage within the Upper Joseph Creek Watershed

Biophysical Group	Early Seral	Mid Seral	Late Seral
G4 (Cool Dry)	PP, DF, WL, LP	ES, DF, WL	GF, ES
G5 (Warm Dry)	PP	DF, PP	GF, DF
G6 (Warm Moist)	PP	DF, PP	DF
G7 (Warm Dry	PP	DF, PP	DF
G8 (Hot Dry)	PP	PP	PP

Forest Cover Types:	PP – Ponderosa Pine	DF – Douglas-fir
	WL – Western Larch	LP – Lodgepole Pine
	GF – Grand Fir (& White Fir)	ES – Englemann Spruce

Appendix 6: Structural Stages of Stand Development



SI (Stem Initiation) - Stands in this stage are primarily composed of seedlings and saplings.

UR (Understory Reinitiation) - Past overstory removal harvest practices and minor disturbance patterns have allowed for the establishment of waves of advanced regeneration. The existing advanced regeneration averages 17 to 25 years of age and displays poor to good vigor characteristics depending upon the available growing space. Stand character in this stage of development is still dominated by the dense second growth overstory.

SECC (Stem Exclusion Closed Canopy) or SEOC (Stem Exclusion Open Canopy) - In the stem-exclusion state of stand development, the overstory trees form a dense canopy. Complete crown closure, in which the lower, shaded branches die and the functional live crown begins to recede, has been attained within the dense second growth stands. Inter-tree competition for available moisture, nutrients, and sunlight is very high in this stage of stand development. As a result, growth rates on an individual tree basis are low and stands are vulnerable and susceptible to increased disturbance events such as insect infestations and stand replacement fires.

MSLTU (Multi-Storied Large Trees Uncommon) - This multi-layered stage is comprised of trees in a variety of age and size classes, although large trees are uncommon. Minor disturbances such as past harvest practices, defoliator activity, and localized windthrow have favored the development of multi-layered structures.

MSLTC (Multi-Storied Large Trees Common) or SSLT (Single-Storied with Large Trees) - These structures are referred to as late and old structure. These structures consist of a mosaic pattern of "even-aged groups" when viewed on a landscape scale. Periodic, low intensity ground fires maintained large-diameter, single stratum stands of ponderosa pine and Douglas fir. Discrete disturbance events; such as bark beetle group mortality, localized windthrow, and enlarging root rot centers; allowed for the establishment of waves of advanced regeneration within the single stratum matrix.

Photographs illustrating structural stages and treatment results in the UJCW
Paul Survis, WWNF Zone Silviculturalist, 2002

Stand Initiation: 12 yr old plantation
5' in height, 18" leader growth

Stem Exclusion Closed Canopy (SECC)
25 year old plantation (20-25')

SECC unthinned

SECC thinned and under-burned

SECC thinned (Wapiti)

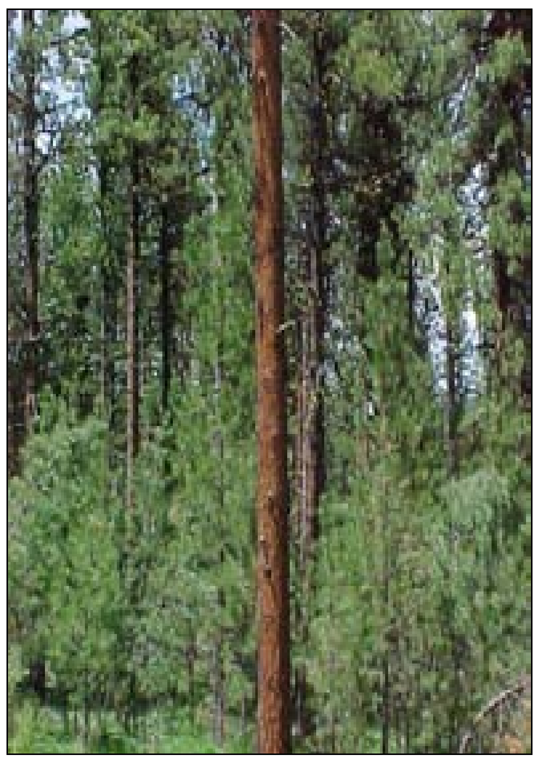
SECC thinned (note release 4 years ago)

SECC (thinned / unthinned split)

SECC: marked thinning from below

Self-thinning of Stem Exclusion Closed Canopy stand (fuel loadings exceed 20 tons per acre)

Understory Reinitiation stand stage

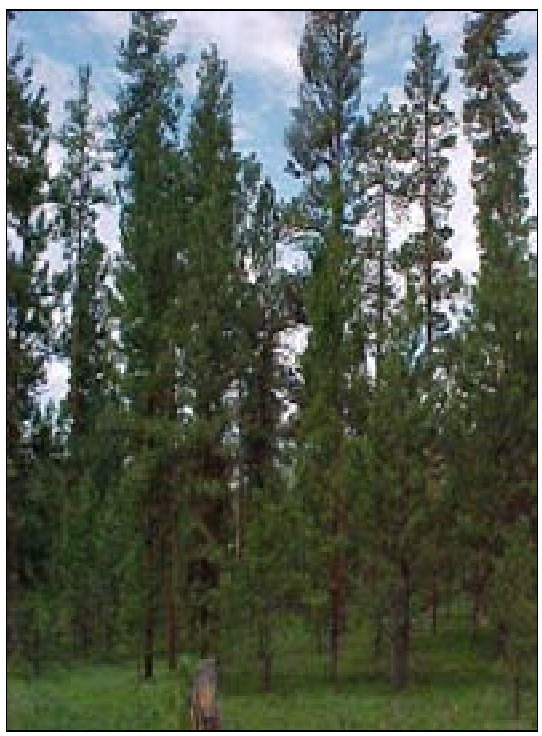


Understory Reinitiation stand stage

Multistory Large Tree Uncommon untreated

Multistory Large Tree Uncommon treated to increase % of early seral species, reduce potential fire loss, and accelerate large tree development.

Multistory Large Tree Uncommon treated



Multistory Large Tree Uncommon treated


Natural opening filled in with advanced regeneration typifying the mosaic structure of age/size class distributions of cool dry Late Old Structure.

Group select in cool dry (G4) replicating mosaic structure influenced by historic fire cycles and other disturbances

Multistory Large Tree Common G7 structure (uncommon given historic disturbance regimes)

Single Story Large Tree Stand Typical of Warm Dry (G7) Late Old Structure

Appendix 7: Forest Stand Historic Range of Variation (HRV)

For every biophysical environment, natural disturbance processes such as fire, floods, wind, etc. have measurable patterns of frequency, intensity, and spatial scale. The pattern of variability over time constitutes the historical range of variation (HRV). This ability of an ecosystem to absorb and recover from disturbances without drastic alteration of their inherent function is central to the concept of HRV.

The study of HRV attempts to understand the ecological context of an area and the landscape-scale effects of disturbance. It also offers context and guidance for managing ecological systems. When humans alter the components and structure of ecosystems beyond the historical range of variation, they risk fundamental change that can threaten biodiversity. One of the largest human influences upon the HRV is the suppression of natural variations that are not economically profitable. Attempts to make landscapes more predictable or profitable by controlling the historic rate of variation through the suppression of certain natural disturbances such as fire or flood may reduce resiliency of ecosystems that arises as a byproduct of these disturbances.

In determining the historic range of variation, it is essential to find the appropriate geographical and temporal scale. Relevance is lost if too long a time period is used, as climate and species variation may have changed drastically. Geographically, a balance must be found that provides a large enough area to fit local systems into regional context without losing the specificity within the HRV of the given area. In measuring historic rates of variation over periods of time and space, basic measurements include mean, median, range and standard deviation. However these measurements can vary depending on the disturbance. For example, fire managers use descriptors such as frequency, severity, size, and shape distributions to establish measurements of the disturbance throughout history.

As these descriptors imply, the size and severity of disturbances vary quite a bit. One aspect of HRV that is not fully understood is how different disturbances interact. Large disturbances can have effects that last a hundred years. This leaves room for interaction between large and small-scale disturbances. Understanding these interactions could be essential in making management practices socially acceptable. It’s possible that many small-scale disturbances could compile to mimic effects of a large-scale disturbance. Extreme disturbances, which transformed landscapes, may not be socially acceptable today. For example, large-scale, stand-replacing wildfires are within the HRV for higher elevation sub-alpine fir forests of the Wallowa Mountains, but the occurrence of such a wildfire above the Wallowa Lake Basin poses considerable risk to public safety, private property and the economic well being of the Lake Basin area and the City of Joseph.

Management that sustains the complexity of forest structure and landscape diversity within its historical bounds may also sustain historical biodiversity; however attempting to restore earlier landscapes may not lead to resilience in the face of new forces, such as climate change, mega fires, exotic species invasions, or pollution. At regional scales, changes have been profound and pervasive nearly everywhere and managing ecosystems to function within their historical bounds is neither possible nor desirable. Because these variations not only affect the ecosystem’s function, but the value that humans place upon the ecosystem as well, management plans that include reference to HRV must fit within local social and ecological contexts.

Forest management should try to understand how historical processes shaped ecosystems and set management targets based on the lessons of history, not a re-creation of history. When natural disturbance regimes are absent or altered, restoration and management approaches that integrate concepts of ecosystem responses to natural disturbances may achieve biodiversity goals.

The dominant biophysical environments in the Upper Joseph Creek Watershed are G-4 (Cool Dry Grand Fir Stands) and G-7 (Warm Dry Ponderosa Pine / Douglas-fir Stands). G4 has a historic fire return interval of 20-30 years for small under-story fires, and G7 has a return interval of 7-14 years. Historically, these fires served to eliminate under-story conifers and maintain an open park like structures of ponderosa pine and Douglas fir; however, even with these reoccurring low intensity fires, there would be occasional intense fires in areas of fuel build up.

When fire regimes were altered in the Upper Joseph Creek Watershed, succession, rather than disturbance became a much larger force in altering forest structure. Succession shifts forest composition towards increasingly shade tolerant species, which in the absence of normal fire disturbance leads to overcrowded stands and increased risk of severe fire and pest disturbance. Recent field exams and analysis suggest that 68% of the public lands within the UJCW are significantly altered from their historical fire regimes. Both fire and pest infestations are part of the HRV in the Upper Joseph Creek Watershed. However the density and uniformity of forest structure created through overstory logging and fire suppression could cause a large-scale catastrophic disturbance that is not consistent with the historic pattern. Such an event could inhibit the ecosystem from returning to steady-state equilibrium and thus cause it to depart even further from its historical state.

In response to our understanding of HRV within the Upper Joseph Creek Watershed, forest thinning practices are gradually being implemented to reduce fuel loads, increase heterogeneity in stand structure and species composition, and promote more late and old structure.

Appendix 8: Rangeland Relationships in the Upper Joseph Creek Watershed

Final Report

By

Dennis P. Sheehy
Michael Hale

January 2004

Table of Contents

	Pg.
I. Introduction	1
II. Methods	1
Sampling Protocol	1
TNC Field Sampling Procedures	1
Private and Public Land Sampling Procedures	2
Public Lands Condition and Trend Field Sampling Procedures	3
Data Standardization and Analysis	4
Defining Plant Association/Seral Stages	4
Ground Truthing-Validation	5
III. Forest Steppe Communities	7
Overstory Characteristics	8
Understory of Forest Plant Communities	8
Understory Cover	8
Understory Yield	10
Shrub Characteristics of Forest Plant Associations	10
Density And Yield	10
Herbaceous Characteristics	11
Ground Surface Layer	12
Characteristics of Forest Steppe Vegetation in the UJCW	13
Site Attributes	13
Growth Form Attributes	14
Community Relationships	15
IV. Grass Steppe Rangeland Communities	16
Grass Steppe Communities of the UJCW	16
Idaho Fescue Series	18
Site Attributes	18
Growth Form Attributes	20
Community Relationships	22
Bluebunch Wheatgrass Series	23
Site Attributes	23
Growth Form Attributes	24
Community Relationships	25
Scabland Series	26
Site Attributes	26
Growth Form Attributes	27
Community Relationships	28
Shrub Series	29
Site Attributes	29
Growth Form Attributes	30
Community Relationships	31

Oldfield Communities	31
Site Attributes	31
Growth Form Attributes	32
Community Relationships	33
Meadow Communities	34
Site Attributes	34
Growth Form Attributes	35
Community Relationships	35
Annual Grass Community	36
Site Attributes	36
Growth Form Attributes	36
Community Relationships	37
Comparison Among Communities	37
V. Invasive Species In The UJCW	40
Idaho Fescue Series	40
Bluebunch Wheatgrass Series	42
Scabland Series	43
Shrub Series	44
Oldfield Communities	45
Meadow Communities	46
VI. Rangeland Improvements in the UJCW	47
Improvement Categories	47
Ecological Constraints	49
Rangeland Improvements	54
VII. Vegetation Mapping	57
Forest Steppe Communities	57
Grass Steppe Communities	57
Meadow-Oldfield Communities	58
Shrubland Communities	59
Idaho Fescue-Prairie Junegrass Ridgetop Communities	59
Idaho Fescue-Prairie Junegrass Mound Communities	60
Idaho Fescue-Prairie Junegrass High Elevation Communities	61
Idaho Fescue-Bluebunch Wheatgrass Communities	61
Bluebunch Wheatgrass-Sandberg’s Bluegrass Communities	61
Scabland Communities	62
VIII. Discussion	63

Tables

		Pg.
Table 1.	Biophysical attributes of forest plant associations common to the Upper Joseph Creek Watershed in the Boise Cascade study area.	7
Table 2.	Attributes of forest overstory in forest plant communities in the Boise Cascade study area.	8
Table 3.	Shrub characteristics in the understory of forest plant communities in the Boise Cascade study area.	11
Table 4.	Herbaceous understory vegetation characteristics in forest plant communities in the Boise Cascade study area.	12
Table 5.	Growth form vegetation yield in forest plant communities in the Boise Cascade study area.	12
Table 6.	Characteristics of the ground surface layer in forest plant communities in the Boise Cascade study area.	13
Table 7.	Partial list of potential rangeland improvements in the Upper Joseph Creek Watershed.	47
Table 8.	Community dynamics in the Upper Joseph Creek Watershed.	49
Table 9.	Community mapping units (Level I) in Forest Communities (Level II).	57
Table 10.	Mapping units (Level I) in Meadow-Oldfield Communities (Level II).	58
Table 11.	Mapping units (Level I) in Shrub Communities (Level II).	59
Table 12.	Mapping units (Level I) in Idaho Fescue-Prairie Junegrass Ridgetop Communities (Level II).	60
Table 13.	Mapping units (Level I) in Idaho Fescue-Prairie Junegrass Mound Communities (Level II).	60
Table 14.	Mapping units (Level I) in Idaho Fescue-Prairie Junegrass High Elevation Communities (Level II).	61
Table 15.	Mapping units (Level I) in Idaho Fescue-Bluebunch Wheatgrass Communities (Level II).	61
Table 16.	Mapping units (Level I) in Bluebunch Wheatgrass-Sandberg's Bluegrass Communities (Level II).	61
Table 17.	Community mapping units (Level I) in Scabland Communities (Level II).	62
Table 18.	General condition of vegetation in the Upper Joseph Creek Watershed as indicated by field site evaluation of seral stage.	63
Table 19.	Forage species with highest representation in diets of large herbivores seasonally grazing Zumwalt Prairie.	65

Figures

		Pg.
Figure 1.	Comparison of cover characteristics in forest plant communities in the Boise Cascade study area (% cover).	9
Figure 2.	Comparison of cover characteristics in forest plant communities in the Upper Joseph Creek Watershed (% cover).	14
Figure 3.	Comparison of plant growth form in forest plant communities in the Upper Joseph Creek Watershed (% cover).	15
Figure 4.	Vegetation series sampled in the Upper Joseph Creek Watershed by ownership (% of total).	16
Figure 5.	Comparison of cover characteristics of Idaho Fescue plant communities in the Upper Joseph Creek Watershed (% cover).	19
Figure 6.	Comparison of plant growth form of Idaho Fescue communities in the Upper Joseph Creek Watershed (% cover).	21
Figure 7.	Comparison of cover characteristics of Bluebunch Wheatgrass plant communities in the Upper Joseph Creek Watershed (% cover).	23
Figure 8.	Comparison of plant growth form of Bluebunch Wheatgrass communities in the Upper Joseph Creek Watershed (% cover).	24
Figure 9.	Comparison of cover characteristics of Scabland plant communities in the Upper Joseph Creek Watershed (% cover).	27
Figure 10.	Comparison of plant growth form of Scabland communities in the Upper Joseph Creek Watershed (% cover).	28
Figure 11.	Comparison of cover characteristics of Shrub plant communities in the Upper Joseph Creek Watershed (% cover).	29
Figure 12.	Comparison of plant growth form of Shrub communities in the Upper Joseph Creek Watershed (% cover).	30
Figure 13.	Comparison of cover characteristics of Oldfield communities in the Upper Joseph Creek Watershed (% cover).	32
Figure 14.	Comparison of plant growth form in Oldfield communities in the Upper Joseph Creek Watershed (% cover).	33
Figure 15.	Comparison of cover characteristics of Meadow communities in the Upper Joseph Creek Watershed (% cover).	34
Figure 16.	Comparison of plant growth form in Meadow communities in the Upper Joseph Creek Watershed (% cover).	35
Figure 17.	Cover characteristics of Annual Grass communities in the Upper Joseph Creek Watershed (% cover).	36
Figure 18.	Comparison of plant growth form in Annual Grass communities in the Upper Joseph Creek Watershed (% cover).	37
Figure 19.	Summary comparison of cover characteristics of vegetation series encountered in the Upper Joseph Creek Watershed (% cover.)	38
Figure 20.	Comparison of invasive species cover of Idaho Fescue communities in the Upper Joseph Creek Watershed (% cover).	41
Figure 21.	Comparison of invasive species cover of Bluebunch Wheatgrass communities in the Upper Joseph Creek Watershed (% cover).	43
Figure 22.	Comparison of invasive species cover of Scabland communities in the Upper Joseph Creek Watershed (% cover).	44
Figure 23.	Comparison of invasive species cover of Shrub communities in the Upper Joseph Creek Watershed (% cover).	45
Figure 24.	Comparison of invasive species cover of Oldfield communities in the Upper Joseph Creek Watershed (% cover).	45
Figure 25.	Comparison of invasive species cover of Meadow communities in the Upper Joseph Creek Watershed (% cover).	46

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Grass and Forest Steppe Rangeland Component

I. Introduction

A collaborative assessment of forest and range conditions was initiated to gather information on current vegetative and soil conditions of forests and rangelands in Wallowa County. The Wallowa County Assessment Group was formed to lead a multi-party assessment to provide information to the Natural Resource Advisory Committee on a regular basis.

Through a community planning process, the Upper Joseph Creek Watershed (UJCW) was chosen for an assessment of rangeland vegetation and condition. The UJCW rangeland study was initiated in the summer of 2002 to create a baseline inventory of important biological components, including plant species, plant associations, terrain, and soil types. Once analysis of the inventory data is completed, a reference guide of selected biological information will aid in decision-making oriented to sustaining and/or improving biological, ecological, economic, and land use values of the UJCW. The information provided by the study should improve the capacity of cooperators to identify pertinent issues affecting the watershed and to manage and monitor the UJCW in the future.

Plant community vegetation was sampled on grass and forest steppe rangeland comprising the UJCW and on rangeland with similar vegetation adjoining the UJCW. Collaborators involved were: (1) The Nature Conservancy (TNC), (2) US Forest Service (USFS), and (3) private landowners with land in the UJCW.

II. Methods

Sampling Protocol

Field sampling of existing vegetation communities in the UJCW involved similar but slightly different protocols depending on whether land stewardship lay with the USFS, TNC, or private landowners. After sampling points were identified, a point-intercept sampling frame was used on the three land stewardship types to determine terrain attributes and cover attributes of vegetation and ground surface. Additional sampling methods were employed on lands under USFS stewardship. These additional methods are described in detail below.

TNC Field Sampling Procedures

Forest and grass steppe rangeland forming the UJCW was initially defined into Ecological Land Units (ELU) consisting of soil type and terrain attributes (slope, aspect, and topographical position). On TNC stewardship land, an actual ELU map was electronically available and was used extensively in selecting measurement sites. On land under TNC stewardship, and for a small number of private and public land sites, selection of measurement points was specific and non-random. These sites were selected in this manner to ensure that a maximum of different ELU/Vegetation communities existing in the UJCW were represented in the database used to link remotely sensed spectral QUICKBIRD information to actual information collected at points in the UJCW.

Private and Public Land Sampling Procedures

Sampling points on UJCW owned by private land cooperators and a portion of the sample sites on land administered by the USFS were selected by using a random number generator table to identify points on a grid overlay of the study area. Points were then converted to numbers and randomly selected sample points were converted to Latitude and Longitude coordinates. The coordinates identified macropoint locations within the watershed, which became the initial location for determining actual sample sites or micropoints.

Macro-transects in the four cardinal directions (N, S, E, and W) were used as general directions of travel in selecting micropoints in the field. Along the macro-transect, obvious differences in combinations of soils, terrain, and vegetation represented different Ecological Land Units (ELU), and were sampled. Micropoints were selected within contiguous boundaries of the ELU. The Latitude/Longitude coordinates recorded at each selected micropoint, as determined by GPS, became the primary identifier of site location. Latitude/Longitude coordinates also allow relocation of specific sampling points in the future.

ELU micropoints were generally selected along each macro–transect line until no new ELUs were encountered. Factors influencing cessation of ELU micro-point selection and measurement were major terrain changes or the decision by the field crew that continuing along the specific macro-transect would not yield significantly different ELU micro-points.

Sampling procedures at each ELU micro-point were:

a. Record GPS coordinates (lat/long coordinates in WSG84 format) in the center of the defined ELU (plot center could have variable distance and direction from the cardinal direction macro-transect).

b. In non-linear ELU/vegetation, three 25 m transects at 0, 120, and 240 degrees were established from plot center within the contiguous confines of the plant community. If sampling occurred in a complex of vegetation types (i.e., mound-intermound complex), the center of the plot was established in the dominant type in the complex and transects were laid out in the same manner as in non-complexes. As point intercept measurements were made along each of the three transect lines, data from each ELU was recorded (e.g., all hits on the mound from each transect line were recorded on separate data forms).

c. In linear ELU/vegetation communities, one or two 50 m transects, depending on the total area and juxtaposition of the ELU were established within the contiguous boundaries of the visually defined linear ELU/vegetation community.

The number of point intercepts along each of the three micro-transect lines was variable but was typically not less than 25 and not more than 50. The suggested sampling interval along the micro-transect line was 1.0 meter intervals with 25 intercept points per transect in ELUs with limited area and 50 point intercepts made in spatially large ELUs.

A point-intercept sampling frame was used to inventory percent cover of vegetation and site attributes comprising the ELU. Cover at each micropoint was recorded for:

a. Plant species
b. Herbaceous litter (ground and standing)

c. Ground surface exposed soil
d. Exposed soil caused by burrowing animals
e. Type and size of rock encountered at the site (rock, gravel, and bedrock)
f. Type and kind of cryptogams encountered at the site (moss and lichens)

Plants encountered at the site were recorded by genus/species or acronym. Unknown plant species encountered during sampling were identified by number (i.e., Unk # 1, Unk #2, etc.) and macro/micro point. Samples of unknown species were also obtained for identification by the Forest Service botanist. Intercepts of the first plant or aerial litter (or surface attribute if no plant was encountered at the micropoint) were recorded at each sampling point along the transect.

Public Lands Condition and Trend Field Sampling Procedures

Range vegetation and ground attribute data were collected from established condition and trend clusters on USFS lands within the UJCW boundaries. Condition and trend clusters were primarily located on upland sites and consisted of two to three 50 to 100 foot transects. Reading and recording transect data followed three methodologies:

a. 0.75 inch loop technique
b. Canopy coverage technique
c. Line point-intercept technique.

The loop data was used to determine range condition and trend by evaluating species composition, and soil stability. The loop technique consisted of making observations at one-foot intervals using a 0.75-inch loop. The handle of the loop was placed vertical at the foot mark on the right hand edge or uphill side of the tape, with the loop resting on the ground surface. The area within the loop was recorded as hits or near hits of:

a. Vegetation
b. Litter,
c. Moss or lichens,
d. Rock,
e. Pavement and
f. Bare soil

Direct hits and near hits of perennial vegetation species were recorded. When the loop did not hit a perennial plant, the nearest perennial growing within a 180-degree radius towards the 99.5-foot stake, was recorded as a near hit. Litter was recorded when greater than one half of the loop covered dead plant or animal material on the ground surface. Green or dead annual and biennial vegetation were also recorded as litter. Hits on shrubs were recorded if basal area was hit by the loop, or if the loop hit anywhere within or under the live perennial crown. A hit on rock fragments greater than 0.75 inch were recorded as rock; fragments less than 0.75 inch were recorded as pavement. Bare soil was recorded if it covered more than one-half of the loop area. Moss or lichens were recorded if they covered greater than one half of the loop area.

Canopy-coverage data was used to obtain a two-dimensional evaluation of the influence of plant taxon over other components of the ecosystem. This technique used a 20 cm x 50 cm Daubenmire frame (quadrat) placed at five-foot intervals along a 100 foot transect, or at one-meter intervals along a 20 meter transect. Percent canopy cover of individual species was estimated for each quadrat, and averaged over the total number of quadrats per transect. These estimates provided average crown canopy coverage and soil surface coverage as a percent of the total composition.

The line point-intercept technique was also used at each condition and trend cluster. The mid-point of transect one was used to radiate outward three additional transects following the compass bearings of 0, 120, and 240 degrees. Transect length was 20 meters, with 30 data points collected along each one. Total data points for each site varied somewhat depending on the heterogeneity or species richness found. For example, more data points may have been collected from a highly diverse site, compared to fewer data points from a homogenous site. Transect length was also sometimes adjusted in length to remain within a specific ecotype (e.g., a mound within a scab-mound site may allow for a 10 meter transect along the mound top). The inter-space was classified separate from the mounds.

All sites were located using GPS coordinates, and ground directions were updated. Photo-records of condition and trend clusters (C&Ts) and intensive plots (I-Plot) were also updated. Long oblique views of the transects were photographed from the 0 foot and 100 foot ends, and short oblique views were photographed using square foot plot frames placed at 20 foot intervals. Photographs were catalogued in C&T and I-Plot folders.

Data Standardization and Analysis

Some unavoidable discrepancies existed between recorded site information collected by the three field crews measuring ELU/vegetation sites on different land stewardships in the UJCW. Field data collected at measurement sites was standardized to plant species acronym and to reflect actual cover by species and cover of ground surface attributes to 100 %. Total cover recorded at each micropoint exceeded 100 % and reflected aerial cover of vegetation and basal cover of ground surface attributes. Cover by growth form (i.e., grass, forb, shrub, tree, and ground cover attributes) was also summarized. Data sets of information summarized in the above manner were analyzed by the Oregon Natural Heritage Program (ONHP) to define preliminary mapping units (PMU) for the remotely sensed QUICKBIRD images to construct a draft UJCW vegetation map. Standardized data sets were given to the ONHP for use in defining a draft UJCW vegetation map.

Defining Plant Association/Seral Stages

Cluster analysis was used to determine similarity of data collected from field sites in the UJCW with pre-identified plant associations and seral stages. Vegetation cover and site attributes collected at field sites were compared by Twinspan Analysis with previously collected cover and constancy information that was grouped into plant associations and seral stages. Several iterations of Twinspan were used to arrive at the final grouping of sites into plant communities and seral stage, including: (1) comparison of each micropoint information with plant communities and seral stage, (2) comparison of variable information with variable information derived by Johnson and Simon, and (3) comparison across groups of sites assigned to plant communities and seral stage to determine level of similarity.

After Twinspan analysis assigned sites to groups of plant community and seral stage, all sites were visually compared to rangeland plant communities and seral stage assigned by Johnson and Simon during the previous study. This comparison was initiated as a “check” to the Twinspan Analysis to ensure that assignment to plant communities and seral stage made intuitive sense.

Ground Truthing-Validation

Data obtained through field measurements and statistical analysis and observer knowledge was used to correlate UJCW rangeland vegetation communities with remotely sensed reflectance values that indicated differences in vegetation at the ground surface. The ONHP correlated differences in vegetation and ground surface attributes with different remotely sensed reflectance to define Preliminary Mapping Units (PMU) comprising the UJCW. A 1:100,000-scale resolution map of the PMUs was prepared and used to ground-truth previously inventoried vegetation of the watershed.

The “ground-truthing” protocol consisted of the following steps:

- A point on the PMU map identified as a specific PMU was located on the ground,
- The point was assigned GPS derived location coordinates,
- The field observer identified indicator plant species and site attributes at the point and assigned them to cover classes designated by the ONHP,
- The observer correlated the point to a defined map PMU; if the point was incorrectly assigned to a PMU, it was reassigned to the correct PMU,
- The observer assigned the community at the point to a plant community and seral stage defined previously by field sampling and data analysis and which correlated with communities and seral stages defined by Johnson and Simon (1987),
- Ground-truth information was transferred to the ONHP to facilitate preparation of vegetation maps.

Maps were created using ground survey data and digital image data from satellite imagery. To assess mapping unit accuracy, an initial ground truthing survey was conducted during late summer, 2003.

What appeared to occur on the ground was a repeating pattern of plant communities resembling a complex mosaic across the landscape. Patterns repeated in a predictable fashion depending on abiotic factors such as slope, aspect, elevation and soil type. Mapping units also created a mosaic with similar repeating patterns. For example, north facing slopes above the numerous creeks and canyons were dominated by open canopy or closed forests with ecotone values ranging from shrubland to riparian meadow-cove landforms. South facing slopes formed a gradient of riparian and shrub communities to xeric bunchgrass and sunflowers to mixed scabland and ridge brow canyon grassland sites. Ridge tops formed a complex of numerous plant communities dependent upon the variable abiotic factors. These included open forested grasslands containing mound-intermound sites and wet meadows, or xeric stiff sage scablands and degraded mound sites with high cover of introduced forage grasses.

Field notes from ground-truthing were related to the mapping units from the satellite image and a table of comparison values was created. Generally, it appeared that the mapping units have a close correlation with what was found on the ground. A more thorough accuracy assessment will need to be completed in the future.

The final output from spatial classification of vegetation and ground surface attributes of the UJCW will be a vegetation map at 1:100,000 scale resolution. Mapping units of the vegetation maps will be plant communities (Level II) and seral stages (Level I). The Level II vegetation map output will only spatially define plant communities and will be accessible to the general public. The Level I vegetation map output will spatially define plant communities and seral stages within plant communities. Level I vegetation map output derived from privately owned rangeland in the UJCW will only be available to private landowners.

III. Forest Steppe Communities

A considerable area of the UJCW, especially the portion of the watershed managed by the USFS, is comprised of forest steppe vegetation. Forest steppe is a mosaic of vegetation types ranging from: (1) vegetation communities dominated by trees, (2) vegetation communities formerly dominated by trees but which are now dominated by lower stature vegetation comprised of shrubs, grasses, and forbs, (3) transitory openings between forest stands that will disappear as trees reestablish, and (4) natural openings between forest stands that will remain rangeland grass steppe or meadow communities indefinitely.

The primary focus of the rangeland portion of the UJCW assessment has been grass steppe communities. Consequently, gaining an understanding of vegetation comprising forest understory is lacking. However, considerable information on the ecological relationships of forest understory vegetation in forest stands of the same ecological zone as the UJCW is available from other sources. Inference from these sources will, where appropriate, be used to increase understanding of vegetation relationships existing in forest stands of the UJCW. This information, even if not specific to the UJCW, should be useful in determining management options relating to goals of the watershed.

Although not all biophysical groups present in forest steppe of the UJCW were evaluated in the Boise Cascade study area, dominant forest communities were common to both areas. Dominant communities were in the Grand fir Douglas-fir, and Ponderosa Pine series. These groups represented most of the biophysical environments found in the UJCW including Cool/Moist, Cool/Dry, Warm/Dry, and Hot/Dry (Table 1).

Table 1. Biophysical attributes of forest plant communities common to the Upper Joseph Creek Watershed from the Boise Cascade study area.

Community	Temperature/Moisture Criteria (UJCW)	Bio-Physical Group (UJCW)	Area (ha.) (UJCW)	Area (%)	Seral Stage (UJCW)	Seral Species (%)
Grand Fir/Queen's Cup	Cool/Moist	G4	520.9	1.8	Late	13.2
Grand Fir/Twinflower	Cool/Dry	G4	7284.6	25.2	Late	6.5
Douglas-fir/Pinegrass	Warm/Dry	G7	9194.2	31.8	Early	89.4
Douglas-fir/Elk Sedge						77.2
Douglas-fir/Common Snowberry						78.4
Ponderosa Pine/Elk Sedge					Mid	31.8
Ponderosa Pine/Idaho Fescue	Warm/Dry Hot/Dry	G8	255.1	8.8	Early	100.0
Total			19547.7	67.6		

The criteria[1] developed by Christoffersen and Survis (2000) to place forest stands in respective seral stages was used to classify the forest stands from the Boise Cascade study area to seral stage. The two Grand Fir plant communities were classified as late seral. All Douglas-fir plant communities were classified as early seral. The two Ponderosa Pine plant communities were classified as mid seral Ponderosa Pine/Elk Sedge and early seral Ponderosa Pine/Idaho Fescue.

Overstory Characteristics

Tree attributes measured to define overstory characteristics of tree stands in the Boise Cascade forest were: (1) trees/hectare, (2) tree diameter, (3) tree height, (4) tree live crown ratio, (5) tree canopy cover, and (6) tree overstory shade (Table 2).

[1] See criteria in Upper Joseph Creek Watershed Forest Assessment.

Table 2. Attributes of forest overstory in forest plant communities in the Boise Cascade study area.

Community	No.	Trees (no./ha)	Tree Diameter (cm)	Tree Height (m)	Tree Live Crown Ratio	Tree Crown Cover (%)	Overstory Shade (%)
Grand Fir/Queen's Cup	20	142.2	25.0	14.4	59.6	15.6	49.3
Grand Fir/Twinflower	21	204.9	24.3	13.3	61.4	24.2	67.9
Douglas-fir/Pinegrass	13	128.8	24.8	16.7	49.6	16.1	24.5
Douglas-fir/Elk Sedge	2	236.5	20.3	16.4	53.5	45.8	16.0
Douglas Fir/ Common Snowberry	14	152.6	24.2	19.3	53.3	19.7	42.4
Ponderosa Pine/Elk Sedge	4	219.3	18.3	11.0	59.8	13.9	46.2
Ponderosa Pine/Idaho Fescue	1	175	26.6	14.5	53.0	18.1	50.0
All Stands	75	166.4	24.1	15.2	56.8	19.4	47.2

Among specific forest communities, the Douglas-fir/Pinegrass community had the least number of trees (128.8 trees/ha) while the Douglas-fir/Elk Sedge community had the most trees (236.5 trees/ha). The range of trees per hectare in the seven forest plant communities indicated that a considerable difference in tree presence existed at measured sites. Although little difference in tree diameter and tree height was encountered, communities with the highest number of trees present tended to have trees with smaller diameter and less height. Communities with fewer trees tended to have trees with larger diameter and more height. Tree live crown ratio was also higher in communities with a greater number of trees. Tree crown cover tended to be less in stands with fewer trees and higher in stands with more trees. Tree overstory shade tended to be highest in stands with moderate number of trees per hectare.

Understory of Forest Plant Communities

The presence of species and their association in understory layers is the result of interactions between tree overstory shade, soils, climate, and previous site alterations induced by natural or human factors. Although the seven forest plant communities studied have the same layers, considerable difference in cover exists between layers within and among communities. These layers, together with the overstory tree layer, combine different amounts of the structural components which, combined with food value, becomes herbivore security and forage habitat.

Although trees are the most obvious growth form in the forest ecosystem of the UJCW and are a major component of habitat, other plant growth forms dominate different layers of forest stands and provide or contribute to habitat for wildlife and domestic animals. Generally, layers consistently found in tree stands of forest communities are a layer dominated by shrubs, an herbaceous layer dominated by grasses and forbs, and a ground surface layer dominated by litter but which often includes bare soil, rock, and cryptogams.

<u>Understory Cover.</u> Although understory layers are often difficult to define as separate layers, measurement of the amount of ground cover provided by species comprising different growth forms in the layers forming understory provides a method to interpret understory. Shrubs and herbaceous plants are important to many animals using forest habitat and often form a separate or an intermixed understory layer that is intermediate between the tree overstory layer and the ground surface layer. The shrub and herbaceous plant layers often provide a multidimensional continuity between overstory and ground surface layers (Figure 1).

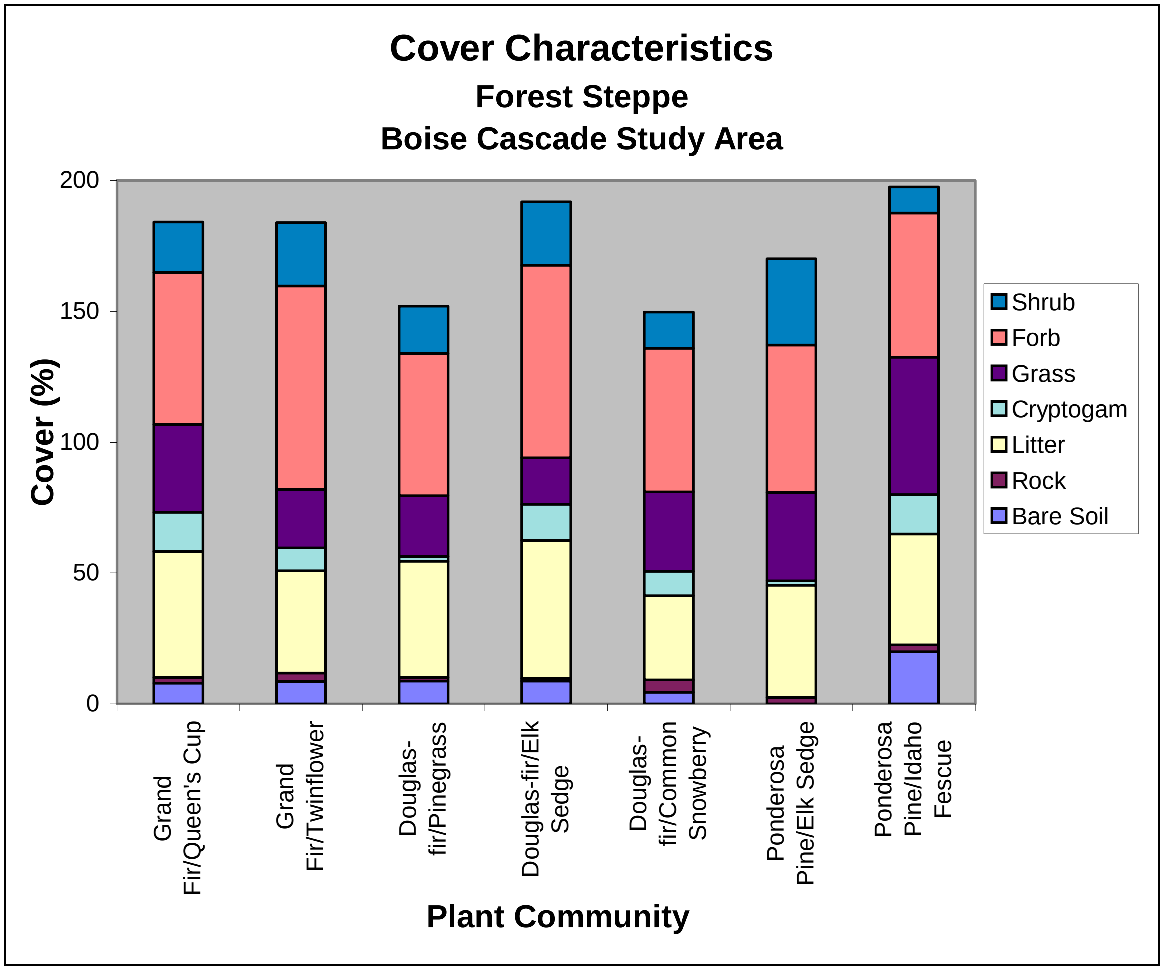


Figure 1. Comparison of cover characteristics in forest plant communities in the Boise Cascade study area (% cover).

Average cover of understory plants and non-plant cover at the ground surface of stands ranged from 150 to 200 %. The single tree stand in the Ponderosa Pine/Idaho Fescue community and stands in the Douglas-fir/Elk Sedge community had almost 200 % cover of shrubs, herbaceous plants, and non-plant cover at ground surface. Stands in both the Grand Fir/Twinflower and Grand Fir/Queen's Cup communities had similar cover values (175.0%) while stands of the Ponderosa Pine/Elk Sedge community had almost 170.0 % cover. Stands in the Douglas-fir/Common Snowberry and Douglas-fir/Pinegrass communities had lowest cover of understory plants and non-plant cover at ground surface.

The contribution of different layers to cover was variable. A high proportion of cover was herbaceous plants in the understory layer of all forest plant communities. Although ground surface cover was less than plant cover in all forest communities, ground surface cover was proportionally higher in stands of forest communities that had highest total cover. Grass cover was a major component of cover in stands of seven forest communities and especially in stands of the Douglas-fir/Twinflower community. In the single measured stand of the Ponderosa Pine/Idaho Fescue community, grasses and forbs comprising the herbaceous layer together provided highest cover among understory components. Ground surface litter was a major component of cover in stands of all seven communities. Stands of the Douglas-fir/Pinegrass community had highest litter cover at the ground surface.

Understory Yield. The kind of plants combined with yield of plants is another measure of habitat value. Stands with highest diversity of plant species generally provide habitat of greatest value to different animals inhabiting forest ecosystems. Likewise, stands with plants that are preferred or desirable to animals as food increase the value of the stand as animal habitat. If plants in the stand are both desirable as food and high yielding, then the stand becomes even more important as habitat.

Stands in the seven forest communities had different total yield, browse yield in the shrub layer, and grass and forb yield in the herbaceous layer. Vegetation yield in stands of the seven forest communities ranged from less than 200 kg/ha to more than 1100 kg/ha. Stands in the Grand Fir/Queen's Cup community had highest average yield of understory vegetation while the single stand of the Ponderosa Pine/Idaho Fescue community had lowest average yield. Stands in the three Douglas-fir communities had average yield of understory vegetation between 800 and 900 kg/ha. Stands in the Grand Fir/Twinflower community had average understory vegetation yield of 600 kg/ha.

Yield provided by grasses in the understory comprised a major proportion of total understory yield in stands of all seven forest communities. Highest understory yield was obtained from grasses in four of the seven communities. Although forbs contributed substantially to yield in stands of all communities, forb yield was dominant only in the Douglas-fir/Elk Sedge and Grand Fir/Queen's Cup communities. Shrub yield, while substantial in stands of six of the seven communities, did not dominate understory yield in any of the seven forest plant communities. In general, yield from understory vegetation was relatively evenly distributed among the three growth forms comprising understory vegetation layers.

Shrub Characteristics of Forest Plant Communities

Low growing shrubs were usually an important component of understory vegetation in stands of the seven communities. Thirty different shrub species were encountered in the 76 stands measured. The number of individual shrub species ranged from 18 species in the Douglas-fir/Common Snowberry community to five in the Ponderosa Pine/Idaho Fescue community. The two Grand Fir communities and two of the Douglas-fir communities had between 18 and 14 shrub species represented in the average stand. One of the Douglas-fir communities and both Ponderosa Pine communities had between five and eight shrub species in the average stand.

Density And Yield. Shrub attributes measured at each tree stand were: (1) shrub density, (2) shrub canopy cover, (3) shrub yield, and (4) shrub cover (Table 3).

Table 3. Shrub characteristics in the understory of forest plant communities in the Boise Cascade study area.

Community	Sample Size (n)	Shrub Density (no./ha)	Shrub Canopy Cover (%)	Shrub Yield (kg/ha)
Grand Fir/Queen's Cup	20	9991	10.9	339.7
Grand Fir/Twinflower	21	9574	13.4	163.5
Douglas-fir/Pinegrass	13	9492	9.9	89.2
Douglas Fir/Elk Sedge	2	9970	6.1	280.0
Douglas-fir/Common Snowberry	14	10602	11.8	136.8
Ponderosa Pine/Elk Sedge	4	3600	5.1	116.0
Ponderosa Pine/Idaho Fescue	1	2541	0.9	5
All Stands	75	9365	10.4	188.6

The Grand Fir and Douglas-fir forest communities had average shrub density greater than 9000 shrubs per hectare. Stands in the Douglas-Fir/Common Snowberry community had the highest average shrub density. Shrub density in stands of this community averaged over 10,000 shrubs/ha. Stands of the Ponderosa Pine communities had average shrub density between 2500 and 3600 shrubs/ha, which was the lowest average shrub density among stands of the seven communities. Shrub density, as indicated by the range of shrub density and different shrub species encountered in tree stands of the seven communities, was highly variable across all tree stands regardless of community.

Shrub canopy cover, which measured cover along a line transect, reflected shrub density in tree stands. Less shrub canopy cover usually indicated lower shrub density and higher canopy cover usually indicated higher shrub density. Stands in the grand fir community and two of the Douglas-fir community had shrub canopy cover ranging between 9.9 % and 13.4 %. Shrub canopy cover in stands of the Douglas-Fir/Elk Sedge community and both Ponderosa Pine communities was lower even though shrub density in stands of the Douglas-fir/Elk Sedge was relatively high.

Shrub foliage yield did not appear to be related to shrub density or canopy cover. Stands of the Grand Fir/Queen's Cup community had highest average shrub yield (339.7 kg/ha) but not highest shrub density or shrub canopy cover. Stands in the Douglas-fir/Common Snowberry community had moderate average yield (136.8 kg/ha) but had the highest density of shrubs/ha and relatively high shrub canopy cover. Stands in the Grand Fir/Twinflower community had only moderate average yield (163.5 kg/ha) but had highest shrub canopy cover. The lack of direct relationship between shrub attributes indicates that shrubs were not evenly dispersed in the stand and that browse yield differed among shrub species in the understory.

Herbaceous Characteristics. Herbaceous plants were common to understories of all stands in the seven forest communities (Table 4). Forbs and grasses, which commonly grow intermixed together and with shrubs in the shrub layer, form a distinctive layer of the understory. Forbs and grasses, along with shrubs in the shrub layer, are often major items in diets of herbivores as well as being important structural components of the understory vegetation.

Table 4. Herbaceous understory vegetation characteristics in forest plant communities in the Boise Cascade study area.

Community	Sample Size (n)	Vegetative Cover (%)	Shrub Cover (%)	Grass Cover (%)	Forb Cover (%)
Grand Fir/Queen's Cup	20	138.2	27.2	24.1	86.9
Grand Fir/Twinflower	21	119.5	28.4	17.1	74.1
Douglas Fir/Pinegrass	13	92.9	7.1	30.8	55.0
Douglas Fir/Elk Sedge	2	107.9	17.9	33.8	56.2
Douglas Fir/ Common Snowberry	14	105.9	20.1	30.0	55.6
Ponderosa Pine/Elk Sedge	4	95.6	18.1	23.1	54.4
Ponderosa Pine/Idaho Fescue	1	117.0			
All Stands	75	114.7	22.0	24.7	68.0

Average vegetation cover in stands of the seven forest plant communities was 114.7 %. The Grand Fir communities had highest average vegetation cover (138.2 % and 119.5 %, respectively) while stands of the Douglas-fir/Pinegrass and Ponderosa Pine/Elk Sedge communities had lowest average vegetation cover (92.9 % and 95.6 %, respectively). In all stands, except stands in the Grand Fir/Queen's Cup community, the forb component of cover was highest, followed by the grass component of cover, with shrubs contributing least to cover. In the Grand Fir/Queen's Cup community, the contribution of shrubs to vegetation cover was slightly higher than the contribution of grass to vegetation cover.

Average vegetation yield of stands in the seven forest plant communities was 814.5 kg/ha (Table 5). Average vegetation yield ranged from 96.0 kg/ha in the single stand of the Ponderosa Pine/Idaho Fescue community to 1195.0 kg/ha in stands of the Grand Fir/Queen's Cup community. For all stands, forbs had highest yield, followed by grasses, and shrubs. Shrub browse contribution to total vegetation yield was highest in the Grand Fir/Queen's Cup community although browse contribution to yield was consistently less than either grass or forb contribution to yield in all communities. Grass contribution to vegetation yield was highest in stands of the Douglas-fir/Pinegrass community while forb contribution to yield was highest in the Grand Fir/Queen's Cup community.

Table 5. Growth form vegetation yield in forest plant communities in the Boise Cascade study area.

Community	Sample Size (n)	Total Herbaceous Yield (kg/ha)	Total Shrub Yield (kg/ha)	Total Grass Yield (kg/ha)	Total Forb Yield (kg/ha)
Grand Fir/Queen's Cup	20	1195.0	339.7	233.2	622.0
Grand Fir/Twinflower	21	598.8	163.5	199.5	235.8
Douglas-fir/Pinegrass	13	779.0	89.2	419.0	270.1
Douglas-fir/Elk Sedge	2	907.0	280.0	290.0	337.0
Douglas-fir/Common Snowberry	14	768.0	136.8	383.0	248.1
Ponderosa Pine/Elk Sedge	4	662.0	116.0	356.0	190.0
Ponderosa Pine/Idaho Fescue	1	96.0	5.0	-	-
All Stands	75	814.5	188.6	286.2	339.8

<u>Ground Surface Layer.</u> The ground surface layer is an important component of forest habitat (Table 6). It is the interface between above-ground biomass and soil profile. It is also the medium for litter collection and herbaceous and woody material decay. Cryptogamic mosses and lichens are often found at the ground surface, either growing on rocks or the soil surface itself. The presence or absence of bare ground and rock at the ground surface is informative relative to litter collection, nutrient cycling, and capability of the stand to support aboveground biomass.

Table 6. Characteristics of the ground surface layer in forest plant communities in the Boise Cascade study area..

Community	Sample Size (n)	Ground Surface Cover (%)	Bare Ground Cover (%)	Rock Cover (%)	Litter Cover (%)	Cryptogam Cover (%)
Grand Fir/Queen's Cup	20	66.3	10.9	3.3	43.1	9.0
Grand Fir/Twinflower	21	63.3	8.5	3.7	49.4	14.3
Douglas-fir/Pinegrass	13	55.8	4.8	5.4	36.0	9.6
Douglas-fir/Elk Sedge	2	47.1	0.0	2.5	42.9	1.7
Douglas-fir/Common Snowberry	14	68.6	7.5	2.1	45.2	13.8
Ponderosa Pine/Elk Sedge	4	56.4	8.8	1.3	44.4	1.9
Ponderosa Pine/Idaho Fescue	1	80.0	20.0	2.5	42.5	15.0
All Stands	75	62.3	9.4	3.4	43.5	10.8

All stands of the seven forest plant communities had high ground surface cover that ranged between 47.1 % and 80.0 %. Ground surface cover was highest in the single stand of the

Ponderosa Pine/Idaho Fescue community and lowest in stands of the Douglas-fir/Elk Sedge community. Among the four variables that comprise the ground surface layer, litter cover was consistently high in all communities while rock cover was consistently low in all communities. Stands of the Douglas-fir/Pinegrass community had lowest litter cover (36.0 %) while stands of the Grand Fir/Twinflower community had highest litter cover (49.4 %). Rock cover was lowest in stands of the Ponderosa Pine/Elk Sedge community and highest in stands of the Douglas-fir/Pinegrass community. Bare ground and cryptogamic cover was highest in the single stand of the Ponderosa Pine/Idaho Fescue community, which also had highest total ground surface cover among forest plant communities.

Characteristics of Forest Steppe Vegetation in the UJCW

All forest steppe communities sampled in the UJCW were in the Warm/Dry biophysical group. Twelve sites were sampled in forest steppe vegetation of the UJCW: eleven sites in the Douglas-fir/Common Snowberry community and one site in the Ponderosa Pine/Idaho Fescue community.

<u>Site Attributes.</u> Sites in both forest steppe communities were dominated by grasses, forbs, and ground litter (Figure 2). Cover of grasses was 20.9 % in the Douglas-fir/Common Snowberry community and 31.0 % in the Ponderosa Pine/Idaho Fescue community. Cover of forbs in the two communities was 12.0 % in the Douglas-fir/Common Snowberry community and 13.9 % in the Ponderosa Pine/Idaho Fescue community. Both forest steppe plant communities had cover of shrubs but only the Douglas-fir/Common Snowberry community had young, low stature trees present. In the Douglas Fir/Common Snowberry community, cover of shrubs was 2.3 % while cover of trees was 3.6 %. Cover of shrubs was <1.0 % in the Ponderosa Pine/Idaho Fescue community.

Ground litter, which was relatively high in both communities, was >45.0 % in the Douglas-fir/Common Snowberry community and 20.8 % in the Ponderosa Pine/Idaho Fescue community. Cover of bare soil was relatively high in both communities, especially in the Ponderosa Pine/Idaho Fescue community which had >23.0 % cover of bare soil. Ground surface rock and cryptogams was relatively low in both communities. Comparison of the two forest steppe plant communities indicated that Douglas-fir/Common Snowberry had greater diversity of plant species and higher productivity of herbaceous biomass.

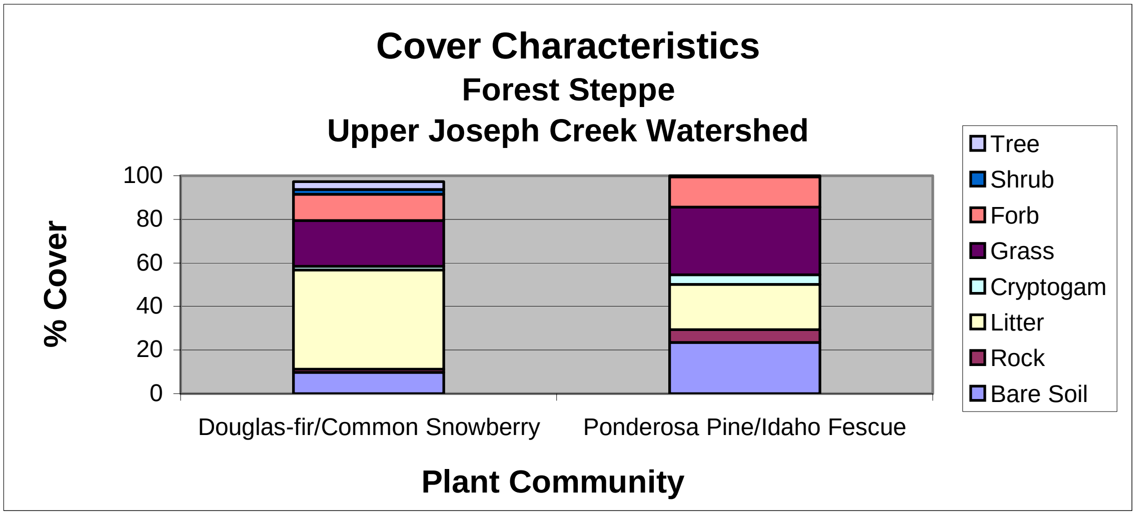


Figure 2. Comparison of cover characteristics in forest plant communities in the Upper Joseph Creek Watershed (% cover).

<u>Growth Form Attributes.</u> Dominant native perennial grasses in the Douglas-fir/Common Snowberry community were mountain brome, pinegrass, and Idaho fescue (Figure 3). The Ponderosa Pine/Idaho Fescue community also had Sandberg's bluegrass and bluebunch wheatgrass as dominant native perennial grasses. Cover of native perennial grasses was relatively high in both communities (10.3 % and 20.3 %, respectively) while cover of introduced perennial grasses was relatively low. In the Douglas-Fir/Common Snowberry community, cover of introduced perennial grasses was 5.1 % while in the Ponderosa Pine/Idaho Fescue community; cover of introduced perennial grasses was 1.6 %. Cover of annual grasses was 6.4 % in the Ponderosa Pine/Idaho Fescue community.

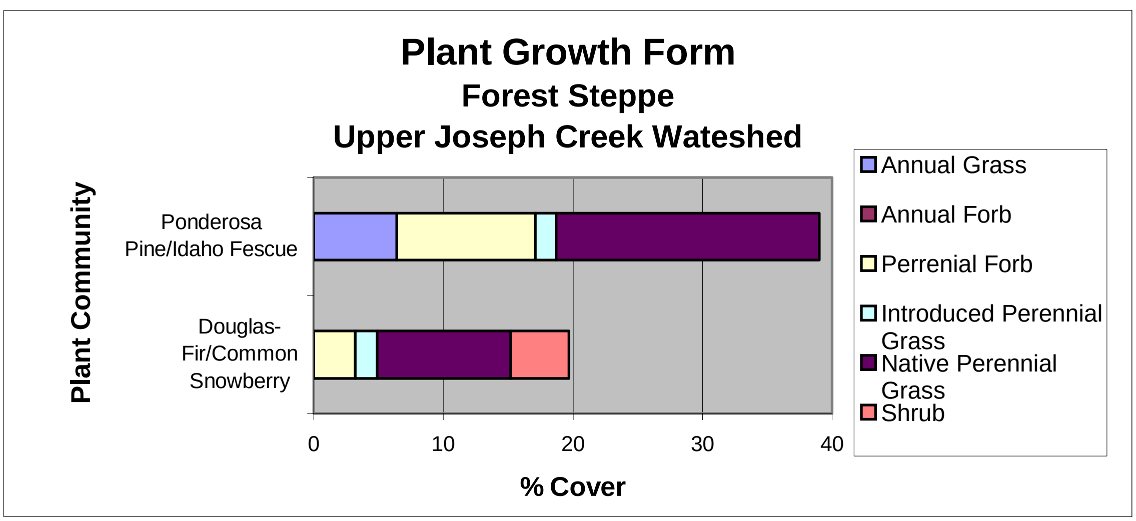


Figure 3. Comparison of plant growth form in forest plant communities in the Upper Joseph Creek Watershed (% cover).

Cover of perennial forbs was 3.2 % in the Douglas-fir/Common Snowberry community and 10.7 % in the Ponderosa Pine/Idaho Fescue community. Neither forest steppe community had substantial cover of annual forbs. The Douglas-fir/Common Snowberry community had low cover of shrubs (0.9 %) and young, low stature trees (3.6 %).

Community Relationships. The Douglas-fir/Common Snowberry and Ponderosa Pine/Idaho Fescue communities were representative of 40.6 % of the forested public land in the UJCW. A characteristic of these sites was low overstory tree dominance because of prior timber harvest, fire, disturbance facilitated establishment of successional shrub and herbaceous vegetation, or sites characteristically of low overstory cover.

The majority of sampled sites were classified as being in the Douglas-fir/Common Snowberry community. Comparison of shrub and herbaceous vegetation with stands classified by Johnson and Simon (1987) indicated herbaceous and shrub vegetation was generally in mid to late seral stage as opposed to the early to mid seral stage found in the Boise Industrial Forest.

A single stand of the Ponderosa Pine/Idaho Fescue community at mid seral stage was sampled. Grasses and forbs dominated cover of the stand. Herbaceous ground litter was lower at this site compared to ground litter in the Douglas-fir/Common Snowberry community. As dominant forest steppe communities with high cover of herbaceous plants, they can provide a focal point for integrated management of the UJCW. The herbaceous component of these types can be increased by timber harvest or thinning of overstory trees. Accordingly, judicious management of the understory vegetation can increase foraging habitat while maintaining security habitat for wild and domestic herbivores.

IV. Grass Steppe Rangeland Communities

Grass steppe rangeland communities comprise the primary vegetation component of the UJCW (Figure 4). Plant communities evaluated during the 2002 field season were from the Idaho Fescue, Bluebunch Wheatgrass, Scabland, and Shrubland Series described by Johnson and Simon (1987). Additional communities evaluated were Oldfield, Forest Shrubland, Meadow and Annual Grass incidental communities.

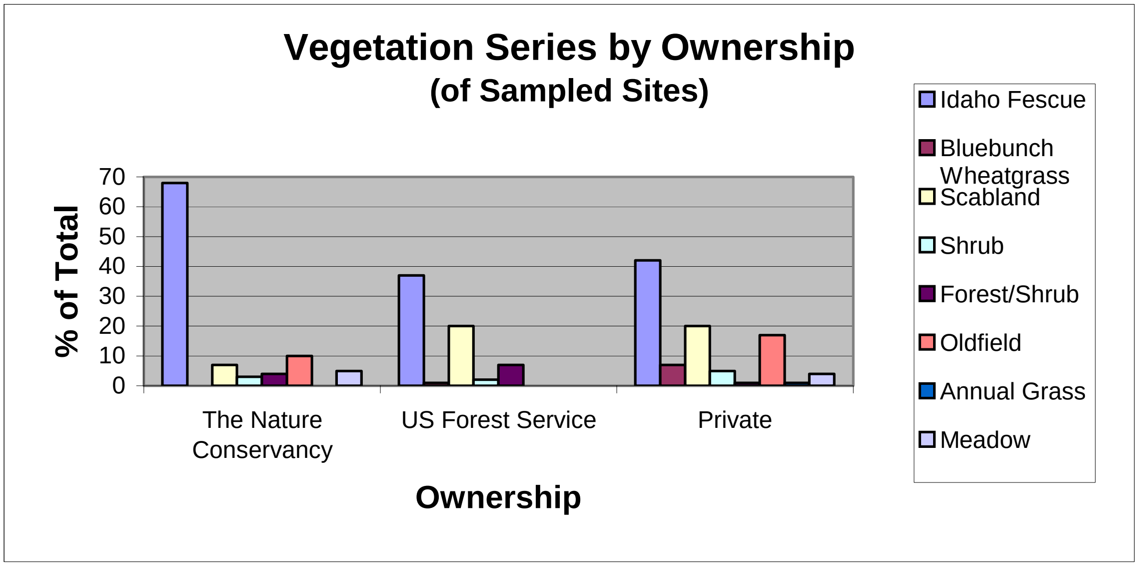


Figure 4. Vegetation series sampled in the Upper Joseph Creek Watershed by ownership (% of total).

Eleven plant communities in the Idaho Fescue series, including 2 disclimax communities of the mound component of the mound-intermound complex, were evaluated on steppe rangeland. Three plant communities were evaluated in the Bluebunch Wheatgrass series. Four plant communities were evaluated in the Scabland series while three plant communities were evaluated in the Shrub series. Two plant communities were evaluated in forest shrub and meadows. Six different Oldfield communities and one annual grass community were evaluated.

Plant communities in the Idaho Fescue series dominated rangeland in the three stewardship categories. Almost 69 % of the TNC communities and over 55 % of USFS communities were classified as belonging to the Idaho Fescue series. Private land had the greatest diversity of series and plant communities but also had the greatest number of communities in the Idaho Fescue series. Plant communities in the Scabland series were also frequently encountered in the three stewardship categories. Oldfields (i.e., formerly cultivated) were encountered only on TNC and private land.

Grass Steppe Communities of the UJCW

Evaluation of grass steppe communities inventoried in the UJCW during 2001 and 2002 indicated the occurrence of 30 different plant communities within the boundaries of the watershed. Plant communities were classified into four series, including Idaho Fescue, Bluebunch Wheatgrass, Scabland, and Shrubland. Incidental plant communities included Forest Shrubland, Oldfield, Annual Grass, and Meadow.

Among the incidental plant communities, Forest Shrubland was separated from the Shrub series because of the transitory nature of shrubland communities under forest overstory or following tree harvest. Oldfields, which occur on current or formerly private cultivated land are vegetation disclimax communities caused by conversion of native rangeland plant communities to cropland with subsequent seeding to primarily non-native forage species. Oldfields, although classified by default as very early seral, are important foraging areas for large domestic and wild herbivores. Meadows, which have limited occurrence in the UJCW, are located along stream drainages or around springs, seeps and reservoirs. Although meadow area is limited, meadows can be focal points of herbivory as well as degradation. Annual grass dominated rangeland generally occurs as patch areas reflecting previous disturbance and/or changes in the microenvironment.

Less than 4 % of the sites sampled were in the Bluebunch Wheatgrass series. The low number of Bluebunch Wheatgrass communities encountered indicates, besides dominance by Idaho Fescue plant communities, the higher elevation and more mesic environment of the UJCW. The general aspect of the UJCW is northerly rather than southerly. Plant communities in the Bluebunch Wheatgrass series tend to be more prevalent on drier southerly aspects typical of steep canyon slopes.

A relatively high number of communities in the Scabland series (18.0 %) were encountered in the UJCW. Generally, scabland communities are associated with Idaho Fescue-Prairie Junegrass communities and form the intermound component of the mound-intermound complex as well as inhabit larger contiguous spatial areas. This relationship is especially true of the Sandberg's Bluegrass-Onespike Oatgrass and Bluebunch Wheatgrass-Sandberg's Bluegrass communities. Scabland dominated by the Stiff Sagebrush/Sandberg's Buegrass community is occasionally encountered, especially near the forest boundary.

True shrubland is rarely encountered in the grass steppe dominated UJCW. Most shrubland communities are associated with forest communities, either as ecotonal communities between forest and grassland or as transitory communities at forest harvest sites. The most common shrubland community occurring in grass steppe of the UJCW is the Common Snowberry-Rose community and the Stiff Sagebrush/Sandberg's Bluegrass community. In forest steppe, the most common shrubland community is the Douglas-fir or Ponderosa Pine/Common Snowberry community. Although not sampled, riparian areas in forest steppe habitat generally contain a number of deciduous shrubs and small trees such as willow and alder, and which enhance the value of the riparian area as wildlife habitat and improve stream quality.

Considerable area of privately owned grass steppe rangeland in the UJCW has been converted to Oldfields. Prior to 1950, most Oldfields were used to produce grain or hay. Since then, most Oldfields have been abandoned as cropland but seeded to introduced forage species. Oldfields are now used as foraging areas by domestic livestock and large wild herbivores. Most Oldfields are no longer monocultures of introduced species but contain relatively high components of native forbs and, in some fields, native grasses. Either native plants were not completely eliminated from the Oldfields while they were used as crop fields, or succession towards the native plant community is occurring.

True meadows are uncommon in the UJCW. In grass steppe rangeland, wet meadows are generally narrow "green lines" of land with high water table immediately adjacent to streams or dry meadows on stream terraces. The latter meadow type is highly susceptible to invasion and dominance by non-native perennial grasses and unpalatable forbs. The value and contribution to vegetation diversity and herbivore foraging areas exceeds its relative area. Meadows, unless protected, are susceptible to overuse by large herbivores.

Non-native annual grasses occur as a species component of most plant communities in the UJCW. Especially common are annual brome grasses (i.e., cheatgrass, soft chess, rattle brome, and Japanese brome) and ventenata. In some locations, annual grasses comprise a monoculture on relatively small spatial areas or patches. Annual grasses and woody forbs often dominate mounds of the mound-intermound complex in early seral stage. Oldfields often have patches dominated by annual grasses or early successional forbs.

Idaho Fescue Series

Although not directly related to spatial area, the high number of sites occurring in the Idaho Fescue series indicates the dominance of the series in the UJCW. Over 56 % of all sampled sites were plant communities in the Idaho Fescue series, primarily Idaho Fescue-Prairie Junegrass Ridgetop, Mounds, and High Elevation communities. Both Kentucky Bluegrass and Wyeth's Buckwheat disclimax communities are also well represented in the UJCW Idaho Fescue Series. Idaho Fescue-Bluebunch Wheatgrass communities have less representation in the series. Other Idaho Fescue communities in the series have low community representation in the UJCW.

<u>Site Attributes.</u> Eleven plant communities in the Idaho Fescue series were encountered in the UJCW. Comparison of averaged vegetation and ground surface attributes characteristic of the Idaho Fescue plant communities indicated that most plant communities had relatively proportional cover of site attributes (Figure 5). The grass component of cover averaged close to 20 % except in the Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine community which had > 30 % grass cover and the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox community which had < 20 % grass cover. Cover of forbs ranged between 14 % and 26 % in all plant communities except the Idaho Fescue-Bluebunch Wheatgrass/Arrowleaf Balsamroot community which had < 9 % cover.

Two plant communities in the Idaho Fescue series had shrubs as a major component of vegetation cover. The Idaho Fescue-Prairie Junegrass/Buckwheat Disclimax community had >8.0 % cover of Wyeth's buckwheat and the Common Snowberry/Idaho Fescue-Prairie Junegrass community had > 4.0 % cover of common snowberry. None of the 11 communities in the Idaho Fescue series had trees as a component of vegetation cover.

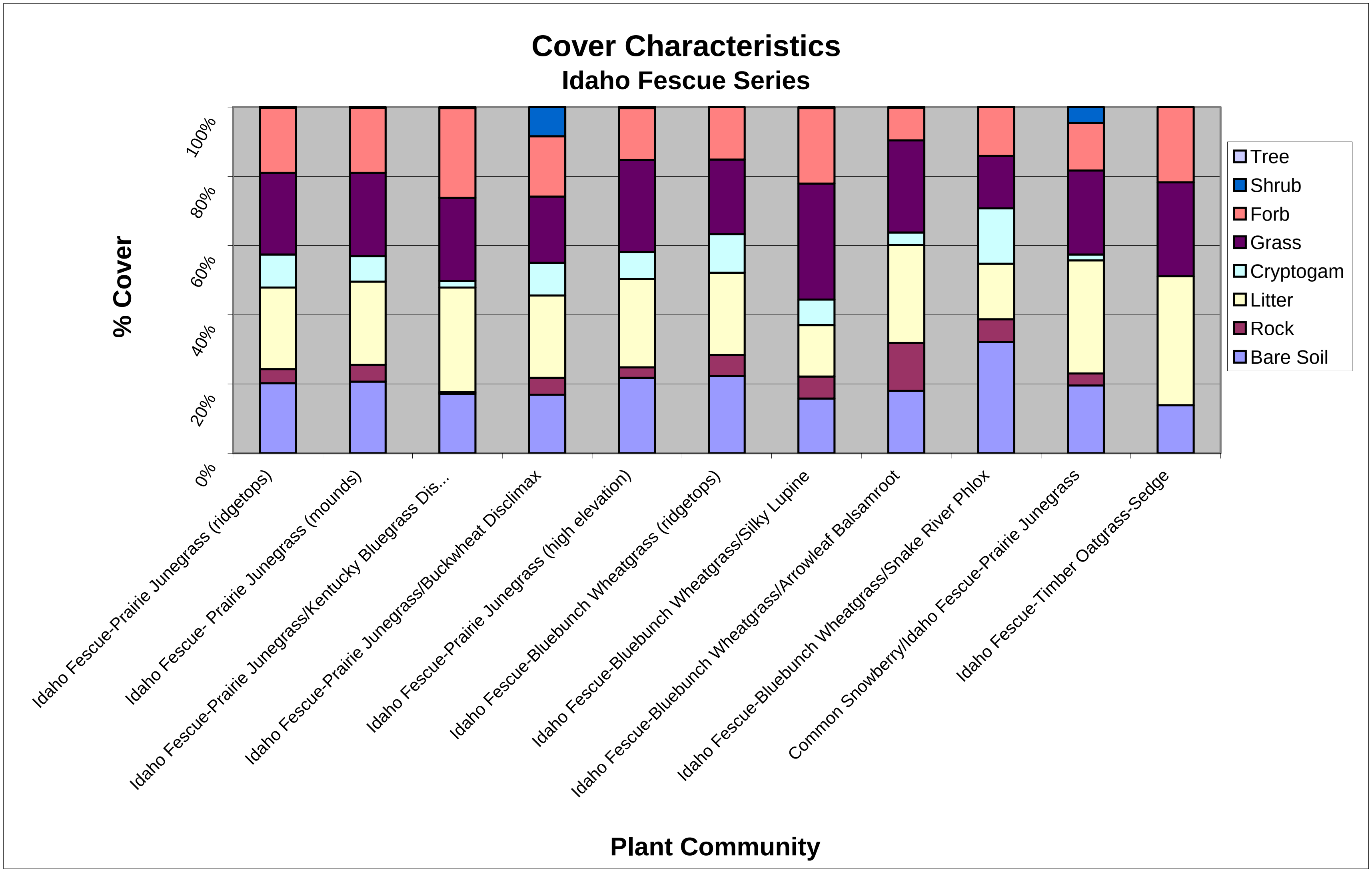


Figure 5. Comparison of cover characteristics of Idaho Fescue plant communities in the Upper Joseph Creek Watershed (% cover).

Cover of bare soil ranged from 12.0 % to 32.0 %. The Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox community, which had relatively low grass and forb cover, had the highest cover of bare soil (32.0 %). The Idaho Fescue-Timber Oatgrass-Sedge community, which had high cover of grass and forbs, had the lowest cover of bare soil (12.9 %). Litter cover ranged from 16.0 % in the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox community to 34.5 % cover in the Idaho Fescue-Timber Oatgrass-Sedge community. Rock cover was highest in the Idaho Fescue-Bluebunch Wheatgrass/Arrowleaf Balsamroot community (12.4 %) but was <7.0 % in other Idaho Fescue communities. Cryptogam cover ranged from 0.0 % in the Idaho Fescue-Timber Oatgrass-Sedge community to 16.0 % in the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox community.

Evaluation of site attributes indicates that communities in the Idaho Fescue series are associated with a moisture gradient. Higher cover of grasses, forbs, and litter and low cover of bare soil indicate deeper soils with greater moisture holding capacity. Communities with moisture holding capacity include the Idaho Fescue-Prairie Junegrass communities, including Ridgetop, Mounds, High Elevation, and the Wyeth's Buckwheat and Kentucky Bluegrass Disclimax communities as well as the Idaho Fescue-Timber Oatgrass-Sedge community and the Common Snowberry/Idaho Fescue-Prairie Junegrass community. Lower cover of grass and forb and higher cover of bare soil and rock indicate more xeric communities on shallower soils with less moisture holding capacity. Communities with lower moisture holding capacity include the Idaho Fescue-Bluebunch Wheatgrass communities.

<u>Growth Form Attributes.</u> Most common native perennial grasses occurring in Idaho Fescue communities were Idaho fescue, bluebunch wheatgrass, Sandberg's bluegrass, and prairie junegrass. Native perennial grasses had highest cover among plant growth forms in all Idaho Fescue communities except the Common Snowberry/Idaho Fescue-Prairie Junegrass and the Kentucky Bluegrass and Wyeth's Buckwheat Mound Disclimax communities (Figure 6). Average cover of native perennial grasses in the three communities ranged between 5.9 % and 7.5 % compared to the range of native perennial grass cover between 11.1 % and 29.6 % in the other Idaho Fescue plant communities.

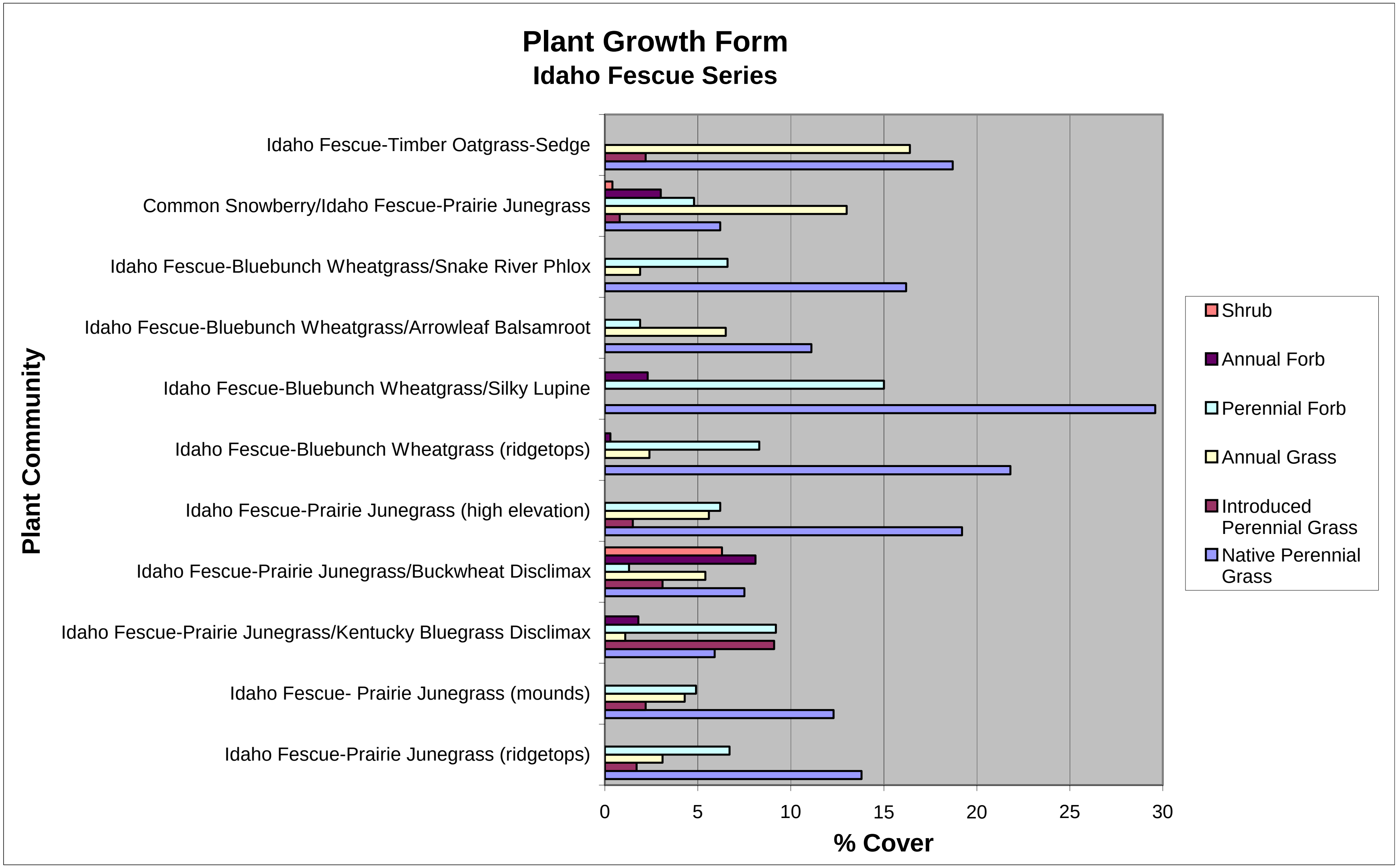


Figure 6. Comparison of plant growth form of Idaho Fescue communities in the Upper Joseph Creek Watershed (% cover).

Introduced perennial grasses most common to Idaho Fescue communities were Kentucky bluegrass, introduced wheatgrasses, and timothy. Introduced perennial grasses had highest cover in the Idaho Fescue-Prairie Junegrass/Kentucky Bluegrass Disclimax community. In this community, introduced perennial grasses had 9.1 % cover compared to 5.9 % cover of native perennial grasses.

Most common annual grasses in Idaho Fescue communities were annual brome grasses and ventenata. Cover of annual grasses was highest in the Common Snowberry/Idaho Fescue-Prairie Junegrass community (13.0 %) and the Idaho Fescue-Timber Oatgrass-Sedge community (16.4 %). Cover of annual grasses was also relatively high in the Idaho Fescue-Bluebunch Wheatgrass/Arrowleaf Balsamroot community (6.5 %). In other Idaho Fescue communities, cover of annual grasses ranged between 0.0 % and 5.4 %.

Perennial forbs were common in Idaho Fescue communities. Cover of perennial forbs ranged from 0.0 % in the Idaho Fescue-Timber Oatgrass-Sedge community to 15.0 % in the Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine community. Annual forbs were less common compared to perennial forbs. The only Idaho Fescue community with annual forb cover exceeding 3.0 % was the Idaho Fescue-Prairie Junegrass/Buckwheat Disclimax community. Cover of annual forbs in this community was 8.1 %.

Community Relationships. Idaho Fescue communities in the UJCW are generally high biomass yielding communities even though other vegetation communities may have higher relative vegetation cover. Communities in this series, whether dominated by native bunchgrass perennials or introduced perennials are high biomass communities. However, community sites that have degraded to very early or early seral stages produce less forage because highly palatable bunchgrass species are replaced by annual grasses and forbs which are productive for a shorter season (i.e., annual brome grasses) or are less palatable (i.e., cluster tarweed). The exception to the above generalization is the Kentucky Bluegrass Disclimax community that has high productivity in a longer growing season.

The high relative cover of bare soil in plant communities of the Idaho Fescue series is both indicative of dominance by bunchgrass plants in communities in a higher seral stage and of disturbance in communities in the lower seral stages. In the latter communities, especially in very early and early seral stages of the mound community, high bare soil may indicate considerable soil turnover by gophers and voles. The influence of soil turnover by these small herbivores on community stability is poorly understood. Further study of the relationship is warranted because of the potential importance of these species to bird and animal predators.

High cover of bare soil in communities of the Idaho Fescue series generally indicates deep soils. Communities that are degraded but retain deep soils are potential candidates for mechanical seeding and other improvement treatments. In the Idaho Fescue series, Idaho Fescue-Prairie Junegrass/Ridgetop, Idaho Fescue-Prairie Junegrass/Mounds, and Idaho Fescue-Prairie Junegrass/High Elevation in very early and early seral stages have potential to be developed through mechanical seeding treatments because of their deep soil characteristics and generally mild terrain relief. The same communities in early and mid seral stages have potential to improve through herbivore management.

There appears to be little consistent pattern relative to cover of different plant growth forms in the Idaho Fescue communities except for introduced perennial grasses. Introduced perennial grasses occurred in Idaho Fescue-Prairie Junegrass communities (including the Common Snowberry/Idaho Fescue-Prairie Junegrass community) and the Idaho Fescue-Timber

Oatgrass-Sedge community but not in the Idaho Fescue-Bluebunch Wheatgrass communities. Lack of introduced perennial grasses in the latter community type is indicative of the shallower soils and less moisture holding capacity of these communities.

Bluebunch Wheatgrass Series

Seven stands of plant communities in the Bluebunch Wheatgrass series were evaluated in the UJCW. The relatively low number of stands compared to plant communities in the Idaho Fescue series and Scabland series indicates that Bluebunch Wheatgrass communities have limited occurrence and spatial area. Plant communities in the Bluebunch Wheatgrass series tend to inhabit drier, southerly aspects. In the UJCW, these aspects are limited because the predominant aspect of the watershed is north.

Site Attributes. Three plant communities in the Bluebunch Wheatgrass Series were encountered in the UJCW (Figure 7). Comparison of average vegetation and ground surface attributes characteristic of the Bluebunch Wheatgrass Series indicated considerable difference in cover of site attributes among the three communities.

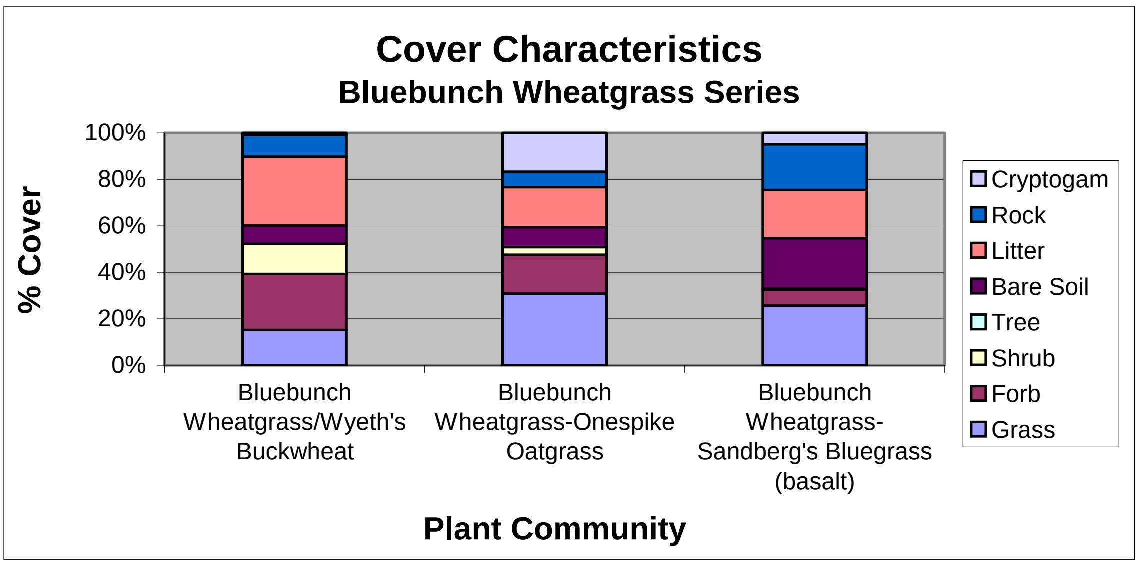


Figure 7. Comparison of cover characteristics of Bluebunch Wheatgrass plant communities in the Upper Joseph Creek Watershed (% cover).

Cover of grass was low in the Bluebunch Wheatgrass/Wyeth’s Buckwheat community compared to the Bluebunch Wheatgrass-Onespike Oatgrass and Bluebunch Wheatgrass-Sandberg’s Bluegrass/Basalt plant communities. In the latter two communities, cover of grass ranged between 25 % and 31 % while in the former community cover of grass was 15.0 %. Cover of forbs was >23.0% in the Bluebunch Wheatgrass/Wyeth’s Buckwheat community, >16.0 % in the Bluebunch Wheatgrass-Onespike Oatgrass community, and <7.0% in the Bluebunch Wheatgrass-Sandberg’s Bluegrass community. The two plant communities with high cover of grasses had lower cover of forbs.

The three plant communities in the Bluebunch Wheatgrass series had shrubs present. However, except for shrub cover in the Bluebunch Wheatgrass/Wyeth’s Buckwheat community (12.6 %), shrub cover was relatively low. Shrub cover in the Bluebunch Wheatgrass/Onespike

Oatgrass community was 3.1 % while in the Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) community shrub cover was <1 %. Trees were not present in the three Bluebunch Wheatgrass communities.

Among ground surface attributes, bare soil was highest in the Bluebunch Wheatgrass-Sandberg's Bluegrass community (21.6 %). Bare soil was 7.9 % in the Bluebunch Wheatgrass/Wyeth's Buckwheat and 8.5 % in the Bluebunch Wheatgrass-Onespike Oatgrass community. Litter was relatively high in the three Bluebunch Wheatgrass communities, ranging between 16.9 % and 29.1 %. Litter was especially high in the Bluebunch Wheatgrass/Wyeth's Buckwheat community, which had lowest bare soil among the three Bluebunch Wheatgrass communities.

Ground surface rock in the three Bluebunch Wheatgrass communities ranged from 6.5 % to 19.6 %. The Bluebunch Wheatgrass-Sandberg's Bluegrass community had 19.6 % cover, which was considerably higher than cover of rock in the other Bluebunch Wheatgrass communities. Ground surface cover of cryptogams was highest in the Bluebunch Wheatgrass-Onespike Oatgrass community (16.4 %).

Growth Form Attributes. Most common native perennial grasses occurring in Bluebunch Wheatgrass communities were bluebunch wheatgrass, Sandberg's bluegrass, and in the Bluebunch Wheatgrass/Wyeth's Buckwheat community, oniongrass (Figure 8).

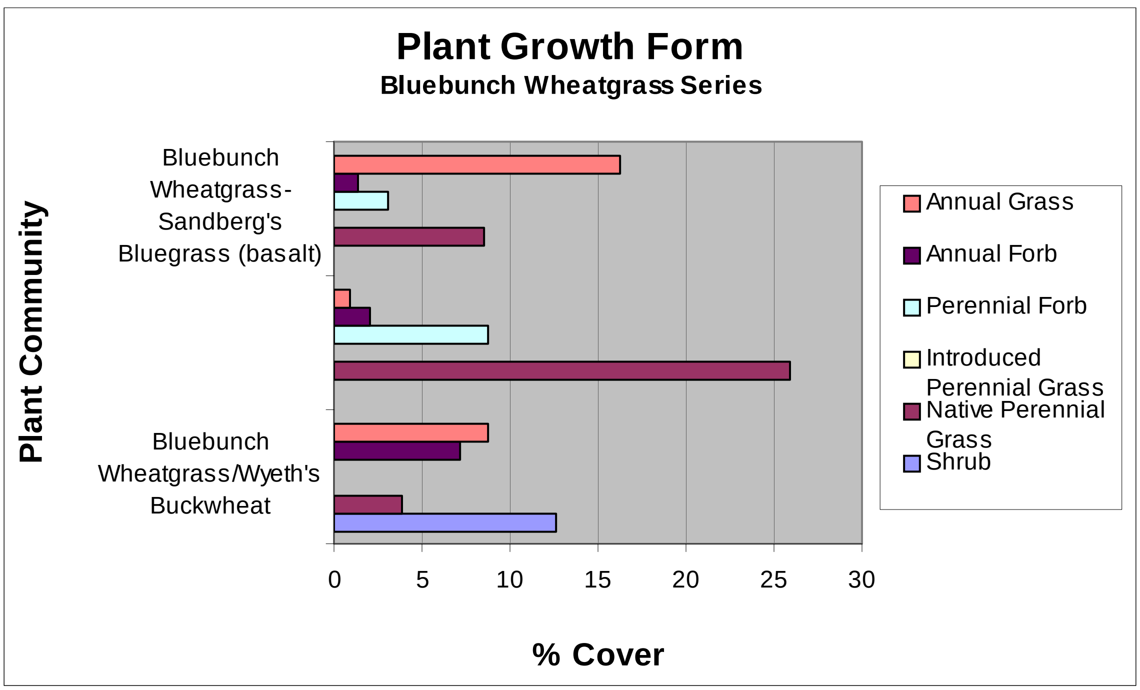


Figure 8. Comparison of plant growth form of Bluebunch Wheatgrass communities in the Upper Joseph Creek Watershed (% cover).

Among the three Bluebunch Wheatgrass communities, native perennial grasses had highest relative cover in the Bluebunch Wheatgrass-Onespike Oatgrass community (25.9 %). Native perennial grass cover was <10 % in the other Bluebunch Wheatgrass communities. Introduced perennial grasses were not present in the Bluebunch Wheatgrass communities.

Annual brome grasses were the only annual grass encountered in the Bluebunch Wheatgrass communities. Cover of annual brome grasses ranged from 16.2 % cover in the Bluebunch

Wheatgrass-Sandberg's Bluegrass community to <1.0 % in the Bluebunch Wheatgrass-Onespike Oatgrass community. Annual brome grasses were relatively high in the Bluebunch Wheatgrass/Wyeth's Buckwheat community (8.7 %).

Forbs had low to moderate cover in the three Bluebunch Wheatgrass communities. Perennial forbs had 8.8. % cover in the Bluebunch Wheatgrass-Onespike Oatgrass community but only 3.1 % cover in the Bluebunch Wheatgrass-Sandberg's Bluegrass community. Perennial forbs were not measured in the Bluebunch Wheatgrass/Wyeth's Buckwheat community but annual forbs had relatively high cover (7.2 %). Annual forb cover was <2.0 % in the other Bluebunch Wheatgrass communities. Shrubs had relatively high cover (12.6 %) in the Bluebunch Wheatgrass/Wyeth's Buckwheat community (12.6 %) while absent in the other Bluebunch Wheatgrass communities.

Site attributes indicate that Bluebunch Wheatgrass communities occur on drier sites than Idaho Fescue communities. Less diversity of plants with cover >1.0 % are found on Bluebunch Wheatgrass community sites even though herbaceous plant cover of species present is only slightly lower compared to Idaho Fescue communities. The relatively low cover of annual grasses and forbs, except in the Bluebunch Wheatgrass/Wyeth's Buckwheat community indicates that more xeric Bluebunch Wheatgrass communities may be less susceptible to invasive annuals, especially the annual grass ventenata.

<u>Community Relationships.</u> Three plant communities in the Bluebunch Wheatgrass series were identified in the UJCW. A distinguishing feature of the Bluebunch Wheatgrass communities was the relatively low cover of grasses and forbs. The Bluebunch Wheatgrass/ Wyeth's Buckwheat had less than 20 % cover of grasses but over 20 % cover of forbs. The Bluebunch Wheatgrass-Sandberg's Bluegrass/Basalt community had higher relative cover of grasses but lower relative cover of forbs. Although no tree species were encountered in communities of the Bluebunch Wheatgrass series, shrubs had relatively high cover in the Bluebunch Wheatgrass/ Wyeth's Buckwheat community. Ground surface attributes generally accounted for over 40 % of ground cover in communities of the series and over 60 % of cover in the Bluebunch Wheatgrass-Sandberg's Bluegrass/Basalt community.

In all Bluebunch Wheatgrass communities encountered in the UJCW, ground cover is primarily comprised of current year's standing crop and litter from the previous year. Over 70 % of the relative ground cover in the Bluebunch Wheatgrass/ Wyeth's Buckwheat community was comprised of current or previous year's standing crop. While litter as a component of ground cover declined in the Bluebunch Wheatgrass-Onespike Oatgrass and Bluebunch Wheatgrass-Sandberg's Bluegrass/Basalt communities, the three cover attributes still dominated relative ground cover.

Compared to communities in the Idaho Fescue series, relative cover of rock and cryptogams increased while relative cover of herbaceous vegetation and litter declined. Shrubs had relatively high ground cover only in one community of the Bluebunch Wheatgrass series. Cover of bare soil was high only in the Bluebunch Wheatgrass-Sandberg's Bluegrass/Basalt community.

Bluebunch Wheatgrass communities in the UJCW are moderately yielding communities. Compared to Idaho Fescue communities and Shrub communities, area of Bluebunch Wheatgrass communities in the UJCW is limited. These communities inhabit southerly aspects that have limited occurrence in the upper watershed. Communities in this series, whether dominated by native bunchgrass perennials or introduced annual bromes are moderately high biomass communities because of more xeric site conditions. Community sites that have degraded to very early or early seral stages produce less forage because highly palatable bunchgrass species are replaced by annual grasses and forbs which are productive for a shorter season (i.e., annual brome grasses) or are less palatable. Soils in these communities are shallower compared to Idaho Fescue and Shrub communities and have less moisture holding capacity.

The high relative cover of bare soil, rock, and cryptogams indicates the shallow, rocky soils characteristic of these communities. Although bunchgrass dominates communities in later seral stages, coarse forbs increase presence in early seral stages. Bare soil and development of stands of woody forbs may indicate considerable soil turnover by gophers and voles. The influence of soil turnover by these small herbivores on community stability is poorly understood. Further study of the relationship is warranted because of the potential importance of these species to bird and animal predators.

While high cover of bare soil in communities of the Idaho Fescue series generally indicates deep soils, deeper soils in the Bluebunch Wheatgrass communities often contain a high percentage of rock fragments. In general, communities in the Bluebunch Wheatgrass series in the UJCW are not suitable for mechanical seeding treatments except in limited areas with level terrain. Treatments other than mechanical seeding need to be implemented to improve degraded sites in the Bluebunch Wheatgrass communities. Potential improvement treatments that should be evaluated in communities of this series include modifications to animal management, seed banks, and small-scale seed distribution plots.

Scabland Series

Communities in the Scabland series were relatively common. A total of 47 stands in four communities were evaluated. Scabland communities tend to be associated with broad ridgetops of the watershed and form the intermound component of the mound-intermound complex.

<u>Site Attributes.</u> Four Scabland communities were identified in the UJCW. A distinguishing feature of communities in the Scabland series is the high relative cover of ground surface attributes compared to cover of vegetation (Figure 9). Relative cover of the four ground surface attributes ranged between 50 and 80 %. Cover of rock

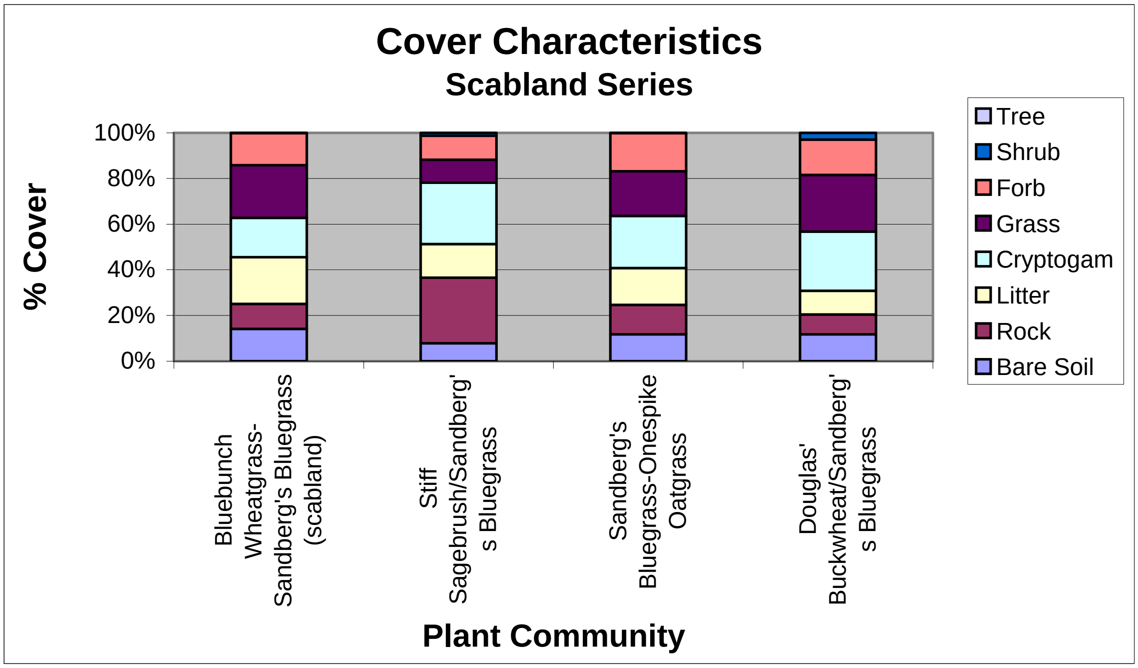


Figure 9. Comparison of cover characteristics of Scabland plant communities in the Upper Joseph Creek Watershed (% cover).

was especially high in the Stiff Sagebrush/Sandberg's Bluegrass community. In general, communities in the Scabland series have highest cover of rock and cryptogams because of the rock pavement often associated with scabland communities. Cover of litter and bare soil are low except in the Bluebunch Wheatgrass-Sandberg's Bluegrass/Scabland community.

Vegetation cover in all plant communities in the series was lowest among plant communities identified in the UJCW. Two of the plant communities in the Scabland series had a shrub component. The Stiff Sagebrush/Sandberg's Bluegrass community had low cover of stiff sagebrush while the Douglas' Buckwheat/Sandberg's Bluegrass had moderate cover of Douglas' buckwheat. Cover of grasses and forbs in the four communities was proportional.

<u>Growth Form Attributes.</u> The most common native perennial plant species occurring in Scabland communities were Sandberg's bluegrass, bluebunch wheatgrass, onespike oatgrass, and squirreltail. Among annual grasses, annual bromes and ventenata were common in all scabland communities. Most common forbs were balsamroot, lomation, sedum, and knotweed.

Cover of native perennial grasses ranged from 5.0 % to 14.8 % in the four scabland communities. Native perennial grasses had highest cover among growth form in three of the four Scabland communities; the exception was the Stiff Sagebrush/Sandberg's Bluegrass plant community in which perennial forbs had slightly higher cover. Introduced perennial grasses had little or no cover in the four scabland plant communities. Lack of introduced perennial grasses is indicative of harsh site conditions characteristic of Scabland plant communities.

Annual grasses had relatively high cover in Scabland communities. Cover of annual grasses ranged from 4.1 % in the Stiff Sagebrush/Sandberg's Bluegrass plant community to 8.2 % in the Bluebunch Wheatgrass/Sandberg's Bluegrass plant

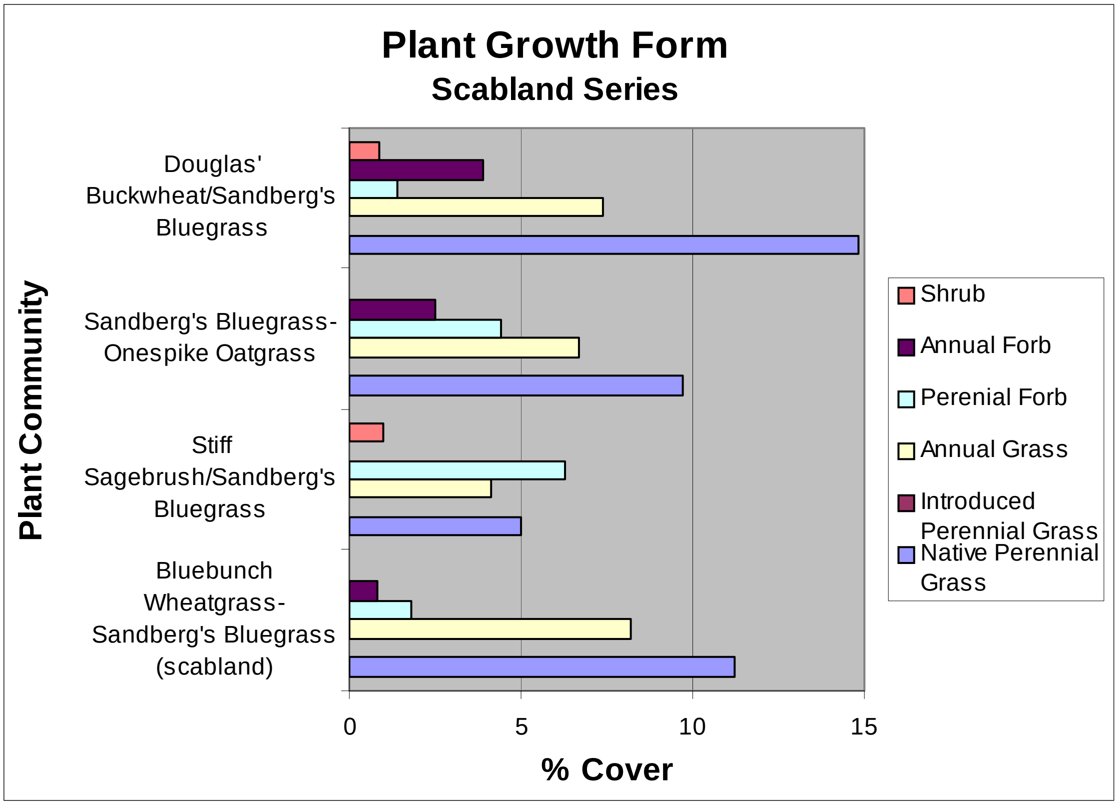


Figure 10. Comparison of plant growth form of Scabland communities in the Upper Joseph Creek Watershed (% cover).

community. Annual brome grasses, ventenata, and annual hairgrass had relatively high cover in the four Scabland communities. Annual hairgrass occurs in scabland communities that form vernal pools before drying out and can be mistaken for ventenata.

Perennial forbs were common to the four scabland communities. Highest cover of perennial forbs occurred in the Stiff Sagebrush/Sandberg's Bluegrass community (6.3 %) and the Sandberg's Bluegrass-Onespike Oatgrass community (4.4 %). Lower cover of annual forbs compared to perennial forbs occurred in scabland communities except in the Douglas' Buckwheat/Sandberg's Bluegrass plant community, which had 3.9 % cover of annual forbs.

Two of the four scabland communities in the UJCW had a shrub component. Cover of shrubs was approximately 1.0 % in the Stiff Sagebrush and Douglas' Buckwheat scabland communities. In the former community, Stiff Sagebrush has low density and is widely dispersed throughout the community area. In the latter community, Douglas' Buckwheat is a "half shrub." Both plant communities despite their shrub components should be regarded as scabland communities.

<u>Community Relationships.</u> Communities in the Scabland series form the Intermound component of the Mound-Intermound complex. These communities, especially the Sandberg's Bluegrass-Onespike Oatgrass community, cover relatively large spatial areas adjacent to deeper soil mound communities and intergraded with the mounds. As the mounds become larger and ultimately become Idaho Fescue communities occupying contiguous deep soil northerly aspects, scabland communities and the Mound-Intermound Complex disappear. Mechanical seeding and most improvement treatments are not an option to improve communities in the Scabland series.

Restricting large herbivore use until soils are dry and vegetation has completed growth has most potential to raise vegetation to a higher seral stage.

Shrub Series

Three Shrub communities in addition to the two Scabland shrub communities were identified in the UJCW. The Common Snowberry-Rose plant community occurs in grass steppe rangeland with low stature, non-dominating shrubs and on northerly aspect ecotones between forest and grass steppe communities. The Mountain Snowberry community often occurs on mounds of the Idaho Fescue-Prairie Junegrass (Mound) community associated with relatively large opening within forest-dominated communities. Ninebark-Common Snowberry communities often occur as shrub patches in ecotonal areas between forest communities and grass steppe communities.

Site Attributes. Distinguishing features of communities in the Shrub series are the presence of shrubs and the high relative cover of grasses and litter (Figure 11). Forbs have high relative cover in the Common Snowberry-Rose community but relatively low cover in the Mountain Snowberry and Ninebark-Common Snowberry communities.

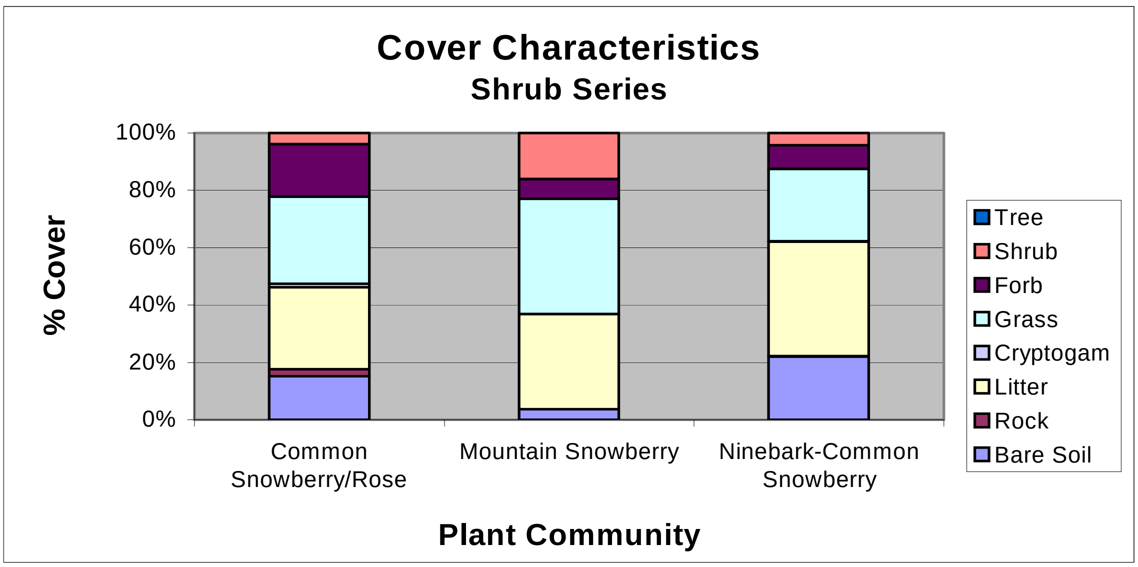


Figure 11. Comparison of cover characteristics of Shrub plant communities in the Upper Joseph Creek Watershed (% cover).

Grasses and litter have highest cover in Shrub communities. Grass cover ranges from 25.0 % in the Ninebark-Common Snowberry community to 40.0 % in the Common Snowberry-Rose community. The former community is usually associated with forest and grassland ecotones while the latter community is associated with both grass steppe and forest steppe communities. The presence of litter in the Shrub series communities is highest among the plant communities in the UJCW.

The forbs component of cover in Shrub communities contributes little to cover except in the Common Snowberry-Rose community. In this community, forb cover is >15.0 % and reflects the usual presence of the community within grass steppe rangeland. Shrub cover is relatively high only in the Mountain Snowberry community (14.0 %) where it occurs as relatively dense patches but with limited spatial area.

Rock and cryptogams have low cover or are not present in the Shrub communities while bare soil has high relative cover in the Common Snowberry-Rose and Ninebark-Common Snowberry communities.

Growth Form Attributes. Native perennial grasses common to shrub communities include bluebunch wheatgrass, onespike oatgrass, Idaho fescue, and pinegrass. Introduced perennial grasses including wheatgrasses, timothy, and Kentucky bluegrass are common in shrub communities. Common annual grasses in shrub communities are annual brome grasses and ventenata. Forbs often encountered in shrub communities are Old Man's Beard and cinquefoil.

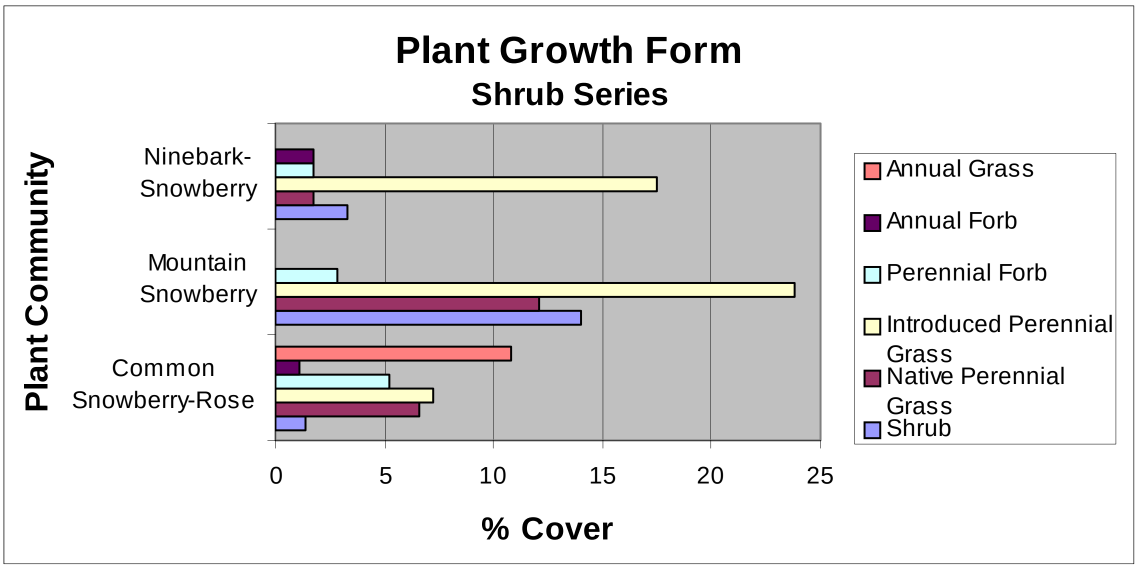


Figure 12. Comparison of plant growth form of Shrub communities in the Upper Joseph Creek Watershed (% cover).

Cover of native perennial grasses in Shrub communities ranges between 1.7 % and 12.1 %. The Mountain Snowberry and Common Snowberry-Rose communities have highest cover of native perennial grasses (12.1 % and 6.6 %, respectively) while the Ninebark-Common Snowberry community has low cover of perennial grasses (1.7 %).

Cover of introduced perennial grasses in Shrub communities is high compared to native perennial grasses. Cover of introduced perennial grasses ranges from 7.2 % in the Common Snowberry-Rose community to 23.8 % in the Mountain Snowberry community. Although cover of native perennial grasses was low in the Ninebark-Common Snowberry community, cover of introduced perennial grasses was relatively high (1.7 % vs. 17.5 %, respectively). The Common Snowberry-Rose community was the only Shrub community that had cover of annual grasses. Cover of annual grasses was 10.8 % in this community.

Cover of forbs in Shrub communities ranged from 1.7 % to 5.2 % for perennial forbs and from 0.0 % to 1.7 % for annual forbs. The Common Snowberry-Rose community had highest cover of both perennial forbs. Cover of perennial forbs was 5.2 % while cover of annual forbs was 1.1 %. Cover of both perennial and annual forbs in the Ninebark-Common Snowberry community was 1.7 %. The Mountain Snowberry community had 2.8 % cover of perennial forbs.

Two of the three Shrub communities had low cover of shrubs. Cover of shrubs in the Common Snowberry-Rose community was 1.4 % while cover of shrubs in the Ninebark-Common Snowberry community was 3.3 %. The Mountain Snowberry community had highest cover of shrubs (14.0 %).

<u>Community Relationships.</u> Shrub communities are associated with both grass and forest steppe rangeland (Figure 12). In grass steppe rangeland, the Common Snowberry-Rose community is associated Idaho Fescue communities on relatively steep northerly aspects. Both the Mountain Snowberry and Ninebark-Common Snowberry communities tend to form ecotonal boundaries between Forest communities and grass steppe rangeland communities. The Ninebark-Common Snowberry is the successional community in Douglas-fir overstory communities that have been disturbed by timber harvest or fire.

Mountain Snowberry and Ninebark-Common Snowberry shrub communities are important habitat for small and large herbivores. The latter community provides highly nutritious browse to livestock and large wild herbivores during fall and early winter. Fruit of snowberry and rose are important food items for a number of birds and mammals common to the UJCW.

Shrub communities within the grass and forest steppe dominated rangeland of the UJCW add significantly to community biodiversity. Consequently, management and improvement programs initiated during subsequent phases should focus on maintaining or expanding the shrub community component of the watershed. In forest steppe, an increase in shrub habitat should be a major consideration of tree thinning programs. In grass steppe dominated rangeland, maintaining shrubs as a component of wildlife habitat should be a major consideration of livestock management.

Oldfield Communities

Five Oldfield Communities were identified in the UJCW. Distinguishing characteristics of the Oldfield communities included having the appearance of cultivated fields as indicated by “plow lines”, a monoculture appearance, and an obvious lack of native bunchgrass species as community dominants. Grasses, forbs, and litter dominated ground surface cover in Oldfield communities. Cover of bare soil was highest among ground surface attributes while rock and cryptogams had very low or no cover.

<u>Site Attributes.</u> Relatively high cover of introduced perennial grasses and litter are characteristic of Oldfield communities. Cover of grasses in Oldfield communities range from 18.0 % in the Timothy Oldfield community to >45.0 % in the Kentucky Bluegrass Oldfield community. Cover of forbs is <15.0 % in Oldfield communities except in the Kentucky Bluegrass Oldfield community. In the latter community, cover of forbs is >33.0 %. Shrubs and trees are seldom encountered in Oldfield communities.

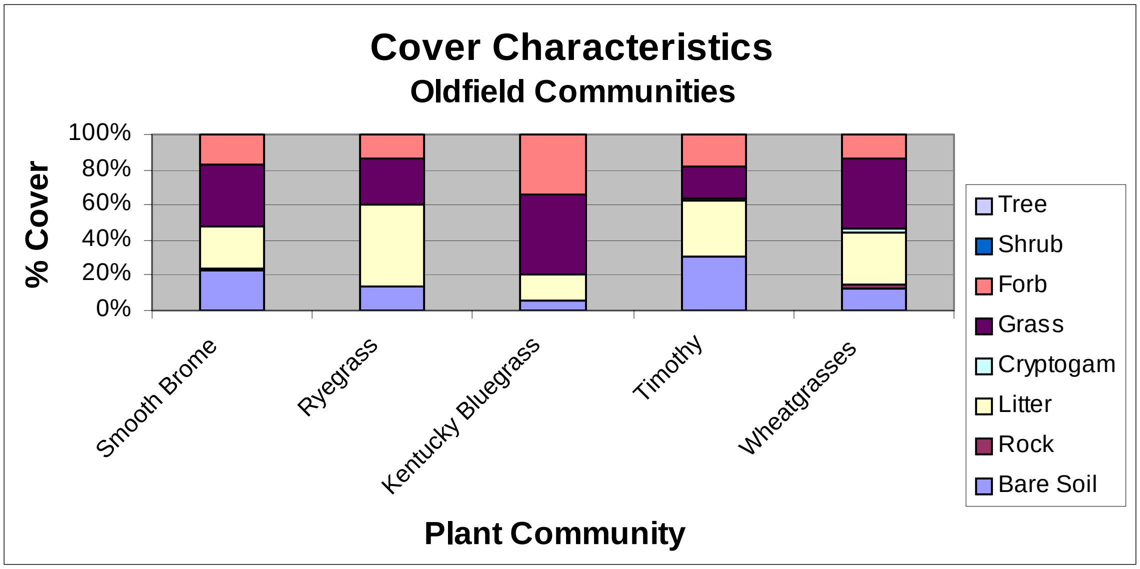


Figure 13. Comparison of cover characteristics of Oldfield communities in the Upper Joseph Creek Watershed (% cover).

Cover of litter ranges from <16.0 % in the Kentucky Bluegrass Oldfield community to >45.0 % in the Ryegrass Oldfield community. In general, soils of Oldfields are deep. This feature is expected, as soil depth was a primary rationale for selecting Oldfield sites as cultivated fields. Observations of surrounding native bunchgrass communities indicate that native bunchgrass communities most often converted to cultivated fields were communities in the Idaho Fescue series. These communities have deeper soils and higher moisture holding capacity. Rocks and cryptogams are seldom encountered in Oldfield communities.

Growth Form Attributes. Introduced perennial grasses were common in Oldfield communities. Depending on the specific Oldfield community, grasses with high cover included smooth brome, timothy, ryegrass, wheatgrasses and bulbous bluegrass. Native perennial grasses often occurring in Oldfield communities were Idaho fescue, Sandberg's bluegrass, and mountain brome. Annual grasses often encountered in Oldfield communities were annual bromes and ventenata. Perennial forbs usually encountered in Oldfield communities were cinquefoils, meadowrue, Old Man's Beard, and lupines while the most common annual forb was tarweed.

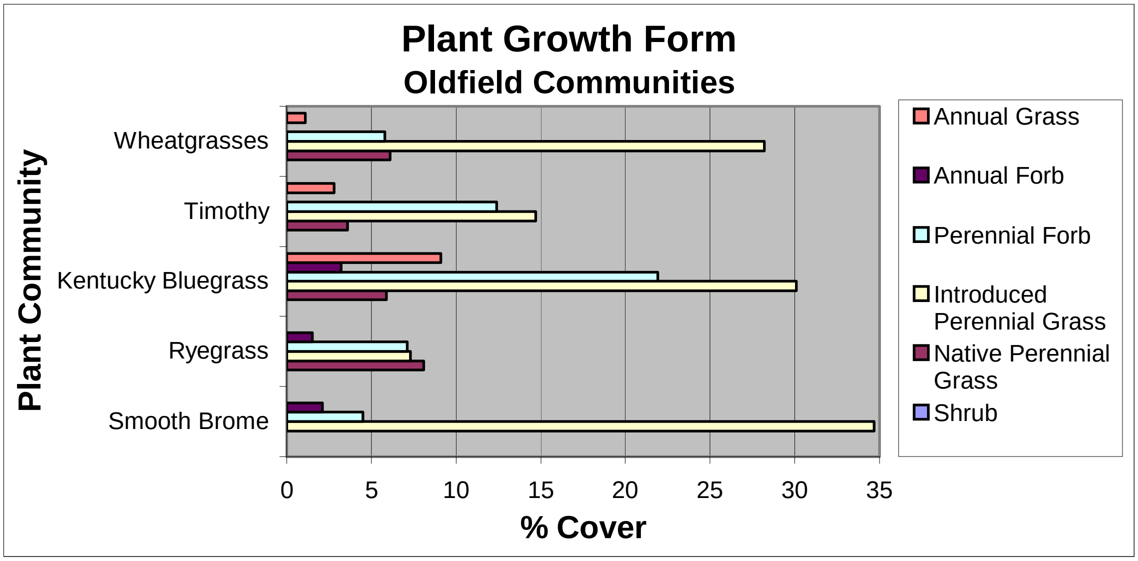


Figure 14. Comparison of plant growth form in Oldfield communities in the Upper Joseph Creek Watershed (% cover).

Native perennial grasses with cover <10.0 % are a relatively minor component of cover in all Oldfield communities except Ryegrass Oldfields. In the latter community, native perennial grasses have highest cover among plant growth forms. Introduced perennial grasses dominate cover in all Oldfield communities except the Ryegrass Oldfield community. Cover of introduced perennial grasses ranges from 7.3 % in the Ryegrass community to 34.7 % in the Smooth Brome Oldfield community. Cover of annual grasses is highest in the Kentucky Bluegrass Oldfield community (9.1 %). In other Oldfield communities, annual grasses have <3.0 % cover.

Perennial forbs have relatively high cover in Oldfield communities. Cover of perennial forbs range from 4.5 % cover in the Smooth Brome Oldfield community to 21.9 % cover in the Kentucky Bluegrass Oldfield community. Annual forb cover, which ranges from 0.0 % cover to 3.2 % cover, is low in Oldfield communities.

Community Relationships. During the period of cultivation, Oldfields in the UJCW were used primarily to produce cereal grains. Oldfields have been seeded to introduced forage species, especially smooth brome, ryegrass, wheatgrasses (*Agropyron sp.*) and timothy. Kentucky bluegrass, whether seeded or invading, is common to most Oldfield communities. Currently, Oldfields are used to produce forage for livestock, and inadvertently, for small and large wild herbivores.

Oldfields have a high capacity to produce forage. However, the capacity of many Oldfields to produce forage appears to be declining. Native increaser forbs are reestablishing in Oldfields and replacing forage species as the dominant species.

Improvement of Oldfield capacity to produce forage should be a major consideration in subsequent phases of the UJCW project. The rationale for this conclusion is: (1) Oldfields are, and will remain in a very early seral stage for an indefinite time period because of the past severe disturbance to soils and native vegetation; (2) insufficient information on methods and the time required to restore Oldfields to native bunchgrass communities currently exists, and (3) developing the capacity of Oldfields to produce quality forage for livestock and large wild herbivores can induce flexibility in livestock management and be used to reduce grazing pressure on native bunchgrass communities.

Meadow Communities

Two Meadow communities were identified in the UJCW. Meadow communities were not a major vegetation type, usually occurring along riparian area high water tables as streamside "greenlines" or as meadow terraces. Meadow communities also develop near seeps, springs and man-made water tanks. Meadow communities of relatively large area in the UJCW are usually associated with forest steppe rangeland.

Site Attributes. Nine Meadow community stands were evaluated in the UJCW. Four of the stands represented a moist Riparian Meadow dominated by typical meadow plant species. Five stands were representative of dry, ephemeral Meadow Complexes that are moist for only a portion of the growing season (Figure 15).

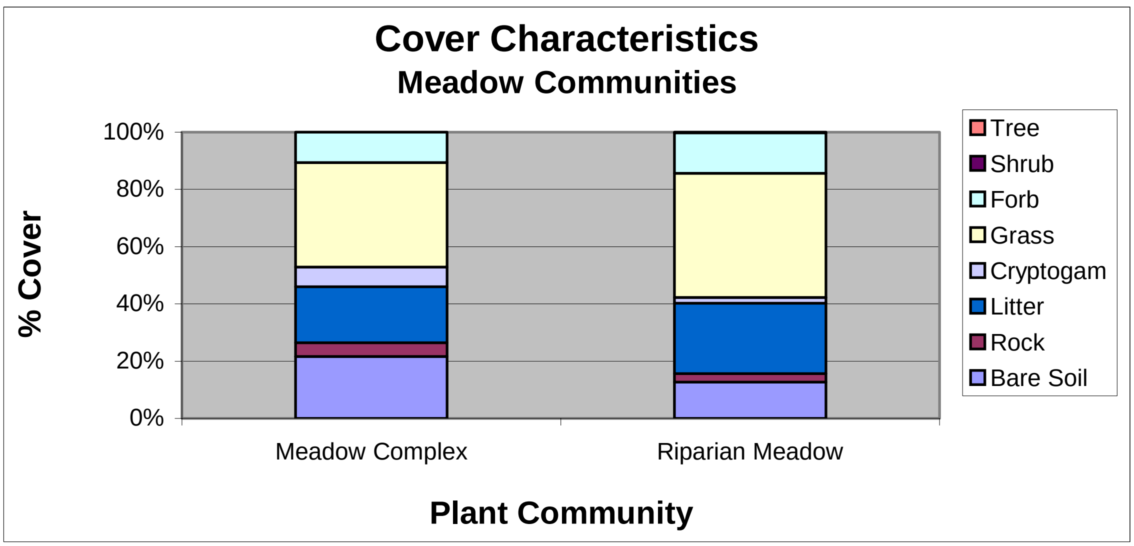


Figure 15. Comparison of cover characteristics of Meadow communities in the Upper Joseph Creek Watershed (% cover).

Distinguishing features of Meadow communities were the relatively high cover of grasses/grasslikes, bare soil, and litter. Cover of grass/grasslikes in the two Meadow communities was 36.7 % and 46.2 %, respectively. Forbs had moderate cover, especially in riparian meadows in early and mid seral stages.

Cover of bare soil and litter was relatively high in both Meadow communities. High cover of litter was a characteristic of Meadow communities and reflects the higher biomass produced by meadow communities. Cover of litter was 19.7 % in the Meadow Complex and 25.6 % in the Riparian Meadow. Cover of bare soil was 21.7 % in moist, Riparian Meadows and 25.6 % in the Meadow Complex. The higher cover of bare soil and lower cover of litter in the ephemeral Meadow Complex indicate the drier site conditions characteristic of dry meadows.

Rock and cryptogams had relatively low cover in both Meadow communities. The Riparian Meadow had higher cover of both ground attributes compared to Meadow Complexes. Although the former meadow community has higher cover of herbaceous plants, presence of the community along stream channels accounts for the higher cover of rock and cryptogams.

Growth Form Attributes. Cover of native and introduced perennial grasses/grasslikes was high in Meadow communities. Common native perennial grasses in the Riparian Meadow community were sedge and rush while in the Meadow Complex Idaho fescue, Sandberg's bluegrass, and rush were common. Common introduced perennial grasses in both Meadow communities were timothy and Kentucky bluegrass while hairgrass, wheatgrasses, and quackgrass were common in the Meadow Complex community. Cover of introduced perennial grasses was higher in the Meadow Complex community while cover of native perennial grasslikes was high was high in the Riparian Meadow community. Annual brome grasses were most common in the Meadow Complex community.

Cinquefoils were a common forb in both Meadow communities. Forbs common to the Meadow Complex community were western meadowrue, aster, heartleaf arnica, fleabane, and biscuitroot.

Cover of native perennial grasses in the Meadow Complex was 10.8 %. In the Riparian Meadow, cover of native perennial grasses was 18.8 %. Introduced perennial grasses had higher cover in the Meadow Complex community compared to the Riparian Meadow community (15.8 % vs. 11.8 %, respectively). Cover of annual grasses in the Riparian Meadow community was 13.0 %. Cover of perennial forbs was 10.9 % in the Riparian Meadow community and 5.2 % in the Meadow Complex community.

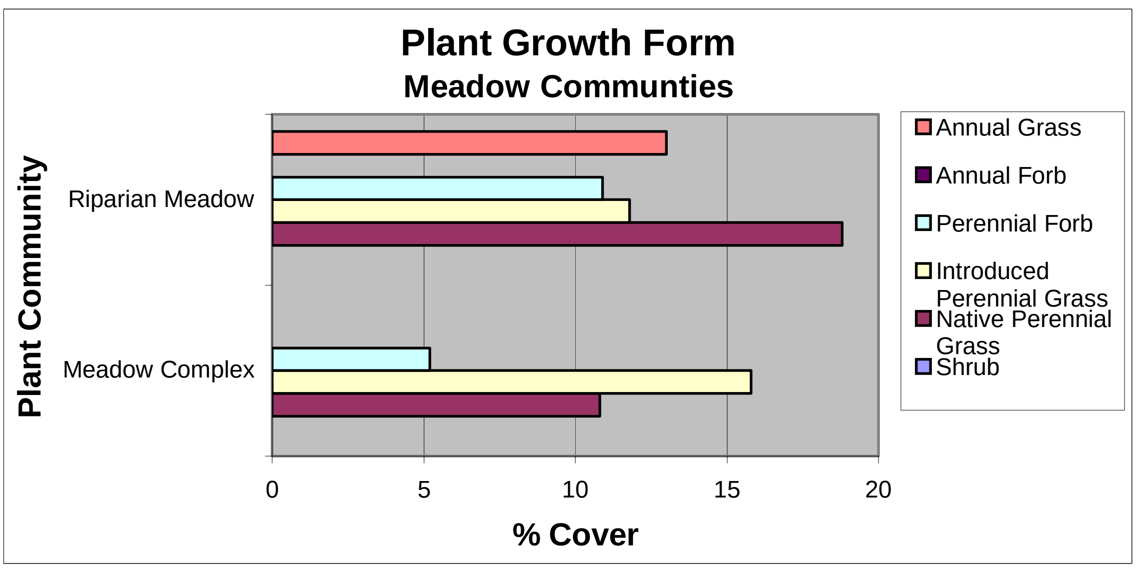


Figure 16. Comparison of plant growth form in Meadow communities in the Upper Joseph Creek Watershed (% cover).

Community Relationships. Meadow communities generally have relatively small spatial area in grass steppe rangelands and moderate spatial area in forest steppe rangelands. However, meadows/riparian areas receive a disproportionate amount of use by wildlife and uncontrolled domestic livestock because of their association with drinking water, shade and the high quality browse and herbaceous forage comprising meadow vegetation.

A properly functioning riparian ecosystem is important to sustaining aquatic wildlife populations as well as animal populations. Because of the propensity for overuse, meadow/riparian areas have high potential to be degraded, usually by drying out because of lowered water table and/or changes in species composition.

Meadow/riparian communities evaluated in the UJCW were in the early to mid seral stage. However, severely degraded meadow/riparian communities have been identified in the watershed. A major focus of subsequent phases of the UJCW project should be on implementing improvement and management alternatives that maintain and improve condition of meadow/riparian habitat.

Annual Grass Community

Although most communities in the UJCW have annual grasses as a component of vegetation, and very early and early seral communities usually have relatively high annual grass components, communities dominated solely by annual grasses are rare. Grass steppe rangeland in the UJCW that is dominated by annual grasses is usually patches with relatively small spatial area.

Site Attributes. The single annual grass site evaluated was dominated by cheatgrass (*Bromus tectorum*) (Figure 17). Cover of grasses at the measured site was 23.0 %. Rock had highest cover among all site attributes (39.3 %). Cover of bare soil and litter were <5.0 % while cover of cryptogams was 7.6 %.

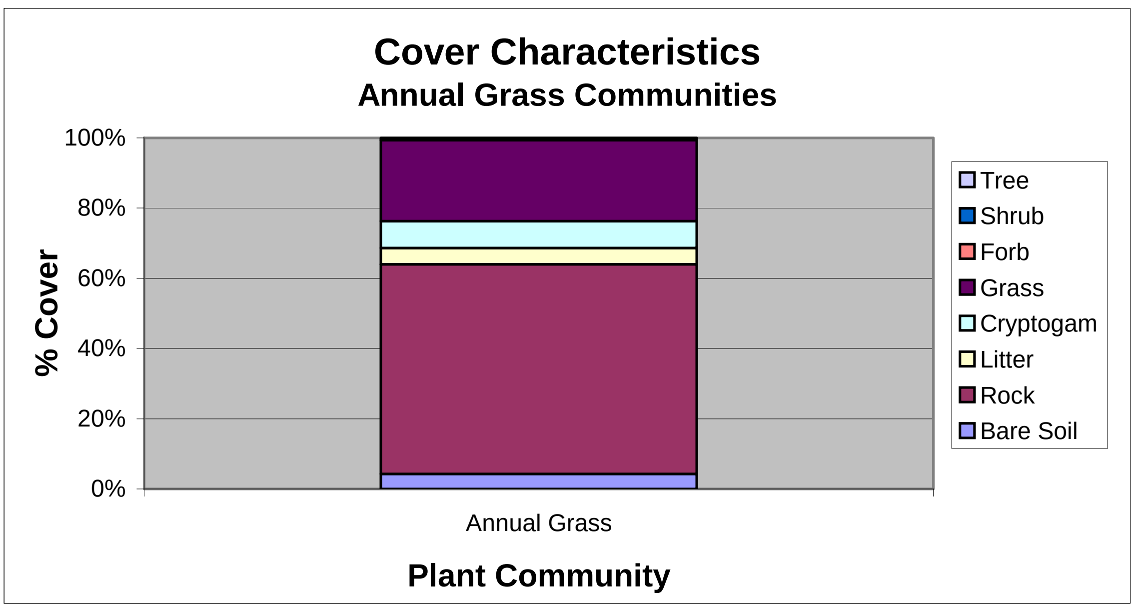


Figure 17. Cover characteristics of Annual Grass communities in the Upper Joseph Creek Watershed (% cover).

Growth Form Attributes. Cheatgrass and autumn willow-weed were the only species recorded on the annual grass dominated site (Figure 18). Cover of cheatgrass was 23.0 % while cover of autumn willow-weed was 0.3 %.

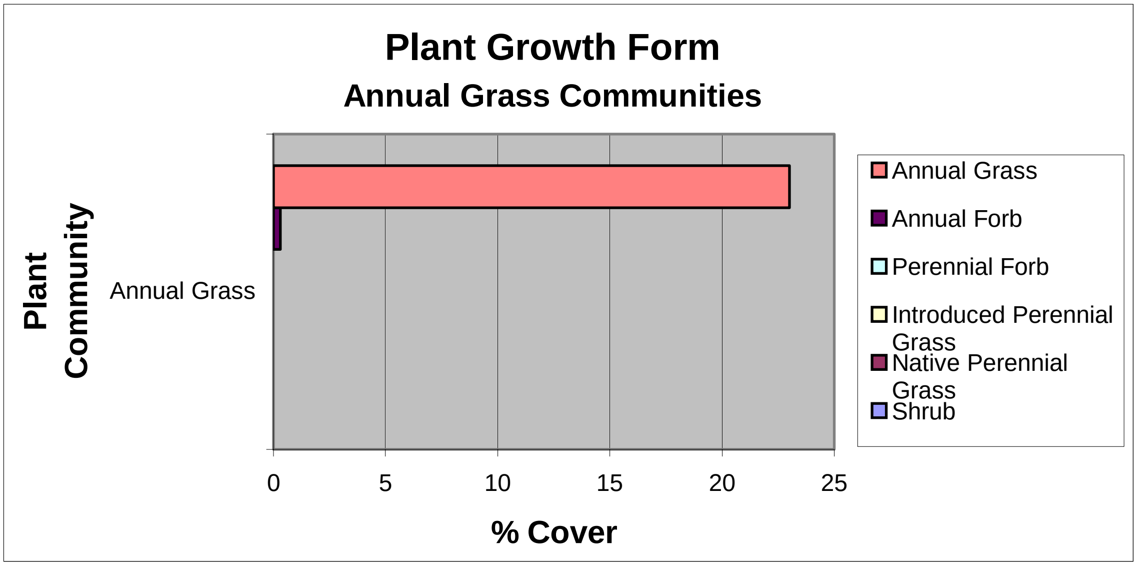


Figure 18. Comparison of plant growth form in Annual Grass communities in the Upper Joseph Creek Watershed (% cover).

<u>Community Relationships.</u> Only one stand dominated by annual grasses was evaluated although small patches of annual grass dominated stands are relatively common. The relatively small size of the patches reduces the overall importance of the community, other than potential for providing sites favoring establishment of invasive annual grasses and forbs. Grasses dominated vegetation cover and rock dominated ground surface cover. All other vegetation and ground surface attributes had low cover.

Comparison Among Communities

Plant communities identified in the UJCW are from several series and communities. Characteristics of these communities have considerable difference (Figure 19). Comparison of cover components among the six prevalent plant series in the

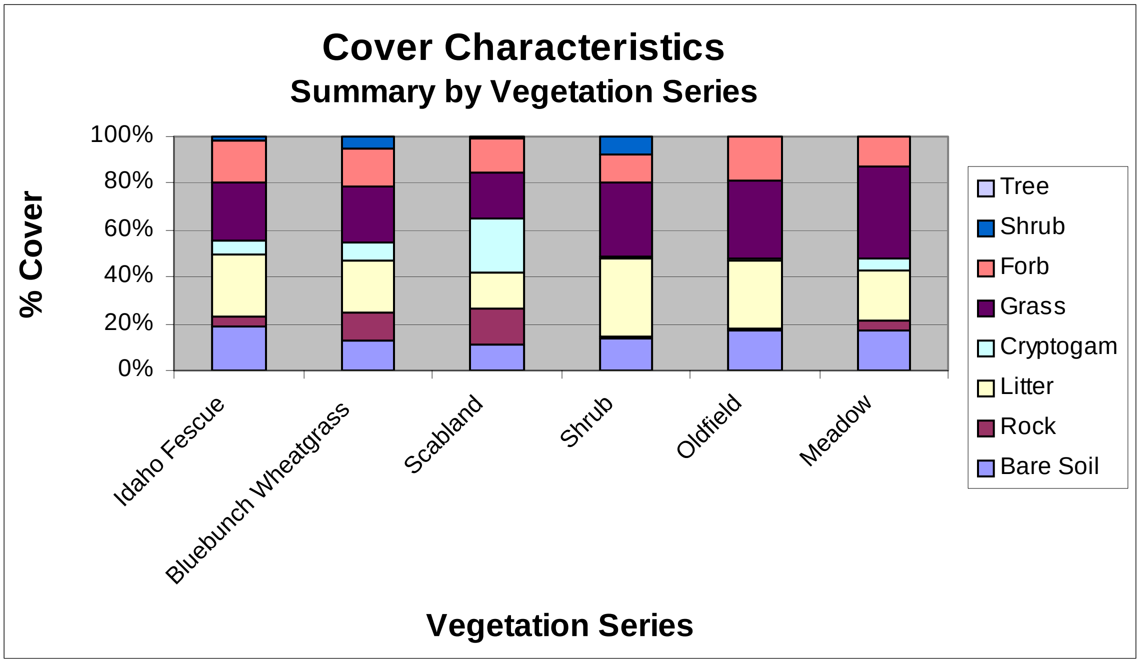


Figure 19. Summary comparison of cover characteristics of vegetation series encountered in the Upper Joseph Creek Watershed (% cover.)

UJCW indicated considerable difference existed in relative proportions of vegetation and ground surface cover. Total vegetation cover had highest cover in the Meadow and Shrub series and Oldfield community type. Approximately 50 % of total cover in these series/community types was vegetation. Shrubs comprised a substantial proportion of vegetation cover in the Shrub series while grasses and forbs comprised vegetation cover in the Meadow series and the Oldfield Community type. Among ground surface attributes, litter had highest cover followed by bare soil. Cover of rocks and cryptogams was low or absent.

Vegetation cover in the Idaho Fescue and Bluebunch Wheatgrass series was lower compared to the former series/community types but was still substantial. Vegetation cover, which was comprised of grasses, forbs, and shrubs, averaged approximately 45 % in the two series. Both series had relatively high cover of bare soil and litter as well as relatively high cover of rock and cryptogams. The Bluebunch Wheatgrass series had higher rock and cryptogam cover compared to the Idaho Fescue series.

While many plant communities forming the Idaho Fescue series are associated with deeper soils, location on ridgetops and upper slope positions induces higher drainage potential. In general, vegetation of plant communities in the Idaho Fescue series has less vegetation producing capacity than communities in Meadow, Oldfield and Shrub series/community types. Improvement alternatives applied to the Idaho Fescue series should focus on communities that have highest moisture holding capacity. Plant communities in the Bluebunch Wheatgrass series inhabit drier sites with shallower soils than communities in the Idaho Fescue series.

Cover of vegetation in the Scabland series was less than 40 %. In this series, rock and cryptogams together had highest cover. Bare soil and litter had proportional cover but which was lower than vegetation cover or cover of rock and cryptogams. Plant communities in the Scabland series are associated with xeric, shallow soils that have very low moisture holding capacity. Consequently, total biomass production is low and the growing period is short.

Communities in this series have low potential for site improvement other than management of herbivore grazing.

In general, plant series/community types identified in the UJCW are influenced by both a moisture and soil depth gradient. The three series with highest vegetation cover have highest moisture holding capacity because of a direct association with moisture (i.e., Mead) or deeper soils in conjunction with northerly aspects. Oldfields were probably selected for cultivation because of their deeper soils and higher moisture holding capacity. Shrub communities, especially shrub communities associated with forest communities, are located on deeper ecotonal soils.

V. Invasive Species in the UJCW

A number of weedy plant species commonly occur in the UJCW. The most common weed species are generally non-native annual grasses that include cheatgrass (*Bromus tectorum*), softchess (*B. mollis*), Japanese brome (*B. japonicus*), rattle brome (*B. brizaeformis*), ventenata (*Ventenata dubius*), and annual hairgrass (*Deschampsia danthonioides*). Cheatgrass, because of its long awns at maturity and potential to be injurious to grazing herbivores, should be viewed and treated separately from the other annual bromes.

Another increasingly common weedy annual grass is ventenata, which was introduced from Europe and appears to be spreading throughout the UJCW and Zumwalt Prairie. Earlier vegetation studies on the prairie have little or no mention of ventenata as a weedy annual increaser species. Annual hairgrass occurs on scablands, including intermound scablands, where high water tables create a late season "vernal pool" effect. Annual hairgrass and ventenata, which often inhabit the same site, can be easily confused. Slender muhlenbergia (*Muhlenbergia filiformis*) is infrequently encountered, usually within the mound-intermound complex.

Kentucky bluegrass (*Poa pratensis*) is the most widely distributed perennial increaser encountered in the UJCW and Zumwalt Prairie. Kentucky bluegrass can withstand heavy herbivore grazing and replaces Idaho fescue and other native perennial bunchgrass species on mesic sites in the UJCW. According to Johnson and Simon (1987), reestablishing native perennials on sites that are now dominated by Kentucky bluegrass has very little potential for success. Also, Kentucky bluegrass is a highly palatable and nutritious species for many of the large and small herbivore grazers in the UJCW. As a C^4 plant (i.e., warm season), it enters senescence later during the summer season and, when mature, retains high palatability and nutrient availability. Consequently, Kentucky bluegrass as a component of grass steppe rangeland in the UJCW increases rangeland capacity to support grazing herbivores by increasing seasonal access to nutrients.

Cluster tarweed (*Madia glomerata*) is an annual forb having widespread distribution on grass steppe and forest steppe rangeland in the UJCW and Zumwalt Prairie. The forb is usually associated with degraded sites, especially sites in the mound-intermound complex. Mounds, especially mounds in a very early seral stage, are often dominated by cluster tarweed. The forb, because of low palatability caused by the "tar" scent and exuda from numerous glands, has little or no value as forage to herbivores.

Although native forbs are a component of all plant associations and communities of the UJCW, and some forbs are both increaser and toxic or deleterious species, these species tend to dominate specific communities rather than have widespread distribution throughout the watershed. Introduced weedy forb species, which are of greater concern, are present in the watershed but are generally site specific. Control of these species and prevention of further distribution throughout the watershed should be a primary focus of a second phase of the UJCW project.

Idaho Fescue Series

The Idaho Fescue series dominates vegetation resources in the UJCW (Figure 20). Plant communities in the series are the major communities of grass steppe rangeland relative to forage provided and spatial area covered. Consequently, maintaining and improving vegetation resources is important to the entire watershed.

Although high cover sites containing invasive, noxious weeds were not identified in plant communities of the Idaho Fescue series, invasive annual bromes and ventenata were common in very early and early seral stages of most plant communities found in the watershed. Kentucky bluegrass, an introduced perennial, was also common in plant communities of the watershed.

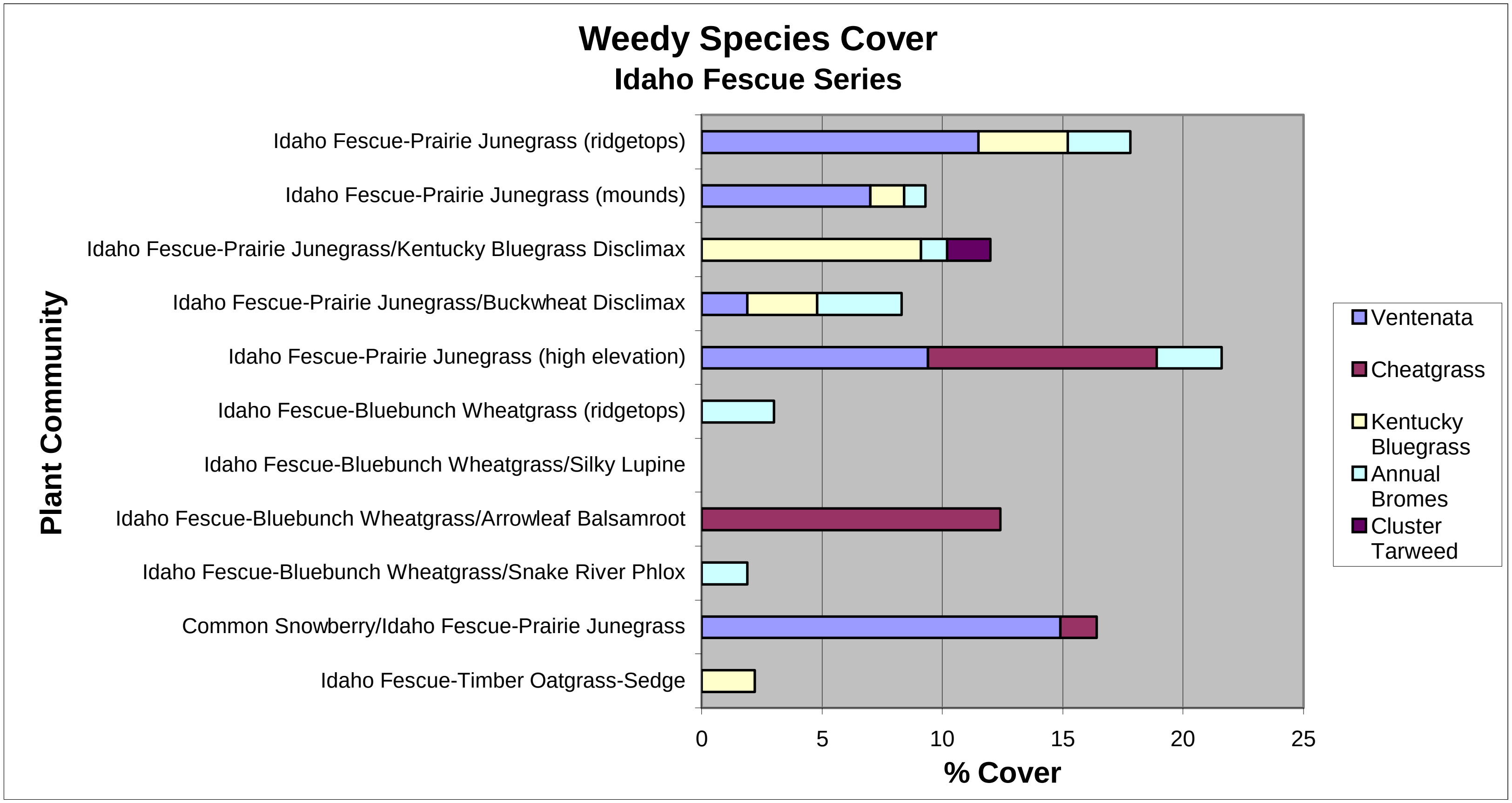


Figure 20. Comparison of invasive species cover of Idaho Fescue communities in the Upper Joseph Creek Watershed (% cover).

Annual brome grasses had low cover (<5%) in seven of the 11 plant communities in the Idaho Fescue series. Cheatgrass, which can be injurious to grazing herbivores, had moderately high cover in three plant communities of the series. The two plant communities with high cover of cheatgrass were the Idaho Fescue-Prairie Junegrass/High Elevation and the Idaho Fescue-Prairie Junegrass/Arrowleaf Balsamroot communities. The relatively high cover of cheatgrass in the two communities may reflect the more xeric nature of the two communities.

Ventenata, which appears to be increasing throughout the watershed, had relatively high cover in four plant communities of the Idaho Fescue series. Cover of ventenata in the three communities ranged between 7 and 15 % and was highest in the Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine and Idaho Fescue-Prairie Junegrass/Ridgetop communities. The Idaho Fescue-Prairie Junegrass/Mounds and Idaho Fescue-Prairie Junegrass/Wyeth's Buckwheat Disclimax communities had lower but still relatively high cover of ventenata.

Kentucky bluegrass had >9 % cover in the Idaho Fescue-Prairie Junegrass/Kentucky Bluegrass Disclimax plant community. Other communities in the Idaho Fescue series with < 5 % cover were the Idaho Fescue-Prairie Junegrass/Ridgetop, Idaho Fescue-Prairie Junegrass/Mounds and Idaho Fescue-Prairie Junegrass/Wyeth's Buckwheat Disclimax communities. Tarweed, an annual forb, had substantial cover in the Idaho Fescue-Prairie Junegrass/Kentucky Bluegrass Disclimax plant community.

Bluebunch Wheatgrass Series

Annual brome grasses, including cheatgrass, are the dominant weedy species in the Bluebunch Wheatgrass series (Figure 21). Annual brome grasses occur with low to moderate cover in the three plant communities identified in the UJCW.

The Bluebunch Wheatgrass/Wyeth's Buckwheat community had approximately 8 % cover of annual brome grasses while the other two communities in the series had < 5 % cover. This community also had low cover of tarweed. The Bluebunch Wheatgrass-Sandberg's Bluegrass/Basalt community had >10.0 % cover of cheatgrass as well as low cover (< 5.0 %) of other annual brome grasses and ventenata. Kentucky bluegrass either had very low cover or did not occur in the three communities identified as belonging to the Bluebunch Wheatgrass series.

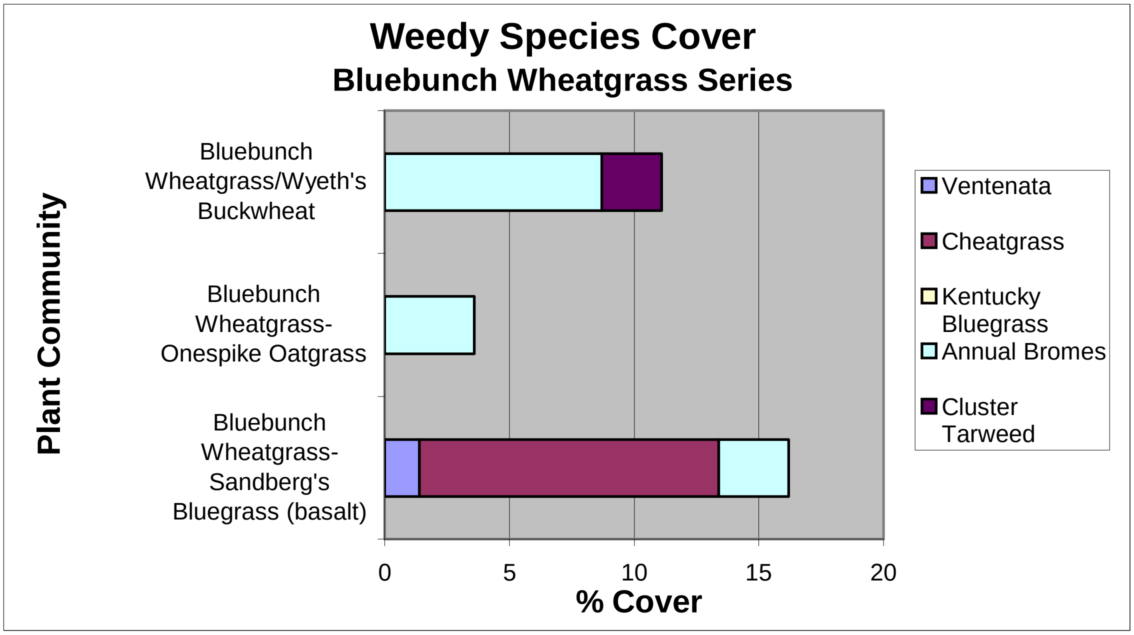


Figure 21. Comparison of invasive species cover of Bluebunch Wheatgrass communities in the Upper Joseph Creek Watershed (% cover).

Scabland Series

Cheatgrass and ventenata were common weedy species in plant communities of the Scabland series (Figure 22). Cover of cheatgrass in the Douglas' Buckwheat/Sandberg's Bluegrass community was highest among all plant communities identified in the UJCW. Cheatgrass also had relatively high cover (< 5.0 %) in the Bluebunch Wheatgrass-Sandberg's Bluegrass and Sandberg's Bluegrass-Onespike Oatgrass communities.

Ventenata had relatively high cover (> 5.0 %) in the Stiff Sagebrush-Sandberg's Bluegrass community. Ventenata also had relatively high cover (> 3.0 %) in the Sandberg's Bluegrass-Onespike Oatgrass and the Bluebunch Wheatgrass-Sandberg's Bluegrass communities. Annual brome grasses had low cover in the Bluebunch

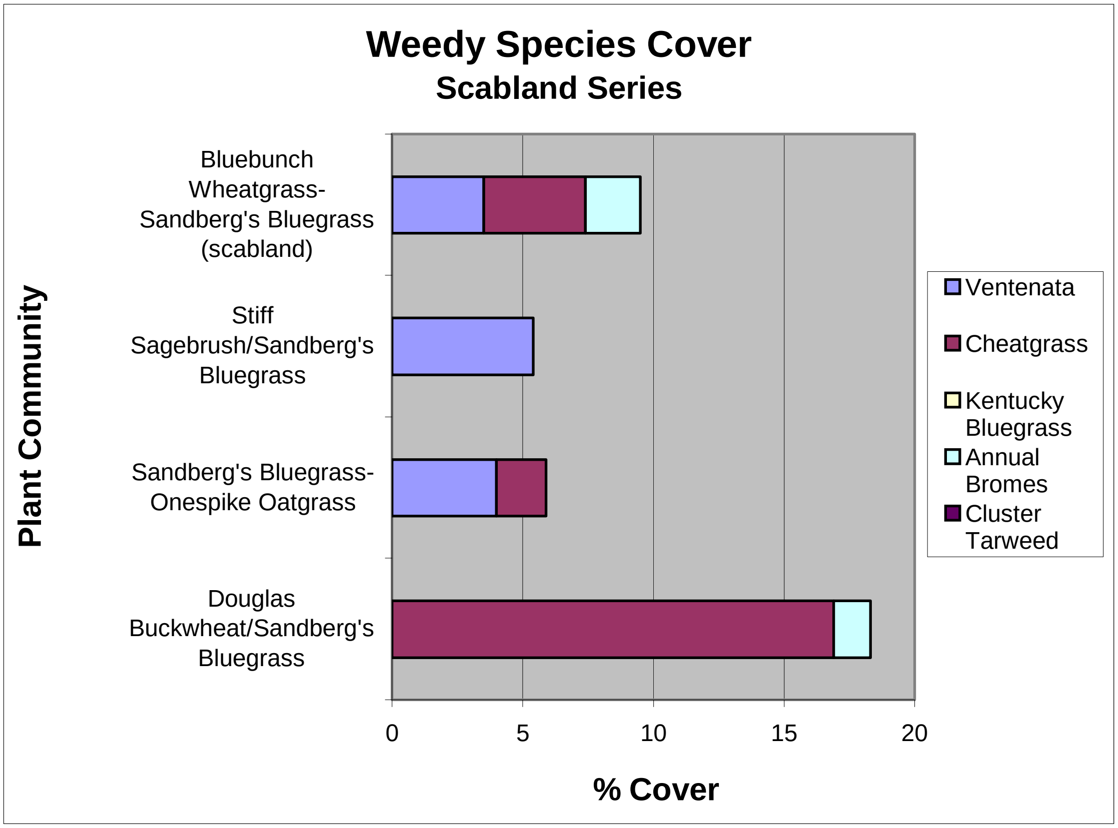


Figure 22. Comparison of invasive species cover of Scabland communities in the Upper Joseph Creek Watershed (% cover).

Wheatgrass-Sandberg's Bluegrass and Douglas' Buckwheat/Sandberg's Bluegrass communities. Tarweed and Kentucky bluegrass either had very low cover or were not measured in communities of the Scabland series identified in the UJCW.

Degradation based on cover of weedy species indicates that the two communities with a shrub component are most degraded. In the Douglas' Buckwheat/Sandberg's Bluegrass plant community, the high cover of cheatgrass was indicative of degradation. In the Stiff Sagebrush/Sandberg's Bluegrass plant community, the relatively high cover of ventenata indicated degradation. Since communities in the Scabland series are xeric with have high cover of rock and shallow soils, there is little potential to implement improvement alternatives other than management of large grazing herbivores.

Shrub Series

Kentucky bluegrass has high cover in two of the shrub communities identified in the UJCW. Cover of Kentucky bluegrass in the Mountain Snowberry community was > 20.0 %. In the Common Snowberry-Rose community, Kentucky bluegrass cover was > 5.0 %. Cheatgrass and ventenata had substantial cover only in the Common Snowberry-Rose community, which is associated with grass steppe communities.

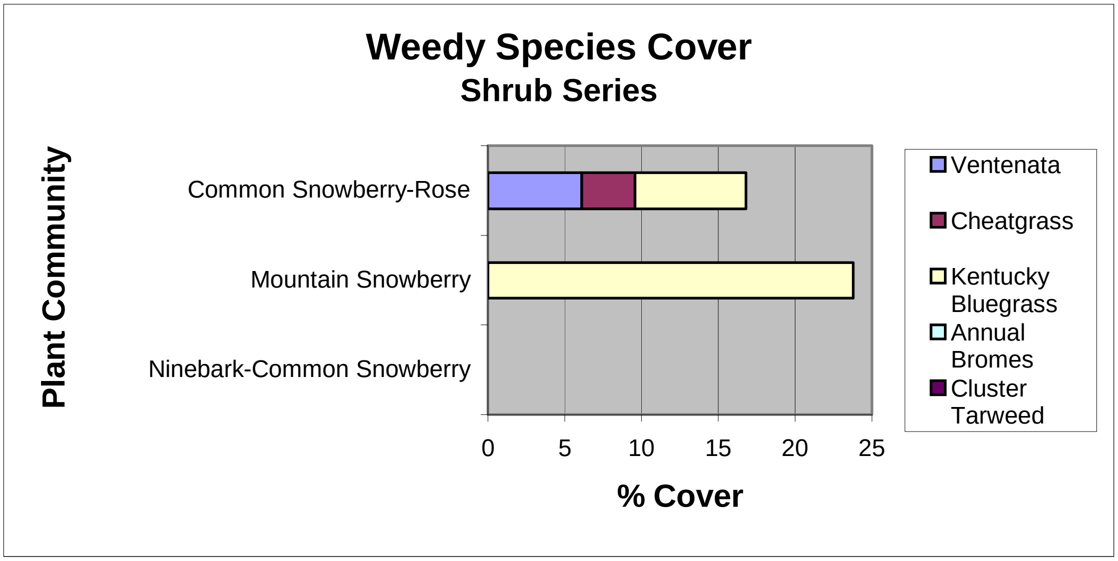


Figure 23. Comparison of invasive species cover of Shrub communities in the Upper Joseph Creek Watershed (% cover).

Oldfield Communities

In general, cover of weedy species in Oldfield communities was low except for Kentucky bluegrass (Figure 24). Cover of Kentucky bluegrass was very high (> 20.0 %) in the Kentucky Bluegrass Oldfield and low to moderately high in the Wheatgrass Oldfield and Smooth Brome Oldfield communities. In the former community, Kentucky bluegrass was either seeded into the former cultivated field or invaded. If the latter, the native plant community at the site was probably deep soil, northerly aspect communities in the Idaho Fescue series.

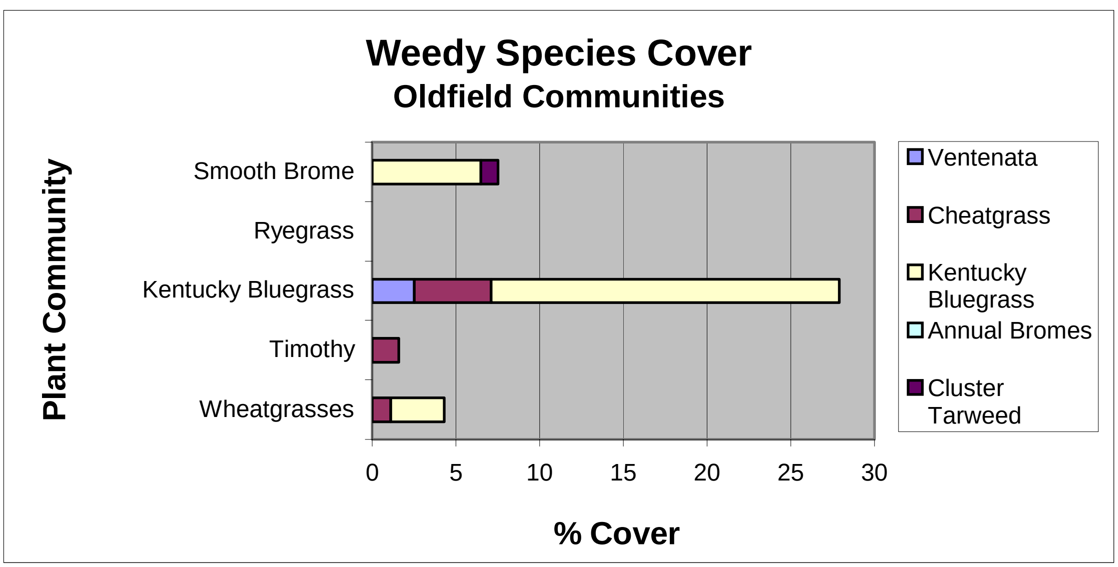


Figure 24. Comparison of invasive species cover of Oldfield communities in the Upper Joseph Creek Watershed (% cover).

Annual brome grasses, other than Cheatgrass, either had very low or no cover in Oldfield communities. Cheatgrass had relatively low cover in three of the Oldfield communities. Highest cover of cheatgrass occurred in the Kentucky Bluegrass Oldfield community. Ventenata also had low cover in the Kentucky Bluegrass Oldfield community. Tarweed had low cover in the Smooth Brome Oldfield community.

In general, Oldfield communities do not provide appropriate conditions for weedy species, with the exception of Kentucky bluegrass in the Kentucky Bluegrass Oldfield. This is an important consideration as Oldfields are by definition in the very early seral stage. Evidently, the process of cultivation followed by seeding highly competitive introduced forage species creates disclimax conditions in the disturbed site. In some Oldfield sites, there is evidence that native perennial species are colonizing the site but at a very slow rate. If this assumption is correct, consideration should be given to interseeding introduced forage species into degraded plant communities in the Idaho Fescue series as a means to improve site conditions and reduce herbivore grazing selectivity and pressure on native perennial grasses. In sites with even low cover and density of native perennial grasses, the rate at which ecological condition improves and secondary succession occurs may be higher than in sites altered by cultivation.

Meadow Communities

Cover of weedy species was relatively low in both meadow communities (Figure 2). Kentucky bluegrass had 4.0 % cover in the Riparian Meadow community and 6.4 % cover in the Meadow Complex community. Annual brome grasses had 7.4 % cover in the Meadow Complex community.

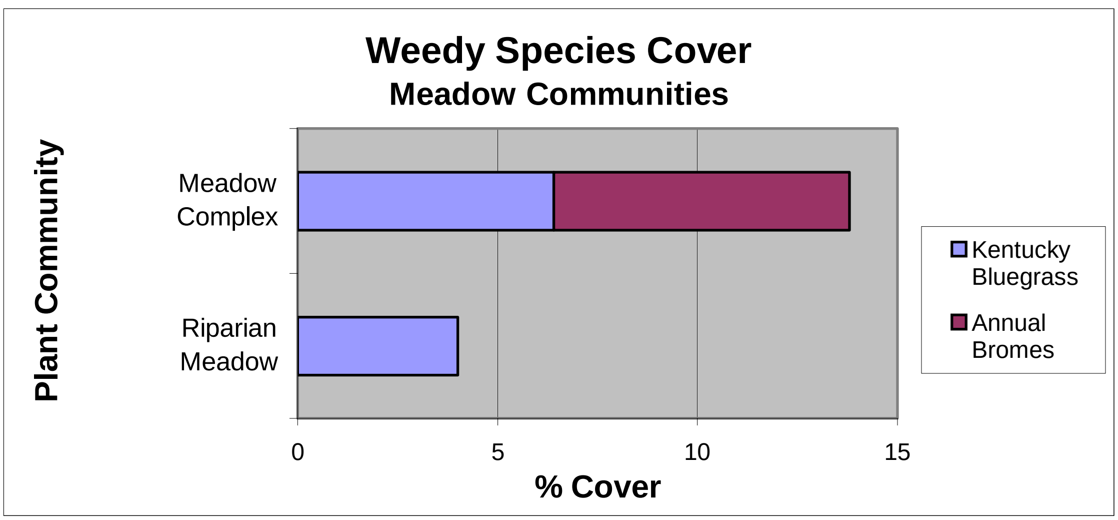


Figure 25. Comparison of invasive species cover of Meadow communities in the Upper Joseph Creek Watershed (% cover).

The lower cover of weedy species in both Meadow communities, other than Kentucky bluegrass, may be related to the higher moisture available later in the communities growing season. Higher moisture favors establishment of perennial grasses and grasslikes, especially warm season species such as Kentucky bluegrass, sedges, and rush. Under higher moisture conditions, perennial grasses will have competitive advantage over annual grasses and forbs.

VI. Rangeland Improvements in the UJCW

The first phase of the UJCW project focused on obtaining baseline vegetation information and spatial images of watershed vegetation. Rehabilitation and improvement of rangelands in the UJCW should be the primary focus of the second phase UJCW project. Access to baseline information that was collected, analyzed, and summarized during the first phase and the availability of up-to-date community and seral stage vegetation maps will significantly improve application of specific rangeland improvements within the watershed.

Improvement Categories

Several categories of rangeland improvements with application to the UJCW exist. These broad and often over-lapping categories include animal management, direct physical improvements to soil and vegetation resources, and indirect enhancement of vegetation resources. Phased improvement of UJCW rangelands will also be necessary as some improvement projects will require multi-year time periods for completion while other improvements can be implemented during relatively short time periods (Table 7).

Table 7. Partial list of potential rangeland improvements in the Upper Joseph Creek Watershed.

Improvement Type	Improvement Category	Potential Project Implementation	Implementation Factors
Physical	Water Development	1. Spring and tank development and rehabilitation. 2. Riparian zone exclusion fencing. 3. Change stream dynamics in the riparian zone.	1. Implement during summer and fall seasons; periodic maintenance required. 2. Implement during summer and fall seasons; annual maintenance and periodic replacement of materials needed; costly; needs to address large wild herbivore use as well as livestock; creation of riparian pastures may be more cost and management efficient. 3. Implement during summer and fall seasons; stream placement of materials or planting of vegetation costly; periodic maintenance required;
	Fencing	1. Grazing management fencing including perimeter, cross fencing, and grazing system. 2. Exclosure & protection fencing.	1. Implement conceivably within a season but more likely implementation will extend over several years due to cost and time factors; annual maintenance needed. 2. Implement as needed prior to implementation of the project; costly; annual maintenance as needed.
	Seeding	1.Mechanical seeding degraded native range. 2. Mechanical reseeding depleted Oldfields and older rangeland seedings. 3. Site specific seedings (seed production exclosures, seed dispersal stations, experimental plots, broadcast seeding, etc.). 4. Mechanical interseeding.	1. Two-year exclusion from grazing to ensure stand establishment required; periodic reseeding required depending on seeded species and site; more intensive management required. 2. Two-year exclusion from grazing to ensure stand establishment required; periodic reseeding required depending on seeded species and site; protection required. 3. Exclusion from grazing needed; protection related to seeding objectives. 4. One year exclusion from grazing required; protection not required.

	Control of invasive species.	1. Herbicide & pesticide control of herbivore competitors and invasive species.	1. Expensive; control of invasive species requires multi-year application.
	Burning	1. Large-scale burning to increase forage quality and reduce potential for wildfire. 2. Small-scale burning at specific sites for specific purposes	1. Periodic application of treatment required; inherent danger of loosing control of fire; costly; negative and positive impacts not fully understood for grass steppe communities; grazing may achieve the same objectives. 2. Periodic application of treatment required; inherent danger of loosing control of fire; costly; negative and positive impacts not fully understood for grass steppe communities; grazing may achieve the same objectives.
Animal Management	Grazing management.	1. Herding & pastoral grazing strategies for direct control of livestock grazing. 2. Mixed species grazing for effective weed control. 3. Forage backgrounding to improve nutrient content for other species and during other seasons. 4. Implement grazing systems such as rest-rotation, deferred, and intensive.	1. Implementation is seasonal and annual; higher costs of production should be expected. 2. Herding and some pastoral strategies needed required; constraints on using some livestock breeds probable. 3. Herding and some pastoral strategies needed required; constraints on using some livestock breeds probable. 4. Requires increased knowledge of plant-animal relationships; may require increased inputs of materials and/or labor; increased cost because of greater inputs of labor, materials and management.
	Change herbivore numbers	1. Ensure proper herbivore stocking rates. 2. Adjust herbivore stocking rates to fit seasonal and annual forage production. 3. Reduce, restrict, or eliminate herbivore grazers.	1. Both private and public rangeland in the UJCW are grazed relative to overt or implicit stocking rates; changing stocking rates can be difficult unless "slack" has been previously introduced to the livestock production system, i.e., forage banks, allotments grazed in alternate years, etc. 2. Difficult to accomplish for the same reasons as above, also because of contractual obligations and economic hardships to the producer. 3. Many non-livestock herbivores use both forest and grass steppe rangeland; reducing or eliminating livestock only may not facilitate rangeland improvement; may upset predator-prey relations or interfere with mutually beneficial interactions between animal and plant resources; should only be used in situations where the need is obvious to all stakeholders.
Indirect Enhancement	Rest	1. Seasonal and annual rest periods may enhance over-utilized rangeland. 2. Forage banks and alternate seasonal and annual use of pastures.	1. Requires increased management of large herbivores; knowledge of plant-animal relationships. 2. Requires creation of "slack" in the system; non-use of some pastures may concentrate use by all herbivores on used pastures by diminishing nutrient availability on rested pastures, i.e., elk may follow cattle because of forage backgrounding.
	Tree Harvest	1. Release of herbaceous understory vegetation providing forage enhanced by removing tree overstory.	1. High potential in forest steppe; sequential, planned tree harvest throughout the forest needed to ensure availability of herbaceous vegetation; should be used as a grazing

			management tool only in forest communities that have potential for significantly increasing growth of herbaceous understory vegetation.
	Grass banks	1. Grass banks can be used as alternate pastures to reduce grazing pressure during adverse environmental conditions or to allow improvements to be implemented on other rangeland pastures	1. Difficult to reduce stocking rate to create enough slack to permit grass banks unless created outside the current livestock production system; in the UJCW vacant allotments or TNC rangeland have potential to be used as grass banks.
	Fertilization	1. Fertilization of high yielding sites to increase forage production.	1. Requires a cost/benefit analysis; previous research indicates fertilization of native rangeland is not cost efficient; should be tested during Oldfield rehabilitation.
	Nutritional Balance	1. Develop nutrient based stocking rates.	1. Change emphasis from stocking rate based on volume to nutrient based stocking rate will promote improved control of animals; improvement of ecological condition expected because of correlation between nutrients and preferred species; require greater knowledge of animal-plant/community relationships.

Ecological Constraints.

Rangeland improvement treatments undertaken in the UJCW should consider site potential as the key indicator for successful intervention. Site potential will differ by vegetation type, plant community, and seral stage of the plant community (Annex 2). Equally important is awareness that rangeland improvements will be influenced by environmental constraints and ecological relationships that influence site dynamics. Selection and implementation of improvement treatments for grass steppe and forest steppe rangeland should be cognizant of site dynamics or the probability of treatment success will be lowered (Table 8).

Table 8. Community dynamics in the Upper Joseph Creek Watershed.

Series	Community	Ecological Site Dynamics
Idaho Fescue-Prairie Junegrass	Ridgetop Mound High Elevation	• The presence of prairie junegrass and a wide variety of perennial forbs is indicative of a moist climate. • Kentucky bluegrass is the leading increaser species under heavy grazing pressure. • Species diversity of the series, especially perennial forbs, is at a maximum in the mesic portion of grass steppe and culminates in the meadow steppe belt of grass steppe rangelands. • Perennial forb species have high constancy throughout the association but can have considerable variation between stands. • Bluebunch wheatgrass tends to be both rhizomatous and caespitose in these plant communities. • Approximately one-third of the perennial forbs continue to photosynthesize during the winter. • Flowering of annuals is concentrated earlier during the season than perennials. • In lightly grazed stands, *Bromus mollis*, *B. japonicus*, and *B. brizaeformis* are often abundant. • All the invader plants and more than half of the increaser plants are annual plants. • As part of an UJCW management plan, deferment of livestock grazing to fall season grazing in alternate years should be considered.

	Kentucky Bluegrass Snowberry-Rose Shrub	• Degraded sites should be identified and treated through grazing modification and seeding. • These communities are important to the UJCW because of ridgetop dominance in grass steppe rangeland and should be viewed as "key" communities. • Domestic ungulate grazers used as an improvement tool should be allowed grazing access after seed maturity. • Sites can be reseeded with mechanized equipment. • Communities dominated by Kentucky bluegrass should not be reseeded because of competitive capacity of the Kentucky bluegrass. • Kentucky bluegrass is not a primary increaser in High Elevation communities on steep slopes. • Plant communities in very early and early seral stages unless dominated by Kentucky bluegrass should be considered for mechanical seeding of native bunchgrass plants. • Regression of Mound and High Elevation communities to forbs or Kentucky bluegrass precedes either a Wyeth's Buckwheat or a Kentucky Bluegrass Disclimax. • Hot burns may increase Kentucky bluegrass dominance over native bunchgrass species. • Kentucky bluegrass replaces native perennial grasses reduced by heavy grazing. Although native plants may have more to offer relative to food and nutrient diversity, Kentucky bluegrass remains palatable with maturity and can better withstand heavy grazing. • The amount of Kentucky bluegrass in a community is a measure of the most extreme degradation to which a stand has been subjected. • Mounds dominated by Kentucky bluegrass can be grazed heavier than mounds dominated by native perennial grasses. • Shrub thickets (i.e., Common Snowberry-Rose as described by J&S, 1987) are considered a phase of the same association and represent a reversal of dominance between the herbaceous and woody components of the association. • Common snowberry and rose are palatable and decline under heavy grazing.
Idaho Fescue-Bluebunch Wheatgrass	Ridgetop Silky Lupine	• Community has low total forage yield. • Bluebunch wheatgrass and Idaho fescue comprise forage species. • Yield substantially reduced in very early and early seral stages. • Early season frost-heaving and soil moisture saturation. • Early season use by large herbivores should be avoided. • Overgrazing can easily degrade the community. • Difficult to use fire in this community because of low vegetation cover. • Community occurs on steep canyon slopes with primarily southwesterly aspects. • More mesic soils tend to support more forbs. • Bluebunch wheatgrass and Idaho fescue are replaced by Sandberg's bluegrass as degradation occurs. • Increase in forbs in the mid seral stage increases site stability. • Fire tends to invigorate bluebunch wheatgrass in this association while potentially having little impact on the Idaho fescue component. • Every month throughout the year the Bluebunch Wheatgrass-Idaho Fescue association is warmer than the Idaho Fescue-Common Snowberry association and the P/T ratio is lower for at least 6 months.

		Snake River Phlox	• Community is suitable for livestock use but best for domestic sheep use. • Winter grazing by multiple large herbivores can damage plant community and promote weedy forbs. • Fire can damage perennial bunchgrasses and promote weedy forbs. • Cheatgrass is a major increaser with disturbance. • Suitable for cattle and sheep grazing but most suited to grazing by sheep if weedy forbs present. • Early spring grazing by sheep will significantly reduce arrowleaf balsamroot. • Winter grazing by both cattle and elk can potentially damage the community. • Grazing use of Idaho fescue and bluebunch wheatgrass during flowering to seed ripening is detrimental to the plants. • Controlled grazing by sheep can control perennial weeds. • Hot summer or autumn fires can damage the plant community.
		Idaho Fescue-Timber Oatgrass-Sedge	• Community represents highest moisture sites in the Idaho fescue series. • Community occurs on deeper soil sites. • Oatgrass and sedges increase over Idaho fescue with heavy large herbivore grazing. • Community has potential for invasion by Kentucky bluegrass, Stoc, and weed
Bluebunch Wheatgra ss		Sandberg's Bluegrass	• Undisturbed vegetation of the Bluebunch Wheatgrass-Sandberg's Bluegrass community consists primarily of the two, caespitose grasses. Approximately 80 % of dry matter is provided by bluebunch wheatgrass. • Growth of plants in the association reflects the hot-dry extreme of climatic variation in the Washington steppe. Approximately half of the perennial forbs begin new growth with fall rains and remain green over winter. The most pervasive annuals germinate in the spring with peak photosynthetic activity in April and turnover to litter by late summer. • All perennials and shrubs and half shrubs present in the association go completely dormant in the winter. Shrubs readily sprout following fire and grasses are usually stimulated unless the fire is too hot. A hot fire may open up the community to invasive annuals. • Overgrazing by large herbivores may eliminate bluebunch wheatgrass and reduce Sandberg's bluegrass. Cheatgrass and rabbitbrush usually replace the caespitose bunchgrasses with overgrazing unless overgrazing by sheep seeking the annual bromes occurs. Sheep grazing may stimulate Sandberg's bluegrass. • Oldfields developed from the Bluebunch Wheatgrass-Sandberg's Bluegrass community and subsequently abandoned tend to develop dense stands of cheatgrass. Rabbitbrush also tends to increase density in the abandoned Oldfields. • Stands of Bluebunch Wheatgrass-Sandberg's Bluegrass are found in a warmer environment than stands of Idaho Fescue-Common Snowberry. The latter association has colder temperature every month. The former association has a higher precipitation/temperature ratio (P/T) during November through March and a lower P/T during April, May, and June. In July, August, and September, P is higher in the latter association. • Degradation reduces bluebunch wheatgrass and moss.

		• Annual grasses, especially brome grasses, are common in earlier seral stages. • Sandberg's bluegrass does not persist well on longer, steeper slopes. • Hot fire and/or overgrazing by large herbivores promote dense stands of annual grasses.
	Wyeth's Buckwheat	• Overgrazing causes Bluebunch wheatgrass to decline and Wyeth's buckwheat to increase. • Yield is low compared to other communities in the Idaho Fescue and Bluebunch Wheatgrass series. • Fire as a management tool may increase Wyeth's buckwheat and bluebunch wheatgrass except if fire occurs during driest months. • Reduction of early season use may improve bluebunch wheatgrass and onion grass.
	Onespike Oatgrass	• Bluebunch wheatgrass dominates in late seral stages. • Overgrazing causes decline in bluebunch wheatgrass and an increase in bare ground. • Skullcap increases as terracettes increase. Skullcap indicates hot, dry and unstable slopes. • Large herbivore use should be initiated after soils dry to avoid creating terracettes. • Use of the community by large herbivores should follow seed set. • Fuel load may be insufficient to carry fire. • Management of the community should focus on importance of the community to large wild herbivores in spring because of southerly aspect.
Scabland	Stiff Sagebrush	• Litter from the deciduous shrub, together with mosses, tends to build mounds. • Species diversity is high but productivity and cover of any one species is low. • Stiff sagebrush is highly preferred browse by elk, and cattle at specific times. Cheatgrass is the most obvious increaser species in the community. • Reseeding of degraded sites has low probability of success because of shallow, rocky soils, potential for erosion, and high value of the Stiff Sagebrush to wildlife. • Fire use on the site is difficult and may damage grass crowns on bunchgrasses exposed by frost heaving. • Site may have high potential for dominance by ventenata. • Sandberg's bluegrass and onespike oatgrass have low vigor on these sites and moderate disturbance may increase relative amounts of bare ground. • Frost heaving increases with exposure of bare ground. • Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred. • Maintain stiff sagebrush as a component of the community because of the high value diversity potential of the shrub within the prairie habitat.
	Douglas Buckwheat	• Communities are predominantly Sandberg's bluegrass with few to many plants of the dwarf, white-leaved buckwheat. • Buckwheat will vigorously invade recently bared, gravelly soils, which indicates potential use to artificially stabilize sandy or gravel soils. • Buckwheat appears to recover well from cattle use even when grazed to the ground surface while that intensity of grazing will cause replacement of Sandberg's bluegrass with annual

		bromes and fescues (and apparently in the UJCW with ventenata). • No potential for artificial revegetation. • Avoid using communities when soils are water saturated. • Insufficient biomass to carry fire. • Domestic livestock use should be timed to occur when soils are dry and flowering/seed set of Sandberg's bluegrass has occurred.
	Sandberg's Bluegrass-Onespike Oatgrass	• Community forms a mantle of plants, rock, and moss, which is able to withstand drought because of the moisture retention capabilities of the mantle. • Reseeding of degraded sites has low probability of success because of shallow, rocky soils, potential for erosion, and high value of the Arri to wildlife. • Fire use on the site is difficult and may damage grass crowns on bunchgrasses exposed by frost heaving. • Community has high wildlife value because of early greening of Sandberg's bluegrass and growth following fall rains. • Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on associated deeper soil communities has occurred.
	Bluebunch Wheatgrass -Sandberg's Bluegrass	• Severe ungulate grazing and soil loss may induce the community. • Manage to maintain bunchgrasses. • Trampling may reduce moss coverage. • Utilization should occur after soils dry and bunchgrasses flower. • Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.
Shrub Communities	Snowberry-Rose Shrub Community	• Snowberry is palatable to cattle and sheep and can stand moderate grazing intensity. • Resistant to fire and sprouts after burning. • Reduction in shrubs may be achieved by combination of burning and grazing. • Important habitat for wildlife. • Increase of Snowberry-Rose may be due to lack of fire or overgrazing. • Increase in shrubs may be a response to favorable moisture. • Shrub thickets are considered a phase of the same association and represent a reversal of dominance between the herbaceous and woody components of the association. • Common snowberry and rose are palatable and decline under heavy grazing.
	Mountain Snowberry	• May dominate on mounds near forested communities of ridgetops. • Kentucky bluegrass often is an invasive, herbaceous dominant on Mountain Snowberry dominated mounds. • Important habitat for a diversity of wildlife. • Promote natural reseeding with existing vegetation.
	Ninebark-Common Snowberry	• Forage productivity is high in early seral stages but low in advanced seral stages because of shade provided by shrubs. • Important as wildlife habitat. • Moderately resistant to fire and probably sprouts following burning. • Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as "elk calving."

Oldfield Communities	Oldfield	• Oldfields, because of previous cultivation, are classified as being in a very early seral stage or "Disclimax." • Although Oldfields appear as monocultures, most Oldfields are a mosaic of native communities (either areas on the boundary not cultivated or patches with some reestablishment of native species). • Successional timelines for reestablishment of the prior native community are unknown but probably are long term. • Potential for establishment of invasive weedy species is probably high but currently unknown. • Dominant forage species are introduced perennial grasses capable of withstanding heavy grazing by domestic livestock. • Oldfields prior to cultivation and cropping were probably characterized by deep soils with favorable moisture holding capacity, which led to their selection as cropland. • Accelerating natural succession in Oldfields is improbable because of soil disturbance caused by prior cultivation. • Highest value use of Oldfields is to produce forage for wild and domestic herbivores. • Consideration should be given to applied research initiatives to track succession towards native communities to determine potential for successfully restoring native communities. • Reseeding Oldfields to best adapted introduced or native forage species should be part of a management plan for the UJCW. • Highly productive Oldfields should be used to reduce grazing pressure on native communities during implementation of native community improvement alternatives.
Meadow Communities	Meadow and Riparian Areas	• Occupy areas with standing water throughout the summer. • Nutrient level is high throughout the summer because of moist growing environment. • Heavy and continuous use can degrade meadow and change moisture regimes by "drying out the site." • Meadow degradation results in change in species composition. • Meadows are important wildlife habitat and provide diversity in forest and grass steppe rangelands. • High nutrient level in forage and general association with surface water and deciduous shrub and tree vegetation attract wildlife and domestic animals. • Management of meadow/riparian areas often dictates management of associated uplands. • Important habitat for all animal species because of water, shade and succulent forage over the summer. • Meadows and Riparian areas require coordinated management with upland grass steppe. • Management focus should be not only on protection/exclusion but also on shifting timing and density of large herbivore use. • Trials to establish deciduous woody growth forms to stabilize riparian areas and diversify habitat should be initiated.
Annual Communities	Annual Grass	• Sites dominated by annual grasses such as cheatgrass usually have small spatial area and reflect major past and present disturbance. • Ventenata appears to be a relatively recent invasive annual grass about which little information exists. • Annual grasses, especially the annual bromes, can provide high quality forage for all kinds of herbivores during early growth. • It is questionable if a serious effort to reduce or eradicate annual brome grasses in the UJCW is either desirable or

		possible. • Manage to increase establishment potential and sustainability of caespitose bunchgrasses in stands with high density of cheatgrass and ventenata. • Initiate applied research initiatives to study ventenata to increase information about invasive potential and habit requirements.

Rangeland Improvements

Improving grass and forest steppe rangelands of the UJCW will be a major focus of the Phase II program. Potential improvement sites should be evaluated relative to the most appropriate treatment or set of treatments to ensure improvement success. The following rehabilitation methods have potential application to rangeland plant communities in the UJCW:

- Plant highly palatable forage plants such as alfalfa with native plant seedings. The theory is that herbivores will concentrate on the highly palatable species, thereby reducing pressure on the native desirable plants allowing establishment of root reserves and stand establishment. Additionally, more palatable introduced plants receiving heavy selective grazing pressure will be gradually eliminated from the stand.

- Establish seed production exclosures in the head of watershed tributaries to allow natural seed production, distribution, germination, and seed establishment. Plant in small, herbivore protected exclosures to allow establishment. This improvement alternative has potential to work well in grass steppe rangeland of the UJCW, especially in plant communities inhabiting moderately sloping terrain with northerly aspects.

- Establish seed distribution stations on steep slopes and at the head of erosion channels. This procedure is very low cost and suitable on all terrain and aspects of grass steppe plant communities. The operating premise for seed dispersal stations is that wind and water will disperse seeds downslope for seeding in a natural manner. The disadvantage of the method is the small spatial area covered by the procedure.

- Mechanically seed flat, deep soil ridgetop communities in very early and early seral stages with native and introduced forage plants.

- Rehabilitate Oldfields with mechanical seeding of native and introduced forage species. Use Oldfields with high forage production capacity to reduce grazing pressure on native communities.

- Change allotment management to new forms of co-management structures to increase flexibility in grazing management decision-making. A major element of co-management strategies should be utilization of allotments as “grass banks” to facilitate improvement initiatives on private and public rangeland. A second major element should be setting timing of grazing to coincide with non-disruptive developmental stages of forage species.

- Use allotments and TNC as grass banks to allow public and private land improvement programs to be initiated.

- Test pastoral livestock production systems as a method to improve forage and soil resources. Livestock producers who have access to the type and kind of grazing resources needed to support pastoral production systems and are willing to manage production resources with the intensity required by pastoral systems should be encouraged and supported to test this system in the UJCW.

- Evaluate sources of problems affecting ecological condition of soil and vegetation resources in the UJCW. Finding causes and solutions to problems in the watershed may require intervention in areas not included within the boundaries of the watershed (i.e., back-grounding forage on winter range of large wild herbivores, placing salt and creating other inducements to attract wild herbivores to selected seasonal ranges, etc.).

- Mechanically seed native or introduced forage species into degraded ecotone strips between forest communities and grass steppe and meadow communities. Ecotonal strips usually have deep soils, are often highly degraded by activities of small and large herbivores, and have the capacity to significantly improve forage availability for livestock and wild herbivores. Control of ground-dwelling small herbivores, such as gophers and moles, may be a necessary preliminary step to realize stand establishment.

- Develop and improve the availability of water for livestock and wildlife. Cleaning, expanding, and protecting existing water sources including man-made tanks and reservoirs, springs, and streams has high priority among improvements for the watershed. Development of new water sources from springs and collection of runoff water should also be initiated. Location of new water sources should be selected as part of the over-all management plan for an allotment or pasture.

- Expand program to control invasive weed species on grass steppe rangeland communities to reduce competition with desirable native and introduced forage species. Long-term benefits can be expected if program focuses on controlling recent introductions of weed species or new colonies of established invasive species.

VII. Vegetation Mapping

The community mapping unit table has been prepared to assist preparation of vegetation maps for the UJCW. The table correlates Potential Mapping Units prepared earlier by the ONHP with a general vegetation type/community classification (Level II) and a community/seral stage classification (Level I).

Forest Steppe Communities

Approximately 40% of the UJCW and a major proportion of the USFS managed portion of the watershed is forest steppe. Although stands of closed canopy old growth grand fir and ponderosa pine occur on the watershed, the majority of conifer forest is successional open canopy stands with shrub and herbaceous vegetation understories. On privately owned portions of the watershed, most forested land occurs on north aspects and along stream drainages. Deciduous trees, such as alder and quaking aspen/cottonwoods, tend to occur as groves along streams or on cold, moist sites of north aspects.

Open canopy conifer stands of Douglas-fir and ponderosa pine both tend to have understory shrub and herbaceous plants. Depending on the site, the most common forest communities are Ponderosa Pine/Snowberry, Ponderosa Pine/Idaho Fescue, and Douglas-fir/Snowberry. The Mapping unit for these communities is Open Canopy Forest.

Pipo-syol Closed Forest will generally be Old Growth Grand Fir, mid to old aged stands of Douglas-fir, and dense stands of young aged ponderosa pine, lodgepole pine, and Douglas-fir. Most stands of closed canopy Old Growth Grand Fir will have minimal shrub and herbaceous understory vegetation. The mapping unit for these communities is Closed Canopy Forest.

The Potr-ribes-phma-syol glen within forest and grass steppe occur infrequently on moist sites of northerly aspects and along streams. These sites can be characterized as “frigid” microenvironments with site attributes suitable for deciduous tree/shrub communities. The mapping unit for these communities is Deciduous Forest/Shrub. The Level II community mapping units is “Forest Communities.”

Table 9. Community mapping units (Level I) in Forest Communities (Level II).

Identifier	Potential Mapping Unit	Community	Community Mapping Unit (Level I)
Open Canopy Conifer	Open Canopy Conifer-Tree Shadow	Open Canopy Conifer 1.Pipo/Syal (high presence of snowberry) 2.Pipo/Feid (low presence of snowberry and other shrubs. 3.Psme/Syal (high presence of snowberry.	Open Canopy Forest
t720	Pipo-syol Closed Forest	Closed Canopy Conifer	Closed Canopy Forest
Potr-ribes-phma-syol glen	Potr-ribes-phma-syol glen	1.Potr/shrub	Deciduous Forest/Shrub

Grass Steppe Communities

Approximately 60 % of the UJCW and the major portion of privately owned land in the watershed is grass steppe rangeland. Eight Level II vegetation type/community classifications and 32 Level I community/seral stage classifications were defined in grass steppe rangeland.

<u>Meadow-Oldfield Communities.</u> Meadows have relatively low occurrence and area in the UJCW. Currently, most meadow area occurs as green strips along streams, drier meadow terraces along streams, as seep areas in upland communities, and as meadow complexes along streams in Open Canopy Forest. Vegetation comprising degraded meadows and Oldfields can be similar, and vegetation reflects a moisture gradient that influences species composition, productivity and cover/density of vegetation.

Meadow-Oldfield sites range from xeric and disturbed sites (i.e., oldfields seeded to or currently dominated by *Agropyron sp*.) to green strips on the fringe of open deep water in stock water tanks. The Crdo-ribes-rosa-shrubland PMU was partially assigned to vernal wetlands that occur during early June on some interstitial scablands associated with the Mound-Intermound Complex. Final mapping unit designators should be corrected to reflect the difference between vernal scablands and crdo-ribes-rosa shrubland.

The Agrop Oldfield PMU reflects the most xeric portion of the moisture gradient influencing meadow formation in the UJCW. Although not a meadow, wheatgrasses commonly occur in moist meadows and with other introduced perennial grasses in Oldfields and meadows. The Level II community mapping unit is “Meadow-Oldfield Communities.”

Table 10. Mapping units (Level I) in Meadow-Oldfield Communities (Level II).

Identifier	Potential Mapping Unit	Community	Community Mapping Unit (Level I)
Dark Blue	Dark Blue: Water Tank/Tree Shadow	Water Tank/Deep Reservoir	Open Water
t53	Vhi cover streamside meadows moist sedge rush	1.Tufted hairgrass-wet sedge meadows	Tufted Hairgrass-Sedge Wet Meadow Early Seral
t810	Popr dominate riparian meadow cove landform	1.Tufted hairgrass-moist sedge meadow 2. Feid-Kocr (HE) Very Early Seral 3. Former ridgetop meadows in Oldfields.	Tufted Hairgrass-Sedge Moist Meadow Early Seral
RGF	Riparian Gallery Forest	1.Meadow complexes along stream courses in Open Canopy Conifer Forest.	Deciduous Tree/Shrubs/ Moist-Wet Meadow Complex
t53b	Medium cover moist-sedge-rush/feid-popr	1.Periodically moist meadow terrace communities dominated by IP grasses. 2.Deeper soil areas with water holding capacity in Oldfields dominated by IP grasses.	Moist Early Seral Stream Terrace Meadows/Oldfield-Timothy
t14	Hi cover riparian corridor popr/meadow/oldfield	1.Brin dominated areas of Oldfield. 2. Forest upland meadows with deeper soils and higher sub-soil moisture.	Moist Early Seral Oldfield (Smooth Brome)/ Forest Upland Meadow/Open Canopy Forest Understory
CRR Shrubland	Crdo-ribes-rosa shrubland	1. Moist Vernal Wetland Communities	Ephemeral Early Seral Scabland Vernal Wetland
t932	Agrop oldfield	1.Dry shallow soils in Oldfields dominated by seeded IP Agropyron grasses.	Very Early Seral Oldfield (IP Wheatgrass)

<u>Shrubland Communities.</u> The UJCW is predominately forest or grass steppe communities. In the grass steppe portion of the watershed, only two communities occur that can be classified as having a significant shrub component: Stiff Sagebrush scabland and Snowberry-Rose. Shrubs can be a major understory layer in conifer stands undergoing secondary succession resulting from tree harvest or fire. Also, shrubs are often ecotonal between Open and Closed Canopy Conifer stands and grassland communities in the forest steppe zone. Patches of semi-tree shrubs occur on moist sites with north aspect in the grass steppe and along streams throughout the watershed. The Level II community-mapping unit is "Shrubland Communities."

Table 11. Mapping units (Level I) in Shrub Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit (Level I)
Canyon Shrubland	Canyon Shrubland	1.Canyon Shrubland	Lower Steep Rocky Canyon Shrublands
Crdo-ribes-rosa shrubland	Crdo-ribes-rosa shrubland	Mixed Tall Shrub communities in grass steppe and stream drainages.	Upland Mixed Tall Shrub Communities in Grass and Forest Steppe
Phma-syol w potr shrubland	Phma-syol w potr shrubland	1.Ecotonal shrub communities in forest steppe.	Shrub Communities Ecotonal Between Forest and Grass Steppe Communities
Salix-hawthorne shrubland	Salix-hawthorne shrubland	Semi-tree/shrub patches occurring along stream drainages and northerly aspect draws in both grass and forest steppe zones of the watershed.	Tall Shrub Communities Along Forest Steppe Stream Drainages
Syol-ribes shrubland	Syol-ribes shrubland	Shrub patches primarily in forest steppe.	Upland Forest Steppe Shrub Patches
t922	Agsp-Posa3_Agsp dominated	1.Arri/Posa3 (Scabland) 2.Agsp-Posa3 (Ridgetop)	Ridgetop Stiff Sagebrush/Bluebunch Wheatgrass-Sandberg's Bluegrass Scabland Mid Seral
1.feid-kocr popr disclimax N aspect syol-ribes-rosa 2. t124n	1.Feid-Kocr Popr disclimax N aspect syol-ribes-rosa 2.Feid-kocr oldfield popr disclimax N yol-rosa-ribes	Syal-Rosa Popr Disclimax	Syal-Rosa (North Aspect Feid-Kocr)/Syal-Rosa (Oldfield)

<u>Idaho Fescue-Prairie Junegrass Ridgetop Communities</u>. The Idaho Fescue-Prairie June grass (Ridgetop) community is a dominant community in the grass steppe portion of the UJCW. As "ridgetop" implies, the community type, along with Idaho Fescue-Prairie Junegrass Mound and High Elevation communities, occurs on ridgetop and upper slopes of most broad ridges in the UJCW. The introduction of disturbance factors, and the availability of highly competitive introduced perennial (IP) grasses, facilitates dominance of Idaho Fescue-Prairie Junegrass Ridgetop and Mound Communities by Kentucky bluegrass. In the Idaho Fescue-Prairie Junegrass Mound community, a Kentucky Bluegrass Disclimax occurs in grass steppe and a Wyeth Buckwheat Disclimax occurs in forest steppe. With degradation, cover of annual grasses increases in the three communities.

Distinguishing between the two Idaho Fescue-Prairie Junegrass community types in the field can be difficult. Mounds versus not mounds can be used to distinguish between Mound and Ridgetop communities but determining what is a "mound" and what is not a "mound" can be difficult. Both communities can have high cover of Kentucky bluegrass and annual grasses in a degraded state. Both communities have similar vegetation composition in all seral stages.

Selection of realistic Community Mapping Units required partial blending of the two communities. The Popr Very Early Seral Idaho Fescue-Prairie Junegrass community-mapping unit includes both Very Early Seral Ridgetop communities and Popr Disclimax Mound communities. The Very Early to Early Seral Degraded Idaho Fescue-Prairie Junegrass community includes early seral Ridgetop and Very Early seral Mound communities. The two Potential Mapping Units comprising the Community Mapping Unit are "Hi cover feid-rock" and "Mounds-Intermounds Degraded." The Level II community-mapping unit is "Idaho Fescue-Prairie Junegrass Ridgetop Communities."

Table 12. Mapping units (Level I) in Idaho Fescue-Prairie Junegrass Ridgetop Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit (Level I)
t127	Feid-kocr late seral	Feid-Kocr (Ridgetop) Late seral	Mid Seral Ridgetop Idaho Fescue-Prairie Junegrass
t126	Feid-Kocr Popr Disclimax hi annuals	1.Feid-Kocr (Ridgetop) Very Early Seral 2. Feid-Kocr (Mounds) Popr Disclimax)	Popr Very Early Seral Idaho Fescue-Prairie Junegrass Community
Hi cover feid-rock	Hi cover feid-rock	1.Feid-Kocr (Ridgetop) Very Early & Early Seral	Early Seral Ridgetop Idaho Fescue-Prairie Junegrass Community

<u>Idaho Fescue-Prairie Junegrass Mound Communities.</u> The Idaho Fescue-Prairie Junegrass Mound Community is a complex of mound with vegetation similar to Idaho Fescue-Prairie Junegrass Ridgetop Community and interstitial scabland communities. With disturbance, mounds in Grass Steppe can degrade to Kentucky Bluegrass Disclimax while mounds in forest steppe can degrade to Wyeth Buckwheat Disclimax. Mound-Intermound complexes of Idaho Fescue-Prairie Junegrass Mound community with small dimension mounds are relatively easy to distinguish as mound communities. However, with increasing mound size, distinguishing between Ridgetop and Mound communities becomes difficult. Also, distinguishing degraded Mound communities from degraded Ridgetop communities where erosion of soil from the mound into the interstitial scabland community occurs can be difficult. The Level II community-mapping unit is "Idaho Fescue-Prairie Junegrass Mound Communities."

Table 13. Mapping units (Level I) in Idaho Fescue-Prairie Junegrass Mound Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit (Level I)
t941	Mounds-Intermounds Degraded	2.Feid-Kocr (Mounds) Very Early Seral	Very Early Seral Idaho Fescue-Prairie Junegrass Mounds
t942	Low cover Agsp-Feid annual dominates	Feid-Kocr (Mounds)	Early Seral Feid-Kocr Mounds
T943	Agsp-feid mounds annual dominated	Feid-Kocr (Mounds) Erhe Disclimax	Wyeth Buckwheat Disclimax Feid-Kocr Mounds
T945	Feid-kocr mounds mid seral	Feid-Kocr (Mounds)	Mid Seral Feid-Kocr Mounds
T944	Feid-kocr mounds late seral	Feid-Kocr (Mounds)	Late Seral Feid-Kocr Mounds

<u>Idaho Fescue-Prairie Junegrass High Elevation Communities.</u> The Idaho Fescue-Prairie Junegrass High Elevation community occurs on relatively steep slopes with deep soils. The occurrence of this community in the watershed is limited to higher elevations.
The Level II community-mapping unit is "Idaho Fescue-Prairie Junegrass High Elevation Communities."

Table 14. Mapping units (Level I) in Idaho Fescue-Prairie Junegrass High Elevation Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit (Level I)
t124	Feid-Kocr hi elevation oldfield popr disclimax	Feid-Kocr (High Elevation)	Early Seral Idaho Fescue-Prairie Junegrass High Elevation
t11	Feid-kocr mid seral	Feid-Kocr (High Elevation)	Mid Seral Idaho Fescue-Prairie Junegrass High Elevation
t127	Feid-kocr late seral	Feid-Kocr (High Elevation)	Late Seral Idaho Fescue-Prairie Junegrass High Elevation

Idaho Fescue-Bluebunch Wheatgrass Communities. The Idaho Fescue-Bluebunch Wheatgrass community occurs relatively infrequently in the UJCW. The community tends to occur in narrow bands along ridge brows on relatively shallow soils. The Level II community-mapping unit is "Idaho Fescue-Bluebunch Wheatgrass communities."

Table 15. Mapping units (Level I) in Idaho Fescue-Bluebunch Wheatgrass Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit (Level I)
t1	Low cover feid-agsp hi forb	Feid-Agsp (Ridgetop)	Feid-Agsp Ridgetop Brow Late seral
t2	Low cover agsp-feid hi forb	Feid-Agsp (Ridgetop)	Feid-Agsp Ridgetop Brow Mid Seral

Bluebunch Wheatgrass-Sandberg's Bluegrass Communities. The Bluebunch Wheatgrass-Sandberg's Bluegrass community generally occurs on slopes associated with southerly aspects of relatively deep canyons in the UJCW. The Level II community-mapping unit is "Bluebunch Wheatgrass-Sandberg's Bluegrass Community."

Table 16. Mapping units (Level I) in Bluebunch Wheatgrass-Sandberg's Bluegrass Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit
Low elevation canyon agsp-hi annual disclimax	Low elevation canyon agsp-hi annual disclimax	1. Agsp-Posa3 (Canyon)	Early Seral Steep Slope Southerly Aspect Canyon Bluebunch Wheatgrass-Sandberg's Bluegrass
t710	Agsp-bare ground S face grassland	1.Agsp-Posa3 (Canyon)	Mid Seral Moderate Slope Southerly Aspect Canyon Bluebunch Wheatgrass-Sandberg's Bluegrass
t921	Agsp-Posa 3_Posa3 dominated	Agsp-Posa3 (Ridgetop)	Early Seral Ridgetop Bluebunch Wheatgrass-Sandberg's Bluegrass

Scabland Communities. Scabland communities often occur as complexes, either with other scabland communities or with Idaho Fescue-Prairie Junegrass communities. Interstitial areas in mound-intermound complexes can be several different scabland communities ranging from High Rock Sandberg's Bluegrass-One Spike Oatgrass to Douglas Buckwheat/Sandberg's Bluegrass communities.

Rocky/gravelly surfaces are a general characteristic of Scabland communities. Although relatively easy to separate Scabland communities from other communities in the UJCW, it can be difficult to distinguish between Scabland communities and between seral stages of Scabland communities.

The Stiff Sagebrush/Sandberg's Bluegrass community, even though visually dominated by Stiff Sagebrush, is usually included with Scabland communities. Scabland communities in very early and early seral stages often have invasive annual grasses present, especially ventenata and annual hairgrass. The Level II community mapping unit is "Scabland Communities."

Table 17. Community mapping units (Level I) in Scabland Communities (Level II).

Identifier	Potential Mapping Unit	Actual Mapping Unit	Community Mapping Unit (Level I)
t142	Agsp-Posa3 scabland-mid/late seral	Agsp-Posa3 (Scabland) Mid seral	Mid Seral Northerly Aspect Bluebunch Wheatgrass-Sandberg's Bluegrass Scabland
t72	Low cover rocky Posa3-agsp-feid hi forb	Agsp-Posa3 (Scabland)	Mid Seral Steep Southerly Aspect Bluebunch Wheatgrass-Sandberg's Bluegrass Scabland
Hi rock soils posa3-Dain/Rock outcrop	Hi rock soils posa3-Dain/Rock outcrop	1.Posa3-Daun (Scabland)	Mid Seral Sandberg's Bluegrass Scabland
t910	Thin soils Posa3	1.Posa3-Daun (Scabland) 2.Douglas Buckwheat/Sandberg's Bluegrass (Scabland)	Mid Seral Sandberg's Bluegrass-One Spike Oatgrass Scabland
t911	Mixed scabland	Posa3-Daun (Scabland)	Early Seral Sandberg's Bluegrass-One Spike Oatgrass
t218	Xeric hi annual perennial grasses	Posa3-Daun (Scabland)	Low Rock High Annual Grass Sandberg's Bluegrass-One Spike Oatgrass (Deda) Scabland

VIII. Discussion

Ownership of the UJCW is separated into two stewardship categories: (1) private grass steppe rangeland owned primarily by local ranch operations; and (2) public land, which is a mixture of grass and forest steppe rangeland, managed by the USFS. The third stewardship category involved in the UJCW project, private land owned by TNC, is technically not in the UJCW but otherwise has similar terrain and vegetation characteristics. A range group consisting of representatives from Wallowa Resources, Wallowa-Whitman National Forest, The Nature Conservancy, Nez Perce Tribe, OSU Extension Service, ICAPS, and local landowners was formed to direct acquisition of baseline information in the Phase I project component.

The Phase I goal of the UJCW Project (Rangeland) was to obtain "baseline information" on rangeland vegetation in the upper watershed. Information collected during field investigation was used to classify vegetation into plant community and seral stage to develop a watershed vegetation map using QUICKBIRD imagery. During the second field season, preliminary vegetation mapping units defined by correlating field measurements with remotely sensed QUICKBIRD imagery were ground-truthed and validated. A vegetation map defining watershed vegetation by plant communities and seral stage accompanied by descriptive and quantitative information will be the final outcome of the Phase I watershed analysis. During Phase II, access to the Phase I baseline information will aid selection and implementation of improvement treatments within the watershed.

Evaluation of field site measurements indicated that most grass steppe plant communities in the UJCW were represented by multiple seral stages (Table 18). Vegetation in the majority of field sites in plant communities comprising the Idaho Fescue and Bluebunch Wheatgrass series, which dominate rangeland vegetation in the UJCW, was in mid or late seral stages. The majority of sites in the Idaho Fescue series that were classified to the very early seral stage were Kentucky Bluegrass or Wyeth's Buckwheat disclimax communities. Vegetation in the majority of field sites in plant communities comprising the scabland series was in early seral stages, although more total sites were in mid and late seral stages. Among sites measured in shrub communities, the majority of sites had vegetation in early and mid seral stages. Idaho Fescue-Prairie Junegrass communities with vegetation in very early and early seral stages should be the primary focus of the Phase II improvement program.

Table 18. General condition of vegetation in the Upper Joseph Creek Watershed as indicated by field site evaluation of seral stage.

	Idaho Fescue Series	Bluebunch Wheatgrass Series	Scabland Series	Shrub Series	Oldfield Communities	Meadow Communities	Annual Grass Communities
V.Early	23	0	4.2	10	100	0	100
Early	18.2	14.3	44.6	40	0	88.9	0
Mid	40.5	71.4	37.5	50	0	11.1	0
Late	18.2	14.3	13.4	0	0	0	0

Vegetation in Oldfields was in very early seral condition because of previous cultivation and seeding of introduced plant species. The durability of the seeded species, even though livestock heavily graze vegetation annually, indicates there is low probability that vegetation will move through secondary succession to a higher seral stage, at least within a time frame that has applicability to Phase II improvements. Rehabilitation of Oldfield seedings to increase forage for large herbivores, especially domestic livestock should be a priority of the Phase II improvement program.

Meadow sites measured indicated that vegetation was in an early seral stage. Meadows, because of their association with water and higher late season forage quality, generally receive high utilization by grazing herbivores unless protected. Although rehabilitating and restoring meadows will be a priority of the Phase II improvement program, creation of riparian pastures rather than riparian exclusion fencing should be considered. If exclusion fencing is selected as the improvement treatment, the fence structure should also be sufficient to exclude large wild herbivores.

Although non-native annual grasses are common in the UJCW, sites in which annuals dominate vegetation generally have small spatial area and occur as patches. Annual brome grasses occur as a species component in the majority of plant communities found on the UJCW. During the spring season, annual brome grasses can be a primary source of high quality nutrients to grazing herbivores during this period. Although annual grasses have an early and relatively short growing season, large and small herbivore access to these nutrients during spring may be critical in restoring adult animal body condition and providing optimal lactation for newborn young. Although improvement treatments designed to replace annual brome grasses or introduced perennials with native perennials may be warranted in some communities dominated by annuals or introduced species, treatment application should be made only after prior consideration has been made of herbivore needs, if grazing is to remain an objective in the UJCW.

Although noxious weeds exist within the UJCW, plant community dominance by invasive and noxious non-native weeds was not observed. However, developing and implementing a noxious weed control program should be a major focus of the Phase II improvement program.

Analysis of herbivore diets indicates that invasive annual bromes and Kentucky bluegrass are major seasonal components of large herbivore diets (Table 19). Although spatial area of plant community and plant community seral stage is not yet available for the UJCW, evaluation of field site data combined with observer intuition indicates the general ecological condition of the upper watershed is good. The Idaho Fescue-Prairie Junegrass community in both grass and forest steppe vegetation types probably has greatest spatial area of plant community vegetation in lower seral stages. Although having limited spatial area, meadow communities including riparian strip meadows have vegetation in lower seral stages. These two communities, and the Oldfield communities, should be the focus of treatments to enhance ecological attributes of the watershed. In forested areas of the watershed, developing a sequential program to open forest overstory canopies to allow optimal response of herbaceous understory vegetation should be considered.

In the forest steppe portion of the watershed, seral stage of grass steppe communities surrounded by forest communities was generally very early seral or a

Table 19. Forage species with highest representation in diets of large herbivores seasonally grazing Zumwalt Prairie.

Herbivore	Season	No. Species	Dominant Species (% of Diet)	Dietary Component (>10 %)
Elk	Winter	19	Idaho Fescue (20.2 %)	Bluebunch Wheatgrass Idaho Fescue Kentucky Bluegrass
Elk	Spring	21	Kentucky Bluegrass (24.9 %)	Kentucky Bluegrass Sandberg's Bluegrass Needlegrass
Elk	Summer	34	Kentucky Bluegrass (18.5 %)	Kentucky Bluegrass
Cattle	Summer	15	Annual Brome grass (21.6) Idaho Fescue (20.5 %)	Smooth Brome Annual Brome Grasses Pinegrass Idaho Fescue
Cattle	Fall	10	Idaho Fescue (40.3 %)	Idaho Fescue Annual Brome Grasses
Mule Deer	Summer	10	Bluebunch Wheatgrass (18.3 %)	Bluebunch Wheatgrass Annual Brome Grasses Ponderosa Pine

Kentucky Bluegrass or Wyeth's Buckwheat Disclimax. Although undocumented, the relatively small spatial area of grass steppe plant communities within forest communities may provide the preponderance of forage yield for small and large herbivores, especially early in the annual grazing season.

A number of factors influence the intensity of herbivore grazing in these vegetation "islands" or "patches" including species growth characteristics, palatability to grazing herbivores, and relative availability. Most species in grass steppe are C^3 cool season plant species that initiate growth earlier than the C^4 warm season species that dominate herbaceous vegetation in the understory of forest communities. During early growth, forage from cool season species has high nutrient content (i.e., crude protein and total digestible nutrients), which is attractive to herbivores seeking to restore body condition and/or need high quality nutrients for optimal lactation. Location of grass steppe communities within or near forest boundaries also enables herbivores to access high quality forage without compromising security needs provided by the forest communities.

An important consideration of the Phase II improvement program is to design and implement improvement treatments that have highest potential for success. Designing and implementing an improvement treatment should considered with regard to potential impacts throughout the watershed, not just for the site at which the treatment will be implemented. Unless all impacts are considered, the improvement treatment may be successfully implemented on the treatment site while negatively impacting associated components of the watershed. Examples of possible improvement treatments that might have positive site specific impacts but negative impacts elsewhere in the watershed include:

- Controlled burning to improve nutrient cycling may increase nutrient availability and intensify large herbivore utilization with detrimental effect on plant community ecological stability.

- Seeded areas will require at least two years for stand establishment and will require planning in advance relative to finding alternate forage for herbivores customarily using the rehab areas.

- Improvement treatments to large wild herbivore summer range habitat in the upper watershed may need to be implemented in conjunction with improvement treatments on large herbivore winter range if causes of degradation on summer range are to be resolved.

- Adding new animal watering points without consideration of trampling and grazing impacts on associated rangeland may increase degradation rather then decrease degradation.

- Areas seeded to palatable forage species unless protected against all herbivore grazing during stand establishment may concentrate grazing of large wild herbivores to the detriment of the newly seeded stand and stands of native vegetation associated with the improvement site.

Goodwin and Sheley (2003) have defined steps to provide a framework for planning and implementing a revegetation program. Following steps similar to those suggested for revegetation treatments can prove useful in successfully implementing an improvement program in the 2nd Phase of the UJCW project (Appendix 2).

On grass steppe rangeland and oldfields, improvement treatments anticipated as most useful are variants of rehabilitation seeding, water development, protection from animal use, and implementation of alternative grazing management strategies. The improvement treatment usually implemented for meadow communities is fencing to protect riparian zones from large herbivore use. Hopefully, variants of this improvement treatment can be developed that utilize timing and intensity of herbivore grazing and development of riparian pastures rather than exclusion of all grazing.

Improving productivity of herbaceous understory vegetation in forest communities can potentially improve availability of forage for all herbivores as well as reduce intensity of herbivore use on associated grass steppe communities. Although the UJCW is dominated by grass steppe rangeland, forest communities are a major vegetation type. Forest structure, composition of shrub and herbaceous understory vegetation, and juxtaposition of grass steppe and meadow communities influence the value of forest as habitat for herbivores. Tree crown cover is related to tree overstory shade and both attributes interact with soils, terrain, climate and site alterations from human and natural causes to influence tree structure and shrub and herbaceous vegetation layers that exist comprise forest plant associations. As a result, considerable potential exists in the UJCW to use tree harvest that changes forest structure to improve herbivore habitat availability in forest communities, especially in the Douglas-fir and Ponderosa Pine plant associations. Together, Douglas-fir and Ponderosa Pine communities comprise over 40% of forestland in the UJCW. During secondary succession, forest communities of both community types have high cover of shrubs, forbs, and grass and capacity to produce more than 800 kg/ha of herbaceous dry matter.

Developing sequential thinning of trees in forest communities of the UJCW can be a very useful improvement treatment. Potentially, communities in the Grand Fir type could be managed to provide shade and security from tree overstory and browse and herbaceous understory vegetation for late season herbivore grazing. Communities in the Douglas-fir and Ponderosa Pine associations could be managed to provide optimal herbivore grazing of herbaceous understory vegetation. Creation of more optimal habitat in forest communities associated with degraded grass steppe communities can potentially mitigate herbivore impacts on these communities and improve potential for successful rehabilitation.

An action plan for implementing improvement treatments in the UJCW should be prepared as the initial steppe of the Phase II improvement program. The action plan should present in detail the “What, Where, When, Who, and How Much” of the improvement treatments to be implemented in Phase II. The action plan should also develop monitoring and evaluation procedures for implemented improvements in the watershed.

A major component of Phase I of the UJCW project was preparation of vegetation maps of the watershed. QUICKBIRD imagery, which was provided to the project by TNC, was used as an image source. Site information, including vegetation and ground surface attributes, collected during the initial field season was processed and analyzed to determine a set of Preliminary Mapping Units. During the second field season, PMUs were validated. Ground-truthing of the PMUs allowed development of Mapping Units that classified watershed vegetation into plant communities (Level II) and seral stage (Level I) mapping units. Using this approach, plant communities and seral stages defined by Johnson and Simon (1987) for grass steppe and forest steppe vegetation and plant community and seral stage data bases compiled in the Phase I study are linked to vegetation maps that provide spatial area of plant communities and seral stages present in the watershed. Availability of the vegetation maps will contribute to selection of appropriate sites to implement improvement treatments in the UJCW.

Appendix 1. Vegetation Series and Plant Communities by Stewardship in the Upper Joseph Creek Watershed.

Series	Code	Plant Community	TNC	USFS	Private
Idaho Fescue	GB5911	Idaho fescue-Prairie junegrass (Ridgetops)	11	4	11
	GB5912M	Idaho fescue-Prairie junegrass (Mounds)	10	15	11
	GB5912P-D	Idaho fescue-Prairie junegrass (Mounds-Kentucky bluegrass Disclimax)	5	7	5
	GB5912E-D	Idaho fescue-Prairie junegrass (Mounds-Wyeth's buckwheat Disclimax)	1	5	
	GB5913	Idaho fescue-Prairie Junegrass (High Elev.)	21		5
	GB5915	Idaho fescue-Bluebunch wheatgrass (Ridgetops)	9	1	8
	GB5916	Idaho fescue-Bluebunch wheatgrass/Silky lupin		1	
	GB5917	Idaho fescue-Bluebunch wheatgrass/Arrowleaf balsamroot	5	2	1
	GB5918	Idaho fescue-Bluebunch wheatgrass/Snake River Phlox	1		
	GB5919	Common Snowberry/Idaho fescue-Prairie junegrass	5	2	1
	GB5920	Idaho fescue-California oatgrass-Sedge			1
			68	*37*	*43*
Bluebunch Wheatgrass	GB4111	Bluebunch wheatgrass-Wyeth's buckwheat		1	1
	GB4112	Bluebunch wheatgrass-Onespike oatgrass			4
	GB4113	Bluebunch wheatgrass-Sandberg's bluegrass (Basalt)			2
			0	*1*	*7*
Scabland	GB4911	Bluebunch wheatgrass-Sandberg's bluegrass (Scabland)	5	10	8
	GB9111	Sandberg's bluegrass-Onespike oatgrass	2	6	8
	FM9111	Douglas' Buckwheat/Sandberg's bluegrass		1	3
	SD9111	Stiff sagebrush/Sandberg's bluegrass		3	1
			7	*20*	*20*
Shrubland	SM3111	Common snowberry-Rose	3	1	4
	SM32	Mountain Snowberry			1
	SM19X	Ninebark-Common snowberry		1	
			3	*2*	*5*
Forest-Shrub	CPS%22	Ponderosa pine/Common snowberry	3	7	1
		Ponderosa pine/Idaho fescue	1	0	
			4	*7*	*1*

Table . (Cont.)

Oldfield	Old-Brin	Oldfield-Smooth Brome	6		7
	Old-Elre	Old-Elre			2
	Old-Popr	Oldfield-Kentucky bluegrass			2
	Old-Agcr	Oldfield-Crested wheatgrass	1		1
	Old-Phpr	Oldfield-Timothy	1		
	Old-Agro	Oldfield-Wheatgrass	2		5
			10	*0*	*17*
Annual grass	Unk-Brte	Cheatgrass	0	0	1
			0	*0*	*1*
Meadow	Mead-Sedge	Wet Sedge Meadow	4		
	Mead-Hairgrass	Meadow-Tufted hairgrass-moist sedge	1		4
			5	*0*	*4*
Total			**97**	**67**	**98**

Appendix 2. Steps to Follow in Rehabilitating UJCW Rangelands

Goodwin and Sheley (2003) have defined steps to provide a framework for planning and implementing a revegetation program. Following these steps can prove useful to implementing an improvement program in the 2nd Phase of the UJCW project. The steps are summarized in the following table.

Step	Statement
1. Make a goal statement.	Improve community ecological stability Improve plant and animal diversity Improve the hydrologic cycle of streams in the watershed. Improve forage and security habitat for wildlife and livestock Create resource management flexibility
2. Determine improvement/revegetation necessity.	Prevent soil erosion and noxious weed invasion and restore healthy plant communities. Meet seasonal forage requirements of herbivores. Assess need for revegetation (Vallentine suggests 1 bunchgrass plant/10 ft^2 in the Intermountain Region.)
3. Determine likelihood of successful revegetation.	Determine problem soils and amendment potential. Determine if native or introduced species should be used and are available.
4. Salvage vegetation and topsoil prior to planned disturbance	Preserve existing plants and seeds adapted to the site. Salvage and store topsoil for replacement after disturbance.
5. Site preparation.	Site preparation (i.e., disking and/or harrowing) is usually needed for broadcast and mulch seeding but not drill seeding. Do not fertilize as N provides a competitive advantage for weeds.
6. Reduce weed interference.	Manage infestations prior to seeding by using herbicides, mowing, or domestic animal grazing or combinations to reduce site competition. Plant fast growing cover crops to sequester Nitrogen. Use fall dormant no-till seed drilling.
7. Design a seed mix.	Customize seed mix to the site. Purchase weed free seed. Buy certified native seed providing collection location. Seed a variety of compatible species to ensure establishment. Seeding for weed control requires that seed mix contain a functional diversity of aggressive, fast growing grasses and forbs that can quickly occupy the site.
8. Assist seeding establishment.	Use locally adapted species. Reduce weed interference. Inoculate legumes with the proper bacterium. Prepare a seedbed before and after seeding. Plant plugs in meadow/riparian sites. Use a land imprinter to increase moisture retention.

	Increase seeding rates. Add small amounts of water as needed in dry sites. Defer grazing until stand is established, Use treated seeds. Provide a mulch cover to protect seeds and conserve soil moisture.
9. Determine appropriate seeding method for the site.	Potential seeding methods are drilling, broadcasting, imprinting, hay/straw mulching, sprigging, hydroseeding, and plugging. Method selected will depend on site characteristics. Transplanting circumvents the critical seed germination and allows rapid establishment.
10. Implement selected seeding treatment	Treatment selected should be appropriate for the site. Guaranteed weed-free seed should be used. Seeded area should be protected until stand establishment.
11. Monitor and evaluate treatment results.	Monitor treatment at least annually during stand establishment and modify utilization as needed. Monitor to determine productive life of the stand and success of the treatment.

Annex 1. Plant Community Attributes in the UJCW

Idaho Fescue-Prairie Junegrass Series

Although not directly related to spatial area, the high number of sites occurring in the Idaho fescue series indicates the dominance of the series in the UJCW. Over 56 % of all sampled sites were plant communities in the Idaho Fescue series, primarily Idaho fescue-Prairie Junegrass Ridgetop, Mounds, and High Elevation communities. Both Kentucky bluegrass and Wyeth's Buckwheat disclimax communities are also well represented in the UJCW Idaho Fescue Series. Idaho fescue-Bluebunch Wheatgrass communities have less representation in the series. Other communities in the series have low to moderate representation.

Idaho Fescue-Prairie Junegrass (Ridgetop) Community

Table . Characteristics of the Idaho Fescue-Prairie Junegrass (Ridgetop) Community.

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Feid-Kocr	26	Grass	27.7	22.0	21.6	20.7	24.2	Agsp	7.6	3.4	2.0	4.9	3.8
Ridgetop		Forb	8.7	17.0	20.8	14.0	19.2	Feid	0.0	2.9	4.8	8.1	5.5
		Shrub	0.0	0.1	0.4	0.0	0.2	Kocr	0.3	0.0	2.2	1.0	1.3
GB5911		Tree	0.0	0.0	0.0	0.0	0.0	Popr	3.7	1.3	1.5	0.8	1.7
		Soil	34.4	17.3	17.8	14.2	20.7	Posa	0.0	4.1	4.1	1.1	3.2
		Litt	23.3	28.6	16.9	21.8	24.1	Brmo	2.6	3.5	0.8	0.7	1.7
		Rock	0.7	1.9	4.3	5.4	4.2	Vedu	11.5	0.7	0.6	0.3	1.4
		Cryp	5.5	5.9	9.0	12.8	9.8	Acmi	1.0	0.4	1.8	2.5	1.7
								Getr	1.3	1.7	1.2	2.1	1.8
								Luse	0.0	2.4	1.0	0.6	1.2
								Pogr	0.0	0.2	3.6	1.0	2.0

Community Characteristics. The majority of sites evaluated in the Idaho fescue-Prairie junegrass (Ridgetop) community were in the mid to late seral stage. Less than 8.0 % of the sites were in the very poor seral stage and less than 24.0 % of sites were in the early seral stage. Except for specific sites identified as being in the very early and early seral stage that might warrant intervention, current management of the plant community type across the UJCW appears adequate to maintain the plant community in higher seral stages.

Ecological Relationships. The Idaho fescue-Prairie junegrass (Ridgetop) community had the following ecological relationships:

- Common ridgetop grassland community.
- Continued over utilization by ungulate grazers will eliminate Feid from the community.
- Areas with past overuse by domestic sheep contain extensive stands of gumweed.
- High biomass production.
- Spatial area of the community is relatively large.

- Most communities sampled (69.2%) were in mid or late seral stages. Very early and early seral communities were approx 30% 0f plant communities sampled.
- Dominant species in all seral stages are bunchgrasses except for high presence of Vedu in Early Seral stages.

Management Considerations. Management considerations for the Idaho fescue-Prairie junegrass (Ridgetop) community include:

- Domestic ungulate grazers should be allowed grazing access after seed maturity.
- Sites can be reseeded with mechanized equipment.
- Communities dominated by Kentucky bluegrass should not be reseeded because of competitive capacity of the Popr.
- The community is important to the UJCW because of ridgetop dominance in the rangeland type and should be viewed as a "key" community.

Recommendations. Recommendations for improving the Idaho fescue-Prairie junegrass (Ridgetop)plant community include:

- Plant communities in very early and early seral stages unless dominated by Popr should be considered for mechanical seeding of native bunchgrass plants.
- As part of an UJCW management plan, deferment of livestock grazing to fall season grazing in alternate years should be considered.
- Degraded sites should be identified and treated through grazing modification and seeding.

Idaho Fescue-Prairie Junegrass (Mounds) Community

Table .Characteristics of the Idaho fescue-Prairie junegrass (Mounds) plant community.

Feid-Kocr	36	Grass	15.9	21.0	26.0	20.8	24.8	Agsp	1.0	1.0	2.7	6.3	2.2
(Mounds)		Forb	15.3	17.5	18.3	25.8	19.3	Brca	0.0	0.1	1.5	0.0	0.9
		Shrub	0.0	0.4	0.1	0.0	0.1	Daun	0.5	0.6	0.6	0.0	0.7
GB5912 (M)		Tree	0.0	0.0	0.0	0.0	0.0	Feid	0.0	3.2	7.4	10.7	5.6
		Soil	20.4	24.4	17.5	10.1	21.3	Popr	1.4	1.2	2.7	0.0	2.2
		Litt	19.2	17.0	26.8	24.5	24.7	Posa	2.6	3.9	2.2	0.0	2.9
		Rock	12.0	4.6	2.8	0.6	5.0	Brja	0.5	0.9	1.8	0.0	1.4
		Cryp	13.4	7.1	5.2	4.4	7.6	Brmo	0.4	2.3	1.7	0.0	1.7
								Vedu	7.0	3.2	0.8	0.0	2.6
								Acmi	0.0	0.6	1.5	0.0	1.0
								Arnic	1.5	1.3	0.7	2.5	1.1
								Getr	0.0	0.6	2.7	13.2	2.1
								Pogr	0.5	0.8	0.6	3.1	0.7

Community Characteristics. Vegetation cover of the Idaho fescue-Prairie junegrass (Mounds) plant community was dominated by grasses and forbs. Grasses and forbs in this community had cover similar to the Idaho fescue-Prairie Junegrass (Ridgetop) plant community. Idaho fescue and Bluebunch Wheatgrass had higher cover in later seral stages while Sandberg's bluegrass, Ventenata and annual bromes had highest cover in lower seral stages. Ventenata also tended to dominate among annual grasses although less so compared to the Ridgetop community. Forbs had only moderate cover in the plant community. Kentucky bluegrass had relatively low cover in all seral stages and was not sampled in the late seral stage.

Cover values for bare soil and ground litter were also similar to the Ridgetop community. Bare soil had high cover in the very early, early and mid seral stages but only moderate cover in the late seral stage. Ground litter was relatively high in all seral stages. Both rock and cryptogam had decreasing cover as seral stage advanced which was different than the Ridgetop community.

The majority of sites evaluated in the Idaho fescue-Prairie junegrass (Mound) community were in the early to mid seral stage. Less than 14.0 % of the sites were in the very poor seral stage and less than 3.0 % of sites were in the late seral stage. The relatively high number of sites classified as early seral indicates that intervention to change management of implement improvement alternatives in this community type may be warranted in the UJCW.

Ecological relationships. Ecological relationships characterizing the the Idaho fescue-Prairie junegrass (Mounds) plant community include:

- Patterned ground community.
- Regression of community to forbs or Popr preceeds either a Erhe or a Popr Disclimax.
- Regression to annual forbs indicates a very early seral stage.
- Spatial area of the community is moderate.
- Mounds are highly productive.
- Feid and Agsp dominate in late seral communities.
- Over 58 % of the communities sampled were in mid or late seral stages.

Management Considerations. Management considerations for the Idaho fescue-Prairie junegrass (Mounds) plant community include:

- Reseeding lower seral stage mounds is possible unless mounds are dominated by continuous cover of Popr or Erhe.
- Hot burns may increase Popr competiveness with perennial bunchgrass plants.
- Popr dominated mounds are highly productive and capable of withstanding heavy grazing.
- Improving of degraded mounds will require intervebtion through protection and seeding, especially in forest steppe areas.

Recommendations. Recommendations for improving the Idaho fescue-Prairie junegrass (Mounds) plant community include:

- Grazing mound communities before soil stabilizes should be avoided because of unstable soil stability characteristics.
- Mounds are highly susceptible to churning caused by frost heaving and hoof action and grazing should be avoided during this period.

Idaho Fescue-Prairie Junegrass (Mounds-Popr Disclimax) Community

Table . Characteristics of the Idaho Fescue-Prairie Junegrass (Mounds-Popr Disclimax)

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C 2	C3	C4	Ave.
Feid-Kocr (Mound) Popr Disclimax GB5912 (M) P-D	17	Grass Forb Shrub Tree Soil Litt Rock Cryp	23.3 25.1 0.3 0.0 16.6 29.3 0.5 1.9				23.3 25.1 0.3 0.0 16.6 29.3 0.5 1.9	Agsp Brca Feid Popr Posa Brmo Acmi Getr Lupine Pogr Magl	1.3 1.5 1.6 9.1 1.5 1.1 3.3 3.0 1.1 1.8 1.8				1.3 1.5 1.6 9.1 1.5 1.1 3.3 3.0 1.1 1.8 1.8

Community Characteristics.

Grasses and forbs dominated vegetation cover of the Idaho fescue-Prairie junegrass (Mounds) Kentucky Bluegrass Disclimax plant community. Cover of grasses was similar to the Ridgetop and Mound communities while the cover of forbs in the comparable very early seral stage was considerably higher. Idaho fescue, Bluebunch Wheatgrass, and Sandberg’s bluegrass, while present, had much lower cover in the Kentucky bluegrass Disclimax compared to cover of these species in the Ridgetop and Mound communities.

In this community, Kentucky bluegrass dominated among herbaceous perennial plants. Annual grasses had low presence and cover in the Disclimax community, indicating that Kentucky bluegrass outcompetes annual grasses on this site. Dominant perennial forbs in the Disclimax community were similar to the Ridgetop and Mound communities. The presence and relatively high cover of Magl (cluster tarweed) was distinctive of the Kentucky bluegrass Disclimax community.

Cover values for bare soil and ground litter were similar to other communities in the series. Both rock and cryptogams in the Kentucky bluegrass had much lower cover compared to the Ridgetop, Mound, and Wyeth’s Buckwheat Disclimax communities. The low cover of these ground surface attributes possibly indicates the mat-forming potential of Kentucky bluegrass on deeper soil sites. Deeper soil and higher moisture holding capabilities of mounds located on northerly aspects may be the primary reason for establishment and dominance by Kentucky bluegrass.

All sites evaluated in the Idaho fescue-Prairie junegrass (Mound) Kentucky bluegrass Disclimax community were classified to the very early seral stage. This classification was the result of dominance by Kentucky bluegrass and designation of the community as being in disclimax.

Ecological Relationships. Ecological relationships characterizing the Idaho Fescue-Prairie Junegrass (Mounds-Popr Disclimax) plant community include:

- Same as for Feid-Kocr (Mounds) except mounds in a Kentucky bluegrass disclimax should not be reseeded because of the high competitiveness of the Kentucky bluegrass.
- Mounds dominated by Popr are considered in a very early seral state relative to potential natural vegetation.

Management Concerns. Management concerns for the Idaho Fescue-Prairie Junegrass (Mounds-Popr Disclimax) plant community include:

- Livestock grazing should be allowed after seed set of Feid.
- Hot burns may increase Popr over native bunchgrass species.

Recommendations. Recommendations for improving the Idaho Fescue-Prairie Junegrass (Mounds-Popr Disclimax) plant community include:

- Manage with other communities forming the Mound-Intermound complex.
- Mounds dominated by Kentucky bluegrass can be grazed heavier than mounds dominated by native perennial grasses.

Idaho Fescue-Prairie Junegrass (Mounds) Wyeth Buckwheat Disclimax Community

Table . Characteristics of the Idaho Fescue-Prairie Junegrass (Mounds) Wyeth Buckwheat Disclimax Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Feid-Kocr	6	Grass	18.3				18.3	Agsp	1.2				1.2
(Mound)		Forb	16.7				16.7	Arel3	1.2				1.2
E-D		Shrub	8.1				8.1	Popr	1.9				1.9
		Tree	0.0				0.0	Posa	5.2				5.2
GB5912(M)E-D		Soil	16.2				16.2	Brmo	3.5				3.5
		Litt	22.8				22.8	Mufi	1.1				1.1
		Rock	4.7				4.7	Vedu	1.9				1.9
		Cryp	9.1				9.1	Acmi	1.3				1.3
								Copa	1.3				1.3
								Podo	2.1				2.1
								Migr	2.3				2.3
								Vear	2.4				2.4
								Erhe	6.3				6.3

Community Characteristics:

Cover of the Idaho fescue-Prairie junegrass (Mounds) Wyeth Buckwheat Disclimax plant community was dominated by grasses, forbs, and the half-shrub Wyeth's Buckwheat. Grasses and forbs in this community had lower cover compared to the Kentucky bluegrass Disclimax and the Ridgetop and Mound communities. Idaho fescue and Bluebunch Wheatgrass, while often present in this Disclimax community, had lower cover than the former communities although Sandberg's bluegrass had higher cover. In this community, Wyeth's buckwheat dominated among herbaceous plants. Annual grasses, including Ventenata and soft chess, had higher cover than perennial grasses compared to other Idaho fescue-Prairie Junegrass communities in the series. The presence and relatively high cover of oatgrass in the Wyeth's Buckwheat Disclimax also distinguished this community from other communities in the series. Forbs in the Wyeth's buckwheat community had relatively high cover.

Cover values for bare soil and ground litter were similar to other communities in the series. Both rock and cryptogams in the Wyeth's buckwheat community had higher cover compared to the Kentucky bluegrass Disclimax community but lower cover than the Ridgetop and Mound communities.

All sites evaluated in the Idaho fescue-Prairie junegrass (Mound) Wyeth's Buckwheat Disclimax community were classified to the very early seral stage. This classification was the result of dominance by Wyeth's buckwheat and designation of the community as being in disclimax.

Ecological Relationships. Ecological relationships characterizing the Idaho fescue-Prairie junegrass (Mounds) Wyeth Buckwheat Disclimax plant community include:

- Same as for Feid-Kocr (Mounds) except mounds in a Wyeth Buckwheat disclimax should not be reseeded.
- Mounds dominated by Wyeth Buckwhea are considered in a very early seral state relative to potential natural vegetation.

Management Relationships. Management concerns in the Idaho fescue-Prairie junegrass (Mounds) Wyeth Buckwheat Disclimax plant community include:

- Livestock grazing should be allowed after seed set of Feid.
- Hot burns may increase Popr over native bunchgrass species.

Recommendations. Recommendations for improving the Idaho fescue-Prairie junegrass (Mounds) Wyeth Buckwheat Disclimax plant community include:

- Manage with other communities forming the Mound-Intermound complex.

Idaho Fescue-Prairie Junegrass (High Elevation) Community

Table . Characteristics of the Idaho Fescue-Prairie Junegrass (High Elevation) Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Feid-Kocr	26	Grass	33.6	26.0	37.1	25.4	34.0	Agsp	0.8	1.8	6.9	8.5	6.2
(High		Forb	7.9	13.4	24.6	15	19.2	Feid	0.0	2.1	15.7	9.1	9.7
Elevation)		Shrub	0.2	0.5	0.4	0.2	0.4	Popr	0.0	2.1	1.4	1.3	1.5
		Tree	0.0	0.0	0.0	0.0	0.0	Posa	1.8	2.9	3.4	2.8	3.3
GB5913		Soil	19.2	30.9	26.9	20.4	27.9	Brja	2.7	1.0	1.9	0.0	1.3
		Litt	23.6	25.2	33.1	30.1	32.6	Brte	9.5	2.1	0.0	0.0	1.7
		Rock	5.2	2.5	5.4	1.7	3.9	Mufi	1.6	1.1	1.8	0.2	1.2
		Cryp	10.2	3.8	14.3	6.8	10.0	Vedu	9.4	0.0	0.8	0.0	1.4
								Acmi	0.4	1.5	2.2	0.8	1.6
								Getr	0.0	0.6	4.0	1.2	2.1
								Lupine	0.0	1.4	1.4	1.1	1.3
								Pogr	0.3	1.2	1.8	0.5	1.2

Community Characteristics

Cover of the Idaho fescue-Prairie junegrass (High Elevation) plant community was dominated by grasses.in the very early and early seral stages and by grasses and forbs in the mid and late seral stages. Shrub cover, although low, characterized all seral stages. Idaho fescue and Bluebunch Wheatgrass, had low cover in very early and early seral stages but highest cover in mid and late seral stages. Annual grasses, which had high cover in the earlier seral stages, had low cover in mid and late seral stages. Forb cover compared to cover of grasses was lower in all seral stages. Highest cover of forbs occurred in the mid seral stage.

Cover values for bare soil and ground litter were similar to other communities in the series. Both rock and cryptogams had highest cover in the mid seral stage.

Over 65.0% of the sites evaluated in this community were classified to mid and late seral stages. Only 11.5 % of the sites were classified as very early seral stage while 23.1 % of the sites were classified to the early seral stage.

Ecological Relationships. Ecological relationships in the Idaho fescue-Prairie junegrass (High Elevation) plant community included:

- One of most extensive higher elevation communities.
- Popr is not a primary increaser in this site on steep slopes.
- Presence of moisture and lower temperatures necessary for this site; otherwise site will be dominated by Feid-Agsp Communities.
- Over 65% of the sites sampled were in mid-late seral stages.

Management Concerns. Management concerns for the Idaho fescue-Prairie junegrass (High Elevation) plant community include:

- Livestock grazing should be allowed after seed set of Feid.
- Hot burns may increase forbs over native bunchgrass species.

Recommendations. Recommendations for improving the Idaho fescue-Prairie junegrass (High Elevation) plant community include:

- Manage this community similar to and with other steep sloped Idaho Fescue communities.

Idaho Fescue-Bluebunch Wheatgrass (Ridgetops) Community

Table . Characteristics of the Idaho Fescue-Bluebunch Wheatgrass (Ridgetops) Community

Community	No.	Cover (%)						Dominant Species (%)				
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4
Feid-Agsp	18	Grass		21.0	19.8	24.9	21.0	Agsp		5.1	2.5	6.4
(Ridgetop)		Forb		12.2	15.3	13.9	14.7	Feid		0.8	5.7	9.2
		Shrub		0.0	0.0	0.0	0.0	Posa		6.8	6.6	6.2
GB5915		Tree		0.0	0.0	0.0	0.0	Brja		3.0	1.0	2.0
		Soil		32.1	22.1	15.5	21.7	Brte		0.0	1.3	0.4
		Litt		29.0	22.2	23.2	23.1	Acmi		0.0	0.8	2.2
		Rock		2.9	6.8	4.6	5.9	Bain		1.9	3.0	2.8
		Cryp		1.4	12.1	11.6	10.8	Loam		3.6	1.4	1.2
								Luse		0.0	0.2	2.1
								Eppa		0.8	0.7	0.3

Community Characteristics:

Cover of the Idaho fescue-Bluebunch Wheatgrass (Ridgetop) plant community was dominated by grasses.in the early through late seral stages. Perennial grasses dominating cover were Feid, Agsp, and Posa. Highest forb cover is provided by Bain, which has highest cover in the mid-seral stage, and Loam, which has highest cover in the early seral stage. Annual grasses have relatively low cover in the three seral stages sampled.

Cover values for bare soil and ground litter were highest among plant communities in the Idaho Fescue series. Cover of the two ground surface attributes together provided over 60 % of total cover in the very early seral stage of the community and remained high in all seral stages. Both rock and cryptogams had lower cover in the very early seral stage but increased cover in later seral stages. .

Almost 90.0 % of sites in the Idaho fescue-Bluebunch Wheatgrass (Ridgetop) community sampled in the UJCW were in mid to late seral condition. Less than 12.0 % of the sites sampled were in early seral stage and no sites were sampled in the very early seral stage.

Ecological Relationships. Ecological relationships in the Idaho fescue-Bluebunch Wheatgrass (Ridgetop) plant community include:

- Transitional community between Ridgetop and steep canyon slopes.

- The community on thinner soils may have been impacted by overgrazing by herbivores.
- The community is often found adjacent to scabland communities.
- Sites sampled were in early, mid

Management Concerns. Management concerns for the Idaho fescue-Bluebunch Wheatgrass (Ridgetop) plant community include:

- Community has low total forage yield.
- Agsp and Feid comprise forage species.
- Yield substantially reduced in very early and early seral stages.
- Early season frost-heaving and soil moisture saturation.

Recommendations. Recommendations for improving the Idaho fescue-Bluebunch Wheatgrass (Ridgetop) plant community include:

- Early season use by large herbivores should be avoided.
- The community can be easily degraded by overgrazing.
- Difficult to use fire in this community because of low vegetation cover.

Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine Community

Table . Characteristics of the Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Feid-Agsp/Luse	1	Grass			31.9		31.9	Agsp			8.9		8.9
		Forb			20.7		20.7	Daun			8.5		8.5
		Shrub			0.3		0.3	Kocr			1.4		1.4
GB5916		Tree			0.0		0.0	Posa			10.8		10.8
		Soil			15.0		15.0	Bain			6.6		6.6
		Litt			14.1		14.1	Lotr			7.0		7.0
		Rock			6.1		6.1	Luse			1.4		1.4
		Cryp			7.0		7.0	Eppa			2.3		2.3

Community Characteristics:

Cover in the Idaho fescue-Bluebunch Wheatgrass/Silky Lupine plant community was dominated by grasses and forbs in the mid seral stage. Perennial grasses dominating cover were Feid, Agsp, and Posa. Highest forb cover was Lotr and Bain. Annual grasses have low cover in the mid seral stage community sampled.

Cover values for bare soil and ground litter were moderate among plant communities in the Idaho Fescue series. Cover of the two ground surface attributes together provided less than 30.0 % of total cover in the mid seral stage community. Both rock and cryptogams had low cover in the mid seral stage.

The single site sampled in the plant community was in the mid seral stage.

Ecological Relationships. Ecological relationships in the Idaho fescue-Bluebunch Wheatgrass/Silky Lupine plant community include:

- Community occurs on steep canyon slopes with primarily southwesterly aspects.
- More mesic soils tand to support more forbs.
- Agsp and Feid are replaced by Posa3 as degradation occurs.
- Increase in forbs in the mid seral stage increases site stability.
- Only a single site was sampled in the UJCW.

Management Concerns. Management concerns for the Idaho fescue-Bluebunch Wheatgrass/Silky Lupine plant community include:

- Community has moderate to high forage yield.
- Higher forb production in mid seral stages compared to late seral stage.

Recommendations. Recommendations for improving the Idaho fescue-Bluebunch Wheatgrass/Silky Lupine plant community include:

- Community is suitable for livestock use but best for domestic sheep use.
- Winter grazing by multiple large herbivores can damage plant community and promote weedy forbs.
- Fire can damage perennial bunchgrasses and promote weedy forbs.

Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox Community

Table . Characteristics of the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox Community

Community	No.	Cover (%)						Dominant Species (%)				
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4
Feid-Agsp/Phlox	1	Grass				15.1	15.1	Agsp				6.7
		Forb				14.1	14.1	Feid				5.7
GB5918		Shrub				0.0	0.0	Posa				3.8
		Tree				0.0	0.0	Brja				1.9
		Soil				32.0	32.0	Astra				1.9
		Litt				16.0	16.0	Bain				1.9
		Rock				6.6	6.6	Getr				1.9
		Cryp				16.0	16.0	Phlox				0.9

Community Characteristics.

Cover of the Idaho fescue-Bluebunch Wheatgrass/Snake River Phlox community was dominated by grasses and forbs in the late seral stage. Perennial grasses providing highest vegetation cover were Feid, Agsp, and Posa. Two annual brome grasses had low cover in the late seral stage. The relatively high cover of locoweed among forb species may be only a characteristic of the single site sampled.

Cover of bare soil is highest among all cover categories and may reflect the steep slope nature of the site. Cover of ground litter, while lower than bare soil, is higher than either the grass or forb cover categories. Although rock cover is moderate, cryptogam cover is high. The high cover of cryptogams compared to rock may indicate the common occurrence of cryptogams on rock at the site.

Ecological Relationships. Ecological relationships of the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox Community include:

- Idaho fescue series community.
- Brte is a major increaser with disturbance.

Management Concerns. Management considerations of the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox Community include:

- Suitable for cattle and sheep grazing but most suited to grazing by sheep if weedy forbs present..
- early spring grazing by sheep will significantly reduce arrowleaf balsamroot.
- Winter grazing by both cattle and elk can potentially damage the community.
- grazing use of Feid and Agsp during flowering to seed-ripening is detrimental to the plants.
- Controlled grazing by sheep can control perrenial weeds.
- Hot summer or autumn fires can damage the plant community.

Recommendations. Recommendations for improving the Idaho Fescue-Bluebunch Wheatgrass/Snake River Phlox plant community include:

- Manage community in coordination with other steep sloped Idaho fescue communities in the Idaho fescue series.

Common Snowberry/Idaho Fescue-Prairie Junegrass Community

Table . Characteristics of the Common Snowberry/Idaho Fescue-Prairie Junegrass Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Syal/Feid-Kocr	8	Grass	20.1	27.3	21.8		24.1	Agsp	0.0	4.4	4.2		2.9
		Forb	9.7	12.1	20.3		13.6	Feid	0.0	3.3	4.3		2.5
GB5919		Shrub	1.5	6.8	3.2		4.6	Popr	0.0	0.0	2.3		0.8
		Tree	0.0	0.0	0.0		0.0	Posa	2.2	0.0	0.3		0.8
		Soil	12.6	21.6	21.7		19.4	Brja	0.0	4.9	5.1		3.3
		Litt	50.0	26.3	26.9		32.4	Brte	1.5	3.7	0.0		1.7
		Rock	5.3	3.5	1.7		3.5	Vedu	14.9	9.1	0.0		8.0
		Cryp	2.8	0.2	3.6		1.7	Basa	1.5	2.3	1.4		1.7
								Getr	0.0	1.3	3.6		1.6
								Gevi	0.0	0.0	2.4		0.8
								Pogr	0.0	1.1	0.9		0.7
								Eppa	3.7	0.0	1.4		1.7
								Podo	1.5	2.5	0.0		1.3
								Syal	0.0	0.0	1.3		0.4

Community Characteristics

Species composition of the Common Snowberry/Idaho Fescue-Prairie Junegrass community was among the most diverse of all communities occurring on the UJCW. Common Snowberry was encountered on some sites in the mid-seral stage. Cover of grasses was high in the three seral stages measured while forb cover was highest in the mid seral stage. Bare soil was low in earlier seral stages and highest in the mid seral stage. Ground litter was high in all seral stages and was especially high in the very early seral stage. Both Rock and Cryptogams had low cover in all three seral stages.

Perennial grass cover was low in the earlier seral stages. Except for Sandberg’s bluegrass and the annual grass Ventenata, very early and early seral stages had low cover of grasses and forbs. Cover of perennial grasses, annual brome grasses, and forbs increased in early and mid seral stages while cover of Ventenata and annual forbs decreased.

Cover of bare soil was low in the very early seral stage but increased in the early and mid seral stages. Conversely, cover of ground litter was very high in the very early seral stage but was substantially lower in the early and mid seral stages. Both rock and cryptogams had generally low cover in the three seral stages.

Ecological Relationships. Ecological relationships of the Common Snowberry/Idaho Fescue-Prairie Junegrass plant community include:

- Community occurs on moisture holding steep slopes at higher elevations.
- Syal is scattered and dominated by perennial grasses.
- Community is not a Syal-Rosa community.

Management Concerns. Management concerns of the Common Snowberry/Idaho Fescue-Prairie Junegrass plant community include:

- Manage with Feid-Kocr (High Elevation) steppe community.

Recommendations. Recommendations for improving the Common Snowberry/Idaho Fescue-Prairie Junegrass plant community include:

- Manage with Feid-Kocr (High Elevation) steppe community.

Idaho Fescue-Timber Oatgrass-Sedge Community

Table . Characteristics of the Idaho Fescue-Timber Oatgrass-Sedge Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Feid-Daun-Caho	1	Grass			25.2		25.2	Agsp			3.6		3.6
		Forb			20.1		20.1	Brca			4.3		4.3
GB5920		Shrub			0.0		0.0	Caho			2.2		2.2
		Tree			0.0		0.0	Daun			1.4		1.4
		Soil			12.9		12.9	Feid			7.2		7.2
		Litt			34.5		34.5	Popr			2.2		2.2
		Rock			0.0		0.0	Acmi			3.6		3.6
		Cryp			0.0		0.0	Arnica			7.2		7.2
								Pogl			5.6		5.6

Community Characteristics:

Only a single stand of the Idaho Fescue-Timber Oatgrass-Carex community was evaluated in the UJCW. The stand had high cover of grasses and forbs and Ground Litter but only moderate cover of Bare Soil. Cover of Rock and Cryptogam was not measured in the site.

Perennial grasses and forbs dominated the stand. Although a single stand can not accurately represent the community, the presence of annual grasses and forbs may be constrained in this community. Idaho Fescue and Arnica had highest cover among all species present in the stand.

Vegetation had higher cover than ground surface attributes. Cover of Bare Soil was moderate in the mid seral stand while Ground Litter was high. Cover of both Rock and Cryptogams was not measurable in the single mid seral stand.

Ecological Relationships. Ecological relationships in the Idaho Fescue-Timber Oatgrass-Sedge plant community include:

- Community represents highest moisture sites in the Idaho fescue series.
- Community occurs on deeper soil sites.
- Oatgrass and sedges increase over Feid with heavy large herbivore grazing.
- Community has potential for invasion by Popr, Stoc, and weed

Management Concerns. Management concerns in the Idaho Fescue-Timber Oatgrass-Sedge plant community include:

- Community has high potential to support weedy plant species.
- Moderate to high forage production potential.

Recommendations. Recommendations for improving the Idaho Fescue-Timber Oatgrass-Sedge plant community include:

- Potential spatial area of the community is low.
- Community should be managed in conjunction with dominate adjacent communities in the Idaho fescue series.

Bluebunch Wheatgrass Series

Seven stands of plant communities in the Bluebunch Wheatgrass series were evaluated in the UJCW. The relatively low number of stands compared to plant communities in the Idaho Fescue series and Scabland series indicates that Bluebunch Wheatgrass communities have limited occurrence and spatial area. Plant communities in the Bluebunch Wheatgrass series tend to inhabit drier, southerly aspects. In the UJCW, these aspects are limited because the predominant aspect of the watershed is north.

Characteristics of the Bluebunch Wheatgrass/Wyeth's Buckwheat Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Agsp/Erhe	1	Grass			15.0		15.0	Mebu			3.9		3.9
		Forb			23.8		23.8	Brmo			8.7		8.7
GB4111		Shrub			12.6		12.6	Magl			2.4		2.4
		Tree			0.0		0.0	Migr			2.4		2.4
		Soil			7.9		7.9	Podo			2.4		2.4
		Litt			29.1		29.1	Erhe			12.6		12.6
		Rock			9.4		9.4						
		Cryp			0.8		0.8						

Community Characteristics:

Vegetation cover, dominated cover of ground surface attributes including Ground Litter in the Bluebunch Wheatgrass/Wyeth's Buckwheat community. Ground Litter with 29.1 % cover had highest cover among all cover categories. Cover of Rock was moderate while cover of cryptogams was low.

Species composition of the Bluebunch Wheatgrass/Wyeth's Buckwheat community had limited diversity. In the mid seral stage, Wyeth's buckwheat had highest cover among all species. Among herbaceous species, soft chess (Brmo) had highest cover, which together with annual forbs, comprised highest cover in the mid seral stand

Ecological Relationships. Ecological relationships of the Bluebunch Wheatgrass/Wyeth's Buckwheat plant community include:

- Higher elevation community of the Bluebunch Wheatgrass series.
- Balsamroot is the major increaser species.
- Presence of oniongrass indicates higher soil moisture that lasts longer into the season.
- This site had annual brome grass although J&S indicate that annual bromes do not inhabit the site.

Management Considerations: Management concerns of the Bluebunch Wheatgrass/Wyeth's Buckwheat plant community include:

- Overgrazing causes Bluebunch Wheatgrass to decline and Wyeth's buckwheat to increase.
- Yield is low compared to other communities in the Idaho fescue and Bluebunch Wheatgrass series.
- Fire as a management tool may increase Wyeth's buckwheat and Bluebunch Wheatgrass except if fire occurs during driest months.

Recommendations. Recommendations for improving the Bluebunch Wheatgrass/Wyeth's Buckwheat plant community include:

- Manage to maintain Bluebunch Wheatgrass on the site.
- Reduction of early season use may improve Bluebunch Wheatgrass and onion grass.

Bluebunch Wheatgrass-Onespike Oatgrass Community

Table . Characteristics of the Bluebunch Wheatgrass-Onespike Oatgrass Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.

Agsp- Posa3/Scan GB4112	4	Grass Forb Shrub Tree Soil Litt Rock Cryp		36.4 21.9 12.1 0.0 12.8 12.7 4.1 8.0	26.9 16.2 0.0 0.0 8.5 18.9 6.1 19.7	31.4 11.1 0.3 0.0 4.4 17.1 9.5 18.2	30.4 16.3 3.1 0.0 8.5 16.9 6.5 16.4	Agsp Posa Brbr Acmi Anten Bain Loam Scan Trdu		17.8 13.6 3.6 5.8 0.0 0.0 5.6 0.0 5.8	8.5 13.2 0.0 1.5 1.2 1.8 2.7 2.7 1.1	19.0 10.2 0.0 2.3 1.6 0.0 0.0 0.0 0.0	13.4 12.5 0.9 2.8 1.0 0.9 2.7 1.4 2.0

Community Characteristics:

Highest number of species in the Bluebunch Wheatgrass-Onespike Oatgrass community occurred in the mid seral stage. Grasses, especially Agsp and Posa3, had highest cover among all species in the three seral stages. Among forbs, biscuitroot and salsify had relatively high cover in the early seral stage.

Cover of grasses was high in the three seral stages measured while forb cover was highest in the early seral stage. Cover of shrubs was relatively high in the early seral stage. Bare soil was highest in the early seral stage and decreased in higher seral stages. Ground Litter was high in all seral stages and was especially high in the mid seral stage. Both Rock and Cryptogams had relatively high cover in the three seral stages. Cryptogams in the mid and late seral stages were highest among all plant communities in the UJCW.

Cover of annual brome grasses was low and confined to the early seral stage. Only Rattle Brome had any substantial cover in the stand. Ventenata and other annual grasses were not measured in the stand.

Ecological Relationships. Ecological relationships of the Bluebunch Wheatgrass-Onespike Oatgrass plant community include:

- Occupies gravelly steep canyon slopes.
- Bluebunch Wheatgrass dominates in late seral stages.
- Overgrazing causes decline in Bluebunch Wheatgrass and an increase in bare ground.
- Skullcap (Scan) increases as terracettes increase.

Skullcap indicates hot, dry and unstable slopes.

Management Considerations: Management considerations in the Bluebunch Wheatgrass-Onespike Oatgrass plant community include:

- Manage the community to maintain Bluebunch Wheatgrass.
- Large herbivore use should be initiated after soils dry to avoid creating terracettes.
- Use of the community by large herbivores should follow seed set.
- Fuel load may be insufficient to carry fire.

Recommendations. Recommendations for improving the Bluebunch Wheatgrass-Onespike Oatgrass plant community include:

- Location of plant community on southerly aspects limits total area of the community in the UJCW.
- Management of the community should focus on importance of the community to large wild herbivores in spring because of southerly aspect.

Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) Community

Table . Characteristics of the Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C 1	C2	C3	C4	Ave.
Agsp-Posa3 (Basalt) GB4113M	2	Grass Forb Shrub Tree Soil Litt Rock Cryp			25.6 6.9 0.4 0.0 21.6 20.7 19.6 5.0		25.6 6.9 0.4 0.0 21.6 20.7 19.6 5.0	Agsp Posa Juncu Brja Brbr Brte Vedu Alal Basa Blsc			6.7 0.9 0.9 1.8 1.0 12.0 1.4 1.4 1.7 1.4		6.7 0.9 0.9 1.8 1.0 12.0 1.4 1.4 1.7 1.4

Community Characteristics:

Grasses had highest vegetation cover in the single mid seral stand of the Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) community. Forb cover was moderate. Shrubs, which were present, had low cover. Both Bare Soil and Ground Litter had high ground surface cover. Rock also had high ground surface cover while Cryptogams had low ground surface cover.

Agsp had highest cover among perennial grasses. Higher cover of annual grasses dominated the stand. Among the annual grasses, Brte had 12.0 % cover. Other perennial grasses and all forbs had low cover in the mid seral stand.

Ecological Relationships. Ecological relationships of the Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) plant community include:

- Highest extension of the Agsp-Posa3 communities.
- Degradation reduces Bluebunch Wheatgrass and moss.
- Annual grasses, especially brome grasses, are common in earlier seral stages.
- Sandberg's bluegrass does not persist well on longer, steeper slopes.
- Hot fire and/or overgrazing by large herbivores promotes dense stands of annual grasses.

Management Concerns. Management consideration in the Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) plant community include:

- Community productivity is moderate.
- Cattle prefer Bluebunch Wheatgrass and Sandberg's bluegrass in the community.

Recommendations. Recommendations for improving the Bluebunch Wheatgrass-Sandberg's Bluegrass (Basalt) plant community include:

- Management of the community should focus on proper grazing to sustain Bluebunch Wheatgrass.
- Large herbivore grazing should end before boot stage and not resume until after flowering.

Scabland Communities

Communities in the Scabland series were relatively common. A total of 47 stands in four communities were evaluated. Scablands tend to be associated with broad ridgetops of the watershed and as the intermound component of the mound-intermound complex.

Bluebunch Wheatgrass-Sandberg's Bluegrass (Scabland) Community

Table . Characteristics of the Bluebunch Wheatgrass-Sandberg's Bluegrass (Scabland) Community.

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Agsp-Posa3	23	Grass		22.3	23.1	18.6	22.1	Agsp		5.1	5.7	8.3	5.7
(scabland)		Forb		13.6	14.4	10.5	13.4	Brca		2.1	0.0	0.0	1.2
		Shrub		0.2	0.2	0.0	0.2	Posa		2.9	6.6	5.1	4.3
GB4911 (Scab)		Tree		0.0	0.0	0.0	0.0	Brbr		0.7	1.2	0.0	0.8
		Soil		13.9	10.9	18.3	13.6	Brmo		1.4	1.8	0.0	1.3
		Litt		20.1	19.3	17.2	19.5	Brte		3.9	2.2	0.0	2.9
		Rock		7.6	11.5	20.2	10.5	Vedu		3.5	4.0	0.0	3.2
		Cryp		18.8	14.5	12.3	16.6	Bain		0.8	0.2	3.3	0.9
								Lotr		1.6	0.0	0.0	0.9
								Podo		0.6	1.4	0.0	0.8

Community Characteristics

Grasses had highest vegetation cover in all seral stages. Change in grass cover in the three seral stages was minimal. Forbs, which also had relatively high cover, had minimal differences in cover in the three seral stages. Shrubs were minimally present in the stand.

Both Bare Soil and Ground Litter had moderate vegetation cover in the three seral stages. Although cover of the two ground surface attributes was variable, no distinctive tendency existed.

Perennial grasses tended to have higher vegetation cover in mid and late seral stages. Annual grasses tended to have higher cover in the early seral stage although Ventenata had higher cover in the mid seral stage compared to the early seral stage.

Ecological Relationships. Ecological relationships of the Bluebunch Wheatgrass-Sandberg's Bluegrass (Scabland) plant community include:

- Transition community between Posa3-Daun and deeper soil Agsp and Feid communities.
- Agsp and Posa3 always dominate the rocky dry surface.

Management Considerations: Management considerations in the Bluebunch Wheatgrass-Sandberg's Bluegrass (Scabland) plant community include:

- Severe ungulate grazing and soil loss may induce the community.
- Manage to maintain bunchgrasses.
- Trampling may reduce moss coverage.
- Utilization should occur after soils dry and bunchgrasses flower.

Recommendations. Recommendations for improving the Bluebunch Wheatgrass-Sandberg's Bluegrass (Scabland) plant community include:

- Manage as a community associated with Feid-Kocr communities, especially the mound community.
- Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.

Stiff Sagebrush/Sandberg's Bluegrass Community

Table . Characteristics of the Stiff Sagebrush/Sandberg's Bluegrass Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Arri/Posa3	4	Grass		6.9	10.5		9.6	Daun		0.0	0.7		0.6
		Forb		12.9	9.0		10.0	Posa3		4.3	3.7		3.8
		Shrub		0.9	1.3		1.2	Sihy		0.9	0.5		0.6
SD9111		Tree		0.0	0.0		0.0	Vedu		0.0	5.4		4.1
		Soil		5.2	8.1		7.4	Loam		2.6	3.9		3.6
		Litt		12.0	14.7		14.0	Sela2		6.0	1.6		2.7
		Rock		38.5	23.6		27.4	Arri		0.9	1.3		1.0
		Cryp		20.5	27.1		25.5						

Community Characteristics:

Four stands of the Stiff Sagebrush/Sandberg's Bluegrass Community were evaluated. The dominant ground cover was Rock and Cryptogams which together had 59.0 % of ground surface cover. Among herbaceous growth forms, both grasses and forbs had moderate cover while shrubs had low cover. Bare soil had moderate cover and Ground Litter had moderate cover.

Grasses and shrubs had higher cover in the mid seral stage compared to the early seral stage while forb cover was less in the mid seral stage. All ground surface attributes except rock had higher cover in the mid seral stage. Cover of Rock decreased to 23.6 % in the mid seral stage compared to 38.5 % in the early seral stage.

The perennial grass with high cover in both the early and mid seral stage was Posa3. Ventenata had highest cover among all plants in the mid seral stage. Sela2 (Sedum) had highest cover among all species in the early seral stage but had substantially lower cover in the mid seral stage. Stiff sagebrush had low cover in both seral stages.

Ecological Relationships. Ecological relationships of the Stiff Sagebrush/Sandberg's Bluegrass plant community include:

- Community may have resulted from site degradation and soil erosion.
- Posa3 and Daun have low vigor on these sites and moderate disturbance may increase relative amounts of bare ground.
- Frost heaving increases with exposure of bare ground.

Management Considerations. Management considerations of the Stiff Sagebrush/Sandberg's Bluegrass plant community include:

- Reseeding of degraded sites has low probability of success because of shallow, rocky soils, potential for erosion, and high value of the Arri to wildlife.
- Fire use on the site is difficult and may damage grass crowns on bunchgrasses exposed by frost heaving.
- Site may have high potential for dominance by Ventenata.

Recommendations. Recommendations for improving the Stiff Sagebrush/Sandberg's Bluegrass plant community include:

- Manage as a community associated with Feid-Kocr communities, especially the Mound and Ridgetop communities.
- Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.
- Maintain Arri as a component of the community because of the high value diversity potential of the shrub within the prairie habitat.

Sandberg’s Bluegrass-Onespike Oatgrass (Scabland) Community

Table . Characteristics of the Sandberg’s Bluegrass-Onespike Oatgrass (Scabland) plant community.

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Posa3-Daun	16	Grass	14.6	22.5	15.5	24.8	18.7	Agsp	0.0	3.9	1.0	0.9	1.8
(Scabland)		Forb	12.6	12.3	17.1	24.0	15.9	Daun	1.3	1.2	1.2	6.7	1.9
		Shrub	0.0	0.0	0.4	0.0	0.2	Feid	0.0	1.7	0.0	1.1	0.7
GB9111		Tree	0.0	0.0	0.0	0.0	0.0	Posa3	9.1	4.8	5.1	3.0	5.3
		Soil	23.1	11.3	9.1	7.3	11.3	Brte	0.0	1.9	0.0	11.1	2.0
		Litt	11.6	17.2	16.3	11.4	15.4	Deda	0.0	0.0	1.8	0.0	0.8
		Rock	15.8	13.4	10.1	12.8	12.2	Vedu	4.0	5.1	4.2	0.0	3.9
		Cryp	19.1	15.5	27.6	19.5	21.8	Grna	0.0	1.4	0.7	0.0	0.7
								Loam	1.1	0.0	4.4	0.9	2.1
								Lotr	0.0	1.7	0.0	8.5	1.6
								Podo	2.5	0.5	4.7	0.0	2.5

Community Characteristics:

Sixteen stands of the Sandberg’s Bluegrass-Onespike Oatgrass (Scabland) community were evaluated. Both grasses and forbs had moderate to high cover in all seral stages. Ground surface attributes comprised nearly 70.0 % of ground surface cover. Generally, cover of herbaceous vegetation increased from the very early to late seral stages. Bare soil and Rock had decreasing cover in the mid and late seral stages while Ground Litter and Cryptogams had higher cover in the early and mid seral stages. Overall, ground surface attributes tend to dominate cover in the community in all seral stages.

Species of grass dominate over forbs in the community. Among the seven grass species, the perennial grass Posa3 and the annual grass Ventenata have highest cover in the very early, early and mid seral stages. In the late seral stage, cover of the perennial grass Daun was 6.7 %. The annual grass Brte had 11.1 % cover. Forbs had low cover in all seral stages except for Lotr in the late seral stage.

Annual grasses appear to be aggressive in this community. Ventenata appears to be aggressive in the very ealy and early seral stages and Brte appears to be aggressive in the late seral stage.

Ecological Relationships. Ecological relationships of the Sandberg’s Bluegrass-Onespike Oatgrass (Scabland) plant community include:

- Community forms a mantle of plants, rock, and moss which is able to withstand drought because of the moisture retention capabilities of the mantle.
- Often occurs as a mosaic with other scabland communities.
- Total herbage productivity is very low.

Management Considerations. Management considerations of the Sandberg’s Bluegrass-Onespike Oatgrass (Scabland) plant community include:

- Reseeding of degraded sites has low probability of success because of shallow, rocky soils, potential for erosion, and high value of the Arri to wildlife.
- Fire use on the site is difficult and may damage grass crowns on bunchgrasses exposed by frost heaving.
- Community has high wildlife value because of early greening of Sandberg's bluegrass and growth following fall rains.

Recommendations. Recommendations for improving the Sandberg's Bluegrass-Onespike Oatgrass (Scabland) plant community include:

- Manage as a community associated with Feid-Kocr communities, especially the Mound and Ridgetop communities.
- Grazing of the mound-intermound complex by large herbivores should occur only after scabland soils are dry and flowering of bunchgrasses on both mounds and intermounds has occurred.

Douglas' Buckwheat/Sandberg's Bluegrass Community

Table . Characteristics of the Douglas' Buckwheat/Sandberg's Bluegrass Community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Erdo/Posa3	4	Grass		45.5	3.6	25.1	24.0	Agsp		0.0	0.0	3.0	1.5
		Forb		13.6	10.8	17.9	15.0	Daun		0.0	0.0	0.0	2.0
		Shrub		0.0	4.5	3.4	2.8	Posa		12.2	3.6	10.5	9.2
FM9111		Tree		0.0	0.0	0.0	0.0	Sihy		2.3	0.0	0.0	0.6
		Soil		8.9	2.7	32.3	11.4	Stoc		0.0	0.0	3.1	1.5
		Litt		19.7	7.2	5.4	9.9	Brja		1.4	0.0	1.0	1.3
		Rock		2.7	13.5	6.1	8.4	Brte		16.9	0.0	3.7	6.1
		Cryp		5.1	56.7	12.1	25.1	Lotr		1.9	0.0	1.8	1.4
								Eppa		2.3	0.0	6.6	3.9
								Erdo		0.0	3.6	0.0	0.9

Community Characteristics:

Four stands of the Douglas' buckwheat/Sandberg's Bluegrass Community were evaluated. Grasses had high cover in all seral stages and very high cover in the earlier seral stages. Forbs had moderate cover in all seral stages. The shrub component had low cover in early, mid, and late seral stages. Bare soil had higher cover in the early and late seral stages compared to earlier seral stages. Ground Litter tended to have lower cover in the later seral stages. Both Rock and Cryptogams tended to have higher cover in later seral stages. Stands represented in the mid seral stage appear to have component cover influenced by higher cover of Rock and Cryptogam compared to stands in other seral stages.

Sandberg's Bluegrass (Posa3) and Brte had highest cover among species in the very early seral stage. The former species maintains relatively high cover in all seral stages except the mid seral stage. In the latter seral stage, Douglas Buckwheat has highest cover among all species. Cheatgrass is an indicator of the community in an early seral stage.

Ecological Relationships. Ecological relationships of the Douglas' Buckwheat/Sandberg's Bluegrass plant community include:

- Shallow soil Ridgetop communities.
- May be a product of past soil loss.
- Disturbance causes soil loss and erosion pavement.
- Herbage production similar to other scabland communities.

Management Considerations. Management considerations of the Douglas' Buckwheat/Sandberg's Bluegrass plant community include:

- No potential for revegetation.
- Avoid using communities when soils are water saturated.
- Insufficient biomass to carry fire.

Recommendations. Recommendations for improving the Douglas' Buckwheat/Sandberg's Bluegrass plant community include:

- Manage similar to other scabland communities.
- Domestic livestock use should be timed to occur when soils are dry and flowering/seed set of Sandberg's bluegrass has occurred.

Shrubland Communities

Shrub communities are a relatively minor community in the UJCW. Most shrub communities, except for the Common Snowberry-Rose community, are found as patches inhabiting small micro-environments or in association with forest. The majority of shrub communities are found in or near communities with forest overstory.

Common Snowberry-Rose Community

Table . Characteristics of the Common Snowberry-Rose plant community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Syal-Rosa	8	Grass		28.8	30.9		29.8	Agsp		2.0	3.5		2.8
		Forb		22.6	13.6		18.1	Daun		1.3	1.2		1.2
		Shrub		1.3	6.4		3.8	Feid		2.4	2.7		2.6
SM3111		Tree		0.0	0.0		0.0	Phpr		2.4	0.0		1.2
		Soil		14.7	15.1		14.9	Popr		7.2	4.8		6.0
		Litt		30.5	26.0		28.2	Brja		2.4	0.4		1.4
		Rock		0.4	4.4		2.4	Brmo		1.1	3.7		2.4
		Cryp		1.6	0.7		1.2	Vedu		6.1	7.8		7.0
								Getr		6.3	1.2		3.7
								Pogr		3.1	0.0		1.5
								Eppa		1.5	0.7		1.1
								Syal		0.2	2.6		1.4

Community Characteristics:

Eight stands of the Common Snowberry-Rose Community were evaluated in the UJCW. Vegetation in the stands was classified to the early and mid seral stages. Species diversity of the plant community which included eight grasses, three forbs and one shrub, was high.

Grasses and forbs dominated ground surface cover. Average cover of grasses increased from 28.8 % in the early seral stage to 30.9 % in the mid seral stage. Forbs had higher cover in the mid seral stage compared to the early seral stage. Ground Litter had very high cover in both seral stages. Bare soil had moderate cover and Rock and Cryptogam had low cover. The high vegetation and Ground Litter cover indicate that sites dominated by the Common Snowberry-Rose community have high productivity.

Grasses in the community are dominated by perennials. Kentucky bluegrass has highest perennial grass cover in both the early and mid seral stages.Both Bluebunch Wheatgrass and Idaho fescue, which are native perennials, have higher cover in the mid seral stahe compared to the early seral stage. Soft chess and Ventenata had higher cover in the mid seral stage compared to the early seral stage.

Ecological Relationships. Ecological relationships of the Common Snowberry-Rose plant community include:

- Increase of Syal-Rosa may be due to lack of fire or overgrazing.
- Increase in shrubs may be a response to favorable moisture.

Management Considerations. Management considerations of the Common Snowberry-Rose plant community include:

- Snowberry is palatable to cattle and sheep and can stand moderate grazing intensity.

- Resistant to fire and sprouts after burning.
- Reduction in shrubs may be achieved by combination of burning and grazing.
- Important habitat for wildlife.

Recommendations. Recommendations for improving the Common Snowberry-Rose plant community include:

- Manage to maintain shrub stands but monitor to prevent invasive tendencies of the shrubs.
- Especially monitor the Rosa component.

Mountain Snowberry Community

Table . Characteristics of the Mountain Snowberry plant community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Syor	1	Grass			35.1		35.1	Agsp			6.9		6.9
		Forb			6.0		6.0	Caru			5.2		5.2
SM32		Shrub			14.0		14.0	Popr			23.8		23.8
		Tree			0.0		0.0	Acmi			2.8		2.8
		Soil			3.2		3.2	Vame			6.0		6.0
		Litt			29.0		29.0	Syor			4.8		4.8
		Rock			0.0		0.0	Spbe			3.2		3.2
		Cryp			0.0		0.0						

Community Characteristics.

A single stand of the Mountain Snowberry community in the mid seral stage was evaluated. Grasses and Ground Litter had highest cover among cover components. The community also had the highest shrub cover in the UJCW. Rock and Cryptogam cover was not measured in the stand and cover of Bare Soil was low.

Perennial grasses dominated cover. In the mid seral stand, Kentucky Bluegrass had 23.8 % cover while Bluebunch Wheatgrass and Pinegrass had moderate cover. In addition to Mountain Snowberry, two other shrubs were present at the stand. Both Huckleberry and Spirea had moderate cover in the mid seral stand.

Ecological Relationships. Ecological relationships in the Mountain Snowberry plant community include:

- Often a dominant species in ecotonal communities between forest and grassland.
- May dominate on mounds near forested communities of ridgetops.
- Kentucky bluegrass often is an invasive, herbaceous dominant on Syor dominated mounds.

Present on higher elevation slopes with forbs dominating the herbaceous understory.

Management Considerations. Management considerations in the Mountain Snowberry plant community include:

- Manage to maintain the diversity offered by Syor.
- Important habitat for a diversity of wildlife.
- Promote natural reseeding with existing vegetation.

Recommendations. Recommendations for improving the Mountain Snowberry plant community include:

- Manage to maintain current stands of mountain snowberry where they occur.
- Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as "elk calving."

Ninebark-Common Snowberry Community

Table . Characteristics of the Ninebark-Common Snowberry plant community

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Phma-Syal	1	Grass	20.0				20.0	Agro	14.2				14.2
		Forb	6.7				6.7	Agsp	1.7				1.7
		Shrub	3.3				3.3	Phpr	3.3				3.3
		Tree	0.0				0.0	Eppa	1.7				1.7
SM19X		Soil	17.5				17.5	Trma	1.7				1.7
		Litt	31.7				31.7	Phma	3.3				3.3
		Rock	0.1				0.1						
		Cryp	0.1				0.1						

Community Characteristics:

A single stand of the Ninebark-Common Snowberry community was evaluated. Similar to the Mountain Snowberry community, Grasses and Ground Litter had highest cover, together accounting for over 50.0 % of total ground surface cover. Shrubs had low cover in the stand. Cover of Bare Soil in the stand was high.

Grasses had high cover in the very early seral stage. Introduced wheatgrasses and Timothy together had over 50.0 % ground surface cover in the very early seral stage.

Ecological Relationships. Ecological relationships of the Ninebark-Common Snowberry plant community include:

- Common to north aspects of bunchgrass dominated canyon slopes.
- Shrub sites may or may not be related to forest overstory potential depending on soil depth and moisture retention capacity.

Management Considerations. Management considerations of the Ninebark-Common Snowberry plant community include:

- Forage productivity is high in early seral stages but low in advanced seral stages because of shade provided by shrubs.
- Important as wildlife habitat.
- Moderately resistant to fire and probably sprouts following burning.

Recommendations. Recommendations for improving the Ninebark-Common Snowberry plant community include:

- Manage to maintain current stands of Ninebark-Common snowberry where they occur.
- Utilize primarily by wildlife by insuring timing of domestic livestock use does not conflict with important wildlife events such as “elk calving.”

Oldfield Communities

Characteristics of Oldfield Communities

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Old-Brin		Grass	31.0				31.0	Brin	13.7				13.7
Smooth		Forb	15.9				15.9	Phpr	2.4				2.4
Brome		Shrub	0.0				0.0	Popr	6.5				6.5
		Tree	0.0				0.0	Acmi	1.6				1.6
		Soil	21.1				21.1	Hial2	1.6				1.6
		Litt	21.6				21.6	Pogr	1.3				1.3
		Rock	0.8				0.8	Eppa	1.1				1.1
		Cryp	0.3				0.3	Magl	1.0				1.0
Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Old-Elre	2	Grass	27.2				27.2	Elre	5.3				5.3
Elymus		Forb	13.1				13.1	Feid	5.5				5.5
		Shrub	0.0				0.0	Pobu	2.0				2
		Tree	0.0				0.0	Posa	2.6				2.6
		Soil	14.1				14.1	Acmi	2.6				2.6
		Litt	45.6				45.6	Getr	1.2				1.2
		Rock	0.0				0.0	Luse	1.8				1.8
		Cryp	0.0				0.0	Pogr	1.5				1.5
								Coli2	1.5				1.5
Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.

Old-Popr	2	Grass	45.8				45.8	Agro	2.0				2.0
Kentucky		Forb	33.6				33.6	Agpu	2.2				2.2
Bluegrass		Shrub	0.0				0.0	Brca	5.9				5.9
		Tree	0.0				0.0	Phpr	5.1				5.1
		Soil	5.2				5.2	Popr	20.8				20.8
		Litt	15.4				15.4	Brmo	2.0				2.0
		Rock	0.0				0.0	Brte	4.6				4.6
		Cryp	0.0				0.0	Vedu	2.5				2.5
								Acmi	12.3				12.3
								Getr	1.5				1.5
								Lalu	1.0				1.0
								Lule	3.5				3.5
								Luse	1.6				1.6
								Pogr	2.0				2.0
								Trdu	2.2				2.2
								Erhe	1.0				1.0

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Old-Phpr	1	Grass	18.6				18.6	Equis	1.2				1.2
Timothy		Forb	17.8				17.8	Kocr	2.4				2.4
		Shrub	0.0				0.0	Phpr	14.7				14.7
		Tree	0.0				0.0	Brte	1.6				1.6
		Soil	30.9				30.9	Mufi	1.2				1.2
		Litt	31.3				31.3	Erpu	1.6				1.6
		Rock	0.0				0.0	Fragaria	4.8				4.8
		Cryp	1.6				1.6	Lupine	1.2				1.2
								Penst	2.0				2.0
								Phlox	2.8				2.8

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Old-Agro	7	Grass	38.8				38.8	Agcr	1.6				1.6
Wheatgrass		Forb	12.5				12.5	Agro	21.8				21.8
		Shrub	0.5				0.5	Brin	2.0				2.0
		Tree	0.0				0.0	Feid	2.3				2.3
		Soil	12.4				12.4	Phpr	2.8				2.8
		Litt	28.7				28.7	Popr	3.2				3.2
		Rock	2.2				2.2	Posa	3.8				3.8
		Cryp	2.5				2.5	Brte	1.1				1.1
								Acmi	3.3				3.3
								Luse	1.5				1.5
								Pogr	1.0				1.0

Community Characteristics.

A total of   Oldfield Communities were evaluated in the UJCW. Community types included Smooth Brome, Elymus, Kentucky Bluegrass, Timothy, and Wheatgrass. As a result of prior cultivation, including deep plowing to destroy the native plant community, Oldfields located in the UJCW are presumed to be in an ecological Disclimax or a very early seral stage. Since some Oldfields have evidence that ecological succession is occurring, Oldfields in general are regarded as being in a very early seral stage.

Cover of Grasses in all Oldfields except the Timothy Oldfield was high, Cover of grasses ranged between 18.6 % in the Timothy Oldfield and 45.8 % in the Kentucky Bluegrass Oldfield. Except in the Kentucky Bluegrass Oldfield, cover of forbs was moderate. Shrub cover, if present at all, was very low. Cover of Bare Soil ranged from low to high depending on the Oldfield community. Cover of Rock and Cryptogam was low in all Oldfield communities.

Oldfield communities, except for the Kentucky Bluegrass Oldfield, had an average number of species present. The former Oldfield community had a diversity of species of which many were members of surrounding native communities. Although annual grasses and forbs were represented in most Oldfield communities, cover of these species was low. Cheatgrass and Ventenata, which are invasive annual grasses, had highest cover in the Kentucky Bluegrass Oldfield community. Future dominance of Oldfield communities by invasive annual grasses appears unlikely.

Ecological Relationships. Ecological relationships of Oldfield plant communities include:

- Oldfields, because of previous cultivation, are classified as being in a very early seral stage or "Disclimax."
- Although oldfields appear as monocultures, most oldfields are a mosaic of native communities (either areas on the boundary not cultivated or patches with some reestablishment of native species).
- Successional timelines for reestablishment of the prior native community are unknown but probably are long term.
- Potential for establishment of invasive weedy species is probably high but currently unknown.
- Dominant forage species are introduced perennial grasses capable of withstanding heavy grazing by domestic livestock.
- Oldfields prior to cultivation and cropping were probably characterized by deep soils with favorable moisture holding capacity which led to their selection as cropland.

Management Considerations: Management considerations of Oldfield plant communities include:

- Accelerating natural succession in oldfields is improbable because of soil disturbance caused by prior cultivation.
- Highest value use of oldfields is to produce forage for wild and domestic herbivores.
- Consideration should be given to applied research initiatives to track succession towards native communities to determine potential for successfully restoring native communities.

Recommendations. Recommendations for improving Oldfield plant communities include:

- Reseeding oldfields to best adapted introduced or native forage species should be part of a management plan for the UJCW.
- Highly productive oldfields should be used to reduce grazing pressure on native communities during implementation of native community improvement alternatives.

Meadow/Riparian Communities

Table . Characteristics of the Meadow/Riparian Communities plant communities.

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Mead-	4	Grass		36.7			36.7	Carex		4.9			4.9
Sedge		Forb		10.7			10.7	Phpr		11.8			11.8
(moist)		Shrub		0.0			0.0	Popr		4.0			4.0
		Tree		0.0			0.0	Juncu		5.9			5.9
Mead/R		Soil		21.7			21.7	Acmi		2.0			2.0
		Litt		19.7			19.7	Aster		1.1			1.1
		Rock		5.0			5.0	Pogr		2.1			2.1
		Cryp		6.9			6.9						

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Mead-	5	Grass		46.2	40.8		45.1	Agro		1.1	2.3		1.3
Complex		Forb		11.0	29.5		14.7	Carex		1.9	3.4		2.2
		Shrub		0.1	0.0		0.1	Daca		3.5	9.8		4.7
Mead/C		Tree		0.0	0.0		0.0	Agre		2.4	0.0		1.9
		Soil		16.2	1.1		13.2	Feid		1.3	0.0		1.1
		Litt		25.1	27.8		25.6	Phpr		4.0	4.6		4.1
		Rock		3.7	0.0		3.0	Popr		4.4	14.5		6.4
		Cryp		2.7	0.0		2.1	Posa		4.6	0.0		3.7
								Jupa		5.2	0.0		4.1
								Juncu		1.1	1.1		1.1
								Brmo		7.0	0.0		5.6
								Brome		9.3	0.0		7.4
								Arnica		1.5	0.0		1.2
								Erpu		0.0	7.0		1.4
								Lotr		2.3	0.0		1.8
								Pogr		2.0	19.7		5.5
								Taof		0.8	1.8		1.0

Community Characteristics.

Nine Meadow Community stands were evaluated in the UJCW. Four of the stands represented a moist meadow dominated by typical meadow plant species. Five stands were representative of Ridgetop Meadows.

Both meadow types in the early seral stage had high cover of Grasses, Ground Litter and bare Soil. The Meadow-Ridgetop had higher forb cover than the Wet Sedge meadow. In both meadow communities, cover of Rock and Cryptogams was low.

Less species diversity was found in the Meadow/Sedge community compared to the Meadow – ridgetop. The latter meadow community had highest species number of any plant community evaluated in the UJCW. The majority of species in the meadow communities were perennial grasses and grasslikes. Introduced perennial grasses dominated vegetation cover. Kentucky bluegrass and Timothy had high cover in both communities. In the Meadow-ridgetop community, most perennial grasses had higher cover in the mid seral stage compared to the early seral stage. Forb cover, although low in both seral stages, tended to have higher cover in the mid seral stage.

Ecological Relationships. Ecological relationships of Meadow plant communities include:

- Occupy areas with standing water throughout the summer.
- Nutrient level is high throughout the summer because of moist growing environment.
- Heavy and continuous use can degrade meadow and change moisture regimes by "drying out the site."
- Meadow degradation results in change in species composition.

Management Considerations. Management considerations of Meadow plant communities include:

- Meadows are important wildlife habitat and provide diversity in the Bunchgrass Steppe.
- High nutrient level in forage and general association with surface water and deciduous shrub and tree vegetation attract wildlife and domestic animals.
- Management of meadow/riparian areas often dictates management of associated uplands.
- Important habitat for all animal species because of water, shade and succulent forage over the summer.

Recommendations. Recommendations for improving Meadow plant communities include:

- Meadows and Riparian areas require coordinated management with upland grass steppe.
- Management focus should be not only on protection/exclusion but also on shifting timing and density of large herbivore use.
- Trials to establish deciduous woody growth forms to stabilize riparian areas and diversify habitat should be initiated.

Annual Grass Community

Table . Characteristics of the Annual Grass plant community.

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Cheatgrass (Degraded)	1	Grass Forb Shrub Tree Soil Litt Rock Cryp	23.0 0.6 0.0 0.0 4.3 4.6 59.3 7.6				23.0 0.6 0.0 0.0 4.3 4.6 59.3 7.6	Brte Eppa	23.0 0.3				23.0 0.3

Community Characteristics.

Only one stand dominated by annual grasses was evaluated. Grasses dominated vegetation cover and Rock dominated ground surface cover. All other vegetation and ground surface attributes had low cover.

Two annual plants dominated vegetation cover of the stand. Cheatgrass had 23.0 % cover and willowweed had very low cover.

Ecological Relationships. Ecological relationships of Annual plant communities include:

- Sites dominated by annual grasses such as cheatgrass usually have small spatial area and reflect major past and present disturbance.
- Ventenata appears to be a relatively recent invasive annual grass about which little information exists.

Management Considerations. Management considerations of Annual plant communities include:

- Annual grasses, especially the annual bromes, can provide high quality forage for all kinds of herbivores during early growth.
- It is questionable if a serious effort to reduce or eradicate annual brome grasses in the UJCW is either desirable or possible.

Recommendations. Recommendations for improving Annual plant communities include:

- Manage to increase establishment potential and sustainability of caespitose bunchgrasses in stands with high density of Chgeatgrass and Ventenata.

- Initiate applied research initiatives to study Ventenata to increase information about invasive potential and habit requirements.

Douglas Fir/Common Snowberry

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Psme/Syal	11	Grass		15.4	18.7	25.7	20.9	Agsp		0.0	0.4	8.7	3.4
		Forb		4.0	7.4	20.9	12.0	Brca		0.0	0.9	1.4	1.0
		Shrub		0.7	2.6	2.2	2.3	Caru		12.1	7.3	3.1	6.3
CDG121		Tree		10.0	5.0	0.0	3.6	Feid		1.3	2.0	5.0	3.0
		Soil		2.7	7.2	15.3	9.7	Popr		0.0	1.0	2.0	1.7
		Litt		57.8	55.0	28.1	45.5	Acmi		1.3	1.0	2.5	1.5
		Rock		0.0	1.0	2.7	1.5	Getr		0.0	0.2	4.3	1.7
		Cryp		0.0	0.9	3.7	1.8	Syal		0.0	1.7	0.0	0.9
								Pipo		10.0	5.0	0.0	3.6

Ponderosa Pine/Idaho Fescue

Community	No.	Cover (%)						Dominant Species (%)					
			C1	C2	C3	C4	Ave.		C1	C2	C3	C4	Ave.
Pipo/Feid	1	Grass			31.0		31.0	Agsp			6.4		6.4
		Forb			13.9		13.9	Caru			1.6		1.6
		Shrub			0.5		0.5	Feid			10.2		10.2
CPG13		Tree			0.0		0.0	Popr			1.6		1.6
		Soil			23.5		23.5	Posa3			2.1		2.1
		Litt			20.8		20.8	Brja			6.4		6.4
		Rock			5.9		5.9	Acmi			1.6		1.6
		Cryp			4.3		4.3	Arnica			2.1		2.1
								Erigeron			1.1		1.1
								Getr			2.1		2.1
								Hial2			1.1		1.1
								Lupine			1.1		1.1
								Pogr			1.6		1.6

Community Comparison

Daubenmire (1970), in an earlier publication on steppe vegetation of Washington, describes communities that have obvious similarities to grass steppe rangeland of Zumwalt Prairie and the Imnaha/Snake River Canyon as described by Johnson and Simon (1987) and evaluated during 2002 in the UJCW. Associations that appear to be very similar in species composition, location within the landscape, response to disturbance factors, and management implications are described below (Table).

Table .

Daubenmire (1970)	Johnson and Simon (1987)
Idaho fescue-Common Snowberry	Idaho fescue-Prairie junegrass
Bluebunch Wheatgrass-Sandberg’s Bluegrass	Bluebunch Wheatgrass-Sandberg’s Bluegrass
Bluebunch Wheatgrass-Idaho Fescue	Idaho Fescue-Bluebunch Wheatgrass
Bluebunch Wheatgrass-Sandberg’s bluegrass	Bluebunch Wheatgrass-Sandberg’s bluegrass
Stiff sagebrush-Sandberg’s bluegrass	Stiff sagebrush-Sandberg’s bluegrass
Buckwheat-Sandberg’s Bluegrass (Lithosols)	Sandberg’s Bluegrass-Onespike Oatgrass (Scablands)

Idaho Fescue-Common Snowberry Association

Characteristics of the Idaho fescue-Common snowberry association as described by Daubenmire (1970) that are pertinent for management of the UJCW include:

- Kentucky bluegrass is the leading increaser species under heavy grazing pressure.

- The presence of Prairie Junegrass and a wide variety of perennial forbs is indicative of a wetter climate.

- Species diversity, especially perennial forbs, is at a maximum in the wettest portion of grass steppe and culminates in the meadow steppe belt of grass steppe rangelands.

- Perennial forb species have high constancy throughout the association but can have considerable variation between stands.

- Bluebunch Wheatgrass tends to be both rhizomatous and caespitose in the association.

- Approximately one-third of the perennial forbs remain photosynthetically active during the winter.

- Flowering of annuals is concentrated earlier during the season than perennials.

- Common snowberry and rose are palatable and decline under heavy grazing.

- All the invader plants and more than half of the increaser plants are annual plants.

- Native perennial grasses reduced by heavy grazing are replaced by Kentucky bluegrass. Although native plants may have more to offer relative to food and nutrient diversity, Popr remains palatable with maturity and can better withstand heavy grazing. The amount of Popr in a measure of the most extreme degradation to which a stand has been subjected.

- In lightly grazed stands, Bromus mollis, B. japonicus, and B. brizaeformis are often abundant.

- Shrub thickets (i.e., Common snowberry-Rose as described by J&S, 1987) are considered a phase of the same association and represent a reversal of dominance between the herbaceous and woody components of the association.

Bluebunch Wheatgrass-Idaho Fescue Association

Characteristics of the Bluebunch Wheatgrass-Idaho fescue association as described by Daubenmire (1970) that are pertinent for management of the UJCW include:

- In undisturbed stands, vegetation in the Bluebunch Wheatgrass-Idaho Fescue association is dominated by Bluebunch Wheatgrass and Idaho Fescue, and secondarily by Sandberg’s bluegrass.

- The Bluebunch Wheatgrass-Idaho Fescue association differs from the Bluebunch Wheatgrass-Sandberg’s Bluegrass association only by the presence of Idaho Fescue.

- In locations where Bluebunch Wheatgrass-Idaho Fescue intersects with stands in the Idaho Fescue-Common Snowberry Association, the latter association occupies relatively xeric slopes.

- Fire tends to invigorate Bluebunch Wheatgrass in this association while potentially having little impact on the Idaho Fescue component.

- Every month throughout the year the Bluebunch Wheatgrass-Idaho Fescue association is warmer than the Idaho Fescue-Common Snowberry association and the P/T ratio is lower for at least 6 months.

Bluebunch Wheatgrass-Sandberg's Bluegrass

Characteristics of the Bluebunch Wheatgrass-Sandberg's Bluegrass association as described by Daubenmire (1970) that are pertinent for management of the UJCW include:

- Undisturbed vegetation of the Bluebunch Wheatgrass-Sandberg's Bluegrass association consists primarily of the two caespitose grasses. Approximately 80 % of dry matter is provided by Bluebunch Wheatgrass.

- Growth of plants in the association reflects the hot-dry extreme of climatic variation in the Washington steppe. Approximately half of the perennial forbs begin new growth with fall rains and remain green over winter. The most pervasive annuals germinate in the spring with peak photosynthetic activity in April and turnover to litter by late summer.

- All perennials and shrubs and half shrubs present in the association go completely dormant in the winter. Shrubs readily sprout following fire and grasses are usually stimulated unless the fire is too hot. A hot fire may open up the community to invasive annuals.

- Overgrazing by large herbivores may eliminate Bluebunch Wheatgrass and reduce Sandberg's bluegrass. Cheatgrass and Rabbitbrush usually replace the caespitose bunchgrasses with overgrazing unless overgrazing by sheep seeking the annual bromes occurs. Sheep grazing may stimulate Sandberg's Bluegrass.

- Oldfields developed from the Bluebunch Wheatgrass-Sandberg's Bluegrass community and subsequently abandoned tend to develop dense stands of Cheatgrass. Rabbitbrush also tends to increase density in the abandoned oldfields.

- Stands of Bluebunch Wheatgrass-Sandberg's Bluegrass are found in a warmer environment than stands of Idaho Fescue-Common Snowberry. The latter association has colder temperature every month. The former association has a higher precipitation/temperature ratio (P/T) during November through March and a lower P/T during April, May, and June. In July, August, and September, P is higher in the latter association.

Stiff sagebrush-Sandberg's bluegrass.

Characteristics of the Stiff Sagebrush-Sandberg's Bluegrass association as described by Daubenmire (1970) that are pertinent for management of the UJCW include:

- The community is recognized by well-spaced stiff sagebrush plants supported by Sandberg's bluegrass on thin stony soil overlaying basaltic bedrock

- Litter from the deciduous shrub, together with mosses, tends to build mounds.

- Species diversity is high but productivity and cover of any one species is low.

- Stiff sagebrush is highly preferred browse by elk, and cattle at specific times. Cheatgrass is the most obvious increaser species in the community.

Annex 2. Species composition of shrub and herbaceous layers in forest biophysical groups.

Shrub Composition

Stands in both grand fir ecotypes had between 14 and 15 shrub species in the shrub layer. Total cover in the shrub layer of the two ecotypes was 19.34 % and 24.32 %, respectively. Shrubs with highest cover (>1.0 %) in tree stands of the Abgr/Clun ecotype were Acglg (1.0 %), Libo (2.5 %), Pamy (1.13 %), Rogy (2.38 %), Syal (3.46 %), and Vame (2.46 %). Although shrub species composition and cover were similar in stands of the two grand fir ecotypes, cover of the important shrub species was generally higher in the Abgr/Libo2 ecotype. Cover of Libo2 (2.88 %), Pamy (1.25 %), Rogy (2.88 %), and Vame (4.25 %) was higher while cover of Acglg (0.38 %) and Syal (2.88 %) was lower. Tree stands in the Abgr/Libo2 ecotype also had relatively high cover of Loin (1.38 %).

Total browse yield of shrubs averaged 304.9 kg/ha in tree stands of the Abgr/Clun ecotype and 161.5 kg/ha in stands of the Abgr/Libo2 ecotype. Shrub species contributing most to browse yield in stands of the Abgr/Clun ecotype were Libo (112.6 kg/ha), Vame (30.3 kg/ha), Syal (28.6 kg/ha), Cesa (24.0 kg/ha), Chum (13.5 kg/ha) and Amal (15.5 kg/ha). Shrub species contributing most to browse yield in stands of the Abgr/Libo2 ecotype were Libo2 (33.4 kg/ha), Vame (18.1 kg/ha), Rogy (17.2 kg/ha), Syal (16.5 kg/ha) and Spbe (16.4 kg/ha). Although different shrub species dominated yield in the two ecotypes, all shrub species that contributed most to yield in one ecotype were present in the other ecotype.

Shrub species number and cover in stands of two Douglas fir ecotypes (Psme/Syal and Psme/Caru ecotypes) were similar to both grand fir ecotypes. Stands of the Psme/Cage ecotype had fewer shrub speices but cover similar to other Douglas fir ecotypes and the grand fir ecotypes. In stands of the Psme/Syal and Psme/Caru ecotypes, average cover of shrubs was 19.34 % and 13.65 % , respectively. Stands in the Psme/Cage ecotype had 18.1 % shrub cover. Shrubs with highest cover (>1.0 %) in stands of the Psme/Syal ecotype were Acglg (2.73%), Phma (1.18 %), Rogy (1.34 %), Spbe (3.64 %), and Syal (4.93 %). Shrubs with highest cover in stands of the Psme/Caru ecotype were Spbe (4.62 %), Syal (3.65 %), Amal (1.73 %) and Bere (1.15 %). Although the number of shrub species in stands of the Psme/Cage ecotype were lower, average shrub cover and cover of individual shrub species was higher. Among shrub species in the latter ecotype, Apme had highest cover (8.13 %) followed by Amal and Libo (3.75 %), Rogy and Syal (5.0 %), Spbe (2.5 %) and Acglg, Aruv, and Loin (1.25 %).

Shrubs in stands of the Douglas fir ecotypes also differed in amount of browse available. Shrubs in stands of Psme/Syal and Psme/Caru ecotypes had lower browse yield (144.3 and 89.2 kg/ha, respectively) compared to the Psme/Cage ecotype (280.0 kg/ha). Shrubs in stands of the Psme/Syal ecotype providing highest browse yield (>10.0 kg/ha) were Syal (56.2 kg/ha), Vame (14.0 kg/ha), Phma (17.1 kg/ha), Libo (13.9 kg/ha) and Lout2 (9.9 kg/ha). Shrubs in stands of the Psme/Caru ecotype providing highest browse yield were Amal (19.9 kg/ha), Ronuh (17.8 kg/ha), Libo (14.8 kg/ha) and Spbe (10.1 kg/ha). Other shrubs providing lower amounts of browse yield in the two ecotypes were generally the same species. However, shrub species providing highest browse yield in stands of the Psme/Cage ecotype were different than shrub species in the other Douglas fir ecotypes. Highest browse yield was provided by Rogy (44.8 kg/ha) followed by Vame, Pamy, and Loin (23.0-25.0 kg/ha), and Ceve and Rupa (15-16 kg/ha).

Few shrubs were found in the understory of tree stands in the two ponderosa pine ecotypes. The average number of shrubs in stands of the Pipo/Cage ecotype was 10 while the single stand measured in the Pipo/Feid ecotype had two shrubs. Shrub cover in stands of the Pipo/Cage ecotype was 18.1 %, which was lower but within the range of shrub cover in the grand fir and Douglas fir ecotypes. Shrub species with highest cover (>1.0 %) were Vame (3.8 %), Syal and Rogy (3.1 %), Rupa (1.9 %), and Ceve, Pamy, and Riau (1.3 %). Shrub cover (10.0%) in the single stand of the Pipo/Feid ecotype was the lowest of the seven ecotypes studied. Cover of the single shrub species, Ronuh, was 10.0 %.

Average browse yield of shrub species in stands of the Pipo/Cage ecotype was 285.3 kg/ha which was higher than browse yield in grand fir and Douglas fir ecotypes. Highest browse yield in this ecotype was provided by Rogy (44.8 kg/ha) followed by Vame (25.8 kg/ha), Pamy (25.0 kg/ha), Loin (23.0 kg/ha), Ceve (16.3 kg/ha) and Rupa (15.0 kg/ha). The Pipo/Feid ecotype had the lowest browse yield of all ecotypes. Amal and Ronuh together provided 5.0 kg/ha of browse yield.

Herbaceous Plant Composition

Stands in the grand fir ecotypes had similar herbaceous species composition. Both ecotypes had 15 species of grasses. The Abgr/Clun ecotype had 58 species of forbs and the Abgr/Libo2 ecotype had 49 species of forbs. Although some difference in grass and forb species occurred in the two grand fir ecotypes, dominate species were the same in both ecotypes.

Average cover of grasses was higher in stands of the Abgr/Clun ecotype (21.59 % vs. 17.67 %) while average cover of forbs was nearly the same in both grand fir ecotypes (77.74 % vs. 73.75 %). Grass species with highest cover in stands of both ecotypes were Feid, Popr, Ag sp., Brca, and Cage. These species together comprised 13.77 % of cover in the Abgr/Clun ecotype and 12.52 % of cover in the Abgr/Libo2 ecotype. Stands in the Abgr/Clun ecotype also had relatively high cover of Caru (1.13 %) and Elgl (1.00 %). Forb species with relatively high cover in stands of both ecotypes were Acmi, An sp., Adbi, Anpi, Arma3, Clun, Cygr, Frve, Gatr, Hial2, Mist, Osch, Thmo, Thoc, Tr. sp. and Vi sp. These species together comprised 47.90 % of plant cover in the Abgr/Clun ecotype and 51.04 % of cover in the Abgr/Libo2. Forb species which had high cover only in stands of the Abgr/Clun ecotype were Civu (1.00 %), Cogr (1.25 %), Eppa (2.00 %), Magl (1.88 %), Ptaq (2.63 %), and Smst (2.54 %). Forb species which had high cover only in stands of the Abgr/Libo2 ecotype were Frvi (1.25 %), Pera (1.25 %), and Sest (3.75 %).

Avarage stand yield of grasses in both ecotypes was similar. In the Abgr/Clun ecotype, grass yield was 226.2 kg/ha while in the Abgr/Libo2 ecotype grass yield was 209.5 kg/ha. Grass species contributing most to yield in stands of both ecotypes were Ag. sp., Brca, Cage, Caru, Feid, Phpr, Popr and Unknown grasses. These species together comprised 85.9 % of grass yield in stands of the Abgr/Clun ecotype and 88.4 % of grass yield in stands of the Abgr/Libo2 ecotype. Grass species which had high yield (>10.0 kg/ha) only in stands of the Abgr/Clun ecotype were Ca sp. (11.2 kg/ha) although Brin, Brte, Caho, Pone3, and Posa3 contributed between 1.9 and 9.7 kg/ha to total grass yield. No other grass species in stands of the Abgr/Libo2 ecotype contributed more than 10.0 kg/ha to total grass yield but Kocr and Tr sp. each contributed 8.7 kg/ha.

Average stand yield of forbs in the two ecotypes was different. Average forb yield in the Abgr/Clun ecotype was 607.4 kg/ha while average forb yield in the Abgr/Libo2 ecotype was only 220.3 kg/ha. Despite the large difference in yield, many forb species contributing to stand yield occurred in both ecotypes. Forb species with relatively high yield in stands of both ecotypes were Acmi, An sp., Adbi, Anpi, Arma3, Clun, Civa, Eppa, Frve, gatr, Hial2, Hype, Lu sp., Magl, Mist, Osch, Pera, Thmo, Pogl, Ptaq, Ruoc, Thoc, Tr sp., and Vi sp. These species together comprised 89.9 % of forb yield in stands of the Abgr/Clun ecotype and 95.7 % of forb yield in stands of the Abgr?Libo2 ecotype. Forb species contributing at least 1.0 kg/ha of total forb yield that were not common to the two ecotypes were Ca sp., Capu, Cygr, Cyof, Lase, Li sp., Podo, Ruac, Smst, Soca, Taof, Thme, and Trdu in the Abgr/Clun ecotype and Arco, Ditr, Frvi, La sp., Pebo, Prvu, Smra, Tr sp., and Veca in the Abgr/Libo2 ecotype.

The herbaceous layer in stands of three Douglas fir ecotypes was evaluated as to species number, cover , and yield. Stands in all Douglas fir ecotypes had similar cover of grasses and forbs. Stands in the Psme/Syal ecotype appeared be closely related to stands in the grand fir ecotypes. Although grass cover was higher and forb cover was lower, the number and species of grass and forb species were similar. Stands in the Psme/Caru ecotype had less species of grass and forbs than either the Psme/Syal ecotype or the grand fir ecotypes but cover of grasses and forbs was similar to the Psme/Syal ecotype. The number of grass and forb species in stands of the Psme/Cage ecotype were lower than the other Douglas fir ecotypes and the grand fir ecotypes. This ecotype appeared to be a transition ecotype between Douglas fir ecotypes and ponderosa pine ecotypes.

Grass cover in the three ecotypes averaged between 30.38 % and 33.75 %. Species of grass with highest cover in all three Douglas fir ecotypes were Feid, Brca, and Cage. Other grass species with relatively high cover that were common to the Psme/Syal and Psme/Caru ecotypes were Feid, Popr, Ag sp., and Caru. Grass species that had relatively high cover only in the Psme/Cage ecotype were Ca sp., Br sp., Caho, and Tr. sp. Although fewer grass species occurred in this ecotype compared to the other Douglas fir ecotypes, those species had higher cover. Cover of forb species in stands of the three ecotypes followed the same trend as grass species. Forb cover averaged between 55.04 % and 58.13 %. Forb species that had relatively high cover in stands of the three ecotypes were Acmi, Frve, Hial2, and Smst. Stands in the Psme/Syal and Psme/Caru ecotypes had more forbs with relatively high cover common to both ecotypes while stands in the Psme/Cage ecotype had many forbs with higher cover that were not common to the other Douglas fir ecotypes.

Grass yield in stands of the three Douglas fir ecotypes averaged between 290.0 kg/ha and 501.1 kg/ha. Species of grass with higher yield that were common to all ecotypes were Brca, Ca sp., Cage, Caru, Feid. And Popr. Although many of the higher yielding grass species also occurred in the grand fir ecotypes, grass species in the Douglas fir ecotypes were generally higher yielding. This relationship was also consistent for forb species in the three Douglas fir ecotypes. Common species with higher yield in stands of the three ecotypes were Eppa, Frve, Gabo, Gatr, Hial2, Lu sp., Sest, Smst, Thmo, Thoc and Tr sp. Stands in both the Psme/Syal and Psme/Caru ecotypes had more forb species than stands in the Psme/Cage ecotype.

Grass cover in stands of the two ponderosa pine ecotypes was the highest among forest ecotypes. The Pipo/Feid ecotype had average grass cover of 52.5 % while the Pipo/Cage ecotype had average grass cover of 23.1 %. Species of grass common to both ecotypes were Feid, Popr, and Ag sp. Most species of grass in stands of the Pipo/Cage ecotype were common to grand fir and Douglas fir ecotypes, especially the Psme/Cage ecotype.

Stands of both ponderosa pine ecotypes had similar forb cover although only four species contributed to forb cover in the single stand in the Pipo/Feid ecotype. The Pipo/Feid ecotype had 55.0 % forb cover and the Pipo/Cage ecotype had 54.4 % forb cover. Acmi was the only forb species common to both ponderosa pine ecotypes. Species composition of forbs in stands of the Pipo/Cage ecotype had forbs common to grand fir and Douglas fir ecotypes. Common species and the number of forb species contributing to forb cover in stands of this ecotype had greatest similarity to stands of the Psme/Cage ecotype.

Average vegetation yield in stands of the Pipo/Cage ecotype was much higher than yield of the single stand measured of the Pipo/feid ecotype (662.0 kg/ha vs. 96.0 kg/ha, respectively). Although the two ecotypes had several common grass species, the Pipo/Cage ecotype had additional grass species as well as common grass species with higher yields. Common grass species in stands of the two ecotypes were Ag sp., Feid, and Popr. The Pipo/Cage ecotype had a number of grass species common to grand fir and Douglas fir ecotypes that were also high yielding including Caru, Brca, Cage, and Caru.

Forb yield was lower in the two ponderosa pine ecotypes compared to the grand fir and Douglas fir ecotypes. Forb yield in stands of the Pipo/Cage ecotype was 190.0 kg/ha while forb yield in the Pipo/Feid ecotype was only 17.0 kg/ha. Fewer forb species occurred in these ecotypes and those present were usually lower yielding. The only forb species common to both ecotypes was Acmi. As with grass species, the Pipo/Cage ecotype had more forb species than the Pipo/Feid ecotype and had more common species with the grand fir and Douglas fir ecotypes.

Appendix 9: Forest Service Roads Data

SEG NO	RD NO	Road Miles	SEG ID	TS1	TS2	TS3	TS4	PA1	PA2	PA3	PA4	SU1	AU1	AU2		FMP1		AQ1	AQ2	AQ3	AQ4	AQ 6,8,9,11	CULVERTS	SUB-WS	TW 1	TW 2	TW 3	TW 4	nox	bot	RPxWO		OP-MTNC	OBJ-MTNC
4	477	0.02	46004770									1		1		1								626L	2	2	2	2		3			2	2
7	460	0.52	46004600						2	2	2	1	2	1		1								626K	3	3	2	3		3			2	2
8	445	0.01	46004450									1		1		1								626K	2	2	2	1					2	2
9	580	0.19	46005800					3	2	2	3	2	1	1		1								626M	2	2	1	1		3			3	3
10	580	0.32	46005800					3	2	2	3	1	1	1		1			1					626M	2	2	1	1		3			3	3
11	475	0.17	46004750						2		2	1		2		1								626M	2	2	2	2		3			2	2
12	4600	0.27	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626I	2	2	2	1		3			3	3
13	570	0.02	46005700		1							1		1										626M	2	3	3	2					2	2
15	4600	1.06	460000013.84	3	3	3	3	3	3	3	3	3	3	2		1								626K	2	2	2	1		3			3	3
16	4600	0.32	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1							3	626I	2	2	2	1		3			3	3
18	442	0.34	46004420		1				2	2	2	2	2	2		1							3	626K	3	2	2	2		3			2	2
19	4600	1.05	460000013.84	3	3	3	3	3	3	3	3	3	3	2		1								626I	2	2	2	1		3			3	3
21	485	0.01	46004850									1												626K	2	2	2	2					2	2
22	490	0.05	46004900									1												626K	2	2	2	1		3			2	2
25	4600	0.08	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626K	2	2	2	1		3			3	3
26	4600	0.30	460000013.84	3	3	3	3	3	3	3	3	3	1			1								626M	2	2	2	1		3			3	3
27	4600	0.29	460000013.84	3	3	3	3	3	3	3	3	3	1			1								626K	2	2	2	1		3			3	3
28	420	0.04	46004200		1						1			1		1								626I	3	2	2	1					2	2
29	431	0.17	46004310											2										626I	2	1	1	1					2	2
30	438	0.27	46004380										1	2		1						3		626K	2	2	1	1					2	2
31	495	0.02	46004950								1					1								626I	2	3	2	2		3			2	2
32	4650	0.12	46500000	1	3	3	3	3	3	3	3	3		1		1								626K	3	3	3	2		3			3	3
33	4600	0.28	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626K	2	2	2	1		3			3	3
34	4600	0.71	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1								626M	2	2	2	1		3			3	3
35	4600	0.46	460000013.84	3	3	3	3	3	3	3	3	3	2			1							3	626I	2	2	2	1		3			3	3
36	432	0.23	46004320									2	2			1								626K	3	3	2	1					2	2
39	588	4.83	46005880								2	2	3	2		1								626M	3	3	3	2	3	3	3		2	2
41	560	0.05	46005600								1	2	2	1										626M	2	3	2	2		3			2	2
42	15	0.15	46650150		1						3	1		1		1						2		626M	2	1	1	1		3			2	2
43	4600	0.65	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1								626L	2	2	2	1		3			3	3

44	205	0.10	46652050						3	3	3	1													626K	2	2	1	1		3			2	2
46	57	0.20	46650570								1	1		1											626M	2	2	2	1		2			2	2
47	50	2.22	46650500		1				1	2	2	2	3	2		1						2			626K	3	2	2	2		3			2	2
48	80	0.94	46650800		1				1	1	3	2	3	2		1									626M	3	3	2	2		3			2	2
52	429	0.33	46004290							2	2	2	1	1		1									626K	2	2	2	2		3			2	2
54	25	0.11	46700250			3		3	3	3	3	3				1						2			626M	1	2	1	1		2			3	3
55	613	0.05	46006130									1		1					1			2			626L	2	2	2	1		3			2	2
57	4600	0.42	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1									626K	2	2	2	1		3			3	3
58	437	1.25	46004370		1							2	3	2		1									626L	3	3	2	2		3			2	2
59	4600	0.35	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1									626I	2	2	2	1		3			3	3
60	517	1.38	46005170		1				1		2	2	3	3		1									626L	3	2	2	2	2	3	2		2	2
62	210	0.59	46652100									2	2	2		1						2			626I	3	3	2	1					2	2
67	200	1.40	46652000		2		1		3	3	3	1	3	2		1									626K	3	2	2	2		3			2	2
68	4600	0.14	460000013.84	3	3	3	3	3	3	3	3	3	2			1						2			626L	2	2	2	1		3			3	3
69	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	1			1									626K	2	2	2	1		3			3	3
74	69	0.26	46650690								1	1	1	1											626L	2	2	2	1		1			2	2
79	335	0.83	46303350		1						2	1	3	2		1									626K	3	2	2	2	1				2	2
81	4600	0.35	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1									626M	2	2	2	1		3			3	3
84	4600	0.71	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1									626K	2	2	2	1		3			3	3
86	265	0.13	46652650									1		2								2			626M	2	2	2	1					2	2
88	670	0.04	46006700		1				3		3	1	2												626I	3	3	2	3		3			2	2
93	71	0.50	46650710								1	2	1			1						2			626M	2	2	2	2		2			2	2
94	4600	0.54	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1							3		626L	2	2	2	1		3			3	3
95	635	0.63	46006350		1				3		2	1	2	2		1						2	3		626I	3	2	2	2		3			2	2
97	4600	0.29	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1							3		626M	2	2	2	1		3			3	3
98	4680	0.06	46800000	3	3	3	3	3	3	3	3	3	2			1									626I	3	2	2	2		3			3	3
99a	60	0.50	46650600		1						2	2	3	1		1			1		3				626I	2	2	2	2		2			2	2
99b	60	1.90	46650600		1						2	2	3	1		1									626M	2	2	2	2		2			2	2
102	4625	0.41	462500020.4	2	3			3	3	3	3	3	2			1									626K	2	2	2	2		3			3	3
103	4600	0.10	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1						2			626K	2	2	2	1		3			3	3
104	346	0.19	46653460								1	1		1		1									626K	2	2	2	1					2	2
105	430	3.65	46004300		1						1	2	3	2								2			626K	3	3	2	2		3			2	2
110	457	1.00	46254570									1	3	1								2			626K	3	2	2	3					2	2
114	695	0.26	46006950						3	2	3	2	1	2		1							3		626K	3	2	2	1					2	2
117	830	0.71	46258300									2	1	1											626K	3	2	2	1		3			2	2
121	450	4.50	46004500		2				1	3	3	2	3	2		1									626K	3	2	2	2		3			2	2
122	620	1.40	46006200		2						2	2	3	3		1							3		626M	3	2	2	2					2	2

125	4600	0.40	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626K	2	2	2	1		3			3	3
127	835	1.56	46258350		1					1	3	1	3	1		1								626K	3	2	2	3		3			2	2
128	343	2.45	46653430		2				1	2	3	2	3	1		1								626I	3	2	2	3		3			2	2
129	48	0.25	46700480									1				1						2		626I	3	1	1	1					2	2
130	698	0.86	46006980									2	3	2		1						2		626I	3	2	2	3					2	2
131	45	0.20	46700450						1			1										2		626L	3	1	1	1					2	2
134	910	1.85	46259100						1		1	2	3	3		1								626K	3	2	2	3		3			2	2
141	300	7.73	46303000		2				1	2	3	3	3	3		1								626I	3	2	3	3	3	3	3		2	2
148	4600	0.07	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626I	2	2	1	1		3			3	3
150a	4665	2.00	46650000		2				3	3	3	3	3	2		1								626I	3	2	2	2		3			3	3
150b	4665	4.31	46650000		2				3	3	3	3	3	2		1								626M	3	2	2	2		3			3	3
150c	4665	2.00	46650000		2				3	3	3	3	3	2		1								626I	3	2	2	2		3			3	3
151	715	0.24	46007150						1	3	3	2		3		1						2		626J	2	2	1	1		3			2	2
152	706	0.38	46007060								2	1	1	1		1			3					626K	3	2	1	2		2			2	2
154	125	0.81	46701250		2					1	2	2	3			1								626J	3	2	2	1		1			2	2
156	452	1.05	46254520		2							2	3	1										626M	3	2	1	3					1	2
157	653	0.57	46006531		1				1		1	2	2	1		1								626K	3	2	2	2					2	2
167	4600	0.14	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626I	2	2	2	1		3			3	3
170	718	0.15	46007180									1		1										626K	2	2	1	1		3			2	2
172	724	0.04	46007240								1	1	2											626I	2	2	1	1					2	2
173	263	0.28	46902630									2		1										626K	3	2	2	2					2	2
176	705	3.82	46007050		2						3	2	3	3		1								626K	3	3	2	2		3			2	2
177	4600	3.52	460000013.84	3	3	3	3	3	3	3	3	3	3	3		1								626I	2	2	2	1		3			3	3
179	260	0.60	46902600									1	1	1										626I	3	2	2	3					2	2
180	703	0.60	46007030									1	2	1		1						2		626I	3	2	2	1					2	2
182		0.92	46258050		2				1	1	1	2	3	1		1								626K	3	2	2	3					2	2
184a	800	1.50	46258000		2				1	3	3	2	3	3		1								626I	3	2	2	2		1			2	2
184b	800	1.75	46258000		2				1	3	3	2	3	3		1								626L	3	2	2	2		1			2	2
188	131	0.10	46701310							2	1	1												626K	2	1	1	1					2	2
199	712	0.48	46007120									2	1	1		1							3	626K	3	3	2	2					2	2
205	4600	0.89	460000013.84	3	3	3	3	3	3	3	3	3	3	1		1								626K	2	2	1	1		3			3	3
207	350	2.53	46303500		3				3	2	3	2	3	3		1			1		3			626K	3	2	2						2	2
212	724	0.64	46007240								2	1	1	2		1								626M	2	2	1	1		3			2	2
215	708	0.98	46007080									2	3	1		1			3		3		3	626I	3	2	1	1					2	2
226	4600	0.25	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626I	2	2	2	1		3			3	3
227	4625	2.45	462500017.92	2	3			3	3	3	3	3	3	3		1								626K	3	2	2	2		2			3	3
229	4625	0.12	462500017.8	3	3	3	1	3	3	3	3	3	2	1		1								626M	2	2	2	3					3	3

230	736	0.67	46007360						1	1	1	1	2	1								2		626I	3	2	2	2		2			2	2
231	423	0.13	46254230						3	3	3	2		1										626M	3	2	1	3		2			2	2
232	272	0.57	46902720									1	2	1		1								626I	3	2	2	1					2	2
233	731	2.05	46007310			3					1	1	3	2		1								626M	3	2	2	3		3			2	2
238	728	1.39	46007280								1	1	3	3		1								626K	3	2	2	3					2	2
240	729	0.59	46007290								1	1	2	1		1								626K	3	2	2	1					2	2
243	716	7.99	46007160								1	2	3	2		1								626J	3	2	2	3		3			2	2
244	4600	0.13	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626K	2	2	2	1		3			3	3
245	4600	0.89	460000013.84	3	3	3	3	3	3	3	3	3	3	2		1								626M	2	2	2	1		3			3	3
247	4600	0.01	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1								626M	2	2	2	1		3			3	3
251	357	0.93	46703570		1						2	1	3			1								626M	3	2	1	3		2			2	2
253	4600	0.15	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1								626J	2	2	2	1		3			3	3
254	727	3.70	46007270		2				3	1	3	1	3	3		1								626J	3	2	2	3		3			2	2
255	4600	0.06	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626K	2	2	2	1		3			3	3
257	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626M	2	2	2	1		3			3	3
259	353	2.37	46703530							1	1	1	3	3		1								626M	3	2	2	3	1	2			2	2
261	125	1.94	4670125.94		2					2	2	2	3			1					3		3	626M	3	2	2	2	1	2			2	2
264	725	4.57	46007250		2				3	3	3	2	3	3										626I	3	2	2	3		3			2	2
273	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626M	2	2	2	1		3			3	3
275	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626K	2	2	2	1		3			3	3
276	4600	0.27	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626K	2	2	2	1		3			3	3
277	4600	0.11	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626K	2	2	2	1		3			3	3
278	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2			1							3	626I	2	2	2	1		3			3	3
283	200	3.51	46602000				1		1	1	1	2	3	3		1								626J	3	2	2	3		3			2	2
293	4600	0.16	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626M	2	2	2	1		3			3	3
300	4600	0.09	460000013.84	3	3	3	3	3	3	3	3	3	2			1			1					626J	2	2	2	1		3			3	3
306	177	0.33	46301770									1	1			1								626M	3	1	1	1					2	2
310	4600	0.20	460000013.84	3	3	3	3	3	3	3	3	3	2	3		1								626M	2	2	2	1		3			3	3
321	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1								626K	2	2	2	1		3			3	3
323	745	1.02	46007450		2				2	1	2	2	3	1		1								626K	3	2	2	2		2			2	2
324	120	0.80	4635120.6				1						3	1		1								626J	3	2	2	3		2			2	2
330	4600	0.24	460000013.84	3	3	3	3	3	3	3	3	3	2			1							3	626M	2	2	2	1		3			3	3
331	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626I	2	2	2	1		3			3	3
335	4600	0.18	460000013.84	3	3	3	3	3	3	3	3	3	2	2		1			1				2	626K	2	2	2	1		3			3	3
336	100	0.17	46901000								1	1		2										626I	2	2	2	3					2	2
340	780	0.02	46007800		3	3	3						2			1							3	626M	3	2	2	2					3	3
343	4630	6.13	46300000		3		2	3	3	3	3	3	3	2		1					3			626J	3	2	2	2		2			2	2

344	90	4.32	46900900		2					2	2	2	3	3		1								626J	3	2	2	3		3			2	2
347	135	1.21	46901350		3				3	3	3	2	3	1		1								626J	3	2	2	2					2	2
351	4600	0.04	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626J	2	2	2	1		3			3	3
358	100	0.58	46351000				3						2	1		1								626K	3	2	1	3		2			2	2
366a	250	2.00	46252500		2		3				1		3	1		1			1					626J	3	2	1	1	3	3	3		2	2
366b	250	0.49	46252500		2		3				1		3	1		1								626K	3	2	1	1	3	3	3		2	2
369	18	0.09	46900180		1														1	2	2			626K	3	2	2	2					2	2
370	265	0.04	4625265.3			3						3				1								626J	2	2	1	1	3	2	2		3	3
372	265	0.22	46252650			3						3				1								626M	2	2	1	1	3	2	2		3	3
377	4600	0.62	460000013.84	3	3	3	3	3	3	3	3	3	1	1		1								626J	2	2	2	1		3			3	3
378	265	0.03	46002650		1							1				1								626K	2	2	1	1		3			2	2
379	203	0.62	46952030								1	1	2	1		1								626K	3	2	2	1					2	2
385	16	0.27	46900160									1	1	1										626M	3	2	2	1					2	2
389	20	0.57	46350200								1	1	2	1		1								626M	2	2	2	1		3			2	2
392	47	0.17	46900470		2		2		3	1	3	2												626I	3	2	2	1					2	2
393	199	0.79	46951990									1	3	1		1								626J	3	2	1	1					2	2
395	375	0.82	46703750								1	1	3			1								626K	3	2	2	1					2	2
397	4600	0.55	460000013.84	3	3	3	3	3	3	3	3	3	2			1							3	626M	2	2	2	1		3			3	3
399	237	0.65	46952370		1					3	3	2	2	1		1			1					626J	3	2	2	1					2	2
402	4600	0.02	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626M	2	2	2	1		3			3	3
403	40	0.26	46350400							1		1	1											626K	3	1	1	1		3			2	2
404	4600	0.01	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626I	2	2	2	1		3			3	3
406	4600	0.01	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626J	2	2	2	1		3			3	3
410	4600	0.03	460000013.84	3	3	3	3	3	3	3	3	3	2			1						2		626J	2	2	2	1		3			3	3
413	33	0.33	46900330						3	2	3	2	1	1										626J	3	2	1	1					2	2
414	4600	0.05	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626I	2	2	2	1		3			3	3
415	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626K	2	2	2	1		3			3	3
416	4625	0.18	46250000	3	3	3	3	3	3	3	3		2			1								626J	2	2	2	1	3	3	3		4	4
417	4625	0.07	46250009.934	3	3	3	3	3	3	3	3	3	2			1							3	626M	2	2	2	1	1	3	1		3	3
418	4625	7.72	462500010	3	3	3	1	3	3	3	3	3	3	1		1							3	626K	3	2	2	2	3	3	3		3	3
426	70	0.51	46350700		1					2	1	2	2	1		1								626K	3	2	2	1	2	3	2		2	2
427	227	0.36	46952270		2						1	1	1											626I	3	2	2	1					2	2
429	230	1.45	46952300		1					3	3	2	3	1		1			1					626K	3	2	2	3					2	2
432	4600	0.25	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626J	2	2	2	1		3			3	3
434	225	0.11	46952250		2							1				1								626K	2	2	2	1					2	2
435	4600	0.00	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626J	2	2	2	1		3			3	3
438	15	6.95	46900150		1				3	3	3	2	3	2		1								626M	3	2	2	3		3			2	2

439a	550	1.00	46255501.5		2		2		2	1	2	2	3	2		1								626M	3	2	2	3					2	2
439b	550	1.34	46255501.5		2		2		2	1	2	2	3	2		1								626J	3	2	2	3					2	2
445	4600	0.18	460000013.84	3	3	3	3	3	3	3	3	3	2	1		1								626J	2	2	2	1		3			3	3
449a	140	2.00	46951401.6		3						1	1	3	2		1								626J	3	2	1	1		3			2	2
449b	140	1.21	46951401.6		3						1	1	3	2		1								626M	3	2	1	1		3			2	2
451	253	0.22	46002530						1		2	1		1										626I	3	2	2	2	2	3	2		2	2
453	188	0.92	46951880				2		2	1	3	2	3			1								626J	2	2	2	1					2	2
455	49	0.05	46150490									1												626I	3	2	2	1					2	2
456	4600	0.95	460000013.84	3	3	3	3	3	3	3	3	3	3	1		1								626I	2	2	2	1	2	3	2		3	3
457	252	0.42	46002520						1	1	2	2	1	1		1								626I	3	2	2	3	3	3	3		2	2
459	250	0.02	46002500									1				1								626M	2	1	1	1					2	2
460	273	0.43	46952730								1	2	1	1										626J	3	2	2	1					2	2
462	4600	0.46	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626J	2	2	2	1	3	3	3		3	3
464a	4670	2.00	46700000		3		1	3	3	2	3	3	3	3		1								626M	2	2	2	2	3	3	3		3	3
464b	4670	7.52	46700000		3		1	3	3	2	3	3	3	3		1							3	626I	2	2	2	2	3	3	3		3	3
465	220	0.01	46052200									2												626J	2	1	1	1					2	2
466	4600	0.24	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626J	2	2	2	1		3			3	3
467	4605	0.06	46050000		3		2	3	3	3	3	2				1			1					626I	3	2	2	3					2	2
470	145	4.32	46951450		3						2	2	3	2		1								626J	3	2	2	3		2			2	2
471	4690	5.65	46900000	3	3	3	3	3	3	3	3	3	3	1		1			1					626I	2	2	2	2		3			3	3
475	920	0.11	46009200			3				1	2					1								626I	2	1	1	1		3			2	2
476	4600	0.22	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626I	2	2	2	1		3			3	3
477	140	1.56	46951400		3				1		3	2	3			1								626I	3	2	2	1					2	2
484	4600	0.01	460000013.84	3	3	3	3	3	3	3	3	3	3			1								626I	2	2	2	1		3			3	3
485	4600	0.71	460000013.84	3	3	3	3	3	3	3	3	3	2			1								626J	2	2	2	1	2	3	2		3	3
486	200	0.50	46052000		3		2				3	2	1	1		1								626M	3	2	2	1		3			2	2
489	880	0.02	46008800		1		1					3				1								626I	2	1	1	1					3	3
490	4600	0.22	460000013.84	3	3	3	3	3	3	3	3	3	2			1			3					626I	2	2	2	1		3			3	3
494	4635	3.82	46350000		3		3		3	2	2	2	3	1		1								626M	2	2	2	2	2	3	2		2	2
504	932	0.46	46009320				1	1		2	2	2	1	3										626J	3	2	1	2					2	2
505	185	0.55	46001850			3	1					2	2											626J	3	2	2	2					2	2
511	175	1.96	46951750		3					2	2	1	3	1		1								626I	3	2	1	2					2	2
514	933	3.44	46009330		1		1			2	3	2	3	1		1								626E	3	2	2	1		3			2	2
521	100	1.17	46951000							1	1	2	3			1								626E	3	2	2	3		2			2	2
522	880	0.57	46008800		1		1					3	2			1								626E	2	2	2	1		3			3	3
526	165	1.37	46951650		1		1			1	2	2	3			1			1					626I	3	2	2	1		1			2	2
528	4600	0.83	460000013.00	3	3	3	3	3	3	3	3	3	3			1			1					626I	2	2	2	1		3			3	3

530	888	0.02	46008880										2											626E	2	1	2	1					2	2
532	880	0.10	46008800		1		1					3				1								626I	2	1	2	1		1			3	3
534	930	3.19	46009300		1		2		3	3	3	2	3	3		1								626I	2	2	2	3		3			2	2
536	905	1.59	46009050									2	3	2		1								626B	3	2	2	2					2	2
537	900	3.44	46009000		2	3			2	3	3	2	3			1								626G	3	2	2	3		3			2	2
540		2.34	46150000		3		3		1	1	2	2	3			1								626B	3	2	2	3		3			2	2
541a	160	0.50	46001600		1		1			2	2	2	3	2		1								626M	3	2	2	2		3			2	2
541b	160	0.86	46001600		1		1			2	2		3	2		1								626J	3	2	2	2		3			2	2
544	171	0.34	46001710									1	1	1										626J	2	2	2	2					2	2
548	4600	4.62	460000013.84	3	3	3	3	3	3	3	3	3	3	1		1								626J	2	2	2	1		3			3	3
550	157	0.27	46001570									1	1	1										626B	3	2	2	2	1	3	1		1	2
551	889	0.02	46008890									2				1								626J	2	2	2	1					2	2
555	4625	9.66	46250000	3	3	3	3	3	3	3	3		3	3		1								626J	2	2	2	2	3	3	3		4	4
570	144	1.46	46001440				1					2	3	2		1								626A	3	2	2	2	2	3	2		2	2
573	975	2.30	46009750		1	1	1			2	2	2	3	1		1								626B	3	2	2	3		3			2	2
574	880	1.26	46008800		1		1			3	3	3	3			1								626A	2	2	2	1		1			3	3
586	151	0.19	46001510							1	2	2		1		1			1				3	626G	3	2	2	2		2			2	2
587	25	0.26	46950250		1	2	2			1	2	2	1			1								626J	2	2	2	1		2			2	2
591	153	0.44	46001530				1			1	2	1	1	2		1								626E	3	2	2	3	2	3	2		2	2
597	4600	1.51	460000013.84	3	3	3	3	3	3	3	3	3	3			1								626G	2	2	2	1		3			3	3
598	4605	4.16	46050000		3		2	3	3	3	3	2	3	1		1								626J	3	2	2	2		3			2	2
602	155	3.05	46001550		2		2		3	3	3	2	3	2		1								626J	3	2	2	3	1	3	1		2	2
603	154	0.59	46001540		1		1			1	2	2	2	1		1			3					626G	3	2	2	1	1	2			2	2
604a	4695	4.00	46950000	3	3	3	3		3	3	3	2	3	3		1			1					626F	3	2	1	2		3			2	2
604b	4695	2.00	46950000	3	3	3	3		3	3	3		3	3		1			1					626F	3	2	1	2		3			2	2
604c	4695	2.70	46950000	3	3	3	3		3	3	3		3	3		1								626J	3	2	1	2		3			2	2
618a	990	1.00	46009900	3	1		3		3	3	3	2	3			1								626J	3	2	2	3		3			2	2
618b	990	3.16	46009900	3	1		3		3	3	3	2	3			1								626G	3	2	2	3		3			2	2
620	162	0.95	46001620							2	2	2	3	3		1								626B	3	2	2	2	2	3	2		2	2
622	145	1.58	46001450		1		1				2	2	3	1		1								626G	3	2	2	1	3	1	1		2	2
623	4605	0.74	46050000		3		2	3	3	3	3	2	2			1			1		3			626B	2	2	2	2		1			2	2
624	130	0.47	46201300							2	2	1	1	1		1								626J	3	2	2	2	3	3	3		2	2
631	152	0.80	46001520		1		1			1	2	2	3	2		1								626J	3	2	2	1	2	2			2	2
640	164	0.58	46001640		1					2	2	1	2	1		1								626B	3	1	1	1	3	3	3		2	2
641	127	0.21	46201270									1		2		1								626B	3	2	2	1	2	2			2	2
650	4605	0.74	46050000		3		2	3	3	3	3	2	2			1								626J	2	2	2	2		1			2	2
651	140	2.59	46001400	1	3	2	3		1	2	3		3	3		1								626J	3	2	2	2	2	3	2		2	2

653a	110	1.50	46201100	1	3	2	3			1	2	2	3	2		1								626E	3	2	2	3	3	3	3		2	2
653b	110	1.08	46201100	1	3	2	3			1	2	2	3	2		1								626E	3	2	2	3	3	3	3		2	2
654	166	1.02	46001660		1					2	2	2	3	3		1								626J	3	2	2	2	1	2			2	2
655	4600	4.28	46000008.691	3	3	3	3	3	3	3	3	3	3	2		1								626J	2	2	2	1	3	3	3		3	3
661	168	0.99	46001680	1	1		3					2	3	2										626G	3	2	2	3		1			1	2
667	4605	0.42	46050000		3		2	3	3	3	3	2	2	1		1									2	2	2	1		1			2	2
669	4605	0.03	46050000		3		2	3	3	3	3	2	2	1		1									2	2	2	1		1			2	2
672	140	1.00	46001402.6		2	2	3				2		3	3		1									2	2	2	1	2				2	2
682	81	0.01	46050810									2				1									3	2	2	1					2	2
684a	109	0.50	46001090		1					1	3	1	3	2		1									3	2	2	2		3			2	2
684b	109	0.95	46001090		1					1	3	1	3	2		1									3	2	2	2		3			2	2
686	81	0.19	46050810									1	2			1									3	2	2	1					2	2
701	4605	0.00	46050000		3		2	3	3	3	3	2				1									2	2	2	2					2	2
702	4620	5.25	46200000	3	3	3	3	3	3	3	3	3	3	1		1									2	2	2	2	2	3			3	3
706	510	0.24	46105100				1			2	3		2			1									3	1	1	2					2	2
707	512	0.21	46105120				1			2	3														3	2	2	1					2	2
708	4620	0.09	46200005.3	3	3	3	3					3	2			1									2	2	2	2					3	3
710	530	0.54	46105300							1	2	2	2			1									3	2	2	2		1			2	2
713	535	0.87	46105350								2	2	3			1									2	2	2	2		2			2	2
719	4605	0.20	46050000		3		2	3	3	3	3	2	2			1									2	2	2	2	2	3			2	2
720	4600	2.79	46000000	3	3	3	3	3	3	3	3		3			1									2	2	2	1	2	3			5	5
722a	500	1.00	46105000	1	2		1			1	2	2	3	2		1									3	2	2	1	3	3	3		2	2
722b	500	2.27	46105000	1	2		1			1	2	2	3	2		1									3	2	2	1	3	3	3		2	2
727	4600	0.12	46000000	3	3	3	3	3	3	3	3	3	2			1									2	2	2	1		3			5	5
729a	4610	2.50	46100000	1	2		3	3	3	3	3	2	3	1		1									3	2	2	3		3			2	2
729b	4610	1.09	46100000	1	2		3	3	3	3	3	2	3	1		1									3	2	2	3		3			2	2
730	545	0.43	46105450								2	2	1			1									3	2	1	3	2				2	2
735	80	0.43	46000800		2		3				2	2	2	1		1									2	2	2	1		3			2	2
736	80	0.00	46000800		2		3				2	2	2			1									2	2	2	1					2	2
737	81	1.01	46000810						3	3	3	2	3	2		1									3	2	2	3	3	3	3		2	2
738	540	1.35	46105400		1						1	2	3	1		1									3	2	2	3	1				2	2
740	80	0.45	46000800		2		3				2	2	2			1									2	2	2	1	1	3			2	2
741	80	0.00	46000800		2		3				2	2	2												2	2	2	1					2	2
751	80	2.66	46000800	1	2		3				2					1									3	2	2	3		3			2	2

Appendix 10: Segment Rating Criteria

Benefits

Transportation

TS1 Road value for connectivity to Public roads or communities.

0 no connectivity
1 some value of connectivity
2 moderate value of connectivity
3 high value of connectivity

TS2 Road value for connectivity to another road cluster or a neighboring 6th field subwatershed.

0 no connectivity
1 some value of connectivity
2 moderate value of connectivity
3 high value of connectivity

TS3 Road value for providing recurring administrative access needs to an area.

0 no recurring administrative needs to access the area
1 limited administrative need to access the area
2 recurring administrative needs to access the area
3 ultra recurring administrative needs to access the area

TS4 Road value for access to other ownership land

0 does not access other ownership land
1 provides one of multiple routes accessing other ownership land
2 provides more than one of multiple routes accessing other ownership land
3 provides primary access to other ownership land

Fire Suppression/Fuels

AU1 Values based on estimated effect on suppression methods and response times if road segment access were lost. Decreased access may result in more use of hand crews and alternative resources (rapellers, smokejumpers, retardant) rather than engines. Delayed response times may lead to increased fire size. Criteria follow:

0 if segment is shorter than 0.25 miles, does not connect two separate routes, walk-in time is minimal, and suppression response is not affected.
1 if segment length is between 0.25 and 0.50 miles, does not connect two separate routes, walk-in time is increased, and suppression response is delayed.
2 if segment length is between 0.50 miles and 0.75 miles, walk-in time is increased, and suppression response is delayed; or a connection of separate routes is lost, resulting in rerouting, increased drive time, and moderate delay in suppression response.
3 if segment length is greater than 0.75 miles, walk-in time is increased, and suppression response is delayed; or a critical connection of separate main routes is lost, resulting in rerouting, increased drive time, and great delay is suppression response.

AU2 The following was given ranges of 0-3, describing the road segment's value in providing access to areas that may require future fuels management. Consideration was given to historic occurrences dating back to 1970, and moderate to heavy fuel loading based on existing mapping fuel model 9 and 10 areas. Criteria follow:

0 if segment is located in an area with no record of fire occurrences and without high risk fuels.
1 if segment is located in an area with a record of 1 or 2 fire occurrences and without high risk fuels or; no record of fire occurrences in an area with high risk fuels.
2 if segment is located in an area with a record of 3 to 5 fire occurrences and without high risk fuels or; a record of 1 to 2 fire occurrences in an area with high risk fuels.
3 if segment is located in an area with a record of 3 or 5 fire occurrences and either in or bordering an area of high risk fuels.

Recreation

PA1 Does this road segment provide access to a developed recreation site?

3 high recreation value
2 medium recreation value
1 low recreation value
0 no recreation value

PA2 Does this road segment provide access to a dispersed recreation site?

3 high recreation value
2 medium recreation value
1 low recreation value
0 no recreation value

PA3 Does this road segment provide access to a water source?

3 high recreation value
2 medium recreation value
1 low recreation value
0 no recreation value

PA4 Does this road segment provide access to small forest products and/or hunting and fishing opportunities?

3 high recreation value
2 medium recreation value
1 low recreation value
0 no recreation value

Forest Management

FMP1 Values are based on a road segments ability to provide suitable access to silviculturally manipulate forest vegetation for forest products, restoration, or other management objectives.

0 road provides redundant access.
1 road provides needed access

Costs

Aquatic

AQ1 Modified surface and subsurface hydrology (significance in change of flow routing). Measure: presence and length of ditches, and seeps/springs/wetlands not allowed to flow naturally.

0 No significant modification
3 Significant modification

AQ2 Road generated surface erosion. Measure: presence and length of rutting, road grade.

0 No sediment
1 Minor sediment
2 Some sediment
3 Major sediment

AQ3 Road and mass wasting potential. Measure: hillslope gradient.

0 Less than 30% slope
2 30% to 45% slope
3 Greater than 45% slope

AQ4 Road crossings. Measure: number of crossings.

0 Less than one crossing per mile
2 One crossing per mile
3 Greater than one crossing per mile

AQ6,8, 9 &11 Road interaction with channel, floodplain, riparian function, seeps, and springs. Measure: road distance to stream.

0 Greater than 300 feet distance
1 100 to 200 feet distance
2 50 to 100 feet distance
3 0 to 50 feet distance

CULVERTS Culverts of concern. Measure: culverts survey.

0 Green (good)
2 Grey (fair)
3 Red (poor)

Wildlife

TW1 What are the direct effects of the road system on terrestrial species habitat?

- Fragmentation
- Disruption of migration routes and juvenile dispersal patterns.
- Changes to the micro site (roadside snags, logs, ponds, etc.) that make the habitat unusable.

TW2 How does the road system facilitate human activities that affect habitat?

- Recreation related disturbance; (meadow damage by ATVs, micro site alteration by campers, etc.)
- Transport and spread of noxious weeds
- Loss of snags and LWD to firewood cutting

TW3 How does the road system affect legal and illegal human activities (trapping, hunting, poaching, harassment, road kill, etc.)? What are the effects on wildlife species?

- Direct killing of animals from vehicle collision, illegal or accidental harvest, etc.
- Disturbance during critical reproductive periods (elk and mushroom hunting, snowmobiles and lynx)
- Harassment during stress periods of life cycle; (reproduction, winter, etc)

TW4 How does the road system directly affect unique communities or special features in the area?

- Old growth fragmentation and disturbance
- Calving, denning, and nesting habitat

- Micro sites (aspen pockets, ponds, snags, etc.)

Ratings
0 No impacts; no concerns – no recommendations for closure.
1 Low impacts to sensitive species*****; minor concerns – low priority for closure.
2 Probable impacts to sensitive species – medium priority for closure.
3 Significant impacts to sensitive or listed species – high priority for closure.

* Sensitive species can be either those listed on the Regional Forester's Sensitive species list, species of concern as listed by USFWS, or unique species that are particularly sensitive to road-caused disturbance.

Rare Plants and Noxious Weeds

NOX- Noxious Weeds - The following was given ranges of 0-3, describing the road segment's proximity to weed occurrence. Criteria follow:

0 if no portion of the segment is less than 0.75 miles from the weed occurrence boundary.
1 if any portion of segment is less than 0.75 miles but greater than 0.50 miles from the weed occurrence boundary.
2 if any portion of segment is less than 0.5 miles but greater than 0.25 miles from the weed occurrence boundary
3 if any portion of segment is less than 0.25 miles from the weed occurrence boundary.

BOT - Rare plant Occurrence - Values are based on distance between road and rare plant occurrence in current GIS layer. The closer a rare plant occurrence is to a road, the higher the likelihood of being negatively affected by roads and associated off-road travel.

0 if no portion of the segment is less than 0.75 miles from the rare plant occurrence boundary.
1 if any portion of segment is less than 0.75 miles but greater than 0.50 miles from the rare plant occurrence boundary.
2 if any portion of segment is less than 0.5 miles but greater than 0.25 miles from the rare plant occurrence boundary.
3 if any portion of segment is less than 0.25 miles from the rare plant occurrence boundary.

NOXxWO - Rare Plant x Weed Occurrence - The following are given ranges of 0-3 based on the proximity of rare plants and weeds to each other. Negative effects to rare plants due to roads are more likely with close proximity to both roads and weeds due to spread of weeds by vehicles. Generally, double the Noxious Weed Rating above if a Rare Plant Occurrence is within 0.25 miles of the Weed Occurrence.

0 if no rare plant or weed occurrence is within 0.75 miles of the segment.
1 if noxious weed rating is "1" and Rare plant occurrence within 0.25 miles.
2 if noxious weed rating is "2" and Rare plant occurrence within 0.25 miles.
3 if noxious weed rating is "3" and Rare plant occurrence within 0.25 miles.

Appendix 11: Segment Benefit Scores

BENEFIT FACTORS FOR MAINTAINING ROAD SEGMENTS				Transportation System				Public Access				Special Uses	Administrative Uses			Forest Management and Products (cumulative)	TOTALS
				TS1	TS2	TS3	TS4	PA1	PA2	PA3	PA4	SU1	AU1	AU2		FMP1	
				Connectivity to Public roads or communities	Connectivity to another road cluster or a neighboring 6th field subwatershed	Provides recurring adminitstrative access needs to an area	Road value for access to other ownership land	Public access to developed or potential developed recreation sites	Public access to traditional, regularly used dispersed recreation sites (forest camps)	Provide access to a water source	Access for small forest products and/or hunting and fishing opportunities	Provides access for Range Management activities	Provides important suppression or control access as part of a fire management strategy	Provides access to future fuels projects and areas of high fire and fuel loads		Suitable access to siviculturally manipulate forest vegetation for forsest products, restoration, or other management objectives	
	Segment #	FS Road #	Segment Length (miles)	**Weighting Factors** (multipiers applied to normalized data to establish relative signifigance among factors)													
				3.0	2.0	1.0	2.0	4.0	2.0	2.0	1.0	3.0	3.0	2.0		2.0	
				Normalizing Coefficients (multipliers applied to segment data to bring all data into same range of 0 to 1, before weighting)													
				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	
	4	477	0.02									3		2		2	7
	7	460	0.52						4	4	2	3	6	2		2	23
	8	445	0.01									3		2		2	7
	9	580	0.19					12	4	4	3	6	3	2		2	36
	10	580	0.32					12	4	4	3	3	3	2		2	33
	11	475	0.17						4		2	3		4		2	15
	12	4600	0.27	9	6	3	6	12	6	6	3	9	6	2		2	70
	13	570	0.02		2							3		2			7
	15	4600	1.06	9	6	3	6	12	6	6	3	9	9	4		2	75
	16	4600	0.32	9	6	3	6	12	6	6	3	9	6	4		2	72
	18	442	0.34		2				4	4	2	6	6	4		2	30
	19	4600	1.05	9	6	3	6	12	6	6	3	9	9	4		2	75
	21	485	0.01									3					3

	22	490	0.05									3					3
	25	4600	0.08	9	6	3	6	12	6	6	3	9	6			2	68
	26	4600	0.30	9	6	3	6	12	6	6	3	9	3			2	65
	27	4600	0.29	9	6	3	6	12	6	6	3	9	3			2	65
	28	420	0.04		2						1			2		2	7
	29	431	0.17											4			4
	30	438	0.27										3	4		2	9
	31	495	0.02								1					2	3
	32	4650	0.12	3	6	3	6	12	6	6	3	9		2		2	58
	33	4600	0.28	9	6	3	6	12	6	6	3	9	6			2	68
	34	4600	0.71	9	6	3	6	12	6	6	3	9	6	4		2	72
	35	4600	0.46	9	6	3	6	12	6	6	3	9	6			2	68
	36	432	0.23									6	6			2	14
	39	588	4.83								2	6	9	4		2	23
	41	560	0.05								1	6	6	2			15
	42	15	0.15		2						3	3		2		2	12
	43	4600	0.65	9	6	3	6	12	6	6	3	9	6	4		2	72
	44	205	0.10						6	6	3	3					18
	46	57	0.20								1	3		2			6
	47	50	2.22		2				2	4	2	6	9	4		2	31
	48	80	0.94		2				2	2	3	6	9	4		2	30
	52	429	0.33							4	2	6	3	2		2	19
	54	25	0.11			3		12	6	6	3	9				2	41
	55	613	0.05									3		2			5
	57	4600	0.42	9	6	3	6	12	6	6	3	9	6	2		2	70
	58	437	1.25		2							6	9	4		2	23
	59	4600	0.35	9	6	3	6	12	6	6	3	9	6	2		2	70
	60	517	1.38		2				2		2	6	9	6		2	29
	62	210	0.59									6	6	4		2	18
	67	200	1.40		4		2		6	6	3	3	9	4		2	39
	68	4600	0.14	9	6	3	6	12	6	6	3	9	6			2	68
	69	4600	0.00	9	6	3	6	12	6	6	3	9	3			2	65
	74	69	0.26								1	3	3	2			9
	79	335	0.83		2						2	3	9	4		2	22
	81	4600	0.35	9	6	3	6	12	6	6	3	9	6	2		2	70
	84	4600	0.71	9	6	3	6	12	6	6	3	9	6	4		2	72
	86	265	0.13									3		4			7
	88	670	0.04		2				6		3	3	6				20
	93	71	0.50								1	6	3			2	12

	94	4600	0.54	9	6	3	6	12	6	6	3	9	6	2		2	70
	95	635	0.63		2				6		2	3	6	4		2	25
	97	4600	0.29	9	6	3	6	12	6	6	3	9	6	4		2	72
	98	4680	0.06	9	6	3	6	12	6	6	3	9	6			2	68
	99a	60	0.50		2						2	6	9	2		2	23
	99b	60	1.90		2						2	6	9	2		2	23
	102	4625	0.41	6	6			12	6	6	3	9	6			2	56
	103	4600	0.10	9	6	3	6	12	6	6	3	9	6	2		2	70
	104	346	0.19								1	3		2		2	8
	105	430	3.65		2						1	6	9	4			22
	110	457	1.00									3	9	2			14
	114	695	0.26						6	4	3	6	3	4		2	28
	117	830	0.71									6	3	2			11
	121	450	4.50		4				2	6	3	6	9	4		2	36
	122	620	1.40		4						2	6	9	6		2	29
	125	4600	0.40	9	6	3	6	12	6	6	3	9	6	2		2	70
	127	835	1.56		2					2	3	3	9	2		2	23
	128	343	2.45		4				2	4	3	6	9	2		2	32
	129	48	0.25									3				2	5
	130	698	0.86									6	9	4		2	21
	131	45	0.20						2			3					5
	134	910	1.85						2		1	6	9	6		2	26
	141	300	7.73		4				2	4	3	9	9	6		2	39
	148	4600	0.07	9	6	3	6	12	6	6	3	9	6	2		2	70
	150a	4665	2.00		4				6	6	3	9	9	4		2	43
	150b	4665	4.31		4				6	6	3	9	9	4		2	43
	150c	4665	2.00		4				6	6	3	9	9	4		2	43
	151	715	0.24						2	6	3	6		6		2	25
	152	706	0.38								2	3	3	2		2	12
	154	125	0.81		4					2	2	6	9			2	25
	156	452	1.05		4							6	9	2			21
	157	653	0.57		2				2		1	6	6	2		2	21
	167	4600	0.14	9	6	3	6	12	6	6	3	9	6			2	68
	170	718	0.15									3		2			5
	172	724	0.04								1	3	6				10
	173	263	0.28									6		2			8
	176	705	3.82		4						3	6	9	6		2	30
	177	4600	3.52	9	6	3	6	12	6	6	3	9	9	6		2	77
	179	260	0.60									3	3	2			8

	180	703	0.60									3	6	2		2	13
	182	0	0.92		4				2	2	1	6	9	2		2	28
	184a	800	1.50		4				2	6	3	6	9	6		2	38
	184b	800	1.75		4				2	6	3	6	9	6		2	38
	188	131	0.10							4	1	3					8
	199	712	0.48									6	3	2		2	13
	205	4600	0.89	9	6	3	6	12	6	6	3	9	9	2		2	73
	207	350	2.53		6				6	4	3	6	9	6		2	42
	212	724	0.64								2	3	3	4		2	14
	215	708	0.98									6	9	2		2	19
	226	4600	0.25	9	6	3	6	12	6	6	3	9	6			2	68
	227	4625	2.45	6	6			12	6	6	3	9	9	6		2	65
	229	4625	0.12	9	6	3	2	12	6	6	3	9	6	2		2	66
	230	736	0.67						2	2	1	3	6	2			16
	231	423	0.13						6	6	3	6		2			23
	232	272	0.57									3	6	2		2	13
	233	731	2.05			3					1	3	9	4		2	22
	238	728	1.39								1	3	9	6		2	21
	240	729	0.59								1	3	6	2		2	14
	243	716	7.99								1	6	9	4		2	22
	244	4600	0.13	9	6	3	6	12	6	6	3	9	6	2		2	70
	245	4600	0.89	9	6	3	6	12	6	6	3	9	9	4		2	75
	247	4600	0.01	9	6	3	6	12	6	6	3	9	6	4		2	72
	251	357	0.93		2						2	3	9			2	18
	253	4600	0.15	9	6	3	6	12	6	6	3	9	6	4		2	72
	254	727	3.70		4				6	2	3	3	9	6		2	35
	255	4600	0.06	9	6	3	6	12	6	6	3	9	6	2		2	70
	257	4600	0.00	9	6	3	6	12	6	6	3	9	6			2	68
	259	353	2.37							2	1	3	9	6		2	23
	261	125	1.94		4					4	2	6	9			2	27
	264	725	4.57		4				6	6	3	6	9	6			40
	273	4600	0.00	9	6	3	6	12	6	6	3	9	6			2	68
	275	4600	0.00	9	6	3	6	12	6	6	3	9	6			2	68
	276	4600	0.27	9	6	3	6	12	6	6	3	9	6			2	68
	277	4600	0.11	9	6	3	6	12	6	6	3	9	6			2	68
	278	4600	0.00	9	6	3	6	12	6	6	3	9	6			2	68
	283	200	3.51				2		2	2	1	6	9	6		2	30
	293	4600	0.16	9	6	3	6	12	6	6	3	9	6			2	68
	300	4600	0.09	9	6	3	6	12	6	6	3	9	6			2	68

	306	177	0.33									3	3			2	8
	310	4600	0.20	9	6	3	6	12	6	6	3	9	6	6		2	74
	321	4600	0.00	9	6	3	6	12	6	6	3	9	6	4		2	72
	323	745	1.02		4				4	2	2	6	9	2		2	31
	324	120	0.80				2						9	2		2	15
	330	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	331	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	335	4600	0	9	6	3	6	12	6	6	3	9	6	4		2	72
	336	100	0								1	3		4			8
	340	780	0.02		6	3	6						6			2	23
	343	4630	6.13		6		4	12	6	6	3	9	9	4		2	61
	344	90	4.32		4					4	2	6	9	6		2	33
	347	135	1.21		6				6	6	3	6	9	2		2	40
	351	4600	0.04	9	6	3	6	12	6	6	3	9	6	2		2	70
	358	100	0.58				6						6	2		2	16
	366a	250	2.00		4		6				1		9	2		2	24
	366b	250	0.49		4		6				1		9	2		2	24
	369	18	0.09		2												2
	370	265	0.04			3						9				2	14
	372	265	0.22			3						9				2	14
	377	4600	0.62	9	6	3	6	12	6	6	3	9	3	2		2	67
	378	265	0.03		2							3				2	7
	379	203	1								1	3	6	2		2	14
	385	16	0									3	3	2			8
	389	20	1								1	3	6	2		2	14
	392	47	0		4		4		6	2	3	6					25
	393	199	1									3	9	2		2	16
	395	375	1								1	3	9			2	15
	397	4600	1	9	6	3	6	12	6	6	3	9	6			2	68
	399	237	1		2					6	3	6	6	2		2	27
	402	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	403	40	0							2		3	3				8
	404	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	406	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	410	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	413	33	0						6	4	3	6	3	2			24
	414	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	415	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	416	4625	0	9	6	3	6	12	6	6	3		6			2	59

	417	4625	0	9	6	3	6	12	6	6	3	9	6			2	68
	418	4625	8	9	6	3	2	12	6	6	3	9	9	2		2	69
	426	70	1		2					4	1	6	6	2		2	23
	427	227	0		4						1	3	3				11
	429	230	1		2					6	3	6	9	2		2	30
	432	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	434	225	0		4							3				2	9
	435	4600	0	9	6	3	6	12	6	6	3	9	6	2		2	70
	438	15	7		2				6	6	3	6	9	4		2	38
	439a	550	1		4		4		4	2	2	6	9	4		2	37
	439b	550	1		4		4		4	2	2	6	9	4		2	37
	445	4600	0	9	6	3	6	12	6	6	3	9	6	2		2	70
	449a	140	2		6						1	3	9	4		2	25
	449b	140	1		6						1	3	9	4		2	25
	451	253	0						2		2	3		2			9
	453	188	1				4		4	2	3	6	9			2	30
	455	49	0									3					3
	456	4600	1	9	6	3	6	12	6	6	3	9	9	2		2	73
	457	252	0						2	2	2	6	3	2		2	19
	459	250	0									3				2	5
	460	273	0								1	6	3	2			12
	462	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	464a	4670	2		6		2	12	6	4	3	9	9	6		2	59
	464b	4670	8		6		2	12	6	4	3	9	9	6		2	59
	465	220	0									6					6
	466	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	467	4605	0		6		4	12	6	6	3	6				2	45
	470	145	4		6						2	6	9	4		2	29
	471	4690	6	9	6	3	6	12	6	6	3	9	9	2		2	73
	475	920	0			3				2	2					2	9
	476	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	477	140	2		6				2		3	6	9			2	28
	484	4600	0	9	6	3	6	12	6	6	3	9	9			2	71
	485	4600	1	9	6	3	6	12	6	6	3	9	6			2	68
	486	200	1		6		4				3	6	3	2		2	26
	489	880	0		2		2					9				2	15
	490	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	494	4635	4		6		6		6	4	2	6	9	2		2	43
	504	932	0				2	4		4	2	6	3	6			27

	505	185	1			3	2					6	6				17
	511	175	2		6					4	2	3	9	2		2	28
	514	933	3		2		2			4	3	6	9	2		2	30
	521	100	1							2	1	6	9			2	20
	522	880	1		2		2					9	6			2	21
	526	165	1		2		2			2	2	6	9			2	25
	528	4600	1	9	6	3	6	12	6	6	3	9	9			2	71
	530	888	0										6				6
	532	880	0		2		2					9				2	15
	534	930	3		2		4		6	6	3	6	9	6		2	44
	536	905	2									6	9	4		2	21
	537	900	3		4	3			4	6	3	6	9			2	37
	540	0	2		6		6		2	2	2	6	9			2	35
	541a	160	1		2		2			4	2	6	9	4		2	31
	541b	160	1		2		2			4	2		9	4		2	25
	544	171	0									3	3	2			8
	548	4600	5	9	6	3	6	12	6	6	3	9	9	2		2	73
	550	157	0									3	3	2			8
	551	889	0									6				2	8
	555	4625	10	9	6	3	6	12	6	6	3		9	6		2	68
	570	144	1				2					6	9	4		2	23
	573	975	2		2	1	2			4	2	6	9	2		2	30
	574	880	1		2		2			6	3	9	9			2	33
	586	151	0							2	2	6		2		2	14
	587	25	0		2	2	4			2	2	6	3			2	23
	591	153	0				2			2	2	3	3	4		2	18
	597	4600	2	9	6	3	6	12	6	6	3	9	9			2	71
	598	4605	4		6		4	12	6	6	3	6	9	2		2	56
	602	155	3		4		4		6	6	3	6	9	4		2	44
	603	154	1		2		2			2	2	6	6	2		2	24
	604a	4695	4	9	6	3	6		6	6	3	6	9	6		2	62
	604b	4695	2	9	6	3	6		6	6	3		9	6		2	56
	604c	4695	3	9	6	3	6		6	6	3		9	6		2	56
	618a	990	1	9	2		6		6	6	3	6	9			2	49
	618b	990	3	9	2		6		6	6	3	6	9			2	49
	620	162	1							4	2	6	9	6		2	29
	622	145	2		2		2				2	6	9	2		2	25
	623	4605	1		6		4	12	6	6	3	6	6			2	51
	624	130	0							4	2	3	3	2		2	16

	631	152	1		2		2			2	2	6	9	4		2	29
	640	164	1		2					4	2	3	6	2		2	21
	641	127	0									3		4		2	9
	650	4605	1		6		4	12	6	6	3	6	6			2	51
	651	140	3	3	6	2	6		2	4	3		9	6		2	43
	653a	110	2	3	6	2	6			2	2	6	9	4		2	42
	653b	110	1	3	6	2	6			2	2	6	9	4		2	42
	654	166	1		2					4	2	6	9	6		2	31
	655	4600	4	9	6	3	6	12	6	6	3	9	9	4		2	75
	661	168	1	3	2		6					6	9	4			30
	667	4605	0		6		4	12	6	6	3	6	6	2		2	53
	669	4605	0		6		4	12	6	6	3	6	6	2		2	53
	672	140	1		4	2	6				2		9	6		2	31
	682	81	0									6				2	8
	684a	109	1		2					2	3	3	9	4		2	25
	684b	109	1		2					2	3	3	9	4		2	25
	686	81	0									3	6			2	11
	701	4605	0		6		4	12	6	6	3	6				2	45
	702	4620	5	9	6	3	6	12	6	6	3	9	9	2		2	73
	706	510	0				2			4	3		6			2	17
	707	512	0				2			4	3						9
	708	4620	0	9	6	3	6					9	6			2	41
	710	530	1							2	2	6	6			2	18
	713	535	1								2	6	9			2	19
	719	4605	0		6		4	12	6	6	3	6	6			2	51
	720	4600	3	9	6	3	6	12	6	6	3		9			2	62
	722a	500	1	3	4		2			2	2	6	9	4		2	34
	722b	500	2	3	4		2			2	2	6	9	4		2	34
	727	4600	0	9	6	3	6	12	6	6	3	9	6			2	68
	729a	4610	3	3	4		6	12	6	6	3	6	9	2		2	59
	729b	4610	1	3	4		6	12	6	6	3	6	9	2		2	59
	730	545	0								2	6	3			2	13
	735	80	0		4		6				2	6	6	2		2	28
	736	80	0		4		6				2	6	6			2	26
	737	81	1						6	6	3	6	9	4		2	36
	738	540	1		2						1	6	9	2		2	22
	740	80	0		4		6				2	6	6			2	26
	741	80	0		4		6				2	6	6				24
	751	80	3	3	4		6				2					2	17

Appendix 12: Segment Cost Scores

ENVIRONMENTAL COST FACTORS FOR MAINTAINING ROAD SEGMENTS			Riparian and Aquatic Habitat W-W							Terrestrial Management Species							TOTALS
			AQ1	AQ2	AQ3	AQ4	AQ6,8,9,11	AQ10		TW 1	TW 2	TW 3	TW 4	NOX	BOT	RPxWO	
			Modified surface and subsurface	Road generated surface erosion	Road and mass wasting	Road crossings	Road interaction with cannel, floodplain, riparian function, seeps, springs	Culverts of concern	Sub-Watersheds	Effects of roads on terrestrial species habitat	Human activities that affect habitat	Legal_illegal activites on wildlife species	Unique habitats or special features	Noxious weeds	Rare Plant Occurrence	Rare Plant x Weed Occurrence	TOTALS
Segment #	FS Road #	Segment Length (miles)	**Weighting Factors** (multipiers applied to normalized data to establish relative signifigance among factors)														
			3.0	1.0	1.0	2.0	3.0	2.0		3.0	2.0	1.0	2.0	3.0	3.0	1.0	
			Normalizing Coefficients (multipliers applied to segment data to bring all data into same range of 0 to 1, before weighting)														
			1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	
4	477	0.02							626L	6.00	4.00	2.00	4.00		9.00		25
7	460	0.52							626K	9.00	6.00	2.00	6.00		9.00		32
8	445	0.01							626K	6.00	4.00	2.00	2.00				14
9	580	0.19							626M	6.00	4.00	1.00	2.00		9.00		22
10	580	0.32		1.00					626M	6.00	4.00	1.00	2.00		9.00		23
11	475	0.17							626M	6.00	4.00	2.00	4.00		9.00		25
12	4600	0.27							626I	6.00	4.00	2.00	2.00		9.00		23

	13	570	0.02							626M	6.00	6.00	3.00	4.00				19
	15	4600	1.06							626K	6.00	4.00	2.00	2.00		9.00		23
	16	4600	0.32						6.00	626I	6.00	4.00	2.00	2.00		9.00		29
	18	442	0.34						6.00	626K	9.00	4.00	2.00	4.00		9.00		34
	19	4600	1.05							626I	6.00	4.00	2.00	2.00		9.00		23
	21	485	0.01							626K	6.00	4.00	2.00	4.00				16
	22	490	0.05							626K	6.00	4.00	2.00	2.00		9.00		23
	25	4600	0.08							626K	6.00	4.00	2.00	2.00		9.00		23
	26	4600	0.30							626M	6.00	4.00	2.00	2.00		9.00		23
	27	4600	0.29							626K	6.00	4.00	2.00	2.00		9.00		23
	28	420	0.04							626I	9.00	4.00	2.00	2.00				17
	29	431	0.17							626I	6.00	2.00	1.00	2.00				11
	30	438	0.27					9.00		626K	6.00	4.00	1.00	2.00				22
	31	495	0.02							626I	6.00	6.00	2.00	4.00		9.00		27
	32	4650	0.12							626K	9.00	6.00	3.00	4.00		9.00		31
	33	4600	0.28							626K	6.00	4.00	2.00	2.00		9.00		23
	34	4600	0.71							626M	6.00	4.00	2.00	2.00		9.00		23
	35	4600	0.46						6.00	626I	6.00	4.00	2.00	2.00		9.00		29
	36	432	0.23							626K	9.00	6.00	2.00	2.00				19
	39	588	4.83							626M	9.00	6.00	3.00	4.00	9.00	9.00	3.00	43
	41	560	0.05							626M	6.00	6.00	2.00	4.00		9.00		27
	42	15	0.15					6.00		626M	6.00	2.00	1.00	2.00		9.00		26
	43	4600	0.65							626L	6.00	4.00	2.00	2.00		9.00		23
	44	205	0.10							626K	6.00	4.00	1.00	2.00		9.00		22
	46	57	0.20							626M	6.00	4.00	2.00	2.00		6.00		20
	47	50	2.22					6.00		626K	9.00	4.00	2.00	4.00		9.00		34
	48	80	0.94							626M	9.00	6.00	2.00	4.00		9.00		30
	52	429	0.33							626K	6.00	4.00	2.00	4.00		9.00		25
	54	25	0.11					6.00		626M	3.00	4.00	1.00	2.00		6.00		22
	55	613	0.05		1.00			6.00		626L	6.00	4.00	2.00	2.00		9.00		30
	57	4600	0.42							626K	6.00	4.00	2.00	2.00		9.00		23
	58	437	1.25							626L	9.00	6.00	2.00	4.00		9.00		30
	59	4600	0.35							626I	6.00	4.00	2.00	2.00		9.00		23
	60	517	1.38							626L	9.00	4.00	2.00	4.00	6.00	9.00	2.00	36
	62	210	0.59					6.00		626I	9.00	6.00	2.00	2.00				25
	67	200	1.40							626K	9.00	4.00	2.00	4.00		9.00		28
	68	4600	0.14					6.00		626L	6.00	4.00	2.00	2.00		9.00		29
	69	4600	0.00							626K	6.00	4.00	2.00	2.00		9.00		23
	74	69	0.26							626L	6.00	4.00	2.00	2.00		3.00		17

	79	335	0.83							626K	9.00	4.00	2.00	4.00	3.00			22
	81	4600	0.35							626M	6.00	4.00	2.00	2.00		9.00		23
	84	4600	0.71							626K	6.00	4.00	2.00	2.00		9.00		23
	86	265	0.13					6.00		626M	6.00	4.00	2.00	2.00				20
	88	670	0.04							626I	9.00	6.00	2.00	6.00		9.00		32
	93	71	0.50					6.00		626M	6.00	4.00	2.00	4.00		6.00		28
	94	4600	0.54						6.00	626L	6.00	4.00	2.00	2.00		9.00		29
	95	635	0.63					6.00	6.00	626I	9.00	4.00	2.00	4.00		9.00		40
	97	4600	0.29						6.00	626M	6.00	4.00	2.00	2.00		9.00		29
	98	4680	0.06							626I	9.00	4.00	2.00	4.00		9.00		28
	99a	60	0.50		1.00		6.00			626I	6.00	4.00	2.00	4.00		6.00		29
	99b	60	1.90							626M	6.00	4.00	2.00	4.00		6.00		22
	102	4625	0.41							626K	6.00	4.00	2.00	4.00		9.00		25
	103	4600	0.10					6.00		626K	6.00	4.00	2.00	2.00		9.00		29
	104	346	0.19							626K	6.00	4.00	2.00	2.00				14
	105	430	3.65					6.00		626K	9.00	6.00	2.00	4.00		9.00		36
	110	457	1.00					6.00		626K	9.00	4.00	2.00	6.00				27
	114	695	0.26						6.00	626K	9.00	4.00	2.00	2.00				23
	117	830	0.71							626K	9.00	4.00	2.00	2.00		9.00		26
	121	450	4.50							626K	9.00	4.00	2.00	4.00		9.00		28
	122	620	1.40						6.00	626M	9.00	4.00	2.00	4.00				25
	125	4600	0.40							626K	6.00	4.00	2.00	2.00		9.00		23
	127	835	1.56							626K	9.00	4.00	2.00	6.00		9.00		30
	128	343	2.45							626I	9.00	4.00	2.00	6.00		9.00		30
	129	48	0.25					6.00		626I	9.00	2.00	1.00	2.00				20
	130	698	0.86					6.00		626I	9.00	4.00	2.00	6.00				27
	131	45	0.20					6.00		626L	9.00	2.00	1.00	2.00				20
	134	910	1.85							626K	9.00	4.00	2.00	6.00		9.00		30
	141	300	7.73							626I	9.00	4.00	3.00	6.00	9.00	9.00	3.00	43
	148	4600	0.07							626I	6.00	4.00	1.00	2.00		9.00		22
	150a	4665	2.00							626I	9.00	4.00	2.00	4.00		9.00		28
	150b	4665	4.31							626M	9.00	4.00	2.00	4.00		9.00		28
	150c	4665	2.00							626I	9.00	4.00	2.00	4.00		9.00		28
	151	715	0.24					6.00		626J	6.00	4.00	1.00	2.00		9.00		28
	152	706	0.38		3.00					626K	9.00	4.00	1.00	4.00		6.00		27
	154	125	0.81							626J	9.00	4.00	2.00	2.00		3.00		20
	156	452	1.05							626M	9.00	4.00	1.00	6.00				20
	157	653	0.57							626K	9.00	4.00	2.00	4.00				19
	167	4600	0.14							626I	6.00	4.00	2.00	2.00		9.00		23

	170	718	0.15							626K	6.00	4.00	1.00	2.00		9.00		22
	172	724	0.04							626I	6.00	4.00	1.00	2.00				13
	173	263	0.28							626K	9.00	4.00	2.00	4.00				19
	176	705	3.82							626K	9.00	6.00	2.00	4.00		9.00		30
	177	4600	3.52							626I	6.00	4.00	2.00	2.00		9.00		23
	179	260	0.60							626I	9.00	4.00	2.00	6.00				21
	180	703	0.60					6.00		626I	9.00	4.00	2.00	2.00				23
	182	0	0.92							626K	9.00	4.00	2.00	6.00				21
	184a	800	1.50							626I	9.00	4.00	2.00	4.00		3.00		22
	184b	800	1.75							626L	9.00	4.00	2.00	4.00		3.00		22
	188	131	0.10							626K	6.00	2.00	1.00	2.00				11
	199	712	0.48						6.00	626K	9.00	6.00	2.00	4.00				27
	205	4600	0.89							626K	6.00	4.00	1.00	2.00		9.00		22
	207	350	2.53		1.00		6.00			626K	9.00	4.00	2.00					22
	212	724	0.64							626M	6.00	4.00	1.00	2.00		9.00		22
	215	708	0.98		3.00		6.00		6.00	626I	9.00	4.00	1.00	2.00				31
	226	4600	0.25							626I	6.00	4.00	2.00	2.00		9.00		23
	227	4625	2.45							626K	9.00	4.00	2.00	4.00		6.00		25
	229	4625	0.12							626M	6.00	4.00	2.00	6.00				18
	230	736	0.67					6.00		626I	9.00	4.00	2.00	4.00		6.00		31
	231	423	0.13							626M	9.00	4.00	1.00	6.00		6.00		26
	232	272	0.57							626I	9.00	4.00	2.00	2.00				17
	233	731	2.05							626M	9.00	4.00	2.00	6.00		9.00		30
	238	728	1.39							626K	9.00	4.00	2.00	6.00				21
	240	729	0.59							626K	9.00	4.00	2.00	2.00				17
	243	716	7.99							626J	9.00	4.00	2.00	6.00		9.00		30
	244	4600	0.13							626K	6.00	4.00	2.00	2.00		9.00		23
	245	4600	0.89							626M	6.00	4.00	2.00	2.00		9.00		23
	247	4600	0.01							626M	6.00	4.00	2.00	2.00		9.00		23
	251	357	0.93							626M	9.00	4.00	1.00	6.00		6.00		26
	253	4600	0.15							626J	6.00	4.00	2.00	2.00		9.00		23
	254	727	3.70							626J	9.00	4.00	2.00	6.00		9.00		30
	255	4600	0.06							626K	6.00	4.00	2.00	2.00		9.00		23
	257	4600	0.00							626M	6.00	4.00	2.00	2.00		9.00		23
	259	353	2.37							626M	9.00	4.00	2.00	6.00	3.00	6.00		30
	261	125	1.94				6.00		6.00	626M	9.00	4.00	2.00	4.00	3.00	6.00		40
	264	725	4.57							626I	9.00	4.00	2.00	6.00		9.00		30
	273	4600	0.00							626M	6.00	4.00	2.00	2.00		9.00		23
	275	4600	0.00							626K	6.00	4.00	2.00	2.00		9.00		23

	276	4600	0.27							626K	6.00	4.00	2.00	2.00		9.00		23
	277	4600	0.11							626K	6.00	4.00	2.00	2.00		9.00		23
	278	4600	0.00						6.00	626I	6.00	4.00	2.00	2.00		9.00		29
	283	200	3.51							626J	9.00	4.00	2.00	6.00		9.00		30
	293	4600	0.16							626M	6.00	4.00	2.00	2.00		9.00		23
	300	4600	0.09		1.00					626J	6.00	4.00	2.00	2.00		9.00		24
	306	177	0.33							626M	9.00	2.00	1.00	2.00				14
	310	4600	0.20							626M	6.00	4.00	2.00	2.00		9.00		23
	321	4600	0.00							626K	6.00	4.00	2.00	2.00		9.00		23
	323	745	1.02							626K	9.00	4.00	2.00	4.00		6.00		25
	324	120	0.80							626J	9.00	4.00	2.00	6.00		6.00		27
	330	4600	0.24						6.00	626M	6.00	4.00	2.00	2.00		9.00		29
	331	4600	0.00							626I	6.00	4.00	2.00	2.00		9.00		23
	335	4600	0.18		1.00				4.00	626K	6.00	4.00	2.00	2.00		9.00		28
	336	100	0.17							626I	6.00	4.00	2.00	6.00				18
	340	780	0.02						6.00	626M	9.00	4.00	2.00	4.00				25
	343	4630	6.13				6.00			626J	9.00	4.00	2.00	4.00		6.00		31
	344	90	4.32							626J	9.00	4.00	2.00	6.00		9.00		30
	347	135	1.21							626J	9.00	4.00	2.00	4.00				19
	351	4600	0.04							626J	6.00	4.00	2.00	2.00		9.00		23
	358	100	0.58							626K	9.00	4.00	1.00	6.00		6.00		26
	366a	250	2.00		1.00					626J	9.00	4.00	1.00	2.00	9.00	9.00	3.00	38
	366b	250	0.49							626K	9.00	4.00	1.00	2.00	9.00	9.00	3.00	37
	369	18	0.09		1.00	2.00	4.00			626K	9.00	4.00	2.00	4.00				26
	370	265	0.04							626J	6.00	4.00	1.00	2.00	9.00	6.00	2.00	30
	372	265	0.22							626M	6.00	4.00	1.00	2.00	9.00	6.00	2.00	30
	377	4600	0.62							626J	6.00	4.00	2.00	2.00		9.00		23
	378	265	0.03							626K	6.00	4.00	1.00	2.00		9.00		22
	379	203	0.62							626K	9.00	4.00	2.00	2.00				17
	385	16	0.27							626M	9.00	4.00	2.00	2.00				17
	389	20	0.57							626M	6.00	4.00	2.00	2.00		9.00		23
	392	47	0.17							626I	9.00	4.00	2.00	2.00				17
	393	199	0.79							626J	9.00	4.00	1.00	2.00				16
	395	375	0.82							626K	9.00	4.00	2.00	2.00				17
	397	4600	0.55						6.00	626M	6.00	4.00	2.00	2.00		9.00		29
	399	237	0.65		1.00					626J	9.00	4.00	2.00	2.00				18
	402	4600	0.02							626M	6.00	4.00	2.00	2.00		9.00		23
	403	40	0.26							626K	9.00	2.00	1.00	2.00		9.00		23
	404	4600	0.01							626I	6.00	4.00	2.00	2.00		9.00		23

	406	4600	0.01							626J	6.00	4.00	2.00	2.00		9.00		23
	410	4600	0.03					6.00		626J	6.00	4.00	2.00	2.00		9.00		29
	413	33	0.33							626J	9.00	4.00	1.00	2.00				16
	414	4600	0.05							626I	6.00	4.00	2.00	2.00		9.00		23
	415	4600	0.00							626K	6.00	4.00	2.00	2.00		9.00		23
	416	4625	0.18							626J	6.00	4.00	2.00	2.00	9.00	9.00	3.00	35
	417	4625	0.07						6.00	626M	6.00	4.00	2.00	2.00	3.00	9.00	1.00	33
	418	4625	7.72						6.00	626K	9.00	4.00	2.00	4.00	9.00	9.00	3.00	46
	426	70	0.51							626K	9.00	4.00	2.00	2.00	6.00	9.00	2.00	34
	427	227	0.36							626I	9.00	4.00	2.00	2.00				17
	429	230	1.45		1.00					626K	9.00	4.00	2.00	6.00				22
	432	4600	0.25							626J	6.00	4.00	2.00	2.00		9.00		23
	434	225	0.11							626K	6.00	4.00	2.00	2.00				14
	435	4600	0.00							626J	6.00	4.00	2.00	2.00		9.00		23
	438	15	6.95							626M	9.00	4.00	2.00	6.00		9.00		30
	439a	550	1.00							626M	9.00	4.00	2.00	6.00				21
	439b	550	1.34							626J	9.00	4.00	2.00	6.00				21
	445	4600	0.18							626J	6.00	4.00	2.00	2.00		9.00		23
	449a	140	2.00							626J	9.00	4.00	1.00	2.00		9.00		25
	449b	140	1.21							626M	9.00	4.00	1.00	2.00		9.00		25
	451	253	0.22							626I	9.00	4.00	2.00	4.00	6.00	9.00	2.00	36
	453	188	0.92							626J	6.00	4.00	2.00	2.00				14
	455	49	0.05							626I	9.00	4.00	2.00	2.00				17
	456	4600	0.95							626I	6.00	4.00	2.00	2.00	6.00	9.00	2.00	31
	457	252	0.42							626I	9.00	4.00	2.00	6.00	9.00	9.00	3.00	42
	459	250	0.02							626M	6.00	2.00	1.00	2.00				11
	460	273	0.43							626J	9.00	4.00	2.00	2.00				17
	462	4600	0.46							626J	6.00	4.00	2.00	2.00	9.00	9.00	3.00	35
	464a	4670	2.00							626M	6.00	4.00	2.00	4.00	9.00	9.00	3.00	37
	464b	4670	7.52						6.00	626I	6.00	4.00	2.00	4.00	9.00	9.00	3.00	43
	465	220	0.01							626J	6.00	2.00	1.00	2.00				11
	466	4600	0.24							626J	6.00	4.00	2.00	2.00		9.00		23
	467	4605	0.06		1.00					626I	9.00	4.00	2.00	6.00				22
	470	145	4.32							626J	9.00	4.00	2.00	6.00		6.00		27
	471	4690	5.65		1.00					626I	6.00	4.00	2.00	4.00		9.00		26
	475	920	0.11							626I	6.00	2.00	1.00	2.00		9.00		20
	476	4600	0.22							626I	6.00	4.00	2.00	2.00		9.00		23
	477	140	1.56							626I	9.00	4.00	2.00	2.00				17
	484	4600	0.01							626I	6.00	4.00	2.00	2.00		9.00		23

	485	4600	0.71							626J	6.00	4.00	2.00	2.00	6.00	9.00	2.00	31
	486	200	0.50							626M	9.00	4.00	2.00	2.00		9.00		26
	489	880	0.02							626I	6.00	2.00	1.00	2.00				11
	490	4600	0.22		3.00					626I	6.00	4.00	2.00	2.00		9.00		26
	494	4635	3.82							626M	6.00	4.00	2.00	4.00	6.00	9.00	2.00	33
	504	932	0.46							626J	9.00	4.00	1.00	4.00				18
	505	185	0.55							626J	9.00	4.00	2.00	4.00				19
	511	175	1.96							626I	9.00	4.00	1.00	4.00				18
	514	933	3.44							626E	9.00	4.00	2.00	2.00		9.00		26
	521	100	1.17							626E	9.00	4.00	2.00	6.00		6.00		27
	522	880	0.57							626E	6.00	4.00	2.00	2.00		9.00		23
	526	165	1.37		1.00					626I	9.00	4.00	2.00	2.00		3.00		21
	528	4600	0.83		1.00					626I	6.00	4.00	2.00	2.00		9.00		24
	530	888	0.02							626E	6.00	2.00	2.00	2.00				12
	532	880	0.10							626I	6.00	2.00	2.00	2.00		3.00		15
	534	930	3.19							626I	6.00	4.00	2.00	6.00		9.00		27
	536	905	1.59							626B	9.00	4.00	2.00	4.00				19
	537	900	3.44							626G	9.00	4.00	2.00	6.00		9.00		30
	540	0	2.34							626B	9.00	4.00	2.00	6.00		9.00		30
	541a	160	0.50							626M	9.00	4.00	2.00	4.00		9.00		28
	541b	160	0.86							626J	9.00	4.00	2.00	4.00		9.00		28
	544	171	0.34							626J	6.00	4.00	2.00	4.00				16
	548	4600	4.62							626J	6.00	4.00	2.00	2.00		9.00		23
	550	157	0.27							626B	9.00	4.00	2.00	4.00	3.00	9.00	1.00	32
	551	889	0.02							626J	6.00	4.00	2.00	2.00				14
	555	4625	9.66							626J	6.00	4.00	2.00	4.00	9.00	9.00	3.00	37
	570	144	1.46							626A	9.00	4.00	2.00	4.00	6.00	9.00	2.00	36
	573	975	2.30							626B	9.00	4.00	2.00	6.00		9.00		30
	574	880	1.26							626A	6.00	4.00	2.00	2.00		3.00		17
	586	151	0.19		1.00				6.00	626G	9.00	4.00	2.00	4.00		6.00		32
	587	25	0.26							626J	6.00	4.00	2.00	2.00		6.00		20
	591	153	0.44							626E	9.00	4.00	2.00	6.00	6.00	9.00	2.00	38
	597	4600	1.51							626G	6.00	4.00	2.00	2.00		9.00		23
	598	4605	4.16							626J	9.00	4.00	2.00	4.00		9.00		28
	602	155	3.05							626J	9.00	4.00	2.00	6.00	3.00	9.00	1.00	34
	603	154	0.59		3.00					626G	9.00	4.00	2.00	2.00	3.00	6.00		29
	604a	4695	4.00		1.00					626F	9.00	4.00	1.00	4.00		9.00		28
	604b	4695	2.00		1.00					626F	9.00	4.00	1.00	4.00		9.00		28
	604c	4695	2.70							626J	9.00	4.00	1.00	4.00		9.00		27

	618a	990	1.00							626J	9.00	4.00	2.00	6.00		9.00		30
	618b	990	3.16							626G	9.00	4.00	2.00	6.00		9.00		30
	620	162	0.95							626B	9.00	4.00	2.00	4.00	6.00	9.00	2.00	36
	622	145	1.58							626G	9.00	4.00	2.00	2.00	9.00	3.00	1.00	30
	623	4605	0.74		1.00		6.00			626B	6.00	4.00	2.00	4.00		3.00		26
	624	130	0.47							626J	9.00	4.00	2.00	4.00	9.00	9.00	3.00	40
	631	152	0.80							626J	9.00	4.00	2.00	2.00	6.00	6.00		29
	640	164	0.58							626B	9.00	2.00	1.00	2.00	9.00	9.00	3.00	35
	641	127	0.21							626B	9.00	4.00	2.00	2.00	6.00	6.00		29
	650	4605	0.74							626J	6.00	4.00	2.00	4.00		3.00		19
	651	140	2.59							626J	9.00	4.00	2.00	4.00	6.00	9.00	2.00	36
	653a	110	1.50							626E	9.00	4.00	2.00	6.00	9.00	9.00	3.00	42
	653b	110	1.08							626E	9.00	4.00	2.00	6.00	9.00	9.00	3.00	42
	654	166	1.02							626J	9.00	4.00	2.00	4.00	3.00	6.00		28
	655	4600	4.28							626J	6.00	4.00	2.00	2.00	9.00	9.00	3.00	35
	661	168	0.99							626G	9.00	4.00	2.00	6.00		3.00		24
	667	4605	0.42								6.00	4.00	2.00	2.00		3.00		17
	669	4605	0.03								6.00	4.00	2.00	2.00		3.00		17
	672	140	1.00								6.00	4.00	2.00	2.00	6.00			20
	682	81	0.01								9.00	4.00	2.00	2.00				17
	684a	109	0.50								9.00	4.00	2.00	4.00		9.00		28
	684b	109	0.95								9.00	4.00	2.00	4.00		9.00		28
	686	81	0.19								9.00	4.00	2.00	2.00				17
	701	4605	0.00								6.00	4.00	2.00	4.00				16
	702	4620	5.25								6.00	4.00	2.00	4.00	6.00	9.00		31
	706	510	0.24								9.00	2.00	1.00	4.00				16
	707	512	0.21								9.00	4.00	2.00	2.00				17
	708	4620	0.09								6.00	4.00	2.00	4.00				16
	710	530	0.54								9.00	4.00	2.00	4.00		3.00		22
	713	535	0.87								6.00	4.00	2.00	4.00		6.00		22
	719	4605	0.20								6.00	4.00	2.00	4.00	6.00	9.00		31
	720	4600	2.79								6.00	4.00	2.00	2.00	6.00	9.00		29
	722a	500	1.00								9.00	4.00	2.00	2.00	9.00	9.00	3.00	38
	722b	500	2.27								9.00	4.00	2.00	2.00	9.00	9.00	3.00	38
	727	4600	0.12								6.00	4.00	2.00	2.00		9.00		23
	729a	4610	2.50								9.00	4.00	2.00	6.00		9.00		30
	729b	4610	1.09								9.00	4.00	2.00	6.00		9.00		30
	730	545	0.43								9.00	4.00	1.00	6.00	6.00			26
	735	80	0.43								6.00	4.00	2.00	2.00		9.00		23

	736	80	0.00								6.00	4.00	2.00	2.00				14
	737	81	1.01								9.00	4.00	2.00	6.00	9.00	9.00	3.00	42
	738	540	1.35								9.00	4.00	2.00	6.00	3.00			24
	740	80	0.45								6.00	4.00	2.00	2.00	3.00	9.00		26
	741	80	0.00								6.00	4.00	2.00	2.00				14
	751	80	2.66								9.00	4.00	2.00	6.00		9.00		30

Appendix 13: Results

	Benefit Break Points L <= 22.84 < M <= 49.18 < H					Cost Break Points L <= 23.14 < M <= 28.48 < H					Final Recommendations
SEG ID	SEG NO	FS Road #	Segment Length (miles)	Benefit Score	Benefit Rating	Cost Score	Cost Rating	Matrix Result	Matrix Category	Team Recommendations after resolving Quandrys in analysis	Team Recommendations after review of mapped output
46004770	4	477	0.02	7	L	25	M	3	Close	Close	Close
46004600	7	460	0.52	23	M	32	H	2	Close	Close	Close
46004450	8	445	0.01	7	L	14	L	6	Leave	Leave	Leave
46005800	9	580	0.19	36	M	22	L	8	Leave A	Leave A	Leave A
46005800	10	580	0.32	33	M	23	L	8	Leave A	Leave A	Leave A
46004750	11	475	0.17	15	L	25	M	3	Close	Close	Close
460000013.84	12	4600	0.27	70	H	23	L	9	Leave A	Leave A	Leave A
46005700	13	570	0.02	7	L	19	L	6	Leave	Leave	Leave
460000013.84	15	4600	1.06	75	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	16	4600	0.32	72	H	29	H	4	H/HQuand	Leave	Leave
46004420	18	442	0.34	30	M	34	H	2	Close	Close	Close
460000013.84	19	4600	1.05	75	H	23	L	9	Leave A	Leave A	Leave A
46004850	21	485	0.01	3	L	16	L	6	Leave	Leave	Leave
46004900	22	490	0.05	3	L	23	L	6	Leave	Leave	Leave
460000013.84	25	4600	0.08	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	26	4600	0.30	65	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	27	4600	0.29	65	H	23	L	9	Leave A	Leave A	Leave A
46004200	28	420	0.04	7	L	17	L	6	Leave	Leave	Leave
46004310	29	431	0.17	4	L	11	L	6	Leave	Leave	Close
46004380	30	438	0.27	9	L	22	L	6	Leave	Close	Close
46004950	31	495	0.02	3	L	27	M	3	Close	Close	Close
46500000	32	4650	0.12	58	H	31	H	4	H/HQuand	Leave	Leave
460000013.84	33	4600	0.28	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	34	4600	0.71	72	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	35	4600	0.46	68	H	29	H	4	H/HQuand	Leave	Leave
46004320	36	432	0.23	14	L	19	L	6	Leave	Close	Close
46005880	39	588	4.83	23	M	43	H	2	Close	Close	Close
46005600	41	560	0.05	15	L	27	M	3	Close	Close	Close

46650150	42	15	0.15	12	L	26	M	3	Close	Close	Close
460000013.84	43	4600	0.65	72	H	23	L	9	Leave A	Leave A	Leave A
46652050	44	205	0.10	18	L	22	L	6	Leave	Leave	Leave
46650570	46	57	0.20	6	L	20	L	6	Leave	Leave	Close
46650500	47	50	2.22	31	M	34	H	2	Close	Close	Leave (open North end for approx .75 mi for recreation access
46650800	48	80	0.94	30	M	30	H	2	Close	Close	Close
46004290	52	429	0.33	19	L	25	M	3	Close	Close	Close
46700250	54	25	0.11	41	M	22	L	8	Leave A	Leave A	Leave A
46006130	55	613	0.05	5	L	30	H	1	Close	Close	Close
460000013.84	57	4600	0.42	70	H	23	L	9	Leave A	Leave A	Leave A
46004370	58	437	1.25	23	M	30	H	2	Close	Close	Close
460000013.84	59	4600	0.35	70	H	23	L	9	Leave A	Leave A	Leave A
46005170	60	517	1.38	29	M	36	H	2	Close	Close	Close
46652100	62	210	0.59	18	L	25	M	3	Close	Close	Close
46652000	67	200	1.40	39	M	28	M	5	M/MQuand	Leave B (Close Last Mile)	Leave B (Close Last Mile)
460000013.84	68	4600	0.14	68	H	29	H	4	H/HQuand	Leave	Leave
460000013.84	69	4600	0.00	65	H	23	L	9	Leave A	Leave A	Leave A
46650690	74	69	0.26	9	L	17	L	6	Leave	Leave	Close
46303350	79	335	0.83	22	L	22	L	6	Leave	Close	Close
460000013.84	81	4600	0.35	70	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	84	4600	0.71	72	H	23	L	9	Leave A	Leave A	Leave A
46652650	86	265	0.13	7	L	20	L	6	Leave	Leave	Leave
46006700	88	670	0.04	20	L	32	H	1	Close	Close	Close
46650710	93	71	0.50	12	L	28	M	3	Close	Close	Close
460000013.84	94	4600	0.54	70	H	29	H	4	H/HQuand	Leave	Leave
46006350	95	635	0.63	25	M	40	H	2	Close	Close	Close
460000013.84	97	4600	0.29	72	H	29	H	4	H/HQuand	Leave	Leave
46800000	98	4680	0.06	68	H	28	M	7	Leave B	Leave B	Leave B
46650600	99a	60	0.50	23	M	29	H	2	Close	Close	Close
46650600	99b	60	1.90	23	M	22	L	8	Leave A	Leave A	Close
462500020.4	102	4625	0.41	56	H	25	M	7	Leave B	Leave B	Leave B
460000013.84	103	4600	0.10	70	H	29	H	4	H/HQuand	Leave	Leave
46653460	104	346	0.19	8	L	14	L	6	Leave	Leave	Leave
46004300	105	430	3.65	22	L	36	H	1	Close	Close	Close

46254570	110	457	1.00	14	L	27	M	3	Close	Close	Close
46006950	114	695	0.26	28	M	23	L	8	Leave A	Leave A	Leave A
46258300	117	830	0.71	11	L	26	M	3	Close	Close	Close
46004500	121	450	4.50	36	M	28	M	5	M/MQuand	Leave B (w/ Seasonal Closure Soft)	Leave B (w/ Seasonal Closure Soft)
46006200	122	620	1.40	29	M	25	M	5	M/MQuand	Close (Provide for Admin Use)	Quandry (review at project level to select best route for access to area between Billy Cr. and Summit Cr.)
460000013.84	125	4600	0.40	70	H	23	L	9	Leave A	Leave A	Leave A
46258350	127	835	1.56	23	M	30	H	2	Close	Close	Close
46653430	128	343	2.45	32	M	30	H	2	Close	Close	Leave B (soft in wet weather needs seasonal closure)
46700480	129	48	0.25	5	L	20	L	6	Leave	Leave	Close
46006980	130	698	0.86	21	L	27	M	3	Close	Close	Close
46700450	131	45	0.20	5	L	20	L	6	Leave	Leave	Close
46259100	134	910	1.85	26	M	30	H	2	Close	Close	Close
46303000	141	300	7.73	39	M	43	H	2	Close	Close	Leave (need priority for restoration/reconstruction to stabilize surface and improve drainage
460000013.84	148	4600	0.07	70	H	22	L	9	Leave A	Leave A	Leave A
46650000	150a	4665	2.00	43	M	28	M	5	M/MQuand	M/MQuand	Leave B (close under green dot)
46650000	150b	4665	4.31	43	M	28	M	5	M/MQuand	M/MQuand	Leave B (close under green dot)
46650000	150c	4665	2.00	43	M	28	M	5	M/MQuand	M/MQuand	Leave B (close under green dot)
46007150	151	715	0.24	25	M	28	M	5	M/MQuand	Close	Close
46007060	152	706	0.38	12	L	27	M	3	Close	Close	Close
46701250	154	125	0.81	25	M	20	L	8	Leave A	Leave A	Leave A
46254520	156	452	1.05	21	L	20	L	6	Leave	Leave	Close
46006531	157	653	0.57	21	L	19	L	6	Leave	Leave	Leave
460000013.84	167	4600	0.14	68	H	23	L	9	Leave A	Leave A	Leave A
46007180	170	718	0.15	5	L	22	L	6	Leave	Close	Close

46007240	172	724	0.04	10	L	13	L	6	Leave	Leave	Close (below dispersed camp use
46902630	173	263	0.28	8	L	19	L	6	Leave	Close	Close
46007050	176	705	3.82	30	M	30	H	2	Close	Close	Close
460000013.84	177	4600	3.52	77	H	23	L	9	Leave A	Leave A	Leave A
46902600	179	260	0.60	8	L	21	L	6	Leave	Close	Close
46007030	180	703	0.60	13	L	23	L	6	Leave	Close	Close
46258050	182	805	0.92	28	M	21	L	8	Leave A	Leave A	Leave A
46258000	184a	800	1.50	38	M	22	L	8	Leave A	Leave B	Close (close from rd 805 to rd 640)
46258000	184b	800	1.75	38	M	22	L	8	Leave A	Leave A	Leave A
46701310	188	131	0.10	8	L	11	L	6	Leave	Leave	Close
46007120	199	712	0.48	13	L	27	M	3	Close	Close	Close
460000013.84	205	4600	0.89	73	H	22	L	9	Leave A	Leave A	Leave A
46303500	207	350	2.53	42	M	22	L	8	Leave A	Leave A	Leave A
46007240	212	724	0.64	14	L	22	L	6	Leave	Close	Close
46007080	215	708	0.98	19	L	31	H	1	Close	Close	Close
460000013.84	226	4600	0.25	68	H	23	L	9	Leave A	Leave A	Leave A
462500017.92	227	4625	2.45	65	H	25	M	7	Leave B	Leave B	Leave B
462500017.8	229	4625	0.12	66	H	18	L	9	Leave A	Leave A	Leave A
46007360	230	736	0.67	16	L	31	H	1	Close	Close	Close
46254230	231	423	0.13	23	M	26	M	5	M/MQuand	Leave	Leave
46902720	232	272	0.57	13	L	17	L	6	Leave	Close	Close
46007310	233	731	2.05	22	L	30	H	1	Close	Close	Close
46007280	238	728	1.39	21	L	21	L	6	Leave	Close	Close
46007290	240	729	0.59	14	L	17	L	6	Leave	Close	Close
46007160	243	716	7.99	22	L	30	H	1	Close	Close	Close
460000013.84	244	4600	0.13	70	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	245	4600	0.89	75	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	247	4600	0.01	72	H	23	L	9	Leave A	Leave A	Leave A
46703570	251	357	0.93	18	L	26	M	3	Close	Close	Leave
460000013.84	253	4600	0.15	72	H	23	L	9	Leave A	Leave A	Leave A
46007270	254	727	3.70	35	M	30	H	2	Close	Close	Close
460000013.84	255	4600	0.06	70	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	257	4600	0.00	68	H	23	L	9	Leave A	Leave A	Leave A
46703530	259	353	2.37	23	M	30	H	2	Close	Close	Leave (rd 357 to rd 4670)
4670125.94	261	125	1.94	27	M	40	H	2	Close	Close	Leave (to jct w/ rd 357)

46007250	264	725	4.57	40	M	30	H	2	Close	Leave	Close (open for admin use only if needed)
460000013.84	273	4600	0.00	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	275	4600	0.00	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	276	4600	0.27	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	277	4600	0.11	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	278	4600	0.00	68	H	29	H	4	H/HQuand	Leave	Leave
46602000	283	200	3.51	30	M	30	H	2	Close	Close	Quandry (review at proj lvl for connection to rd 4600)
460000013.84	293	4600	0.16	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	300	4600	0.09	68	H	24	M	7	Leave B	Leave B	Leave B
46301770	306	177	0.33	8	L	14	L	6	Leave	Close	Close
460000013.84	310	4600	0.20	74	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	321	4600	0.00	72	H	23	L	9	Leave A	Leave A	Leave A
46007450	323	745	1.02	31	M	25	M	5	M/MQuand	Leave B	Leave B (open to jct w/ rd 112 project level decision needed to reverse previous decsion and provide connected route to rd 4690 via rd 090
4635120.6	324	120	0.80	15	L	27	M	3	Close	Close	Quandry (review at proj lvl for connection to rd 4600)
460000013.84	330	4600	0.24	68	H	29	H	4	H/HQuand	Leave	Leave
460000013.84	331	4600	0.00	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	335	4600	0.18	72	H	28	M	7	Leave B	Leave B	Leave B
46901000	336	100	0.17	8	L	18	L	6	Leave	Close	Close
46007800	340	780	0.02	23	M	25	M	5	M/MQuand	Leave	Leave
46300000	343	4630	6.13	61	H	31	H	4	H/HQuand	Leave	Leave
46900900	344	90	4.32	33	M	30	H	2	Close	Close	Close
46901350	347	135	1.21	40	M	19	L	8	Leave A	Leave B	Leave B
460000013.84	351	4600	0.04	70	H	23	L	9	Leave A	Leave A	Leave A
46351000	358	100	0.58	16	L	26	M	3	Close	Close	Quandry (review at proj lvl for connection to rd 4600)
46252500	366a	250	2.00	24	M	38	H	2	Close	Close	Close
46252500	366b	250	0.49	24	M	37	H	2	Close	Close	Close
46900180	369	18	0.09	2	L	26	M	3	Close	Close	Close
4625265.3	370	265	0.04	14	L	30	H	1	Close	Close	Close

46252650	372	265	0.22	14	L	30	H	1	Close	Close	Close
460000013.84	377	4600	0.62	67	H	23	L	9	Leave A	Leave A	Leave A
46002650	378	265	0.03	7	L	22	L	6	Leave	Leave	Leave
46952030	379	203	0.62	14	L	17	L	6	Leave	Leave	Close
46900160	385	16	0.27	8	L	17	L	6	Leave	Close	Close
46350200	389	20	0.57	14	L	23	L	6	Leave	Leave	Close
46900470	392	47	0.17	25	M	17	L	8	Leave A	Leave A	Leave A
46951990	393	199	0.79	16	L	16	L	6	Leave	Close	Close
46703750	395	375	0.82	15	L	17	L	6	Leave	Leave	Close
460000013.84	397	4600	0.55	68	H	29	H	4	H/HQuand	Leave	Leave
46952370	399	237	0.65	27	M	18	L	8	Leave A	Leave A	Leave A
460000013.84	402	4600	0.02	68	H	23	L	9	Leave A	Leave A	Leave A
46350400	403	40	0.26	8	L	23	L	6	Leave	Leave	Close
460000013.84	404	4600	0.01	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	406	4600	0.01	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	410	4600	0.03	68	H	29	H	4	H/HQuand	Leave	Leave
46900330	413	33	0.33	24	M	16	L	8	Leave A	Leave A	Leave A
460000013.84	414	4600	0.05	68	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	415	4600	0.00	68	H	23	L	9	Leave A	Leave A	Leave A
46250000	416	4625	0.18	59	H	35	H	4	H/HQuand	Leave	Leave
46250009.934	417	4625	0.07	68	H	33	H	4	H/HQuand	Leave	Leave
462500010	418	4625	7.72	69	H	46	H	4	H/HQuand	Leave	Leave
46350700	426	70	0.51	23	M	34	H	2	Close	Close	Close
46952270	427	227	0.36	11	L	17	L	6	Leave	Close	Close
46952300	429	230	1.45	30	M	22	L	8	Leave A	Leave A	Close (west of jctn w/ rd 237)
460000013.84	432	4600	0.25	68	H	23	L	9	Leave A	Leave A	Leave A
46952250	434	225	0.11	9	L	14	L	6	Leave	Leave	Close
460000013.84	435	4600	0.00	70	H	23	L	9	Leave A	Leave A	Leave A
46900150	438	15	6.95	38	M	30	H	2	Close	Close	Close (Check first .5mi on west end for dispersed use)
46255501.5	439a	550	1.00	37	M	21	L	8	Leave A	Leave A	Leave A
46255501.5	439b	550	1.34	37	M	21	L	8	Leave A	Leave A	Leave A
460000013.84	445	4600	0.18	70	H	23	L	9	Leave A	Leave A	Leave A
46951401.6	449a	140	2.00	25	M	25	M	5	M/MQuand	Leave (South End Open Close at Rd 240 jct.)	Leave (South End Open Close at Rd 240 jct.)

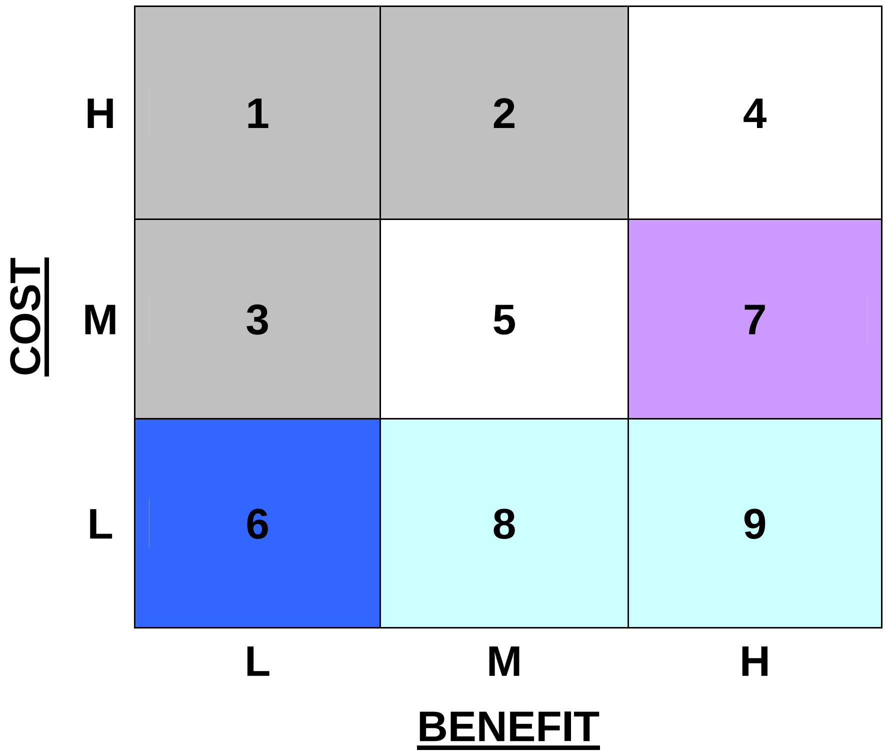
46951401.6	449b	140	1.21	25	M	25	M	5	M/MQuand	Leave (South End Open Close at Rd 240 jct.)	Leave (South End Open Close at Rd 240 jct.)
46002530	451	253	0.22	9	L	36	H	1	Close	Close	Close
46951880	453	188	0.92	30	M	14	L	8	Leave A	Leave A	Leave A
46150490	455	49	0.05	3	L	17	L	6	Leave	Leave	Close
460000013.84	456	4600	0.95	73	H	31	H	4	H/HQuand	Leave	Leave
46002520	457	252	0.42	19	L	42	H	1	Close	Close	Close
46002500	459	250	0.02	5	L	11	L	6	Leave	Leave	Leave
46952730	460	273	0.43	12	L	17	L	6	Leave	Leave	Leave
460000013.84	462	4600	0.46	68	H	35	H	4	H/HQuand	Leave	Leave
46700000	464a	4670	2.00	59	H	37	H	4	H/HQuand	Leave B	Leave B
46700000	464b	4670	7.52	59	H	43	H	4	H/HQuand	Leave B	Leave B
46052200	465	220	0.01	6	L	11	L	6	Leave	Leave	Close
460000013.84	466	4600	0.24	68	H	23	L	9	Leave A	Leave A	Leave A
46050000	467	4605	0.06	45	M	22	L	8	Leave A	Leave A	Leave A
46951450	470	145	4.32	29	M	27	M	5	M/MQuand	Leave A	Leave A (north of jctn w/ rd 273, close between 273 and rd 4695
46900000	471	4690	5.65	73	H	26	M	7	Leave B	Leave B	Leave B
46009200	475	920	0.11	9	L	20	L	6	Leave	Leave	Leave
460000013.84	476	4600	0.22	68	H	23	L	9	Leave A	Leave A	Leave A
46951400	477	140	1.56	28	M	17	L	8	Leave A	Leave A	Leave A
460000013.84	484	4600	0.01	71	H	23	L	9	Leave A	Leave A	Leave A
460000013.84	485	4600	0.71	68	H	31	H	4	H/HQuand	Leave	Leave
46052000	486	200	0.50	26	M	26	M	5	M/MQuand	Leave	Leave
46008800	489	880	0.02	15	L	11	L	6	Leave	Leave	Leave (is shown as rd 975 on map)
460000013.84	490	4600	0.22	68	H	26	M	7	Leave B	Leave B	Leave B
46350000	494	4635	3.82	43	M	33	H	2	Close	Close	Leave
46009320	504	932	0.46	27	M	18	L	8	Leave A	Leave A	Leave A
46001850	505	185	0.55	17	L	19	L	6	Leave	Leave	Leave
46951750	511	175	1.96	28	M	18	L	8	Leave A	Leave A	Leave A
46009330	514	933	3.44	30	M	26	M	5	M/MQuand	Leave (w/seasonal closure)	Leave (w/seasonal closure)
46951000	521	100	1.17	20	L	27	M	3	Close	Close	Close
46008800	522	880	0.57	21	L	23	L	6	Leave	Leave	Leave
46951650	526	165	1.37	25	M	21	L	8	Leave A	Leave A	Leave A
460000013.00	528	4600	0.83	71	H	24	M	7	Leave B	Leave B	Leave B

46008880	530	888	0.02	6	L	12	L	6	Leave	Leave	Leave
46008800	532	880	0.10	15	L	15	L	6	Leave	Leave	Leave
46009300	534	930	3.19	44	M	27	M	5	M/MQuand	Leave B	Leave B
46009050	536	905	1.59	21	L	19	L	6	Leave	Close	Close
46009000	537	900	3.44	37	M	30	H	2	Close	Close	Close
46150000	540	0	2.34	35	M	30	H	2	Close	Close	Leave
46001600	541a	160	0.50	31	M	28	M	5	M/MQuand	Leave	Leave
46001600	541b	160	0.86	25	M	28	M	5	M/MQuand	Leave	Leave
46001710	544	171	0.34	8	L	16	L	6	Leave	Leave	Close
460000013.84	548	4600	4.62	73	H	23	L	9	Leave A	Leave A	Leave A
46001570	550	157	0.27	8	L	32	H	1	Close	Close	Close
46008890	551	889	0.02	8	L	14	L	6	Leave	Leave	Leave
46250000	555	4625	9.66	68	H	37	H	4	H/HQuand	Leave	Leave
46001440	570	144	1.46	23	M	36	H	2	Close	Close	Close
46009750	573	975	2.30	30	M	30	H	2	Close	Close	Close (provide pvt land access if needed)
46008800	574	880	1.26	33	M	17	L	8	Leave A	Leave A	Leave A
46001510	586	151	0.19	14	L	32	H	1	Close	Close	Close
46950250	587	25	0.26	23	M	20	L	8	Leave A	Leave A	Leave A
46001530	591	153	0.44	18	L	38	H	1	Close	Close	Close
460000013.84	597	4600	1.51	71	H	23	L	9	Leave A	Leave A	Leave A
46050000	598	4605	4.16	56	H	28	M	7	Leave B	Leave B	Leave B
46001550	602	155	3.05	44	M	34	H	2	Close	Close	Leave
46001540	603	154	0.59	24	M	29	H	2	Close	Close	Close
46950000	604a	4695	4.00	62	H	28	M	7	Leave B	Leave A (south section above jct. w/rd4600930 - close section down draw from rd 930 to rd 4625)	Leave A (south section above jct. w/rd4600930 - close section down draw from rd 930 to rd 4625)
46950000	604b	4695	2.00	56	H	28	M	7	Leave B	Leave A (south section above jct. w/rd4600930 - close section down draw from rd 930 to rd 4625)	Leave A (south section above jct. w/rd4600930 - close section down draw from rd 930 to rd 4625)

46950000	604c	4695	2.70	56	H	27	M	7	Leave B	Leave A (south section above jct. w/rd4600930 - close section down draw from rd 930 to rd 4625)	Leave A (south section above jct. w/rd4600930 - close section down draw from rd 930 to rd 4625)
46009900	618a	990	1.00	49	M	30	H	2	Close	Close	Close
46009900	618b	990	3.16	49	M	30	H	2	Close	Close	Close
46001620	620	162	0.95	29	M	36	H	2	Close	Close	Close
46001450	622	145	1.58	25	M	30	H	2	Close	Close	Close
46050000	623	4605	0.74	51	H	26	M	7	Leave B	Leave B	Leave B
46201300	624	130	0.47	16	L	40	H	1	Close	Close	Close
46001520	631	152	0.80	29	M	29	H	2	Close	Close	Close
46001640	640	164	0.58	21	L	35	H	1	Close	Close	Close
46201270	641	127	0.21	9	L	29	H	1	Close	Close	Close
46050000	650	4605	0.74	51	H	19	L	9	Leave A	Leave A	Leave A
46001400	651	140	2.59	43	M	36	H	2	Close	Close	Leave B (portions need heavy maintenance and stream crossing at Elk Creek
46201100	653a	110	1.50	42	M	42	H	2	Close	Close	Close
46201100	653b	110	1.08	42	M	42	H	2	Close	Close	Close
46001660	654	166	1.02	31	M	28	M	5	M/MQuand	Leave	Close
46000008.691	655	4600	4.28	75	H	35	H	4	H/HQuand	Leave	Leave
46001680	661	168	0.99	30	M	24	M	5	M/MQuand	Close (obj lvl 1)	Close (obj lvl 1)
46050000	667	4605	0.42	53	H	17	L	9	Leave A	Leave A	Leave A
46050000	669	4605	0.03	53	H	17	L	9	Leave A	Leave A	Leave A
46001402.6	672	140	1.00	31	M	20	L	8	Leave A	Leave A	Leave
46050810	682	81	0.01	8	L	17	L	6	Leave	Leave	Leave
46001090	684a	109	0.50	25	M	28	M	5	M/MQuand	Leave B	Close
46001090	684b	109	0.95	25	M	28	M	5	M/MQuand	Leave B	Close
46050810	686	81	0.19	11	L	17	L	6	Leave	Leave	Leave
46050000	701	4605	0.00	45	M	16	L	8	Leave A	Leave A	Leave A
46200000	702	4620	5.25	73	H	31	H	4	H/HQuand	Leave B	Leave B
46105100	706	510	0.24	17	L	16	L	6	Leave	Leave	Leave
46105120	707	512	0.21	9	L	17	L	6	Leave	Leave	Close
46200005.3	708	4620	0.09	41	M	16	L	8	Leave A	Leave A	Leave A
46105300	710	530	0.54	18	L	22	L	6	Leave	Leave	Close
46105350	713	535	0.87	19	L	22	L	6	Leave	Leave	Close

46050000	719	4605	0.20	51	H	31	H	4	H/HQuand	Leave	Leave
46000000	720	4600	2.79	62	H	29	H	4	H/HQuand	Leave	Leave
46105000	722a	500	1.00	34	M	38	H	2	Close	Close	Close
46105000	722b	500	2.27	34	M	38	H	2	Close	Close	Close
46000000	727	4600	0.12	68	H	23	L	9	Leave A	Leave A	Leave A
46100000	729a	4610	2.50	59	H	30	H	4	H/HQuand	Leave B	Leave B
46100000	729b	4610	1.09	59	H	30	H	4	H/HQuand	Leave B	Leave B
46105450	730	545	0.43	13	L	26	M	3	Close	Close	Close
46000800	735	80	0.43	28	M	23	L	8	Leave A	Leave A	Leave A
46000800	736	80	0.00	26	M	14	L	8	Leave A	Leave A	Leave A
46000810	737	81	1.01	36	M	42	H	2	Close	Close	Close
46105400	738	540	1.35	22	L	24	M	3	Close	Close	Close
46000800	740	80	0.45	26	M	26	M	5	M/MQuand	Leave	Leave
46000800	741	80	0.00	24	M	14	L	8	Leave A	Leave A	Leave A
46000800	751	80	2.66	17	L	30	H	1	Close	Close	Close

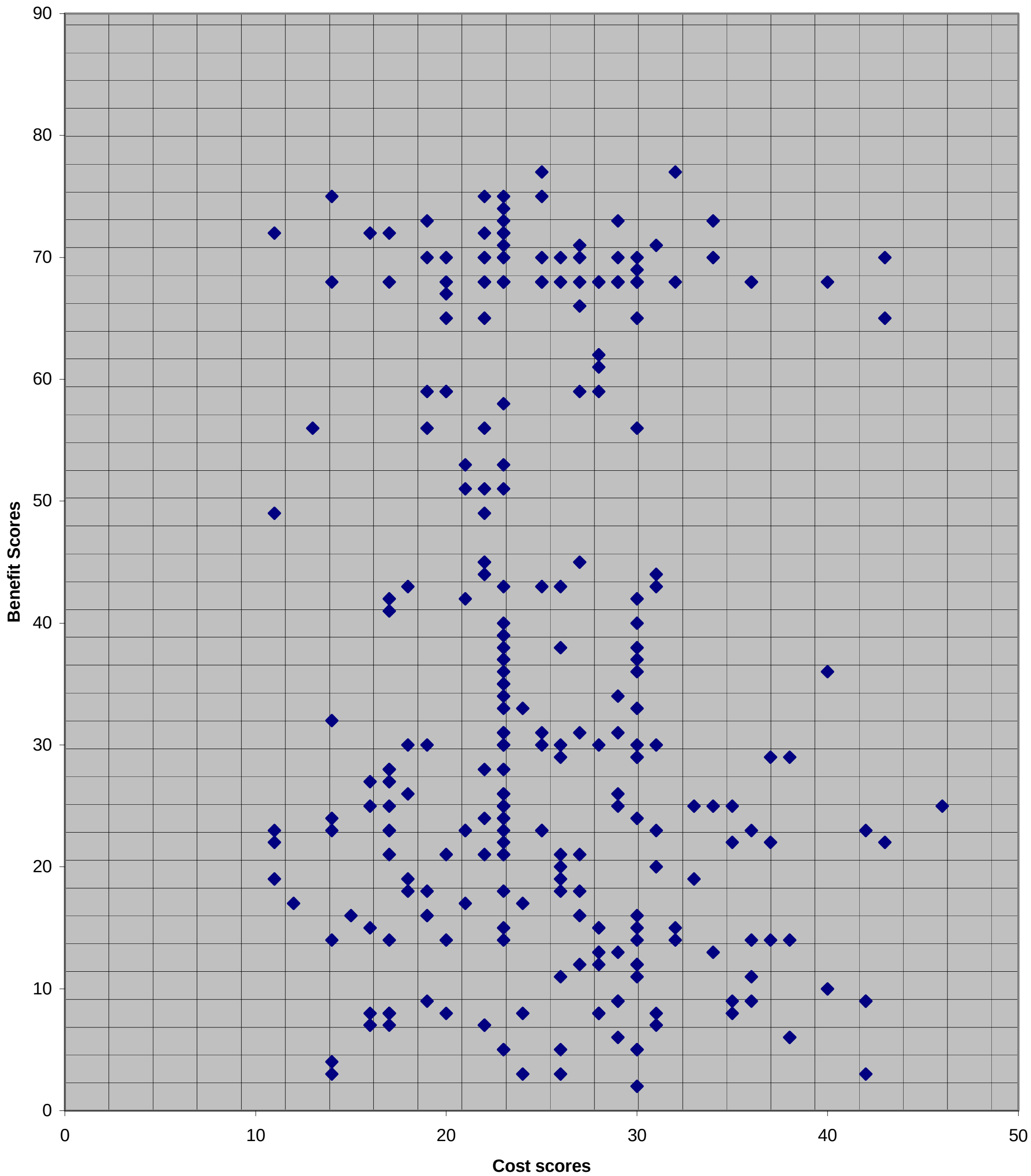
Appendix 14: Category Matrix



CATEGORIES

Matrix Position/No. of Segs.		Action
1,2,3	18,42,20	Close
4,5	52,45	Quandry
6	58	Leave
7	13	Leave B
8,9	31,54	Leave A

Appendix 15: Scatter Plot of Cost and Benefit Scores



Appendix 16: Percentile Arrays

Segment #	Cost Score	Rank	Percent		Segment #	Benefit Score	Rank	Percent
171	46	1	100.00%		90	77	1	99.60%
27	43	2	98.90%		98	77	1	99.60%
75	43	2	98.90%		9	75	3	98.20%
193	43	2	98.90%		12	75	3	98.20%
188	42	5	97.50%		113	75	3	98.20%
253	42	5	97.50%		256	75	3	98.20%
254	42	5	97.50%		132	74	7	97.80%
282	42	5	97.50%		187	73	8	96.40%
54	40	9	96.40%		198	73	8	96.40%
121	40	9	96.40%		225	73	8	96.40%
247	40	9	96.40%		266	73	8	96.40%
146	38	12	95.00%		10	72	12	93.30%
234	38	12	95.00%		24	72	12	93.30%
274	38	12	95.00%		30	72	12	93.30%
275	38	12	95.00%		49	72	12	93.30%
147	37	16	94.00%		55	72	12	93.30%
192	37	16	94.00%		114	72	12	93.30%
228	37	16	94.00%		116	72	12	93.30%
41	36	19	91.90%		133	72	12	93.30%
62	36	19	91.90%		138	72	12	93.30%
184	36	19	91.90%		202	71	21	92.20%
229	36	19	91.90%		215	71	21	92.20%
244	36	19	91.90%		235	71	21	92.20%
252	36	19	91.90%		7	70	24	87.70%
169	35	25	90.50%		38	70	24	87.70%
191	35	25	90.50%		40	70	24	87.70%
249	35	25	90.50%		48	70	24	87.70%
256	35	25	90.50%		53	70	24	87.70%
11	34	29	89.10%		60	70	24	87.70%
33	34	29	89.10%		68	70	24	87.70%
172	34	29	89.10%		76	70	24	87.70%
237	34	29	89.10%		112	70	24	87.70%
170	33	33	88.40%		118	70	24	87.70%
207	33	33	88.40%		144	70	24	87.70%
2	32	35	87.00%		177	70	24	87.70%
51	32	35	87.00%		181	70	24	87.70%
226	32	35	87.00%		171	69	37	87.30%
232	32	35	87.00%		15	68	38	75.70%
22	31	39	84.20%		23	68	38	75.70%
101	31	39	84.20%		25	68	38	75.70%
105	31	39	84.20%		44	68	38	75.70%
141	31	39	84.20%		56	68	38	75.70%
187	31	39	84.20%		85	68	38	75.70%

203	31	39	84.20%		102	68	38	75.70%
266	31	39	84.20%		119	68	38	75.70%
272	31	39	84.20%		123	68	38	75.70%
34	30	47	75.00%		124	68	38	75.70%
37	30	47	75.00%		125	68	38	75.70%
39	30	47	75.00%		126	68	38	75.70%
69	30	47	75.00%		127	68	38	75.70%
70	30	47	75.00%		129	68	38	75.70%
74	30	47	75.00%		130	68	38	75.70%
89	30	47	75.00%		136	68	38	75.70%
108	30	47	75.00%		137	68	38	75.70%
111	30	47	75.00%		159	68	38	75.70%
117	30	47	75.00%		161	68	38	75.70%
120	30	47	75.00%		163	68	38	75.70%
122	30	47	75.00%		164	68	38	75.70%
128	30	47	75.00%		165	68	38	75.70%
142	30	47	75.00%		167	68	38	75.70%
149	30	47	75.00%		168	68	38	75.70%
150	30	47	75.00%		170	68	38	75.70%
178	30	47	75.00%		175	68	38	75.70%
220	30	47	75.00%		191	68	38	75.70%
221	30	47	75.00%		195	68	38	75.70%
230	30	47	75.00%		200	68	38	75.70%
242	30	47	75.00%		203	68	38	75.70%
243	30	47	75.00%		206	68	38	75.70%
245	30	47	75.00%		228	68	38	75.70%
277	30	47	75.00%		276	68	38	75.70%
278	30	47	75.00%		151	67	71	75.40%
286	30	47	75.00%		104	66	72	75.00%
10	29	73	69.80%		16	65	73	73.60%
25	29	73	69.80%		17	65	73	73.60%
44	29	73	69.80%		45	65	73	73.60%
53	29	73	69.80%		103	65	73	73.60%
55	29	73	69.80%		239	62	77	72.90%
57	29	73	69.80%		273	62	77	72.90%
60	29	73	69.80%		141	61	79	72.60%
127	29	73	69.80%		169	59	80	70.80%
136	29	73	69.80%		192	59	80	70.80%
159	29	73	69.80%		193	59	80	70.80%
165	29	73	69.80%		277	59	80	70.80%
238	29	73	69.80%		278	59	80	70.80%
248	29	73	69.80%		22	58	85	70.50%
250	29	73	69.80%		59	56	86	69.10%
273	29	73	**69.80%**		236	56	86	69.10%
Breakpoint Value	**28.48**		**66.67%**					
43	28	88	**63.80%**		240	56	86	69.10%
52	28	88	63.80%		241	56	86	69.10%
56	28	88	63.80%		258	53	90	68.40%

66	28	88	63.80%		259	53	90	68.40%
77	28	88	63.80%		246	51	92	67.30%
78	28	88	63.80%		251	51	92	67.30%
79	28	88	63.80%		272	51	92	**67.30%**
Breakpoint Value						**49.18**		**66.67%**
80	28	88	63.80%		242	49	95	**66.60%**
138	28	88	63.80%		243	49	95	66.60%
222	28	88	63.80%		36	45	97	65.60%
223	28	88	63.80%		196	45	97	65.60%
236	28	88	63.80%		265	45	97	65.60%
239	28	88	63.80%		218	44	100	64.90%
240	28	88	63.80%		237	44	100	64.90%
255	28	88	63.80%		77	43	102	63.10%
262	28	88	63.80%		78	43	102	63.10%
263	28	88	63.80%		79	43	102	63.10%
21	27	105	60.00%		207	43	102	63.10%
28	27	105	60.00%		252	43	102	63.10%
63	27	105	60.00%		99	42	107	62.10%
72	27	105	60.00%		253	42	107	62.10%
81	27	105	60.00%		254	42	107	62.10%
97	27	105	60.00%		269	41	110	61.70%
135	27	105	60.00%		122	40	111	61.00%
197	27	105	60.00%		143	40	111	61.00%
212	27	105	60.00%		43	39	113	60.30%
218	27	105	60.00%		75	39	113	60.30%
241	27	105	60.00%		94	38	115	59.20%
29	26	116	55.40%		95	38	115	59.20%
65	26	116	55.40%		178	38	115	59.20%
106	26	116	55.40%		179	37	118	58.20%
115	26	116	55.40%		180	37	118	58.20%
145	26	116	55.40%		220	37	118	58.20%
148	26	116	55.40%		4	36	121	57.10%
198	26	116	55.40%		66	36	121	57.10%
204	26	116	55.40%		282	36	121	57.10%
206	26	116	55.40%		117	35	124	56.40%
211	26	116	55.40%		221	35	124	56.40%
246	26	116	55.40%		274	34	126	55.70%
279	26	116	55.40%		275	34	126	55.70%
284	26	116	55.40%		5	33	128	54.70%
1	25	129	51.50%		142	33	128	54.70%
6	25	129	51.50%		231	33	128	54.70%
35	25	129	51.50%		70	32	131	54.30%
42	25	129	51.50%		33	31	132	52.60%
59	25	129	51.50%		134	31	132	52.60%
67	25	129	51.50%		222	31	132	52.60%
103	25	129	51.50%		255	31	132	52.60%
134	25	129	51.50%		260	31	132	52.60%
140	25	129	51.50%		11	30	137	49.40%

182	25	129	51.50%		34	30	137	49.40%
183	25	129	51.50%		89	30	137	49.40%
130	24	140	50.10%		128	30	137	49.40%
215	24	140	50.10%		174	30	137	49.40%
257	24	140	50.10%		185	30	137	49.40%
283	24	140	**50.10%**		211	30	137	49.40%
Breakpoint Value	**23.14**		**33.33%**					
5	23	144	**30.50%**		230	30	137	49.40%
7	23	144	30.50%		257	30	137	49.40%
9	23	144	30.50%		41	29	146	47.70%
12	23	144	30.50%		67	29	146	47.70%
14	23	144	30.50%		197	29	146	47.70%
15	23	144	30.50%		244	29	146	47.70%
16	23	144	30.50%		248	29	146	47.70%
17	23	144	30.50%		64	28	151	45.90%
23	23	144	30.50%		93	28	151	45.90%
24	23	144	30.50%		201	28	151	45.90%
30	23	144	30.50%		210	28	151	45.90%
38	23	144	30.50%		280	28	151	45.90%
40	23	144	30.50%		121	27	156	44.90%
45	23	144	30.50%		160	27	156	44.90%
48	23	144	30.50%		208	27	156	44.90%
49	23	144	30.50%		74	26	159	43.50%
64	23	144	30.50%		204	26	159	43.50%
68	23	144	30.50%		281	26	159	43.50%
85	23	144	30.50%		284	26	159	43.50%
90	23	144	30.50%		54	25	163	39.60%
92	23	144	30.50%		80	25	163	39.60%
102	23	144	30.50%		82	25	163	39.60%
112	23	144	30.50%		156	25	163	39.60%
113	23	144	30.50%		182	25	163	39.60%
114	23	144	30.50%		183	25	163	39.60%
116	23	144	30.50%		214	25	163	39.60%
118	23	144	30.50%		223	25	163	39.60%
119	23	144	30.50%		245	25	163	39.60%
123	23	144	30.50%		262	25	163	39.60%
124	23	144	30.50%		263	25	163	39.60%
125	23	144	30.50%		146	24	174	37.80%
126	23	144	30.50%		147	24	174	37.80%
129	23	144	30.50%		166	24	174	37.80%
132	23	144	30.50%		238	24	174	37.80%
133	23	144	30.50%		285	24	174	37.80%
137	23	144	30.50%		2	23	179	33.60%
144	23	144	30.50%		27	23	179	33.60%
151	23	144	30.50%		39	23	179	33.60%
155	23	144	30.50%		57	23	179	33.60%
161	23	144	30.50%		58	23	179	33.60%
162	23	144	30.50%		69	23	179	33.60%

163	23	144	30.50%		106	23	179	33.60%
164	23	144	30.50%		120	23	179	33.60%
167	23	144	30.50%		140	23	179	33.60%
168	23	144	30.50%		172	23	179	33.60%
175	23	144	30.50%		229	23	179	33.60%
177	23	144	30.50%		233	23	179	**33.60%**
Breakpoint Value						**22.84**		**33.33%**
181	23	144	30.50%		47	22	191	**31.90%**
195	23	144	30.50%		62	22	191	31.90%
200	23	144	30.50%		108	22	191	31.90%
202	23	144	30.50%		111	22	191	31.90%
213	23	144	30.50%		283	22	191	31.90%
225	23	144	30.50%		72	21	196	29.40%
235	23	144	30.50%		83	21	196	29.40%
276	23	144	30.50%		84	21	196	29.40%
280	23	144	30.50%		109	21	196	29.40%
4	22	200	24.20%		213	21	196	29.40%
20	22	200	24.20%		219	21	196	29.40%
31	22	200	24.20%		249	21	196	29.40%
36	22	200	24.20%		51	20	203	28.70%
47	22	200	24.20%		212	20	203	28.70%
58	22	200	24.20%		35	19	205	27.30%
76	22	200	24.20%		101	19	205	27.30%
86	22	200	24.20%		188	19	205	27.30%
94	22	200	24.20%		271	19	205	27.30%
95	22	200	24.20%		31	18	209	25.60%
98	22	200	24.20%		42	18	209	25.60%
99	22	200	24.20%		115	18	209	25.60%
100	22	200	24.20%		234	18	209	25.60%
152	22	200	24.20%		270	18	209	25.60%
174	22	200	24.20%		209	17	214	24.50%
196	22	200	24.20%		267	17	214	24.50%
270	22	200	24.20%		286	17	214	24.50%
271	22	200	24.20%		105	16	217	23.10%
91	21	218	22.10%		145	16	217	23.10%
93	21	218	22.10%		157	16	217	23.10%
109	21	218	22.10%		247	16	217	23.10%
179	21	218	22.10%		6	15	221	21.00%
180	21	218	22.10%		28	15	221	21.00%
214	21	218	22.10%		135	15	221	21.00%
32	20	224	18.90%		158	15	221	21.00%
50	20	224	18.90%		205	15	221	21.00%
71	20	224	18.90%		217	15	221	21.00%
73	20	224	18.90%		26	14	227	17.80%
82	20	224	18.90%		63	14	227	17.80%
83	20	224	18.90%		100	14	227	17.80%
199	20	224	18.90%		110	14	227	17.80%
233	20	224	18.90%		149	14	227	17.80%

260	20	224	18.90%		150	14	227	17.80%
8	19	233	16.10%		153	14	227	17.80%
26	19	233	16.10%		155	14	227	17.80%
84	19	233	16.10%		232	14	227	17.80%
88	19	233	16.10%		92	13	236	16.40%
143	19	233	16.10%		97	13	236	16.40%
209	19	233	16.10%		107	13	236	16.40%
219	19	233	16.10%		279	13	236	16.40%
251	19	233	16.10%		29	12	240	15.00%
104	18	241	14.30%		52	12	240	15.00%
139	18	241	14.30%		81	12	240	15.00%
160	18	241	14.30%		190	12	240	15.00%
208	18	241	14.30%		65	11	244	14.00%
210	18	241	14.30%		173	11	244	14.00%
18	17	246	8.00%		264	11	244	14.00%
46	17	246	8.00%		87	10	247	13.60%
107	17	246	8.00%		20	9	248	11.20%
110	17	246	8.00%		46	9	248	11.20%
153	17	246	8.00%		176	9	248	11.20%
154	17	246	8.00%		184	9	248	11.20%
156	17	246	8.00%		199	9	248	11.20%
158	17	246	8.00%		250	9	248	11.20%
173	17	246	8.00%		268	9	248	11.20%
186	17	246	8.00%		61	8	255	7.00%
190	17	246	8.00%		88	8	255	7.00%
201	17	246	8.00%		91	8	255	7.00%
231	17	246	8.00%		96	8	255	7.00%
258	17	246	8.00%		131	8	255	7.00%
259	17	246	8.00%		139	8	255	7.00%
261	17	246	8.00%		154	8	255	7.00%
264	17	246	8.00%		162	8	255	7.00%
268	17	246	8.00%		224	8	255	7.00%
13	16	264	5.60%		226	8	255	7.00%
157	16	264	5.60%		227	8	255	7.00%
166	16	264	5.60%		261	8	255	7.00%
224	16	264	5.60%		1	7	267	4.90%
265	16	264	5.60%		3	7	267	4.90%
267	16	264	5.60%		8	7	267	4.90%
269	16	264	5.60%		18	7	267	4.90%
217	15	271	5.20%		50	7	267	4.90%
3	14	272	2.40%		152	7	267	4.90%
61	14	272	2.40%		32	6	273	3.80%
131	14	272	2.40%		194	6	273	3.80%
176	14	272	2.40%		216	6	273	3.80%
185	14	272	2.40%		37	5	276	2.10%
227	14	272	2.40%		71	5	276	2.10%
281	14	272	2.40%		73	5	276	2.10%
285	14	272	2.40%		86	5	276	2.10%
87	13	280	2.10%		189	5	276	2.10%

216	12	281	1.70%		19	4	281	1.70%
19	11	282	.00%		13	3	282	.30%
96	11	282	.00%		14	3	282	.30%
189	11	282	.00%		21	3	282	.30%
194	11	282	.00%		186	3	282	.30%
205	11	282	.00%		148	2	286	.00%