Salmon Interface
Watershed Assessment

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Salmon Interface Watershed Assessment

US Department of Agriculture
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Introduction

The Salmon Interface Watershed Assessment (SIWA) was conducted to begin the necessary first steps in identifying, assessing, and analyzing the issues, characteristics, current conditions, risks, and opportunities at the sub-watershed level. This initial analysis will lead to site specific recommendations for on the ground project work designed within the project area. With the completion of this initial analysis and background information, the project level environmental analysis can be streamlined for on the ground project work that could begin in 2003.

In the aftermath of the severe wildfire season in 2000, the National Fire Plan and the 10-year Comprehensive Strategy were developed. Both provide direction for prioritizing treatments in fire-prone forest environments that are at risk of severe wildland fires, especially when near communities in the wildland-urban interface and municipal watersheds. In May 2002, an Implementation Plan for the 10-year Comprehensive Strategy was completed by Federal, State, tribal, and local government and non-government representatives. This Plan set forth four primary goals: 1) Improve fire prevention and suppression, 2) reduce hazardous fuels, 3) restore fire-adapted ecosystem, and 4) promote community assistance. The recommendations described in this assessment responds to each of these national goals in varying degrees.

This assessment for the Salmon interface is somewhat unique from previous watershed assessments completed on the Salmon-Challis National Forest in several areas. 1) There is a very high level of public interest in this project due to the proximity of the assessment area to the town of Salmon. Because of this, the Human Uses portion of the assessment has been greatly expanded. There have been efforts to reach out to the public through organizing and meeting with several focus groups to learn what are the interests, concerns, and expectations of the public in regards to public land management. These results led to numerous issues that were carried forward and discussed at length in the assessment document. 2) Since the risk from wildland fire is an over-riding theme within the assessment area, the team classified the area by fire regime condition class (FRCC), fire regime groups, and other related information. The fire regime condition class classification process is relatively new and very complex using satellite imagery and other modeling processes to identify areas at risk from disturbances (i.e. wild fire) by characterizing and interpreting several indicators of current conditions and historic reference conditions. The synthesis and interpretation from these products were used in developing project level recommendations. 3) The Salmon Interface Watershed Assessment took a different approach to “stepping down” from the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The typical step down process includes validating the findings and conclusions from ICBEMP first through the sub-basin review level and then at the watershed level through watershed assessments. Although a sub-basin review has not been completed for the Salmon interface, some information from ICBEMP was utilized in SIWA, primarily as a means to describe the historic or reference conditions. The ICBEMP also provided some useful landscape level trends regarding fire frequency and severity that were used for comparison within the Salmon interface. Furthermore, ICBEMP also provided some valuable information that was very useful in describing the social and demographic character of the human environment utilized in the Human Uses sections.

The Salmon Interface Watershed Analysis area occupies the area west of the Salmon River from North Fork south to the Lake Creek drainage. The western boundary extends to include the entire

Napias Creek watershed due to high risk fuel loads and prevailing winds jeopardizing the Phelan Ridge and Williams Lake Summit divides. The southeast boundary crosses the Salmon River to include the 12-Mile Creek drainage, and northward to include the Hot Springs drainage. These east side drainages were added to the project area to include areas not previously assessed in the Lemhi River Sub-basin Review. Map I-1 displays the project area and land ownership.

Elevation of the analysis area ranges from a low of about 3,600 feet near the confluence of the North Fork Salmon River and the main Salmon River on the northern boundary to over 9,100 feet on Mt. Baldy just west of Salmon. Rocky outcrops and talus slopes are common features over much of the analysis area. Vegetation ranges from high elevation mosaics of coniferous forest to sagebrush-grass steppe at lower elevations. Riparian communities occur along most creeks and drainages. The total acreage of the project area is 205,455 acres with multiple land ownerships; 153,892 S-CNF, 24,697 BLM, 24,127 private, 1,588 Idaho State Lands, and 1,151 acres of water including the Salmon River and Williams Lake (see Map I-1).

The process used for this assessment is the six-step process for Ecosystem Analysis at the Watershed Scale (EAWS). In this process, specific issues or concerns were identified for the assessment area. The reference, current and desired future conditions of the resources related to these issues were identified and the reasons for the departure from reference condition to current condition were explained. The risk associated with the current condition and trend was identified. Recommendations were then developed to address this risk and to help achieve the desired future conditions. This report contains a summary of the above information organized in an 'issue driven' format which provides easy tracking of the key issues through the various steps. More detailed information on each of these steps is located in the project file for the Salmon Interface Watershed Assessment located in the Salmon/Cobalt Ranger District office in Salmon, Idaho.

The interdisciplinary analysis team consisted of:

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Characterization of the Watershed (Step 1)

The purpose of characterization is to identify the dominant physical, biological, and human processes and features of the watershed that affect ecosystem function or condition. The Team reviewed and evaluated the seven core topics shown in the Federal Guide for Watershed Analysis and decided to combine four of them into one.

I. Vegetation

A. Non-Forested Vegetation

The non-forested vegetation makes up approximately 45,293 acres of the 178,587 acres (25.4%) of the federally managed lands within the analysis area. The non-forested vegetation within the assessment area can be placed into one of three major potential vegetation groups (PVGs); Dry Shrub, Cool Shrub, and Woodland (An Assessment of Ecosystem Components in the Interior Columbia Basin PNW-GTR-405, June 1997). Potential Vegetation Groups is a vegetation grouping mechanism that groups vegetation with similar environmental conditions and vegetation type dominance.

The Dry Shrub PVG occupies the lower elevation rangelands from the Salmon River corridor up to about 5500 feet in elevation. Average precipitation in a normal year ranges between 7 and 13 inches falling mainly from fall through spring. The Dry Shrub PVG plant communities are dominated by shrubs most commonly by a wide variety of sagebrush (*Artemesia*) species with herbaceous understories of bunchgrasses and perennial forbs. Total production on these plant communities can range from 200 to 700 pounds per acre depending on site characteristics such as precipitation, soil depth and texture, percent coarse fragments within the root zone, and soil horizon development.

The Cool Shrub PVG lies above the lower elevation Dry Shrub and extends up to and within the coniferous forest types. Annual precipitation at this higher elevation ranges between 13 and 22 inches falling between fall and spring and into summer. The Cool Shrub PVG is dominated by mountain big sagebrush (*Artemisia tridentata vaseyana*) and mountain snowberry (*Symphoricarpus oreophilus*) with a grass understory most often dominated by Idaho fescue (*Festuca idahoensis*). A wide variety of perennial and annual native forbs are also abundant and occasionally dominate the plant community. The Cool Shrub plant communities can also be seen as sagebrush ‘parks’ within the forested communities. Annual production is higher than the Dry Shrub ranging from 800 to 900 pounds per acre on an average year. Slope and aspect can often influence how the Dry and Cool Shrub PVGs transition. On northerly aspects the Cool Shrub extends down into the Dry Shrub while on southerly aspects the Dry Shrub extends up into the Cool Shrub zone.

The Woodland PVG can be seen ranging between the Dry and Cool Shrub PVG zones but is most commonly associated with the middle and upper elevations where precipitation ranges between 11-22 inches. Two very distinct plant communities are included in the Woodland PVG. The most common Woodland PVG is indicated by the presence of mountain mahogany (*Cercocarpus ledifolius* varieties *ledifolius* and *intricatus*). Dense stands of mountain mahogany (which shade out understory plants) are occasionally present but most commonly its associated with mountain and Wyoming big sagebrush, and occasionally with mountain snowberry and ninebark (*Physocarpus malvaceus*) shrub species. Annual production and the range of variability is dependent upon the density of mahogany. Soils are often very stony and shallow and typically associated with limestone parent materials. A second Woodland PVG community type is upland aspen that is not associated with the typical bottomland or streamside aspen stands. These upland aspen stands are located on the periphery of tallus slopes where subsurface water is adequate to support their needs and also in snow pockets or swales where soils stay moist longer than the surrounding uplands.

Also included within the assessment area are dry and wet meadows where grasses, sedges, and forbs occupy areas influenced by fluctuating water tables. These sites are not included in the Interior Columbia Basin (PNW-GTR-405) potential vegetation grouping scheme and are hence addressed separately. Although these sites exist throughout the assessment area, they generally are not large enough to be mapped at a typical inventory mapping scale. These areas are highly productive with annual production ranging from 2200 to over 3600 pounds per acre. Soils are well developed, high in organic matter, generally lack large course fragments, and are typically too wet to support upland shrub species yet too dry to support wetland species.

Fire was an important component in the development and maintenance of these vegetation types (PNW-GTR 405 pages 480-506). Lethal fire intervals in the Dry Shrub PVG historically had a wide range from 15 to 100 years while the non-lethal fire interval was much reduced (5-10 years). The Cool Shrub lethal fire interval was shorter at 25-75 years yet somewhat longer (15-25 years) for non-lethal fires. Most fires in the Dry and Cool shrub PVGs typically were lethal to the non-sprouting shrubs (sagebrush species) but not to the sprouting shrubs (rabbitbrush, snowberry) or the herbaceous understory. The woodland mountain mahogany communities also experienced some fire episodes; however, lethal fire frequencies were widely spaced because of the rocky nature of the plant's typical habitat. Fire also occurred in the meadow grasslands possibly at fairly frequent intervals but rarely, if ever, lethal to the herbaceous species. Any invading shrub species possibly becoming established during periods of extended drought would have been removed by periodic fire thus keeping the meadow's herbaceous structure.

Exotic, Invasive, and Noxious Weeds

"Noxious" is a legal classification used for a non-native (exotic) plant that can exert substantial negative environmental or economic impact. All of the non-forested plant communities are susceptible to non-native, invasive plant species encroachment and establishment. This is primarily due to the relatively low precipitation and droughty soils that result in wide plant spacing, less production and ground cover, and less shading than the forested community types. Invasive plant species encroachment is also exacerbated by impacts associated with livestock grazing which tends to be more concentrated on the non-forested plant communities rather than on the forested community types. Listing the non-forested PVGs in order of most to least susceptible to non-native, invasive plant species encroachment would yield Dry Shrub, Woodland, Cool Shrub, and finally meadow grassland.

There are 22 recognized weed species of concern currently established on the Salmon-Challis National Forest. Of those 22 species, eleven have been identified within the SIWA area through field inventories performed over the last several years. As more inventories are completed it is likely the number of acres and populations will increase, in addition to the discovery of additional species. Cheatgrass (*Bromus tectorum*) is an exotic annual grass species that is widely distributed throughout the assessment area. It is not designated a state or county listed noxious species and typically acts more like a colonizer than an invader, being very responsive to surface disturbances.

Threatened, Endangered, and Forest or State Sensitive plant Species

There are a total of 24 species of focus plant species that are either occupying sites within the S-C NF or have potentially suitable habitat within the Forest. These 24 species are either State or USFS Region 4 listed as 'sensitive'. This listing provides management direction to ensure that species do not become threatened or endangered because of Forest Service actions, and to maintain viable populations of all native plant species. Of the 24 species of focus, only two are present within the SIWA area; the most common being Lemhi penstemon (*Penstemon lemhiensis*) occupying 10 of the 13 sub-watersheds and pink agoseris (*Agoseris lackschewitzii*) occupying 2 of the 13 sub-watersheds.

B. Forested Vegetation

Conifers interspersed with deciduous trees and mountain grasslands characterize the forested landscape. Forest vegetation is comprised of Douglas-fir, lodgepole pine, ponderosa pine, subalpine fir, Englemann spruce and whitebark pine. Aspen and cottonwood deciduous trees are found in small patches and moist areas. Understory vegetation varies from sparse, pauperate sites to rich and diverse.

The forested vegetation within the assessment area can be placed in to one of four potential vegetation groups (PVGs); Dry Forest, Cool Forest, Moist Forest, and Riparian Woodland (An Assessment of Ecosystem Components in the Interior Columbia Basin PNW-GTR-405, June 1997).

The Dry Forest PVG occupies the lower elevations and mid elevations, usually on south or west facing slopes. Douglas-fir and scattered ponderosa pine are interspersed with sagebrush. The trees are usually large diameter and widely spaced. Historically, these landscapes were maintained by frequent fire and fuel loads are light to moderate. Understory vegetation composed of grasses and shrubs is sparse. Douglas-fir is encroaching into the sagebrush sites because of lack of disturbances such as fire.

On north facing slopes, the vegetation becomes denser and the sites are moister and the Dry Forest PVG transitions to the Cool Forest PVG. Tree diameters are smaller and more trees are found on a site. As the elevation increases, lodgepole pine and Douglas-fir are intermixed. At higher elevations subalpine fir and lodgepole pine comprise the conifer mix. These landscapes were maintained by fire at less frequent intervals creating the extensive areas of lodgepole pine. Fuel loads are generally light to moderate depending on stand density and increase as the trees mature and die. Ladder fuels are present in greater abundance than prior to fire suppression. At the highest elevations, whitebark pine is found in pure stands or intermixed with subalpine fir. These are harsh sites exhibiting slow growth and light to moderate fuel loads. Lethal fires were at longer intervals. White pine blister rust is present in the whitebark pine sites in the watershed.

The Moist Forest PVG is characterized by Englemann spruce which is found along streams and on north facing slopes in moist areas. It is usually mixed with subalpine fir and has moderate to high fuel loads. These stands burn infrequently and the fire is usually lethal.

Aspen and cottonwood are the primary deciduous trees making up the Riparian Woodland PVG found in the watershed. Aspen occurs at all elevations in more moist areas and cottonwood is found along streams. The understory vegetation is lush and diverse. Lack of disturbance and grazing has decreased the amount of aspen in the watershed. Aspen restoration treatments have been completed in Napias, Moccasin, Phelan and Deep Creeks.

Logging of various types has occurred over some of the watershed as well as fire suppression. This has changed the landscape patterns from the natural range of variation. Douglas-fir bark beetle, spruce budworm and mountain pine beetle are present at endemic levels, but the presence of mature, susceptible hosts could elevate the levels to epidemic. Mistletoes are present in Douglas-fir and lodgepole pine with extensive amounts present in Douglas-fir at lower elevations.

II. Terrestrial and Aquatic Species and Habitat

A. Terrestrial Species and Habitat

Potential vegetation types (PVT), cover type, structural stage, and disturbance regime are used to describe source habitat characteristics and special habitat features (Appendix 1, Tables 1 and 2 in Wisdom et al. 2000) for selected wildlife species. Source habitats are part of the overall set of environmental conditions that contribute to a species stationary or positive population growth (Wisdom et al. 2000). Source habitat families represent groups of species that utilize similar habitat conditions. There are nine source habitat families representing 28 groups used to describe the species (Table 1-1) selected for evaluation in this assessment. Species selected are those for which there is ongoing concern about population or habitat status, and are known to occur or have potentially suitable habitat within the project area. Species include three federally listed endangered or threatened; 13 Forest Service R4 sensitive species for which there is a concern within the planning area; and 15 Salmon National Forest management indicator species (MIS). A Forest Plan Amendment Decision Notice was signed in February 2004 amending the MIS list. The new species list is also reflected in Table 1-1. Also included is the greater sage-grouse which is a species of interest and newly designated MIS on the Forest.

Family 1 Low Elevation, Old Forest Family
Pygmy nuthatch

Of the three groups represented in Family 1, only one species is present. Species in Family 1 use late-seral multi- and single layered stages of lower montane forests, including riparian woodlands. Cover types important to this family include lower elevation ponderosa pine and pine mixed with interior Douglas-fir (Wisdom et al. 2000). Large diameter trees and snags with cavities for nesting and/or foraging are required. Low elevation old forest habitat are limited and estimated at only 1057 acres within the project area.

Family 2 Broad Elevation, Old Forest Family
Boreal owl, brown creeper, fisher, pine marten, flammulated owl, great gray owl, northern goshawk (summer), pileated woodpecker, ruby-crowned kinglet, three-toed woodpecker, and yellow-bellied sapsucker

Five different groups are represented in Family 2. Source habitats for Family 2 are predominately coniferous forests, including spruce/ fir, lodgepole pine, Douglas fir, and ponderosa pine, in the mid- and late- seral single layer and multi layer structures. Large snags, hollow trees and down logs are important special habitat components. Some species in this family also depend on the presence of riparian woodlands (aspen, cottonwood), upland shrubs (chokecherry, serviceberry, and rose) and openings with young conifer trees for hunting prey species. Stands that display high edge contrast, such as early seral adjacent to late seral, provide important habitat conditions for some members of this family. There is a wide range of PVTs, cover types and structural stages included as source habitats for Family 2 with considerable overlap between the five groups.

Family 3 Forest Mosaic Family
Canada lynx and wolverine

Family 3 is characterized by the cold forest (spruce/ fir) and dry forest (Douglas fir without ponderosa pine and Douglas fir with lodgepole) in all structural stages. Species in this family are habitat generalists and use a variety of different habitats in the lower montane, montane, subalpine and riparian woodlands. Snags, large hollow trees, abundant downed logs and rock (talus) are important special features that provide denning sites for family members (Wisdom et al. 2000, Copeland 1996). There is a wide range of PVTs, cover types and structural stages included as source habitats for Family 2 with considerable overlap between the two groups within the assessment area.

Family 5 Forest and Range Mosaic Family
Bighorn sheep, elk, gray wolf, mule deer, Rocky Mountain goat

Four groups represent Family 5. Ponderosa pine, Douglas fir, spruce/ fir and lodgepole types in all seral stages characterize source habitats for species in Family 5. Non-forested types are also important including riparian woodlands (aspen, cottonwood), upland shrubs (chokecherry, service berry, rose), mountain mahogany, sagebrush and grass in all seral stages. Source habitats include all terrestrial community groups except non-native vegetation and agriculture. Down logs and rock (talus and cliffs) are important special features. There is a wide range of PVTs, cover types and structural stages included as source habitats for Family 2 with considerable overlap between the four groups.

Family 6 Forest, Woodland and Montane Shrub Family
Northern Goshawk (winter)

Source habitats for species in Family 6 include montane and lower montane forests, upland woodland and shrub communities, and riparian shrublands. The source habitat within the assessment area for goshawk winter range is virtually identical to the summer range. Special habitat components, including snags, down logs and herbaceous understories and small forest openings, help provide high densities of prey species.

Family 7 Forest, Woodland and Sagebrush Family
Bald eagle, Columbia spotted frog, harlequin duck, peregrine falcon, spotted bat, Townsend's big-eared bat and yellow warbler

Species in this family group use a mosaic of forest, woodland and sagebrush vegetation types and structural stages, including all conifer types except spruce/fir, as source habitats. Mid-seral and late-seral single layer and multiple layer structures are strongly represented in Family 7, however there are some species that also utilize the early seral stages in Douglas-fir and Douglas-fir with ponderosa pine forests. Riparian and shrub habitats are important prey habitat for the members of this family. The notable special features are rocks, cliffs, caves, mining shafts, and proximity to water (lakes, streams, rivers). There is a wide range of PVTs, cover types and structural stages included as source habitats for Family 2 with considerable overlap between the three groups.

Family 8 Rangeland and Early- and Late-Seral Forest Family
Mountain bluebird

Early-seral and late-seral single-storied montane and lower montane forests (all conifer types except spruce/ fir) provide source habitats for Family 8. Riparian woodlands (aspen, cottonwood), upland shrub (chokecherry, serviceberry, rose), mountain mahogany, sagebrush and grass are also included as habitat for this family. Important features include burned pine forests, snags and contrast between community types (forest and grass, forest and shrub, forest and riparian).

Family 10 Range Mosaic Family
Vesper sparrow

Source habitats for all species in this family include several cover types in the upland shrubland and upland herbland communities. The vesper sparrow uses mountain mahogany, sagebrush (Wyoming big sage, basin big sage, and low sage), fescue bunchgrass and native forb habitats.

Family 11 Sagebrush Family
Greater sage-grouse

Source habitats for this family center around open and closed low-medium shrub stages of big sagebrush, low sage, three-tip sage, and mountain big sagebrush cover types. The sage-grouse, a member of Group 33, is the only member of this Family chosen for inclusion in this assessment.

Table 1-1. Source habitat families for focal species including threatened (T), endangered (E), sensitive (S), and management indicator species (MIS) status.

Source Habitat Family	Species	Status				
		T	**E**	**S**	**Old MIS**	**New MIS**
Family 1 Low elevation, old forest	Pygmy nuthatch				MIS	
Family 2 Broad elevation, old forest	Boreal owl			S		
	Brown creeper				MIS	
	Fisher			S		
	Flammulated owl			S		
	Great gray owl			S	MIS	
	Northern goshawk (summer)			S	MIS	
	Pileated woodpecker				MIS	MIS
	Pine Marten				MIS	
	Ruby crowned kinglet				MIS	
	Three-toed woodpecker			S		
	Yellow-bellied sapsucker				MIS	
Family 3 Forest mosaic	Canada lynx	T		S		
	Wolverine			S		
Family 5 Forest and range mosaic	Bighorn sheep				MIS	
	Elk [WMR]				MIS	
	Gray wolf		E[NE]			
	Mule deer [WMR]				MIS	
	Rocky Mountain goat				MIS	
Family 6 Forest, woodland, and montane shrub	Northern goshawk (winter)			S	MIS	
Family 7 Forest, woodland, and sagebrush	Bald eagle	T				
	Columbia spotted frog			S		MIS
	Harlequin duck			S		
	Peregrine falcon			S		
	Spotted bat,			S		
	Townsend's big-eared bat			S		
	Yellow warbler				MIS	
Family 8 Rangeland and early- and late-seral forest	Mountain bluebird				MIS	
Family 10 Range mosaic	Vesper sparrow				MIS	
Family 11 Sagebrush family	Greater sage-grouse	species of interest				MIS

[WMR] – Winter range and migration routes; [NE] – experimental, non-essential population

B. Aquatic Species and Habitat

The mainstem of the Salmon River runs through the southeastern portion of the study area north along the northeastern boundary. The river provides an important migration corridor for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and steelhead trout between freshwater spawning and rearing waters and oceanic feeding grounds. Spring/summer chinook salmon and steelhead use the spawning and rearing habitat within the study area. Bull trout and cutthroat trout are also found within the study area.

Stream gradients that range from 1 to over 10 percent contribute to aquatic species habitat. The main Salmon, being under 4 percent in gradient, contributes to spawning and rearing habitat. Streams ranging from 4-10 percent contribute to rearing habitat. Streams over a 10 percent gradient contribute to water quality for downstream aquatic species. Most tributaries flowing into the main Salmon River from the study area are higher in gradient with only short portions of the streams on private and BLM lands near the main Salmon River suitable for rearing and spawning habitat.

III. Erosion Processes / Hydrology / Stream Channel / and Water Quality

Climate

Climate of the watershed analysis area is characterized by warm dry, summers and cool, moist winters. Average annual precipitation ranges from about 9 inches in the Salmon River valley to about 20 inches at higher elevations within the analysis area. Most of the precipitation is the result of orographic lifting of low-pressure systems that approach from the Pacific Ocean. About 50 to 55 percent of the annual precipitation occurs between October 1 and March 31 and is received as snow. During summers, storm tracts shift to the north, and high-pressure systems bring fair, dry weather for extended periods. Summers (July through September) are generally dry, receiving less than 20 percent of the annual precipitation.

Mean annual temperatures within the analysis area range from 44° F at Salmon to less than 30° F near the Ridge Road. The mean annual temperature at Cobalt, about seven miles southwest of the analysis area is 36° F. Diurnal temperature fluctuations typically exceed 20° F. The average summer temperature at Salmon is about 65° F and the average winter temperature is about 23° F.

Landforms

Elevation within the watershed analysis area ranges from 3,600 feet near the Salmon River valley to 9,100 feet at Mt. Baldy. The topography is characterized by glaciated landforms at high elevations, mountain slopelands at mid-elevations, and steep canyonlands at lower elevations adjacent to the Salmon River.

Glacial landforms within the analysis area include cirque headwalls, basins, and troughlands carved by snow and ice during the last glacial period. Through the processes of wetting and drying, freezing and thawing, and mass wasting, smooth, convex slopes developed. The mid-elevation mountain slopelands were shaped by fluvial action. Stream cutting and concentrations of overland flow created incised, convex slopes. The steep canyonlands were formed by faulting and undercutting by the Salmon River. Slope dissections on this landform are generally shallow and parallel.

Geology within the watershed analysis area includes quartzite, granite and volcanic rocks. Unstable landforms and active landslides occur on volcanic parent materials especially along the Salmon River Face. Within the analysis area, landforms derived from quartzite parent materials are generally stable and have low inherent erosion hazard while landforms derived from granite parent materials are generally stable but have relatively high inherent erosion hazard.

Hydrology

The watershed analysis area encompasses 205,455 acres within the Middle Salmon-Panther Subbasin. The Middle Salmon-Williams and Napias Creek watersheds and portions of the Middle Salmon-Carmen and Middle Salmon-Twelvemile watersheds are the 5th field hydrologic units comprising the analysis area. These are divided further into thirteen subwatersheds or 6th field hydrologic units (see Map 1-1). Subwatersheds within the analysis area are the Salmon-Wagonhammer, Salmon-Wallace, Salmon-Fenster, Jesse Creek, Salmon-Perreau, Williams Creek, Salmon-Henry, Lake Creek, Twelvemile Creek, Arnett Creek, Upper Napias Creek, Napias-Phelan, and Lower Napias Creek subwatersheds.

Surface streams in the watershed analysis area follow a dendritic pattern. Streams in the Middle Salmon-Carmen, Middle Salmon-Twelvemile, and Middle Salmon-Williams watersheds drain into the Salmon River, while streams in the Napias Creek watershed flow first into Napias Creek and then into Panther Creek, which is tributary to the Salmon River approximately 19 miles downstream. Surface hydrologic features within the analysis area are composed of an ephemeral, intermittent and perennial stream network, small seeps, wetlands and several small high elevation lakes.

The Idaho Department of Water Quality (DEQ) has designated beneficial uses of Salmon River waters within the analysis area. They are domestic water supply, agricultural water supply, cold water biota, salmonid spawning, primary and secondary contact recreation and special resource water. The Jesse Creek subwatershed has the special designation of a municipal watershed.

IV. Human Uses, Values, and Expectations / Recreation / Visual Resources

The Local Communities

> In the fall of 1866, five experienced prospectors and miners outfitted at Deer Lodge, Montana and quietly made their way southward toward and over the Nez Perce Indian trail that led into the lower end of the Lemhi valley…Discovery was made the 12th of August, 1866. Prospecting quickly proved this to be their destination as gold lay shining in their pan…This party with its well loaded pack train, did not escape the eagerly anticipating community [Deer Lodge]; they were quietly trailed out and the important discovery of Leesburg was out and heralded far and wide. During the remaining short period before winter, many people hurried into the basin…The city of Salmon was in the making. Lemhi County's birth and continuity began upon the date of discovery of gold in Leesburg Basin.
>
> G.E. Shoup, p. 5
> *The History of Lemhi County*
> 1940

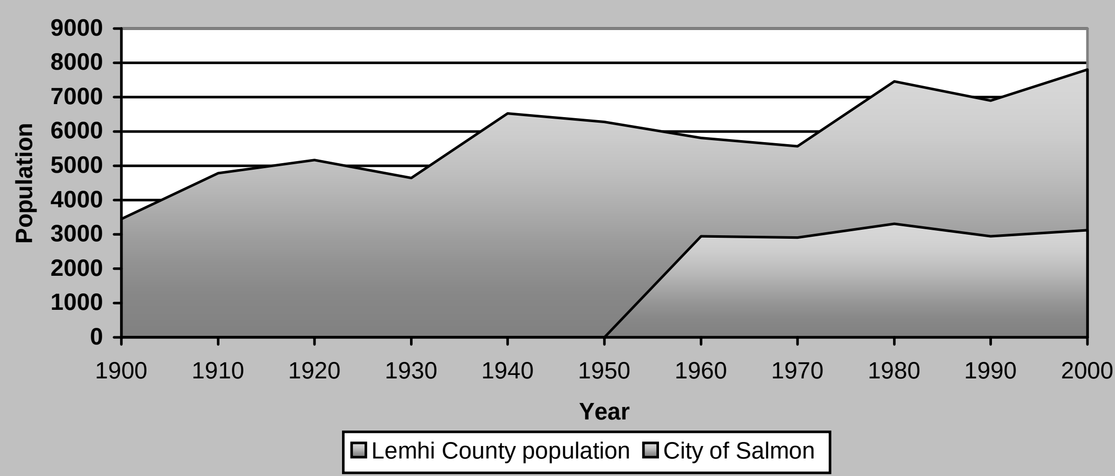
With the 1866 discovery of gold in Leesburg Basin, the city of Salmon and its satellite communities became inextricably tied to the lands stretching to the west of them. Now part of an analysis called the Salmon Interface Watershed Assessment (SIWA), this land and the communities that began with its offer of gold are the focus of an endeavor meant assess wildland-urban interface fire risks and other important issues, concerns, risks and opportunities surrounding the area. Though the city of Salmon is the primary community around which the SIWA revolves, other smaller community areas such as North Fork, Carmen, Baker, Elk Bend, Lemhi, and Tendoy remain part of the primary relevant social environment due to their proximity and historic ties to the area. Though termed communities, most of these areas include a very dispersed population centered around, at most, a post office and store. Their definition as a community is based more on the perception of residents, though membership is not always mutually exclusive as many residents consider themselves residents of both Salmon and their smaller community.

These communities are located in Lemhi County, a rural county that comprises six percent of the state of Idaho's land area and, with a 2000 population of 7806, less than one percent of the State's population (U.S. Census Bureau). Ninety-one percent of the land in the County is under federal ownership. The city of Salmon is the County seat and, with a 2000 population of 3122, is the only "urban" center within a 110-mile radius (U.S. Census Bureau).

Through the waxing and waning of mining and the other extractive-based industries comprising the traditional economic base of the area, the County has maintained a long-term trend of growth, experiencing a net growth in population of 56% between 1900-

2000. Figure 1-1 illustrates the pattern of growth for Lemhi County over the past century.

Figure 1-1. Lemhi County Population, 1900-2000, and City of Salmon Population, 1960-2000.



Data Source: U.S. Census Bureau, Inside Idaho

The city of Salmon has followed a similar, if somewhat more muted, pattern of growth as Lemhi County over the past 40 years (Figure 1-1). Current populations of the smaller community areas, based on Census 2000 Zip Code Tabulation Area (ZCTA) boundaries, show North Fork at 204 persons, Carmen at 597, Lemhi at 128, and Tendoy at 187 (U.S. Census Bureau).[1] The population of Elk Bend is estimated to be 200-300 persons. In-depth community demographic profiles of the Salmon, Lemhi, Tendoy, and North Fork areas based on 1990 Census data can be found in Harp and Pauley (1993).

American Indian Use and Treaty Rights

The watershed falls within the traditional occupation area of the Shoshone-Paiute and the Shoshone-Bannock Tribes (Walker, 1993). Prehistoric archaeological evidence indicates that Native American use of the area extends back at least eight thousand years. Today, the Shoshone-Bannock Tribes continue to exercise their treaty rights to hunt and gather within the watershed. The rights are protected on all open and unclaimed lands ceded by them to the United States government under the Fort Bridger Treaty of 1868, which include most of the Salmon-Challis National Forest. Under the American Indian

[1] Caution should be used when interpreting ZCTA numbers as they are based on different geographical borders than place-based counts and encompass a greater population area. For example, the 2000 population for the 83467 ZCTA (Salmon) is 6086 while the population count for the city of Salmon is only 3122.

Religious Freedom Act the Shoshone-Bannock Tribes also have the right to access traditional areas for religious observances.

Because of the unique relationship that sovereign Tribal governments have with the United States government, various laws, executive orders, and Federal government policies have been created which direct Federal, State, and local governments to consult with Indian Tribes prior to actions and undertakings. Government-to-government relations between the USDA Forest Service and the sovereign Shoshone-Bannock Tribes are ongoing. Consultation with the Shoshone-Bannock Tribes regarding proposed actions will occur so that tribal interests, concerns and values may be integrated into the development of alternatives and, ultimately, into the decision-making process.

The Local Economy: Past and Present

The roots of Lemhi County and the city of Salmon were established with mining that occurred in the SIWA area. Mining has historically been a main contributor to the local economies, both directly and indirectly. Evidence of historical mining activities and related, but now abandoned communities can be seen through out the area. Particularly important, is the broad technological diversity represented in historical mining features tied to the economic development of the region.

According to the Salmon-Challis National Forest (Forest) Minerals Projects Director, over 600,000 ounces of gold were taken out of the Leesburg area between 1866 and the early 1900s. While there were a number of mining operations occurring throughout the 1900s elsewhere on the Forest, a second boom occurred in the assessment area in the late 1980s with the discovery and operation of Beartrack Mine. The gold output from Beartrack mirrored the 600,000 ounces of gold removed from Leesburg, and did so in a shorter time period. The local communities supported this effort, providing employees, homes and services. Currently the only large-scale mine in the area, the Beartrack Mine is no longer active and is in reclamation stage. While a large number of placer claims remain active in the area, permit processes and low metal prices have made mining currently unmarketable, resulting in large declines in mining contributions to the local economy in recent years (mining currently accounts for little more than 5% of earnings in Lemhi County).

Agricultural and timber industries utilizing the assessment area have also played important roles in the traditional livelihood of Lemhi County residents. Historically, ranching was established throughout Lemhi County to feed the Leesburg miners and continued as demand for beef remained high region- and nation-wide. In 1997, livestock sales accounted for 91% of the market value of agricultural products sold in Lemhi County (Idaho Agricultural Statistics Service, 1997 Census of Agriculture). With private property comprising only a small portion of the County, 38% of all farms/ranches hold permits for federal grazing allotments, many of which are located within the assessment area. While permits issued in the assessment area are very important to the individual permittees, the contribution of these ranches, and agriculture in general, is only a small slice of the local economic pie. Harris, McLaughlin, Brown and Becker (2000) calculated that the levels of direct employment in agriculture for the local communities based on 1995 data is high (20% or more of total employment) only for Carmen and Lemhi, and medium low (6-10% of total employment) for Salmon, and low (less than 6% of total employment) for Tendoy.

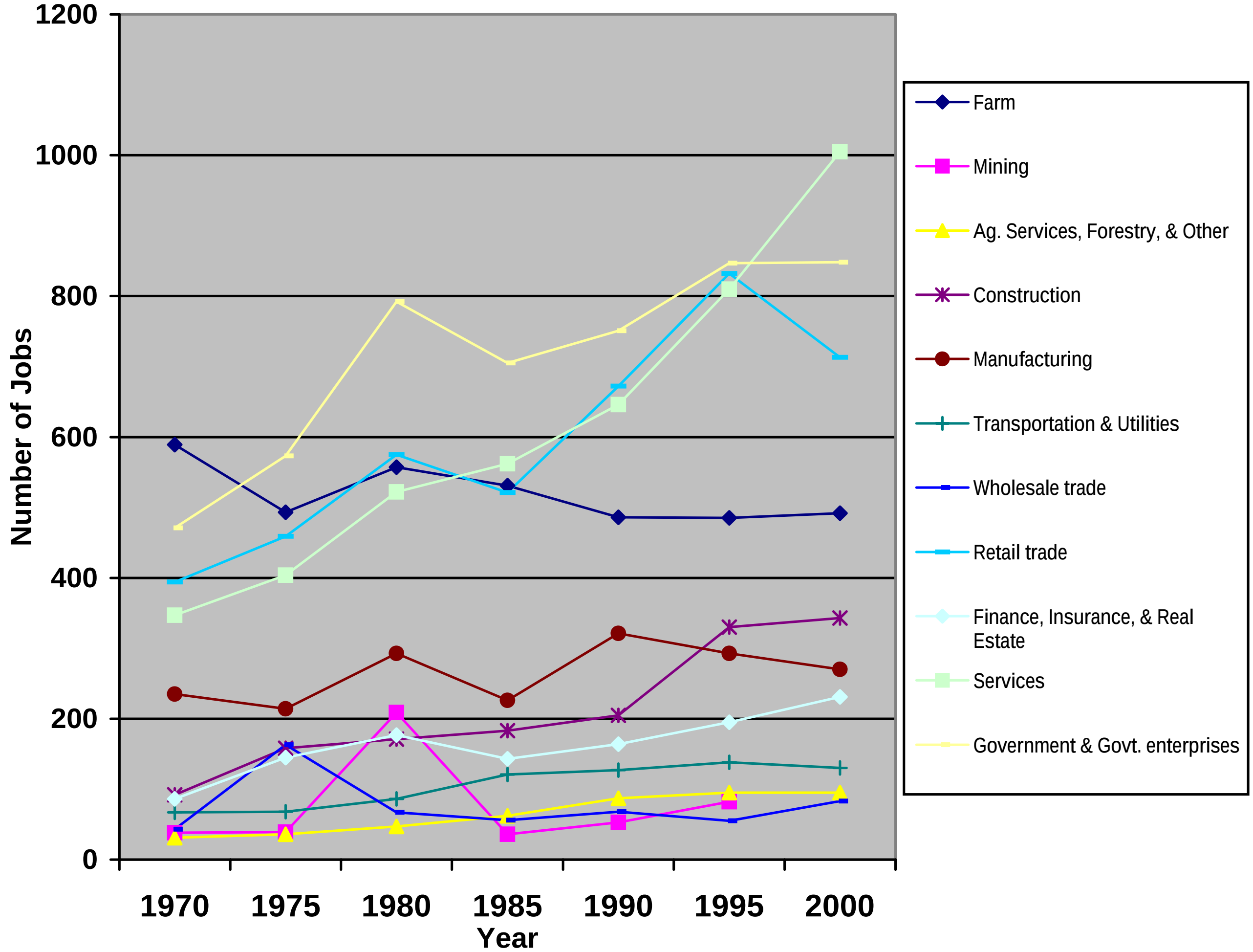
Occurring to a lesser extent than mining and grazing in the assessment area, timber harvests were still historically common in parts of the assessment area, providing products, income, and jobs to the local communities. By 1975, over ten million board feet had been removed from the Twelvemile drainage (USDA Forest Service 1976a). The Leesburg area was also harvested, but produced less than one percent of the Salmon National Forest's commercial timber (USDA Forest Service 1976b). No timber harvests have occurred in the assessment area since the 1980s and today forestry, lumber and wood products comprise only 6% of earnings in the County (U.S. Bureau of Economic Analysis).

Large scale declines in the mining and timber harvest industries in recent decades, and increasing recreational use of the area's natural amenities, have propelled Salmon, many of the smaller local communities, and Lemhi County with them from the realm of natural resource extraction-based economies to a foundation based on tourism and services. Lemhi County is described by the Idaho Department of Commerce (1999) as a recreational/tourism center due to its high lodging sales per capita, high tourism-related employment, and large portion of housing stock (11%) classified as "seasonal/recreational." Encompassing the public lands adjacent to Salmon and portions of the Salmon River, the assessment area has been a primary backdrop for not only the traditional uses described above, but also this burgeoning amenity-based tourism use.

In 2000, Lemhi County had a per capita personal income (PCPI) of $19,584, 83% of the state average ($23,727) and 66% of the national average ($29,469) (U.S. Bureau of Economic Analysis). Nearly half (49%) of the total personal income for the County comes from non-wage sources (dividends, interest, rent, and transfer payments) (U.S. Bureau of Economic Analysis). With an estimated 15.3% of the County population living below poverty in 1999 (U.S. Census Bureau), and an unemployment rate of 7.6% in 2001 (compared to 5.0% for the state of Idaho), local community economic well-being is a very salient issue (U.S. Department of Labor).

In terms of earnings by place of work, the largest industries in Lemhi County in 2000 were state and local government (comprising 19.9% of earnings), federal civilian government (18.5%), and services (17.3%) (U.S. Bureau of Economic Analysis). Figure 1-2 displays the full-time and part-time employment for Lemhi County by industry for 1970-2000.

Figure 1-2. Full-time and Part-time Employment by Industry, Lemhi County, 1970-2000.



Data Source: U.S. Department of Commerce, Bureau of Economic Analysis
Note: Data was not available for mining and services in 1995, thus the number of jobs for each in 1994 was used. Data also was not available for mining and agricultural services, forestry, & other for 1998-2000.

Rural/Wildland Interface Risks

The growth in the services/tourism sector heralds increasing acknowledgement of the natural amenities offered by the County. Attracted by the natural amenities of the area, in-migrants, comprising 14% of the County population growth between 1990-1998 (Idaho Department of Commerce 1999), are increasingly laying their foundations at the foot of the forest. This growth, compounding with the residents traditionally living within or on the edge of the wildland boundary, is creating an expanding wildland-urban interface (WUI). The city of Salmon has been listed by the USFS in the Federal Register, January 2001, as a WUI community at risk of catastrophic fire. North Fork was not on the list, but this might be due to the fact that outside of the area it is not recognized as a separate community. Given its dispersed pattern of residency and close proximity to

Gibbonsville, a small community 10 miles to the north, North Fork and Gibbonsville are often lumped together as one community complex. Like Salmon, Gibbonsville is also listed as a community at risk of catastrophic fire. Given North Fork's location between Salmon and Gibbonsville and the contiguity of forest conditions throughout the area, North Fork is likely another "at risk" community.

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) provides an evaluation of the risk of wildfire in the interface area around Salmon with a rural population/wildland interface fire risk assessment (Quigley and Arbelbide 1997a). By combining data on wildfire occurrence/intensity risk and estimates of areas in the urban and rural/wildland interface in the Basin, a risk of wildfire damage to dwellings and residents can be viewed. The Rural Population/Wildland Interface Fire Risk Map illustrates the ICBEMP rural population/wildland interface fire risk for the SIWA area. Current data on the locations of businesses and private residences in the area are included in the map. The combination, along with concurrence by the Forest Fire Ecologist on the fire risk in the area, validates the ICBEMP assessment of the fire risk within the assessment area. For the area as a whole, risk is similar to that found in the greater Subbasin, averaging low to moderate. However, risk is elevated to predominantly high in the area adjacent to the line of businesses/residences west of Salmon. Thus, while the overall project area may average a low to moderate interface fire risk, there is a significant band of moderate to high-risk areas that exist within the assessment area, specifically in the Salmon-Henry, Williams Cr., Salmon-Perreau, Jesse Cr., Salmon-Fenster, Salmon-Wallace, Salmon-Wagonhammer, Lower Napias, and Napias-Phelan HUC 6 sub-watersheds.

Local Social Characteristics

Although the County and the local communities have shifted towards a new economic base, the social importance of the traditional uses of the resources within the assessment area to the residents cannot be underplayed. In a profile of communities including Salmon and North Fork, Harp and Pauley (1993) identified the presence of three "community narratives," two of which stress customary rights and the priority of traditional uses of the resources. Harp and Pauley (1993) define community narratives as structures of meaning outlining the relationship between the human community and the land. A narrative "not only determines action and shapes what people do, think, feel, and believe but also constrains options and inhibits people from alternative ways of doing, thinking or feeling" (Harp and Pauley 1993: 48). They are not necessarily mutually exclusive, but each is distinctive. The collection of narratives reflects community identity by forming the filters of values and beliefs through which community members define themselves and the land.

The first narrative identified in Salmon and North Fork is based on the century-long belief that resources have value only within the framework of their capture and use. The narrative describes a relationship with the land based on use, with community members as the user and their community as the locus of control over the land. The second narrative is similar to the first in stressing the importance of subduing nature for economic opportunity. The difference is that the second narrative believes in the codification of prior communal use rights into formal right (e.g., water rights, grazing permits, etc.). The transfer of permits and rights is communally legitimized and formalized into law. Similar to the first narrative, the community is to be the locus of control, however, those benefiting from the use (primarily ranchers) are seen to have an obligation of social and political participation in the community.

A third community narrative was also identified in a small segment of the population, one based on a more recent and fragmented legacy. Within this narrative, use is primarily defined within the context of conservation and quality of life. Resource use is associated with long-term stewardship. Locally defined uses that give priority to customary rights are seen as secondary if perceived to be contrary to conservation and quality of life. Decisions about resources should occur outside the sphere of the local community, an important difference between this view and the other two narratives. This narrative was present in Salmon, but not in North Fork.

Although the community narratives provide a good overview of community values and views as they relate to the public lands, the research was done ten years ago and many communities have received some degree of in-migration since that time. As in-migrants ("newcomers") often hold different, less commodity-oriented views regarding land use than long-term residents ("old-timers"), there is a strong likelihood that the emphasis of traditional utilization dominating many communities has been tempered somewhat in recent years.

Recent data providing validation of the community narratives can be found in focus group research analysis conducted for the SIWA in July of 2002 (see Salmon Interface Watershed Assessment Focus Group Summary Report). Focus group discussions were conducted with four groups of local community members representing general interests in the area: political leaders, interface residents, traditional/commodity-based interests, and recreational interests. Two additional discussions with business and environmental interests were planned, but low attendance resulted in their cancellation. Individuals unable to attend the environmental interest group discussion submitted comments that were still taken into consideration.

Results from the input received suggest that the majority of interest groups place a high degree of importance on the maintenance and enhancement of traditional uses of the area such as logging, mining, and grazing. Most interest groups also highly value the preservation of access in the form of roads and trails. Environmental interests supported environmentally mitigated uses of the area and preservation of roadless area attributes. Evidence of a newcomer/old-timer culture clash is not apparent though, as all of the 18 focus group participants had been residents of the Salmon area for at least 18 years.

The National Community

As one of the most accessible and visible areas of the Forest to the general public, the assessment area is used, enjoyed, and valued by many people who visit from near and far. Some never even visit but benefit from the use and intrinsic values the area provides. With their long history of direct use and interest in the area, the local communities—especially the city of Salmon—are more directly affected by changes in the SIWA area and, conversely, more directly affect ecosystem conditions in the area than people living outside of the area. However, the USFS mission is to care for the land and serve people, regardless of their proximity to the land in question. National concerns and interests must be taken into consideration as management directives employed under their influence can similarly affect ecosystem conditions in the area and ecosystem conditions can affect the national public's use and/or value of the area.

Environmental Justice and Civil Rights

The local area has a high degree of racial and ethnic homogeneity (Lemhi County and the city of Salmon are both 97% White, and only 8% of the County and 2% of Salmon are Hispanic or Latino of any race) (U.S. Census Bureau). At this time there is no known segregation of low-income groups in any one specific area where Forest actions recommended in this report might inequitably impact them. Comments and research have indicated that disabled persons use Forest roads in the SIWA area as their primary or only means of enjoying the Forest. Whereas most other users have alternative means of access to the area (trails, floating the river, etc.), disabled persons will be disproportionately affected by any actions concerning roads that they rely solely upon for their use of the SIWA area. However, no specific roads were identified as more important than others—all roads were said to be important to this faction. Without specific information regarding the importance of certain roads and what types of changes will incur significant changes in use (i.e., can/will disabled users still use a Level 3 road that is downgraded to a Level 2), the extent of the potential impact is unpredictable. The likelihood of some disproportionate impact occurring will have to be evaluated on a case by case basis, but will likely only be significant regarding roads that provide the only vehicle access to an area.

Validation of Interior Columbia Basin Ecosystem Management Project:

In 1993, presidential directive launched the Interior Columbia Basin Ecosystem Management Project (ICBEMP) in an effort to develop "a scientifically sound, ecosystem-based strategy for 72 million acres of land administered by the BLM and Forest Service" stretching across parts of Oregon, Washington, Montana, Wyoming, Nevada, and Idaho (Quigley and Bigler Cole 1997: 2). Scientific assessments of this area, the Interior Columbia River basin, were conducted to advise the development of management strategies and provide context for the USFS and BLM. As the SIWA area is encompassed within ICBEMP, ICBEMP assessments can provide a context for SIWA social current conditions. Where possible, this analysis will validate and "step down" the ICBEMP process to the local watershed and community level. To help bridge the large gap in scale between the regional assessment and this watershed assessment, a review of the human uses of the Middle Salmon River-Panther Creek Subbasin was completed (see the Middle Salmon River-Panther Creek Subbasin Human Uses Report in the SIWA project file). SIWA human uses analyses will build upon the validation of ICBEMP findings as validated in the Subbasin report.

Issues and Key Questions (Step 2)

The purpose of this step is to focus the analysis on the key elements of the ecosystem and to determine which core topics are applicable. The Team reviewed and evaluated the Forest-wide issues listed in the Salmon and Challis Framework and, similar to the characterization process, decided to combine four of them into two. Specific key questions were reviewed and developed to address each issue. The core topics addressed are identified under each issue.

Issue A. Changes in Vegetation Structure and Composition (Forested and Non-forested)

Under natural conditions, vegetation structure and composition have a high degree of resiliency and diversity. Past human activities and natural processes have changed forested and non-forested communities. These changes may affect ecosystem function and overall sustainability.

Core topics addressed: vegetation

Key Questions:

- How has fire suppression, fire exclusion, timber harvest, silvicultural practices and grazing affected vegetation structure, composition and ecosystem process of forested and non-forested vegetation?
- How has the change in forested and non-forested vegetation structure and composition affected the risk associated with wide spread wild fire and the ability to suppress forest fires adjacent to human developments (urban interface) and to protect the municipal watershed?
- How has the introduction and establishment of non-native species affected plant communities within the watershed?

Issue B. Changes in Terrestrial and Aquatic Species and Habitat

Under natural conditions, habitat and species populations have a high degree of resiliency and diversity. Existing and past human uses and natural processes have caused changes to habitat and associated species. These changes may have affected the amount and distribution of habitat and population numbers, thereby reducing the overall sustainability of species and their habitat.

Core topics addressed: species and habitat

Key Questions:

- How have management practices influenced the historic distribution of key species and habitat within the watershed?

- How have wetlands, aspen, larger diameter late seral stage, and large diameter snag habitats been affected by management practices?

Issue C. Changes in Riparian Health, Riparian Function, Hydrologic and Watershed Conditions, and Geomorphic Processes

Under natural conditions, riparian function and processes have a high degree of resiliency, structure and compositional diversity. Hydrologic and geomorphic processes such as ground water recharge, streambank stability and sediment filtering, provide high water quality that sustains beneficial uses. In some areas, management activities and accelerated erosion have contributed to the degradation of hydrologic systems on the Forest, which could exceed State water quality guidelines and Forest Plan standards and guides.

Core topics addressed: erosion processes, hydrology, stream channel morphology, water quality

Key Questions:

- Does the increased risk of severe wildfire exist, and if so, what is the potential for adverse impacts to soil and water resources?

- How have human activities, such as fire suppression, roads, mining, and residential development affected the Jesse Creek municipal watershed?

- How has mining affected water quality and stream channel conditions?

- How has timber harvest and road building affected slope hydrology and stability, water quality, stream channel conditions, and the potential to experience adverse effects to hydrologic resources?

- How has livestock grazing affected riparian vegetation, hydrology and soils?

Issue D. Changing Human Values, Expectations, and Uses

Broadening of human uses and values regarding natural resources are affecting the existing services, products and quality of life (sense of place) provided by the Forest. These shifts have resulted in differing societal ideas on resource use and management, ranging from management ideals based on close economic and/or social ties to resource use to management ideals based not on actual use but on purely existence value. Additionally, on a local level, the social awareness of risks from wildfire to the community has increased recently due to the intense wildfires of 2000. On a national level, forest management has shifted in recent years to address the increased wildfire hazard in the wildland/urban interface (WUI). The broadening of ideas on resource use and management and the increased social awareness of wildfire risk in the WUI are the predominant issues to be addressed in this analysis.

Core topics addressed: human uses

Key Questions:

- What are the major human uses including tribal uses and treaty rights? Where do they generally occur in the watershed?
- The Shoshone-Bannock Tribes have identified off-reservation rights to hunt, fish, and gather on off-reservation lands including the Salmon-Challis National Forest. How have the presence and activities of other user groups affected historic uses by Tribal members within the watershed?
- How have changing local and national social and economic interests and values affected public use and expectations in the area?
- What do people care about in this watershed?
- Do current or anticipated management practices or uses threaten valuable heritage resources, particularly known historic mining districts and historic trails, within the watershed?
- What is the economic and social resiliency of the local community and county?
- What is the degree of reliance of human uses on public lands within the watershed?
- How do the identified human uses relate to local economy, custom and culture? Magnitude of contribution? Importance of contribution?
- What are the current trends for each of the identified human uses?
- What factors in this watershed may cause changes to the current pattern and types of human uses?
- Are there opportunities for new, or expansion of existing, human uses?
- How has societal (local and national) perception of wildfire and wildfire risks affected the public expectations of management in the watershed to address the risks?

Issue A. Changes in Vegetation Structure and Composition (Non-forested and Forested)

Description of Current Conditions (Step 3)

I. Non-Forested Vegetation

Two sources of non-forested vegetation data are described; rangeland field inventory data dating back from the late 1960s to mid 1980s, and satellite imagery data taken in 1991. These two sources provide different perspectives and approaches in describing the current condition of the non-forested vegetation. Although some results and characteristics from the two sources are comparable, they are discussed separately in this assessment.

A. Descriptions of Potential Vegetation Group (PVG) Plant Communities

The non-forested vegetation makes up approximately 45,293 acres of the 178,587 acres (25.4%) of the federally managed lands within the assessment area and approximately 63,515 (35.6%) of all land ownerships. The Dry Shrub Potential Vegetation Group (PVG) is the dominant of the three non-forested potential vegetation groups comprising 57% of the non-forested vegetation. The Cool Shrub PVG is second in line with 38% and the Woodland PVG is third at 3%. The meadow grassland plant communities make up the remaining 2%. Map A-1 displays the distribution of the PVGs within the assessment area.

The Dry Shrub PVG shrub/grass plant communities are dominated by Wyoming big sagebrush (*Artemisia tridentata wyominensis*) and threetip sagebrush (*Artemisia tripartita*). Low sagebrush (*Artemisia arbuscula*), rabbitbrush (*Chrysothamus* species), and shadscale (*Atriplex confertifolia*) are also present in minor amounts. Perennial bunch grasses make up the understory, most commonly comprised of bluebunch wheatgrass (*Agropyron spicatum*), Sandberg's bluegrass (*Poa secunda*), needle grasses (*Stipa* species), and squirreltail (*Sytanian hystrix*). Cheatgrass (*Bromus tectorum*), an invasive non-native annual grass, is also relatively common in varying amounts. Many native perennial and annual forbs are also present within these plant communities. There is a wide range of physical site characteristics, such as precipitation, soil depth and texture, percent coarse fragments within the root zone, and soil horizon development, that account for a broad range of variability of life forms, species composition, and production between and within the various plant communities that make up the Dry Shrub PVG. Life form and species composition is also influenced by the lack of fire, extended drought, and by human uses such as livestock grazing that tends to increase shrub density and cover.

The Cool Shrub PVG is dominated by mountain big sagebrush (*Artemisia tridentata vaseyana*) and mountain snowberry (*Symphoricarpus oreophilus*) with a grass understory dominated by Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass, bluegrasses (*Poa* species), and sedge (*Carex*) species. A wide variety of perennial and annual native forbs are also abundant and occasionally dominate the plant community. The annual growing season is somewhat reduced in the cool shrub zone compared to the Dry Shrub PVG, however the higher elevation soils are more productive due to higher organic matter and greater soil development. Although the range of variability of plant species and plant life forms between and within plant communities exists in the Cool Shrub PVG it is less pronounced than for the dry shrub communities, primarily due to increased soil productivity, less competition, increased soil cover, and being less influenced by drought conditions.

Two very distinct plant communities are included in the Woodland PVG; those dominated by mountain mahogany (*Cercocarpus ledifolius* varieties *ledifolius* and *intricatus*), and those dominated by upland aspen. Mountain mahogany is most often seen in open stands associated with mountain big sage, and occasionally with mountain snowberry and ninebark (*Physocarpus malvaceus*) shrub species. Idaho fescue and bluebunch wheatgrass are the dominant understory grass species. The upland aspen stands are located on the periphery of tallus slopes, in snow pockets, or in swales where soils stay moist longer than the surrounding uplands. Other species associated with these stands are quite variable depending upon the local soil and moisture conditions. Sagebrush, snowberry, rose, and currants are common shrubs while bunchgrasses and bluegrasses are common herbaceous species. These upland aspen stands are generally smaller in size and less vigorous than those stands associated with perennial or intermittent water flows.

As stated above, the Woodland PVG is estimated to represent only 3% of the federally managed non-forested plant communities within the SIWA. It is strongly believed this is an under representation for a variety of reasons. The upland aspen community occupies very small, isolated areas and therefore, are often undiscovered or not mapped at the survey scale. The mountain mahogany communities can range in size from just a few acres to over 100 acres. The small sites are often un-mapped at the survey scale while the larger sites, being strongly associated with rock outcrop, are often mapped as un-vegetated barren or rock outcrop. Additional field surveys will be necessary to rectify this situation as these two plant communities are very important components that contribute to a diversely vegetated landscape.

The meadow grassland communities are complexes of dry and wet meadows where grasses, sedges, and forbs occupy areas influenced by fluctuating water tables. These areas exist throughout the assessment area but are generally isolated and very small in size. Those areas that were inventoried were located within the upper elevation sub-watersheds typically associated with the larger perennial streams. Because of their herbaceous dominance, high productivity, and association with surface water they are very attractive to, and often impacted by, both big game grazers and domestic livestock.

B. Exotic, Invasive, and Noxious Weeds

“Noxious” is a legal classification used for a non-native (exotic) plant that can exert substantial negative environmental or economic impact. Noxious weeds are often referred to as colonizers or invaders (PNW-GTR 405 page 436). Colonizers tend to invade a site after an intense disturbance or after a frequency of disturbances while invaders are capable of invading an undisturbed site. Noxious, invasive weeds are able to germinate under a wide range of environmental conditions, establish quickly, exhibit fast seedling growth, and out-compete native species for water and nutrients.

There are 22 recognized weed species of concern currently established on the Salmon-Challis National Forest. Of those 22 species, eleven have been identified within the SIWA area through field inventories performed over the last several years. These eleven species are listed in descending order of acreage infested or number of populations: Spotted knapweed (*Centaurea maculosa*), musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), yellow toadflax (*Linaria vulgaris*), black henbane (*Hyoscyamus niger*), scotch thistle (*Onopordum acanthium*), sulfur cinquefoil (*Potentilla recta*), common tansy (*Tanecetum vulgare*), and whitetop (*Cardaria draba*). As more inventories are completed it is likely the number of acres and populations will increase, in addition to the discovery of additional species. Cheatgrass (*Bromus tectorum*) is an exotic annual grass species that is widely distributed throughout the assessment area. It is not designated a state or county listed noxious species and typically acts more like a colonizer than an invader, being very responsive to surface disturbances.

Current (as of 2001) weed distribution within the assessment area is displayed in Table A-1 by subwatershed and on Map A-2.

C. Threatened, Endangered, and Forest or State Sensitive Plant Species

There are no listed threatened or endangered plant species within the Salmon-Challis National Forest nor the Salmon interface. There are a total of 24 species of focus plant species that are either occupying sites within the S-C NF or have potentially suitable habitat within the Forest. Of these 24 species of focus, only two are present within the SIWA area; the most common being Lemhi penstemon (*Penstemon lemhiensis*) occupying 10 of the 13 subwatersheds and pink agoseris (*Agoseris lackschewitzii*) occupying 2 of the 13 subwatersheds. Typical habitat for Lemhi penstemon includes sagebrush/grasslands and open conifer forests between 3,200 and 8,100 feet elevation. It is an early seral species that requires bare soil to become established. It appears to be dependent on small-scale disturbances and has adapted to man-made disturbed sites such as road cuts and fills and responds favorably after fire. Pink agoseris occupies wet montane and subalpine meadows with soils moist throughout the growing season. Although pink agoseris can occupy saturated soil conditions, it is not considered an indicator species for wetland status.

Current (as of 2001) species of focus plant distribution is displayed in Table A-1 by sub-watershed.

Table A-1. Distribution of Weed Species and Sensitive Plant Species by Subwatershed[1]

Weed species*		CADR	CANU	CEMA	CIAR	CIVU	EUES	HYNI	LIVU	ONAC	PORE	TAVU		
Sensitive species**													PENLEM	AGOLAC
*Subwatershed Name-Number****	*S-ws Acres*													
Arnett Cr.-1102	12,099			1 / 6									1	
Jesse Cr.-0403	13,021			2 / 35									1	
Lake Cr.-0303	12,913		1 / 2	17 / 435	2 / 3					3 / 6			5	
Lower Napias-1104	12,148		3 / 3	47 / 79	1 / 1		1 / 2						12	1
Napias-Phelan 1103	18,179		2 / 53	8 / 39									4	1
Salmon-Fenster 0404	13,847			26 / 286					1 / 2				4	
Salmon-Henry 0305	14,699			4 / 27										
Salmon-Perreau 0402	36,869			6 / 63									2	
Salmon-Wagonhammer 0506	10,565			7 / 91			13 / 36		5 / 10			1 / 2		
Salmon-Wallace 0504	14,828		49 / 193	68 / 967	6 / 14	35 / 282	4 / 8	6 / 12			3 / 6		2	
Twelvemile-0304	14,267			3 / 121										
Upper Napias-1101	13,962			1 / 2									1	
Williams Cr. 0401	18,056	1 / 2		57 / 395									5	

[1] Columns show the number of populations and the total acres for each weed species; only the number of populations are shown for each sensitive species. Acre estimates: for linear miles, 1 mile = 1 acre; for point data (ranging from .1 to 5 acres) used mid point of 2 acres.
* Weed species codes: CADR – hoary cress (whitetop); CANU – musk thistle; CEMA – spotted knapweed; CIAR – Canada thistle; CIVU – bull thistle; EUES – leafy spurge; HYNI – black henbane; LIVU – yellow toadflax; ONAC – scotch thistle; PORE – sulfur cinquefoil; TAVU – common tansy
** Sensitive species codes: PENLEM – Lemhi pentsemon; AGOLAC – pink agoseris
*** Subwatershed number: A 12 digit Hydrologic Unit Code number that uniquely describes a series of nested watersheds. Not shown is 17060203 which describes the Middle Salmon-Panther Sub-basin. The next two numbers describe the 5th field watershed and the last two describe the 6th field subwatershed.

D. Non-Forested Vegetation Condition Derived From Field Inventories

Lands within the National Forest were inventoried in the late 1960s. The inventory methods (USFS Range Analysis Handbook Chapter 20) mapped individual areas based on plant community types and livestock grazing suitability. Species composition was calculated from production estimates. The range analysis process derived range 'condition' using livestock forage values. Range (vegetation) condition was derived by combining the species composition rating index (using desirable and intermediate forage value species) with a forage production rating index. The numeric sum of these two indices was then placed in one of five possible condition categories (very poor 0-20, poor 21-40, fair 41-60, good 61-80, and excellent 81-100). The current concept of range condition is derived from ecological seral stage which is based on a comparison with a defined potential natural community. However, a connection between these two procedures can be inferred since the desirable livestock forage species are also the key indicator species in the shrub/grass potential natural communities. Although a direct relationship to the potential natural community or ecological seral stage does not exist, it seems reasonable to presume that those plant communities rating out at the low end (poor range condition) are not supporting a diverse assemblage of native indicator plant species that are potential for the site while those rating at the high end (good range condition) are.

Vegetation condition on Bureau of Land Management administered lands were inventoried in the mid 1980s using the Ecological Site Inventory (ESI) method(NRCS National Range Handbook 1997). Field mapping was based on plant community types and delineated soil map units. Soil mapping was completed in the early 1980s by the Natural Resources Conservation Service (NRCS; previously the Soil Conservation Service) during an Order 3 soil survey (Custer and Lemhi Counties Soil Survey, SCS, in press). Similar to the FS methods, annual total production was measured or estimated and species composition by weight was calculated. However, instead of evaluating livestock forage value this method compared the species composition of the sampled site to documented ecological site guides developed by the Natural Resources Conservation Service. The result is a seral stage rating of early, mid, late, and potential natural community (PNC) seral stage. The ESI method does not place qualitative value ratings on the results but merely places the sampled site in a defined seral stage based on ecological site guides that were developed from sampling undisturbed sites with similar physical characteristics (soils, climate, land form, etc.) within the same physiographic region.

Table A-2 displays the non-forested range condition distributed by potential vegetation groups within each subwatershed. Table A-3 is a composite summary of the non-forested vegetation characteristics by combining Tables A-1 and A-2.

It is important to note that these quantitative range condition inventories are nearing 20 to over 30 years old. It is quite likely the conditions reported are not entirely reflective of the conditions existing today thus creating a temporal data gap warranting a more site specific closer look. In addition, wildfire episodes have occurred since these field inventories were performed. The Sunset fire in 2001 burned 191 acres (mostly on State land) in the Salmon-Henry subwatershed and the Twelvemile fire in 2000 burned 120 acres within the Twelvemile subwatershed. The Lake Creek fire in 1985 and the Fenster fire in 2000 dramatically altered the findings from the inventories, returning the shrub/grass community types back to an early seral stage dominated by grasses. Similar situations resulted from the large Clear Creek fire of 2000 which returned many forested communities back to an early seral grassland type. The most recent fire (Withington Fire) occurred in August of 2003 on SAL Mountain burning 2,777 acres within the Salmon-Henry subwatershed and 686 acres in the Salmon-Perreau subwatershed burning both forested and non-forested community types. Through succession, these types will gradually establish shrubs and young trees and eventually return to their potential forest habitat types. Map A-3 displays the fire history within the assessment area.

E. Non-Forested Vegetation Condition Trend

Vegetation condition trend is defined as the direction of change in ecological status or resource value rating observed over time (A Glossary of Terms Used in Range Management, 3rd Edition, Society for Range Management, 1989). There are two general concepts of assessing trend; quantitative long term measurement of trend and qualitative observed apparent trend. As part of the vegetation inventories mentioned above, a qualitative observed apparent trend was assessed using subjective interpretations of numerous indicators of the plants and soils. Observed apparent trend provided a good, one point in time description of plant health, vigor, spatial distribution, and soil erosion features that were apparent at the time of observation. Observed apparent trend can be useful and informative if the assessed sites are revisited periodically and reassessed for comparison. It is not surprising that the vast majority (>90%) of the inventoried sites were assessed as having a ‘static’ or ‘not apparent’ trend indicating the plants were lacking any obvious health indicators and the soils were relatively stable. No follow-up comparison visits were made since the initial observations.

Quantitative measurements of trend require establishing repeatable study plots and measuring a variety of spatial attributes of the site. Most common measurements include ground (soil) cover, and frequency of occurrence and cover of key indicator species. The Forest Service has established 11 study sites within the SIWA area, however, only two have a long enough repeat measuring history to show a trend (one being upward trend, the other being downward trend). The BLM does not have any long term trend monitoring sites established within the SIWA area.

Because of this general lack of useful, meaningful, or widely distributed data, non-forested range condition trend cannot be effectively evaluated in the Salmon Interface Watershed Assessment.

Table A-2. Non-Forested Vegetation Condition Summary---FS/BLM Administered Lands
Percent Range Condition; Distribution by SubWatershed and Potential Vegetation Groups[1]

PVG Distribution		Dry Shrub			Cool Shrub			Woodland			Meadow Grassland			Other*
*Percent Range Condition***		Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	
*Subwatershed Name-Number****	*Fed. Acres*													
Arnett Cr.-1102	11,921	No non-forested vegetation types identified at survey scale												100
Jesse Cr.-0403	11,961	No vegetation type surveys completed												
Lake Cr.-0303	11,965	9.1			22.8	4.3	1.5							62.3
Lower Napias-1104	11,789				4.7	2.9	.2				.7	.4		91.1
Napias-Phelan 1103	17,054				2.1	2.1	.9				.6	1.0		93.3
Salmon-Fenster 0404	9,960	20.0	2.6	3.4	3.3	6.3	2.7	7.8	2.1					51.8
Salmon-Henry Cr.-0305	12,807	31.3	19.4	1.4	12.8	.4								34.7
Salmon-Perreau 0402	23,905	4.9	30.8	.3	1.2	4.9	.2							57.7
Salmon-Wagonhammer 0506	9,339	4.4	24.8		4.9	7.2								58.7
Salmon-Wallace 0504	13,023	5.3	7.7	3.0	8.0		1.0	1.6						73.4
Twelvemile-0304	14,040	7.7			.7	1.7	.2	1.2			.5			88.0
Upper Napias-1101	13,735										3.0			97.0
Williams Cr.-0401	17,088	4.1	5.0		17.3	4.8	3.1		1.1		1.5			63.1

* Other = indicates the acres of other vegetation life forms or land types that were excluded in the assessment (i.e. forested community types, tallus, rock outcrop, barren).
** Combined Excellent with Good and Very Poor with Poor Range Condition.
*** Subwatershed number: A 12 digit Hydrologic Unit Code number that uniquely describes a series of nested watersheds. Not shown is 17060203 which describes the Middle Salmon-Panther Sub-basin. The next two numbers describe the 5th field watershed and the last two describe the 6th field subwatershed.
[1]The table does not reflect changes resulting from the 2003 Withington Fire.

Table A-3. Non-Forested Vegetation Composite Summary Table

*Subwatershed Name-Number****	*S-ws Acres*	Weeds; # of locations, acres, % of subwatershed			% Susceptible PVGs* (of federal acres) w/in subwatershed				% Road less **	Road Den-sity ***	Condition Distribution (federal acres)							
											DS		CS		MG		Wdl	
		# locs	Ac	%	DS	CS	MG	Wdl			G	F+P	G	F+P	G	F+P	G	F+P
Arnett Cr.-1102	12,099	1	6	.05	0	0	0	0	60	H								
Jesse Cr.-0403	13,021	2	35	.3	Unknown-not surveyed				90	M	Unknown-not surveyed							
Lake Cr.-0303	12,913	23	446	3.5	9.1	28.6	0	0	0	H	9.1	0	22.8	5.8				
Lower Napias-1104	12,148	52	85	1.0	0	7.8	1.1	0	20	H			4.7	3.1	.7	.4		
Napias-Phelan 1103	18,179	10	92	.9	0	5.1	1.6	0	50	H			2.1	3.0	.6	1.0		
Salmon-Fenster 0404	13,847	27	288	2.1	26.0	12.3	0	9.9	0	H	20.0	6.0	3.3	9.0			7.8	2.1
Salmon-Henry 0305	14,699	4	27	.2	52.1	13.2	0	0	10	M	31.3	20.8	12.8	.4				
Salmon-Perreau 0402	36,869	6	63	.2	36.0	6.3	0	0	15	H	4.9	31.1	1.2	5.1				
Salmon-Wagonhammer 0506	10,565	26	139	1.3	29.2	12.1	0	0	45	M	4.4	24.8	4.9	7.2				
Salmon-Wallace 0504	14,828	171	1482	8.4	16.0	9.0	0	1.6	0	H	5.3	10.7	8.0	1.0			1.6	0
Twelvemile-0304	14,267	3	121	.8	7.7	2.6	.5	1.2	40	H	7.7	0	.7	1.9	.5	0	1.2	0
Upper Napias-1101	13,962	1	2	.013	0	0	3.0	0	96	H					3.0	0		
Williams Cr.-0401	18,056	58	397	2.2	9.1	25.2	1.5	1.1	20	H	4.1	5.0	17.3	7.9	1.5	0	0	1.1

* PVGs; DS=dry shrub; CS=cool shrub; MG=meadow grassland; Wdl=woodland

** % roadless area visually estimated from maps

*** road density derived from roads analysis data: L= < .07 road miles per square mile; M=.07-1.7 road miles per square mile; H=> 1.7 road miles per square mile.

F. Satellite Imagery Classification

The satellite imagery classification process utilized satellite images flown in 1991. Using color spectral band computerized enhancement, cover types and structural stages were identified for each potential vegetation type. These three attributes can be viewed as hierarchal subsets of the potential vegetation groups and, when combined, are used to classify and spatially map vegetation. Hann et al. (1997) in Volume II provides glossary definitions for these terms. A potential vegetation type (PVT) is a kind of physical and biological environment that produces a kind of vegetation, identified by the indicator species for that environment. Due to disturbance the species named in a particular PVT may not be currently present. Cover type (CT) is a vegetation classification depicting a species, a group of species, or life forms. Cover types describe what is currently occupying a site. Structural stage (SS) describes a stage of development of a vegetation community that is classified on the dominant processes of growth and development. The table below shows the hierarchy from the potential vegetation groups down through the structural stages that were used to classify the non-forested vegetation. Map A-1 displays the PVGs while Maps A-4 through A-6 show the distribution of the PVTs, CTs, and SS, respectively, for both the non-forested and forested vegetation.

TABLE A-4. Hierarchy of PVGs - PVTs - Cover Types - Structural Stages

PVG	PVT	Cover Type	Structural Stage
Dry Shrub	101 bunchgrass grass-land	3001 native bunchgrass	22 closed herbland
		3012 dry shrub/bunchgrass	24 open low shrub
	109 Wyoming big sagebrush	3013 Wyoming big sage/bunch-grass	24 open low shrub
		4097 native bunchgrass	21 open herbland
	118 threetip sagebrush	3010 fescue/bunchgrass	22 closed herbland
		3022 threetip sage/native bunchgrass	23 closed low shrub
Cool Shrub	111 bunchgrass/fescue	3011 sedge/fescue	21 open herbland
		5010 sage/sedge/fescue	25 open mid shrub
		5012 sedge/fescue/conifer	11 stand initiation woodland
		5020 conifer/sedge/fescue	14 young multi-strata woodland
	112 mountain big sagebrush	3010 fescue/bunchgrass	21 open herbland
		5009 mountain big sage/fescue	25 open mid shrub
	113 mountain big sagebrush/conifer	3010 fescue/bunchgrass	21 closed herbland
		5009 mountain big sage/fescue	25 open mid shrub
		5011 mountain big sage/conifer	11 stand initiation woodland
		5019 conifer/mountain big sage	14 young multi-strata woodland
Woodland	121 mountain mahogany	3007 mountain mahogany	27 open tall shrub

The fires of 2000 dramatically modified the cover types and structural stages in the burned areas. In order to update the imagery classification within these areas (excluding the Sunset, Twelvemile, and Withington fires), various rule sets were developed that uniformly modified the pre-burn classification to an appropriate post-burn classification based on fire severity.

The two different 'mapping' techniques (the field inventory range condition mapping of 20 plus years ago and the classification process from the satellite imagery) cannot be directly compared in regards to vegetation condition or rangeland health. However, it is interesting to note and compare the acres and vegetation type distribution at the broader PVG level. The table below compares the acres by PVG for each subwatershed from both methods. Some subwatersheds are surprisingly similar while others are vastly different. These discrepancies can be acceptably rationalized by; the Jesse Creek subwatershed was not field inventoried; only federal acres (not state or private lands) were field inventoried; many of the vegetation types that supported conifers were field inventoried as forested types but the imagery classified them as any one of a variety of shrub/conifer types; and much of the mountain mahogany vegetation type was ignored as barren or rock in both processes (although the field inventories identified considerably more than the satellite imagery). The inventoried mixed grass type (770 acres) was imagery classified as any one of several cover types or structural stages within the Dry Shrub or Cool Shrub.

Table A-5. Comparison of Subwatershed Acres Between Field Inventory and Satellite Imagery Methods

Subwatershed	Field Inventoried Acres				Satellite Imagery Classification Acres		
	DS	CS	Wdl	MG	DS	CS	Wdl
Arnett	no non-forested types mapped at inv. scale				--	75	--
Jesse Creek	not field inventoried				1323	1048	--
Lake Creek	1089	3422	--	--	1083	3650	16
Lower Napias	--	920	--	130	139	774	--
Napias-Phelan	--	870	--	273	--	932	--
Sal-Fenster	2590	1225	986	--	3739	2132	28
Sal-Henry	6634	1691	--	--	6085	3958	8
Sal-Perreau	8606	1506	--	--	14248	3394	--
Sal-Wagonhmr	2727	1130	--	--	2173	2955	5
Sal-Wallace	2084	1172	208	--	2732	2925	51
Twelvemile	1081	365	168	70	938	1864	7
Upper Napias	--	--	--	41	--	111	--
Williams Creek	1555	4306	188	256	1867	5255	--
PVG totals	26366	16607	1550	770	34327	29073	115
Method totals	45293				63515		

DS=Dry Shrub, CS=Cool Shrub, Wdl=Woodland, MG=mixed grass

The distribution of the potential vegetation types (PVT), their associated cover types, and their corresponding structural stages as classified by the satellite imagery, are shown below in Table A-6, organized by subwatershed, for the three potential vegetation groups making up the non-forested vegetation within the Salmon interface. Although the table appears somewhat daunting, it follows the same hierarchy as that shown in Table A-4 with the percentages reflecting the acres shown for each PVG.

Table A-6. Satellite Image Classification Distribution of PVG, PVT, Cover Types, and Structural Stages By Subwatersheds

Arnett Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Cool Shrub (75 acres)	Mountain bigsage/ conifer 100%	mountain bigsage/conifer 61.3%	stand initiation woodland 100%
			mountain bigsage/fescue 38.7%	open mid shrub 100%

Jesse Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (1323 acres)	Bunchgrass 17%	bunchgrass 8.4%	closed herbland 100%
			dry shrub/bunchgrass 91.6%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 83%	native bunchgrass 28.1%	open herbland 100%
			Wyoming bigsage 71.9%	open low shrub 100%
	Cool Shrub (1048 acres)	Mountain bigsage 19.8%	fescue/bunchgrass 13.9%	open herbland 100%
			mountain bigsage/fescue 86.1%	open mid shrub 100%
		Mountain bigsage/ conifer 80.2%	conifer/mountain bigsage 3.3%	young multi-strata woodland100%
			mountain bigsage/conifer 9.6%	stand initiation woodland 100%
			mountain bigsage/fescue 87.1%	open mid shrub 100%

Lake Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (1083 acres)	Bunchgrass 25.4%	bunchgrass 11.3%	closed herbland 100%
			dry shrub/bunchgrass 88.7%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 62.5%	native bunchgrass 15.8%	open herbland 100%
			Wyoming bigsage 84.2%	open low shrub 100%
		Three-tip sagebrush 12.1%	fescue/bunchgrass 29.8%	closed herbland 100%
			three-tip sage/bunchgrass 70.2%	closed low shrub 100%
	Cool Shrub (3650 acres)	Mountain bigsage 25.1%	fescue/bunchgrass 46.2%	open herbland 100%
			mountain bigsage/fescue 53.8%	open mid shrub 100%

		Mountain bigsage/ conifer 73.6%	conifer/mountain bigsage 10.0%	young multi-strata woodland 100%
			mountain bigsage/conifer 13.5%	stand initiation woodland 100%
			mountain bigsage/fescue 76.5%	open mid shrub 100%
		Fescue Grassland 1.3%	sage/sedge/fescue 59.6%	open mid shrub 100%
			sedge/fescue 40.4%	open herbland 100%
	Woodland (16 acres)	Mountain mahogany 100%	mountain mahogany 100%	open tall shrub100%

Lower Napias Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (138 acres)	Wyoming bigsage/ bunchgrass 100%	Wyoming bigsage 100%	open low shrub 100%
	Cool Shrub (774 acres)	Mountain bigsage 2.4%	fescue/bunchgrass 68.4%	open herbland 100%
			mountain bigsage/fescue 31.6%	open mid shrub 100%
		Mountain bigsage/ conifer 73.6%	conifer/mountain bigsage 6.1%	young multi-strata woodland 100%
			mountain bigsage/conifer 31.1%	stand initiation woodland 100%
			mountain bigsage/fescue 58.1%	open mid shrub 100%
			fescue/bunchgrass 4.7%	open herbland 100%

Napias-Phelan Subwatershed	PVG	PVT	Cover type	Structural stage
	Cool Shrub (932 acres)	Mountain bigsage 9.5%	fescue/bunchgrass 89.9%	open herbland 100%
			mountain bigsage/fescue 10.1%	open mid shrub 100%
		Mountain bigsage/ conifer 87.9%	conifer/mountain bigsage 7.4%	young multi-strata woodland 100%
			mountain bigsage/conifer 30.2%	stand initiation woodland 100%
			mountain bigsage/fescue 62.4%	open mid shrub 100%
		Fescue Grassland 2.6%	sedge/fescue/conifer 83.3%	stand initiation 100%
			sedge/fescue 16.7%	open herbland 100%

Salmon-Fenster Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (3739 acres)	Bunchgrass 3.9%	bunchgrass 34.9%	closed herbland 100%
			dry shrub/bunchgrass 65.1%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 85.0%	native bunchgrass 38.6%	open herbland 100%
			Wyoming bigsage 61.4%	open low shrub 100%
		Three-tip sagebrush 11.1%	fescue/bunchgrass 41.4%	closed herbland 100%
			three-tip sage/bunchgrass 58.6%	closed low shrub 100%
	Cool Shrub (2132 acres)	Mountain bigsage 17.4%	fescue/bunchgrass 17.2%	open herbland 100%
			mountain bigsage/fescue 82.8%	open mid shrub 100%
		Mountain bigsage/ conifer 73.6%	conifer/mountain bigsage 3.4%	young multi-strata woodland 100%
			mountain bigsage/conifer 13.4%	stand initiation woodland 100%
			mountain bigsage/fescue 83.2%	open mid shrub 100%
	Woodland (28 acres)	Mountain mahogany 100%	mountain mahogany 100%	open tall shrub100%

Salmon-Henry Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (6084 acres)	Bunchgrass 1.2%	bunchgrass 41.7%	closed herbland 100%
			dry shrub/bunchgrass 58.3%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 79.9%	native bunchgrass 44.4%	open herbland 100%
			Wyoming bigsage 55.6%	open low shrub 100%
		Three-tip sagebrush 18.9%	fescue/bunchgrass 24.3%	closed herbland 100%
			three-tip sage/bunchgrass 41.4%	closed low shrub 100%
	Cool Shrub (3958 acres)	Mountain bigsage 40.8%	fescue/bunchgrass 32.6%	open herbland 100%
			mountain bigsage/fescue 67.4%	open mid shrub 100%
		Mountain bigsage/ conifer 57.3%	conifer/mountain bigsage 5.3%	young multi-strata woodland 100%

			mountain bigsage/conifer 9.8%	stand initiation woodland 100%
			mountain bigsage/fescue 84.9%	open mid shrub 100%
		Fescue Grassland 1.9%	sedge/fescue/conifer 21.3%	stand initiation 100%
			sedge/fescue 8.0%	open herbland 100%
			sage/sedge/fescue 70.7%	open mid shrub 100%
	Woodland (8 acres)	Mountain mahogany 100%	mountain mahogany 100%	open tall shrub100%

Salmon-Perreau Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (14248 acres)	Bunchgrass 4.3%	bunchgrass 7.5%	closed herbland 100%
			dry shrub/bunchgrass 92.5%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 90.5%	native bunchgrass 55.6%	open herbland 100%
			Wyoming bigsage 44.4%	open low shrub 100%
		Three-tip sagebrush 5.2%	fescue/bunchgrass 16.9%	closed herbland 100%
			three-tip sage/bunchgrass 83.1%	closed low shrub 100%
	Cool Shrub (3394 acres)	Mountain bigsage 42.3%	fescue/bunchgrass 22.8%	open herbland 100%
			mountain bigsage/fescue 77.2%	open mid shrub 100%
		Mountain bigsage/ conifer 57.5%	conifer/mountain bigsage 4.0%	young multi-strata woodland 100%
			mountain bigsage/conifer 6.4%	stand initiation woodland 100%
			mountain bigsage/fescue 89.6%	open mid shrub 100%
		Fescue Grassland .2%	sage/sedge/fescue 66.7%	open mid shrub 100%
			sedge/fescue 33.3%	open herbland 100%

Salmon-Wagonhammer Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (2173 acres)	Bunchgrass 4.4%	bunchgrass 43.2%	closed herbland 100%
			dry shrub/bunchgrass 56.8%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 67.6%	native bunchgrass 44.3%	open herbland 100%
			Wyoming bigsage 55.7%	open low shrub 100%

		Three-tip sagebrush 28.0%	fescue/bunchgrass 44.4%	closed herbland 100%
			three-tip sage/bunchgrass 55.6%	closed low shrub 100%
	Cool Shrub (2390 acres)	Mountain bigsage 33.4%	fescue/bunchgrass 40.2%	open herbland 100%
			mountain bigsage/fescue 59.8%	open mid shrub 100%
		Mountain bigsage/ conifer 66.6%	conifer/mountain bigsage 45.1%	young multi-strata woodland 100%
			mountain bigsage/conifer 13.4%	stand initiation woodland 100%
			mountain bigsage/fescue 41.5%	open mid shrub 100%
	Woodland (5 acres)	Mountain mahogany 100%	mountain mahogany 100%	open tall shrub100%

Salmon-Wallace Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (2430 acres)	Bunchgrass 26.0%	bunchgrass 44.1%	closed herbland 100%
			dry shrub/bunchgrass 55.9%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 61.5%	native bunchgrass 31.4%	open herbland 100%
			Wyoming bigsage 68.6%	open low shrub 100%
		Three-tip sagebrush 12.5%	fescue/bunchgrass 25.7%	closed herbland 100%
			three-tip sage/bunchgrass 74.3%	closed low shrub 100%
	Cool Shrub (2425 acres)	Mountain bigsage 19.6%	fescue/bunchgrass 26.1%	open herbland 100%
			mountain bigsage/fescue 73.9%	open mid shrub 100%
		Mountain bigsage/ conifer 80.4%	conifer/mountain bigsage 24.3%	young multi-strata woodland 100%
			mountain bigsage/conifer 33.0%	stand initiation woodland 100%
			mountain bigsage/fescue 39.1%	open mid shrub 100%

			fescue/bunchgrass 3.6%	open herbland 100%
	Woodland (50 acres)	Mountain mahogany 100%	mountain mahogany 100%	open tall shrub100%

Twelvemile Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (939 acres)	Bunchgrass 15.8%	bunchgrass 4.0%	closed herbland 100%
			dry shrub/bunchgrass 96.0%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 62.6%	native bunchgrass 47.1%	open herbland 100%
			Wyoming bigsage 52.9%	open low shrub 100%
		Three-tip sagebrush 21.6%	fescue/bunchgrass 6.9%	closed herbland 100%
			three-tip sage/bunchgrass 93.1%	closed low shrub 100%
	Cool Shrub (1864 acres)	Mountain bigsage 28.1%	fescue/bunchgrass 28.3%	open herbland 100%
			mountain bigsage/fescue 71.7%	open mid shrub 100%
		Mountain bigsage/ conifer 67.1%	conifer/mountain bigsage 22.9%	young multi-strata woodland 100%
			mountain bigsage/conifer 38.4%	stand initiation woodland 100%
			mountain bigsage/fescue 38.7%	open mid shrub 100%
		Fescue Grassland 4.8%	sage/sedge/fescue 63.3%	open mid shrub 100%
			sedge/fescue 36.7%	open herbland 100%
	Woodland (7 acres)	Mountain mahogany 100%	mountain mahogany 100%	open tall shrub100%

Upper Napias Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Cool Shrub (111 acres)	Mountain bigsage/ conifer 100%	mountain bigsage/fescue 78.4%	open mid shrub 100%
			mountain bigsage/conifer 21.6%	stand initiation woodland 100%

Williams Creek Subwatershed	PVG	PVT	Cover type	Structural stage
	Dry Shrub (1867 acres)	Bunchgrass 2.9%	dry shrub/bunchgrass 100%	open low shrub 100%
		Wyoming bigsage/ bunchgrass 89.2%	native bunchgrass 44.4%	open herbland 100%
			Wyoming bigsage 55.6%	open low shrub 100%
		Three-tip sagebrush 7.9%	fescue/bunchgrass 39.5%	closed herbland 100%
			three-tip sage/bunchgrass 60.5%	closed low shrub 100%
	Cool Shrub (5256 acres)	Mountain bigsage 26.0%	fescue/bunchgrass 28.3%	open herbland 100%
			mountain bigsage/fescue 71.7%	open mid shrub 100%
		Mountain bigsage/ conifer 70.3%	conifer/mountain bigsage 22.9%	young multi-strata woodland 100%
			mountain bigsage/conifer 38.4%	stand initiation woodland 100%
			mountain bigsage/fescue 38.7%	open mid shrub 100%
		Fescue Grassland 3.7%	sage/sedge/fescue 41.1%	open mid shrub 100%
			sedge/fescue 15.2%	open herbland 100%
			conifer/sedge/fescue 23.4%	young multi-strata woodland 100%
			sedge/fescue/conifer 20.3%	stand initiation 100%

II. Forested Vegetation Condition

A. Columbia River Basin-Potential Vegetation Groups

Forested vegetation within the assessment area is grouped into two potential vegetation groups (PVG), Dry Forest and Cold Forest.

Dry Forest PVG
The Dry Forest PVG is limited by low moisture availability and is found at lower elevations on south or west aspects within the assessment area. Since the implementation of fire suppression and traditional silvicultural practices, the Dry Forest PVG generally shifted to a predominance of mid-seral structures occuping approximately 55 percent of the landscape. In the current period, much of the Dry Forest PVG is dominated by a higher density of smaller-diameter trees due to the lack of thinning fires that accelerated the growth rates of fire survivors. The current period areal extent of the late-seral multi-layer structure (ofm) was at the upper end of its historical range (approximately 16% composition). During the current period, early-seral forest structures generally occurred within their historical range, but areas that had been harvested were missing the scattered, large-diameter trees and snags. Current landscapes have a mixed composition rather than dominated by shade intolerant species. Fire intervals range from 40 to 80 years (Hann et al. 1997).

Within the assessment area, Douglas fir/lodgepole pine and Dry Douglas fir PVTs as well as Douglas fir and lodgepole pine cover types compose the dry forest type. Appendix D Table 1 describes the distribution of the Dry Forest PVG by structural stage within the assessment area and subwatersheds.

Cold Forest PVG
The Cold Forest PVG is found at higher elevations and is limited by short growing seasons. Many late seral multi layer forests have been harvested. The extent of late seral single layer forests did not change, but reduction in whitebark pine due to blister rust altered the compostition. Early seral forests increased as a result of timber harvest which also removed much of the snag component. Mid seral forests are within the range of natural variability. Early seral and mid seral shade tolerant forests have increased from historical condition and shade intolerant mid seral forests have decreased. The ratio of shade tolerant to shade intolerant species in late seral forests has not changed dramatically from historical condition. Much of the cold forest is highly susceptible to tree mortality from fires, stress, insects and disease. Fire frequency interval is 75 to 300 years (Hann, et. al. 1997).

Within the watershed, dry and moist subalpine fir and subalpine fir/whitebark pine PVTs as well as Douglas fir, lodgepole pine, subalpine fir, whitebark pine and Englemann spruce cover types compose the Cold Forest PVG.

Table 2 in Appendix D indicates the current distribution of the Cold Forest PVG by structural stages within the assessment area and the subwatersheds.

B. Description of Forested Cover Types

Vegetation in the forested areas consists mainly of conifer cover types, Douglas fir, lodgepole pine, subalpine fir, ponderosa pine, Englemann spruce and whitebark pine. Deciduous cover types are represented in the watershed by quaking aspen and black cottonwood. This discussion will be presented at two different scales, the assessment area and subwatershed (6^{th} code HUC).

Douglas Fir Cover Type

Douglas fir is found in every subwatershed in the assessment area. Potential vegetation groups associated with Douglas fir are Cold Forest, Dry Forest, or Woodland. All structural stages are represented, but not in every subwatershed. Depending on location, Douglas fir is an early seral, mid seral or climax species in this watershed. At lower elevations, Douglas fir is in pure stands or mixed with ponderosa pine and sagebrush. At mid elevations, it is mixed with lodgepole pine. More moist sites contain higher density trees than the drier south facing sites. Habitat types range from PSME FEID (Douglas fir/Idaho fescue) on the dry sites to and PSME VAGL (Douglas fir/blue huckleberry) on the moist sites. PSME CARU (Douglas fir/pinegrass) habitat type is common in the assessment area. Open canopies and slow growth are characteristic of Douglas fir stands on dry sites. These sites are usually adjacent to a non-forest community (Steele, et.al. 1981).

Tables 3 and 4 in Appendix D display the distribution of structural stages by PVT of the Douglas fir cover types within the assessment area and within each subwatershed.

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity in all potential vegetation types. Small (less than 100 acres) fires have burned within the assessment area and were stand replacing or mixed severity. Mixed severity surface fires are not frequent. Extensive, intensive livestock grazing from the late 1800s into the mid 1900s decreased the fine fuels such as grass and forbs.

Logging by early settlers and miners occurred in minor amounts and probably at lower elevations where the timber was more accessible; Douglas fir was not highly desired by the early loggers (Work 1913). Most of the logging within this cover type occurred from the 1950's to the 1980's and concentrated on larger diameter Douglas fir. Some of the cut areas were regenerated to Douglas fir. The silvicultural systems were clearcuts (10%) and shelterwood cuts (90%). Most of the slash was lopped and scattered and in some areas piled and burned.

Insects and disease associated with Douglas fir in the assessment area are western spruce budworm, Douglas fir beetle and mistletoe. An outbreak of western spruce budworm occurred in most drainages east of Ridge Road in 1991 and 1992, defoliating most of the Douglas fir and reducing its growth. A miner outbreak was experienced in 2002. Douglas fir beetle is present in endemic amounts, killing a few trees throughout the drainages. Mistletoe is present throughout this cover type, the worst being along the ecotone with sagebrush. Lack of fire has lead to an increase in dwarf mistletoe infestations

Without disturbance, old multi story Douglas fir will continue to be over represented in the assessment area without providing a variety of other structural stages to maintain this cover type on the landscape. These areas will continue to be susceptible to Douglas fir bark beetle and mistletoe infestations and further expanding areas susceptible to extreme fire behavior such as crown fire.

Lodgepole Pine Cover Type

Lodgepole pine, an early seral species, is abundant in the assessment area. It is found in each subwatershed, in all structural stages and cold, dry, moist PVGs. Lodgepole is in pure stands as well as mixed with Douglas fir, whitebark pine and subalpine fir at mid and high elevations. Habitat types are

PSME CARU (Douglas fir/pinegrass) at mid elevations, ABLA VASC (subalpine fir/grouse whortleberry) and ABLA CARU (subalpine fir/pinegrass) located at mid and higher elevations.

Tables 5 and 6 in Appendix D display the distribution of structural stages by PVT of the lodgepole pine cover types by PVT within the assessment area and within each subwatershed.

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity in all potential vegetation types. Small (less than 100 acres) fires have burned within the assessment area and were stand replacing or mixed severity. Mixed severity surface fires are not frequent.

Logging began in lodepole pine in the late 1860s with the discovery of gold. Trees were cut to meet local needs. Most logging occurred after 1950 for house logs, sawtimber, post and poles and firewood. Clearcuts are the main silviculture system; most of the slash was piled and burned.

Mountain pine beetle is the primary insect associated with lodgepole pine; infestations have been endemic. Mountain pine beetle activity within the assessment area could accelerate to epidemic conditions due to recent droughts, maturity and size of the timber and epidemic infestations nearby. Mistletoe is the most prevalent disease in this cover type and is present in varying amounts throughout the assessment area.

Understory reinitiation structural stage will continue to make up the majority of the landscape slowly, through succession, progressing into old multi story stage. These areas will be susceptible to mountain pine beetle attacks, which will create large areas of down materials. These mature areas will be very susceptible to stand replacing fires.

Spruce/Fir Cover Type
This cover type is found in every subwatershed in the assessment area in minor amounts on north facing, moist sites at higher elevations. Subalpine fir is a climax species associated with lodgepole pine, whitebark pine and Douglas fir cover types. Abundant subalpine fir is present throughout the mid and upper elevations of the assessment area. Engelmann spruce is a mid seral species. Spruce/fir structural stages are mature and represented by cold and moist PVGs. Habitat types are ABLA STAM (subalpine fir/twisted stalk) in the very moist areas, usually dominated by Englemann spruce and ABLA LIBO (subalpine fir/twinflower). Located in Appendix D are Tables 7 and 8 that display the distribution of structural stages by PVT of the spruce/fir cover types within the assessment area and within each subwatershed.

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity. Small (less than 100 acres) fires have burned within the assessment area and were stand replacing or mixed severity. Fuel accumulations are moderate to high due to lack of fire. Fire intervals are within the historic range. Fire suppression has increased subalpine fir across the landscape because any fire would kill subalpine fir and regenerate lodgepole pine or Douglas fir.

Incidental logging in early European history occurred in this cover type.

Predominant insects associated with spruce/fir are western spruce budworm, subalpine fir complex, and western balsam beetle. These occur in endemic amounts throughout the assessment area. The western spruce budworm epidemic in 1991 and 1992 defoliated these trees and decreased growth. The subalpine fir complex is killing pockets of trees at high elevations throughout the watersheds.

Old multi story stands will persist in the assessment area without providing a diversity of structural stages. Disturbance in some of the mature stands would create seedling stages less susceptible to most disturbances.

Ponderosa Pine Cover Type

Ponderosa pine is found in minor amounts in three subwatersheds on dry sites at low elevation. It is an early seral species and is associated with Douglas fir. PVGs are dry forest and dry grass and most structural stages are found. Representative habitat types are PSME CARU (Douglas fir/pinegrass) and PSME PHMA (Douglas fir/ninebark). Tables 9 and 10 in Appendix D show the distribution of structural stages by PVT of the ponderosa pine cover types by PVT within the assessment area and occupied subwatersheds.

Fire return intervals range from 3 to 35 years and large fires (greater than100 acres) that have occurred were of low or mixed severity. Small (less than 100 acres) fires have burned within the assessment area and were mixed severity. Frequent mixed severity surface fires maintained a mosaic of age classes. Extensive, intensive livestock grazing from the late 1800s into the mid 1900s decreased the fine fuels such as grass and forbs.

Logging occurred within this cover type, cutting most of the large diameter trees. Selection logging took place during early settlement and clearcuts occurred in the 1980s. Some areas were planted with ponderosa pine.

Mountain pine beetle has infected single and groups of trees within the assessment area. No epidemic has occurred.

Ponderosa pine will continue to be a minor component in the assessment area and without disturbance, eventually the large diameter trees will be lost without replacement by seedling structure.

Whitebark Pine Cover Type

Whitebark pine is a minor component of the high elevation forested vegetation in the assessment area. It is an early seral species found in half of the subwatersheds in the cold forest PVG. Structures include old single and multi strata forests and young multi strata forest. Some pure stands exist, but most whitebark pine is associated with subalpine fir or lodgepole pine. Habitat types are ABLA CAGE (subalpine fir/elksedge) and PIAL ABLA (whitebark pine/subalpine fir). Trees at the highest elevations are often smaller, deformed and in scattered patches (Steele et. al. 1981). Table 11 in Appendix D displays the distribution of structural stages of the whitebark pine cover types within the assessment area and subwatersheds.

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity. Small (less than 100 acres) fires were stand replacing or mixed severity. Fuel accumulations are light and there is an increase in ladder fuels. (Crane, et. al. 1986)

Firewood gathering in the last decade or so has occurred in this cover type.

The primary insect infecting whitebark pine is mountain pine beetle. The last outbreak was in the 1930s; old remnants are visible on the landscape. Mountain pine beetle has not infected the assessment area yet, but the potential is there for a similar outbreak that kills most of the trees because of drought and stress from blister rust. The key disease infecting whitebark pine is white pine blister rust, an exotic species. All of the stands in the watershed have blister rust although some trees are not infected.

Whitebark pine cover type's presence will continue to decline because of white pine blister rust, mountain pine beetle, or suppression by subalpine fir. Eventually, without disturbance such as fire, whitebark pine will not be present on this landscape.

Quaking Aspen Cover Type

Aspen is found in moist pockets within most of the subwatersheds in minor amounts. It is within the Woodland PVG and is in stand initiation and understory reinitiation structural stages. It is always associated with Douglas fir, subalpine fir or lodgepole pine and is an early seral species. Habitat types are PSME CAGE SYOR (Douglas fir/elk sedge/mountain snowberry), PSME LIBO (Douglas fir/twinflower), PSME SPBE (Douglas fir/white spirea), PSME SYAL (Douglas fir/common snowberry). Aspen sites are rich and diverse. Table 12 in Appendix D displays the distribution of structural stages of the aspen cover types within the assessment area and subwatersheds.

Fire suppression has removed frequent, mixed severity fires from the landscape. Fire return intervals are greater than 100 years. Natural disturbances no longer rejuvenate aspen stands. Extensive, intensive livestock grazing from the late 1800s to the present day has decreased the fine fuels such as grass and forbs. Without fire or other disturbance, quaking aspen will continue to decline and eventually be replaced by conifers. Maintenance and regeneration of riparian and upland aspen is an important component to this landscape. Stands of viable aspen contribute values such as forage for livestock, habitat for wildlife, water for downstream users, esthetics, recreational sites, wood products, and landscape diversity to this ecosystem (Bartos 2000).

Extensive logging has not occurred in this cover type. Pockets of aspen and associated conifers have been cut in Moccasin, Napias and Phelan Creeks to regenerate aspen and increase patch sizes.

Numerous insects and diseases, none of which are prevalent in the assessment area, plague aspen. Domestic ungulates have altered age structure and understory diversity from the natural condition.

Black Cottonwood Cover Type

Cottonwood is a minor component of the forested vegetation found along streams and in very moist areas. It is an early seral species dependent on disturbance such as floods to regenerate. It is in the Woodland PVG and is found only in mature structural stages within the subwatersheds. Appendix D, Table 13 depicts the distribution of structural stages of the black cottonwood cover types within the assessment area and subwatersheds.

Infrequent mixed severity or stand replacing fires have occurred within this cover type. Fire return interval is greater than 100 years. Extensive, intensive livestock grazing from the late 1800s to the present has decreased the fine fuels such as grass and forbs.

Logging has not occurred within this cover type.

Several insects and diseases attack black cottonwood, but none are prevalent in the assessment area.

C. General Disturbances Within the Interface

Logging has occurred in every subwatershed except Jesse Creek and Salmon-Henry. It began at the time of European settlement for personal or mining needs. Selection cuts were the choice of the early settlers removing material for construction, firewood or other ranching needs. Most of the major logging started in the late 1960s through the present. Douglas fir was the major species removed. Logging systems were tractor, jammer, skyline or helicopter. Clearcuts were common as well as shelterwood cuts and individual tree removal. Most of the logged areas were planted with Douglas fir. In the lodgepole cover types, lodgepole has regenerated naturally or planted. Approximately 16,345 acres or 8 percent of the assessment area were harvested.

Fire was the primary natural disturbance in the assessment area. Since settlement, fires were suppressed to protect the timber resource. Several large fires (greater than 100 acres) burned in the assessment area since 1900. The Withington Fire burned 2,777 acres within the Salmon-Henry subwatershed and 686 acres within the Salmon-Perreau subwatershed in 2003. The Twelvemile Fire (2001) burned 120 acres in the Twelvemile subwatershed. The Clear Creek Fire burned 17,904 acres within Arnett, Upper Napias, Napias Phelan, and Lower Napias subwatersheds in 2000. Also in 2000, the Fenster Fire (2,864 acres) burned within Salmon-Wallace subwatershed. Two fires in Williams Creek subwatershed (1985) burned 4,489 and 613 acres. A fire in the Salmon-Perreau subwatershed burned 1,026 acres. Two fires burned 688 and 210 acres within the Jesse Creek subwatershed. A fire in the Salmon-Fenster subwatershed burned 1,043 acres and a fire in Salmon-Wagonhammer burned 858 acres. Numerous (326) small fires have started within the assessment area since 1900.

III. Fire Ecology-Current Forest and Non-forest Vegetative Structures

A. Structural Stage for Dry Forest Potential Vegetation Group-Stepdown

Columbia River Basin: In the dry forest ecosystems, 1991 data shows forest vegetative structural stage (SS) combinations as follows: 7% in ofs; 23 % in ofm; 47 % in a mixture of seo, sec, ur, and/or yfm; 22% in si; and 1% in non-forest (Hann *et al* 1997, pg 485). See Appendix B for structural stage codes.

The composition of late-seral single-layer (ofs) shade-intolerant (ie, ponderosa pine) forest had declined by 25 percent from historical amounts. In addition, current period landscapes had a mixed composition rather than being dominated by shade-intolerant species. This was particularly true in areas that had been actively harvested and in areas where fire suppression has been effective. (Hann et al 1997, page 487).

Central Idaho (ERU 13): In the dry forest ecosystems, 1991 data shows forest vegetative structural stages (SS) combinations as follows: 2% in ofs, 19 % in ofm, 46 % in a mixture of seo, sec, ur, and/or yfm, 33% in si (Hann *et al* 1997, pg 565).

Hann (Hann et al 1997, pg 563) describes the current condition for the Columbia Basin as follows, "For the Dry Forest PVG, the late-seral single-layer forest type (ofs) was well below the historical range of variability (HRV), whereas the late-seral multi-layer forest type (ofm) occurred at the upper limit of the

HRV. The late-seral single-layer forest type (ofs) largely converted into the mid-seral (sec, ur, and yfm) forest type because of insect, disease, and stress mortalities in the overstory layer, and growth of shade-tolerant layers in the understory. The aforementioned transitions occurred primarily as a result of fire exclusion. Fire exclusion substantially reduced the extent of the non-lethal and mixed fire regimes that maintained late-seral single-layer types, and that thinned shade-tolerant tree species in early-, mid-, and late-seral multi-layer types. Timber harvest activities largely occurred in the peripheral areas of the Central Idaho ERU, where the larger, shade-intolerant tree species were those primarily selected for harvest. These trees were more resistant to insect, disease, and stress mortality. Clearcutting and seed tree timber harvest activities commonly created small patches of early-seral structures containing few live or dead-standing trees, and high down fuel accumulations." Similar trends are occurring on the S-C National Forest and on the Salmon Interface.

S-CNF Dry Forest PVG: There has been substantial change in small tree stocking densities per acre in these sites. In the ofms and ur stands, high numbers of seedling, sapling, and pole size trees can often be in patches or clumps. As fire exclusion has continued, these clumps of heavily stocked smaller trees continue to expand and occupy more and more of the area resulting in a substantial increase in the average number of small trees per acre. Studies on the North Fork District (Salmon-Challis National Forest) reflect this trend. Tree data gathered in the dry forest types Gibbonsville area (USDA 2000, pg 14) displayed substantial increases in small diameter trees per acre.

Today, these smaller diameter trees are the ladder fuels that now allow surface fires to climb (ladder) up into the overstory trees crowns and facilitate crown fires. The ladder fuels ranged up to 30 feet or more in height. Regarding the study around Gibbonsville, Hoyt stated, "Ladder fuel height is probably the most significant single factor found in the survey that will affect the potential fire behavior in any of the project stands."(USDA 2000, pg 14).

Salmon Interface area: In the Salmon Interface area, much of the historical Dry Forest PVG (our dry Douglas-fir sites) were similar in structure and disturbance regimes as the Ponderosa pine/Douglas-fir sites on the north end of the Salmon-Challis and in the Bitterroot Valley. The ofm averaged around 10% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the ofm occupies 38% of the dry forest type. The ofs averaged around 15 to 40% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the ofs occupies 6% of the dry forest type.

These changes in forest structure have greatly increased the area in which ladder fuels may promote crown fires. The two forest structures that contain the most ladder fuels and increase the risk of crown fire are ofm and ur. Combined, they make up 61% of the Dry Forest PVG.

The changes have also greatly reduced the area where ladder fuels are not available and basically eliminating the natural crown fire fuel breaks that used to occur on the landscape.

B. Structural Stage for Cold Forest Potential Vegetation Groups-Stepdown

Columbia River Basin: In the Cold Forest ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 9% in ofs, 9 % in ofm, 47 % in a mixture of seo, sec, ur, and/or yfm, and 35% in si (Hann et al. 1997, pg 485).

Central Idaho (ERU 13): In the Cold Forest ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 14% in ofs, 12 % in ofm, 34 % in a mixture of seo, sec, ur, and/or yfm, and 39% in si (Hann et al. 1997, pg 570).

Salmon Interface area: Several structural stages predispose a high crown fire risk. The ofm averaged around 5-25% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the ofm occupies 25% of the cold forest type. The ur and other mid-seral SS averaged around 20-40% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the ur alone occupies 48% of the cold forest type.

Several structural stages are fuel breaks regarding crown fires. The si averaged around 15-30% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the si occupies only 10% of the dry forest type. The ofs averaged around 10% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the ofs occupies <1% of the cold forest type.

These changes in forest structure have greatly increased the area in which ladder fuels may promote crown fires. The two forest structures that contain the most ladder fuels and increase the risk of crown fire are ofms and ur. Combined, they make up 73% of the cold forest PVG.

C. Structural Stage for Dry and Cool Shrub Potential Vegetation Groups-Stepdown

The Dry and Cool Shrub PVGs follow similar trends of altered structural stages due to fire suppression. Trends identified in the Central Idaho Mountain ecological reporting unit parallel those identified in the Columbia Basin and are similar to those identified in the Salmon interface. The resulting structures show an increase in shrub types with a corresponding reduction in herbaceous herblands. Defined structural stages in the non-forested shrub types are not directly correlated to seral stage so historical departures in the seral context is not available. The non-forested vegetation sections discuss historical departure and vegetation condition at length.

D. Fire Frequency

1. Fire Frequency and Livestock Grazing

On the Salmon National Forest the changing of wildfire frequency in both grass/shrub and forested ecosystems began with heavy livestock grazing and marked the onset of the fire exclusion process. The livestock grazing removed much of the grasses that historically covered the forest floor (Losensky 1994, pg 5 and pg 18) and were a primary fuel base for fire spread. Cured grasses are considered a fine fuel, and it is the fine fuel category (less than ¼ inch) that contributes greatly to a fire's ability to spread and influences the fires rate of spread (Rothermel 1983, pg 14).

As livestock continued to consume the natural fine fuels (grasses) the spread of fire would become restricted when compared to pre-European settlement times. With the reduction of the spread of fires, less and less area would be burnt via surface fires and this reduction of fire activity would allow large numbers of conifer seedlings to survive and grow rapidly in the very open stand conditions where they naturally had been controlled by frequent ground fires (Brown 2000, pg 100).

2. Fire Frequency and Severity-Stepdown

Interior Columbia River Basin: For both the regional and landscape level the current areal extent of wildfires is approaching those experienced in the early 1900s, when technology and resources were less available than today. Fuel loadings have steadily increased as a result of suppression efforts and the subsequent decline of fire frequencies. As a result, fire severity has increased, as have suppression costs and the associated hazards to life and property. The average costs of wildfire suppression, number of firefighter fatalities, and areal extent of high-intensity fires during the last 25 years have exceeded the corresponding levels that occurred between 1910 and 1970 (Hann et al. 1997, pg 901).

Columbia River Basin and Central Idaho (ERU 13): In general, wildfires of low severity occur less frequent today than in the historical regimes. Wildfires of lethal and mix-lethal severity occur more frequently than in the historical situation. During drought years, the trend for acres burned by mixed lethal and lethal severity fires is increasing (Barrett et al. 1997).

Central Idaho (ERU 13): There have been substantial changes in the Central Idaho Mountains ERU fire regimes primarily as a result of fire exclusion. Fire severity generally shifted from non-lethal or mixed to lethal, and non-lethal to mixed lethal in the forest PVGs. This shift was caused by longer fire-return intervals. In the non-forest PVGs, fire severity generally shifted from mixed to lethal, and fire intervals increased due to fire exclusion, the removal of fine fuels by livestock grazing, and conifer encroachment (Hann et al. 1997, pg 556). For Central Idaho (ERU 13) fire exclusion substantially reduced the extent of the non-lethal and mixed fire regimes that maintained late-seral single-layer types, and that thinned shade-tolerant tree species in early-, mid-, and late-seral multi-layer types (Hann et al. 1997, pg 563).

Salmon Interface area: From 1919 to year 1985 relatively few acres burnt in the area when compared to historical fire regimes with the exception of the Lake Mountain fire in 1985 which burnt over 4,400 acres (see Map A-3). In 2000 three fires occurred (Pepper Ridge, Fenster, and Clear Creek Fire) with at least some portion lying within the assessment area. The area burnt in 2000 was the largest number of burnt acres recorded in the analysis area since the Forest Service has been keeping fire records starting in 1919. The acres burnt in 1985 and 2000, exceed all acres burnt in other years since 1919. The Withington Fire in 2003 was another large fire burning 3,463 acres within the assessment area. These trends are reflective of trends across the western United States, showing significant increase in burnt acres from wildfire in the last two decades.

Fire severity Near Salmon Interface Area: The fires that occurred under extreme fire condition in recent times have burned with substantial amounts of high severity fire in the Dry and Cold Forest PVGs. The Clear Creek Fire Complex of year 2000, northwest by 25 miles, burned large areas of the dry forest type with lethal and mixed lethal fire severity. Due to extreme fire conditions, multiple fires burned in the same general area, and some fires actually burned together. The final burn perimeter was 400,000 acres. It is note worthy that Clear Creek Fire made a fire run in July that approximated 12 miles long and covered over 20,000 acres in one afternoon. The Withington Fire was also very responsive to extreme fire behavior threatening the Sunset Heights subdivision.

Description of Reference Conditions (Step 4)

I. Non-forested Vegetation

As discussed above, two different approaches were utilized to address the current conditions of the non-forested vegetation. Each approach is somewhat unique and therefore each requires a different discussion to address the reference or historical conditions making up Step 4 of the assessment.

A. Reference (Historical) Condition for Field Inventoried Vegetation Condition

Unlike the forested communities, there are no formalized habitat type descriptions or classification systems that provide detailed plant community descriptions of site characteristics, species presence, plant cover, ground cover, soil characteristics, or successional seral stage descriptions that describe disturbance pathways for the non-forested plant communities. Reference conditions for these communities are best described by the Natural Resources Conservation Service's (NRCS) Ecological Site Guides that have been in development and continually revised since the late 1970's. These site guides are similar in format to the forested habitat types descriptions but lack the rigor of sample technique and statistical reliability. They describe several physical characteristics of the site along with the biological features such as species composition by weight, production, and ground cover. They are useful in identifying and comparing vegetation characteristics between sites based on physical features. Range condition, seral stage, and rangeland health are often assessed using the ecological site guides as a baseline tool of reference conditions (see Step 3).

As mentioned in Step 3, Description of Current Conditions, the Custer/Lemhi County Soil Survey conducted by the NRCS in the early to mid 1980s delineated plant communities associated with the various soil map units. These units were described and compared to the Ecological Site Guides to derive seral stage for the individual plant communities encountered. A total of eight ecological sites were identified within the BLM administered area of the SIWA. As also previously mentioned, the sample techniques used on the US Forest Service administered areas did not utilize the ecological site guides when sampling and assessing the non-forested vegetation. However, these plant communities can be placed in an appropriate ecological site based on elevation, precipitation, land form, soil characteristics, and existing vegetation. An additional six ecological sites were recognized within the forest boundary making a total of fourteen within the SIWA. Although this is a somewhat artificial placement of ecological site units (with little field validation), it does provide a uniform approach in describing reference conditions throughout the assessment area. In order to reliably compare and rate the non-forested vegetation communities to a recognized and established reference, an Ecological Site Inventory would have to be performed comparing existing vegetation to the ecological site guides. This procedure is highly detailed, expensive, and much too time consuming to consider at this time, but would be highly beneficial when considering vegetation manipulation proposals at the site specific, project level.

Table A-7 summarizes the non-forested vegetation community types identified within the assessment area. Notice that the NRCS did not recognize an upland aspen site within this physiographic region (012). This apparent oversight could be due to the typically small size of these communities but is more likely due to the very wide range of species presence, species composition, and site characteristics variability within these communities making it virtually impossible to derive or predict a potential natural community.

Table A-7. Summary Descriptions of the Non-Forested Vegetation Community Types as Described in NRCS Ecological Site Guides

PVG	Vegetation Community Type	Ecological Site Name(s)	Ecological Site Number	% Ground Cover*	Average Production (lbs/acre)**	Grass % Composition Range***	Shrub % Composition Range****
Dry Shrub	Wyoming big sagebrush/ bluebunch wheatgrass	Gravelly Loam 8-12” South Slope Gravelly 11-13” Loamy 8-11” Loamy 11-13” Clayey 7-10”	012XY004I 012XY005I 012XY032I 012XY035I 012XY036I	35 70 50 60 25	400 450 700 700 350	50-60 55-70 45-50 60-70 50-60	20-30 20-30 25-40 20-30 30-40
	Low sagebrush/bluebunch wheatgrass-Idaho fescue	Clayey 13-16”	012XY020I	50	400	50-70	20-30
	Shadscale/Salmon wildrye-ricegrass	Fragilands <8”	012XY019I	30	200	40-60	20-40
	Threetip sagebrush/Idaho fescue	North Slope Loamy 13-16” Gravelly 13-16”	012XY010I 012XY033I	75 70	600 500	50-70 55-65	20-30 20-30
Cool Shrub	Mountain big sagebrush/Idaho fescue-bluebunch wheatgrass	Loamy 13-16”	012XY012I	75	900	55-65	20-30
	Mountain big sagebrush/Idaho fescue	Loamy 16-22”	012XY021I	75	800	50-70	15-30
Woodland	Mountain mahogany/sagebrush/ bluebunch wheatgrass	Steep Limestone 13-16”	012XY015I	65	300 (below 4.5 feet)	40-60	30-40
	Mountain mahogany/sagebrush/ Idaho fescue	Steep Limestone 16-22”	012XY016I	75	400 (below 4.5 feet)	40-60	5-20
Meadow Grassland	Sedge species-wheatgrass species	Semiwet Meadow 12-35”	012XY039I	85	2250	70-80	2-10
	Sedge species-wheatgrass species-hairgrass	Wet Meadow 12-33”	012XY038I	>90	3600	80-90	2-10

* Ground cover includes vegetation, litter, and surface rock fragments
** Average production in pounds per acre for a normal production year
*** Percent grass composition (by weight) range of variability of Potential Natural Community (PNC)
**** Percent shrub composition (by weight) range of variability of Potential Natural Community (PNC)

B. Reference (Historical) Conditions for Satellite Imagery Classification

Historic conditions on the broad, landscape scale are discussed at length in ICBEMP (Hann, et.al. 1997). Two levels of landscape scale are discussed; at the Columbia Basin scale beginning on page 479, and stepping down to the more detailed ecological reporting unit (ERU) scale beginning on page 554. These discussions are somewhat weak when describing the conditions for the non-forested vegetation types, with the discussions centering on physiognomic types instead of the potential vegetation groups or potential vegetation types discussed previously. Only two non-forested physiognomic types are addressed; the upland shrubland and upland herbland. These physiognomic types grouped several PVTs (including mountain mahogany) in to the upland shrubland. This and the lack of any opportunity to step down further to the sub-basin, watershed, or subwatershed level limits the usefulness of this historical comparison as a reference condition. However, it does illustrate (Table A-8) some dramatic changes from the historical (pre-European settlement) to the current, most notable the overall shift from herbland (grassland) to shrubland at both landscape scales. Similar trends are observed within the Salmon interface landscape and throughout the subwatersheds.

Table A-8. Interior Columbia Basin Comparisons from Current to Historic

PVG	Physiognomic Type	Columbia Basin		Central Idaho Mountains (ERU 13)	
		% Current	% Historic	% Current	% Historic
Dry Shrub	Upland Shrubland	91	40-90	86	60-80
	Upland Herbland	4	10-60	7	20-40
Cool Shrub	Upland Shrubland	66	60-80	81	40-60
	Upland Herbland	4	10-40	9	40-60

Possibly a much more useful approach, albeit still in the developmental stage, is found in the Vegetation Dynamics Development Tool (VDDT) model. In developing the model, successional (seral) classes were identified for each PVT based on combinations of cover type and structural stage as influenced by fire regime (a composite of fire interval and fire severity). These classes are used to describe and establish successional and disturbance pathways in box model diagrams. Each box in the box model diagram indicates a successional class with successional and disturbance pathways leading to or from other boxes (classes). The model derives an estimate of the historical range of variability (HRV) of these combinations for each PVT. The resulting HRV can be displayed as a percentage of a landscape with the realization that there is an estimated +/- 20% error (i.e. 30% mid seral in box B ranges from 24% to 36%). A comparison is then made to the current structural stage combinations of the PVTs to derive departure from historic. Table A-9 below, shows the expected distribution of the historical range of variability through the various successional stages for the five non-forested PVTs within the SIWA area. The entire box model diagram is shown in Appendix C. The box model was originally developed for forested vegetation types and modified to describe non-forested types. It is interesting to note that shrub age structures (young versus mature) have been included in addition to percent cover in differentiating between the mid and late seral stages. This leads to confusion and conflicts because field inventories and the satellite imagery fail to identify age structure in the shrub communities.

Table A-9. Historical (HRV) Distribution of Non-Forested Successional Stages

PVG	PVT Name	Box A early seral		Box B mid seral closed		Box C mid seral open		Box D late seral open		Box E late seral closed	
		Name	%	Name	%	Name	%	Name	%	Name	%
Dry Shrub	Wyoming big sage, Three-tip	grass-forb; early seral; early devmt	20	open grass, closed young sage	5	closed grass, open young sage	20	closed grass, open mature sage	50	open grass, closed mature sage	5
Cool Shrub	Mt. big sage	grass-forb; early seral; early devmt	15	open grass, closed young sage	20	closed grass, open young sage	30	closed grass, open mature sage	15	open grass, closed mature sage	20
Cool Shrub	Mt. big sage with conifer	grass-forb; early seral; early devmt; scattered snags-down logs	20	open grass, closed sage; pole/ sapling mix	30	closed grass, open sage; open saplings	35	closed grass, open sage; open pole/ sapling,	10	open grass, closed shrub; closed conifer	5
Wood-land	Mt. mahogany	grass-forb early seral early devmt	10	open grass, closed young shrub	10	closed grass, open young shrub	20	closed grass, open mature shrub	40	open grass, closed mature shrub	20
Dry and Cool Shrub	Bunchgrass	grass-forb early seral early devmt	20	open grass, closed young sage	5	closed grass, open young sage	20	closed grass, open mature sage	50	open grass, closed mature sage	5

Open = >5%-15% cover using line intercept method; Closed = >15% cover using line intercept method
Young = shrubs are sexually mature and produce seed. Growth form is mostly basal with grass understory rather than accumulated leaf litter; little dead wood accumulation in overstory.
Mature = growth form is often mushroom shaped with single or multiple trunks; leaf litter accumulates in understory; abundant dead wood accumulation in overstory.
Bunchgrass = bunchgrass (wheatgrass/fesuce) cover dominates, <5% shrub and tree cover
Sapling = tree less than 1" diameter at breast height; Pole = tree between 1 and 9" diameter at breast height

The percent distribution of the vegetation classes for the various PVTs is based on the historical natural fire regime recognized for the specific PVT. Fire regimes take into consideration fire return interval, degree of severity (or fatality to the overstory species), and the spatial extent of the fire episode. Of the five fire regime groups (Schmidt et al. 2002) four pertain to non-forested PVTs. The Wyoming big sage and three-tip sage experience infrequent (35 to 100 year interval) fires with mixed severity (fatal in relatively small patches) but can also experience stand replacing fires covering large areas (Fire Regime Groups III and IV). Three tip sage can resprout following fire but this ability has no bearing on the fire severity terminology. The mountain big sage and mountain big sage with conifer PVTs experience similar severity but on a shorter interval of less than 35 years (Fire Regime Groups I and II). Mountain mahogany is also on a broad fire interval (>100 years) but is virtually always stand replacing (Fire Regime Group IV). The bunchgrass PVT is itself a seral stage of the shrub PVTs but would maintain its grassland character with frequent, low severity fire (Fire Regime Group I).

The box model is not linear as is presented above so succession does not run from Box A (early seral-early development) through Box E (late development-mature). There are numerous potential successional and disturbance pathways that connect the boxes. Box C (mid development-young) is often shown as a vegetation class or seral stage being maintained by disturbance (fire) episodes. Disturbance pathways can occur anytime within the box model and typically return succession back to Box A, or maintain existing conditions within specific (Box A, C, and D) boxes.

II. Forested Vegetation

A. Columbia River Basin Potential Vegetation Groups

Dry Forest PVG
In native systems, small tree mortality was common due to fire, insects, disease, and competition. A constant unchanging pattern of open communities was maintained. The early seral forest was dominated by shade intolerant species, the mid seral forests were composed of shade tolerant and shade intolerant species and late seral forests were dominated by shade intolerant species. Fire intervals ranged from 20 to 70 years. (Hann, et al. 1997)

Cold Forest PVG
Early seral and mid seral forests were dominated by shade intolerant species. Shade intolerant species dominated the late seral single layer forests. Late seral multi layer forests were composed primarily of shade tolerant species and lesser amounts of shade intolerant species. Native cold forest systems maintained a high composition of late seral multi layer structure in areas where fire rarely burned. Underburning fires maintained later seral single layer structure on benches and ridges dominated by whitebark pine and lodgepole pine. Moist, steep slopes burned with lethal crown fires at intervals that allowed development of early to mid seral structures. Trees were thinned by mortality from stress, insects and disease. Fire intervals were highly variable and correlated with landforms. The non lethal underburns had an interval of 30 to 100 years and comprised 10 percent of the landscape. The lethal crown fire regime had a fire return interval of 25 to 300 years and occurred across 25 to 30 percent of the landscape. The mixed fire regime was intermingled with other regimes and occurred across 60 percent of the cold forest type. The fire return interval was 25 to 300 years. (Hann, et al. 1997)
Table A-10, below, displays the historic distribution of structural stages within each PVG.

Table A-10. Historic Distribution of Structural Stages Within Forested and Woodland PVGs

Structural Stages	Cold Forest	Dry Forest	Moist Forest	Woodland
Stand Initiation	23-25%	10-20%	20-30%	5%
Stem Exclusion	44-53%	25-30%	40-50%	15%
Understory Reinitiation	44-53%	25-30%	40-50%	15%
Young Forest Multi Story	0%	0%	0%	0%
Old Multi Story	15-24%	10-15%	20-30%	1-3%
Old Single Story	6-8%	20-50%	5-10%	5%

Forested vegetation was predominately conifer with patches of quaking aspen and black cottonwood in moist areas. The forested ecosystems were resilient and responded predictably to disturbance (USFS 1996, Hann et al. 1997).

B. Description of Historical Forested Cover Types

This discussion will be presented at the landscape scale because that is the level of the best information and then applied to the subwatersheds where the cover types are present. The information used was presented in An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume II (1997) and Wendel Hann's fire condition class ratings and extrapolated to the cover types found in the assessment area.

Reference is made throughout this section to Table A-11 Historic Distribution of Structural Stages for Forested Cover Types Within the Salmon Interface Landscape. This table reflects an estimated composite range for those cover types that occur within multiple elevation zones, slope breaks, and land forms across the landscape. These highly variable physical settings lead to differences in fire regimes and fire severity, which in turn results in variations of structural stages within like cover types. Douglas fir and lodgepole pine (and to a lesser extent subalpine fir) are most reflective of this situation. Table A-11 should therefore be used only for broad comparisons realizing that the distribution of structural stages can be highly variable depending upon the location and physical setting of a particular cover type.

Douglas Fir Cover Type

Douglas fir in the dry forest type had densities less than the other PVGs. The stands were more open, park-like. The mid seral and late seral stages had less subalpine fir and Dougals fir in the understory. Douglas fir would not have succeeded into sagebrush/grass areas. Where it was mixed with ponderosa pine and lodgepole pine, the pines dominated the area. The habitat types were similar to current condition. Table A-11, below, shows the historic distribution of structural stages of the Douglas-fir cover types across the Salmon interface landscape.

Dry Douglas fir habitat types are in Fire Group Two and Fire Regime Group I: warm dry habitat types that support open forests of Douglas fir. Fire intervals ranged from zero to 35 years and were frequent mixed severity creating a mosaic of different age classes. Fuel loads were usually light (less than five tons per acre). The most abundant ground fuel was grass. Fire maintained open stands of Douglas fir; periodic fires created uneven aged stands (Crane, et. al. 1986, McNicoll et. al. 2002).

Fire Group Four: cool dry Douglas fir habitat types had light fuel loads usually less than 13 tons per acre. Fine fuels and ladder fuels were not very abundant. Fire frequencies averaged 41 years (Crane, et. al. 1986).

Douglas fir lodgepole pine potential vegetation types on slopes less than 30 percent were classified in Fire Regime Group III. Fire intervals ranged from 35 to 100 years and were infrequent mixed severity creating patches of mixed age classes. Douglas fir lodgepole pine potential vegetation types on slopes greater than 30 percent were classified in Fire Regime Group IV. Fires burned infrequently at intervals ranging from 35 to 100 years and were severe enough to replace the stand creating large patches of similar aged trees. (McNicoll et. al. 2002)

No logging occurred. Natural disturbances included endemic levels of bark beetles, western spruce budworm and mistletoe. Douglas fir dwarf mistletoe infestations were reduced or eliminated as were the understory ladder fuels by frequent fires.

Lodgepole Pine Cover Type
Stands were dominated by lodgepole pine with less Douglas fir and subalpine fir in the understory. Habitat types were comparable to those mentioned in current condition. Table A-11, below, displays the historic distribution of structural stages of lodgepole pine cover types across the Salmon interface landscape.

Fire was the main disturbance affecting structural stages. Lodgepole pine associated with Douglas fir habitat types experienced a range of fire intensities depending on slope (see discussion in Douglas fir Cover Type) and fire frequency ranged from five to 67 years. Fuels were light ranging from five to 20 tons per acre with large amounts of fuels less than three inches. Large stand replacing fires were common in higher elevations maintaining lodgepole on the landscape. Subalpine fir in the understory provided a ladder for fire to reach the crowns. High fuel accumulations occurred where mountain pine beetle killed the over story providing fuels for stand replacing fires. (Crane, et al. 1986) Stand replacing fires cleansed the stands of mistletoe. Moderate severity fires maintained mistletoe within the stands and perpetuated growth of shade tolerant species.

Fire frequencies in subalpine fir potential vegetation types were dependent on slope. Areas with less than 30 percent slope experienced mixed severity fires every 35 to 100 years creating a mosaic of different age classes in smaller patches. In areas with slopes greater than 30 percent, fire frequencies ranged from 35 to 100 years with high severity replacing the burned stands creating large patches (greater than 100 acres) of similar age classes. (McNicoll et al. 2002) High fuel accumulations composed of larger diameter material were common due to lack of frequent fires. High severity fires within this group supported lodgepole pine.

Epidemic mountain pine beetle infestations removed mature trees from the landscape initiating early seral stages. Mistletoe was not as prevalent on the landscape.

Spruce/Fir Cover Type
This type was found across the watershed in moist areas and higher elevation. There was less subalpine fir in the understories of other cover types due to more mixed severity fires. Habitat types would be similar to those described in current condition. Table A-11, below, shows the historic distribution of structural stages of the Spruce/Fir cover types across the Salmon interface landscape.

Fire frequency in Fire Group Eight and Fire Regime Group IV is highly variable. Fire frequencies ranged from 35 to 200 years with high severity replacing the stand. Large patches of similar age classes were created. (McNicoll, et al. 2002) High fuel accumulations composed of larger diameter material were common due to lack of frequent fires. Low severity fires supported subalpine fir types. Total domination of subalpine fir was rare because eventually the area would burn. (Crane, et al. 1986)

The natural disturbances consisted of endemic populations of western spruce budworm, subalpine fir complex would not be prevalent on the landscape.

Ponderosa Pine Cover Type
Ponderosa pine occurred in minor amounts at low elevations. Douglas fir was not in the understory due to the frequent fires and patch sizes were larger than in current condition. Habitat types would be similar to those described in current condition. Table A-11, below, shows the historic distribution of structural stages of the Ponderosa Pine cover types across the Salmon interface landscape.

Ponderosa pine is within Fire Group Two and Fire Regime Group I: warm dry habitat types that support open forests of ponderosa pine or Douglas fir. Fire intervals ranged from three to 35 years. Frequent mixed severity fires maintained a mosaic of age classes (McNicoll, et al. 2002). Fuel loads were usually light (less than five tons per acre). The most abundant ground fuel was grass. Fire maintained open stands of ponderosa pine or Douglas fir. Periodic fires created uneven aged stands (Crane, et al. 1986).

Logging would not have removed the large diameter trees. Endemic levels of mountain pine beetle infected larger trees.

Whitebark Pine Cover Type

Whitebark pine seedlings and saplings occurred in disturbed areas at high elevations. The trees were widely spaced with less subalpine fir in the stand. Habitat types would be similar to those described in current condition. Table A-11, below, shows the historic distribution of structural stages of the Whitebark Pine cover types across the Salmon interface landscape.

Fire Regime Group IV experienced infrequent mixed severity fires ranging from 35 to 300 years (McNicoll, et. al. 2002). Stand replacing fires were common during extended periods of drought. Fuel loads were low (14 tons per acre) composed primarily of large diameter material. Small fires burned many little patches of timber eliminating subalpine fir in those areas and creating a seedbed for whitebark pine. (Crane, et. al. 1986)

White pine blister rust was not present and periodic epidemics of mountain pine beetle killed the mature stressed trees.

Quaking Aspen Cover Type

Aspen stands would be healthy and thriving. Patch sizes would be larger than currently found in the watershed. Conifers would not be as prevalent in the stands especially in the areas adjacent to mixed fire regimes. The understory would be more diverse. Table A-11, below, shows the historic distribution of structural stages of the quaking aspen cover types across the Salmon interface landscape.

Fire regimes were dependent on surrounding cover types and their associated fire frequencies. Fire Regime Group I experienced frequent mixed severity fires ranging from zero to 35 years dominated by a mosaic of different age classes (McNicoll, et al. 2002). Frequent fire maintained even aged stands of aspen on the landscape with diverse understory vegetation. Frequent fire reduced conifers within the stands.

Natural disturbances like insects and disease would be at endemic levels. Wild ungulate grazing would decrease suckers in some of the seedling acres.

Black Cottonwood Cover Type

Cottonwood would have grown along streams and in moist areas within the assessment area. Natural disturbances would have maintained a portion of the stands in stand initiation stage. Wild ungulate populations would have reduced seedlings, but the grazing would not have been concentrated all growing season. Table A-11, below, shows the historic distribution of structural stages of the black cottonwood cover types across the Salmon interface landscape.

Fire Regime Group IV experienced infrequent mixed severity fires ranging from 35 to 200 years creating large patches of similar age classes. Fire severity and frequency were dependent on surrounding vegetation types.

Table A-11. Historical Distribution of Structural Stages for Forested Cover Types Within the Salmon Interface Landscape

Cover Type	Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
Douglas-fir	15-30%	10-30%	20-40%	0%	5-10%	10-40%
Lodgepole Pine	10-25%	30-40%	20-30%	0%	5-20%	5-10%
Spruce/Fir	10-15%	20-45%	10-20%	0%	25-35%	5%
Ponderosa Pine	10-20%	10-20%	20%	0%	5-10%	35-40%
Whitebark Pine	10-20%	20-50%	30-50%	0%	15%	15-30%
Quaking Aspen	40%	20%	10%	0%	5%	25%
Cottonwood	5%	45%	55%	0%	35%	5%

III. Fire Ecology-Reference Condition-Historical Vegetative Structure, Fire Frequency, and Fire Severity for Forested and Non-forested Vegetation by PVG

A. Historical Vegetative Structural Stages (SS)

Composite Structural stage for Dry Forest PVG

Columbia River Basin: The dry forest ecosystems would have forest vegetative structural stages (SS) in combinations as follows: 20 to 50% in ofs; 10 to 15 % in ofm; 25 to 30 % in a mixture of seo, sec, ur, and/or yfm; 10 to 20% in si; and 0 to 15% in non-forest (Hann et al. 1997, pg 481).

Central Idaho (ERU 13): The dry forest would have structural stage (SS) combinations as follows: 13 to 43% in ofs; 12 to 16 % in ofm; 31 to 37 % in a mixture of seo, sec, ur, and/or yfm; 10 to 21% in si; and 0 to 15% in non-forest (Hann *et al* 1997, table 3.60, page 565).

Salmon Interface area: The Dry Forest PVG (PVTs 52, 74, 75, and 133) would have SS combinations as follows: 15 to 40% in ofs; 20 to 40% in seo; 5 to 10 % in ofm; 10 to 25% in a mixture of sec/ur/yfm; 15 to 20% in si (see VDDT Table in Appendix C and the historical composition tables for Salmon Interface in Step 6, Table 6-1).

Composite Structural stage for Cold Forest PVG

Columbia River Basin: The Cold Forest PVG would have SS combinations as follows: 6 to 8% in ofs; 15 to 24 % in ofm; 44 to 53 % in a mixture of seo, sec, ur, and/or yfm; 23 to 25% in si (Hann et al. 1997, table 3.36, page 494).

Central Idaho (ERU 13): The Cold Forest PVG would have SS combinations as follows: 8 to 12% in ofs; 10 to 24 % in ofm; 42 to 50 % in a mixture of seo, sec, ur, and/or yfm; 24 to 28 % in si (Hann et al. 1997, table 3.64, page 570).

Salmon Interface area: The Cold Forest PVG (PVTs = 66, 68, 69, 70, 71) would have SS combinations as follows: 5 to 15% in ofs; 10 to 40% in seo; 5 to 25 % in ofm;, 20 to 45% in a mixture of sec/ur/yfm; 15 to 30% in si (see VDDT Table in Appendix C and the historical composition tables for Salmon Interface in Step 6, Table 6-1).

Composite Structural stage for Dry Shrub PVG

Columbia River Basin: The dry shrub would have SS combinations as follows: 10 to 60% in upland herbland, and 40 to 90% in upland shrubland (Hann et al.1997, table 3.36, page 502).

Central Idaho (ERU 13): The dry shrub would have SS combinations as follows: 20 to 40% in upland herbland, and 60 to 80% in upland shrubland (Hann et al. 1997, table 3.36, page 563).

Salmon Interface area: The Dry Shrub PVG would have SS combinations as follows: Grass-forb-20%; Closed young shrub (open grass-forb) with >15% shrub cover- 5%; Closed mature shrub (open grass-forb) with >15% cover shrub- 5%; open young shrub (closed grass-forb) with 5-15% shrub cover-20%; and open mature shrub (closed grass-forb) with 5-15% shrub cover- 50% (see VDDT Table in Appendix C and the historical composition tables for Salmon Interface in Step 6, Table 6-1).

Composite Structural Stage for Cool Shrub PVG

Columbia River Basin: The cool shrub would have SS combinations as follows: 10 to 40% in upland herbland; 60 to 80% in upland shrubland; and 5 to 10% in upland woodland (Hann et al. 1997, table 3.36, page 506).

Central Idaho (ERU 13): The cool shrub would have SS combinations as follows: 40 to 60% in upland herbland, and 40 to 60% in upland shrubland (Hann et al. 1997, table 3.36, page 564).

Salmon Interface area: The cool shrub PVG would have SS combinations as follows: Grass-forb-15%; Closed young shrub (open grass-forb) with 5-15% shrub cover- 20%; Closed mature shrub (open grass-forb) with >15% cover shrub- 20%; open young shrub (closed grass-forb) with 5-15% shrub cover- 30%; and mature open shrub (closed grass-forb) with 5-15% shrub cover- 15% (see VDDT Table in Appendix C and the historical composition tables for Salmon Interface in Step 6, Table 6-1).

B. Historical Fire Frequency for Forested PVGs

Dry Forest PVG

Columbia river Basin: The dry forest would have ranged from 20 to 70 years (Hann et al. 1997, page 484).

Central Idaho (ERU 13): The Columbia River Basin assessment found fire frequencies in Central Idaho **(**ERU 13) of 20 to 70 years for the dry forest PVG (Hann et al. 1997).

Salmon Interface area: the Dry Forest PVG includes Fire Regime Groups I and III (cohesive strategy 2002, Hann et al.) with a mixture of 0 to 35+ years of surface fires and 35 to 100+ years of mixed severity fires.

Cold Forest PVG

Columbia River Basin: For the Cold Forest PVG, Hann (Hann et al. 1997, page 492) states, "Historically, fire intervals in the cold forest PVG were highly variable and correlated with landforms. The non-lethal under burning regime that maintained the late-seral single-layer and some mid-seral physiognomic types, generally comprised approximately 10 percent of these landscapes, and typically occurred on ridges and flat benches. The fire-return interval on these landforms varied from 30 to 100 years. The lethal crown-fire regime generally occurred across 25 to 30 percent of the Cold Forest PVG, and had a fire-return interval which varied from 25 to 300 years. Shorter intervals generally occurred on steeper slopes recycling mid-seral to early-seral physiognomic types. Longer intervals occurred in wet bottoms and basins, which typically supported the late-seral multi-layer physiognomic type. The mixed-fire regime was most common and occurred throughout 60 percent of the PVG; mixed-fire return intervals varied from 25 to 300 years. The mixed-fire regime was often intermingled with the other regimes, either during one fire event or through a series of fire events. The Cold Forest PVG had a relatively short fire season, generally only lasting for the month of August. Most fires were very small, but a few occasionally grew very large".

Salmon Interface area: the Cold Forest PVG includes Fire Regime Groups III and IV (cohesive strategy 2002, Hann et al.) with a mixture of 35 to 100+ years of mixed severity fires and replacement severity fires.

C. Historical Fire Severity for Forested PVGs

Fire Severity for Dry Forest PVG

Columbia River Basin: The dry forest would have been 80% non-lethal, under-burning fires, 5% mixed lethal, and 15% crown fires (lethal) (Hann et al. 1997, page 484**).**

Salmon Interface area: The dry forest had 70% of its landscape sustaining a surface or mosaic fire, and 30% experiencing replacement fire severity (see Appendix C. Salmon Interface VDDT model assumptions, 2002).

Fire Severity for Cold Forest PVG

Columbia River Basin: The cold forest would have been 10% non-lethal under-burning fires occurring mostly on ridges and flat benches, 60% mixed lethal, and 25-30% crown fires (lethal) (Hann et al. 1997, page 493**).**

Central Idaho: Losensky described fire severity in the Lodgepole pine cover type (Cold Forest PVG) as follows; under-burning on a 50-year cycle with stand replacements at 75 to 150 years (Losensky 1994). Morgan reported a mixed lethal regime on the cool dry and warm dry sites in these ecosystems and a lethal fire severity on the cool moist sites (P. Morgan et al. 1996 Final Report RJVA-INT94913.).

Salmon Interface area: The Cold Forest PVG had 15-35% of its landscape sustaining a surface or mosaic fire, and 65-85% would have been a replacement fire severity (see Appendix C. Salmon Interface VDDT model assumptions, 2002).

D. Historical Fire Frequency and Severity for the Dry and Cool Shrub PVGs

Dry Shrub PVG

Columbia River Basin and Central Idaho (ERU 13): The Dry Shrub PVG typically burned with a mixture of non-lethal fires in areas dominated by upland herbs, and lethal fires in areas dominated by shrubs. The dry shrub would have 90% of the PVG in a lethal fire regime with intervals of 15 to 100 years. A non-lethal fire regime would occur on 10% of the area at intervals of 5 to 10 years (Hann et al.1997**).**

Salmon Interface area: The Dry Shrub PVG had a mean fire interval of 40 years, and the following mix of lethal and surface or mosaic fires: Surface or mosaic fires = 40% of the PVG; lethal fires = 60% of the PVG (see VDDT Table in Appendix C and the historical composition tables for Salmon Interface in Step 6, Table 6-1).

Cool Shrub PVG

Columbia River Basin and Central Idaho (ERU 13): The Cool Shrub PVG typically burned with a mixture of non-lethal fires in areas dominated by upland herbs, a mixed lethal fires in mosaics, and lethal fires in areas dominated by shrubs and trees. The cool shrub would have 75% of the PVG in a lethal fire regime with intervals of 25 to 75 years. The mixed lethal fires occurred on about 10% of the area with intervals similar to the lethal. A non-lethal fire regime would occur on 10 to 15% of the area at intervals of 15 to 25 years (Hann et al.1997**).**

Salmon Interface area: The Cool Shrub PVG had a mean fire interval of 25 years with the following mix of lethal and surface or mosaic fires: Surface or mosaic fires = 50% of the PVG; lethal fires = 50% of the PVG (see VDDT Table in Appendix C and the historical composition tables for Salmon Interface in Step 6, Table 6-1).

Synthesis and Interpretation (Step 5)

Issue A. Key Question #1: How has fire suppression, fire exclusion, timber harvest, silvicultural practices, and livestock grazing affected vegetation structure, composition, density, pattern, and ecosystem processes of forested and non-forested vegetation?

Issue A. Key Question #2: How has the change in forested and non-forested vegetation structure and composition affected the risk associated with wide spread wild fire and the ability to suppress forest fires adjacent to human developments (urban interface) and to protect the municipal watershed?

Key questions 1 and 2 are strongly interrelated and will be addressed together in the following narrative.

I. Non-forested Vegetation

The non-forested vegetation types generally occupy the eastern edge of the assessment area along the Salmon River corridor and comprise approximately 26% of the federally managed lands. Of the 13 sub-watersheds included in the assessment area, 4 have less than 10% non-forested vegetation. Only one subwatershed (Salmon-Henry) is dominated by non-forested vegetation.

The non-forested vegetation types are generally considered more susceptible to surface disturbances and subsequent site alteration than forested community types for a variety of reasons. The non-forested plant communities occupy the lower elevations where annual precipitation is considerably less than the higher elevations. Due to limited moisture, native plants are naturally more widely spaced with un-vegetated open spaces relatively larger than in the higher elevations. The growing season is longer but is hampered by a mid to late summer dormancy period when soil moisture is generally absent. These lower elevations are also subject to increased, and often more concentrated, activities associated with surface disturbances such as livestock grazing and complex road networks that exacerbate off road vehicle abuse.

A. Interpreting Field Inventory Data

The status of the non-forested vegetation within the assessment area can be visualized by reviewing the non-forested vegetation condition on Table A-1 and the weed distribution on Table A-2. Both these tables have been summarized in Table A-3 and include a display of the estimated road distribution within each subwatershed. It must be noted that the Jesse Creek subwatershed was not field inventoried and is therefore not included in this synthesis.

None of the subwatersheds within the assessment area would be considered to be in a “degraded” condition as none of the subwatersheds are dominated by or have extensive areas in poor vegetation condition that would warrant re-vegetation efforts. However, 4 out of the 8 inventoried subwatersheds (Salmon-Perreau, Salmon-Wagonhammer, Salmon-Wallace, and Williams Creek) that have Dry Shrub plant communities have more area of those types in fair and poor condition than in good condition. Similar comparison for Cool Shrub is 5 of 10 subwatersheds (Napias-Phelan, Salmon-Fenster, Salmon-Perreau, Salmon-Wagonhammer, and Twelvemile), and for Woodland 0 of 5 subwatersheds. As discussed in Chapter 3, rangeland or vegetation condition is generally based on the proportion of native species present on a site, depending on the methodology used. The native vegetation on sites in poor or fair condition has been altered to some extent, most notably by livestock grazing. The extent of this alteration is generally unknown (i.e. disproportionate compositions of native grasses and shrubs) and can vary considerably within the condition classes. Table A-7 shows the expected distribution of native grasses to shrubs for the numerous Ecological Sites Guides making up the non-forested vegetation types. A site in fair condition has experienced a shift of about 20 to 30% composition from the grass life form to the shrub life form. A poor condition site reflects a shift in excess of 40 to 50% to shrubs or possibly non-native species. Along with these shifts in life form compositions, similar alterations in annual production and percent ground cover would be expected, both of which adversely affect ecosystem processes, soil productivity, and site stability. A cycle is then created of further vegetation alteration leading to additional site deterioration. Their recovery period after disturbance is also longer than the forested communities for similar reasons, with the dry shrub being the slowest to recover and the cool shrub being the most rapid to recover among the non-forested potential vegetation groups.

Several indicators from the field inventory data can be used to rank the subwatersheds in regards to continuing a trend of altered native plant communities and ecosystem processes dependent on those communities: the amount of Dry Shrub (being the most susceptible to site alteration); the percent of Dry Shrub being in poor and fair condition; and the total amount of poor and fair condition non-forested plant communities. Using these three indicators the five subwatersheds being most at risk of continued site alteration, in descending order, are Salmon-Perreau, Salmon-Henry, Salmon-Wagonhammer, Salmon-Fenster, and Salmon-Wallace.

B. Interpreting Satellite Imagery Classification

The Vegetation Dynamics Development Tool was developed to compare HRV departure only at the PVT level with application only at the larger landscape level (Salmon interface assessment area), and not for comparison at the individual subwatershed level. However, Table A-6 Distribution of PVG, PVT, Cover Types, and Structural Stage by Subwatershed, and Table A-9 Historical (HRV) Distribution of Successional Stages can be used to interpret key vegetation indicators useful for evaluation and comparison at the subwatershed scale; a ranking of vegetation cover and structure departure from historic levels, a rating of the risk of disturbances to sustaining ecosystem processes, and a rating of current abundance compared to historic. These indicators are further described in Appendix H.

Vegetation departure results when the historic landscape disturbance mechanisms (most notably wild fire) have not occurred at historic intervals. This results in cover types and structural stages that are not considered natural for the physical environment nor supportive of the biological features dependant on those historic vegetation characteristics. Vegetation departure is rated as low (<33%), moderate (33-66%), and high (>66%). A low rating can be interpreted as the existing vegetation cover and structure is similar to the historic with little influence on the natural physical or biological processes. A high rating can be interpreted as having a high departure from historic conditions resulting in a high likelihood of altered physical and biological processes and uncharacteristic disturbance pathways when they do occur.

The rating of the risk to sustaining ecosystem processes is derived from assessing the departure of current fire regimes to natural fire regimes. Fire regime departure is also determined from the historical departure of the cover types and structural stages. Uncharacteristic seral stages (vegetation classes that are outside the typical Box Model succession) are also considered due to their inherent high risk of altering ecosystem processes. A low risk is interpreted as having similar vegetation characteristics to historic and disturbance events do not pre-dispose the site to losses of key ecosystem components. A high risk indicates a wide departure from historic vegetation characteristics leaving the site pre-disposed of losing or irreversibly altering key ecosystem components, such as natural vegetation life forms, site productivity, or soil characteristics.

Abundance is a rating of how much a particular vegetation class or succession stage is present on the landscape. Ratings of high (too much), similar (within the historical range), or low (too little) are identified for the vegetation classes when compared to the historic conditions. This rating can be visualized by looking across a landscape and seeing a mosaic of vegetation cover types and structures rather than seeing just a homogenous monotype.

Table A-12 displays the vegetation departure, sustainability risk, and abundance ratings for each potential vegetation group within each subwatershed. The percent of the subwatershed for each rating is also displayed.

Tavble A-12. Vegetation Departure (VD), Sustainability Risk (SR), and Abundance (AB) Ratings and Percent of Subwatershed Displayed by PVG

Subwatershed Name (Acres)	PVG/Acres	VD/Percent	SR/Percent	AB/Percent
Arnett (75)	Cool Shrub/75	High/100	Mod/40	High/100
			High/60	
Jesse Creek (2371)	Cool Shrub/1048	High/100	Low/3	Sim/3
			Mod/27	High/97
			High/70	
	Dry Shrub/1323	Mod/100	Low/23	Low/1
			Mod/77	Sim/23
				High/76
Lake Creek (4749)	Cool Shrub/3650	Mod/1	Mod/43	High/100
		High/99	High/57	
	Dry Shrub/1083	Low/12	Low/22	Low/3
		Mod/88	Mod/78	Sim/22
				High/75
	Woodland/16	High/100	Mod/100	High/100
Lower Napias (913)	Cool Shrub/774	High/100	Mod/60	Low/2
			High/40	High/98
	Dry Shrub/139	High/100	Mod/100	High/100
Napias-Phelan (932)	Cool Shrub/932	High/100	Low/1	Sim/1
			Mod/59	High/99
			High/40	
Salmon-Fenster (5899)	Cool Shrub/2132	High/100	Low/3	Sim/3
			Mod/28	High/97
			High/69	
	Dry Shrub/3739	Low/15	Low/10	Sim/10
		Mod/85	Mod/90	High/90
	Woodland/28	High/100	Mod/100	High/100

Subwatershed Name (Acres)	PVG/Acres	VD/Percent	SR/Percent	AB/Percent
Salmon-Henry (10051)	Cool Shrub/3958	Mod/2	Mod/51	High/100
		High/98	High/49	
	Dry Shrub/6085	Low/20	Low/20	Sim/20
		Mod/80	Mod/80	High/80
	Woodland/8	High/100	Mod/100	High/100
Salmon-Perreau (17642)	Cool Shrub/3394	Mod/<1	Low/10	Sim/39
		High/>99	Mod/39	High/61
			High/51	
	Dry Shrub/14248	Low/5	Low/5	Low/<1
		Mod/95	Mod/95	Sim/5
				High/95
Salmon-Wagnhmr (5133)	Cool Shrub/2955	Mod/19	Low/8	Sim/8
		High/81	Mod/60	High/92
			High/32	
	Dry Shrub/2173	Low/32	Low/20	Sim/20
		Mod/68	Mod/80	High/80
	Woodland/5	High/100	Mod/100	High/100
Salmon-Wallace (5708)	Cool Shrub/2925	Mod/17	Mod/61	Low/7
		High/83	High/39	High/93
	Dry Shrub/2732	Low/34	Low/55	Sim/55
		Mod/66	Mod/45	High/45
	Woodland/51	High/100	Mod/100	High/100
Twelvemile (2809)	Cool Shrub/1864	Mod/5	Mod/57	High/100
		High/95	High/43	
	Dry Shrub/938	Mod/100	Low/20	Low/2
			Mod/79	Sim/20
			High/1	High/78
	Woodland/7	High/100	Mod/100	High/100
Upper Napias (111)	Cool Shrub/111	High/100	Mod/22	High/100
			High/78	
Williams Cr (7122)	Cool Shrub/5255	Mod/4	Low/3	Sim/3
		High/96	Mod/96	High/97
			High/1	
	Dry Shrub/1867	Low/8	Low/5	Sim/5
		Mod/92	Mod/95	High/95

The table clearly shows several distinct patterns. Throughout all 13 subwatersheds the Cool Shrub PVG has high vegetation departures while the Dry Shrub PVG is dominated by moderate to low departures. These high vegetation departures indicate a lack of diversity in seral stages within the various PVTs making up the Cool Shrub potential vegetation group. This pattern is also reflected in Table A-6 which only shows open shrub structures and limited closed grassland (herbland) structures within the sub-watersheds. Several seral stages (vegetation classes) described in the box model are either lacking or very weakly represented. The lack of closed shrub structures in the Dry and Cool Shrub is suspicious and reflects errors in the satellite imagery estimating shrub cover. Field reviews estimate that about 30%

of the open shrub is in reality closed shrub. Nevertheless, this lack of seral diversity is primarily due to a disruption of the natural fire regimes. The resulting homogeneosity is also being reflected in the high abundance rating meaning there is too much of some seral stages and not enough of others. The Dry Shrub PVG also shows departures but mostly confined to the moderate range with little showing high departure. The Dry Shrub abundance however, is also disproportionately high for the same reasons as the Cool Shrub.

The risk rating for both the Cool Shrub and Dry Shrub PVGs is somewhat more dispersed. Even though there appears to be little diversity of structure, there is diversity in cover types and PVTs that quells the risk of sustaining ecosystem processes. The risk of significantly altering ecosystem components from an uncharacteristic disturbance is less for a grassland type than in a shrubland type.

In all cases the Woodland PVG (Mountain mahogany PVT) had a vegetation departure of high (no diversity of structure), a sustainability risk of moderate (disturbances to an open structure has less sustainability risk to ecosystem processes than a closed structure), and an abundance of high (too much, compared to historic, of open tall shrub). The satellite imagery failed to recognize a great deal of the mountain mahogany type in the assessment area, and even though much more mahogany was identified by field inventory it is still widely believed to be greatly underestimated with possibly much more diverse characteristics than what is being classified.

Making more refined conclusions from the satellite imagery classifications and the VDDT model results is difficult to do. All the subwatersheds are showing similar characteristics and even though the Cool Shrub PVG has high vegetation departures from historic conditions the landscape is not necessarily at risk of sustaining ecosystem processes or altering ecosystem components, primarily due to the apparent vegetation diversity and complexity at the potential vegetation type and cover type layer. Similar conclusions can be made for the other PVGs. There may be two exceptions to this possibly over-simplified conclusion:

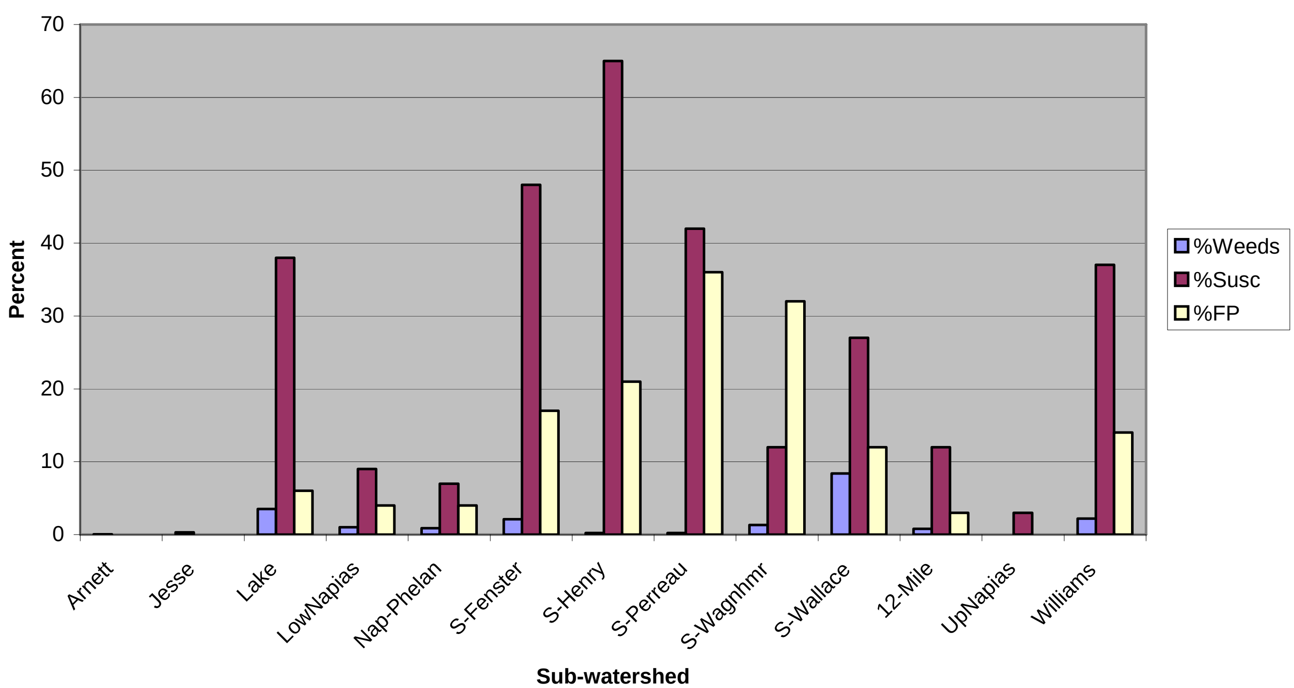
1) Conifers are encroaching into the cool shrub Mountain big sage types. The Mountain bigsage/conifer PVT is present in all the subwatersheds in varying amounts. However, the conifer cover types, namely conifer/mountain bigsage and mountain bigsage/conifer out weigh the shrub or grassland cover types in 6 out of 13 sub-watersheds, specifically Arnett Creek, Jesse Creek, Salmon-Wagonhammer, Salmon-Wallace, Twelvemile, and Williams Creek. This situation is exasperated by altered fire regimes and exemplifies the vegetation departure discussion above. With continued conifer expansion and development, those mountain bigsage community types adjacent to the conifer/shrub transission zone are in jeopardy of being lost.

2) As classified by the imagery, the Woodland PVG is virtually identical throughout the assessment area. This obvious lack of community and structural diversity is very detrimental to any biotic or physical resource dependent on it. The site is no longer resistant or resilient to disturbance and any uncharacteristic disturbance (fire, disease, drought) could eliminate or irreversibly alter whole stands of mahogany with little chance of recovery. Additional field inventories and a closer look at validating the imagery classifications need to be emphasized and initiated prior to any site alteration project.

Issue A. Key Question #3: How has the introduction and establishment of non-native species affected native plant communities within the assessment area?

The presence and distribution of noxious or non-native invasive weeds also play a role in assessing species diversity and ecosystem processes. The physical characteristics and increased human induced activities mentioned above make the non-forested vegetation types more susceptible to noxious and non-native invasive weed encroachment and establishment, resulting in reduced productivity, and accelerated surface soil erosion. Even though every subwatershed within the assessment area has weeds, there are no large, extensive areas where weeds have become the dominant feature. Those subwatersheds with a substantial amount of non-forested vegetation have the most acres of weeds and the greatest diversity of weed species (Table A-1). The risk to further weed establishment can be interpreted from Table A-3. This table shows the relationship between the level of weed establishment and the extent of susceptible vegetation types and vegetation condition. These indicators are also displayed graphically on Figure A-1 as the percent of the area infested with weeds, the percent of the area susceptible to weeds, and the percent of the area in fair and poor condition. Five subwatersheds (Lake Creek, Salmon-Fenster, Salmon-Wagonhammer, Salmon-Wallace, and Williams Creek) have more than 1% of their acres infested with non-native invasive weeds. Each have more than 25% of the watershed comprised of susceptible vegetation types, all but one (Lake Creek) has greater than 10% in fair to poor vegetation condition, and all but one (Salmon-Wagonhammer) have high road densities. Of these five sub-watershed, comparisons in Figure A-1 shows that Salmon-Wallace may have the greatest threat of weed expansion with a high potential for broad scale (subwatershed) ecosystem disturbance due to high weed occurrences combined with a relatively high proportion of altered vegetation conditions within the susceptible vegetation types.

Figure A-1



The subwatersheds within the assessment area can be ranked with regards to risk and susceptibility to native plant disturbances and the threat of weed encroachment using three characteristics; the amount of Dry Shrub; the distribution of vegetation condition; and the density of roads. Using these three indicators (compiled and summarized in Table A-3) the five highest subwatersheds (in descending order) are: Salmon-Perreau, Salmon-Wallace, Salmon-Henry, Salmon-Wagonhammer, and Salmon-Fenster.

II. Forested Vegetation

Key questions 1 and 2 are strongly interrelated and will be addressed together in the following narrative.

Desired Future Condition Statement for Forested Vegetation
Ecosystem sustainability and resiliency will be provided within the forested vegetation community. Vegetation composition, structure and function will reflect natural disturbance regimes. In areas where high intensity fire is not desirable such as adjacent to private land or significant cultural sites, vegetation will be manipulated to allow direct firefighting techniques and lower the potential for extreme fire behavior.

A. Dry Forest Potential Vegetation Group

Columbia River Basin
The areas of highest departure from natural conditions were those that had been harvested, favoring the removal of high value, large shade intolerant tree species and leaving shade tolerant, fire and insect disease susceptible species. The composition of late-seral single-layer shade-intolerant (ie, ponderosa pine) forest had declined by 25 percent from historical amounts. In addition, current period landscapes had a mixed composition rather than being dominated by shade-intolerant species. This was particularly true in areas that had been actively harvested and in areas where fire suppression has been effective. Increased fire intervals without a decrease in fuels has produced higher fuel loads and fire intensities. (Hann et al. 1997, page 487).

Central Idaho
"For the Dry Forest PVG, the late-seral single-layer forest type was well below the natural condition, whereas the late-seral multi-layer forest type occurred at the upper limit of the historic condition. The late-seral single-layer forest type largely converted into the mid-seral forest type because of insect, disease, and stress mortalities in the overstory layer, and growth of shade-tolerant layers in the understory." (Hann, et al. 1997, pg 563)

"These transitions occurred primarily as a result of fire exclusion. Fire exclusion substantially reduced the extent of the non-lethal and mixed fire regimes that maintained late-seral single-layer types, and that thinned shade-tolerant tree species in early-, mid-, and late-seral multi-layer types. Timber harvest activities largely occurred in the peripheral areas of the Central Idaho ERU, where the larger, shade-intolerant tree species were those primarily selected for harvest. These trees were more resistant to insect, disease, and stress mortality. Clearcutting and seed tree timber harvest activities commonly created small patches of early-seral structures containing few live or dead-standing trees, and high down fuel accumulations." (Hann, et al. 1997, pg 563)

"For Central Idaho (ERU 13) fire exclusion substantially reduced the extent of the non-lethal and mixed fire regimes that maintained late-seral single-layer types, and that thinned shade-tolerant tree species in early-, mid-, and late-seral multi-layer types." (Hann, et al. 1997, page 563).

Salmon Interface Assessment Area
Stand initiation structural stage is greater than historic levels in Arnett, Lower Napias and Salmon-Wagonhammer subwatersheds due to wild fire and logging. Stand initiation is lower than historic levels in Jesse, Napias Phelan, Salmon-Henry, and Twelvemile subwatersheds due to lack of disturbance such as fire. Stem exclusion structures are less than natural levels in all subwatersheds in the assessment area. Understory reinitation is less than natural levels in Lake, Salmon-Fenster, Salmon-Henry, Salmon-Perreau, Salmon-Wagonhammer and Salmon-Wallace subwatersheds. There is more young multi story structural stage in the entire watershed than historic conditions due to human caused disturbances. Old multi story is over-represented in all subwatersheds except Arnett and Salmon-Perreau subwatersheds due to lack of fire. Old single story is under-represented in the entire watershed due to lack of low and moderate intensity fires.

B. Cold Forest Potential Vegetation Group

Columbia River Basin
Tree densities and fuel loads have increased from historic condition as a result of fire suppression. Changes in landscape structure and composition have resulted in higher fire intensities and fuel loads. (Hann, et. al. 1997)

Central Idaho
The extent of early seral forests is higher than historic range of variability, mid seral type is below historic range of variability, late seral muli layer is within historic range of variability, and late seral single layer is above its historic range of variability. The amount of early seral shade tolerant species is above historic range of variability and the extent of mid seral and late seral species are below their historic range of variability. The change in mid and late seral is due to decline in whitebark pine due to fire exclusion and being replaced by subalpine fir (Hann, et al. 1997).

Salmon Interface Assessment Area
Within the assessment area, stand initiation structural stage is under-represented when compared to historic condition in all subwatersheds except Arnett because of fire suppression. Stem exclusion stage is less than natural conditions in all subwatersheds. There is more understory reinitiation stage in Lower Napias, Napias Phelan, Salmon-Henry, Salmon-Wagonhammer, Salmon-Wallace and Williams subwatersheds and less in Salmon-Fenster and Twelvemile subwatersheds when compared to historic conditions. Young multi story is over-represented in all subwatersheds except Lower Napias due to timber sales and wildfires. Old multi story stage is more than natural conditions in Lower Napias, Salmon-Wagonhammer and Twelvemile due to lack of moderate and low intensity fires. Old single story structural stage is less than natural conditions in all subwatersheds because of less stand replacing and moderate, low intensity fires.

C. Salmon Interface Cover Type Descriptions

Douglas Fir Cover Type
Lack of disturbance, primarily fire, has lead to a landscape with a lack of structural and age class diversity compared with historic conditions. Stand initiation stage is less than historic in Jesse, Napias Phelan, Salmon-Wagonhammer, Twelvemile, and Williams subwatersheds. Young forest multi story has increased since historic conditions mainly due to shelterwood harvests in Douglas fir and wildfires. Old multi story structural stage is currently over-represented in all subwatersheds except Arnett Creek

because of fire suppression and not maintaining natural fire regimes. Old single story structural stage is on the low end of historic conditions in Arnett Creek, Lower Napias, Napias-Phelan, and Upper Napias due to lack of mixed severity fire and stand replacing disturbances.

Lack of low and moderate severity fire has created an increase of Douglas fir in sage/grasslands and in the understory of areas where Douglas fir is the potential vegetation type. This trend will continue unless disturbance occurs.

Fire intervals have increased two to three times because fires have been suppressed. Within dry Douglas fir habitat types, ground fuels (grass) are relatively similar to historic conditions due to grazing; larger fuels and ladder fuels that create old multi story structure exceeds historic conditions due to lack of low intensity fires. Douglas fir / Lodgepole pine habitat types have experienced an increase in ladder fuels and down woody material due to increased fire intervals.

An increase in ladder fuels, down wood and crown density and lack of structural diversity increases the chance of stand replacing fires in areas that historically burned with greater frequency. If a crown fire occurs adjacent to human developments or municipal watershed, the fire may burn an extensive area prior to going out or being suppressed.

Logging has created most of the young forest multi story structural stage removing most of the larger overstory trees and snags. Thinned sapling and pole stands are not representative of historic stand densities or species composition.

Dwarf mistletoe infestations have increased within Douglas fir cover type due to lack of light and moderate intensity fires as well as an increase in old multi story structural stage. As the old multi story stands age, Douglas fir and lodgepole pine will experience additional stress from competition causing the trees to be more susceptible to bark beetle attacks. The resulting dead trees will create additional fuel concentrations.

Lodgepole Pine Cover Type

Every subwatershed is composed of mature lodgepole pine stands that contain an excess of understory reinitiation structural stage when compared to historical condition. Due to fire suppression, a portion of these stands has not returned to stand initiation. Lodepole pine is relatively young in the watershed and has not grown into the old structural stages. Eventually the understory reinitiation stands will become old multi story stands unless a disturbance occurs. An increase in old multi story in Lower Napias, Salmon-Perreau, Twelvemile, and Williams subwatersheds is due to decreases in mixed severity burns or stand replacing fires. Lack of low intensity burns and stand replacing fires in the watershed has lead to a decrease in old single story structural stage; more subalpine fir and Douglas fir are in the understories. The increase in young multi story structural stage is primarily due to logging and wildfires.

Lodgepole pine associated with Douglas fir and subalpine fir on gentle slopes that were once maintained by mixed severity fires have an increase in ladder fuels and down wood creating conditions conducive to crown fires. Mixed severity fires no longer create patches of open canopies with reduced fuels that would slow a crown fire. Fires if they were to occur today may burn larger patches than historically due to the continuous canopy of mature trees. Crown fires cannot be suppressed with direct attack methods and are more expensive to suppress. If a crown fire occurs adjacent to human developments or municipal watershed, the fire may burn an extensive area prior to going out or being suppressed.

Clearcuts created stands that lack species and structural diversity when compared to areas that historically burned during a stand replacing event. Lodgepole pine regenerated under Douglas fir shelterwood cuts to create some of the young multi story stands. Thinned sapling and pole stands lack species diversity and have more uniform spacing when compared to historic conditions.

Lack of disturbance has increased mistletoe infestations within the watershed. Mountain pine beetle has not played an important role in stand succession, but most of the understory reinitiation and old multi story stands are ripe for an epidemic. Drought conditions are stressing the mature trees and this combined with high stand densities provides ideal conditions for a mountain pine beetle outbreak. An outbreak would increase large fuel loads creating conditions for stand replacing fires.

Spruce/Fir Cover Type
Compared to historical condition, there has been an increase in old multi story structural and a decrease in old single story due to lack of disturbance. Mixed severity fire would have created a diversity of structural stages. In Lower Napias, Napias-Phelan, Salmon-Henry, Salmon-Wagonhammer and Upper Napias subwatersheds, stand initiation stages are less than historic conditions.

Fire intervals are within the historical range. Suppression of small fires has increased subalpine fir within this cover type. Lack of disturbance has reduced the structural stage diversity leading to less resilience. An increase in ladder fuels, down wood and continuous forest canopy creates conditions conducive to crown fire. Crown fires cannot be suppressed until they drop out of the crown. If these occur in areas adjacent to human development or the municipal watershed, large areas may burn before the fire is extinguished.

Multiple crown layers within most stands create conditions conducive to western spruce budworm. Endemic infestations were present within the watershed in 2002. The condition will persist and may become epidemic because the conditions are suitable. Dead needles will increase the fine fuel loads. If trees die, that will increase the large fuel loads.

Ponderosa Pine Cover Type
Due to lack of disturbance (fire) there is an increase in old multi story structural stages, a decrease in old single story and stand initiation stages within the watershed. Harvest activities created young multi story structural stages.

Fire intervals have increased at least three times compared with natural conditions. There has been an increase in ladder fuels and ground fuels due to a reduction in mixed severity fires. Livestock grazing may have reduced fine fuels within some of the areas.

Harvest of ponderosa pine created young multi story stands composed of mature Douglas fir and ponderosa pine saplings and poles. Until these trees achieve large diameters, they are susceptible to fire damage or death if a moderate or high intensity fire burns the stand.

Mature ponderosa pine in old multi story stands is susceptible to mountain pine beetle infestations.

Whitebark Pine Cover Type
The assessment area is composed primarily of young multi story structural stages. Salmon-Wallace subwatershed is composed entirely of old single story structural stages. None of the subwatersheds have adequate stand initiation when compared to historical conditions. Whitebark pine is not resilient within the assessment area due to lack of structural diversity. Subalpine fir and lodgepole pine has increased in the overstory and understory because the stands have not experienced a disturbance.

Fire intervals are within their historical range except for a decrease in small mixed severity fires. Stand replacing fires are probable due to the increase in down fuels and ladder fuels.

Whitebark pine is ripe for mountain pine beetle infestations due to competition stress, drought stress and stress from white pine blister rust. White pine blister rust may kill most of the seed bearing trees within the watershed leading to a reduction of this species and its ability to reproduce.

Quaking Aspen Cover Type
Aspen structural stages are not within historical conditions. There is very little stand initiation (2 percent) within the subwatersheds and conifers have encroached decreasing the patch sizes from historical conditions. Lack of fire has created a non-resilient situation. Fire suppression and grazing has decreased the diversity within the aspen cover type. Ongoing logging operations in aspen stands within Moccasin, Napias and Phelan creeks will create 905 acres of aspen stand initiation in Napias-Phelan and Lower Napias subwatersheds.

An increase in fire frequency would regenerate aspen creating a community with greater structural diversity and areas that are less prone to stand replacing fire resulting in a natural fuel break.

Black Cottonwood Cover Type
Structural diversity is missing in this cover type; stem exclusion and old multi story is present within all subwatersheds where cottonwood is present. Riparian areas have experienced very little disturbance such as floods or fire to create conditions conducive to cottonwood regeneration.

III. Fire Ecology

Key questions 1 & 2 require discussion regarding risks to social and ecological elements due to altered vegetation structure and fire behavior. These topics are inseparable for the synthesis process, therefore the fire ecology synthesis discussion will combine questions 1 and 2.

The synthesis discussion will address the following topics:

- Summary of high-risk crown fire.
- Fire Regime Condition Class.
- FRCC –Risk of sustainability.
- FRCC –Abundance of ecosystem components.

A. Summary of high-risk crown fire initiation fuel profiles: In both the Dry Forest and Cold Forest PVGs, the amount of forest area with high-risk crown fire fuel profile has increased from the historical landscape. High-risk crown fire initiation fuel profiles are those forest structural stages with a closed forest canopy and abundant ladder fuels (seedlings, saplings, and pole size trees), in particular the ofm and ur. The stem exclusion closed canopy structural stage has a closed canopy and is at high risk for crown fire spread, but lacks the ladder fuels for a crown fire to generally initiate within those stands. Therefore, it will not be included in this discussion of high risk crown fire initiation fuel profiles.

Sixty to 70% of the forested landscape in the Salmon Interface area have high risk crown fire initiation fuel profiles (multi-layer forest canopy (ladder fuels) structural stages). This equates to more than 78,000 acres of high-risk crown fire fuel profile forest conditions. This high concentration of potential crown fire fuels is located in a landscape on the windward side of the community of Salmon, Idaho and its surrounding population. Due to the regularly experienced high fire danger weather conditions, prevailing wind patterns, steep mountain topography, and canyons that line-up with fire season wind direction, risk to wildland urban interface, and risks for sustaining ecosystems the wildland urban interface is at increased risk of wildfire due to altered forest structure.

B. Fire Regime Condition Class and predicting risk to Wildland Urban Interface (WUI): Fire Regime Condition Class (FRCC) and related values (risk of sustainability and abundance of ecosystem structure) were calculated for the Salmon Interface area. Map A-7 displays the FRCC distribution and Appendix H further describes the vegetation indicators used to derive the FRCC. These values are important as related to wildfire behavior, especially wildfire burning under high or extreme fire weather conditions.

Fire Regime Condition Class is a calculated value for a particular ecosystem in a given drainage. It is not a value that can be assigned to a given stand of forest or small patch of shrub ecosystem. As such, it is reflective of the current condition of the ecosystem (vegetation/fuel characteristics) in the context of the surrounding landscape. Context combined with current structure is exactly what influences extreme fire behavior.

Fire Regime Condition Class provides a picture of potential fire behavior under high or extreme fire weather conditions because it considers the context of the surrounding vegetation/fuel structure that would contribute to uncharacteristic fire behavior (e.g. amassing of extreme heat or winds).

The Dry Forest PVG throughout the Salmon Interface area was classed as follows: 0% in Condition Class 1; 60% Condition Class 2; and 40% in Condition Class 3. These values have been heavily influenced by the significant increase in multi-story forest structures that have multi-storied fuel profiles (ladder fuels). Noticeable trends include:

> All of the Dry Forest PVG in the municipal watershed (Jesse Creek) for the town of Salmon were classed in Condition Class 3.
>
> All of the Dry Forest PVG in the Spring and Perreau Creek subwatersheds were classed in Condition Class 3.
>
> All of the Dry Forest PVG in the Twelvemile subwatershed was classed in Condition Class 3.
>
> Most of the Dry Forest PVG in the Williams Creek subwatershed was classed in Condition Class 3.
>
> All of the Dry Forest PVG was assigned a Condition Class 2 value for the area around Williams Lake.

The condition class 3 areas mentioned above include the lower elevations and these areas are of the highest concentrations of Wildland Urban Interface (WUI) regarding forested ecosystems in the Salmon Interface. As seen in the fires of 2000 and 2003, these fuel situations have the capability to burn with extreme, un-stoppable fire behavior and produce fire- spotting miles out ahead of the main fire. It should be noted that Condition Class 2 also has similar capability for extreme fire behavior when fire weather conditions become high or extreme and topographic features line up with wind patterns allowing a wildfire to be pushed by high wind conditions generated from a large fire or high wind event. Such is the potential for the Williams Lake WUI.

C. FRCC –Risk of sustainability: The FRCC Risk of Sustainability classification provides an indication of the landscape's probability of sustaining uncharacteristic wildfire behavior (rapid rates of spread, resistance to initial attack and containment, crown fire, potential blowup fire behavior, mass firebrands and long distance spotting). For the Salmon Interface area, in the forested PVGs: 25% of the area is low risk; 58% of the area is moderate risk; and 17% of the area is in high risk. Most of the high risk forest PVGs tend to be at the lower elevation forest zones which also are the forested zones closest to WUI. These high risk areas are intermixed with both low and moderate risk areas, mostly moderate risk.

The moderate risk areas have a "lesser" probability of initiating uncharacteristic fire behavior, but have a strong probability of being able to sustain extreme fire behavior once it is in progress. This was demonstrated time and time again during the fire season of 2000 in Idaho and Montana, and in Colorado, Oregon, and New Mexico in 2002.

The two largest concentrations of low risk forest PVGs occur at the west edge of the Salmon interface analysis area and are in areas of the lowest WUI concentrations. These areas are partly a reflection of the areas that burnt in the Clear Creek Wildfire of 2000. Small patches of low risk are scattered throughout the forest PVG, but appear in such small amounts that it is unlikely that they would significantly influence fire behavior once a fire blowup occurs.

Due to the high amount (75%) of high to moderate risk area in the forest PVGs, any wildfire blowups are most likely to be controlled by topographic and weather situations. Low risk forest PVG areas are so limited they will play a small part in influencing extreme fire behavior. Much of the higher elevation forest PVG area burnt in the 2000 Clear Creek Wildfire was in moderate risk classification, and this wildfire was un-stoppable even with two Type I fire fighting teams, thousands of personnel, many miles of bull dozer constructed fire line, and many helicopters dropping fire retardant. The amount of low risk forest PVG area can have a significant influence on the resulting wildfire behavior, suppression efforts, and post fire ecological impacts.

D. FRCC –Abundance of ecosystem components: The abundance of ecosystem components is an indicator of the distribution of seral stages or structural stages across the landscape. Its simply a classification of whether there is too much, too little, or about right of a particular structural or seral stage compared to historic levels. Structural abundance can have a direct affect on fire behavior and risk of sustainability when high risk crown fire fuel structures are overly abundant while non-lethal, ground fire structures are lacking or inadequate to be effective in moderating fire behavior.

Within the Salmon interface assessment area, the abundance of mid and late seral closed structures is excessive in all subwatersheds while the mid and late seral open structures and early seral structures are low in abundance.

Issue B. Changes in Terrestrial and Aquatic Species Habitat

Terrestrial Species

Compilation of Current Condition (Step 3), Reference Condition (Step 4), and Synthesis and Interpretation (Step 5)

The three steps were combined for discussion of the terrestrial species because of scale. The 29 terrestrial species of focus are described at the Salmon interface assessment level rather than at the sub-watershed level due to the complexity, distribution, and overlap of source habitats. Comparisons to historical vegetation structures as source habitat are also simplified at this broader scale.

This section is organized by the nine Families of species whose presence or habitat exists within the assessment area. The 29 species are individually described with source habitats described by cover type and structural stage, organized by Group within each Family as described by Wisdom et al, 2000. Interpretations of habitat trends are made at the Family level. These 29 species are all species of focus with varying degrees of designation or recognition on the S-C National Forest. Their status is described in Table 1-1 in the Characterization (Step 1) section. Reference is also made throughout this section of the historic characteristics. These are also displayed in the HRV/DFC Description tables (Table 6-1) for each PVT in Recommendations (Step 6).

Family 1: Low-Elevation, Old-Forest Family
Pygmy nuthatch

Primary source habitats for the pygmy nuthatch are the lower montane ponderosa pine grassland/shrublands (PVT 133) in the late-seral single- or multi-layered stages. This species specifically requires large (21 inch dbh or larger) trees and snags with cavities for both nesting and foraging. Only 1057 acres of lower montane ponderosa pine were identified within the assessment area with the following structures: 30 acres (3%) of stand initiation (si), 0 acres of stem exclusion closed (sec) and understory reinitiation (ur), 165 acres (16%) young forest multi (yfm), 13 acres (1%) of stem exclusion open (seo), 298 acres (28%) old forest single-layered (ofs), 550 acres (52%) of old forest multi-layered (ofm),

Historically, the source habitats for the pygmy nuthatch would have been comprised of approximately 20 percent early seral stand initiation (si), 10 percent mid seral closed combining stem exclusion closed (sec), understory reinitiation (ur), and young forest multi-strata (yfm), 20 percent mid seral open stem exclusion open (seo), 40 percent late seral open old forest single-strata (ofs), and 10 percent late seral closed old forest multi-strata (ofm). Large diameter ponderosa pine trees and snags would have been abundant and well distributed and surface fires or underburns would have been very frequent in occurrence.

The magnitude of decline or change in vegetation composition and structure has been greatest for source habitats in the lower montane community groups than for any other forest community groups (Hann et al. 1997). Structural stages si, seo, sec, and ur are essentially missing from this PVT; ofs and yfm stands are similar to reference conditions while ofm stands have increased to approximately five times the amount of acres they would have occupied historically. This has been largely caused by long-term human occupancy and use of these lands for logging the high-value large-diameter timber and firewood gathering. In addition, fire exclusion has allowed these communities to progress from ofs to ofm due to greatly decreased frequency of light surface fires or underburns. Removal of the larger overstory trees thru logging has also contributed to an increase in shade tolerant species (i.e. Douglas-fir) in the much more prevalent multi-layered stands. Thus, these lower montane communities are currently very susceptible to stand-replacing fires and insect and disease-borne tree mortalities.

Family 2: Broad Elevation, Old Forest Family
Northern goshawk-summer (S), flammulated owl (S), fisher (S), American marten, yellow-bellied sapsucker, pileated woodpecker (MIS), brown creeper, ruby-crowned kinglet, Boreal owl (S), great gray owl (S), and three-toed woodpecker (S).

Primary source habitats for all species in Family 2 include late-seral multi- and single-layered stages of the montane community (PVT 52, 74 and 75) but some species also include late-seral stages of the subalpine community (PVT 66, 68, 69, 70 and 71) and/or the lower montane (PVT 133). Table B-1 displays the distribution of source habitat acres by PVT, cover type, and structural stage for each Group within Family 2.

Species in Group 5 of this family include northern goshawk-summer, flammulated owl, fisher, and American marten. Source habitat, within the analysis area, for the goshawk (summer) totals approximately 55,022 acres consisting of several structural stages of Douglas-fir, lodgepole pine, ponderosa pine, and cottonwood cover types. Of this total, approximately 50,539 acres are on lands administered by the FS, 1,951 acres by the BLM and 2,310 acres are in private ownership.

Source habitat within the analysis area for flammulated owl totals approximately 44,214 acres consisting of the above Douglas-fir, ponderosa pine and cottonwood acres plus conifer/mountain big sage and conifer/sedge/fescue cover types. Of this total, approximately 39,693 acres are on lands administered by the FS, 2,445 acres by the BLM and 1,924 acres are in private ownership.

Source habitat within the analysis area for American marten totals approximately 59,782 acres consisting of the same Douglas-fir and lodgepole pine acres as for the goshawk plus a variety of structural stages within whitebark pine and spruce/subalpine fir cover types. Of this total, approximately 56,725 acres are on lands administered by the FS, 1,697 acres by BLM and 1,344 acres are in private ownership.

Source habitat within the analysis area for the fisher totals approximately 52,167 acres consisting of the same Douglas-fir and lodgepole pine acres as for the goshawk. Of this total, approximately 49,172 acres are on lands administered by the FS, 1,690 acres by BLM and 1,289 acres are in private ownership.

Species in Group 6 of Family 2 include yellow-bellied sapsucker, pileated woodpecker, brown creeper and ruby-crowned kinglet. Source habitat within the analysis area for yellow-bellied sapsucker include the same Douglas-fir, ponderosa pine and cottonwood acres as for the goshawk. The total of approximately 38,212 acres consists of 33,951 acres FS, 1,951 acres BLM and 2,310 acres private.

Source habitat within the analysis area for pileated woodpecker totals approximately 43,265 acres consisting of the same Douglas-fir and ponderosa pine acres as for goshawk plus spruce/subalpine fir. Of this total, approximately 39,004 acres are administered by the FS, 1,951 by the BLM and 2,310 acres are in private ownership.

Source habitat within the analysis area for brown creeper totals 32,481 acres and is comprised of Douglas-fir and spruce/subalpine fir. Of this, total approximately 29,979 acres are administered by the FS, 1,474 acres by the BLM and 1,023 acres are in private ownership.

Source habitat within the analysis area for ruby-crowned kinglet totals approximately 38,220 acres consisting of the same spruce/subalpine fir, whitebark pine, Douglas-fir and lodgepole pine acres as for the American marten. Of this total, approximately 35,655 acres are administered by the FS, 1,474 acres by the BLM, and 1,085 acres are in private ownership.

The only species in Group 7 of Family 2 is the boreal owl. Source habitat within the analysis area for this species totals approximately 58,894 acres. With the exception of whitebark pine cover types, source habitats for this species are identical to those for the American marten.

The only species in Group 8 of Family 2 is the great gray owl. Source habitats within the analysis area total 74,423 acres, the most for any species in this family. Source habitats for this species are identical to those for the boreal owl plus the inclusion of spruce/subalpine fir, Douglas-fir and lodgepole pine stand initiation acres. Of the total, 70,958 acres are on lands administered by the FS, 1,819 acres are administered by BLM and 1,646 acres are in private ownership.

The three-toed woodpecker is the only species in Group 11 of Family 2. Source habitats within the analysis area total 16,108 acres, the least for any species in this family. Source habitats for this species include several structural stages of spruce/subalpine fir, whitebark pine, and lodgepole pine cover types. Of the total, 15,992 acres are on lands administered by the FS, 7 acres are on BLM lands and 109 acres are in private ownership.

Table 6-1 presented in Step 6 Recommendations, shows the distribution of structural stages for the historical range of variability (HRV), currently present, and desired future condition (DFC) for each potential vegetation type (PVT). The disparity between the estimated historical range of variability and the current is clearly shown affecting the majority of PVTs and structural stages important to species Groups in Family 2.

Source habitat trends for this family are considered to be predominantly neutral (Hann et al. 1997) with declines in the lower montane and ofs in both lower montane and montane roughly balancing the increases in ofm. Suppression of wildfires and timber harvest activities and techniques have all contributed to a shift from shade intolerant species to shade tolerant species in the lower montane, montane and subalpine communities. This is especially pronounced in the montane and subalpine communities where successional shifts occur more rapidly, thus the shift from ofs to ofm in many PVTs. Fire exclusion and the resulting stand replacing fires, along with insect and disease induced tree mortality in densely stocked stands is also causing shifts to mid- and early-seral forests in some areas. Nine of the species analyzed in Family 2 rely on snags, cavities and large down logs for nesting and/or foraging, commodities that decline as source habitats are roaded, logged and used for firewood gathering purposes.

Historically, the ponderosa pine PVT in the lower montane and to some extent the lower elevation Douglas-fir montane PVT source habitat for Family 2 communities would both have large diameter trees, snags and down logs. These features would have been abundant and well distributed and surface fires or underburns would have been very frequent occurrences.

In the reference condition, the montane communities comprising Douglas-fir/lodgepole source habitats would not have been fragmented by roads and timber harvest, and historical landscape patterns would have been intact.

Family 3: Forest Mosaic Family
Canada lynx (T) and wolverine (S)

Species within this family tend to be habitat generalists and source habitats generally include all structural stages of montane forest communities (PVT 52, 74 and 75), subalpine forest communities (PVT 66, 68, 69, 70, and 71), lower montane communities (PVT 133) and riparian woodland communities. Table B-2 displays the distribution of source habitat acres by PVT, cover type, and structural stage for each Group within Family 3.

Within this analysis area, source habitats for wolverine, a Group 15 species, total approximately 124, 899 acres. These acres are made up of several structural stages and cover types within the following PVTs: Douglas-fir (52); Dry Subalpine fir gentle and steep (66, 68); Moist Subalpine fir (69); Whitebark pine/subalpine fir (70); Subalpine fir/whitebark pine (71); and Douglas-fir/lodgepole pine gentle and steep (74, 75). Of this total, 117,179 acres are on lands administered by the FS, 3,371 acres are on BLM, 3,909 acres are privately owned and 380 acres are on State lands.

Source habitats for Canada lynx, a Group 16 species, total approximately 119,678 acres with 115,482 acres occurring on FS lands, 2,007 acres on BLM lands and 2,173 acres in private ownership. These acres are made up of several structural stages and cover types within the following PVTs: Dry Subalpine fir gentle and steep (66, 68); Moist Subalpine fir (69); Whitebark pine/subalpine fir (70); Subalpine fir/whitebark pine (71); and Douglas-fir/lodgepole pine gentle and steep (74, 75); Mountain Big sage/conifer (113); and Aspen (120). Map B-1 displays the Lynx Analysis Units within the assessment area.

Table 6-1 presented in Step 6 Recommendations, shows the distribution of structural stages for the historical range of variability (HRV), currently present, and desired future condition (DFC) for each potential vegetation type (PVT). The disparity between the estimated historical range of variability and the current is clearly shown, most notably with increases in the late and mid seral closed stages of old forest multi-strata (ofm), young forest multi-strata (yfm), and understory reinitiation (ur) with corresponding decreases in the late and early seral open stages of old forest single-strata (ofs), stem exclusion open (seo), and stand initiation (si).

Although forest habitats for this family do not generally show significant broad-scale changes from historical to current, there are noticeable changes in community structure, especially in early-seral forests. Current early and mid seral forests are largely management induced and lack the large snags, down logs and large emergent trees or clumps of trees that survived fire events (Hann et al. 1997). These changes are also currently evident in mid-seral patches, especially where roads associated with timber management activities facilitated the gathering of firewood. Snags and down logs are important habitat features for denning and/or foraging of both wolverine and lynx. The current condition of simplified, fragmented forest communities does not favor either of these species, both of which should be managed on a metapopulation basis in habitats that provide good, non-fragmented connectivity among existing populations.

Family 5: Forest and Range Mosaic Family
Bighorn sheep, elk, gray wolf (EXN), mule deer, and Rocky Mountain goat

Species in Family 5 use a very broad range of forest, woodland and rangeland source habitats, including all native plant community groups (Wisdom et al. 2000). Source habitats include all structural stages of all PVTs in the lower montane, montane, subalpine fire and whitebark pine communities plus upland woodland and rangeland communities. In addition, some species in this family require rock features such as talus and cliffs. Table B-3 displays the distribution of source habitat acres by PVT for each Group within Family 5.

Species in Group 19 of this family include gray wolf, elk, and mule deer. Source habitats for these species are the most general of all groups within this family and include all forested and non-forested native plant communities, as above. There is a total of approximately 197,130 acres of such habitats within the analysis area.

The overall or net trend for all these source habitats is roughly neutral (Wisdom et al. 2000), especially in the dry forest and cold forest groups where productivity is low and vegetative management options are limited. Declines have occurred in particular source habitats due to such factors as invasion of non-forested native plant communities by exotic and/or noxious weeds, fragmentation and simplification of forested habitats by timber management, and fire exclusion. Structural stage shifts in forested habitats has largely been towards mid and late seral closed structures with declines in early-seral and open structures. All species in this group are subject to human disturbance, displacement from suitable habitats and habitat fragmentation due to roading, vegetation manipulation and recreational development. This is especially evident in seasonally important habitats such as winter range and birthing/rearing areas. In addition, grazing by domestic livestock currently removes forage that would naturally be available to elk and mule deer, thus contributing to a decreased carrying capacity for these two species, both primary prey species for the gray wolf.

Historically, source habitats for this group of species would have been free from human disturbance and presence during all seasons of the year and human conflicts with species like the gray wolf would not have occurred. Forested communities would have been intact at the landscape scale and subject to natural fire regimes and non-forested communities would have been free of noxious weeds. There would have been no domestic livestock grazing and corresponding reduction of available forage on summer and winter ranges. Mountain mahogany stands and old single-strata forests would have been more abundant and would have supplied high quantities of forage, especially on elk and mule deer winter ranges. The reference condition of forested source habitats for these species would have varied by PVT but all would have consisted of more stand initiation (si) and old forest single-strata (ofs) and less stem exclusion closed (sec), understory reinitiation (ur), young forest multi-strata (yfm), and old forest multi-strata (ofm).

The mountain goat is the only species included in Group 20 for this family and the Rocky Mountain bighorn sheep is the only species in Group 22. Source habitats for both these species are similar in that they each require the presence of rock cliffs and talus for escape from predators plus adequate quantities of herbaceous and woody forage and browse. Where suitable rock escape cover is present, both species will use source habitats in lower montane, montane and subalpine communities during all or some portions of the year. Of particular importance are PVTs 133 and 52, especially old forest single-strata, for winter range forage and thermal cover requirements; PVTs 70 and 71, old forest single-strata, for summer ranges; PVTs 121 and 124 for winter and summer forage, respectively; and PVTs 101, 111, 112 and 113 for year-long forage. The current condition of the forested source habitats include a much higher prevalence of old forest multi-strata as fire exclusion has allowed succession to move stands out of the much more open single-strata condition. The multi-strata forests constitute a very real impediment to seasonal movements to and from summer and winter ranges, for both of these species. Also, the prevalence of noxious weeds in non-forested source habitats, particularly in PVTs 101, 111, 112 and 113, can potentially reduce available forage by over 90 percent when full infestation is reached. The rock component of the source habitats is largely intact, however, in some cases roads have been constructed in close proximity, thus greatly reducing the effectiveness of these escape or security areas.

Historically, frequent surface fires and underburns in the forested source habitats for these two species would have maintained more acres in open structures (i.e. precluded advancement to multi-strata structure) thus contributing to adequate forage and easy movement between seasonally important ranges. There would have been no roads or human disturbance and no loss of forage due to noxious weed infestations and/or livestock grazing.

Family 6: Forest, Woodland and Montane Shrub Family
Northern goshawk (winter) (S)

Source habitats for the northern goshawk (winter), the only member of Group 25 of Family 6, include all the same structural stages of all the same PVTs in the lower montane, montane, riparian woodland and upland shrubland terrestrial communities as those listed for the northern goshawk (summer) in Family 2, Group 5 (Wisdom et al. 2000) and are displayed on Table B-1. Current conditions, reference conditions, trends, causes of change, etc., are the same and will not be repeated here. In addition to those source habitats, wintering goshawks also use various PVTs in the upland woodlands terrestrial communities as source habitats, including limber pine and juniper/sagebrush. However, none of these additional PVTs are present in this analysis area. Therefore, this family will not be discussed further in this analysis.

Family 7: Forest, Woodland and Sagebrush Family
Bald eagle (T), Columbia spotted frog (MIS), harlequin duck (S), peregrine falcon (S), spotted bat (S), Townsend's big-eared bat (S), and yellow warbler (S)

Family 7 members, Groups 26, 27 and 28, use a mosaic of cover types and virtually all structural stages of PVT's within the montane (52, 74 and 75), lower montane (133), riparian woodlands (110 and 120), upland woodlands (none within the analysis area), upland shrublands (121, 109, 112, 113 and 118) and shrub wetlands (119) terrestrial communities. Table B-4 displays the distribution of source habitat structural stages by PVT for Family 7.

Within this analysis area there are a total of approximately 141,985 acres of source habitats for the various species in this family. Of this total, approximately 115,497 acres are on lands administered by the FS, 15,271 are on BLM lands, 890 acres on State lands, and 9,971 acres are in private ownership. Special habitat features required by members of this family include rock (talus, cliffs, caves and mines) for bats and large diameter trees and snags for bald eagle perching, roosting and nesting. Although the harlequin duck is in this family, it will not actually be included in the assessment because suitable habitat does not occur within the analysis area.

The current trend in source habitats for these species is approximately neutral due to the wide range of cover types and structural stages used by this family (Wisdom et al. 2000).

Although several forest structural stages, most notably ofs and si, are currently in decline, increases in mid-seral (ur and yfm) and old forest multi-layered (ofm) stands have occurred and continue to offer source habitats even though the mix does not approximate historic conditions. Large diameter trees and snags are in decline in virtually all roaded habitats and human presence and disturbance occurs during all times of the year, thus decreasing habitat values. Human disturbance of bat colonies in caves and mines and loss of mine habitat due to closures for safety reasons collectively decrease the quality and quantity of bat habitat, especially for species like the Townsend's big-eared bat. Human occupancy and use of the lower montane and riparian source habitats, especially in the Cottonwood (110) and Ponderosa Pine (133) PVTs, have reduced the quality of available bald eagle habitat. This is primarily reflected in both disturbance to nesting and/or wintering birds as well as decreases in large diameter trees and snags due to logging and firewood gathering. Riparian habitats for Columbia spotted frogs and yellow warblers are the site of concentrated livestock grazing during hot, dry portions of the year often resulting in changes in composition and vegetative structure in the source habitats for these species.

The reference conditions for source habitats for this family would have included a much more even distribution for structural stages in the various PVTs and a corresponding higher level of diversity in both patch composition and structure (Hann et al. 1997). These habitats would have been unroaded and free of human disturbance, large diameter trees and snags would have been present in natural numbers and distribution patterns domestic livestock would not have been present and riparian habitats would have been fully functioning . Although natural rock features would have been unaltered, no mine tunnels would have been available for bat use.

Family 8: Rangeland and Early- and Late-Seral Forest Family
Mountain bluebird

Source habitats for Family 8 consist of a unique combination of early-seral and late-seral single-strata lower montane and montane forests, riparian and upland woodlands, upland shrub and herblands and burned pine forests (Wisdom et al. 2000). Special habitat features include a mosaic of forested and open areas and the presence of snags, both large and small. The mountain bluebird, a member of Group 29, is the only species of this family that is of concern in the project area. Within this analysis area, source habitats for this family total approximately 68,559 acres including 38,850 acres of FS lands, 19,279 acres of lands administered by BLM, 1,173 acres of state lands and 9,155 acres of lands in private ownership. Table B-5 displays the distribution of source habitat structural stage acres by PVT for Group 29 in Family 8.

Current declines in source habitats for this species are widespread and are attributed to ecologically significant declines in early-seral (si) lower montane forests, late-seral single-strata (ofs) lower montane forests, upland shrublands and upland herblands (Hann et al. 1997). In this assessment area, ponderosa pine (PVT 133) currently only provides 30 acres of si and 298 acres of ofs source habitat. Douglas-fir and lodgepole pine cover types in the montane forests provide limited acres of si and only 4,000 acres of ofs. With the exception of the area burned by the Fenster Fire in 2000, snags, both large diameter and small diameter, are very scarce throughout the roaded portions of the analysis area due to firewood gathering and the proximity to the town of Salmon. Livestock grazing occurs in herbland and riparian communities and noxious weeds are currently well established in many portions of these source habitats.

The reference condition for source habitats for this family would have included much larger proportions of both si and ofs structural stages in PVTs 133, 52, 74, and 75. Snags would have been present in natural abundance and distribution patterns. Noxious weed infestations and the corresponding changes in ecological function of the herbland source habitats would not have been factors. No domestic livestock grazing would have occurred in any source habitats, especially riparian and herbland communities.

Family 10: Range Mosaic Family
Vesper sparrow

Source habitats for species in this family consist primarily of various cover types in the upland shrubland and herbland communities. In this analysis area, the vesper sparrow (member of Group 31) is the only species of concern for this family. Source habitats for this species include mountain mahogany and sagebrush cover types in the upland shrublands (PVTs 109, 112, 118 and 121) and fescue bunchgrass and native forb cover types in the upland herblands (PVT 111) for nesting and cover. A special habitat feature for vesper sparrows is the presence of a good grass/forb component in the upland shrublands community. Within the analysis area there are approximately 56,156 acres of source habitats for this species with 25,776 acres under FS administration, 20,623 acres of BLM, 1,173 acres of state lands and 8,485 acres in private ownership. Table B-6 displays the distribution of source habitat acres by PVT for Group 31 in Family 10.

Current declines in source habitats for this family are particularly evident in both the upland shrubland and herbland terrestrial communities due to conversion to agriculture on private lands, invasion by noxious weeds and cheatgrass, vegetative manipulation, fire exclusion and livestock grazing (Wisdom et al. 2000). Grazing in particular has contributed to a loss of diversity of both the herbaceous species and layers, a reduced canopy closure of grasses and a decrease of forb productivity in these communities. Historically, the functional integrity of these source habitats would have been intact, no weeds would have been present and grazing by domestic livestock would not have occurred.

Family 11: Sagebrush Family
Greater sage-grouse (MIS)

Source habitats for this family center around open and closed low-medium shrub stages of big sagebrush, low sage and mountain big sagebrush cover types for breeding and nesting cover (Wisdom et al. 2000). The sage grouse, a member of Group 33, is the only member of this family chosen for inclusion in this assessment area. A special habitat feature for this species is riparian meadows for brood-rearing. There are approximately

53,000 acres of sage grouse source habitats within the analysis area, most of which is located on the lower elevation BLM and private lands. Table B-7 displays the distribution of source habitat acres by PVT for Group 33 in Family 11.

Although the current source habitat trend for this family is neutral, actual habitat losses of approximately 15 percent have occurred due to agricultural conversion, vegetative manipulation for grazing purposes and invasion by noxious weeds and exotic vegetation (i.e. cheatgrass) (Wisdom et al. 2000). In this analysis area, livestock grazing has, in some areas, altered herbaceous understories and riparian meadows and contributed to noxious weed invasion. High road densities contribute to human presence and disturbance of sage grouse on their wintering and lekking areas and facilitates sport harvest and/or poaching.

The reference condition of source habitats for this species would have included no roads and human presence, no sport harvest or loss of individuals to poaching, no livestock use of herbaceous understories and riparian meadows and no changes in herbaceous communities due to vegetative type conversions or invasion of noxious and/or exotic species.

Table B-1. Family 2 Distribution of Source Habitats Between PVTs, Cover Types, and Structural Stages Among Groups 5, 6, 7, 8, and 11

Cover Type and (structural stage) by PVT	**Percent by struc-tural stage**	**Total Acres by Cover Type**	**Northern Goshawk Group 5**	**Flam-mulated Owl Group 5**	**Fisher Group 5**	**American Marten Group 5**	**Yellow bellied sapsucker Group 6**	**Pileated wood-pecker Group 6**	**Brown creeper Group 6**	**Ruby crowned kinglet Group 6**	**Boreal owl Group 7**	**Great gray owl Group 8**	**Three-toed woodpecker Group 11**
PVT 52; 26470 acres													
Douglas-fir (ofs)	14	26,425 acres	3758	3758	3758	3758	3758	3758	3758		3758	3758	
Douglas-fir (ofm)	56		14744	14744	14744	14744	14744	14744	14744	14744	14744	14744	
Douglas-fir (yfm)	15		3946	3946	3946	3946	3946	3946					
Douglas-fir (si)	9											2344	
PVT 66+68; 48,594 acres													
Douglas-fir (ofm)	41	66 acres	27	27	27	27	27	27	27	27	27	27	
Douglas-fir (yfm)	20		13	13	13	13	13	13	13	13	13	13	
Douglas-fir (si)	0											0	
Lodgepole pine (ofm)	16	41366 acres	6580		6580	6580				6580	6580	6580	6580
Lodgepole pine (yfm)	13		5256		5256	5256					5256	5256	
Lodgepole pine ((si)	11											4467	
Spruce/Subalpine fir (ofs)	0	5365 acres				0					0	0	
Spruce/Subalpine fir (ofm)	80					4305		4305	4305	4305	4305	4305	4305
Spruce/Subalpine fir (yfm)	5					272					272	272	
Spruce/Subalpine fir (si)	15											783	
PVT 69; 2058 acres													
Douglas-fir (ofm)	51	55 acres	28	28	28	28	28	28	28	28	28	28	
Douglas-fir (si)	0											0	
Lodgepole pine (ofm)	6	31 acres	2		2	2				2	2	2	2
Lodgepole pine (yfm)	65		20		20	20					20	20	
Spruce/Subalpine fir (ofs)	0	1908 acres				0					0	0	
Spruce/Subalpine fir (ofm)	95					1818		1818	1818	1818	1818	1818	1818
Spruce/Subalpine fir (yfm)	1					25						25	
Spruce/Subalpine fir (si)	3											63	
PVT 70; 507 acres													
Spruce/Subalpine fir	0	67 acres				0					0	0	
Spruce/Subalpine fir	0					0							
Spruce/Subalpine fir	40					27							
Spruce/Subalpine fir	0											0	
Whitebark pine (yfm)	95	435 acres				413							
Whitebark pine (ofs)	5					22							22
Lodgepole pine (yfm)	100	5 acres	5		5	5					5	5	

Table B-1 (continued)

Cover Type and (structural stage) by PVT	Percent by struc-tural stage	Total Acres by Cover Type	Northern Goshawk Group 5	Flam-mulated Owl Group 5	Fisher Group 5	American Marten Group 5	Yellow bellied sapsucker Group 6	Pileated wood-pecker Group 6	Brown creeper Group 6	Ruby crowned kinglet Group 6	Boreal owl Group 7	Great gray owl Group 8	Three-toed woodpecker Group 11
PVT 71; 1126 acres													
Spruce/Subalpine fir (yfm)	61	433 acres				262					262	262	
Spruce/Subalpine fir (ofs)	0					0					0	0	
Spruce/Subalpine fir (ofm)	16					70		70	70	70	70	70	70
Spruce/Subalpine fir (si)	0											0	
Whitebark pine (yfm)	79	436 acres				346							
Whitebark pine (ofm)	13					55							55
Lodgepole pine (si)	0	124 acres										0	
Lodgepole pine (yfm)	55		68		68	68					68	68	
Lodgepole pine (ofm)	9		11		11	11				11	11	11	11
PVT 74+75; 40119 acres													
Douglas-fir (si)	24	26459 acres										6410	
Douglas-fir (yfm)	22		5825	5825	5825	5825	5825	5825			5825	5825	
Douglas-fir (ofm)	28		7377	7377	7377	7377	7377	7377	7377	7377	7377	7377	
Douglas-fir (ofs)	1		341	341	341	341	341	341	341		341	341	
Lodgepole pine (si)	11	13118 acres										1437	
Lodgepole pine (yfm)	7		921		921	921					921	921	
Lodgepole pine (ofm)	25		3245		3245	3245				3245	3245	3245	3245
PVT 110; 4477 acres													
Cottonwood/conifer/Ken-tucky bluegrass (ofm)	100	1140 acres	1140				1140						
Conifer/Kentucky blue-grass (yfm)	95	752 acres	712	712									
PVT 111; 437 acres													
Sedge/fescue/conifer (si)	100	89 acres		89									
Conifer/sedge/fescue(yfm)	100	45 acres		45									
PVT 113; 19762 acres													
Mtn bigsage/conifer (si)	100	3659 acres		3659									
Conifer/Mtn bigsage (yfm)	100	2637 acres		2637									
PVT 133; 1057 acres													
Ponderosa pine (ofm)	52	1057 acres	550	550			550	550					
Ponderosa pine (ofs)	28		298	298			298	298					
Ponderosa pine (yfm)	16		165	165			165	165					
Total			55,023	44,214	52,167	59,782	38,212	43,265	32,481	38,220	58,894	74,423	16,108

Table B-2. Family 3 Distribution of Source Habitats Between PVTs, Cover Types, and Structural Stages Among Groups 15 and 16

Cover Type and (structural stage) by PVT	**Total Acres by Cover Type** **Errors due to rounding**	**Percent Structural Stage Present**	**Wolverine Group 15 (acres)**	**Canada lynx Group 16 (acres)**
PVT 52; 26740 acres				
Dry Douglas-fir (ofs)	26425 acres		3758	
Dry Douglas-fir (ofm)		56	14744	
Dry Douglas-fir (si)		9	2344	
Dry Douglas-fir (sec)		2	53	
Dry Douglas-fir (ur)		6	1581	
Dry Douglas-fir (yfm)		15	3946	
PVT 66+68; 48594 acres				
Douglas-fir (ofs)	66 acres	0	0	0
Douglas-fir (ofm)		41	27	27
Douglas-fir (yfm)		20	13	13
Douglas-fir (ur)		41	27	27
Douglas-fir (siI)		0	0	0
Douglas-fir (sec)		0	0	0
Lodgepole pine (ofm)	41366 acres	16	6580	6580
Lodgepole pine (yfm)		13	5256	5256
Lodgepole pine (siI)		11	4467	4467
Lodgepole pine (ur)		60	24842	24842
Lodgepole pine (sec)		1	220	220
Spruce/Subalpine fir (ofm)	5365 acres	80	4305	4305
Spruce/Subalpine fir (yfm)		5	272	272
Spruce/Subalpine fir (si)		15	783	783
Spruce/Subalpine fir (ur)		<1	6	6
PVT 69; 2058 acres				
Douglas-fir (ofm)	55 acres	51	28	28
Douglas-fir (ofs)		0	0	0
Douglas-fir (yfm)		0	0	0
Douglas-fir (sec)		0	0	0
Douglas-fir (si)		0	0	0
Douglas-fir (ur)		47	26	26
Lodgepole pine (ofm)	31 acres	6	2	2
Lodgepole pine (yfm)		65	20	20
Lodgepole pine (ur)		29	9	9
Lodgepole pine (sec)		0	0	0
Lodgepole pine (si)		0	0	0
Spruce/Subalpine fir (ofm)	1908 acres	95	1818	1818
Spruce/Subalpine fir (yfm)		1	25	25
Spruce/Subalpine fir (si)		3	63	63
Spruce/Subalpine fir (ur)		<1	1	1
PVT 70; 507 acres				
Lodgepole pine (yfm)	5 acres	100	5	5
Lodgepole pine (ofm)		0	0	0
Lodgepole pine (ur)		0	0	0
Lodgepole pine (sec)		0	0	0
Lodgepole pine (siI)		0	0	0
Whitebark pine (yfm)	435 acres	95	413	
Whitebark pine (ofs)		5	22	
Whitebark pine (ofm)		0	0	
Whitebark pine (ur)		0	0	
Spruce/Subalpine fir (ofm)	67 acres	0	0	0
Spruce/Subalpine fir (yfm)		40	27	27
Spruce/Subalpine fir (ur)		60	40	40

Spruce/Subalpine fir (SI)		0	0	0
Cover Type and (structural stage) by PVT	**Total Acres by Cover Type** **Errors due to rounding**	**Percent Structural Stage Present**	**Wolverine Group 15 (acres)**	**Canada lynx Group 16 (acres)**
PVT 71; 1126 acres				
Lodgepole pine (ofm)	124 acres	9	11	11
Lodgepole pine (yfm)		55	68	68
Lodgepole pine (ur)		37	46	46
Lodgepole pine (sec)		0	0	0
Lodgepole pine (si)		0	0	0
Whitebark pine (ofs)	436 acres	0	0	
Whitebark pine (ofm)		13	55	
Whitebark pine (yfm)		79	346	
Whitebark pine (ur)		8	34	
Spruce/Subalpine fir (ofm)	433 acres	16	70	70
Spruce/Subalpine fir (yfm)		61	262	262
Spruce/Subalpine fir (ur)		23	100	100
Spruce/Subalpine fir (si)		0	0	0
PVT 74+75; 40119 acres				
Douglas-fir (ofs)	26459 acres	1	341	341
Douglas-fir (ofm)		28	7377	7377
Douglas-fir (yfm)		22	5825	5825
Douglas-fir (siI)		24	6410	6410
Douglas-fir (ur)		23	6205	6205
Douglas-fir (sec)		1	302	302
Lodgepole pine (ofm)	13118 acres	25	3245	3245
Lodgepole pine (yfm)		7	921	921
Lodgepole pine (si)		11	1437	1437
Lodgepole pine (ur)		56	7405	7405
Lodgepole pine (sec)		1	111	111
PVT 113; 19762 acres				
Conifer/Mtn bigsage (si)	3659 acres	100		3659
PVT 120; 859 acres				
Aspen (si)	605 acres	2		10
Aspen (ur)		98		595
Barren-rock	8696 acres	99	8605	
Total			124,899	119,678

Table B-3. Family 5 Groups 19, 20, and 22 Distribution of Source Habitat by PVT.

Potential Vegetation Group Number and Name	Acres	Gray wolf, elk, and mule deer Group 19	Mountain goat Group 20[1]	Rocky Mtn big-horn sheep Group 22[1]
52-Dry Douglas-fir w/o Ponderosa Pine	26,740	X	X	X
66-Subalpine fir Dry-Gentle	46,865	X		
68-Subalpine fir Dry-Steep	1,729	X		
69-Subalpine fir Moist	2,058	X		
70-Whitebark pine/Subalpine fir	507	X	X	X
71-Subalpine fir/Whitebark pine	1,126	X	X	X
74-Douglas-fir/lodgepole pine-Gentle	39,994	X		
75-Douglas-fir/lodgepole pine-Steep	125	X		
101-Bunchgrass Grassland	2,263	X	X	X
109-Wyoming big sage	28,360	X		
110-Cottonwood	4,477	X		
111-Fescue Grassland	437	X	X	X
112-Mountain big sage	7,817	X	X	X
113-Mountain big sage with Conifer	19,762	X	X	X
118-Three-tip sage	3,704	X		
119-Riparian Shrub	279	X		
120-Aspen/Conifer	859	X		
121-Mountain mahogany	115	X	X	X
124-Riparian Graminoid	160	X	X	X
133-Ponderosa pine/Grassland	1,057	X	X	X
151-Irrigated Pasture	7,242			
154-Water	885			
155-Barren (rock)	8,696	X	X	X
Total	205,257	197,130	68,680	68,680
[1] source habitat could range throughout all PVTs; only primary source habitat PVTs are highlighted				

Table B-4. Family 7 Groups 26, 27, and 28 Distribution of Source Habitat Structural Stages by PVT.

Potential Vegetation Group Number and Name	Total Acres	% Distribution of current forested structural stages within PVTs (all cover types combined)							
		Acres	SI	SEO	SEC	UR	YFM	OFM	OFS
52-Dry Douglas-fir w/o Ponderosa Pine	26,740	26,426	9		<1	6	15	56	14
74-Douglas-fir/lodgepole pine-Gentle	39,994	39,453	20		1	34	17	27	<1
75-Douglas-fir/lodgepole pine-Steep	125	125	6			42	25	27	
109-Wyoming big sage	28,360								
110-Cottonwood	4,477	3,356			44	<1	21	34	<1
112-Mountain big sage	7,817								
113-Mountain big sage with Conifer	19,762								
118-Three-tip sage	3,704								
119-Riparian Shrub	279								
120-Aspen/Conifer	859	764	1			78		21	<1
121-Mountain mahogany	115								
133-Ponderosa pine/Grassland	1,057	1,057	2	1			16	52	28
155-Barren (rock)	8,696								
Total	141,985	71,181							

Table B-5. Family 8, Group 29 Distribution of Source Habitat Structural Stages by PVT

Potential Vegetation Group Number and Name	Acres	% Distribution of forested structural stages within PVTs (all cover types combined)			
		SI		OFS	
		acres	%	acres	%
52-Dry Douglas-fir w/o Ponderosa Pine	26,740	2344	9	3758	14
74-Doublas-fir/lodgepole pine-Gentle	39,994	7840	20	341	<1
75-Douglas-fir/lodgepole pine-Steep	125	7	6	0	0
101-Bunchgrass Grassland	2263				
110-Cottonwood	4,477	0	0	19	<1
111-Fesuce Grassland	437				
112-Mountain big sage	7,817				
113-Mountain big sage with Conifer	19,762				
118-Three-tip sage	3,704				
119-Riparian Shrub	279				
120-Aspen/Conifer	859	10	1	2	<1
121-Mountain mahogany	115				
124-Riparian Graminoid	160				
133-Ponderosa pine/Grassland	1,057	30	2	298	28
155-Barren (rock)	8,696				
Total	116,485				

Table B-6. Family 10, Group 31 Distribution of Source Habitat by PVT

Potential Vegetation Group Number and Name	Acres
101-Bunchgrass Grassland	2263
109-Wyoming big sage	28,360
111-Fesuce Grassland	437
112-Mountain big sage	7,817
113-Mountain big sage with Conifer (shrub and herbaceous cover types)	13,460
118-Three-tip sage	3,704
121-Mountain mahogany	115
Total	56,156

Table B-7. Family 11, Group 33 Distribution of Source Habitat by PVT

Potential Vegetation Group Number and Name	Acres
109-Wyoming big sage	28,360
112-Mountain big sage	7,817
113-Mountain big sage with Conifer (shrub cover types)	13,460
118-Three-tip sage	3,704
Total	53,341

Aquatic Species

Description of Current conditions (Step 3)

Overall aquatic habitat is good to very good (USDA Forest Service 1998) on the tributaries to the Salmon River on Forest Service land. Historic and current agricultural practices, grazing, channelization, road construction, and irrigation diversions have adversely affected habitat in and along the mainstem Salmon River. The tributary streams are most impacted by private land practices as well. These streams are generally high gradient; bedrock/boulder controlled channels for most of their length, and heavily wooded by willow, dogwood, aspen, and conifers. Irrigation diversions and seasonal dewatering have had the single biggest impact on aquatic species and their habitat within the study area.

Habitat in the mainstem Salmon River is primarily limited to migration, with limited capacity for rearing. Juvenile chinook salmon may migrate from the main river into cooler tributary streams during the summer. This would explain the presence of juvenile salmon in some tributaries that are not considered to have suitable spawning habitat. Chinook salmon are not known to spawn in the main Salmon River within the boundaries of the study area.

Table B-8. Subwatersheds, Streams, and Presence of Fish Species

Subwatershed	Streams	Chinook	Bull Trout	Steelhead	Sockeye	Westslope Cutthroat
Salmon-Wagonhammer (0506)	Dry Gulch	No	No	No	No	No
	Maxwell Gulch	No	No	No	No	No
	Bobcat Gulch	No	No	No	No	No
	Napoleon Gulch	No	No	No	No	No
	Comet Creek	No	No	No	No	No
Salmon-Wallace (0504)	Bird Creek	No	No	No	No	No
	Diamond Creek	No	No	No	No	No
	Wallace Creek	No	No	No	No	No
Salmon-Fenster (0404)	Deriar Creek	No			No	
	Fenster Creek	No			No	
	Bob Moore Creek	No			No	
Jesse Creek (0403)	Jesse Creek	No	Yes	No	No	No
	Turner Gulch	No	Unknown	No	No	Unknown
	Pollard Canyon	No			No	
	Chipps Creek	No			No	

Subwatershed	Streams	Chinook	Bull Trout	Steelhead	Sockeye	Westslope Cutthroat
Salmon-Perreau (0402)	Spring Creek	No	No	Rainbow	No	Unknown
	Gorley Cr	No	No	No	No	No
	Hot Springs Creek	No			No	
	Elf Creek	No			No	
	Tormay Creek	No	No	No	No	Unknown
	Perreau Creek	No	No	Rainbow	No	Yes
	West Fork	No	No	No	No	Unknown
Williams Creek (0401)	North Fork Williams Creek	No	No	No	No	Unknown
	Williams Creek	No	No	Yes	No	Yes
	South Fork Williams Creek	No	Yes	No	No	Yes
Salmon-Henry	Henry Creek				No	
Lake	Lake Creek	No	Yes	Rainbow	No	Yes
Twelvemile	Hot Springs Creek	No	No	No	No	No
	Hyde Creek	No			No	
	Sevenmile Creek	No	No	No	No	No
	Tenmile Creek	No	No	No	No	Unknown
	Elevenmile Creek	No			No	
	Twelvemile Creek	Potential	Yes	Rainbow	No	Yes
Arnett (1102)	Arnett Creek	No	Yes	Yes/1992	No	
	Rapps Creek	No			No	
	Gold Bug Gulch	No			No	
Upper Napias Creek (1101)	Camp Creek	No	Yes		No	
	Jefferson Creek	No			No	
	Napias Creek	No	Yes	No	No	
	Sawpit Creek	No		No	No	
	Smith Gulch	No	Yes	No	No	
	Sharkey Creek	No	Unknown		No	
Napias-Phelan (1103)	Rabbit Creek	No	Unknown		No	
	Pony Creek	No	Unknown		No	
	Cat Creek	No			No	
	Phelan Creek	No	Yes	Yes	No	
	South Fork Phelan Creek	No			No	
Lower Napias Creek (1104)	Mackinaw Creek	No			No	
	Napias Creek	Yes	Yes		No	
	Moccasin Creek	No	Yes	Yes/1992	No	

Twelvemile Creek Subwatershed

This subwatershed includes Twelvemile Creek and its tributaries. Juvenile chinook salmon were identified in the lowest reaches of Twelvemile Creek during snorkeling surveys in 1991, indicating that the culvert under Highway 93 is passable. Diversion structures on lower Twelvemile Creek below the Forest boundary present a migration barrier to fish.

Four miles of Twelvemile Creek are considered spawning and rearing habitat for anadromous species.

Limiting factors within the Twelvemile drainage include water diversion structures in the main creek below stream mile 1.4 that are a barrier to fish migration.

Salmon-Wallace Subwatershed

This subwatershed contains numerous small, face drainages, which empty directly into the Salmon River. No fish are present in any of the streams. There is limited private land within this sub-watershed and the dominant activity is livestock grazing on federal lands. All drainages are very narrow, short, and steep, with high gradients. The steep, rocky sideslopes in many cases prevents access to these streams by livestock. Riparian habitat and water quality are very good, potentially providing inputs on much cooler water to the mainstem Salmon River during the hot, dry summer months.

Wallace Creek contains no anadromous fish spawning or rearing habitat.

Williams Creek Subwatershed

Williams Creek may provide spawning and rearing habitat. It is dewatered in its lowest reaches during the irrigation season, but may still carry sufficient flow to be passable by anadromous fish during some years. Seven miles of Williams Creek are considered spawning and rearing habitat for anadromous species. Westslope cutthroat and rainbow trout have been documented in Williams Creek. Roads, agriculture and residential developments have all impacted stream conditions on Williams Creek. Limiting factors within the Williams Creek drainage include partial dewatering in lower Williams Creek as a probable low-flow barrier to fish passage and sediment within Williams Creek exceeds DFC standards.

Salmon-Perreau Subwatershed

This subwatershed has several perennial streams including Perreau, Elf, Tormay, Hot Springs, Spring, and Gorley Creeks. Only Perreau and Spring Creeks have known populations of fish present. Perreau Creek is not currently accessible to anadromous fish due to dewatering and rechanneliization at the mouth. No evidence exists of its original channel to the Salmon River. Perreau Creek has been modified by road construction up the valley bottom. Roads, agriculture and residential developments have all impacted stream conditions on Perreau and Spring Creeks. Rainbow trout have been documented in Perreau and Spring Creeks. Westslope cutthroat are also present in Perreau Creek.

Jesse Creek Subwatershed

Jesse Creek subwatershed includes Jesse Creek and its tributaries Pollard Canyon, Chipps Creek, and Turner Gulch. Stream gradients are steep, averaging 10.8%. Jesse Creek below the Forest

Boundary is blocked to fish migration by a culvert near its confluence with the Salmon River and by the city waterworks facilities approximately 1.5 miles above the mouth.

Salmon-Henry Subwatershed

Henry Creek has steep gradients, low water flows, and is dewatered for irrigation.

Lake Creek Subwatershed

Lake Creek below Williams Lake is steep and not suitable for anadromous fish habitat. A steep cascade and falls near the mouth of Lake Creek is a migration barrier. Approximately 1.5 miles above its confluence with the main Salmon River, fish migration in Lake Creek is completely blocked by natural earthen dam, which forms Williams Lake. Lake Creek above Williams Lake, within the boundaries of the Salmon National Forest, does not provide anadromous fish habitat.

Limiting factors within the Lake Creek drainage include gradients of 10 percent and higher limit habitat suitability to marginal rearing only.

Napias Creek

Located approximately 1.0 mile above the mouth of Napias Creek is the Napias Falls. Napias Creek above the falls was redesignated by NMFS as non-critical habitat for chinook salmon. Lower Napias Creek below the falls is a high gradient stream with minimal slow pools and no spawning habitat. It is likely that juvenile steelhead trout migrate up lower Napias Creek for thermal refuge in the summer.

Habitat Trend

Streams that were historically occupied have habitat conditions that limit fish presence. Human-caused migration barriers, such as culverts, irrigation diversions, and dewatering prevent migration of species. However, many streams which are accessible and which provide suitable spawning and/or rearing habitat are also unoccupied, because of the low numbers of returning adults.

Aquatic species of special Interest

Snake River Chinook salmon, Snake River steelhead trout, Columbia River bull trout, and westslope cutthroat trout are the species of special interest within the Salmon Interface Assessment Area. Distributions of salmonid species are shown in Table B-8 (Inland West 2001 Data Base).

Chinook Salmon Current Condition

The Snake River spring/summer chinook salmon populations are in poor condition and is on a downward trend toward extinction as is evident from the Federal listing under the Endangered Species Act as “Threatened”.

Some of the streams that were historically occupied now have human-caused migration barriers, such as culverts, irrigation diversions, and dewatering, that prevent anadromous species from using them. However, many streams that are accessible and that could provide suitable spawning and/or rearing habitat are also unoccupied because of the low numbers of returning adult spawners.

There are many opportunities for improvement in habitat conditions in the study area, but until greater numbers of adult spawners return and fragmentation problems are solved, populations will almost certainly continue to decline.

Chinook Salmon Trend

The complete historic distribution of chinook salmon in the study area is unknown. With little data available it is assumed there has been the same declining trend within the study area over the past 30 years that has occurred in the rest of the Middle Salmon-Panther Sub-basin.

Of those streams that are known to have provided habitat for chinook salmon in the past, most have not been occupied for many years. Napias Creek is assumed to have rearing juvenile to the barrier. Only Twelvemile Creek has confirmed observations of occupancy by spawning or rearing chinook salmon in recent years.

Steelhead Current Condition

Within Twelvemile Creek seasonal irrigation diversion structures exist that may be a physical barrier. Off-channel high quality habitat and refugia are impacted on in portions of the watershed that contain existing road in the valley bottom. Change in peak/base flow is impacted on the lowermost reaches by private irrigation practices.

Within Lake Creek sedimentation in spawning reaches above the lake does not meet standards. Volcanic parent material drops out in this low gradient reach forming a natural delta at the lake. Stream flow is impacted on the lowermost reaches by private irrigation practices.

Within Williams Creek private irrigation diversions may pose barriers to steelhead trout. Streams are seasonally dewatered. Road construction and channel modification on private lands have narrowed the riparian width and reduced the potential for large woody debris (LWD) input. Pool frequency and quality, off-channel habitat and refugia, width/depth ratios, streambank condition, and floodplain connectivity have all been affected due to roads, agriculture and residential development. Roads, agriculture, and residential development also have impacted changes in peak/base flows and riparian vegetation condition.

Steelhead Trends

The complete historic distribution of steelhead trout in the study area is unknown. With little data available it is assumed there has been the same declining trend within the study area over the past 30 years that has occurred in the rest of the Middle Salmon-Panther Sub-basin.

Bull Trout Current Condition

Within the Twelvemile Creek Watershed bull trout has a strong resident population for migratory form. The stream is not dewatered, but diversion structures may be barriers to migration. Twelvemile Creek is very stable with good riparian and aquatic habitats, supporting natural processes and healthy resident bull trout populations. Life history diversity and isolation is functioning at risk due to irrigation diversion structures, which may be barriers to migration within the Twelvemile Creek subwatershed. Off-channel habitat, floodplain connectivity, and refugia exists but high quality habitat is being impacted by the road along about a ½ mile of the valley bottom. Stream flow is impacted on the lowermost reaches by private irrigation practices.

Within the Lake Creek subwatershed Lake Creek is the only stream with bull trout. There are at least two distinct populations below the lake that are unable to interact with other populations due to a natural falls at the Salmon River and the dam at the lake. The other population is an adfluvial population with access to and from Williams Lake, but no access to the population below the lake. It is likely low oxygen levels impacted the lake population in the fall of 1998 which resulted in a large fish kill.

Homesites on the west side of the lake are thought to impact water quality within the lake, but impacts to bull trout are unknown. Overall, both reaches of Lake Creek are very stable systems supporting natural processes with little impact from federal actions.

Life history diversity and isolation is functioning at risk due to the two natural barriers which isolate the populations in Lake Creek.

Sedimentation in spawning reaches above the lake does not meet standards. Volcanic parent material drops out in this low gradient reach forming a natural delta at the lake.

Changes in peak/base flows exist in the lower reaches of Lake Creek due to private land irrigation practices.

Bull Trout Trend

Overall Bull Trout populations are expected to remain stable or improve due to changes such as restricted angling pressure and habitat improvements.

Snake River Sockeye Salmon Current Condition

There is no Snake River Sockeye Salmon Habitat within the Study Area. The Salmon River is used as a migration corridor to sockeye salmon.

Snake River Sockeye Salmon Trend

With little data available it is assumed there has been the same declining trend within the study area over the past 30 years that has occurred in the rest of the Middle Salmon-Panther Sub-basin.

Description of Reference Condition (Step 4)

Fish Distribution

The fish species assemblages that comprise the reference condition for watersheds within the Upper Columbia River Basin include chinook salmon, steelhead, bull trout, westslope cutthroat trout, and redband rainbow trout. These species populated virtually all suitable and accessible habitats throughout the Columbia River Basin. Their historic distributions within the Upper Columbia River Basin prior to the time of European settlement have been described within the document An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath Great Basin (Hann et al. 1997). For some species, these historical distributions are speculative and represent potential ranges rather than known historical occurrence. For other species, actual historical distributions may not have included all streams or reaches within their general ranges, but may have been limited by other physical or environmental factors. Table B-9 displays the estimated historical chinook habitat within the assessment area.

Streams of the historic or reference condition would have been expected to have cool, clear water year-round. Stream flows would have provided year-round connectivity within and between watersheds to allow unhindered fish migration opportunities and facilitate genetic interchange of salmonid populations. Sediment transport and stream substrate sediment levels would have been in general balance with relatively stable streamflow regimes, although occasional extreme flows related to rapid snowmelt or localized high intensity storms may have resulted in periods of elevated sediment levels or debris-choked streams.

Table B-9. Historic Chinook Habitat within the Assessment Area

Stream Name	Historic Habitat	Miles
Twelvemile Creek	Spawning and Rearing	4.0
Jesse Creek	Rearing	1.5
Williams Creek	Spawning and Rearing	7.0

Habitat Conditions

Habitat variables and indicators were used as reference benchmarks, potential, or desired conditions as identified as riparian management objectives (RMOs) described in PACFISH/INFISH.

- Bank Stability: >80% stability (PACFISH RMO).

- Surface Fines: <20% (<6 mm diameter) in low gradient riffles and tails of lateral scour pools (Region 4 designated RMO.

- Width-to-Max-Depth Ratio: <10 mean wetted width divided by mean depth (PACFISH RMO).

- Pool frequency- varies by channel width (PACFISH RMO)

wetted width in feet	10	20	25	50	75	100	125	150
number of pools/mile	96	56	47	26	23	18	14	12

Synthesis and Interpretation (Step 5)

Key Question: How have management practices influenced the historic distribution of key species and habitat within the watershed?

Anadromous and resident fish stocks have declined dramatically from historic numbers due to a variety of factors operating both within and outside the study area. All anadromous stocks and bull trout utilizing the study area have been listed under the Endangered Species Act.

Two major factors affecting the anadromous populations are the lack of adult spawner recruitment resulting from adult and juvenile mortality relating to passage at Columbia River basin hydroelectric facilities, which is outside the influence of the study area, and the availability and suitability of spawning and rearing habitat, which can be influenced within the study area.

Within the study area the flow regime of streams has been impacted by irrigation diversions that alter natural processes. Many of these areas are within the lower portions of the streams. Human-caused migration barriers, such as culverts, irrigation diversions, and dewatering also prevent migration of species.

There are many opportunities for improvement in habitat conditions in the study area, but until greater numbers of adult spawners return and fragmentation problems are solved, populations will almost certainly continue to decline.

Issue C. Changes in Riparian Health, Riparian Function, Hydrologic and Watershed Conditions, and Geomorphic Processes

Description of Current Conditions (Step 3)

I. Climate

Precipitation over the watershed area varies due to the influences of elevation, topography and latitude. Valley areas are often subject to rain shadow effect. This effect is most pronounced with winter storms traveling from the Pacific Ocean. High-elevation mountains and ridges release much of the moisture in the air arriving from the west. Valley precipitation is not affected to the same extent from high altitude storms of spring and early summer moving in from the south. A sharp reduction in mean monthly precipitation occurs in the summer (July through September); the combined total summer precipitation is less than the total for a single month in winter or spring.

The mean annual precipitation ranges from about 8.9 inches at Salmon, 20 inches near the Ridge Road and 21.65 inches at Cobalt. Snowfall, which constitutes the larger portion of precipitation at high elevations, occurs somewhat irregularly at the lower elevations, even in midwinter. Total annual snowfall ranges from less than 15 inches at lower elevations (less than 4,500 feet) to between 60 and 120 inches at intermediate elevations (5,000 to 8,000 feet) and greater than 125 inches at high elevations (greater than 8,000 feet). The average maximum accumulations are less than 15 inches at lower elevations and range from 60 to 90 inches at high elevations.

Disturbances to watersheds and stream channels within the watershed area are often a result of localized thunderstorms during the summer months. These storms build over the Salmon River Mountains and move east across the Salmon River valley and then are dissipated by orographic lifting along the Lemhi Range and Beaverhead Mountains. These storms are generally of moderate intensity and short duration contributing little to the total annual precipitation. When the intensity of these storms exceeds the infiltration capacity of the soil, mud-rock flows in gullies and along the steeper, less vegetated hillsides of the lower elevations are often the result.

Storms during the winter season are of Pacific Ocean origin which move eastward over the watershed area. Those rainstorms that occur in the spring and early summer are of local significance and may cause appreciable watershed damage over some areas, especially when the soil is still near saturation. In general, the soils of the watershed are susceptible to erosion and sedimentation from these types of storms. The exceptions are high elevation glaciated landforms in quartzite.

Elevation and aspect affect the rate and timing of snowmelt. Because the analysis area varies in elevation and aspect, snowmelt is not uniform. Snowmelt is a key factor influencing vegetation, timber productivity and runoff patterns. In the lower to intermediate zones (less than 8,000 feet) snow depths do not build up as deep on south-facing slopes as on the north-facing aspects at the same elevation level. This is due primarily to periodic melting throughout the winter and more direct solar radiation in the spring. The lower south facing slopes loose their snow before the peak snowmelt runoff and snow generally melts off south slopes two to three weeks earlier than on north slopes. Peak snowmelt runoff occurs during May and June. High-elevation alpine areas build up deep snowpacks, which persist into early July. Even after the snow leaves the north facing slopes the soils remain very cool. This is an important factor in the presence and growth of vegetation and fire characteristics of the area.

Average annual lake evaporation over the analysis area ranges from about 25 inches near Salmon and 20 inches near Cobalt to less than 15 inches above 7,000 feet. The potential evapotranspiration approaches these values on deeper soils where precipitation exceeds the estimated evaporation. On lower slopes actual evapotranspiration is estimated to be 65 to 75 percent of the potential on soils with an available water capacity of more than 6 inches, but about 55 to 60 percent of the potential on shallow soils. In the intermediate zone evapotranspiration is estimated to be 75 to 90 percent on deeper soils and 65 to 75 percent on shallow soils. At higher elevations where precipitation is abundant and temperatures cooler, the actual evapotranspiration approaches the potential.

Mean annual temperatures in the analysis area range from 44 F° at Salmon to less than 30° F near the Ridge Road. Lowest extremes range from -37° F at Salmon to -50° F near the Ridge Road, and -26° F at Cobalt, ignoring wind chill factors. Basins above 8,000 feet may have temperatures reaching -70° F. The highest temperature extremes range from 106° F at Salmon to 80° to 85 F near the Ridge Road, and 91° F. at Cobalt. The frost-free season, based on the period between the last 32° F temperature in the spring and first of the fall, averages 114 days at Salmon and about 20 to 30 days near the Ridge Road. The frost-free season is about 39 days at Cobalt.

II. Riparian Areas

Approximately 5800 acres of riparian areas occur within the analysis area, close to 80% of which is located on private land. Five major types of riparian areas have been identified. They are:

- Wet and semi-wet meadows vegetated with carex and other graminoid species. These typically occur near springs and seeps, and at high elevations forming the headwaters of streams.
- Riparian “stringers” vegetated with deciduous shrubs and trees such as willow and cottonwood species at lower elevations and alder and birch at higher elevations. This type of riparian area occurs along streams.
- Conifer riparian types vegetated with spruce and often an understory of Labrador tea, huckleberry, and other species of heath. These wetlands occur at high elevations, on glacial landforms in the Napias Creek Basin. The soils are cold and wet and shallow ponds are associated with these riparian types.
- Aspen stands occurring on moist soils, particularly in snow accumulation areas and on the fringes of wet meadows. Within the analysis area, aspen occurs primarily on volcanic soils with a high water-holding capacity.
- Cottonwood stands that may occur as narrow stringers along creeks or most typically on broad active or inactive floodplains along large streams or the Salmon River. Most of the cottonwood stands are located on private land.

Riparian condition varies throughout the analysis area depending on the location, the type of riparian area, soil characteristics, and impacts from livestock grazing, roads, and past mining activities.

III. Landforms / Hydrology / Stream Channels

Map 1-1 displays the general location and topographic characteristics of each subwatershed. Map C-1 is a coarse depiction of the Geology within the project area. Table C-1 displays the mean annual and mean monthly flows for major streams within the analysis area. Table C-2 displays the mean percent fine sediment measured on major spawning streams within the analysis area. Fine sediment is an indicator of water quality to support beneficial uses such as salmonid spawning. Characteristics of the individual subwatersheds are described below.

A. Subwatersheds draining to the Salmon River

Fluvial cutting in a dendritic drainage pattern is the dominant process shaping the landscape in all subwatersheds draining to the Salmon River.

Salmon-Wagonhammer (HUC 170602030506) The Salmon-Wagonhammer subwatershed is 10,565 acres. Major perennial streams include: Dry Gulch, Maxwell Gulch, Bobcat Gulch, Napoleon Gulch, and Comet Creek. Stream gradients are steep, ranging from 9 to 18 percent, with an average of 14 percent.

Mountain slopelands, steep canyonlands, and valley bottom (along the main Salmon River) are the dominant landforms within the subwatershed. The mountain slopelands formed primarily in quartzite parent materials and the steep canyonlands formed primarily in volcanic parent materials. The valley bottom is comprised of alluvium from mixed sources. Within the subwatershed, the inherent erosion hazard ratings are generally moderate for mountain slopelands, high for steep canyonlands, and low for the valley bottom.

The Salmon-Wagonhammer subwatershed has 19.4 miles of road within 16.5 square miles. The road density is 1.17 miles per square mile. There are no roads within Riparian Habitat Conservation Areas (RHCAs). Timber harvesting (equal to about 372 Equivalent Clearcut Acres [ECA]) has occurred on approximately 582 acres within the subwatershed during the past 30 years. About 3.5 percent of the subwatershed is in stands less than 30 years old (ECA = 3.5%). Livestock grazing also occurs within the subwatershed; a portion of the Diamond Moose Allotment is within the subwatershed and the entire Napoleon Gulch Allotment lies within the subwatershed but this allotment has been unallocated to grazing for several years.

Salmon-Wallace (HUC 170602030504) The Salmon-Wallace subwatershed is 14,827 acres. Major perennial streams include: Bird Creek, Diamond Creek, and Wallace Creek. Stream gradients are steep, ranging from 7 to 20 percent, with an average of 10.5 percent.

The dominant landforms within the subwatershed are mountain slopelands in quartzite, granite, and volcanic parent materials. Steep canyonlands formed from granite parent materials are identified along the lower reaches of Wallace Creek. Within the subwatershed, the inherent erosion hazard ratings are moderate for mountain slopelands formed in quartzite and moderate to high for mountain slopelands formed in both granite and volcanic parent materials. The inherent erosion hazard ratings are high to very high for steep canyonlands formed in granite.

The Salmon-Wallace subwatershed has 82.3 miles of road within 23.2 square miles. The road density is 3.5 miles per square mile. There are 5.55 miles of roads in RHCAs. Timber harvesting has occurred on approximately 2,694 acres within the subwatershed during the past 30 years. Fire has occurred on 1,594 acres, however not all of the vegetation was consumed by burning. The Equivalent Clearcut Acres of harvesting and burning is 2,581 acres. About 17 percent of the subwatershed is in stands less than 30 years old (ECA = 17%). The subwatershed encompasses a portion of the Diamond Moose grazing allotment.

Salmon-Fenster (HUC 171602030404) The Salmon-Fenster subwatershed is 13,847 acres. Major perennial streams include: Deriar Creek, Fenster Creek, and Bob Moore Creek. Stream gradients are steep ranging from 4 to 18 percent with an average of 11 percent.

The dominant landforms within the subwatershed are mountain slopelands in quartzite, granite, and volcanic parent materials. Steep canyonlands formed in quartzite are identified along Bob Moore Creek and steep canyonlands formed in granite parent materials are identified along both Fenster and Bob Moore creeks. Cirque lands formed in granite and cryic (cold) ridgelands formed in quartzite and granite are located in the heads of drainages along the western edge of the subwatershed.

The inherent erosion hazard ratings are moderate for mountain slopelands formed in quartzite and moderate to high for mountain slopelands formed in both granite and volcanic parent materials. The inherent erosion hazard ratings are high for steep canyonlands formed quartzite and high to very high for steep canyonlands formed in granite. Cirque lands have moderate to high inherent erosion hazard ratings and cryic ridgelands have low to moderate inherent erosion hazard ratings.

The Salmon-Fenster subwatershed has 65.6 miles of road within 21.6 square miles. The road density is 3.03 miles per square mile. There are 5.15 miles of roads in RHCAs. Timber harvesting (equal to 710 ECA) has occurred on 1,364 acres within the subwatershed during the past 30 years. About 5.1 percent of the subwatershed is in stands less than 30 years old (ECA = 5.1%). The subwatershed encompasses a portion of the Diamond Moose grazing allotment.

Jesse Creek (HUC 170602030403) The Jesse Creek subwatershed is 13,021 acres. Major perennial streams include: Jesse Creek, Turner Gulch, Pollard Canyon, and Chipps Creek. Stream gradients are steep ranging from 3 to 28 percent with an average of 10.8 percent.

The dominant landforms within the subwatershed are cryic ridgelands and glacial troughlands formed in quartzite in the western half of the subwatershed and mountain slopelands and steep canyonlands in quartzite in the eastern half. These landforms comprise about 85 percent of the subwatershed. The inherent erosion hazard ratings are low to moderate for cryic ridgelands and glacial troughlands, moderate to high for mountain slopelands, and high for steep canyonlands.

The Jesse Creek subwatershed has 18.7 miles of road within 20.3 square miles. The road density is .92 mile per square mile. There are 3.11 miles of roads in RHCAs. Timber harvesting has occurred on approximately 3.3 acres within the subwatershed. About 8.1 acres have burned and 44.5 acres have been cleared as a fuel-break. The Equivalent Clearcut Acres of timber harvest, burned area, and fuel break is 83.5 acres. Less than one percent (0.64 percent) of the subwatershed is in stands less than 30 years old (ECA = .64%). The Jesse Creek subwatershed is the municipal water supply for the city of Salmon. The subwatershed is not grazed.

Salmon-Perreau (HUC 170602030402) The Salmon-Perreau subwatershed is 36,896 acres. Major perennial streams include: Gorley Creek, Spring Creek, Hot Springs Creek, Elk Creek, Tormay Creek, Perreau Creek, and West Fork. Stream gradients range from 2 to 11 percent with an average of 5.1 percent.

The dominant landforms within the subwatershed are cryic ridgelands, mountain slopelands, and steep canyonlands in quartzite and volcanic parent materials; and benchy mountain slopelands and dissected foothills in volcanic parent materials. Landforms derived from volcanic parent materials are primarily along the southern and eastern boundaries of the subwatershed.

The inherent erosion hazard ratings are low to moderate for cryic ridgelands in both quartzite and volcanic parent materials, moderate for mountain slopelands in quartzite and moderate to high for mountain slopelands in volcanic parent materials. Steep canyonlands in quartzite and volcanic parent materials have high inherent erosion hazard ratings. Benchy mountain slopelands and dissected foothills in volcanic parent materials have moderate to high inherent erosion hazard ratings. Benchy mountain slopelands in volcanic parent materials have a moderate slump hazard rating.

The Salmon-Perreau subwatershed has 98.25 miles of road within 57.6 square miles. The road density is 1.7 miles per square mile. There are 15.81 miles of roads in RHCAs. Timber harvesting has occurred on approximately 486 acres within the subwatershed during the past 30 years. About 8 acres have been cleared as a fuel break. The Equivalent Clearcut Acres of timber harvest, burned area, and fuel break is 677 acres. About 1.8 percent of the subwatershed is in stands less than 30 years old (ECA = 1.8%). The subwatershed encompasses a portion of the Williams Basin-Napias Creek Allotment.

Williams Creek (HUC 170602030401) The Williams Creek subwatershed is 18,055 acres. Major perennial streams include: North Fork Williams Creek, Williams Creek, and South Fork Williams Creek. Stream gradients range from 3 to 15 percent with an average of 7.9 percent.

The western one-third of the subwatershed is comprised of landforms derived from quartzite parent materials. Cryic ridgelands, cirque lands, glacial troughlands, and steep canyonlands are the dominant landforms. The eastern two-thirds of the subwatershed are comprised of landforms derived from volcanic parent materials. Benchy moraine lands, mountain slopelands, and benchy slopelands are the dominant landforms.

The inherent erosion hazard ratings are low to moderate for cryic ridgelands, cirque lands, and glacial troughlands, and high for steep canyonlands. The inherent erosion hazard ratings are moderate to high for benchy moraine lands and mountain slopelands. Benchy slopelands in volcanic parent materials have low to moderate inherent erosion hazard ratings and a moderate slump hazard rating; benchy moraine lands in volcanic materials have a moderate to high slump hazard rating.

The Williams Creek subwatershed has 57.59 miles of road within 28.2 square miles. The road density is 2.04 miles per square mile. There are 12.43 miles of roads in RHCAs. Timber harvesting has occurred on approximately 569 acres within the subwatershed during the past 30 years. Fire has occurred on 3,819 acres. The Equivalent Clearcut Acres of harvesting and burning is 4,177 acres. About 23 percent of the subwatershed is in stands less than 30 years old (ECA = 23%). The subwatershed encompasses the South Fork Williams Creek Allotment and a portion of the Williams Basin-Napias Creek Allotment.

Salmon-Henry (HUC 170602030305) The Salmon-Henry subwatershed is 14,698 acres. Henry Creek is the only major perennial stream. Stream gradients in the Salmon-Henry subwatershed are estimated to have an average of 12 percent.

The dominant landforms within the subwatershed are mountain slopelands and steep canyonlands in quartzite and volcanic parent materials and dissected foothills in volcanic parent materials.

The inherent erosion hazard ratings are moderate for mountain slopelands in quartzite and moderate to high for mountain slopelands in volcanic parent materials. Steep canyonlands in quartzite and volcanic parent materials both have high inherent erosion hazard ratings. The inherent erosion hazard ratings for dissected foothills in volcanic parent materials are moderate to high.

The Salmon-Henry subwatershed has 19.83 miles of road within 22.9 square miles. The road density is .86 mile per square mile. There are 5.36 miles of roads in RHCAs. The Equivalent Clearcut Acres of burned area is 844 acres. About 5.7 percent of the subwatershed is in stands less than 30 years old (ECA = 5.7%). The subwatershed encompasses the Tenmile, Henry Creek (BLM) and Lake Creek (BLM) allotments.

Lake Creek (HUC 170602030303) The Lake Creek subwatershed is 12,913 acres. Lake Creek is the only major perennial stream.

The western one-third of the subwatershed is comprised of cryic ridgelands, cirque lands, and glacial troughlands formed in quartzite parent materials. The eastern two-thirds of the subwatershed are comprised of cryic ridgelands, mountain slopelands, and benchy mountain slopelands in from volcanic parent materials.

The inherent erosion hazard ratings are low to moderate for cryic ridgelands, cirque lands, and glacial troughlands formed in quartzite parent materials and moderate to high for cryic ridgelands, mountain slopelands, and benchy mountain slopelands formed in volcanic parent materials. Benchy mountain slopelands in volcanic parent materials have a moderate slump hazard rating.

The Lake Creek subwatershed has 38.46 miles of roads within 20.2 square miles. The road density is 1.9 miles per square mile. There are 3.93 miles of roads in RHCAs. Timber harvesting has occurred on approximately 1,342 acres within the subwatershed during the past 30 years. Fire has occurred on 77 acres, however not all of the vegetation was consumed by burning. The Equivalent Clearcut Acres of harvesting and burning is 1,084 acres. About 8.4 percent of the subwatershed is in stands less than 30 years old (ECA = 8.4%). The subwatershed encompasses the Lake Creek grazing allotment and a portion of the Deer-Iron Creek Allotment.

Twelvemile Creek (HUC 170602030304) The Twelvemile Creek subwatershed is 14,267 acres. Major perennial streams include: Hot Springs Creek, Hyde Creek, Sevenmile Creek, Tenmile Creek, Elevenmile Creek, and Twelvemile Creek. Stream gradients in the Lake Creek subwatershed are estimated to have an average of 6 percent.

Mountain slopelands formed in quartzite are the dominant landforms, comprising about 40 percent of the subwatershed. The other major landforms are cryic ridgelands in quartzite, steep canyonlands in quartzite, and mountain slopelands formed in volcanic parent materials.

The inherent erosion hazard ratings are moderate for mountain slopelands in quartzite, low to moderate for cryic ridgelands in quartzite, and high for steep canyonlands in quartzite. The inherent erosion hazard ratings are moderate to high for mountain slopelands in volcanic parent materials.

The Twelvemile Creek subwatershed has 50.49 miles of road within 22.3 square miles. The road density is 2.26 miles per square mile. There are 10.17 miles of roads in RHCAs. Timber harvesting has occurred on approximately 1,729 acres within the subwatershed during the past 30 years. Fire has occurred on 123 acres. The Equivalent Clearcut Acres of harvesting and burning is 928 acres. About 6.5 percent of the subwatershed is in stands less than 30 years old (ECA = 6.5%). The subwatershed encompasses the entire Twelvemile Creek Allotment.

B. Subwatersheds draining to Panther Creek

Glaciation was the dominant process shaping the landscape in the Napias Creek watershed. This is apparent in all subwatersheds except Lower Napias Creek, where fluvial action was the major process. The glaciation that occurred in the basin was more typical of sheet glaciers than alpine glaciation. Geomorphic features such as glacial troughs and cirques are weakly expressed in the heads of Camp and Rapps creeks. The drainage pattern that evolved was influenced by the presence of the glacier more so than by structural and bedrock weakness.

Upper Napias Creek (HUC 170602031101) The Upper Napias subwatershed is 13,962 acres. Major perennial streams within this watershed include: Camp Creek, Jefferson

Creek, Napias Creek, Sawpit Creek, Smith Gulch, and Sharkey Creek. Stream gradients range from 2 to 12 percent with an average of 6 percent.

The dominant landforms within the subwatershed are cryic ridgelands in quartzite, granite, and volcanic parent materials, and cirque lands and glacial troughlands in quartzite parent materials. The inherent erosion hazard ratings are low to moderate for all landforms in the subwatershed.

The Upper Napias Creek subwatershed has 26.9 miles of road within 21.8 square miles. The road density is 1.23 miles per square mile. There are 4.76 miles of roads in RHCAs. Timber harvesting has occurred on approximately 840 acres within the subwatershed during the past 30 years. Wildfire has burned 1,403 acres. About 15 acres have been cleared for fuel break and 43 acres have been cleared for power line right-of-way. Mining has occurred on approximately 655 acres. The Equivalent Clearcut Acres of harvesting, burning, clearing, and mining is 2,129 acres. About 15 percent of the subwatershed is in stands less than 30 years old (ECA = 15%). The subwatershed encompasses portions of the Diamond Moose and Williams Basin- Napias Creek allotments.

Arnett Creek (HUC 170602031102) The Arnett subwatershed is 12,099 acres. Major perennial streams within this subwatershed include: Arnett Creek, Rapps Creek, and Gold Bug Gulch. Stream gradients range from 2 to 8 percent with an average of 4.2 percent.

The dominant landforms within the subwatershed are cryic ridgelands and mountain slopelands in quartzite and granite parent materials, and cirque lands and glacial troughlands in quartzite parent materials.

The inherent erosion hazard ratings are low to moderate for cryic ridgelands, cirque lands, and glacial troughlands in quartzite and granite parent materials, moderate for mountain slopelands in quartzite, and moderate to high for mountain slopelands in granite parent materials.

The Arnett Creek subwatershed has 39.76 miles of road within 18.9 square miles. The road density is 2.1 miles per square mile. There are 7.32 miles of roads in RHCAs. Timber harvesting has occurred on approximately 568 acres within the subwatershed during the past 30 years. Wildfire has burned 4,175 acres. About 21 acres have been cleared for fuel break and 2 acres have been cleared for power line right-of-way. Mining has occurred on approximately 60 acres. The Equivalent Clearcut Acres of harvesting, burning, clearing, and mining is 4,124 acres. About 34 percent of the subwatershed is in stands less than 30 years old (ECA = 34%). The subwatershed encompasses part of the Williams Basin- Napias Creek Allotment.

Napias-Phelan (HUC 170602031103) The Napias-Phelan subwatershed is 19,008 acres. Major perennial streams within this watershed include: Rabbit Creek, Pony Creek, Cat Creek, Phelan Creek, and South Fork Phelan Creek. Stream gradients range from 3 to 12 percent with an average of 7.9 percent.

The dominant landforms within the subwatershed are cryic ridgelands and mountain slopelands formed in quartzite and volcanic parent materials, and steep canyonlands and benchy mountain slopelands formed in volcanic parent materials.

The inherent erosion hazard ratings are low to moderate for cryic ridgelands formed in quartzite parent materials, moderate for mountain slopelands formed in quartzite parent materials, moderate to high for cryic ridgelands, mountain slopelands, and benchy mountain slopelands formed in volcanic parent materials, and high for steep canyonlands formed in volcanic parent materials. Benchy mountain slopelands in volcanic parent materials have a moderate slump hazard rating.

The Napias-Phelan subwatershed has 57.8 miles of road within 29.7 square miles. The road density is 1.9 miles per square mile. There are 6.95 miles of roads in RHCAs. Timber harvesting has occurred on approximately 1,608 acres within the subwatershed during the past 30 years. Wildfire has occurred on 141 acres, however not all of the vegetation was consumed by burning. About 97 acres have been cleared for fuel break and 26 acres have been cleared for power line right-of-way. The Equivalent Clearcut Acres of harvesting, burning, and clearing is 1,433 acres. About 7.5 percent of the subwatershed is in stands less than 30 years old (ECA = 7.5%). The subwatershed encompasses part of the Williams Basin-Napias Creek Allotment.

Lower Napias Creek (HUC 170602031104) The Lower Napias Creek subwatershed is 11,318 acres. Major perennial streams within this watershed include: Mackinaw Creek, Napias Creek, and Moccasin Creek. Stream reach gradients are fairly gentle (2-3 percent) with a few steep reaches up to 25 percent and an average gradient of 6.5. Fluvial cutting in a dendritic drainage pattern is the major land shaping geologic force. The drainage pattern is cut in to what may have been a relatively level surface evidenced by ridges which are at nearly the same elevation of 7000 feet.

The dominant landforms within the subwatershed are cryic ridgelands and mountain slopelands in granite, quartzite, and volcanic parent materials.

The inherent erosion hazard ratings are low to moderate for cryic ridgelands in quartzite, granite and volcanic parent materials. The inherent erosion hazard ratings are moderate for mountain slopelands formed in quartzite and moderate to high for mountain slopelands formed in both granite and volcanic parent materials.

The Lower Napias Creek subwatershed has 48.5 miles of road within 17.7 square miles. The road density is 2.7 miles per square mile. There are 12.81 miles of roads in RHCAs. Timber harvesting has occurred on approximately 1,454 acres within the subwatershed during the past 30 years. Wildfire has occurred on 1,375 acres, however not all of the vegetation was consumed by burning. About 9 acres have been cleared for fuel break and 14 acres have been cleared for power line right-of-way. The Equivalent Clearcut Acres of harvesting, burning, and clearing is 2,372 acres. About 21 percent of the subwatershed is in stands less than 30 years old (ECA = 21%). The subwatershed encompasses part of the Williams Basin-Napias Creek Allotment.

Table C-1. Mean Annual and Mean Monthly Streamflows (Cubic Feet per Second)

Stream Name	**Mean Annual**	**Mean Monthly (cfs)**											
		Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Wallace Cr.	3.1	1.0	1.0	2.2	9.0	12.4	3.9	1.7	1.3	1.3	1.2	1.1	1.0
Jesse Cr.	5.0	1.6	1.6	1.7	3.6	14.6	20.1	6.3	2.7	2.1	2.1	1.9	1.7
Hot Springs Cr.	1.3	0.4	0.4	0.4	0.9	3.6	5.0	1.6	0.7	0.5	0.5	0.5	0.4
Perreau Cr.	4.5	1.4	1.4	1.6	3.2	13.0	17.9	5.6	2.4	1.9	1.8	1.7	1.5
Williams Cr.	9.9	3.2	3.1	3.5	7.2	29.2	40.1	12.5	5.4	4.3	4.1	3.8	3.4
S.F. Williams Cr.	4.0	1.3	1.3	1.4	2.9	11.7	16.1	5.0	2.2	1.7	1.7	1.5	1.4
Lake Cr.	6.7	2.1	2.1	2.3	4.9	19.7	27.0	8.5	3.6	2.9	2.8	2.6	2.3
Twelvemile Cr.	8.2	2.6	2.6	2.9	5.9	23.9	32.9	10.3	4.4	3.5	3.4	3.1	2.8
Arnett Cr.	11.0	3.5	3.5	3.8	8.0	32.3	44.3	19.9	6.0	4.7	4.6	4.2	3.8
Camp Cr.	2.9	0.9	0.9	1.0	2.1	8.3	11.4	3.6	1.5	1.2	1.2	1.1	1.0
Jefferson Cr.	1.1	0.4	0.4	0.4	0.8	3.3	4.5	1.4	0.6	0.5	0.5	0.4	0.4
Napias Cr.	10.7	3.4	3.3	3.7	7.7	31.1	42.7	13.4	5.8	4.6	4.4	4.0	3.7
Sharkey Cr.	1.9	0.6	0.6	0.7	1.4	5.6	7.7	2.4	1.0	0.8	0.8	0.7	0.7
Rabbit Cr.	1.8	0.6	0.6	0.6	1.3	5.2	7.2	2.2	1.0	0.8	0.7	0.7	0.6
Phelan Cr.	8.0	2.5	2.5	2.8	5.8	23.4	32.1	10.0	4.3	3.4	3.3	3.0	2.7
Moccasin Cr.	5.1	1.6	1.6	1.8	3.7	14.8	20.4	6.4	2.7	2.2	2.1	1.9	1.7

Table C-2. Mean Annual Percent Fines Measured on Major Spawning Streams

Subwatershed	**Stream Name**	**Mean % Fines**									
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Arnett Cr.	Arnett Cr.	19.2		21.7	15.1	13.1	12.0	22.2	23.5	10.8	24.2
Jesse Cr.	Jesse Cr.	19.7	33.5				22.6		20.1		10.5
Lake Cr.	Lake Cr. 1	42.7	52	53.8	39.7	50	44.6	35.9		29.8	38.6
Lake Cr.	Lake Cr. 2							28.9		45	
Lower-Napias	Napias Cr. 1	31.4		31.5	37.1	46.5	34.9	31.0	36.2	28.6	32.5
Lower-Napias	Napias Cr. 2	22.5		23.3	27.1	13.1	24.4	25.8	28.8	29.4	28.2
Upper-Napias	Napias Cr. 3	29.2		34.1	23.1	26.5	24.3	33.2	32.9	22.7	28.0
Upper-Napias	Napias Cr. 4	21.1		22.1	18.3	18.9	19.4	21.0	23.6	17.3	16.9
Upper-Napias	Napias Cr. 5	41.5		32.5	24.9	24.9	27.1	20.2	35.7	26.9	30.4
Salmon-Perreau	Perreau Cr.	22.9	20.5	19					7.9	3.5	9.4
Napias-Phelan	Phelan Cr.	34.8			24.7	33.0	23.8	15.8	35.6		29.5
Twelvemile Cr.	Twelvemile Cr.	19.6	29.4		26.9		12.6				17.9
Williams Cr.	Williams Cr.	34.1	24.8	16.1	20.6	14.6	6.6	14.4	17.0	10.7	18.8

V. Water Quality

The state of Idaho has identified Williams Lake and Diamond Creek (from the headwaters to the Salmon River), as a water quality limited water body and a water quality limited stream segment, according to Section 303d of the Clean Water Act. Williams Lake is identified for excessive nutrients and Diamond Creek is identified for an unknown contaminant.

Jesse Creek is designated as a municipal watershed.

The remaining streams have not been designated by the state of Idaho. The beneficial uses of water within the analysis area are for cold water biota, salmonid spawning, primary and secondary contact recreation, and agricultural water supply. Agricultural water supply includes water for irrigation and livestock watering.

Description of Reference Conditions (Step 4)

I. Erosion Processes-Natural Disturbances and their affect on erosion processes

The reference condition is intended to reflect ecosystem conditions prior to influences by Euroamericans and provides a reference for comparing current conditions and the desired condition.

The landforms and soils within the watershed analysis area have formed over millions of years and have been subject to many geologic and climatic changes. The historic condition of the analysis area is characterized by massive changes over geologic time.

Quartzite parent materials are the oldest rocks in the analysis area and formed during the Proterozoic period 2,500 million years ago. Granite parent materials of the Idaho batholith then intruded into the area about 65 million years ago during the Cretaceous period. About 58 million years ago, during the Eocene period, the Challis volcanic rocks erupted from shallow granites. The area was then subjected to massive climatic changes. The climate was warm and wet during the Oligocene period 37 million years ago. Plant remnants of this period are preserved as fossils and evidence of ancient sequoia forests have been identified in volcanic rocks in the Salmon-Perreau subwatershed. A desert climate existed during the early Pleistocene, about 3 million years ago, and at the end of this period modern streams began to flow throughout the analysis area. Two ice ages then followed. The earlier ice age was about 70,000 to 300,000 years ago, and the latest ice age ended about 10,000 years ago. Remnants of glacial features formed during this period are still apparent in the Upper Napias and Napias-Phelan subwatersheds.
The reference condition of the watershed reflects the time period before the influence of Euroamericans began in the early 1800s. Over the past 200 years the climate has been much the same as it is now. There have been periods of drought, wet cycles, years with unusually cold temperatures, as well as years with heat waves and warmer than normal temperatures. Despite these fluctuations, the climate has been relatively stable over the past two centuries and changes occur within a relatively predictable range. Human activities within the watershed have not had a direct affect on climate within the analysis area, although human activities worldwide are affecting climatic phenomena such as acid rain and global warming.

Hillslope and erosion processes in the watershed before the 1800s were affected primarily by climatic fluctuations such as drought, high precipitation and runoff events, and natural disturbances, particularly wildfire. Depending on the magnitude of a climatic event or natural disturbance, the effects on hillslope processes may have been significant.

Steep, highly dissected landforms on Challis Volcanics with high erosion and mass failure potential have been prone to slump-earth flows for thousands of years. Evidence of ancient mass failures is still apparent on the landscape today in the Williams Creek, Salmon-Perreau, and Salmon-Fenster subwatersheds. The most dramatic is the ancient landslide that dammed a valley and created Williams Lake. Modern day landslides still occur on these landforms, particularly in areas that have been converted to agricultural and have been over-irrigated, triggering mass failures. These have occurred mostly on private lands in the Williams Creek, Salmon-Perreau, and Salmon-Fenster subwatersheds.

The highest peaks within the analysis area are on stable quartzite landforms which are more resistant to weathering and erosion than the granite or volcanic landforms.

In summary, before the influence of human activity, the landscape and erosion and hillslope processes in the analysis area were continually adjusting to changes caused by climate and natural disturbance. Catastrophic changes due to massive geologic and climatic events that occurred millions of years ago are still apparent on the landscape today.

II. Riparian Areas

Reference condition for riparian areas is generally considered to be properly functioning condition (PFC), however, not all stream reaches within a drainage are expected to be in PFC at any particular point in time due to natural disturbances, such as fire.

The reference condition of wetlands and riparian areas can be described using the definition of “Properly Functioning Condition” (USDI, BLM, 1993). Riparian-wetland areas are functioning properly when adequate vegetation, landform or large woody debris is present to dissipate energy associated high waterflows, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid floodplain development; improve flood-water retention and ground-water recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation. Although this definition and the methodology to assess riparian condition were developed by the Bureau of Land Management, they were adopted by the Forest Service in 1996, for use in assessing proper functioning condition of riparian areas.

III. Hydrology / Stream Channels / Water Quality

The drainage pattern and most surface hydrology features within the analysis area are assumed to have been very similar during the reference period as they are today. The exceptions are stream channels that have been affected by placer and hydraulic mining and wetlands and riparian areas that have been impacted by roads and livestock grazing. Wetlands and riparian areas would have had uncompacted soils with high water-holding capacity capable of capturing, storing, and releasing water from high flow events and surface rain and melting snow.

The reference condition of streams is again associated with functionality where natural channel stability is achieved by allowing the stream to develop a stable dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades. A stable stream has the ability to consistently transport its sediment load, both in size and type, associated with local deposition and scour (Rosgen). This means that the floodplain is inundated in relatively frequent events; the stream has sinuosity, width/depth ratio, and gradient that is in balance with the landscape setting. Floodplain characteristics are adequate to dissipate energy, point bars are revegetating, lateral stream movement is associated with natural sinuosity, the system is vertically stable, and the stream is in balance with the water and sediment being supplied by the watershed (there is no excessive erosion or deposition).

The reference condition for water quality is not known. It can be assumed, however, that waters were not affected by human activities. This does not mean that waters were free of sediments or naturally occurring pollutants but were of sufficient quality to support historical uses such as salmonid spawning and cold water biota.

Synthesis and Interpretation (Step 5)

I. Key question #1: Does an increased risk of severe wildfire exist, and if so, what is the potential for adverse impacts to soil and water resources?

An increased risk for severe wildfire exists in all subwatersheds in the analysis area. The potential for adverse impacts to soil and water resources is greatest on landforms that have high inherent erosion hazard in combination with a high fire risk. Lower Napias Creek has the highest potential for adverse impacts to soil and water resources based on the percentage of the subwatershed with high inherent erosion hazard and high fire risk. The following table displays the acres and percentage of each subwatershed with high inherent erosion hazard and high fire risk. Map C-3 displays these factors across the Salmon interface project area. Table C-3 does not reflect the acres burned during the 2003 Withington Fire within the Salmon-Henry and Salmon-Perreau subwatersheds.

Table C-3. Acres and Percent by Subwatershed of Areas of High Inherent Soil Erosion and High Fire Risk

Subwatershed	Acres of High Inherent Erosion Hazard and High Fire Risk	Total Acres of Subwatershed	Percent of Subwatershed with High Inherent Erosion Hazard and High Fire Risk
Arnett Creek	566	12,099	4.7
Jesse Creek	635	13,021	4.9
Lake Creek	2302	12,913	17.8
Lower Napias	2920	11,318	25.8
Napias-Phelan	2267	19,008	11.9
Salmon-Fenster	931	13,847	6.7
Salmon-Henry	2028	14,689	13.8
Salmon-Perreau	1190	36,869	3.2
Salmon-Wagonhammer	243	10,565	2.3
Salmon-Wallace	763	14,827	5.2
Twelvemile Cr.	1076	14,267	7.5
Upper Napias	660	13,962	4.7
Williams Creek	1011	18,055	5.6

II. Key question #2: How have human activities, such as fire suppression, roads, mining, and residential development affected the Jesse Creek municipal watershed?

The primary human activities in Jesse Creek include roads, fire suppression, and historic mining.

There are 18.7 miles of roads with a road density of .92 mile per square mile in the Jesse Creek subwatershed. This is one of the lowest road density figures for subwatersheds in the analysis area, with less than one mile of road per square mile. There are 3.1 miles of roads within the Jesse Creek RHCA. The main access road to the historic Leesburg town site parallels Jesse Creek. Segments of road in the Jesse Creek subwatershed identified in the field as sediment sources were modeled using WEPP:Road, a computer model designed to estimated sediment yields. Modeling results indicate that sediment yields could be reduced by 63 percent with the application of surface gravel and installation of drainage features, such as rolling dips, culverts and outsloping at critical points.

Since 1900 approximately 27 fires have started within the Jesse Creek subwatershed. Twenty-five fires were less than 100 acres in size. Two larger fires have also occurred; one being 210 acres and the other being 688 acres. About 1,093 acres have a high risk of wildfire based on present fuel accumulations and departure from historic conditions. Of this, 627 acres or 4.8 percent of the subwatershed have a high fire risk and a high inherent erosion hazard.

Historic mining activities within the Jesse Creek subwatershed were not extensive; however, the Leesburg Stage Road that parallels Jesse Creek was the primary access corridor to mining camps at Leesburg and California Bar. Effects from mining activities are related to use of the road rather than the extraction of minerals.

Residential development within the subwatershed is minor, although westward expansion from the city of Salmon is occurring.

Fine sediments (less than ¼ inch in diameter) are displayed in Table C-2. Sediment measurements for Jesse Creek are relatively low compared to other streams in the analysis area, indicating that sedimentation from human uses is greater in subwatersheds not managed for municipal water supply.

III. Key question 3: How has mining affected water quality and stream channel conditions?

Mining has significantly impacted stream channels in the Napias Creek watershed. There are approximately 8 miles of streams affected by placer mining in the Arnett Creek subwatershed, 12.5 miles in the Upper Napias Creek subwatershed, 4.75 miles in the Lower Napias Creek subwatershed, and 2 miles in the Napias-Phelan subwatershed (Lorain and Metzger 1939). Stream channels that have been placer mined retain little of the channels' natural morphology. Streams affected by placer mining are typically channelized lacking a functioning flood plain. As part of the placer mining process the majority of the fines have been removed leaving banks composed almost entirely of cobbles. Although over sixty years have passed since the last placer mining the raw cobble banks and confined channels are visible throughout the Napias Creek watershed. The lowering of the base elevation of placer mined main channels may also have had an effect on tributary channels. As the base elevation is lowered, tributary channels will downcut, altering their morphology, lowering the water table and in some cases dewatering adjacent floodplains and wet meadows. The down cutting of tributary channels and dewatering of adjacent wet meadows was observed in the headwaters of Napias Creek. Negative water quality contributions related to mining are centered on the Beartrack mining operation with the potential for acid generation from sulfides in the waste rock.

IV. Key question 4: How have roads affected hydrologic function watershed sensitivity?

A broad range of variability exists with respect to inherent watershed sensitivity. Some watersheds are very sensitive due to steep slopes and highly erodible soils. Others are more resilient and capable of accommodating extreme climatic events or higher intensities of management.

Roads can affect hydrologic functions and resultant water quality by altering groundwater interception, runoff distribution over time and space, and the potential for sediment production and delivery to streams. The risks of a road affecting water yield and/or quality are largely determined by level of use, location, maintenance level, dimensions, and surfacing. Road density expressed as miles per square mile provides an index of the overall potential for roads to affect watershed function (USDA, Forest Service, 1993). In general, subwatersheds with less than 30 percent watershed relief and road density of three miles per square mile or less are considered to have a low risk for the overall potential for roads to affect watershed function (USDA, Forest Service, 1993). Watershed relief is the average watershed slope determined as the difference between the lowest and highest points in the watershed divided by the length of a straight line projected along the main axis of the watershed and roughly parallel to the main drainage. Watershed relief was calculated for all subwatersheds in the project area and all had watershed relief less than 30 percent.

Table C-4 displays the total miles of roads, total road density, miles of road within RHCAs, and road density within RHCAs for all subwatersheds within the analysis area. In general, subwatersheds with high road densities and a large proportion of the subwatershed with highly erosive soils have a greater potential for roads to affect watershed function and more susceptible to effects from management activities.

Table C-4. Road Density and Erosion Hazard by Subwatershed

Subwatershed	**Miles of Road**	**Road Density**	**RHCA Miles**	**RHCA Road Density**	**% of Sub watershed w/ High Erosion Hazard**
Arnett Creek	39.7	2.10	7.3	0.84	29
Jesse Creek	18.7	0.92	3.1	0.33	29
Lake Creek	38.5	1.90	3.9	2.93	57
Lower Napias	48.5	2.70	12.8	1.46	65
Napias-Phelan	57.8	1.90	6.9	0.79	28
Salmon-Fenster	65.6	3.03	5.2	3.79	33
Salmon-Henry	19.8	0.86	5.4	0.64	64
Salmon-Perreau	98.3	1.70	15.8	4.50	23
Salmon-Wagonhammer	19.4	1.17	0.0	0.00	25
Salmon-Wallace	82.3	3.50	5.6	0.49	33
Twelvemile Cr.	50.5	2.26	10.2	0.90	34
Upper Napias	26.9	1.23	4.8	0.58	14
Williams Creek	57.6	2.04	12.4	5.68	50

The degree of management and disturbance within a subwatershed influence the potential to experience adverse effects to hydrologic resources. The probability of experiencing adverse effects increases as the percentage of the watershed or subwatershed affected by management actions and/or natural disturbances, such as fire, increases (USDA, Forest Service 1993). Road density and percent of the subwatershed covered with "hydrologically immature" vegetation are used as indicators of potential effects on water yield and timing as well as erosion and sediment potential. The term “hydrologic immaturity” is used to identify forested stands that have not reached the level of water use and influence created by mature stands. For this analysis, hydrologic immaturity is represented by stands that have been harvested or burned which are less than 30 years old. Stands affected by management actions (such as timber harvest and mining), and natural disturbances (such as fire and disease) are indicative of the potential effects on the magnitude and timing of runoff from the watershed as the result of altered interception and soil moisture utilization. This is quantified using Equivalent Clearcut Acres which represent an area being cutover by an even-age method less than a clearcut (Galbraith 1975) such as shelterwood and seed tree harvest. This method is also used to represent stands that have been affected by fire, mining, and disease.

A watershed risk rating based on the percent of the watershed in stands less than 30 years old, road density, and watershed relief was determined for each subwatershed within the analysis area. These ratings are shown below in Table C-5.

Table C-5. Watershed Risk Rating by Subwatershed

Subwatershed	**Watershed Risk Rating**
Arnett Creek	High
Jesse Creek	Low
Lake Creek	Moderate
Lower Napias	High
Napias-Phelan	Low
Salmon-Fenster	Moderate
Salmon-Henry	Low
Salmon-Perreau	Low
Salmon-Wagonhammer	Low
Salmon-Wallace	High
Twelvemile Cr.	Moderate
Upper Napias	Moderate
Williams Creek	High

V. Key question 5: How has livestock grazing affected riparian vegetation, hydrology and soils?

Livestock grazing occurs in all subwatersheds within the analysis area with the exception of Jesse Creek, which is managed as a municipal watershed for the city of Salmon.

Currently, there are 19 permitted grazing allotments covering 161,017 acres of Forest Service and BLM lands within the assessment area (see Map D-1).

Excessive livestock grazing has adversely affected some riparian zones within the analysis area. Sawpit Meadows (Diamond-Moose Allotment) in the Upper Napias Creek subwatershed is one of the most seriously affected. Streambank stability measurements collected by range management specialists in July of 2001 indicate that banks were 35 percent stable and 65 percent unstable. Measurements collected by hydrology and soil resource specialists in 2002 indicate that banks were 49 percent stable and 51 percent unstable. There appears to be an upward trend and riparian conditions seem to be improving in this location. Additional data indicate that greenline vegetation is in an early seral stage. Soils were compacted when the site was reviewed in July of 2002; however frost-heaving and rodent activity were apparent. Frost-heaving and rodent activity break up soil compaction over time and increase moisture infiltration and water-holding capacity.

Riparian evaluations have been conducted on several stream reaches within the assessment area. This data is summarized below. Additional analyses need to be conducted to assess a trend. However, as of 2004, follow-up analyses have not been completed.

Diamond-Moose Allotment

Sawpit Meadow Riparian Evaluation – established and conducted on 07/24/2001

- Greenline – early seral
- Cross Section Summary – very early seral
- Streambank Stability – 35 percent stable
- Woody Species – 1 young/sapling; 1 decadent

Twelvemile Allotment

Twelvemile Bottoms Riparian Evaluation – conducted on 06/12/1998

- Greenline – late seral
- Cross Section Summary – early seral
- Streambank Stability – 99 percent stable
- Woody Species – 78 seedling/sprout; 71 young/sapling, 244 mature; 12 decadent; 36 dead

South Fork Williams Creek Allotment

South Fork Williams Creek Riparian Evaluation – conducted on 07/18/95

- Greenline – mid seral
- Cross Section Summary – mid seral
- Streambank Stability – 97 percent stable
- Woody Species – 15 seedling/sprout; 66 young/sapling, 44 mature;
- 2 decadent; 27 dead

Williams Basin-Napias Creek Allotment

Moccasin Creek Riparian Evaluation – conducted on 07/03/2000

- Greenline – PNC (Potential Natural Community)
- Cross Section Summary – late seral
- Streambank Stability – 68 percent stable

- Woody Species – 16 seedling/sprout; 65 young/sapling, 123 mature; 12 decadent; 1 dead

The BLM also conducted Proper Functioning Condition assessments on several stream reaches (Table C-6). These data represent riparian conditions at a single point in time and do not indicate a trend. More information is needed to determine if conditions are improving or declining over time. This is an obvious data gap. Collecting additional riparian evaluation data and conducting Proper Functioning Condition Assessments are recommended to determine how livestock grazing has affected riparian vegetation, soils, and hydrology.

Table C-6. Proper Functioning Condition Rating by Subwatershed on Stream Segments Administered by BLM

Subwatershed	BLM Allotment	Drainage	Stream Miles	Proper Functioning Condition	Functional at Risk / Trend	Non-Functioning
Salmon-Fenster	Diamond-Moose	Bob Moore	0.6		0.6 miles ↓	
Salmon-Wallace	Diamond-Moose	Bird Creek	1.1	1.1 miles		
Salmon-Fenster	Diamond-Moose	Deriar Creek	0.7		0.7 miles →	
Salmon-Wallace	Diamond-Moose	Diamond Creek	0.9	0.9 miles		
Salmon-Fenster	Fenster Creek	Fenster Creek	1.0		1.0 miles →	
Salmon-Henry	Henry Creek	Henry creek	3.0	2.0 miles	1.0 miles ↑	
Salmon-Perreau	Hot Springs	Hot Springs Creek	2.8	2.8 miles		
Salmon-Perreau	Perreau Creek	Perreau Creek	1.3	1.3 miles		
Jesse Creek	Chipps Creek	Pollard Canyon Creek	0.1	0.1 miles		
Salmon-Henry	Hot Springs	Sevenmile Creek	1.9		1.9 miles ↑	
Salmon-Henry	Ten Mile	Tenmile Creek	1.0	1.0 miles		
Williams Creek	Williams Creek	Williams Creek	1.3	1.3 miles		

Issue D. Changing Human Values, Expectations, and Uses

Composite of Current Conditions (Step 3), Reference Condition (Step4), and Synthesis and Interpretation (Step 5)

The following narrative describes the current conditions (Step 3) regarding human values, expectations, and uses. The narrative is organized by the twelve key questions listed in Step 2. In developing the narrative a great deal of synthesis and interpretation (Step 5) was also included to adequately address and answer the key questions. Following the key question narratives is a brief Reference Condition (Step 4) section and a Synthesis and Interpretation (Step 5) section that is specific to the heritage and cultural resource values present within the Salmon interface assessment area.

I. What are the major human uses? Where do they generally occur in the watershed?

Grazing is one of the dominant traditional human uses of the area. Currently there are 19 permitted grazing allotments covering 161,017 acres of USDA Forest Service (USFS) and USDI Bureau of Land Management (BLM) land within the assessment area. Of the 156 federal grazing permits issued in Lemhi County (USDA National Agriculture Statistics Service, 1997 Census of Agriculture), 23 (15%) are allocated within the assessment area.

ICBEMP provides an assessment of livestock grazing condition at the county level. Comprised of a measure of livestock grazing on federal lands and a measure of relative socioeconomic importance of livestock grazing, the "status" of livestock grazing condition in Lemhi County was determined to be high (Quigley et al. 1997). As Quigley et al. (1997) do not provide enough technical guidance for replicating the analysis quantitatively, a subjective assessment must be made to "step" the analysis down to the SIWA level. For the SIWA area, grazing allotments cover 90% of the federal land within the assessment area. The USFS and BLM administered allotments within the area can support approximately 8700 Animal Unit Months (AUMs) annually[1]. Approximately 6800 (78%) of these AUMs are being used annually (based on average annual actual use from 1997-2001). While not at 100%, the level of actual grazing on federal lands is still high considering that lack of full exploitation is likely the result of external limiting factors such as drought/water availability, cattle prices, etc. that act to constrain ranchers actual use as opposed to pure need.

The socioeconomic importance of livestock grazing is a complex issue to treat qualitatively or quantitatively. On the one hand, the importance of the SIWA allotments to the 23 permittees is likely very high, especially given that only 62 (25%) of the 245 farms/ranches in North Fork, Carmen, Salmon, Lemhi, and Tendoy have more than 100 acres of cropland used for pasture or grazing, and only 61 (25%) have more than 100 acres of pasture and

[1] Values are approximate as many allotment boundaries extend beyond the SIWA boundary. Those with only a small portion in the SIWA area were excluded (Withington Creek and Deer-Iron Creek allotments) and those straddling the boundary were reduced by the amount of forage base outside of the boundaries (e.g., Williams Basin-Napias Creek was reduced by 50% and Diamond-Moose was reduced by 20%) to better reflect actual forage and use within SIWA boundaries.

rangeland other than cropland or woodland (USDA National Agricultural Statistics Service, 1997 Census of Agriculture). A tentative measure of private forage available, it would seem that if only 25% to 50% of farms have forage available for large-scale cattle operations, then the federal allotments are very economically important to the ranches that hold federal grazing permits. Additionally, the social importance of grazing is extremely high in all the local communities as grazing has a longstanding history of use in the area.

The economic importance of grazing to the local economies, however, is a different story. Grazing is couched within the agricultural industry, and is a major component of the industry. Livestock sales comprised 91% of the market value of agricultural products sold in Lemhi County in 1997 and 74% of the farms in North Fork, Carmen, Salmon, Lemhi, and Tendoy have beef cow and/or sheep inventories (USDA National Agricultural Statistics Service, 1997 Census of Agriculture). Although employment in the agricultural industry is high (20% or more of total employment) for the small communities of Lemhi and Carmen, it comprises only six to 10% of employment in the much larger Salmon economy and less than six percent of employment in Tendoy. This suggests that it is important economically, but not a dominant industry for the whole area (Harris et al. 2000). Thus, given that current grazing levels are relatively high in the area, moderate in economic significance to the local economies as a whole, and high in social and individual ranch economic importance, the current status of livestock grazing condition might best be described as moderate to high for the SIWA area.

Similar to grazing, harvesting of timber for commercial and personal uses (such as firewood, posts and poles, etc.) are, or have been, major human uses of the area. Much like the livestock grazing condition analysis, ICBEMP provides an assessment of current status of timber harvest condition, encompassing harvest of commercial saw logs, posts and poles, firewood, and other wood materials. Evaluating timber value, harvest importance, access, and landscape vegetation and agricultural pattern, the timber harvest status on federal lands in Lemhi County was calculated as moderate (Quigley et al. 1997).

Validating this status at the SIWA level, once again without a technical guide, necessitates a qualitative assessment of the relevant factors. According to a Forest Forester, nationally and regionally the value of the timber in the assessment area is moderate to low. However, the value to local purchasers and consumers is high because of limited supply and lack of products available from private lands in the area. With no timber harvests in the area since 1980 though, the importance is more as a potential versus realized income. Harris et al. (2000) calculated the level of timber-related employment to be low in Carmen, Lemhi, and Tendoy, and medium low in Salmon. The social importance of timber harvest is high though, as harvesting timber commercially was once a dominant local industry and utilizing wood products has a history dating back to the birth of the local communities. There are roads throughout the area, although 48% of the federal lands in the area is designated Roadless. Analysis of the area's vegetative cover types reveals 114,444 acres of *potentially* harvestable land (acres of conifer as the primary cover type) within the SIWA area. Thus 64% of the federal land in the area is potentially harvestable. However, this is a very gross estimate, as actual ability to harvest would take into consideration accessibility, volume, stand characteristics, etc.

Considering these factors, the current status of timber harvest in the area is probably best described as low to moderate—for commercial products. The use and social importance of collecting wood products for personal use is still high, though, and the area includes numerous places of long-standing local use (e.g., along the Ridge Road and Stormy Peak area). Thus the status of non-commercial timber harvest is moderate to high.

II. The Shoshone-Bannock Tribes have identified off-reservation rights to hunt, fish, and gather on off-reservation lands including the Salmon-Challis National Forest. How have the presence and activities of other user groups affected historic uses by Tribal members within the watershed?

<u>Native American Use and Treaty Rights</u>
Members of the Shoshone-Bannock Tribes currently exercise their off reservation reserved rights to hunt and fish, and claim the right to gather, on unoccupied lands within and near the SIWA area. Several families are known to visit the Lemhi and Salmon River Valleys at various times throughout the year for subsistence and other cultural purposes (Gowen 1997).

Treaty resources currently used by tribal members in and near the analysis area include brook, cutthroat, rainbow and steelhead trout. Big game currently hunted includes elk, deer and bighorn sheep (Coulter, pers. comm.). Plant resources gathered include willow, chokecherry, serviceberry, gooseberries, sage, peppermint, wild onion and bitterroot (Yupe, pers comm.). Traditional plants not often gathered today but expected to be of continued interest to the Tribes, include lily, rye grass, whitebark pine, wild rose, cattail, and tobacco root among others.

The following tributaries of the Salmon River, Deep, Napias, and Twelve mile Creeks, have all been identified as prominent, traditional salmon fisheries central to the Lemhi Shoshone subsistence round during the ethnohistoric and reservation periods (Walker 1994). Tribal fishing in these drainages persisted into the 1980s, as salmon runs remained adequate. But, by 1990 salmon runs had decreased dramatically and have not increased since. Loss of spawning gravels from erosion and sedimentation, irrigation, depletion of beaver, and downstream dams contributed to the end of the run. Nevertheless, the tribe continues to be interested in programs and partnerships with outside organizations designed to aid in the restoration and protection of this critical, traditional resource. In the interim, their restoration focus in the area has been on enhancing other anadromous runs such as steelhead.

Traditional hunting, fishing and gathering activities within the watershed, and the Lemhi Valley in general, has declined significantly since the removal of the Lemhi Shoshone people from their homeland to Fort Hall in 1907. Distance from Fort Hall, loss of Salmon runs, degradation of root crops and riparian areas resulting from intensive ranching and farming in the basin, and lack of access due to private landownership has also dramatically affected how the Shoshone-Bannock use the area for cultural purposes. In general, the area's desirability has decreased with an increase in use by recreationists and other resource users competing for the same resources and, oftentimes, impaction the privacy of Indian families.

Despite the decrease in tribal use of the area, the Tribes interest in the protection of Treaty resources remains paramount. The Shoshone-Bannock expect federal agencies to follow through with their trust responsibility regarding the protection of Treaty resources. Management activities that would provide for enhancement of big game habitat, riparian areas and native plant and non-game animal species are in the best interest of the Tribes. Projects designed to promote native species of plants and animals and eradicate non-native species are encouraged. Specifically, the Tribes would like to see the effects to all treaty resources considered during environmental analysis and project planning and alternatives selected that protect these resources for future generations.

Native American Traditional Cultural Value

The Tribes have not shared traditional cultural, spiritual or religious practices conducted within the watershed. This does not mean such uses are not taking place or that the area is not of cultural importance to them. Rather, the Tribes are concerned for the privacy of individual Tribal members and families. This kind of information is kept confidential in an effort to protect cultural places and other values of traditional, spiritual or religious significance.

Ethnographic accounts of the Northern or Lemhi Shoshone Indians provide a general overview of many of the traditional values associated with their occupation of the region. The Shoshone homeland is typically associated with documented winter villages located in the Lemhi Valley, but places of traditional cultural importance surround these locations and form the historic landscape that remains integral to the living culture of the Tribes today. Examples of culturally significant places that may be located within the watershed include burials, high elevation power or vision quest sites commanding far reaching vistas, pictographs, customary fishing, hunting, or gathering places and geographical features oftentimes associated with Indian legend.

To date, very few Native American archaeological resources have been documented within the watershed. These inventories have identified small lithic tool scatters, stacked rock cairns, and talus pits. Early Indian travel routes were known to exist, but have probably been almost entirely supplanted with historic and existing trails following drainages or the ridgelines.

Since Native American occupation of the region may date as early as 12,000 years ago, many of the sites are likely associated with the ancestors of the present day Shoshoni-Bannock, but remain cultural significant. The Tribes are typically concerned with the protection of Native American remains and sacred sites for their inherent cultural value rather than for the scientific or archaeological values.

Similar to the exercise of treaty rights for resource procurement, private landownership in the region has greatly affected accessibility to traditional religious or spiritual areas and spiritual practices. Hence, spiritual practices have decreased with the increase of non-Indian settlement and resource uses of the area.

III. How have changing local and national social and economic interests and values affected public use and expectations in the area?

> Every river is more than just one river. Every rock is more than just one rock. Why does a real estate developer look across an open field and see comfortable suburban ranch homes nestled in quiet cul-de-sacs, while a farmer envisions endless rows of waving wheat and a hunter sees a five-point buck cautiously grazing in preparation for the coming winter? The open field is the same physical thing, but it carries multiple symbolic meanings that emanate from the values by which people define themselves.
>
> Greider and Garkovich 1994, p. 1

Changing local and national social and economic interests and values have affected public use and expectations in the SIWA area. Local interests have shifted slightly from a more focused social and economic tie to the area based on traditional extractive uses and commodity-based values to a broader use and value system that includes recreation and other non-commodity-based uses. However, the importance of the traditional uses remains paramount and is reflected in the desires of political leaders and many interest groups for preservation of access and more commodity-based use of Forest resources in the area. Perhaps the greatest factor in how changing social and economic interests and values have affected the area is the increasing divergence and conflict between local and national interests and values regarding public lands management. After all, every tree is more than just one tree.

As indicated previously, local social and economic interests and values in the area predominantly focus on the importance of traditional uses and local rights. The value of traditional uses of the public land is so strong that, despite economic data indicating otherwise, the local communities feel the health of their economy continues to depend on traditional extractive industries. Harris, McLaughlin, Brown, and Becker (2000) found evidence of this in their assessment of small communities in the Interior and Upper Columbia River basins. Calculating an index of economic diversity for communities based on the extent to which a community actually is dependent on a wide variety of industries as opposed to only a few, Salmon received an economic diversity index of “high”. The levels of direct employment by industrial sector (based on proportions of employment) for the city were “medium low” for agriculture (including ranching), “medium low” for timber, “medium high” for travel and tourism, and “low” for mining and minerals. However, the community’s dependence on agriculture, timber and wood products, travel and tourism, and mining and minerals was *perceived* as “high” for each industry sector by a representative sample of Salmon residents. On a scale measuring perceived dependence that ranged from 1 (not dependent) to 7 (very dependent), the average rating of dependence on timber perceived by Salmon residents was high at 6.0, while the actual proportion of employment in wood products was measured as not significant to the economy (only 7 %) (Harris et al. 2000).

The findings by Harris et al. (2000) suggest that the relative economic importance of natural resource dependent industries in Salmon is perceived by residents to be greater than reality suggests. At least in Salmon, this points to a community that, despite data suggesting differently, believes their economic survival depends predominantly on traditional uses of the land and thus will continue to desire and expect the protection and enhancement of such uses in the assessment area. This high priority on traditional resource use is further bolstered by the basic cultural values of area residents described by Harp and Pauley (1993) emphasizing the social importance of traditional uses that extends beyond economic interests.

Focus group results support this evaluation, with the political leaders, interface residents, and the traditional/commodity-based interest groups emphasizing concerns and opportunities for the assessment area that revolve around protecting or enhancing livestock grazing, timber harvests, mining and preserving traditional road access in the area (see Salmon Interface Watershed Assessment Focus Group Summary Report). The loss in community economic support from extractive industry taxes (the "25% tax") that historically occurred in the area was a concern mentioned by both the interface residents and traditional/commodity-based interest groups.

Nationally, public interests and values have traveled a different path than that generally espoused in the coffee shops of Salmon. Historically emphasizing similar interests and values regarding the importance of commodity-based uses of the public lands, national interests and local interests have diverged. Dunlap and Mertig (1992) provide a general overview of the changing national concerns regarding the environment since the late nineteenth century. They describe a path of increasing concern for wise use of the land traveled in response to reckless exploitation of our natural resources. Waves of conservationism and preservationism initially promoted by Gifford Pinchot and John Muir coalesced in the late 1960s into modern environmentalism, concerned with protecting the health of the environment and quality of life.

Over the last forty years, the environmental movement has fragmented considerably, but a mainstream concern remains the preservation of natural resources. The "greening of America" has created environmental groups that "work to protect natural ecosystems everywhere, even if such protection means that traditional economic development in commercial fisheries, logging, and mining have to cease" (Humphrey et al. 1993:159-160). The general public has become increasingly more aware of and concerned with ecological issues. Non- or passive-use values of natural resources have risen in social and economic importance with increasing value placed on the simple existence of the resources or a bequest value that they offer to future generations. Science and the media have focused on the importance of a healthy ecosystem and the negative impacts of various uses. The national economy has become increasingly diversified and much less dependent upon commodity extraction. Numerous other factors have contributed to changing American attitudes regarding the environment, but the net result has been a national-scale social construction of nature, or narrative, that places great value on the importance of ecological health.

Not all Americans share such a strict view, but the institutionalization of environmental concerns into law (e.g., Wilderness Act, Clean Air and Water Acts, National Environmental Policy Act, etc.) and the continued proliferation of national and grassroots environmental organizations indicate the immense power of the movement politically and socially. Of course, the national public holds views regarding the natural environment ranging from those shared by many Salmon residents to those of extreme deep ecologists, and all have a say in the management of their national forests. However, it seems to be the mainstream values emphasizing environmental health and balanced use rather than primarily commodity-based use that has dominated contemporary American ideology regarding resource management. Support for this generalization can be found in recent assessments of public values regarding the environment. Results from a survey of value orientations of the national public and Oregon residents concluded that the national public strongly supported a less commodity-based, more ecologically sensitive approach to Federal forest management (survey by Steel, List, and Shindler 1994, summarized in Quigley and Arbelbide 1997b).

Results from the 1995 National Survey on Recreation and the Environment (NSRE) as reported by Cordell, Tarrant, McDonald, and Bergstrom (1998:31) revealed:

> …broad, more-than-majority, support for wildland protection based on ecological and environmental protection and on intergenerational altruism values or benefits. It seems not to show that the U.S. public supports wilderness for self-serving and economic reasons. This broad support holds across rural/urban, eastern/western, and some different racial segments of society , and if the observed differences among age groups are in any way predictive of the future, this support may be even more pronounced among future generations.

Results from the 2000 NSRE support continuation of the trends noted in the 1995 survey (NSRE 2000-2002). In addition, the 2000 NSRE revealed that 51% of the U.S. population (based on a weighted sample) felt the U.S. was spending too little on protecting the environment (as opposed to 7.8% that felt we were spending too much and 26.3 that felt we were spending about the right amount). When asked what should be emphasized in the management of public parks and forests, 52.7% said improving their natural conditions, 38.4% said balancing natural conditions and commercial opportunities equally, and only 5.3% said developing commercial opportunities such as timber, tourism, and mining.

Compounding the influence of this national “environmental” ideology is the recent surge in growth occurring throughout the rural West. In-migrants have comprised 14% of the Lemhi County population growth between 1990-1998 (Idaho Department of Commerce 1999). Part of a recent trend of metropolitan to nonmetropolitan migration termed the “rural rebound,” the growth differs from previous rural growth spurts in that rebound migrants tend to move to rural areas for non-economic reasons (Johnson 1999, Jobes 2000). According to Cromartie and Wardwell (1999), growth added over 1 million people from 1990-1997 to the nonmetropolitan West, comprising one-third of the total nonmetropolitan population growth in that time. Two-thirds of the growth came from net migration. In a survey of migrants to high amenity areas, Rudzitis (1999) found that migrants consistently emphasized the importance of non-economic factors in their decision to move. For 77% of respondents, amenity characteristics such as the social and physical environment were the primary factors influencing the decision to move, while employment-related reasons were primary for 23%.

Newcomers are generally found to have differing views from old-timers regarding land use (Blahna 1990). Jobes (2000) found that in-migrants to the Gallatin Valley in Montana strongly favored wilderness while the opposite was true with old-timers. Interestingly, he also found that over time and continued residence in the area, newcomer's support for wilderness lessened. Rudzitis (1999) found newcomers to the rural West preferred protective as opposed to commodity-based strategies of managing Federal lands. Given the findings of research on newcomers to rural areas in the West, there is a strong likelihood that the emphasis of traditional utilization dominating the cultural values of Salmon will or has been tempered somewhat by in-migration in recent years.

So how have the differences between a local social orientation of traditional use and a national orientation emphasizing protective management—that is likely also weaving its way into the local community fabric—affected public expectations and use of the SIWA area? The management of the National Forests is, at its most basic level, the management of social values. Proper stewardship of the land is a socially defined concept—what environmental health is, what type of impact is significant or not significant is a social line drawn by the dominant value system. Management of the SIWA area has been no different, increasingly emphasizing providing for more recreational uses and ecological protection and less focus on traditional uses. The differing local and national values have fostered differing expectations for the area, with local factions remaining steadfast in their desire for more traditional uses of the area, while a fraction of local residents and most national interests demand less commodity-oriented use, more non-consumptive uses, and management focusing on natural amenities preservation.

Future management of the area will find the majority of local community members contesting management actions that do not support their views. Concurrently, any management action incorporating the possibility of an enhancement of a traditional use will be contested by national and newcomer interests.

IV. What do people care about in this watershed?

What people care about in this watershed on a general, symbolic level is detailed in the Characterization section and the current conditions for the previous question. In order to gather more specific information on what people care about in this watershed, focus group discussions were conducted with groups of Salmon area residents representing the general interests in the area (see Salmon Interface Watershed Focus Group Summary Report). Specific, detailed input from each of the interests groups is detailed in Appendix D of the Report. It is assumed that concerns identified by participants also indicate care about that particular subject. By no means are the focus group results meant, or able, to be an all-inclusive list of what people care about in the assessment area but it is an indicator of the most important concerns of various interest groups for the area.

Focus group results suggest that, in general, area interest groups care about 18 general themes as they apply to the assessment area:

(1) Maintaining/enhancing commodity or consumptive-based uses,
(2) Maintaining/enhancing recreational use,
(3) Threatened/endangered species issues (primarily influence upon management and traditional uses),

(4) Maintaining/enhancing access (roads and trails),
(5) USFS management and policy in general,
(6) Wildfire risks and fuels reduction,
(7) Maintaining/enhancing multiple uses of the area,
(8) External influences constraining USFS management of the area,
(9) Noxious weeds,
(10) Current USFS management actions,
(11) USFS relationship/interaction with the local publics,
(12) Private property-USFS issues,
(13) Cultural heritage issues/educational opportunities,
(14) Local community well-being,
(15) Forest health,
(16) Enforcement of USFS regulations in the area,
(17) Items not under specific USFS jurisdiction or management control, and
(18) Preservation of resources/roadless area values.

General conclusions from the focus groups highlight concerns of primary importance to area interest groups. Area political leaders, interface residents, and traditional/commodity-based interests (i.e., grazing permittees, loggers, and miners) care about the preservation and enhancement of traditional and commodity-based area uses such as livestock grazing, commercial timber harvest, and mining. Along with the other two groups, they care about the risks of wildfire, especially to the municipal watershed, and the need to address fuel reduction and noxious weeds throughout the area. The need for more public education on the risks from wildfire is emphasized by a number of interest groups. Preservation of access is highly important to all but the environmental group, while environmental interests feel preservation of roadless areas to be important. Each group also cares about how the area is managed in general, mentioning specific concerns about how USFS policies, management actions and external constraints on the agency (e.g., from threatened/endangered species regulations, other agency involvement, powerful special interest groups, etc.) affect the ability of the USFS to "properly" manage or enforce regulations in the area.

V. Do current or anticipated management practices or uses threaten valuable heritage resources, particularly known historic mining districts and historic trails, within the watershed?

The passage of the National Historic Preservation Act of 1966 and the Archaeological Resource Protection Act of 1979 represented a nationwide interest in preserving prehistoric and historic properties as important reflections of our American heritage. Under these acts the Forest Service is mandated to consult with appropriate federal and state agencies and interested publics with regard to adverse effects to significant heritage resources brought about by undertakings resulting from management decisions. Management activities often have the potential to damage archaeological, historical, and traditional use properties that are significant and thus, eligible to the National Register of Historic Places (NRHP). The protection, maintenance, and interpretation of these properties are central to the Forest Management Plan. Management activities, such as upgraded infrastructure in support of recreational activities, also have the potential to diminish Heritage tourism experiences and the overall historical character of humanly modified landscapes indirectly. These potential indirect effects must also be taken into consideration.

Only a fraction of the heritage resources have been identified on the forest hence, definitive statements cannot be made regarding the numbers, much less the significance of all heritage resources within the analysis area. Most of the known sites have been documented during cultural resource inventories dating back to the 1970's. Approximately 25 to 30% of the assessment area has been inventoried to varying standards. The majority of the previous inventories were conducted as intensive complete coverage, which utilized 30 meter transects for all of the proposed project area that could be surveyed. However, larger areas were sometimes inventoried as intuitive complete or under systematic sampling methods. Intuitive inventories utilized professional judgment to identify areas likely to contain heritage resources. Systematic sampling inventories cover all landforms across a project area to help define heritage resources that do not fall within predicted locations. The inventories were conducted at scattered locations throughout the entire analysis area, but inventory coverage tends to be concentrated in the eastern portion of the assessment area along Napias Creek and its tributaries and in select drainages on of the Salmon River Front east of town. There is a notable lack of inventory coverage east of the Salmon River, in the southeastern portion of the assessment area. Although far from complete, the previous inventory that does exist is particularly important due to the fact that it covers several hundred acres of high probability ground situated in areas of historically documented importance.

Cultural resource inventories have identified approximately 287 sites. Of the 287 sites identified, at least 82 sites have been determined to be significant and eligible to the NRHP, 161 sites determined to be not eligible, and the remaining 44 sites still unevaluated but should be considered potentially eligible. While many sites in the analysis area have been well-documented, there still remains several known significant sites such as those associated with the Thunder Mountain Trail/ Red Rock Stage Line in the Jesse Creek Drainage, the Pope Shenon Mine in the extreme southeast of the assessment area and a high elevation prehistoric sheep trap that are not. We predict, based on the average sites densities within the surveyed acres in the area, that there are still several hundred sites as yet identified in the assessment area.

The following discussion outlines important historic themes in the assessment area and generally where the cultural remains associated with these themes are located or would be expected to be found.

<u>Mining</u>

Dense concentrations of significant cultural properties within the SIWA boundaries are generally associated with important historic mining activities. Most notably are the numerous sites found in the vicinity of the historic town of Leesburg, located on the western boundary of the assessment area. Mining activity in the area has been extensive and long standing and several histories detailing these events are available (See Benedict 1996, Gardner 1990, Kirkpatrick 1936, Mariah Associates 1993, Matz 1996). The majority of the analysis area falls within two major historic mining districts, the Eureka and the Mackinaw, but also encompasses a portion of the more recent Poison Peak District. The Eureka Mining District, established in the late 1800s, covers almost all of the area east of the Salmon River Mountain Road following the ridgeline down to the Salmon River. The Mackinaw District, established in 1866, coincides with the area west of the ridgeline. The Poison Peak District, located in the far southeastern extent of the assessment area, dates the 1920s. The only known historic property within the district is the as yet unrecorded Pope Shenon Copper Mine, hence the following discussion focuses on the Eureka and the Mackinaw Districts. Both load and placer mining occurred within the Eureka and Mackinaw districts, but lode mining was by far the principal method of mineral extraction in the Eureka District, while placer mining was dominant within the western, Mackinaw District. Gold was the chief mineral sought throughout the region, but limited development of copper veins also occurred in the Eureka District**.**

Although numerous claims were made in the Eureka Mining District, collectively the strikes provided only a minimal monetary output, namely bullion (Umpleby 1913:155-156). According to Umpleby:

> "Both gold and copper ores are found in the district, but neither has proved very important, and only the gold has been mined. During the spring of 1910 several claims were staked… for the purpose of extracting aluminum from material found in this locality… It is hardly necessary to say that aluminum has not been extracted in commercial amounts. Coal of sufficient purity to find a local market has been worked to a limited extent on Jesse Creek".

Several major lode mines, many with associated stamp mills, are known within the Eureka Mining District. Many of the sites have been documented to some degree and their significance determined. Well known mines include the Queen of the Hills (aka Amagos, Copper Queen and Queen and Crescent), King Solomon, Tendoy, UP Burlington, John Tormey (aka Lemhi Group and Virginia Lee Group), and the Bowman Mines. Most of these mines were established in the late 1880s and 1890s and operations continued in some cases into the 1950s. It is important to note that many of the mines in the area are located in part or entirely on privately owned land and fall outside agency jurisdiction and management.

Placer mining within the Eureka District has been documented along Wallace Creek, Moore Creek, Deriar Creek, and Fenster Creek (Lorain and Metzger 1939). While gold bearing deposits were found in all of these creeks none of them have proved to be significant producers. Most of the placering was conducted on the lower reaches of these streams where the gradient decreased enough that placer deposits could accumulate. Hydraulic mining was introduced in the upper reaches of Wallace Creek, near Wallace Lake, in the late 1930s (Lorain and Metzger 1939).

Forty-seven years after the discovery of gold in Napias Creek, Umpleby reported that within the Mackinaw Mining District " quartz mining has not proved nearly as productive as placer working. Some promising veins have been found, but most of the ore bodies have proved irregular in shape and low in grade" (1913: 146). The only significant lode mine established in the western part of the watershed analysis area is the Ringbone Cayuse Mine located between Phelan and Moccasin creeks on private land.

As of the mid-1900s the Mackinaw District was not only the largest, but was by far the most productive placer-mining district in Lemhi County (Lorain and Metzger 1939). Although it is suggested that the gold production estimates are substantially inflated, the gold produced from Napias Creek and several of its tributaries far outreaches any other drainage in the county (Umpleby 1913). Among the many tributaries of Napias Creek, Arnett, Phelan, Sharkey, and Sawpit creeks, and Wards and Smith Gulches were particularly important for their extensive placer workings. Many of the workings and associated features and structures have been at least partially documented, but a substantial amount of inventory, recordation and stabilization is still required to fully document and preserve important aspects of the mining history in the area.

Known historic sites related to mining are common throughout the analysis area, but the majority of the significant sites protected under the NHPA fall within the districts and drainages outlined above. Among the most prominent of these sites is the early mining community and workings of Leesburg and California Bar, both located on the northwestern edge of the study area. A substantial portion of the Leesburg town site is situated on private ground and has been partially destroyed by operations at the Beartrack Mine in the 1980s. Nonetheless, several structures and associated mining features remain in the area. Features including the remains of a 1906 telephone line from Salmon to Leesburg, cabins, sluice boxes, building platforms, can dumps, dams, ditches, headgates, and remnant sections of wagon roads have been recorded in association with Leesburg and California Bar.

Another site of particular importance to the local history is the Thunder Mountain Trail, a conglomeration of trails, wagon roads, and stage routes leading to the Thunder Mountain workings located more than 100 miles west of Salmon City, where it originates (Matz 1996). The most often used route out of town followed the Leesburg Road up Jesse Creek to the Salmon Mountains ridgeline, where it descended into the town of Leesburg, and then continued southwesterly along Napias Creek. While the general history is written and several portions of the actual route have been field documented, numerous segments that include physically intact remnants and features associated with the transportation corridor remain undocumented. Of note is a toll house that was located on the route about eight miles out of Salmon and a hotel called the Mountain House, located another quarter mile beyond. The remains of these sites have yet to be located during archaeological survey. The Thunder Mountain Trail is eligible to the NRHP and all forest undertakings should endeavor to avoid impacts to this significant historic resource.

Other early trails abound within the analysis area and vary markedly with regard to their historical significance. Most of the historic trails were constructed or modified by the Forest Service, as evidenced by standard blaze types. While documentation of these features is patchy, only a relatively small percentage are, or would be, considered eligible to the NRHP and hence require specific avoidance measures during Forest Service undertakings.

Important, but as yet unrecorded, historic sites such as structures and facilities built to support the minors and mining activities are expected to exist throughout the analysis area. The significance of these potential sites is determined by a variety of criteria that includes their actual physical condition or integrity, their historical context including their association with important persons or events, and their historic architectural and/or engineering qualities.

Prehistoric Archaeological Remains

Significant Native American sites, although few in comparison to historic properties, do occur throughout the analysis area. The types of sites identified include lithic scatters, campsites, stone quarries, rock cairns, talus pits and hunting blinds or traps. The majority of these sites were located in the western portion of the analysis area, but this concentration may be, in part, a product of the disproportionately higher level of inventory coverage carried out in the western portion of the analysis area. Several of the sites have been determined eligible to the NRHP on the basis of their research value. Sites such as constructed hunting traps, talus pits, and stone tool quarries are unique and rare on the forest and require careful consideration in project planning to avoid disturbance from forest undertakings.

It is likely that future inventory will identify additional aboriginal sites in areas yet to be intensively examined. While not entirely absent, paucity of evidence of aboriginal use of the area is no doubt due in large part to the intense disturbance caused by roughly 130 years of industrial mining activities in the region.

In contrast to the highly visible mine workings and structures, aboriginal sites can often be difficult to locate without intensive survey that often includes evaluative shovel testing. Spatial analysis of established prehistoric site locations across the forest illustrate clear patterns of land use. In general, open aboriginal campsites are consistently found on low sloping landforms near water sources. Aboriginal travel routes commonly followed along drainages and continuous ridgelines connecting river valleys and resource procurement areas. However, within the analysis area historic and present-day trails and roads have probably supplanted most of these trails. If remnants of aboriginal travel routes do still exist, their identification may be through their association with peeled trees (Smith nod.). Saddles and rock shelters, especially along travel routes, may have been used as temporary campsites. Rock shelters also often serve as backdrops for rock art, but rock art sites can also be found on boulders, cliffs or any other appropriate rock face. Basins and valleys often provided big game with prime habitat and talus slopes associated with these landforms often yield talus pit features that may have been used as hunting blinds or caches by early Native Americans. Prominent rock outcrops, typically found on ridge tops, have also been incorporated into elaborately constructed hunting traps for bighorn sheep. Terraces and benches adjacent to streams may have been used as seasonal upland hunting camps. Quarry and tool manufacturing sites may be found in association with outcrops of rhyolite or other sillicious high quality tool stone. Hills, ridges and mountains with panoramic views may have been used for spiritual purposes and stacked rock features or cairns typically identifies the sites.

Civilian Conservation Corps (CCC)

Within the eastern portion of the assessment area, CCC workers built the Williams Creek and Salmon Mountain (Ridge Road) truck trails. Both of these 1930's truck trails have been substantially altered but significant remnants of the CCC-built road and other CCC-related sites may still be found adjacent to modern-day grades. The CCC also built the Williams Creek Guard Station and Cougar Point Recreational Area in the 1930s. The guard station has since been removed. Some of the facilities at Cougar Point have been upgraded, but significant features dating to the CCC era remain and have yet to be formally recorded. Management activities should avoid adverse impacts to the remaining pavilion at Cougar Point and possible features associated with the construction of the facilities at both locations. One of the first CCC camps to be established, in 1933, is located much further west on Moccasin Creek. Inhabitants of this camp were responsible for the construction of the Williams Creek Summit Road down to Napias Creek and then up to Leesburg and beyond (Crosby 1994). The campsite and known remnants of the original CCC truck trail found at various locations alongside the modern roadbed should be avoided and preserved.

VI. What is the economic and social resiliency of the local community and County?

The economic and social resiliency of Salmon was calculated in a composite measure, the community resiliency index (CRI), developed by Harris et al. (2000) for ICBEMP communities. As Harris et al. (2000:84) state, "the concept of community resilience refers to a town's ability to manage change and adapt to it in positive, constructive ways relative to other communities." CRI is based on community characteristics critical to a town's capacity to adapt to change, such as strong civic leadership, highly cohesive social organization, local amenities and attractiveness, and a diversified or stable economy. Communities were classified along a continuum of levels from low to high resiliency. The CRI for Salmon based on 1995 data was calculated as "high," with levels of scores on scales comprising the index being "high" for social cohesion, economic structure, and physical amenities, and "medium high" for civic leadership. Salmon ranked ninth (9^{th}) in magnitude of resilience of 198 communities rated.

The community resiliency of the smaller communities surrounding Salmon is likely low for all, given their small, dispersed populations, lack of codified civic leadership, and low levels of economic diversity.

A measure of socioeconomic resiliency was calculated for Lemhi County, also as part of the ICBEMP social and economic assessment. The composite resiliency was based on three factors: economic resiliency (diversity of employment), population density, and lifestyle diversity (Horne and Haynes 1999). Counties were assigned ratings that reflected how their economic resiliency compared relative to all U.S. counties. The economic resiliency of Lemhi County based on 1991 data was medium and given a rating of 2 [range of 1(low) to 3 (high)]. The population density of Lemhi County based on 1994 population estimates was 1.6, resulting in a rating of 0 [range of 0 (low) to 3 (high)]. Lifestyle diversity was calculated from cluster analysis of demographic data on education, affluence, family life cycle, mobility, race, ethnicity, and degree of urbanization. Lemhi County had a lifestyle diversity index in the lowest third and was given a rating of 1 [range of 1(low) to 3 (high)]. The composite socioeconomic resiliency for Lemhi County was calculated as low.

VII. What is the degree of reliance of human uses on public lands within the watershed?

A measure of the degree of reliance of commodity-based/traditional human uses on public lands within the watershed can be provided by “stepping down” ICBEMP analysis of county reliance on USFS/BLM timber harvest and forage to the SIWA level. Looking at the proportion of timber harvested from all ownerships, ICBEMP calculated Lemhi County’s reliance on timber harvested from USFS and BLM administered lands to be low (Quigley, Haynes, and Graham 1996). Given the recent lack of commercial timber sales in the SIWA area, current reliance on timber harvests on USFS/BLM lands in the area would still be low. However, the reliance on the area for non-commercial wood products is more moderate to high given the traditional use of the area for gathering firewood.

As a measure of reliance on federal lands grazing, ICBEMP analysis looked at the proportion of total feed from all land ownerships in each county. Lemhi County’s reliance on USFS/BLM forage was calculated as high (Quigley et al. 1996). Stepping this down to the SIWA level, reliance is still high. First of all, 48% of the farms/ranches with beef cow and/or sheep inventories in Lemhi County hold grazing permits—nearly double the 26% of permit-holding farms/ranches in the state of Idaho running the same (USDA National Agricultural Statistics Service, 1997 Census of Agriculture). Approximately 74% of all farms/ranches in North Fork, Carmen, Salmon, Lemhi and Tendoy run beef cows and/or sheep and it is assumed they require year-round forage (USDA National Agricultural Statistics Service, 1997 Census of Agriculture).

However, only 15% of the federal permits issued within the County are located within the SIWA area and we do not know to what extent the individual permittees truly rely upon those permits for their survival. We can estimate that their reliance on the forage is high given that only 62 (25%) of the 245 farms/ranches in North Fork, Carmen, Salmon, Lemhi, and Tendoy have more than 100 acres of cropland used for pasture or grazing, and only 61 (25%) have more than 100 acres of pasture and rangeland other than cropland or woodland (USDA National Agricultural Statistics Service, 1997 Census of Agriculture). A tentative measure of private forage available, it would seem that if only 25% to 50% of farms have forage available for large-scale cattle operations, then the federal forage is likely very important to the ranches—especially the 50-75% with no or less than 100 acres of private forage available. Additionally, even if large amounts of private forage are available actual reliance on federal forage might still be high, as livestock operations need year-round forage and often depend on federal forage in the summer and private forage to get them through the winter and early spring.

It is also apparent that there is a high reliance on National Forest grazing allotments when used in conjunction with the adjacent BLM grazing allotments. The permit holders within the SIWA area graze cattle (with some horses) under a cow/calf operation. The vast majority (82%) of the grazing permit holders with the assessment area hold permits on both the BLM and National Forest allotments. Typically, the BLM allotments are grazed in the early spring. The herd is then moved up to the National Forest allotment for the summer and then moved down to the home ranch in the fall. The remaining 18% of the permit holders graze BLM allotments seasonally in the spring and then return to the home ranch (or have other arrangements) for the remainder of the year.

Further support that reliance is high concerns the finding that approximately 78% of the allowable AUMs on federal grazing allotments is being used annually. While not a full 100%, local ranchers are likely using less than their allowed AUMs not because they don't rely on the forage, but because other factors dictate the number of cattle they can afford to run in any given year. In other words, they would run more cattle if they could and still rely on the federal forage for their survival.

VIII. How do the identified human uses relate to local economy, custom and culture?

As described in the characterization of area communities, the identified human uses of the assessment area relate directly to the local economy, custom and culture of the area. The magnitude of the economical contribution is quite large, as was illustrated previously in the characterization and description of the reliance of various uses on the area. The Recreation Value Condition for the area, considering the availability of developed, dispersed, and wilderness recreation settings, amount of use, access and population density, is currently rated as high. The SIWA area encompasses some of the most accessible land and water-based recreational destinations in close proximity to the Salmon area. Although the degree to which specific recreational uses of this area contribute to the local economy has not been assessed, the proximity and accessibility of the area and presence of the highly-used Salmon River within it suggest that the uses occurring there are primary contributors to the local service-oriented economies (primarily Salmon and North Fork). The high Recreation Value Condition rating for the area is further validated by assessments from other sources highlighting the importance of recreation to the local economy.

The Idaho Department of Commerce (1999) described Lemhi County as a recreational/tourism center due to its high lodging sales per capita, high tourism-related employment, and large portion of housing stock (11%) classified as "seasonal/recreational." Of the 185 housing units in North Fork listed in the 2000 Census, nearly half (78) are listed as seasonal, recreational, or occasional use (U.S. Census Bureau). The economies of Lemhi County and the communities of Salmon, Tendoy, and North Fork rely more on travel and tourism than any other industry (except state and local government in Salmon) (Harris et al. 2000). A direct reflection of the importance of recreation, tourism and travel in the area, the services industry comprised 17.3% of the total earnings in Salmon in 2000 (U.S. Bureau of Economic Analysis).

Agriculture, mining and timber also play a role in the local communities, to a smaller magnitude than recreation economically (except in the community of Lemhi), but a greater role culturally. The timber harvest status for the area as discussed above is rated as low to moderate for commercial wood products and moderate to high for personal use wood products. The timber industry is a minor contributor to the local economies.

The economic dependence of the area on agriculture, of which livestock grazing is a large component locally, as measured by direct employment and earnings, is not as high as that measured for the recreation/service industry (Harris et al. 2000). Although the importance of grazing in the area is economically high to many individual operators, it is still a small slice of the local economy as a whole.

Traditional uses in the area contribute more to the local culture than the local economy. As examined in the current conditions for the second key question (on changing social interests), Harris et al. (2000) describe the difference in actual versus perceived economic dependence of the city of Salmon on various industries. Salmon residents remained steadfast in their belief that traditional uses were integral components of their economy. This belief is likely more a product of culture (influenced by a history of such reliance) than reality. The emphasis of the community narratives on the importance of traditional uses and rights supports the presence of a bond between traditional human uses and the local communities' custom and culture that is the greatest in magnitude and importance of contribution of any of the identified human uses.

IX. What are the current trends for each of the identified human uses?

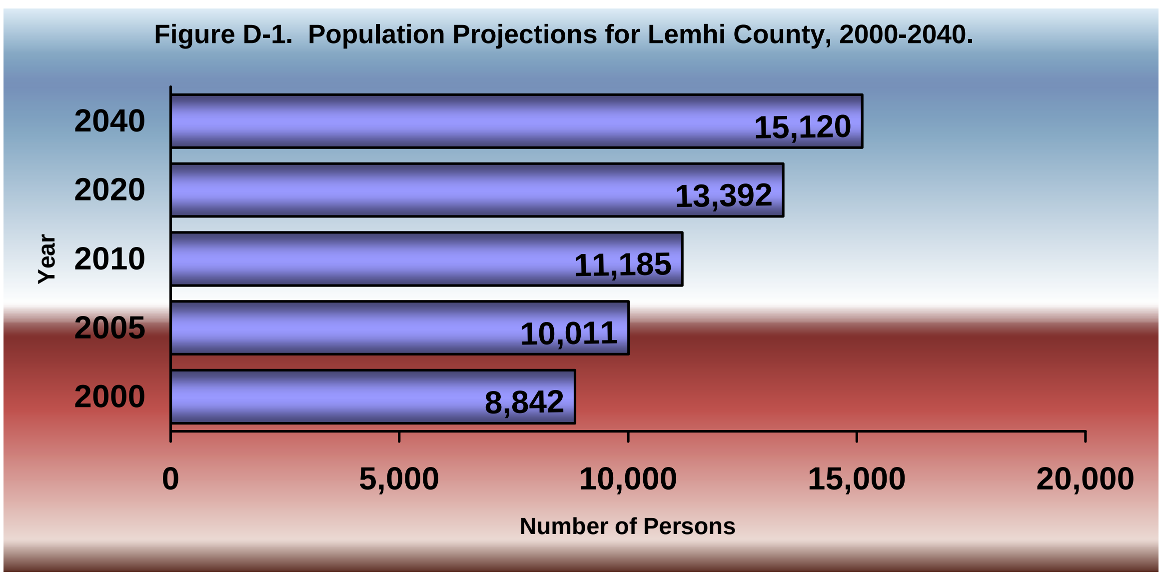
ICBEMP assessments conclude that recreation participation has been increasing steadily over the past 15 years (Quigley and Arbelbide 1997b). The characterization of Lemhi County as a recreational/tourism center and the current trend of increasing in-migration and population growth in the local area validate that the trend is likely occurring within the assessment area.

The increase in newcomers and progressing national influence emphasizing passive uses of forest lands also suggest that the more passive-oriented human uses will continue to increase and diversify in the future. Commercial uses such as timber harvests and mining have declined over the past few decades and will likely continue to do so in the future, especially given lack of wide-spread public support for such uses and increasing policy constraints. Wildfire concerns regarding the risks of high fuel loading may stimulate a small-scale growth in timber harvest, but the probable contention and litigation over using such practices for Forest fuel reduction will likely keep such uses from increasing to anything near the timber harvest of past decades. Agricultural uses will likely continue at current levels or be reduced given the declining public support for grazing, the potential for increasing conflict with growing numbers of recreational users, and increasing permit restrictions to ensure habitat health and compliance with policy mandates (e.g., Endangered Species Act, Forest Land and Resource Management Plan revision, etc.).

X. What factors in this watershed may cause changes to the current pattern and types of human uses?

The high degree of community resiliency noted for the dominant community in the assessment area, the city of Salmon, may facilitate the ability of the local community to promote (and adapt to) changes in the current human uses. Armed with a high level of physical amenities and economic diversity, Salmon could embrace and economically capitalize on declining traditional uses in favor of increasing recreational uses. Likewise, it could do the reverse and still remain economically viable, but at what would probably be a greater economic shortfall because of government constraints limiting such uses. Service industry jobs can be plentiful, but low paying, making them hard for a community with such deep roots in natural resource extraction to willingly embrace in place of their memories of high paying mine jobs. However, the likelihood that mining or timber harvests will be restored to their former glory in the area is minimal, as would be the money entering county and city coffers. Given the cultural importance of traditional uses though, embracing traditional uses as opposed to capitalizing on recreational growth is more likely to occur in the short-term future. This will likely not cause a change in the current pattern and type of human uses in the area, but it could minimize the amount of growth and diversification in recreational and passive uses of the area with Salmon not embracing and capitalizing on them.

There are a number of demographic trends that might also be termed factors in the assessment area (arguably resulting in part from the amenities provided by the area) that may cause changes to the current pattern and types of human uses in the assessment area. Population projections for all the counties within ICBEMP predict "growth for the Northwest and the interior basin, an aging population, and a more racially and ethnically diverse population" (McGinnis and Christensen 1996:32). History has documented a long-term pattern of population growth for Lemhi County. Figure D-1 illustrates population projections for Lemhi County from 2000 to 2040 (McCool and Haynes 1996). Based on historical and projected rates of natural increase (births minus deaths) as well as net migration rates, the calculations are likely inflated estimates (as evidenced by the higher than actually occurred projection for 2000), but still very possible.



Data Source: McCool and Haynes 1996.

The projected population growth to 15,120 persons in 2040 is a factor that could herald a number of potential changes in the current pattern and types of human uses that occur in the assessment area. Population growth from in-migration driven primarily by the "pull" of natural amenities in the area imply changing attitudes and desires regarding public land management and use, aligning more with the national mindset emphasizing more passive uses and preservation as opposed to traditional consumptive uses. Future uses would entail less traditional uses such as grazing and logging and more scenery preserving, passive-type uses such as hiking and biking than currently occur. The increasing influence of national values on USFS management will likely similarly influence increasing directives for the area emphasizing roadless values and less consumptive uses. Similarly, an aging population implies individuals with more leisure time and potential attrition of the traditional use-oriented narratives that have historically dominated the local community identities.

The racial composition of Lemhi County is very homogenous, with 97% of County residents classified as White in 2000 (U.S. Census Bureau). Increasing racial and ethnic diversity will likely bring more diverse uses of the area, along with differing beliefs and desires regarding management of the areas resources. Other factors in the assessment area that might cause changes in the current pattern and types of uses in the area include changing ecological character of the area (due to wild or prescribed fire, noxious weed invasions, natural succession, etc.), implementation of the Northern Rockies Lynx Amendment, changes in Roadless Area Conservation Rule protection which covers 65,377 acres (42%) of USFS land in the assessment area, and Forest Land and Resource Management Plan revisions.

Evaluating risks facing the dominant traditional human uses in the area provides an idea of the possible changes to these uses in the future. ICBEMP provides an assessment of risk to timber harvest at the county level by evaluating current forest health vulnerability to mortality from fire, insects, disease, and stress. The rating given to Lemhi County was low (Quigley et al. 1997). The rating is likely more moderate for the SIWA area because, even though there currently is no commercial timber harvest, there is a large amount of vulnerability to severe fire and parasite infestations due to high fuel loadings from long-term fire suppression within the area. Mistletoe infestations are already established in many areas, such as the Twelvemile drainage. As quality/health of wood is not necessarily as important for many personal wood uses (and actually infestation might help to increase availability of timber for such use), there is likely only a low to moderate risk to non-commercial wood products use, with fire being the greatest risk factor.

A similar ICBEMP assessment of the risk to livestock grazing considered vulnerability to exotic plant invasion, range health risks and hydrologic system risk. The risk from exotic plant invasion was weighted double compared to the other variables. The risk to livestock grazing in Lemhi County was determined to be moderate (Quigley et al. 1997). The risk to livestock grazing on federal lands within the SIWA area is likely more moderate to high. Noxious weed invasions, dominated by spotted knapweed, sulphur cinquefoil, and bull and musk thistle, are becoming increasingly chronic throughout the area but especially in the Diamond Moose, Fenster Creek, Williams Basin-Napias Creek, and South Fork of Williams Creek grazing allotments. Weed control efforts are being implemented throughout the Forest, but are not enough to hinder weed growth other than in a few specific areas. A more aggressive Forest weeds program is currently being analyzed for environmental impacts, but will not be ready for decision until the spring of 2003 at the earliest. Though risks to hydrologic systems from grazing continue to need mitigation, water availability is another important issue within the SIWA area. Other possible risks include increasing restrictions on use of riparian areas and lack of development of alternative water sources. Considering this, along with cumulative effects from ongoing drought conditions, livestock grazing actions affecting range health, and weeds suggests that, at least for the near future, risk to livestock grazing in the area is moderate to high.

XI. Are there opportunities for new, or expansion of existing, human uses?

There are a number of opportunities for new, or the expansion of existing human uses in the assessment area. The need to reduce fuel loading throughout the assessment area and the presence of harvestable timber suggests an opportunity for increased commercial and noncommercial wood utilization on a small scale, emphasizing products such as house logs, firewood, and post and poles. ICBEMP evaluations of timber harvest opportunity on federal lands looked at current harvest status, available wood biomass, forest structure restoration opportunities, and importance to local areas. The opportunity for timber harvest in Lemhi County was determined to be moderate (Quigley et al. 1997). The opportunity for harvest in the SIWA area is likely similar given the moderate amounts of available biomass, the need for restructuring for forest health throughout the area, and the high importance to local communities. The opportunity for noncommercial harvest would be high as available biomass is greater due to fewer product quality constraints.

Regarding opportunities for livestock grazing, ICBEMP considered importance to local areas, current status, potential production for livestock, and reduction of risk. The opportunity for livestock grazing on federal lands in Lemhi County was calculated as high (Quigley et al. 1997). Given that: 1) grazing in SIWA is important socially and economically to the local areas; 2) approximately 78% of the allowable AUMs on federal SIWA range allotments are being used annually (and use may still be constrained by factors beyond anyone's control); 3) an aggressive weed treatment program will hopefully be implemented, but likely not for a year or two; 4) should drought conditions continue, there are ways to develop supplemental water sources, but at some impact to the hydrologic system; and 5) there is a strong willingness among the livestock operators to improve rangeland conditions; the opportunity for livestock grazing in the SIWA area is likely also high.

Opportunities for the expansion, or resurrection, of another traditional use, mining, are potentially moderate to high. Although there are currently no active large-scale mines operating in the area, there are a number of active placer claims and the area remains rich in known and potential metal deposits. The primary causes of the decline in mining in recent years are due to constraints of the environmental permitting process (not implementing mitigation measures the process requires, but constraints on actually just completing the process) and declining metal market prices. Should the price of metals, especially gold, increase and/or the permit process become more amenable to mining interests, expansion of mining in the area could occur. The history of the area and the availability of creeks that still contain specks of gold further provide the opportunity for expanding a related use, recreational mining.

Other opportunities for expanding uses exist. Enhancement of access in the form of roads and trails throughout the non-Roadless designated areas is possible and would allow for increased opportunities of use by both commercial and noncommercial, and consumptive and non-consumptive user groups. Such uses would increase community resiliency by providing access to desirable natural amenities that also provide jobs and income. However, such opportunities would be provided at the expense of opportunities for other interests to passively enjoy roadless qualities of areas not currently protected under Roadless designation. The resultant reduction in aesthetics could act as a counterbalance by decreasing community resiliency, although the negative economic impacts are likely lower than the positive income that would be accrued from increased consumptive and recreational use of the area.

Local area interest groups identified a number of specific opportunities for the expansion of existing human uses during focus group discussions (see Salmon Interface Watershed Assessment Focus Group Summary Report). Numerous groups suggested the expansion of commodity-based uses and personal wood products use such as grazing, commercial timber harvests, personal use posts and poles, firewood (at no charge), and salvaging burned areas for everything from firewood to house-building logs. Promoting recreational mining in such areas as Moose Creek and Napias Creek was also suggested. A number of groups suggested the creation of "recreation areas" in places with a large potential for growth and concentrated use, such as the Beartrack Mine area, or creating accessible and interpretive cultural sites at areas of historical significance, such as Leesburg, Old Leesburg Road, China Bar, and up Pollard Creek. Creation of a non-motorized hike/bike/horse path from Shoup Bridge to Salmon was also suggested.

Other opportunities for expanding use included allowing only all-terrain vehicle use on roads slated for decommissioning instead of totally closing or obliterating them. Opening up the Twelvemile Road was also brought up as an opportunity to restore access that once allowed a number of uses to occur. Maintenance and identification of trails, especially ones of historic importance (such as Napoleon Ridge, Twelvemile to North Basin and the Thunder Mountain trails), was also suggested to improve use of the area. Other opportunities suggested include issuing more trail ride Outfitter and Guide permits to capitalize on the increasing demand for that service, and installing a recreational tram up to Mount Baldy.

XII. How has societal (local and national) perception of wildfire and wildfire risks affected the public expectations of management in the watershed to address the risks?

In 2000, wildfires burned through more than 200,000 acres of the Forest. Smoke cloaked the local communities from mid-July through August—a constant reminder to residents of the burning occurring just miles away. A large-scale fire break created on a ridge above the city of Salmon, burnt embers that were once fences, and homes with lawns framed by black, burnt ground—all of these realities continue to serve as a caution to residents of what wildfire has done and can do again in the Salmon interface.

The fires of 2000 and the reminders and memories that they have left behind—not just around Salmon but nationwide—have contributed to what is widely recognized as an increasing public awareness of wildfire and wildfire risks. With greater awareness has come an increased expectation by the public for management to address wildfire risks. So *how* has societal perception of wildfire and wildfire risks affected public expectations of management to address wildfire risks in the SIWA area? To answer that question, one needs to first look at what the societal perceptions of wildfire and wildfire risks are followed by how the public expects the risks from wildfire to be addressed.

A review of the current research on social attitudes regarding wildfire, the risk of wildfire and fuel reduction methods provides insight into the perceptions that may currently be present nationally, as well as in the local communities. A literature review by Machlis et al. (2002) revealed that while early research suggested the public believed forest fires to be bad and to strongly support suppression strategies of all fires, recent studies suggest the public has grown more knowledgeable about wildland fires and their effects and benefits, and supports management practices that allow wildland fires. Other research suggests that there still exists however, many misconceptions regarding fire, especially as it relates to causes of fire, wildlife mortality from fires, air quality and forest health (Manfredo et al. 1990; Jacobson, Monroe, and Marynowski 2001, Machlis et al. 2002).

In their review, Machlis et al. (2002:96-97) found that perceptions of wildfire risks and the effectiveness of wildland fire management practices are related to:

- Perceived catastrophic potential of wildfires,
- Perceived controllability of wildfire (often with both natural and intentionally set fires viewed as not controllable),
- Familiarity with fire risks (more experience with wildfires tended to increase perceived threats from fire in the WUI and to private forest lands. Personal experience was often a more important factor than the media or other sources of information.),
- Characteristics of individuals and groups in which they are members (income, education, age, and private insurance have been correlated with perceptions about wildfire and wildfire risks. Group membership and location of residence have also been associated with particular views),
- Cognitive “rules of thumb” and biases,
- Emotions such as fear (have the potential to override rational or technical understandings of risk), and
- Prior knowledge of risks (research has shown that people who supported the use of prescribed fire were more knowledgeable about the effects of fire than those who did not support prescribed fire).

Research findings suggest that while there may exist a variety of societal perceptions of wildfire and wildfire risks, there is widespread support for management efforts to address the risks from fire. There is, however, a difference in societal expectations regarding *how* the public expects the risks to be addressed on public lands. On a national level, there is widespread support for allowing some fires to burn their course and for reducing fuels on public lands using both prescribed fire and mechanical thinning to reduce the risk of wildfire. There is strong support by some publics for landscape-level fuel reduction, favoring mechanized removal of fuel over prescribed fire (Kuypers 1995; Winter and Fried 2000). There is also wide-scale support for the use of prescribed fire—although some publics feel it to be reckless—but lack of trust in local agencies’ ability to control prescribed burns (Kuypers 1995; Fried, Winter, and Gilless 1999; Winter and Fried 2000; Brunson 2001). Research has also noted a willingness to pay for public risk-reduction actions (Kuypers 1995; Fried, Winter, and Gilless 1999).

On a local level, focus group responses suggest that most local interest groups are very aware of and concerned about the risks of wildfire in the wildland-urban interface (WUI) and desire management actions such as public education, fuels reduction, and provision of adequate access for suppression efforts by both federal and local fire district forces to address the risks (see Salmon Interface Watershed Assessment Focus Group Summary Report). Although it is evident from the focus group invitation process that some interface residents are not concerned about wildfire risks, a number of residents are and would like to see active management occur to reduce fuel loading throughout the assessment area. Focus group results suggest that the method of choice to reduce fuels in the area varies depending on interest group. Most interest groups prioritized broad-scale wood utilization above prescribed fire, while others felt that only low impact fuel reduction methods, including prescribed fire, or no fuel reduction and only public education, should be used.

Description of Reference Conditions (Step 4)

> Reference conditions as used in the [watershed analysis] guide are a biophysical concept. The concept of reference conditions is based on an assumption that the conditions that prevailed before "significant" human intervention were the result of processes unimpaired by human intervention. Because the ecosystem evolved under those conditions, it is assumed that these conditions represent a sustainable, healthy process. The assumption is further made that deviations from an identified historical range represent warning signs. From a socioeconomic perspective, for most of society, it is deemed desirable to move from prehistorical conditions; that is, away from subsistence lifestyles to higher levels of income, wealth, and creature comforts. For this reason, reference conditions as used in the guide have no counterpart in human dimensions.
>
> *Understanding Human Uses and Values in Watershed Analysis*
> Fight, Kruger, Hansen-Murray, Holden, and Bays 2000, p. 7

With respect to prehistoric and historic cultural resources, the reference condition would refer to the degree of artifact, site or structural integrity, which was clearly greater in the past, and ultimately extends to actual period of use and/or deposition. The period of original use serves as the basis of comparison for determining the potential significance of a resource for visually reflecting and/or interpreting the past. But, with the exception of restoration activities, original condition is not a feasible or even necessarily desired further condition for the resource. Heritage resources are, like many other natural resources, extremely vulnerable to destruction and alteration by subsequent human activities. When heritage resources are found to be significant the goal is typically to preserve those qualities that are of historic value from any further disturbance or deterioration. Protection is typically achieved through documentation, avoidance and sometimes restoration.

Synthesis and Interpretation (Step 5)

I. Heritage Resources

The SIWA area contains at least 82 sites that are considered to be significant historic and prehistoric heritage resources requiring protection and 44 sites that are potentially eligible to the NRHP. The majority of sites is located along Napias Creek or one of its numerous tributaries and is associated with the historic mining operations and communities at Leesburg and California Bar. Other important resources include historic travel routes and highly sensitive prehistoric hunting and habitation sites. Most of the sites, regardless of age or cultural affiliation, are found in association with drainages or other water sources or prominent ridgelines.

II. Cultural Resources

Approximately 25-30% of the assessment area has been previously inventoried for cultural resources. The surveys were conducted over the past 30 years and reflect varying degrees of intensity and completeness. Many do not all meet the current standards of the SHPO for cultural clearance. That said, many of the more recent, large-scale inventories were well-designed sample inventories based on forest wide predictive modeling. These surveys focused on high site probability landforms and rarely covered less than 25 percent of the project area. Due to the informed sampling design, a portion of the inventory shown fulfills the minimum requirements for complete coverage under Section 106 and the SHPO over even broader regions than indicated. Given the variance in survey design and quality, the map does not necessarily indicate complete coverage, but rather provides a general overview of our knowledge base and where extensive heritage work would likely be required prior to proposed undertakings. The cultural resource site locations within the assessment area have also been updated in the GIS corporate database as part of this assessment.

Recommendations (Step 6)

There are generally two types of recommendations resulting from the assessment process; those that are site specific and those that encompass the entire Salmon interface assessment area. Site specific recommendations are 'project' oriented where physical activities are recommended to obtain an objective within a sub-watershed. These may include simple activities such as replacing a non-functioning culvert to complex vegetation manipulation projects using prescribed fire and/or mechanical (harvest) methods. Recommendations that encompass the entire assessment area include many of the Human Uses recommendations that focus on expanding public involvement through public outreach programs, newsletters, and open houses. Other examples include recommendations addressing livestock grazing and weed treatments that may include several sub-watersheds.

Therefore, recommendations will be presented both at the assessment area level describing those recommendations applicable across several sub-watersheds or the entire assessment area, and at the sub-watershed level showing site specific project recommendations.

I. Assessment Area Level Recommendations

A. Human Uses

1. The current Land and Resource Management Plan for the Salmon National Forest (Forest Plan) outlines the general direction and standards and guidelines for management activities Forest-wide. The general directions and standards and guidelines that pertain primarily to human uses and the local community include:

Recreation and Visual Quality

- Provide appropriate development facilities where the private sector is not meeting the demand.
- Maintain cost effective developed recreation facilities which complement non-Forest Service developments.
- Encourage development of private sector recreation oriented support services.
- Provide a broad spectrum of dispersed recreation opportunities in accordance with the established Recreation Opportunity Spectrum classifications.
- Close or rehabilitate dispersed sites where unacceptable environmental damage is occurring or where required by other management objectives.

Heritage

- Complete documentation, excavation and/or stabilization on those heritage resources that have been determined to be important to the prehistoric and historic

character of the region and are currently threatened by natural processes and/or human related activities. Projects of particular interest include:
    - Conduct clean up, restoration and/or structure stabilization, and additional interpretation within historic Leasburg town site.

    - Construct a signed hiking trail from the town site to the cemetery with possible interpretation along the way.

- Implement fuels reduction projects around significant cultural resources, particularly historic structures that are currently threatened by the potential of severe wildfire. The highest site densities, as well as the highest priority sites, fall within the Eureka and Mackinaw Mining Districts in the eastern portion of the assessment area.

Rangeland
- Improve and maintain environmental quality of NFS ranges by managing the grazing in harmony with the needs of other resources and their uses.
- Contribute to the maintenance of viable rural economics by promoting stability of family ranches and farms.

Timber
- Commercial sale of forest products will be made in a variety of sizes and species mix in order to provide a wide range of timber purchaser opportunities.
- Design timber sales to encourage greater utilization and enhance the availability of firewood.

Fire Planning and Suppression
- Provide a level of protection from wildfires that is cost efficient and that will meet management objectives for the area considering social, economic, political, cultural, environmental, life and property concerns (in addition to a number of other factors).

Fire Prevention
- Maintain a fire prevention program through use of annually prepared Forest and District Prevention Plan with emphasis on public contacts, industrial inspection, and appropriate signing.

Additional recommendations described within Human Uses Issue D are presented below in full narrative as displayed in the Human Uses Report in order to maintain the link with the findings and discussions that resulted from the Focus Group meetings.

2. Initiate a **Salmon Interface Management Board—**comprised of city, county, and state government officials, homeowners, BLM and FS representatives, etc. to deal with cross-boundary issues such as fire risks, roads, water and weeds.
    - Board could then initiate and implement the **Salmon Interface Fire Prevention/Public Education Outreach Program** for interface residents,

highlighting education and assessment of specific property risk and defensible space needs. Program could be cooperative effort in conjunction with the BLM, Lemhi County, City of Salmon, Lemhi County Fire Protection District, North Fork Volunteer Fire Department, and Lemhi County Extension Service (possibly High Country RC&D also to tap into the SCA resources).

- Board ensures that we efficiently work together and pool resources to deal with problems that don't abide by ownership boundaries and can nullify mitigation actions done by one group due to neglect/inability to address problem by other groups (i.e., Forest not controlling weeds leads to weeds invading adjacent lands and vice versa).
- Fulfills a local desire for more control in the management of their public lands and provides Forest opportunity to create a trusting, supportive relationship with constituents.

3. Initiate a **Salmon-Cobalt Ranger District Public Planning Group** or **Roundtable—** comprised of representatives from Forest stakeholder/interest groups, city, county, and state government officials, relevant local federal agencies (NFMS, BLM). Group will serve as a collaborative effort to help direct and inform future Forest management. Group will initially be "called up" to help determine project priorities coming out of SIWA. Group will then be placed on "active call" whereby they will be utilized in the *initiation* and ongoing process of future planning efforts such as watershed assessments, environmental assessments, etc. Similar to RAC, but purely Forest-focused. Ideally the group will serve as a template and similar groups will be set up for each Ranger District to provide coverage Forest-wide. If not begun before, groups can be initiated and utilized for Forest Plan revisions.

- This will NOT be like a canned public meeting where the Forest representative outlines a number of alternatives and asks for input from the group. The group should be used at the beginning of any planning effort (ideally having been involved in the watershed assessment that determined the priority of the projects being initiated) to help determine alternatives. It is important that the Forest be a willing partner and truly uses the group as opposed to just giving it lip service so it can check public involvement off the required "to do" list.
- Group cannot be a true collaboration as Forest will always retain power of decision and ultimate responsibility (as will be made explicit to the group), but the group forum will allow two-way communication between the Forest and the public and other government agencies and decisions made will be fully informed. In order to work, the Forest must incorporate or address all the groups concerns and suggestions to gain participants' trust in the process (i.e., if the group makes all these recommendations and the Forest seemingly ignores them, the group will fail. Forest must consider all input and communicate with group why or why not certain decisions were made).
- Group meetings will always be open to the public, to comply with FACA regulations, but general public will be allowed to comment only during "open mike" time.

- Fulfills a local desire for more control in the management of their public lands and provides Forest opportunity to create a trusting, supportive relationship with constituents.

4. Develop a monthly or quarterly **Salmon-Challis National Forest Newsletter**
    - Focus group results emphasize there are definite themes of importance to the public and a desire to be involved in and understand forest management. There is also frustration and misunderstandings about various USFS policies and Forest management objectives (e.g., access and commodity management). The newsletter would include a calendar of events (to publicize public meetings, project report deadlines, etc.), various articles on new and ongoing Forest projects, and a section devoted to increasing understanding about specific management policies. For example, one issue could deal with Forest road management, including an article on the National roads policy and the Forest's status regarding roads. Another issue could address the NEPA process or the changing focus from commodity-based uses to recreation and what Forest objectives are along those lines. These articles should NOT be full of technical jargon and "company line" but instead be written to answer specific questions the public is asking or rebut/confirm conclusions the public has made about Forest actions (i.e., why is the Forest closing roads…do they just want to keep people out? Why aren't roads being maintained as they should be?). We need to have an avenue to keep the public informed on what we're doing, help them understand our policies and management mandates, toot our own horn, explain our actions, and clarify misconceptions due to our previous lack of communication. The newsletter will also provide contact information so that the public has an avenue to provide input or get more information.
    - Newsletter can initially be sent out internally, to SOPA mailing list and posted on the Internet.
        - Newsletter should be sent out internally to update FS and BLM employees on what their co-workers are doing. Employees are our constituents also, and a newsletter will provide a means to keep us all in the loop.
        - We could also set up a Forest email listserv and mail it that way also.

5. Conduct **fuels reduction project to protect the Salmon Municipal watershed** emphasizing low-impact methods (if done within the municipal watershed it will likely require a Plan amendment, area is also designated Roadless).

6. Other priority areas for **forest health and fuels reduction projects** are **Twelvemile area, East Baldy,** and **Napoleon Ridge.**
    - Twelvemile needs treated primarily for mistletoe infestation.
        - Project should consider re-opening the upper part of Twelvemile Road to restore historic recreational access, ideally as Level 3 road (if possible) to facilitate access by disabled users.

- Road re-opening will have to provide suitable displacement areas for big game and abide by cover restrictions as listed under Forest Plan Standards and Guidelines for Management Area 5B and 4b.

- **Any** projects proposed should emphasize commercial and/or personal use wood utilization by the public (i.e., house-building logs, post and poles, firewood, etc.) when appropriate and according to the management area timber prescriptions (high, moderate, and low output levels).

7. **Preservation and maintenance of traditional uses** of an area (i.e., grazing, firewood collecting, mining, etc.) should be emphasized in projects proposed.

8. Forest should hold a **Roads Open House**, a widely publicized day event open to the public where Forest transportation specialists are available to discuss and explain USFS Roads Policy and take comments. Nice display of Forest roads map (that public can write on), roads issues, frequently asked questions and answers, etc. should be put up (maybe stay up by Front Desk for a while).

9. **Projects involving changes in road management** in the area should include emphasis on public involvement.

- When roads are to be decommissioned, closed, constructed or added to the system, a **Roads Forum** should be part of the scoping/public involvement process. Widely publicized locally and regionally and open to the public, Forest representatives present the USFS Roads Policy (explaining classified vs. unclassified, decommissioning, funding, etc.), discuss resource needs/constraints and gather public input. Forum can be part of the public meeting for the larger project, but should be emphasized in publicity.
- Notification of the proposed road changes and explanation of why should be widely publicized in the local and regional media and on site before Roads Forum is held.

10. Create **historical interpretive travel route and site enhancement** emphasizing important heritage sites within the area such as Leesburg, China Bar, Napias Creek, the Old Leesburg Road, and Pollard Creek. Project would include preserving and enhancing sites for educational purposes (i.e., kiosks, trails w/ signs, etc.).

- The Forest could work cooperatively with the Salmon Valley Chamber of Commerce and/or BLM to do a **brochure/booklet** outlining driving, hiking, and ATV-accessible routes to the areas and providing in-depth historical interpretive information. Similar in format to the USFS/BLM/Idaho State Parks and Recreation's "Land of the Yankee Fork Historic Area" brochure and John Aulik's "Salmon River of No Return Adventure Travel Guide" (which do not cover Leesburg and many of the areas integral to the history of the city of Salmon).

11. Coordinate a wide-scale **volunteer "Adopt a Trail" program** with recreational groups (Backcountry Horsemen, local Blue Ribbon Coalition members, Idaho Outfitters

and Guides Association members, snowmobilers, cross-country skiers, etc.) and youth groups (local Boy Scouts troops, etc.) to formally maintain certain trails and signs in the area (especially historic ones such as Napoleon Gulch or Thunder Mountain Trail). USFS will provide equipment and limited guidance and training, primarily letting the groups do the work on their own under a liability waiver and with few restrictions. Forest should provide volunteers with GPS units so that trails can be more accurately mapped and represented on the Forest Travel Map. Potential for making it a cooperative effort with the BLM.

- Signs marking each trail will include recognition of the sponsor group.

12. Work with area grazing permittees to create environmentally sensitive **alternative water sources for area grazing allotments** to avert resource damage (pull livestock off of perennial water sources) and better distribute livestock. It is often the case that water, not forage, is the primary limiting factor to grazing use in the area and providing alternative sources will directly and indirectly benefit rangeland health, the local community, and wildlife as well.

B. Livestock Grazing

Ensure livestock grazing use standards are being applied and successfully met according to Allotment Management Plan or Annual Operating Instruction direction. Take appropriate actions if standards are not being met or operating instructions are not being followed.

This recommendation is applicable to the entire assessment area, however, special focus should be made on those allotments tied in with BLM spring use allotments to ensure proper scheduled turn out onto Forest, herd size, and fall trailing requirements are being met. Specific sub-watersheds where such coordinated grazing systems occur include Salmon-Perreau, Salmon-Henry, Salmon-Wagonhammer, Salmon-Fenster, and Salmon-Wallace.

C. Noxious and Invasive Weeds

Coordinate weed treatments through BLM and the Lemhi County Coordinated Weed Management Area to focus treatment efforts on high priority infestations and within watersheds most susceptible to weed expansion and encroachment. Although this recommendation is applicable throughout the assessment area, the most susceptible sub-watersheds include Salmon-Perreau, Salmon-Wallace, Salmon-Henry, Salmon-Wagonhammer, and Salmon-Fenster. Weed treatment activities should include pre-treatment inventory for sensitive plant species or sensitive habitat and post treatment monitoring for effectiveness and site restoration needs.

D. Fire Ecology

The following discussion relates to general recommendations and suggestions to the approach of reducing wildland urban interface fire risks, reducing the fire regime condition class, and reducing fire severity. Specific projects designed to meet fire risk related objectives at the sub-watershed level are presented as site specific recommendations later in this section.

1. Wildland Urban Interface (WUI)

Location of treatments: Treatments for WUI must take into consideration the complete context of fuels in the landscape surrounding the WUI when extreme fire conditions are experienced.

Dr. Hann suggests an excellent approach to reducing wildfire risk to WUI areas. Most of the following discussion has been adapted from Hann and Strohm, 2002.

There is a landscape design fuels treatment option that can reduce wildfire risk to WUI and have the added benefit of reducing risk to ecosystems at landscape scales. This type of design would involve treatment and maintenance to achieve the condition class 1 landscape objective across a watershed to change large wildfire behavior and effects. Essentially focusing on treatment of high departure polygons throughout the watersheds in a pattern most effective at changing large wildfire behavior and effects (Finney and Cohen 2002; Hann and Bunnell 2001). The first set of treated polygons would focus on mechanical and prescribed fire treatment of operationally accessible high departure polygons and maintenance of low departure polygons that are in the zone of wildfire influence to the WUI areas (Hann and Strohm, 2002).

The second set of treatments would tie in the intermingled less operationally accessible high departure polygons through use of hand cutting and prescribed fire by being able to anchor into the first set of treatments. In addition, prescribed fire with minimal mechanical or hand treatment could be used at the higher elevations and in areas where fuel breaks (natural or human made) currently exist and in the roadless areas, to reduce the potential for uncharacteristic fire spreading from or to that area. In addition, the design could take into account ecosystem objectives for reducing risks to air, water, native species habitats, and sustainability; in essence achieving risk reduction for multiple benefits at the same cost (Hann and Strohm, 2002).

This landscape approach to treatment would substantially change the behavior and effects of a large wildfire run originating from within the Salmon Interface watersheds or from adjacent landscapes. Wildfire from any of these sources would still spread fairly rapidly in grass and shrub surface fuels, but would have low risk of torching and spotting and little risk of sustaining a running crown fire. Initial attack would have a much higher chance of containing the fire and if the fire escaped initial attack suppression efforts could contain the fire using retardant lines or hand or dozer lines anchored across strategic areas. There would be little spotting into urban interface structures, thus reducing risk to both vulnerable and non-vulnerable structures. It is reminded that the vulnerability of structures primarily exists within the narrow zone of the structure and surrounding area that typically is in the ownership of the structure owner (Cohen 2002, Finney and Cohen 2002). However, by substantially reducing firebrands and changing fire behavior from crown to surface, the risk even to vulnerable structures becomes less. We have generally found that even in communities with high awareness of wildfire risks and ability of structure owners to reduce these risks with mitigation of structure vulnerability and fuel management, there is at best only about half of the structure owners that will take action. This type of wildfire behavior could be managed within the availability of typical suppression resources without having to redirect most of the resources to protection of structures. Some redirection would probably be necessary to protect vulnerable structures in areas with torching, but this would be for a small number of areas compared to the WUI wide vulnerability that exists under the no treatment or WUI focus options. Costs of suppression would be much less under this scenario than the no treatment or WUI focus scenario and damage to resources would be minimal (Hann and Strohm, 2002).

Effective Fuels Treatments: For WUI areas located within the path of extreme fire behavior and treated with only "doughnut hole" style defensible space treatments, the high risk from an oncoming extreme fire event would not be effectively mitigated. In such a situation fire suppression crews would be unable to attack this wildfire at the head even if the urban interface buffer areas had been treated for crown fire and fuel risk reduction, because of the mass fire brands raining into the area and fire jumping lines constructed by dozer or hand crews.

2. Fire Regime Condition Class Restoration

Location of treatments for ecosystem condition class 2 & 3 restoration: One of the first steps for identifying priority treatment locations will be to identify the overlap of the FRCC high abundance and FRCC high risk for sustainability layers (see Map A-7). Then these locations for treatment should be evaluated in light of reducing WUI risk, reducing risk of losing ecosystem components, sustaining T&E habitat, and cost effectiveness. Other factors will need to be considered.

Minimum area to treat to restore the PVTs to a condition class 1: Using the method outlined by Hann (Hann and Strohm, 2002) the following estimated acres are the minimum needed to <u>restore</u> the listed PVTs to a mid-point departure for a fire regime condition class of 1. Dry Douglas fir minimum of 7,200 acres; Douglas fir-lodgepole minimum of 16,800 acres; and dry subalpine fir minimum of 8,200 acres.

3. Reducing Fire Severity

Pollet and Omi studied the effects of wildfire on forest stands that had a variety of fuel treatments before the stands were burnt by a wildfire. Pollet and Omi studied fuels treatment that included prescribed broadcast burning, thinning and under burning, and whole tree removal and concluded that fire severity and crown scorch were significantly lower in the treated stands (Pollet and Omi, 2002, page 2).

In the Salmon interface analysis forest structural stages were used to address forest structural characteristics (e.g. crown closure, tree diameters, and the relative vertical/spatial arrangement of trees) (Hessburg et al.1999, pg 46-47). Fewer trees/acre will result in less continuous crowns and ladder fuels. Also, larger Douglas-fir trees will have thicker bark which increases fire resistance, and will generally have live branches higher above the ground. Fuels treatment activities can provide an increase in fire resistance characteristics. Pollet and Omi found “the benefits of treated stands are lower potential for crown fire initiation and propagation, and less severe fire effects” (Pollet and Omi, 2002, pg 8).

Old forest single strata (ofss) is the most under represented structural stage in the dry forest landscapes across the S-CNF and the Northern Rockies regarding fire resistant forest structures, while the old forest multi strata (ofms) is over represented. These ofms are very prone to crown fire during periods of high fire danger or drought. Crown fires will result in converting ofms to stand initiation (si). Avoiding the conversion of forests with mature large diameter ponderosa pine or Douglas-fir to si is a primary objective of fuels treatment. In most situations, ofms forests would be converted to ofss forests that are characterized by a high degree of crown fire resistance. Generally, it is only when the mature large diameter trees are not healthy enough to provide the large tree component of the post treatment stand that they should be intentionally killed or harvested. For example, when the primary overstory trees are heavily infected with mistletoe, Hawksworth rating of 4 or higher, conversion of ofss to si is warranted (Hawksworth 1961).

Thinning smaller trees and understory trees as a tool to reduce fire severity: Thinning from below will have a direct effect on the height of live limbs that may become available fuel for fires in high fire danger situations. These live lower limbs are the fuels (ladder fuels) that allow fire to climb into the forest canopy and result in high severity crown fires.

Reducing upper level crown fuels: The ladder fuel profile is important in the context of crown fire initiation, propagation, and crown fire spread. When considering multistoried stands, the higher up into the ladder fuel profile where dense canopies can be treated to open the stand, the greater the opportunity to reduce the risk of crown fire. Maximum reduction in crown fire risk will be accomplished by treating the entire ladder fuel profile (Omi and Martinson, 2002, pg 23; Fiedler 2001, pg 17). Stand density and basal area were found to be important descriptors of fire severity, the lower the basal area and the lower the stand density, the lower the fire severity indicators (Pollet and Omi, 2002).

Ofms stands are characterized by excessive amounts of small and medium size trees (ladder fuels). Some ofms stands in the dry forest landscape may have too many large diameter trees per acre in their overstory to promote a functioning crown fire resistant dry forest ecosystem. Too many large trees per acre in the overstory can result in too high of a crown bulk density condition, increasing the risk that a crown fire could spread across that stand. In such cases, the large overstory trees that are at greatest risk from other mortality factors (insects, low vigor, stem rot, surface fires) should be thinned out to a level that results in the large overstory canopy closure reflective of historical conditions.

In such a treatment, it would be desirable to convert ofms to an ofss stand condition, increasing the stand's resistance to crown fire.

4. Ladder Fuels Reduction and Reduction of Crown Fire Potential

Killing smaller trees: Smaller trees can be thinned (killed) via cutting or the use of broadcast burning (fire).

Low severity broadcast burns will result in less heat damage to larger fire resistant trees than to smaller seedling/sapling and pole size trees. Ponderosa pine and Douglas-fir's ability to resist heat damage to the bole of the tree is a function of bark thickness. The thicker the bark, the more heat resistance the tree has. Bark thickness is related to tree diameter, the large the diameter, the thicker the tree's bark. Small diameter trees will be at higher risk of receiving lethal burn damage from the prescribed fire than large trees. An objective of the broadcast burn is to assist in thinning out the overstocked component of tree seedlings, saplings, and pole size trees. In the smaller size classes, Douglas-fir is more susceptible to fire damage from heating at the base of the tree than ponderosa pine.

Thinning using broadcast burning will reduce the risk of crown fire initiation, crown fire propagation, and to some extent crown fire spread in the overstory. Surface fuels will be reduced. Risk of crown fire initiation and propagation fuels will be reduced for the next 20 to 30 year period, as influenced by tree stocking density and height to live crowns. Risk of crown fire spread, fire moving from one overstory tree to another, is not likely to be greatly reduce, since it is correlated to reduction in basal area (Pollet and Omi, 2002), and the thinning of only small diameter trees (understory) has less impact on basal area or overstory crown density.

Cutting smaller trees (up to 8 inch dbh) with follow-up slash treatment: All thinning actions should treat the slash generated from the tree cutting.

All tree cutting activities should be accomplished with a thin-from-below treatment. Treating the ladder fuels by cutting allows for a more controlled thinning of the overstocked small tree component. It allows for more control in ensuring that larger trees that are more fire resistant are left. It also allows for more control when reducing ladder fuels around other high value resources (e.g. old-growth trees, cultural resources, etc…).

Thinning up to 8 inch dbh in combination with slash treatment will reduce the risk of crown fire transition, crown fire propagation, and to some extent crown fire spread. Surface fuels will be reduced, crown fire initiation and propagation fuels will be reduced (influenced by tree stocking density and height to live crowns), and crown fire spread rate may be reduces with some reduction in basal area.

Cutting smaller trees (including trees greater than 8 inch dbh), removing some wood products, and burning hazardous fuels: By thinning small trees, and removing some trees that are larger than 8 inches dbh, and leaving the largest trees in the stand, risk of crown fire initiation, propagation, and spread will be reduced. Cut trees larger than 8 inches will reduce ladder fuels in the upper portions of the ladder fuel profile and will reduce risk of crown fire propagation and crown fire spread. Thinning trees from seedling size to trees greater than 8 inches dbh will be displayed by a reduction of basal area, a reduction in stocking density, and an increase of height to live crown (and crown base height).

Understory plant vigor and plant species diversity: The trend of high levels of competition for water, nutrients, and sunlight will be reversed on areas with commercial and pre-commercial thinning.

Important grasses and forbs that are adapted to frequent low severity fire regimes and open forest canopy conditions will be allowed to reoccupy the understory of these dry forest type stands when low severity fire becomes a part of the disturbance regime again. The broadcast burns will prepare seedbeds, cycle nutrients, and stimulate plant species that sprout. Understory plants will have light, nutrients, and moisture available if forest canopy or tree stocking levels are low. Low levels of competition for needed resources will result in high plant vigor. Higher vigor plants will generally be able to produce more viable seeds or vegetative reproductive starts than plants of poor vigor. This will increase the understory plant community's ability to respond to wildfire and provide for rapid soil cover for stabilization.

E. Roads Analysis

Opportunities for road closure with a focus on eliminating roads identified as highly erosive.
Improve drainage on roads with granitic soils.
Replace signs (especially in northern half of the focus area).

F. Forested and Non-forested Vegetation

Recommendations pertaining to the forested and non-forested vegetation were site specific in nature and identified and described within each sub-watershed. These recommendations are presented later in this section in table format. An integral component of identifying vegetation treatment objectives included the development of a desired future condition (DFC) and the historical (or natural) range of variability (HRV). These were developed for each non-riparian potential vegetation type that occurred within the assessment area, and since these DFCs and HRVs pertain to the entire assessment area they will be presented in Table 6-1 of this section.

Table 6-1. Historical Range of Variability (HRV) and Desired Future Conditions (DFCs)

The historical range of variability (HRV) and short and long term desired future conditions (DFC) are described below for each potential vegetation type (PVT). The distribution of the current vegetation is also displayed. The format follows the box model diagrams to provide comparisons and consistency between the numerous PVTs making up the assessment area. Included in this discussion are brief narratives describing the site characteristics of the PVTs and the rationale for defining the desired future conditions. The codes shown in the five boxes refer to vegetation structural stages, the descriptions of which are defined in Appendix A.

Mountain Big Sage /Conifer PVT (113) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral oh, ch, si	Box B Mid Seral Closed cms (young), sec, ur, yfm	Box C Mid Seral Open oms (young), seo	Box D Late Seral Open oms (mature), ofss	Box E Late Seral Closed cms (mature), ofms
SIWA HRV	20	30	35	10	5
Current (mapped)	19	13	68	0	0
Current (estimated)	19	13	0	22	46
DFC Short Term	36	19	13	22	10
DFC Long Term	10	35	40	10	5

It is recognized that Douglas fir coexisted with mountain big sage under historical disturbance regimes (frequent surface fire). The mountain big sage/conifer PVT occupies a transition zone between the dry Douglas fir forest and the mountain big sage. The spatial extent of the zone is variable, being dependent upon aspect, elevation, fire events, and weather cycles. HRV situation had periods of conifer establishment in between fire events. Current situation may have more in areas fire has been absent, or could have less in areas on drier sites. Some smaller tree mortality has occurred in the past ten years presumably from drought. The transition zone is important for calving and fawning cover for big game (non-migratory elk, deer, and antelope), thermal cover (elk, deer, sheep, and goats in some places), and it provides important foraging areas for raptors, flammulated owls, and three toed woodpeckers. Sage grouse may utilize this zone (primarily old males) but not as key nesting habitat.

Discussion between Current (mapped) and Current (estimated):
-Box model classes for the upland shrub PVTs used early seral for grass-forb, mid seral (open & closed) as 'young' (indicated by a lack of large woody stems and dead wood in the canopy), and late seral (open & closed) as 'mature' (the presence of large woody stems and abundant dead wood in the canopy). Data used from the Forest vegetation map does not classify sagebrush by age class

(young and mature), but instead uses canopy cover (open & closed). Field observations suggest that open and closed sage comprise the majority of the sagebrush types and should not be classified as mature versus young except where recent (0- 20 years) fires have occurred. Following this discussion, it is believed that the majority of the sagebrush types mapped are mature within this PVT. It is recommended that further research be considered to correctly map shrub age classes or refine the model to use canopy classes.
-Although the imagery identified only open (<15% cover) mid shrub (oms), field investigations have determined that approximately 1/3 is in reality a closed (>15% cover) mid shrub (cms).

Short term: This PVT is comprised of both shrub and woodland cover types; desire to maintain a mix of open and closed woodland and shrub structures. Current woodland structures are early seral (si) and mid seral closed (yfm).
Create 10% mid seral open seo from mid seral closed yfm.
Allow succession from early seral si to mid seral closed and mid seral open through thinning.
Create 36% early seral oh and ch from late seral closed cms (mature).

Long term desired future condition would be some mature pole or larger trees on the landscape at all times with patches of smaller trees (seedling, sapling, pole) and to maintain a shrub-conifer transition zone between mountain big sage PVT and the Dry Douglas-fir PVT. Maintain mid seral open and closed and late seral open woodland structures to provide big game thermal and hiding cover and to act as replacement stock in the event of a stand replacement fire. Retain 40 % to 60 % mid seral closed patches (in entirety) to provide thermal cover. Maintenance of mid seral open would encourage development of late seral open, while some mid seral open could be set back to early seral or some early seral may develop naturally; some mid seral open could be encouraged to develop into mid seral closed.

Recommended treatments for mid seral closed should include retention of healthy trees in the larger diameter snags.
Allow natural establishment of conifers to perpetuate succession versus creating stand initiation through treatments.

Mountain Big Sage PVT (112) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral oh, ch,	Box B Mid Seral Closed cms (young)	Box C Mid Seral Open oms (young)	Box D Late Seral Open oms (mature)	Box E Late Seral Closed cms (mature)
SIWA HRV	15	20	30	15	20
Current (mapped)	34	0	0	66	0
Current (estimated)	24	0	10	44	22
DFC Short Term	40	10	20	20	10
DFC Long Term	15	20	30	15	20

The estimated current adjusts the mapped percentages into the age categories displayed in the box model, since the landscape mapping was unable to pick up the age structures. Based on field observations mature open was split into 1/3 mature closed and 2/3 mature open and 10% early seral (oh and ch) was moved to mid seral open, young (oms).

The short term DFC is displayed with fire disturbance focused on the late seral to refresh stagnated (‘stable state’) mature stands by burning 12% late seral mature closed (to early seral oh and ch) and 24% of late seral mature open (to early seral oh and ch). Succession would move early seral to mid seral open (young) and 10% mid seral open (young) to mid seral closed (young). Shrub maturity is not expected to occur in the short term.

The long term DFC is to maintain natural succession through early and mid seral and provide for mature stand disturbances to maintain open structure and create additional early seral. This can be achieved by allowing for mosaic burns that burn through a variety of structural stages across the landscape. The long term desired condition then approaches the HRV.

Wyoming big sage PVT (109), Three-tip sage PVT (118), and Bunchgrass grassland PVT (101) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral oh, ch,	Box B Mid Seral Closed cms (young)	Box C Mid Seral Open oms (young)	Box D Late Seral Open oms (mature)	Box E Late Seral Closed cms (mature)
SIWA HRV	20	5	20	50	5
Current (mapped)	44	0	0	48	8
Current (estimate)	34	0	10	30	26
DFC Short Term	24	5	15	20	36
DFC Long Term	20	2	20	49	9

Wyoming big sage and bunchgrass/grassland are evaluated together as a PVT. This is a different approach than that described in the Columbia Basin since the "bunchgrass/grassland PVT" described in there differs from the grassland types of the Salmon NF. Three tip sage PVT was combined with the Wyoming big sage/bunchgrass grassland PVT in the current version of the succession model. Recommendations are that future versions should consider separating the Wyoming and three tip PVT's because of the difference in response to fire disturbance (three tip has a tendency to sprout after fire, and effects of fire are most often lethal to Wyoming big sage).

The Current (estimate) has been altered to reflect the previous discussion of age structure used as an indicator of seral stage. In addition, mapping indicates that all the shrub structure is open while field investigations indicate that there is approximately 1/3 in a closed structure. The entries under Current (estimate) show these modifications to the Current (mapped) data set: 10% early seral went to mid seral open (young); 18% late seral open (mature) went to late seral closed (mature).

The short term scenario is based on natural succession without fire disturbance. Herbland communities remain as herblands and a small amount (10%) grows into young sage (open). Young sage (10% estimated) continues to remain as young open and a small amount (5%) develops as young closed. Mature open remains open and a small amount (10%) develops into mature closed. Mature closed remains mature closed without fire. A small amount of young sage (less than 5%) may develop into mature, however is debatable due to the short (10 year) timeframe.

In the long term it is expected that about half of the mature open would stay mature open and about 2/3 of the open young would succeed to old open. The majority of the early seral herbland would succeed to mature open. The remaining structural stages that don't go to mature open should recycle with fire and mature through natural succession through herbland, young open and closed. The lack of disturbance has reduced mature open that was the majority of the historical landscape. In order for this long term scenario to occur, some natural fire should occur on the landscape. Without fire, no young will be created and the current open mature will become closed.

Prescribed fire in this low elevation shrub zone is constrained by the presence of invasive non-native species and the potential risk of their expansion and establishment after site disturbance. These species are present in varying amounts across the assessment area and due to their colonizing abilities may become established and dominate the treatment site following disturbance. Taking a close look at the site characteristics is emphasized when considering treatment opportunities within the Wyoming sagebrush and tree-tip sagebrush vegetation types.

Mountain mahogany PVT (121) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral oh, ch,	Box B Mid Seral Closed cms (young)	Box C Mid Seral Open oms (young)	Box D Late Seral Open oms (mature)	Box E Late Seral Closed cms (mature)
SIWA HRV	10	10	20	40	20
Current (mapped) [1]				100	
DFC Short Term	0	0	0	100[2]	0
DFC Long Term	10	10	20	40	20

[1]Current mapped acres (115 acres) underestimate existing extent. Estimate exiting stands at over 2,000 acres (1960's &1970's field mapping).
[2]Short term DFC is to protect existing stands by reducing fuel accumulation

Site Characteristics and Historic Situation:

-Mountain mahogany occupied areas with very shallow soils associated with rock outcrops.
-Stands were most common in the mountain sagebrush/conifer transition zone.
-Fire was frequent in the transition zone, but infrequent in the rocky sites. Mahogany burned possibly every other event (50 to over 100 year intervals).
-Mahogany is grazed heavily by big game, especially elk. Big game numbers were much lower than today prior to game management initiated in the 1940's. Numbers have increased through 2000. Since then game numbers declined and are below the target levels in 2003. Domestic livestock also browse on mahogany to some extent. Cattle and sheep grazing was widespread in the late 1800s through the mid 1960s. Since then sheep grazing has dramatically decreased and cattle grazing is under more direct management.
-Mountain mahogany is highly susceptible to fire with little or no spouting ability and sporadic reseeding potential.
-Few mahogany plants become established due to big game grazing pressure.

The vegetation mapping products have greatly underestimated the current extent of mahogany due to being mapped as rock.

There is concern that recent fires have been lethal to mahogany. Several attempts by Forest staff to establish new mahogany plants have not been successful (spring & fall burning, cutting, and planting of seedlings).

The majority of the existing mahogany is old, and lacks multiple age structure. Many individuals are dead or decadent creating an unnatural fuel accumulation and an increased risk of lethal fire. Most stands would not survive with even a few live individuals in the rocks. Any plants that do survive or new plants that establish are likely to be damaged from grazing (elk, deer).

Most mahogany are open tall shrub (actual canopy closure 20% – 40%). Recommendations include careful study with demonstrated success for any proposed treatment methods. Natural fires may provide some insight. Suggest monitoring the 2000 Fenster fire and the rehabilitation projects in the Clear Creek fire (2000). Some fuel reduction treatments by using hand methods to remove fuel accumulation may prevent lethal fires in existing stands.

Ponderosa pine grassland PVT (133) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
SIWA HRV	20	10	20	40	10
SIWA Revised Draft[1]	10	0	20	70	0
Current	1	16	3	28	52
DFC Short Term	1	0	19	80	0
DFC Long Term	10	0	9	80	0

[1]Revised draft data was not incorporated into this analysis; once final, it should be substituted in future analysis. The revised data updated the box model for use in the S-C Fire Plan.

Historical frequent surface fires (20 year interval) maintained open structure (mid and late seral) with a grass understory. Trees that survived low intensity fires grew into large diameter trees with thick, fire resistant bark. These sites are marginal for conifer establishment due to their hot, dry character. Due to the frequent fire regime, these sites are dominated by bunchgrasses with sparse shrub cover. Fire exclusion has encouraged shrubs and conifers to become established and increase in dominance. This increase in woodies has resulted in fires with higher severity and intensity. Currently 68% of the landscape is in a closed canopy structure (mid and late seral) with a high risk of crown fire. Relatively few acres (1,057) of this PVT was mapped within the assessment area.

The recommendation is to convert the closed late seral (52%) to open late seral and the closed mid seral (16%) to open mid seral. Wild fire is expected to occur within 10 to 50 years and create sufficient early seral structures.

Douglas fir without ponderosa pine, PVT (52) HRV, Current, and DFC (short and long term)

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
SIWA HRV	20	10	20	40	10
Current	9	21	0	14	56
DFC Short Term	9	5	16	60	10
DFC Long Term	20	10	20	40	10

Site Characteristics and Historical Situation:

-Historically crown fires were not sustained due to open canopy.
-Extensive historical harvest of mid and large diameter trees (mine timbers).
-Multiple harvest activities from the 1880s to 1980s; some have totally regenerated (early to mid seral) and not had time to develop fire resistant characteristics or large trees (exasperated by fire exclusion).
-Current situation is comprised of multi layered canopies, high ladder fuel (live canopy layers), excessive duff and surface woody fuel accumulation. Dwarf mistletoe has increased due to stand densities and the dwarf mistletoe structures (brooms) facilitates crown fire initiation and spread. The majority (77%) of dry Douglas fir on the landscape is in a closed canopy forest structure; 56 % is late seral closed, and 21% is mid seral closed. Historically the majority (60%) was open (mid and late seral) and resistant to crown fire spread.

In the short term the primary focus is to protect existing late seral in a fire resistant structure and to manage for more late seral open than was present historically. This would allow for improved fire resistance (rapid crown fire spread) on the landscape. Open forest structures are resistant to large fire spread and the large diameter trees are resistant to lethal damage from surface fires. Currently, across the Forest, the large diameter component has a higher mortality rate than is being replaced. This situation is not restricted to the Salmon Forest but is a common trend across the northern Rockies and the western United States.

Short term treatments should focus on converting late seral closed to late seral open and maintenance of existing late seral open, along with converting mid seral closed to mid seral open. Treatment of approximately 10, 000 acres (half of the existing mid and late seral closed) in the short term is feasible leaving an additional 10,000 acres at high risk to lethal fire. It is reasonable that a lethal fire could occur within then next 10 years, resulting in a substantial amount of early seral. Recommendations would generally be limited to treating mistletoe infestations by converting late seral to early seral for this reason.

Long term: Maintain late seral open and create more mid seral open. Once the landscape has structural patterns that allow it to be resilient and resistant to wild fire, treatments should focus on returning landscape diversity similar to historical variety.

Douglas fir/Lodgepole PVT (74 & 75, gentle and steep slope) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
Gentle (<30%)					
SIWA HRV	15	25	40	15	5
SIWA Current[1]	21	52	0	+	27
DFC Short term	21	12	40	20	7
DFC Long term	15	20	40	20	5
Steep (>30%)					
SIWA HRV	30	35	20	10	5
SIWA Current[1]	21	52	0	<1	27
DFC short term	21	22	30	22	5
DFC Long Term	30	35	20	10	5

[1] Current data combines gentle and steep. Separate PVTs (and HRVs and DFCs) were developed in recognition of differences in fire behavior and fire regimes occurring on steep slopes versus gentle slopes. Developing the mapping procedures to capture the 30% slope break for the current vegetation is still being refined.

Nearly 80% of this PVT is closed structure. Historically gentle terrain had more than 50% in open structure, while currently there is virtually no open structure.

Short term:
Recommend where gentle slope conditions are present, converting mid seral closed (up to 40%), where crowns have lifted, to mid seral open and leave some closed (younger stands with full crowns) for wildlife habitat (in large patches). Create 20% late seral open from late seral closed. Allow early seral to progress naturally into mid seral closed to provide wildlife habitat (lynx, thermal cover, hiding cover). Do not recommend treating late seral to create early seral because it is likely that a fire event will occur in 10 years and create more early seral. An exception would be to treat mistletoe infestations. In open structures Douglas fir is the primary overstory species. This species has thick bark cambium and is resistant to surface fires. Recommend not leaving lodgepole as the primary overstory species because it is not resistant to surface fires and therefore cannot maintain large diameter stand structure.

Historically, where slopes are steep, the open structure (mid and late seral) components were dominated by a Douglas fir overstory similar to the gentle terrain. Closed seral structures were a mix of Douglas fir and lodgepole pine. Steep slopes have a higher probability of higher severity surface and crown fire resulting in a mixed severity fire regime with relatively smaller patches of crown fire. Much of the lethal fire severity was a mosaic surface fire resulting in stand structure with a high amount of variability (diameter and age class) with Douglas fir as the dominant species. The occurrence of lodgepole pine has increased due to fire exclusion. Recommendations on steep slopes include creating slightly less (30%) of the mid seral closed to mid seral open and slightly less of the late seral open (22%) to late seral closed.

Long term
Recommend maintaining late and mid seral open at levels similar or slightly above HRV to help reduce the risk of large landscape fires if effective wildlife habitat can be maintained. Treatments will require close coordination with lynx and big game guidelines.

The Aspen/conifer PVT is often associated within the Douglas fir/Lodgepole potential vegetation type. Opportunities to address departures from historic structural stages for aspen/conifer can also be identified.

Subalpine fir, Dry PVT (66 and 68, gentle and steep slope), HRV, DFC (short and long term), and Current

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
Gentle (<30%)					
SIWA HRV	10	35	40	5	10
SIWA Current[1]	11	65	0	0	24
DFC Short term	21	15	40	5	19
DFC Long term	10	35	40	5	10
Steep (>30%)					
SIWA HRV	25	40	10	5	20
SIWA Current[1]	11	65	0	0	24
DFC short term	26	50	0	0	24
DFC Long Term	26	40	10	5	20

[1] Current data combines gentle and steep. Separate PVTs (and HRVs and DFCs) were developed in recognition of differences in fire behavior and fire regimes occurring on steep slopes versus gentle slopes. Developing the mapping procedures to capture the 30% slope break for the current vegetation is still being refined.

Open mid seral was a substantial component of the historical landscape and was a function of location related to wind patterns and trees developing wind firmness from an early age. Lodgepole pine treatments that move from mid seral closed to mid seral open should consider wind firmness characteristics of leave trees and wind patterns related to the treatment area. In some cases, some stands will not develop wind firmness or wind patterns are such that leave trees would blow down. Wind thrown trees, particularly in lodgepole, were historically common across the landscape and should not be considered a negative attribute. The large patch (greater 1,000 acres) condition of down logs and dense regeneration characterizes ideal lynx habitat (mixture of denning and foraging).

Historical conditions have modeled the landscape at 40% mid seral open, 35% mid seral closed, and 10% early seral based on the assumption that on the gentle slopes 60% of fires were non-lethal and 40% were lethal. However, on the steeper slopes the amount of non-lethal fire was much less (15%) and lethal fires characterized the majority (85%) of the mosaic pattern.

This failure to delineate the steep slopes resulted in all the subalpine fir, dry PVT being classified as gentle. Historically, its expected that there was less seral open and more early seral and mid seral closed on the landscape than our data reflects. Expectations are that a substantial portion of the landscape will be correctly classified as steep and that there should be more early seral and mid seral closed, and less mid seral open on the steeper slopes. In anticipation of the new data (by 2004), recommendations should focus on getting the landscape in a more resilient structural condition by creating early seral from mid seral closed that has begun to mature (crowns are lifted, crown ratios are less than 50%) and from stands that have open understories (advanced pole characteristics), that would total approximately 15% of the current mid seral closed structure. The objectives of these recommendations are to maintain a relatively high proportion (80%) of mid- and late seral closed, combined with maintaining early seral, and mid- and late seral open. Recommendations for the gentle slopes would be focused on creating early seral (10%) and mid seral open (40%) from mid seral closed, and maintaining late and mid seral closed at around 20% each.

Treatments on the steeper terrain would benefit lynx denning habitat and big game hiding cover (mid seral closed and late seral closed). Treatments on the gentle terrain would benefit lynx prey habitat (snowshoe hare). Patch size for lynx foraging and big game hiding cover can be large and must have low open road density. In particular, winter motorized travel compromise habitat effectiveness for lynx.

Treatments that create early seral or open mid seral in a mosaic pattern could be designed to reduce the risk of large crown fires across the landscape. The designs should consider slope, wind direction, fuel structure, and treatment unit shape (Finney 2001). Other considerations in lynx habitat should include placement of treatments in locations that would not encourage snowmobile play areas (e.g., next to groomed routes).

Subalpine fir, moist PVT (69) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
SIWA HRV	15	45	10	5	25
Current	3	4	0	0	93
DFC Short Term	23	4	0	48	25
DFC Long Term[1]	15	45	10	5[2]	25

[1]Long term is for 50 to 100 years and assumes current management restrictions and policies have been modified.

[2]The low amount of late seral open is based on the assumption that the surrounding PVTs on the landscape will have been restored so that large crown risk has returned to natural levels; otherwise late seral open should be maintained at near 50%.

The subalpine fir, moist PVT is typically located along steeply incised stream reaches where current constraints exist in regards to Riparian Habitat Conservation Areas and PACKFISH/INFISH habitat objectives and guidelines.

Tree species in this PVT are very susceptible to fire mortality from surface or crown fires. These ecosystems are located in the upper elevations and are associated with riparian stringers and are relatively very productive vegetatively. Patch size is small (less than 10 to 100 acres) and linear, surrounded by drier types that tend to influence fire behavior in the historical landscape. These ecosystems tend to generate a lot of surface fuels in a rapid time frame and due to their location, the fuels tended to be moist in most burning seasons. Only in drought years would significant portions of these areas carry surface fires. This reflects their HRV infrequent stand replacement fire regime. Current management and policy generally exclude vegetative treatment or Rx fire in these predominately riparian associated areas. Therefore, it will be difficult to create structural diversity similar to the historical conditions that allowed this ecosystem to be resilient to wildfire and insect & disease.

Assume 50% (about 1,000 acres) of late seral closed has little or no road access and probably cannot be treated other than by non-mechanized hand treatments or with fire. Natural fire will create 20% early seral within the late seral closed structure within 10 years. The late seral structures have experienced high severity fire in the past (Clear Creek and Fenster fires). Recommendations include thinning where access is available (1,000 acres) to reduce effects of high severity fires. Natural fire will continue into the long term creating additional early seral. Recommend allowing natural progression of early seral to mid seral versus treating old, large late seral stands to produce early seral structure in the short term.

Leaving this PVT in a late seral closed structure increases the risk of a crown fire replacement event which will result in high intensity post fire effects. Due to landscape conditions of continuous fuel canopies and high crown fire risks, its recommended to maintain the large old diameter trees even at rates above HRV until the surrounding landscape mosaics reduce the current high risk of crown fire. The best way to do this is to convert the bulk (48%) of old forest multi strata (late seral closed) to old forest single strata (late seral open) and treat surface fuels. Late seral open has a much reduce risk of crown fire and has greater fire suppression opportunities. Treatments when converting late seral closed to late seral open should consider where large DF exists and be considered as leave trees because of their higher fire resistance (cambium thickness).

Whitebark pine/Subalpine fir PVT (70) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
SIWA HRV (old)	20	20	30	15	15
SIWA HRV Revised Draft[1]	10	0	30	60	0
Current	0	96	0	4	0
DFC Short Term	0	0	96	4	0
DFC Long Term	5	0	55	40	0

[1]Revised draft data was not incorporated into this analysis; once final, it should be substituted in future analysis. The revised data updated the box model for use in the S-C Fire Plan.

PVT 70 are true whitebark pine habitat types and are generally not capable of obtaining closed structures (mid or late seral). These sites are harsh, tree growth is slow and fuels generally sparse (a few large trees). Due to the open structure historical fires were ground and surface fires, crown fires were very rare (structure couldn't support enough heat to produce sustained crown fires). Historically, these were large diameter scattered trees that were susceptible to mountain pine beetle and surface fire mortality. White bark pine is considered to have a low to moderate resistance to surface fire due to a thin outer cambium. Regeneration is dependent upon the Clark's nutcracker gathering whitebark pine seeds and caching the seeds in high elevation areas that have recently been burned and which historically supported whitebark pine or subalpine fir. Currently, due to fire exclusion, Clark's nutcracker seed cache opportunities (burned sites) are very limited. In addition, tree mortality from blister rust (an exotic disease) present in whitebark pine stands has reduced seed production. Under normal circumstances seed crops are variable and sporadic which has exasperated natural whitebark pine regeneration as well. Historically because this PVT was not subject to crown fire they acted as a seed reservoir for the lower elevation subalpine/whitebark pine zones that evolved with replacement crown fires.

Recommendation:
It is recommended to work towards the protection and maintenance of virtually 100% whitebark pine in an open structure (mid and late seral) and manage these sites as a seed source for both PVT 70 and PVT 71 (subalpine fir/whitebark pine). It is possible to manage stands to be resistant to blister rust but it's a complicated process. Expertise needs to be sought before harvesting trees (harvesting trees with signs of blister rust can actually reduce blister rust resistance). Resistance to blister rust can be expressed in multiple ways, including resistance to infection, branch flagging (branch dies and falls off before main stem is infected), and main stem infections that do not seem to spread. Blister rust mortality results from a canker forming around the main stem and girdling the tree. Rodents (squirrels, mice) often accelerate the effect of girdling because they are attracted to the high sugar concentration around the wound site.

Subalpine fir/Whitebark pine (71) HRV, DFC (short and long term), and Current

PVT	Box A Early Seral si	Box B Mid Seral Closed sec, ur, yfm	Box C Mid Seral Open seo	Box D Late Seral Open ofs	Box E Late Seral Closed ofm
SIWA HRV	20	20	30	15	15
SIWA HRV Revised Draft[1]	20	25	20	15	20
Current	0	86	0	0	14
DFC Short Term	30	21	35	0	14
DFC Long Term	25	26	25	10	14

[1] Revised draft data was not incorporated into this analysis; once final, it should be substituted in future analysis. The revised data updated the box model for use in the S-C Fire Plan.

Historically, this site supported an overstory of whitebark pine as a seral species. Historical fire frequencies approximated 55 year intervals, with a mosaic of 45% non replacement and 55% replacement. This mosaic pattern limited the dominance of subalpine fir.

The subalpine fir/whitebark pine type is more productive than the adjacent, higher elevation whitebark pine type. The increased site productivity supports more biomass and woody fuels, and when burned, provided habitat suitable for whitebark pine seed caching by the Clark's nutcracker. Fire exclusion has encouraged subalpine fir to dominate and has reduced the opportunities for whitebark pine establishment due to reduced nutcracker seed caching.

It is recommended treatments for regeneration of whitebark pine be considered utilizing prescribed fire to prepare suitable sites (mosaic burn pattern in the duff) for seed caching by nutcrackers. Convert (65%) closed mid seral to create open mid seral (35%) and early seral (30%). This PVT is often located on or near high elevation ridges and subject to high wind events. Partial cutting (thinning) near ridges or areas with funnel wind patterns can result in high amounts of wind throw damage (loss of large trees). Current levels (14%) of closed late seral should be maintained intact (but not increased) to reduce the effect of wind damage to large trees. Natural events (fire, insects, wind) are expected to provide early seral and it is not recommended that large trees be regenerated to create early seral.

Riparian areas (general discussion)

Data used in this assessment does not accurately reflect the extent, distribution, or species composition of riparian areas within the assessment area. Less than 280 acres of riparian shrub and 859 acres of aspen/conifer were mapped. The aspen/conifer type is often associated with the Douglas fir/lodgepole types at mid elevations. Riparian cover types currently represent willow, sedges, grasses, sage, deciduous and conifer trees. Currently, riparian areas reflect similar landscape trends as the surrounding conifer upland sites. These trends reflect an increase in closed multi canopy structures that are at risk of high severity crown fires. Fire regime condition classes reflect substantial departure from historical vegetation structures that were resilient and resistant to wild fire.

Current management guidelines (PACKFISH/INFISH) do not support treatment of vegetation within Riparian Habitat Conservation Areas (RHCA's). Unnatural vegetation conditions (closed canopy multi layer structures) encourage large high severity crown fires across the landscape including RHCA's. Due to fuel structure and topographic features it has been demonstrated that RHCA's often support the most extreme fire behavior (funnels heat due to steep concave shaped terrain). The intent of RHCA delineation was to protect fish habitat from disturbances that negatively affect habitat (shade, long term large wood recruitment, sediment capture). Current conditions increase the risk of negative effects to fish habitat due to the affects of large high severity fires in RHCA's. It is recommended that forest structure and fuels be restored to reduce large high risk fires. In the RHCA the entire fuel profile should be addressed for restoration to be effective; this includes ground fuels (duff and litter), surface fuels (live vegetation and woody debris), and multiple forest canopy structure.

Treatments within an RHCA that are designed to reduce fire severity may result in short term impacts but would yield long term benefits. The ramifications of an accumulation of duff and the resulting wildfire intensity is often overlooked. Reduction of duff layers can be accomplished with prescribed fire however this treatment results in a production of ash and may result in some exposure of mineral soil. There remains some controversy about the risk of mineral soil exposed within RHCAs or ash potentially transported to the stream.

It must also be noted that there are other important factors to consider when treating riparian plant communities. Maintenance and regeneration of riparian aspen is an important component to the landscape. Stands of viable aspen contribute values such as habitat for wildlife, forage for livestock, water for downstream users, esthetics, recreational sites, and landscape diversity. All of these opportunities are important within the watershed.

II. Sub-watershed Level Recommendations

A. Forested and Non-forested Vegetation

Sub-watershed level recommendations focused on site specific vegetation treatment actions that were directed towards meeting a specific objective. Delineations (polygons) were drawn within the sub-watersheds based on several objectives identified by the SIWA Core Team. The objectives focused on reducing the risk of large scale lethal wildfire and in the protection of the numerous natural and social resources that make up the Salmon interface assessment area.

Nine of the thirteen sub-watersheds within the SIWA area are along the Salmon River corridor. Recommendations are described for these nine sub-watersheds in Table 6-2 presented below. The individual subwatershed tables contain a considerable amount of information, worthy of a brief introduction.

Treatment Area/Area Objective; describes the polygon label coded for each sub-watershed. The numbers represent objectives that are consistent between the sub-watersheds. The mapping units are shown on Maps 6-1 through 6-9 for each of the nine subwatersheds.
1-Wildland Urban Interface (WUI); reduce wildfire risk by altering structural stages that support high fuel loads adjacent to WUI.
2-Crown Fire Reduction; reduce the risk of sustained crown fire by reducing crown and ladder fuels.
3-Large Crown Fire Reduction; reduce crown and ladder fuels using 'linear block' (speed bump) treatments placed perpendicular to the fire run that are designed to break up and redirect a sustained crown fire.
4-Restoration high erosion/high fire risk; areas where a high fire risk exists and where soil erosion hazards are also high. The objective is to reduce the risk of large fires where a threat of accelerated soil erosion exists.
5-HRV; actions designed to obtain or maintain the historical range of variability described for the assessment area. Treatment actions and acres are not identified for this polygon because this objective is the last step. If the other treatments are completed it is likely the landscape (assessment area) HRV will be met.
6-Retain; areas not identified for treatments. Includes areas that are currently within a desired or historical condition or areas where the risk of invasion by non-native invasive species is too high to recommend treatments (Dry Shrub plant communities).
7-Restoration; areas where opportunities exist to restore altered plant communities but that were not included in #s1 through 4 above.

PVT/CT/SS; the potential vegetation type, cover type, and structural stage codes. These represent specific vegetation types, communities, and structures. Code descriptions are provided in Appendix A.

Treatment Objective; displays vegetation structures as to what is currently present and what is desired to meet the objective. Structural code descriptions are provided in Appendix A.

Acres/% Treatment; shows the number of acres for each PVT/CT/SS combination and the percent recommended for treatment to meet the objective. Only those combinations of PVT/CT/SS that totaled more than 100 acres within the delineated objective area were included in the table.

Tools; shows F for prescribed fire and M for mechanical. The specific type of mechanical method is not defined but may include forest product harvest prescriptions.

Resource Benefits/Constriants; lists those resources that may benefit from the action and those that may constrain the action due to site characteristics, forest plan decisions, policy or regulation, etc.

Also included at the bottom of the tables are site specific ‘point’ projects that have been identified within the sub-watersheds.

Table 6-2. Treatment Recommendations by Sub-watershed

Lake Creek Sub-watershed 170602030303

General characteristics: Sub-watershed total acres- 12,913; ECA- 8.4%; Road density- 1.9 mi/sq mi; RHCA road density- 2.93; Lynx LAU- Iron Hat; Designated Old Growth- 600 acres									
Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA and visual quality).
LC1 2495Ac	WUI	52/2003/6 52/2003/5	ofm to ofs/si[1] yfm to seo	880 129	70-90	F	M	FRCC 3 & 2 to 1 Old Growth Forest products Vesper sparrow	Ground disturbance RHCA, PACFISH/INFISH Vesper sparrow Big game cover Noxious/invasive weeds
		113/5019/14 113/5009/26	yfm to seo/ofs cms to oh/ch	138 120	30-50	F			
		120/ Aspen PVT; limited presence (2 Ac); site inspection required to determine objectives and treatment selection							
		121/ Mountain mahogany PVT; limited presence (5 Ac); site inspection required to determine objectives and treatment selection							
LC2 1798 Ac	Crown Fire Reduction	66/2009/4 74/2003/6 74/2003/5 74/2003/4 74/2009/4	ur to seo/si[2] ofm to ofs yfm to seo ur to seo ur to seo/si[2]	138 174 221 101 206	80-90	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx RHCA, PACFISH/INFISH
		120/ Aspen PVT; limited presence (17 Ac); site inspection required to determine objectives and treatment selection							
LC3 3406 Ac	Large Crown Fire Reduction (speed bump)	66/2001/6 66/2009/4 66/2009/5 66/2009/6	ofm to ofs ur to seo/si[2] yfm to seo/si[2] ofm to ofs/si[2]	165 1334 369 387	40-60	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Old Growth RHCA, PACFISH/INFISH
		70/ Whitebark Pine PVT; limited presence (113 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (253 Ac); site inspection required to determine objectives and treatment selection							
LC4 4240 Ac	Restoration high erosion/ high fire risk	52/2003/5 52/2003/6 113/5011/11 113/5019/14 113/5009/26 112/5009/26	yfm to seo ofm to ofs si to seo yfm to seo/ofs cms to oh/ch cms to oh/ch	250 215 126 129 500 110	40-50	F		FRCC 3 & 2 to 1 Vesper sparrow Rangeland health Water quality	Vesper sparrow Big game cover Key big game winter range Ground disturbance RHCA, PACFISH/INFISH Noxious/invasive weeds
		120/ Aspen PVT; limited presence (23 Ac); site inspection required to determine objectives and treatment selection							
LC5; 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
LC6; 791 Ac	Retain	Remainder of sub-watershed to retain in current condition							
LC7; 0 Ac	Restoration	Included above							
[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3. [2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.									
Additional point project recommendations: -Construct rock barrier to discourage ATV access to streambanks at Upper Lake Creek dispersed campsite. -Repair division fence on lower Lake Creek Allotment. -Replace culvert or install barrier above Williams Lake where stream is accessing road surface.									

Jesse Creek Sub-watershed 170602030403

General characteristics: Sub-watershed total acres- 13,021; ECA- .64%; Road density- .92 mi/sq mi; RHCA road density- .33; Lynx LAU- Salmon City; Designated Old Growth- 1,022 acres

Treatment Area Total Acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints: Sub-watershed wide constraints include ECA, visual quality, and inventoried roadless-IRA).
JC1 2823 Ac	WUI	52/2003/5 52/2003/6	yfm to seo ofm to ofs/si[1]	244 860	70-90	F	M	FRCC 3 & 2 to 1 Old Growth Forest products Vesper sparrow Water quality	Ground disturbance RHCA, PACFISH/INFISH Jesse Cr IRA Vesper sparrow Big game cover Noxious/invasive weeds
		113/5009/26 113/5009/25 112/5009/25	cms to oh/ch oms to oh/ch oms to oh/ch	220 440 133	30-50	F			
		120/ Aspen PVT; limited presence (2 Ac); site inspection required to determine objectives and treatment selection							
JC2 2515 Ac	Crown Fire Reduction	52/2003/6 66/2009/4 74/2003/3 74/2003/4 74/2003/5 74/2003/6 74/2009/4 74/2009/6	ofm to ofs ur to seo/si[2] sec to seo ur to seo yfm to seo ofm to ofs ur to seo/si[2] ofm to ofs/si[2]	100 257 118 367 256 208 512 159	80-90	F		FRCC 3 & 2 to 1 WUI Old Growth	Lynx Old Growth RHCA, PACFISH/INFISH Jesse Cr IRA
JC3 5959 Ac	Large Crown Fire Reduction (speed bump)	66/2001/6 66/2009/4 66/2009/5 66/2009/6 69/2001/6 74/2003/4	ofm to ofs ur to seo/si[2] yfm to seo/si[2] ofm to ofs/si[2] ofm to ofs ur to seo	272 2278 622 540 151 108	40-60	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Old Growth RHCA, PACFISH/INFISH Jesse Cr IRA
		120/ Aspen PVT; limited presence (1 Ac); site inspection required to determine objectives and treatment selection 70/ Whitebark Pine PVT; limited presence (45 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (36 Ac); site inspection required to determine objectives and treatment selection							
JC4; 0 Ac	Restoration high erosion/ high fire risk	Included in JC1							
JC5; 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
JC6; 1724 Ac	Retain	Remainder of sub-watershed to retain in current condition							
		120/ Aspen PVT; limited presence (2 Ac); site inspection required to determine objectives and treatment selection							
JC7; 0 Ac	Restoration	None defined							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:
-Improve drainage and harden road surface on Leesburg Road
-Improve road to UP Lake and provide parking. Construct trial to lake
-Upgrade/redirect power line access road.

Salmon-Perreau Sub-watershed 170602030402

General characteristics: Sub-watershed total acres- 36,869; ECA- 1.8%; Road density- 1.70 mi/sq mi; RHCA road density- 4.50; Lynx LAU- Salmon City; Designated Old Growth- 370 acres

Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA, visual quality, and inventoried roadless areas-IRAs).
SP1 2511 Ac	WUI	52/2003/5 52/2003/6	yfm to seo ofm to ofs/si[1]	308 783	70-90	F	M	FRCC 3 & 2 to 1 Old Growth Forest products Vesper sparrow Rangeland health Water quality	Ground disturbance Perreau and Jesse Cr IRAs Vesper sparrow Big game cover Noxious/invasive weeds
		113/5009/26 113/5009/25	cms to oh/ch oms to oh/ch	180 377	30-50	F			
SP2 4492 Ac	Crown Fire Reduction	52/2003/5 52/2003/6 66/2009/4 66/2009/6 74/2003/4 74/2003/6 74/2009/4 74/2009/6	yfm to seo ofm to ofs/si[1] ur to seo/si[2] ofms to ofs/si[2] ur to seo ofm to ofs ur to seo/si[2] ofm to ofs/si[2]	211 122 342 101 356 614 302 257	20-40	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Perreau and Jesse Cr IRAs
		120/ Aspen PVT; limited presence (3 Ac); site inspection required to determine objectives and treatment selection							
SP3 2525 Ac	Large Crown Fire Reduction (speed bump)	66/2009/4 66/2009/5 66/2009/6	ur to seo/si[2] yfm to seo/si[2] ofm to ofs/si[2]	649 321 244	40-60	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Old Growth Perreau and Jesse Cr IRAs
		120/ Aspen PVT; limited presence (4 Ac); site inspection required to determine objectives and treatment selection 70/ Whitebark Pine PVT; limited presence (62 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (124 Ac); site inspection required to determine objectives and treatment selection							
SP4 1471 Ac	Restoration high erosion/ high fire risk	113/5009/25 113/5009/26 112/5009/25 112/5009/26	oms to oh/ch cms to oh/ch oms to oh/ch cms to oh/ch	172 347 140 327	40-50	F		FRCC 3 & 2 to 1 Vesper sparrow Rangeland health Water quality	Vesper sparrow Ground disturbance Noxious/invasive weeds Perreau and Jesse Cr IRAs
		120/ Aspen PVT; limited presence (1 Ac); site inspection required to determine objectives and treatment selection							
SP5; 1249 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
		120/ Aspen PVT; limited presence (1 Ac); site inspection required to determine objectives and treatment selection							
SP6; 22561 Ac	Retain	Remainder of sub-watershed to retain in current condition							
		120/ Aspen PVT; limited presence (12 Ac); site inspection required to determine objectives and treatment selection							
SP7 2061 Ac	Restoration	52/2003/5 52/2003/6 113/5009/26	yrm to seo ofm to ofs/si[1] cms to oh/ch	204 165 120	40-60	F		FRCC 3 & 2 to 1 Vesper sparrow Rangeland health	Vesper sparrow Noxious/invasive weeds Perreau and Jesse Cr IRAs
		120/ Aspen PVT; limited presence (7 Ac); site inspection required to determine objectives and treatment selection							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:
-Repair and maintain exclosures in Perreau Meadows

Williams Creek Sub-watershed 170602030401

General characteristics: Sub-watershed total acres- 18,056; ECA- 23.0%; Road density- 2.04 mi/sq mi; RHCA road density- 5.68; Lynx LAU- Salmon City; Designated Old Growth- 547 acres

Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA, inventoried roadless areas-IRA, and visual quality).
WC1 3222 Ac	WUI	52/2003/6 52/2003/4 52/2003/5	ofm to ofs/si[1] ur to seo yfm to seo	1081 159 163	70-90	F	M	FRCC 3 & 2 to 1 Old Growth Forest products Water quality Vesper sparrow Water quality Rangeland health	RHCA, PACFISH/INFISH Ground disturbance Vesper sparrow Big game cover Noxious/invasive weeds Ground disturbance Key big game winter range
		113/5011/11 113/5019/14 113/5009/26	si to seo yfm to seo/ofs cms to oms	138 141 200	30-50	F			
		120/ Aspen PVT; limited presence (30 Ac); site inspection required to determine objectives and treatment selection							
WC2 1923 Ac	Crown Fire Reduction	74/2003/6 74/2003/4 74/2003/5 74/2009/4	ofm to ofs ur to seo yfm to seo ur to seo/si[2]	231 316 172 244	80-90	F	M	FRCC 3 & 2 to 1 WUI Forest products Water quality	Lynx Old Growth RHCA, PACFISH/INFISH Perreau Cr IRA Ground disturbance
		120/ Aspen PVT; limited presence (76 Ac); site inspection required to determine objectives and treatment selection							
WC3 2859 Ac	Large Crown Fire Reduction (speed bump)	66/2009/6 66/2009/5 66/2009/4 74/2003/4	ofm to ofs/si[2] yfm to seo/si[2] ur to seo/si[2] ur to seo	683 146 1093 127	40-60	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Old Growth RHCA, PACFISH/INFISH Perreau Cr IRA
		70/ Whitebark Pine PVT; limited presence (6 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (20 Ac); site inspection required to determine objectives and treatment selection							
WC4 0 Ac	Restoration high erosion/ high fire risk	Included in WC1, WC2, and WC7							
WC5; 2788 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
		120/ Aspen PVT; limited presence (4 Ac); site inspection required to determine objectives and treatment selection 70/ Whitebark Pine PVT; limited presence (26 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (207 Ac); site inspection required to determine objectives and treatment selection							
WC6; 2593 Ac	Retain	Remainder of sub-watershed to retain in current condition							
WC7 4671 Ac	Restoration	112/5009/26 113/5009/26 113/5011/11	cms to oms cms to oms si to seo	150 510 292	40-60	F		FRCC 3 & 2 to 1 Rangeland health Vesper sparrow Water quality	Sage-grouse Noxious/invasive weeds Ground disturbance RHCA, PACFISH/INFISH Perreau Cr IRA Key big game winter range
		120/ Aspen PVT; limited presence (206 Ac); site inspection required to determine objectives and treatment selection							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:
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Salmon-Henry Sub-watershed 170602030305

General characteristics: Sub-watershed total acres- 14,699; ECA- 5.7%; Road density- .86 mi/sq mi; RHCA road density- .64; Lynx LAU- North Lemhi; Designated Old Growth- 139 acres

Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA, inventoried roadless areas-IRA, and visual quality).
SH1 0 Ac	WUI	None identified							
SH2 0 Ac	Crown Fire Reduction	None identified							
SH3 0 Ac	Large Crown Fire Reduction (speed bump)	None identified							
SH4 1341 Ac	Restoration high erosion/ high fire risk	113/5009/26 113/5009/25	cms to oh/ch oms to oh/ch	290 590	40-50	F		FRCC 3 & 2 to 1 Sage grouse Rangeland health Water quality Vesper sparrow	Sage grouse Vesper sparrow Big game cover Key big game winter range Ground disturbance Noxious/invasive weeds
		120/ Aspen PVT; limited presence (5 Ac); site inspection required to determine objectives and treatment selection							
SH5 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
SH6 22561 Ac	Retain	Remainder of sub-watershed to retain in current condition							
		120/ Aspen PVT; limited presence (9 Ac); site inspection required to determine objectives and treatment selection							
		121/ Mountain mahogany PVT; limited presence (8 Ac); site inspection required to determine objectives and treatment selection							
SH7 1249 Ac	Restoration	52/2003/5 52/2003/6 66/2009/4 74/2003/4 74/2003/5 113/5009/26	yfm to seo ofm to ofs/si[1] ur to seo/si[2] ur to seo yfm to seo cms to oh/ch	109 712 597 171 232 197	40-60	F	M	FRCC 3 & 2 to 1 Rangeland health Sage grouse Vesper sparrow	Old Growth Sage grouse Vesper sparrow Noxious/invasive weeds Lynx Sal Mountain IRA Key big game winter range
		120/ Aspen PVT; limited presence (18 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (114 Ac); site inspection required to determine objectives and treatment selection							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:
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Twelvemile Sub-watershed 170602030304

General characteristics: Sub-watershed total acres- 14,267; ECA- 6.50%; Road density- 2.26 mi/sq mi; RHCA road density- .90; Lynx LAU-North Lemhi; Designated Old Growth- 902 acres

Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA, inventoried roadless areas- IRA, visual quality).
TM1 3408 Ac	WUI	52/2003/4 52/2003/5 52/2003/6	ur to seo yfm to seo ofm to ofs/si[1]	234 267 1343	70-90	F	M	FRCC 3 & 2 to 1 Old Growth Forest products Water quality Vesper sparrow	Ground disturbance RHCA, PACFISH/INFISH Vesper sparrow Big game cover Noxious/invasive weeds
		113/5011/11 113/5019/14 113/5009/26	si to seo yfm to seo/ofs cms to oh/ch	105 143 109	30-50	F			
		120/ Aspen PVT; limited presence (3 Ac); site inspection required to determine objectives and treatment selection							
		121/ Mountain mahogany PVT; limited presence (9 Ac); site inspection required to determine objectives and treatment selection							
TM2 0 Ac	Crown Fire Reduction	None identified							
TM3 0 Ac	Large Crown Fire Reduction (speed bump)	None identified							
TM4 0 Ac	Restoration high erosion/ high fire risk	Included in TM1 and TM7							
TM5; 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
TM6; 1387 Ac	Retain	Remainder of sub-watershed to retain in current condition							
		120/ Aspen PVT; limited presence (2 Ac); site inspection required to determine objectives and treatment selection							
TM7 9472 Ac	Restoration	52/2003/4 52/2003/5 52/2003/6 66/2001/6 66/2009/4 66/2009/5 66/2009/6 74/2003/4 74/2003/5 74/2003/6 74/2009/4 113/5011/11 113/5019/14	ur to seo yfm to seo ofm to ofs/si[1] ofm to ofs ur to seo/si[2] yfm to seo/si[2] ofm to ofs/si[2] ur to seo yfm to seo ofm to ofs ur to seo/si[2] si to seo yfm to seo	214 106 318 147 1330 649 1493 470 493 786 405 374 144	40-60	F	M	FRCC 3 & 2 to 1 WUI Forest Products Water quality Old Growth	Vesper sparrow Noxious/invasive weeds Lynx RHCA, PACFISH/INFISH Ground disturbance Sal Mountain & Goldbug Ridge IRAs Key big game summer range
		120/ Aspen PVT; limited presence (27 Ac); site inspection required to determine objectives and treatment selection 70/ Whitebark Pine PVT; limited presence (40 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (117 Ac); site inspection required to determine objectives and treatment selection							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:

General characteristics: Sub-watershed total acres- 13,847; ECA- 5.1%; Road density- 3.03 mi/sq mi; RHCA road density- 3.79; Lynx LAU- Salmon City; Designated Old Growth- 418 acres

Treatment Area	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA and visual quality).
SF1 4009 Ac	WUI	52/2003/5 52/2003/6	yfm to seo ofm to ofs/si[1]	324 513	70-90	F	M	FRCC 3 & 2 to 1 Old Growth Forest products Water quality Vesper sparrow	Ground disturbance Vesper sparrow Big game cover Noxious/invasive weeds
		113/5009/26 113/5009/25	cms to oh/ch oms to oh/ch	448 911	30-50	F			
		120/ Aspen PVT; limited presence (3 Ac); site inspection required to determine objectives and treatment selection							
SF2 2388 Ac	Crown Fire Reduction	74/2003/4 74/2003/5 74/2003/6 74/2009/4 113/5011/11	ur to seo yfm to seo ofm to ofs ur to seo/si[2] si to seo	294 346 190 380 132	80-90	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Big game cover Vesper Sparrow
		120/ Aspen PVT; limited presence (30 Ac); site inspection required to determine objectives and treatment selection							
SF3 942 Ac	Large Crown Fire Reduction (speed bump)	66/2009/4 66/2009/5	ur to seo/si[2] yfm to seo/si[2]	320 167	40-60	F	M	FRCC 3 & 2 to 1 WUI Forest products	Lynx Old Growth
		120/ Aspen PVT; limited presence (1 Ac); site inspection required to determine objectives and treatment selection 70/ Whitebark Pine PVT; limited presence (41 Ac); site inspection required to determine objectives and treatment selection							
SF4 0 Ac	Restoration high erosion/ high fire risk	Included in SF1							
SF5; 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
SF6; 6508 Ac	Retain	Remainder of sub-watershed to retain in current condition							
		120/ Aspen PVT; limited presence (1 Ac); site inspection required to determine objectives and treatment selection							
		121/ Mountain mahogany PVT; limited presence (28 Ac); site inspection required to determine objectives and treatment selection							
SF7 0 Ac	Restoration	None identified							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:
-Review field review on 9/18/02 pertaining to Queen of the Hills Mine. Opportunities include weed treatment, road rehab work, site clean up of vehicle removal and trash, close adits using AML money, and remove the dilapidated bridge.

Salmon-Wallace Sub-watershed 170602030504

General characteristics: Sub-watershed total acres- 14,828; ECA- 17.0%; Road density- 3.50 mi/sq mi; RHCA road density- .49; Lynx LAU- Salmon City; Designated Old Growth- 805 acres									
Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA and visual quality).
SWa1 4556 Ac	WUI	113/5019/14	yfm to seo/ofs	379	30-50	F		FRCC 3 & 2 to 1 Water quality	Ground disturbance Vesper sparrow Big game cover Noxious/invasive weeds
		120/ Aspen PVT; limited presence (16 Ac); site inspection required to determine objectives and treatment selection							
		121/ Mountain mahogany PVT; limited presence (50 Ac); site inspection required to determine objectives and treatment selection							
SWa2 0 Ac	Crown Fire Reduction	None identified							
SWa3 0 Ac	Large Crown Fire Reduction (speed bump)	None identified							
SWa4 4906 Ac	Restoration high erosion/ high fire risk	52/2003/5 52/2003/6 112/5009/25 113/5009/25 113/5009/26 113/5011/11 133/2018/5 133/2018/6	yfm to seo ofm to ofs/si[1] oms to oh/ch oms to oh/ch cms to oh/ch si to seo yfm to ofs ofm to ofs	224 1436 228 205 417 190 123 147	40-50	F	M	FRCC 3 & 2 to 1 Vesper sparrow Rangeland health Water quality Old Growth Forest Products WUI	Vesper sparrow Big game cover Ground disturbance Noxious/invasive weeds
		120/ Aspen PVT; limited presence (7 Ac); site inspection required to determine objectives and treatment selection							
SWa5; 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
SWa6; 0 Ac	Retain	Remainder of sub-watershed to retain in current condition							
SWa7a (low) 3214 Ac	Restoration	74/2003/4 74/2003/5 74/2003/6 74/2009/4 74/2009/6 113/5011/11	ur to seo yfm to seo ofm to ofs ur to seo/si[2] ofm to ofs/si[2] si to seo	240 421 436 335 282 384	40-60	F	M	FRCC 3 & 2 to 1 WUI	Lynx Vesper sparrow Big game cover Noxious/invasive weeds
		120/ Aspen PVT; limited presence (57 Ac); site inspection required to determine objectives and treatment selection							
SWa7b (high) 2152 Ac		66/2009/4 66/2009/5 68/2009/4	ur to seo/si[2] yfm to seo/si[2] ur to seo	854 109 278	40-60	F	M	FRCC 3 & 2 to 1 Forest Products WUI	Lynx
		120/ Aspen PVT; limited presence (6 Ac); site inspection required to determine objectives and treatment selection 70/ Whitebark Pine PVT; limited presence (33 Ac); site inspection required to determine objectives and treatment selection 71/ Subalpine fir/Whitebark pine PVT; limited presence (176 Ac); site inspection required to determine objectives and treatment selection							
[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3. [2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.									
Additional point project recommendations: -Investigate water rights and ditch system related to Wallace Lake; possibility of acquiring water rights to raise lake level for recreational purposes.									

Salmon-Wagonhammer Sub-watershed 170602030506

General characteristics: Sub-watershed total acres- 10,565; ECA- 3.5%; Road density- 1.17 mi/sq mi; RHCA road density- 0; Designated Old Growth- 387 acres

Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA, inventoried roadless areas-IRA, and visual quality).
SWg1; 0 Ac	WUI								
SWg2 0 Ac	Crown Fire Reduction								
SWg3 0 Ac	Large Crown Fire Reduction (speed bump)								
SWg4 0 Ac	Restoration high erosion/ high fire risk	Included in SWg7a							
SWg5; 0 Ac	HRV	Depends on distribution of treated acres above vs total SIWA area							
SWg6; 0 Ac	Retain	Remainder of sub-watershed to retain in current condition							
SWg7a 2573 Ac	Restoration	113/5019/14	yfm to seo	199	40-60	F	M	FRCC 3 & 2 to 1 Water quality Forest Products	Vesper sparrow Noxious/invasive weeds Ground disturbance Big game cover Wild and Scenic Rivers Napoleon Ridge IRA
		120/ Aspen PVT; limited presence (2 Ac); site inspection required to determine objectives and treatment selection							
SWg7b 7369 Ac		52/2003/4 52/2003/5 52/2003/6 112/5009/26 113/5009/26 113/5011/11 113/5019/14 133/2018/6	ur to seo yfm to seo ofm to ofs/si[1] cms to oh/ch cms to oh/ch si to seo yfm to seo ofm to ofs	202 351 2612 148 216 168 523 262	40-60	F	M	FRCC 3 & 2 to 1 Vesper sparrow Rangeland health Forest Products	Big game cover Vesper sparrow Noxious/invasive weeds Napoleon Ridge IRA Old Growth
		120/ Aspen PVT; limited presence (5 Ac); site inspection required to determine objectives and treatment selection							
		121/ Mountain mahogany PVT; limited presence (5 Ac); site inspection required to determine objectives and treatment selection							
SWg7c 623 Ac		66/2009/4	ur to seo/si[2]	198	40-60	F	M	FRCC 3 & 2 to 1 Forest Products	Old Growth
		120/ Aspen PVT; limited presence (20 Ac); site inspection required to determine objectives and treatment selection							

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Additional point project recommendations:
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Upper Napias Creek Sub-watershed 170602031101
Napias-Phelan Sub-watershed 170602031103
Lower Napias Creek Sub-watershed 170602031104

These three sub-watersheds do not have a detailed recommendation table because the sub-watersheds located west of the Ridge Road divide have limited treatment opportunities because they are virtually totally constrained due to inventoried roadless areas (Napias, Phelan, and Deep Creek) and Lynx (Phelan LAU). Nevertheless, treatment opportunities have been identified west of the Ridge Road as a means to support the recommendations made on the eastside. Fires that can become active on the west side can make strong runs upslope to the east. Large crown fire reduction (#3) and crown fire reduction (#2) treatments completed east of the ridge may or may not succeed in dropping the fire to the ground for suppression activities nor redirect the fire.

Therefore, recommendations for the west side sub-watersheds are addressed to the upper elevation subalpine fir (66) and Douglas fir/lodgepole (74) PVTs and include treatments designed to reduce the large crown fire as described in treatment 3 on the previous tables. A brief summary table is presented below.

Treatment Area Total acres	Area Objective	PVT/CT/SS Vegetation Codes	Treatment Objective	Affected Acres	% Treatment	Tools (Fire/ Mechan-ical)		Resource Benefits	Resource Constraints (sub-watershed wide includes ECA, inventoried roadless areas-IRA, and visual quality).
UNL3	Large Crown Fire Reduction (speed bump)	66/ 74/	to ofs/seo/si[1,2] to ofs/seo/si[1,2]	Est 2000	40-60	F	M	FRCC 3 & 2 to 1 Forest Products	IRAs Lynx

[1] Treatments resulting in stand initiation should be considered only under certain conditions. See Recommendations narrative section I.D.3.
[2] Treatments resulting in stand initiation in lodgepole pine cover types are appropriate on steeper slopes; the spatial extent limited by the historical range of variability within the sub-watershed.

Arnett Creek Sub-watershed 170602031102

A detailed recommendation table was also not developed for the Arnett Creek sub-watershed because over half of the sub-watershed was burned in 2000 during the Clear Creek fire. This event obviously reduced the fire risk and fire regime condition class, modified the cover types and structural stages, and altered the previous mid and late seral stages to early seral.

III. Prioritization Process

The prioritization process consisted of two steps; one prioritized the thirteen sub-watersheds while the other prioritized activities or actions within the sub-watersheds.

Prioritizing the sub-watersheds took on a qualitative, subjective approach that mainly considered geographic location and their relationship with population clusters or family residences. Of the thirteen sub-watersheds, nine are located along the Salmon River corridor where individual residences and sub-divisions have been developed. One of the nine sub-watersheds also functions as the city's municipal water supply. This zone of wildland urban interface was a leading consideration in prioritizing the nine corridor sub-watersheds from the four western sub-watersheds.

After coordination with the Lemhi County Fuels Committee and consideration of input from public meetings and Focus Group discussions, the nine corridor sub-watersheds were prioritized into three groups, again focusing on population distribution and the city's water supply. No further prioritization of the sub-watersheds within each of the groups was identified.

Group 1: Lake Creek, Jesse Creek, and Salmon-Perreau
Group 2: Williams Creek, Salmon-Henry, and Twelvemile
Group 3: Salmon-Fenster, Salmon-Wallace, and Salmon-Wagonhammer

Within the sub-watershed, prioritizing individual projects is somewhat more complex. One approach of prioritizing treatment areas within the individual sub-watersheds was accomplished by overlaying the Fire Regime Condition Class abundance rating with the risk for sustainability. The result yields low, moderate, and high Potential Restoration Priority areas. Low priority areas have a low abundance of structural departure and low risk of sustaining disturbance events or altering ecosystem function. High priority areas have a relatively high amount of structural departure with a high risk of sustaining uncharacteristic wildfire and ecosystem function. A fourth category of 'maintain' was also identified to reflect areas with rare or similar (compared to historic) abundance to recognize the need to maintain these areas on the landscape. Each of the thirteen sub-watersheds contains a considerable amount of high and moderate priority areas.

The next step in the process is to look at the area objectives described in the Table 6-2 above. Of the seven area objectives, projects directly related to the wildland urban interface (area objective #1) should be considered the highest priority due to their close proximity to the defensible space of structures and residences. Area objective #2 (crown fire reduction) is adjacent to and provides direct support to WUI and therefore should also be considered a high treatment priority. Large crown fire reduction (area objective #3) lie adjacent to objective #2 and provide the first line of defense to reduce the risk of large crown fires. Depending on location these areas should also rate a high priority for treatment. High erosion/high fire risk (area objective #4) and restoration (area objective #7) would make up priorities 4 and 5, respectively, since they are directed towards resolving specific resource concerns or threats, or achieving broad ecosystem benefits.

A composite of these two mechanisms is presented in Table 6-3 below. Only the high and moderate potential restoration priorities are shown along with the distribution of the major potential vegetation types making up the area. Similarly, only the top 5 priority area objectives, if present, (#s 1 through 4 and #7) are listed.

Table 6-3. Potential Restoration Priority Distribution Within Area Objective Units

Treatment Area/Acres	Area Objective	Potential Restoration Priority			
		High Acres/%	Distribution of Primary PVTs	Moderate Acres/%	Distribution of Primary PVTs
Jesse Creek					
JC1 / 2823	WUI	762/27	113 = 88%	1694/60	52 = 68% 112 = 8%
JC2/ 2515	Crown Fire Reduction	873/35	74 = 95%	633/25	66 = 61% 52 = 27%
JC3/ 5959	Lg Crown Fire Red.	240/4	74 = 91%	4191/70	66 = 91%
Lake Creek					
LC1/ 2495	WUI	447/18	113 = 82%	1533/62	52 = 42% 113 = 9%
LC2/ 1798	Crown Fire Reduction	605/34	74 = 82%	679/38	66 = 42% 113 = 20% 52 = 18%
LC3/ 3406	Lg Crown Fire Red.	151/4	74 = 92%	3051/90	66 = 88% 71 = 5%
LC4/ 4240	High Erosion/ High Fire Risk	1663/39	113 = 93%	2044/48	112 = 33% 52 = 23% 113 = 13%
Salmon-Perreau					
SP1/ 2511	WUI	584/23	113 = 95%	1419/56	52 = 82%
SP2/ 4492	Crown Fire Reduction	1957/44	74 = 91% 113 = 9%	985/22	52 = 41% 74 = 26% 66 = 25%
SP3/ 2525	Lg Crown Fire Red.	219/9	74 = 79%	960/38	66 = 81%
SP4/ 1471	High Erosion/ High Fire Risk	554/38	113 = 94%	699/48	112 = 67% 109 = 17%
SP7/ 2061	Restoration	422/20	113 = 89%	1203/58	101 = 42% 52 = 31% 109 = 15%
Williams Creek					
WC1/ 3222	WUI	113/4	74 = 61% 101 = 27%	2582/80	52 = 54% 113 = 34%

Treatment Area/ Acres	Area objective	Potential Restoration Priority			
		High Acres/%	Distribution of Primary PVTs	Moderate Acres/%	Distribution of Primary PVTs
WC2/ 1923	Crown Fire Reduction	796/41	74 = 90%	510/27	113 = 42% 69 = 28% 66 = 20%
WC3/ 2859	Lg Crown Fire Red.	206/7	74 = 96%	1209/42	66 = 94%
WC7/ 4671	Restoration	295/6	120 = 46% 74 = 27%	3909/84	113 = 59% 112 = 25% 52 = 9%
Salmon-Henry					
SH4/ 1341	High Erosion/ High Fire Risk	911/68	113 = 96%	335/25	112 = 82%
SH7/ 4228	Restoration	1085/27	113 = 55% 74 = 39%	2070/49	52 = 34% 66 = 33% 112 = 15%
Twelvemile					
TM1/ 3408	WUI	408/12	113 = 61% 74 = 25%	2497/70	52 = 76% 113 = 14% 112 = 9%
TM7/ 9472	Restoration	2396/25	74 = 73% 113 = 22%	2691/28	66 = 61% 52 = 24%
Salmon-Fenster					
SF1/ 4009	WUI	1437/36	113 = 95%	1830/46	52 = 46% 109 = 21% 112 = 15%
SF2/ 2388	Crown Fire Reduction	962/40	74 = 86%	916/38	74 = 55% 113 = 14% 66 = 14%
SF3/ 942	Lg Crown Fire Red.	80/8	70 = 51% 74 = 48%	698/74	66 = 95%
Salmon-Wallace					
SWa1 /4556	WUI	480/11	113 = 83%	1566/34	109 = 70%
SWa4/ 4906	High Erosion/ High Fire Risk	381/8	113 = 75%	2823/58	52 = 51% 113 = 22% 112 = 11%
SWa7a/ 3214	Restoration	1538/48	74 = 71% 113 = 25%	606/19	74 = 47% 66 = 17%
SWa7b/ 2152	Restoration	264/12	71 = 56% 74 = 20%	1444/67	66 = 67% 68 = 30%
Salmon-Wagonhammer					
SWg7a/ 2573	Restoration	305/12	113 = 66% 110 = 33%	1504/58	109 = 82 % 118 = 9%

Treatment Area/ Acres	Area objective	Potential Restoration Priority			
		High Acres/%	Distribution of Primary PVTs	Moderate Acres/%	Distribution of Primary PVTs
SWg7b/ 7369	Restoration	869/12	113 = 64%	4673/63	52 = 56% 112 = 16% 113 = 14% 133 = 6%
SWg7c/ 623	Restoration	149/24	74 = 58%	345/55	66 = 94%

The table provides a display of the distribution of the high and moderate potential restoration priority areas within the treatment units. Using this table in conjunction with the Treatment Recommendations by Sub-watershed (Table 6-2) that show the current cover types and structural stages and treatment objectives suggested to meet the area objectives, observations can be made that would assist in prioritizing treatments within the sub-watersheds. For example, of the five treatment objectives identified within the WUI of Jesse Creek (JC1) shown on the Treatment Recommendations by Sub-watershed table, consideration should be made on treating the mountain big sage/conifer structures (PVT 113) and dry Douglas-fir structures (PVT 52) and generally not focus any treatment efforts on the mountain big sage types (PVT 112) due to its small acreage and moderate priority rating.

Table 6-3 also shows a common similarity between the sub-watersheds. PVTs 74 and 113 seem to dominate the high restoration priority areas while PVTs 52 and 66 dominate the moderate restoration priority areas. This would indicate to focus treatment design and implementation efforts around the Douglas-fir/lodgepole types (74) and mountain big sage w/ conifer types (113) rather than the dry Douglas-fir (52) and subalpine fir (66) types.

In addition, it appears the bulk of the wildland urban interface and crown fire reduction area objectives are made up of moderate instead of high restoration priority areas. This could indicate that focusing projects on those high priority zones (having a high abundance and risk) would provide some immediate benefits rather than spreading long term project work over the entire treatment area unit.

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Appendix A. Codes for Potential Vegetation Types (PVT), Cover Types (CT), and Structural Stages (SS)

Potential Vegetation Types

PVT Code	Potential Vegetation Type Name
52	Dry Douglas fir without Ponderosa Pine
66	Subalpine fir Dry-gentle
68	Subalpine fir Dry-steep
69	Subalpine fir Moist
70	Whitebark pine/Subalpine fir
71	Subalpine fir/Whitebark pine
74	Douglas fir/Lodgepole-gentle
75	Douglas fir/Lodgepole-steep
101	Bunchgrass Grassland
109	Wyoming Big sagebrush
110	Cottonwood
111	Fescue Grassland
112	Mountain Big sagebrush
113	Mountain Big sagebrush with Conifer
118	Threetip sagebrush
119	Riparian Shrub
120	Aspen/Conifer
121	Mountain Mahogany
124	Riparian Graminiod
133	Ponderosa Pine/Grassland
151	Irrigated Pasture
154	Water
155	Barren

Cover Types

Cover Type Code	Cover Type Name
1001	Barren
1002	Water
1004	Grass/Forb
1015	Moist Shrub
2001	Spruce fir/Subalpine fir
2002	Whitebark pine
2003	Douglas fir
2008	Aspen
2009	Lodgepole pine
2018	Ponderosa pine
3001	Bunchgrass
3007	Mountain mahogany
3010	Fescue/bunchgrass
3011	Sedge/fescue
3012	Dry shrub/bunchgrass
3013	Wyoming Big sagebrush/bunchgrass
3022	Threetip sagebrush/bunchgrass
4057	Kentucky bluegrass
4060	Grass/sedge
4079	Gravel bar
4084	Cottonwood/shrub/Kentucky bluegrass
4085	Cottonwood/conifer/Kentucky bluegrass
4086	Conifer/Kentucky bluegrass
4087	Shrub/Kentucky bluegrass
4090	Willow/sedge
4097	Native bunchgrass
5009	Mountain Big sagebrush/fescue
5010	Sagebrush/sedge/fescue
5011	Mountain Big sagebrush/conifer
5012	Sedge/fescue/conifer
5019	Conifer/Mountain Big sagebrush
5020	Conifer/sedge/fescue
5041	Irrigated pasture/hayland

Structural Stages

Numeric Code	Structure Name	Alpha Code
1	stand initiation forest	si
2	stem exclusion open canopy forest	seo
3	stem exclusion closed canopy forest	sec
4	understory reinitiation	ur
5	young forest multi-strata	yfm
6	old forest multi-strata	ofm
7	old forest single-strata	ofs
11	stand initiation woodland	si
14	young multi-strata woodland	yfm
21	open herland	oh
22	closed herbland	ch
23	closed low shrub	cls
24	open low shrub	ols
25	open mid shrub	oms
26	closed mid shrub	cms
28	closed tall shrub	cts
34	Water	
35	Rock	

Appendix B. Forested Structural Stage Descriptions (taken from PNW-GTR-385, 1996)

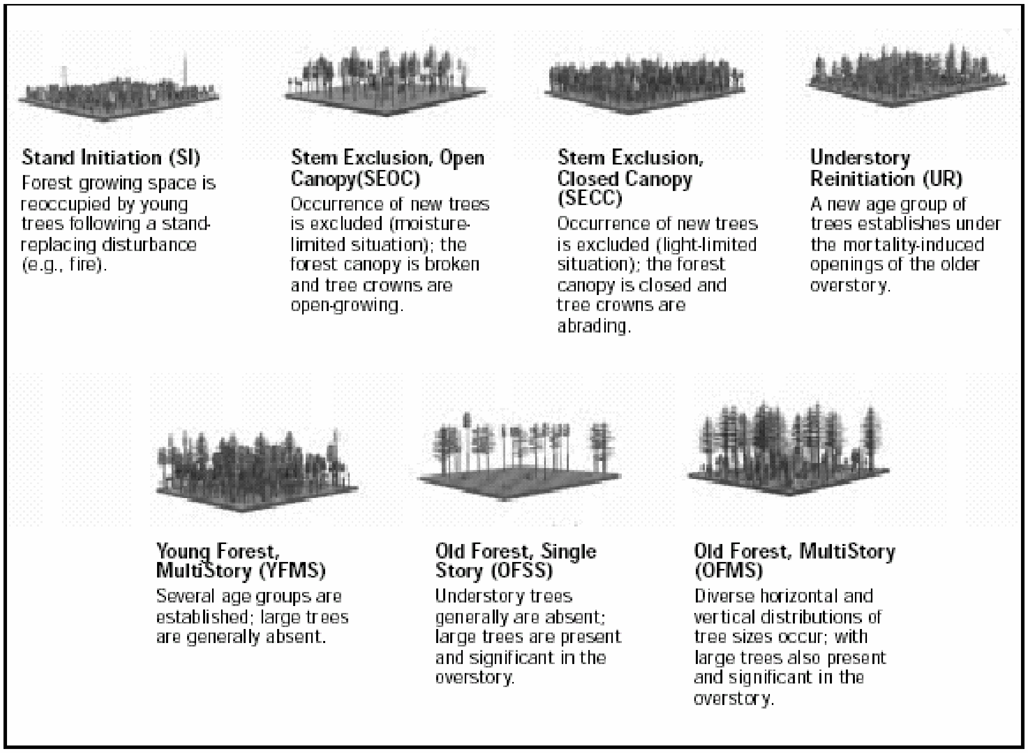

Figure 7—Structural Stage Definitions.

Table 3—Structural stages often used to describe changes in forest vegetation structure over time.

Structural Stage	Definition	Also Referred to As:
Stand initiation	When land is reoccupied by trees following a stand-replacing disturbance.	Early-successional Early-seral Regeneration
Stem exclusion-open canopy	Forested areas where the occurrence of new trees is predominantly limited by moisture.	Mid-successional Mid-seral Young forest
Stem exclusion-closed canopy	Forested areas where the occurrence of new trees is predominantly limited by light.	Mid-successional Mid-seral Young forest
Understory reinitiation	When a second generation of trees is established under an older, typically seral, overstory.	Mid-successional Mid-seral Young forest
Young forest multi-story	Stand development resulting from frequent harvest or lethal disturbance to the overstory.	Mid-successional Mid-seral Young forest
Old multi-story	Forested areas lacking frequent disturbance to understory vegetation.	Late-successional multi-story Late-seral multi-story Old forest multi-story
Old single-story	Forested areas resulting from frequent non-lethal prescribed or natural underburning, or other management	Late-successional single-story Late-seral single-story Old forest single-story

Appendix C. DRAFT Salmon Interface watershed natural (historical) composition and fire frequency and severity.

PVT	Fire Regime Group	A		B		C		D		E		All Natural Fire		Surface or Mosaic Fire		Stand Replace ment Fire	
Name		Name	%	Name	%	Name	%	Name	%	Name	%	Prob	Frq (yrs)	Prob	%	Prob	%
Wyoming Big Sage-Threetip PVT 109,118	III – Infrequent Mixed	Grass-forb	**20**	Closed young sage-open grass/forb	**05**	Open young sage-closed grass/forb	**20**	Open mature sage-closed grass/forb	**50**	Closed mature sage-open grass/forb	**05**	.025	**40**	.01	40	.015	**60**
Mt. Big Sage PVT 112	I – Frequent Mixed	Grass-forb	**15**	Closed young sage-open grass/forb	**20**	Open young sage-closed grass/forb	**30**	Open mature sage-closed grass/forb	**15**	Closed mature sage-open grass/forb	**20**	.04	**25**	.014	30	.026	**65**
Mt. Mahogany PVT 121	IV – Infrequent Replace-ment	Grass-forb	**10**	Closed young shrub-open grass/forb	**10**	Open young shrub-closed grass/forb	**20**	Open mature shrub-closed grass/forb	**40**	Closed mature shrub-open grass/forb	**20**	.02	**50**	.004	20	.016	**80**
Mt. Big Sage/ with conifer PVT 113	I - Frequent Mixed	Grass- forb; Early devmt Scattered snags, down logs	**20**	Closed Sage/ open grass; 50% w/ scattered Snags & down logs – mature, pole, & sapling	**30**	Open Sage/closed grass; open mixed conifers; some mt. Mahogany & mt. shrubs	**35**	Open pole-sapling/ mature sage/ grass; some mt. Mahogany & mt. shrubs	**10**	Closed Conifer/ litter-duff; some grass and open sage/shrubs	**5**	.04	**25**	.02	50	.02	**50**
Dry Douglas-fir with ponderosa pine (+ ponderosa pine grassland) PVT 53, 133	I – Frequent Surface	Shrub-Grass-forb; 50% w/ no snags; 50% w/ scattered large snags – more pole, & sapling snags	**20**	Closed pole-sap /shrub/ litter-duff; scattered large snags –more pole & sapling snags; 90% ponderosa pine-Doug-fir; 10% aspen	**10**	Open pole-sapling/ shrub-grass; 80% w/ no snags-down logs; 20% with pole & sapling snags & down logs; 100% ponderosa pine-Doug-fir	**20**	Open large tree/shrub-grass; 80% w/ no snags-down logs; 20% w/ large snags-down logs; 100% ponderosa pine-Doug-fir	**40**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 100% ponderosa pine-Doug-fir	**10**	.04	**25**	.03		.01	**25**
Dry Douglas-fir with no ponderosa pine (+ Douglas-fir grassland + aspen/ conifer) PVT 54, 132, 120	I – Frequent Mixed	Shrub-Grass-forb; 50% w/ no snags; 50% w/ scattered large snags – more pole, & sapling snags	**20**	Closed pole-sap /shrub/ litter-duff; scattered large snags –more pole & sapling snags; 80% Doug-fir; 20% aspen	**10**	Open pole-sapling/ shrub-grass; 80% w/ no snags-down logs; 20% with pole & sapling snags & down logs; 100% Doug-fir	**20**	Open large tree/shrub-grass; 80% w/ no snags-down logs; 20% w/ large snags-down logs; 100% Doug-fir	**40**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 100% Doug-fir	**10**	.033	**30**	.023	70	.01	**30**

PVT	Fire Regime Group	A		B		C		D		E		All Natural Fire		Surface or Mosaic Fire		Stand Replace ment Fire	
Name		Name	%	Name	%	Name	%	Name	%	Name	%	Prob	Frq (yrs)	Prob	%	Prob	%
Douglas-fir-lodgepole ≤ 30% slope PVT 74	III – Infre-quent Mixed	Shrub-grass-forb-tree seedling; 20% w/ no snags; 80% w/ scattered snags – mature, pole, & sapling	**15**	Closed pole-sapling/ shrub/ litter-duff; scattered pole snags –more sapling snags; 60% lodgepole-20% Doug-fir; 20% aspen	**25**	Open pole-sapling/ shrub-grass; 60% w/ no snags-down logs; 40% with pole & sapling snags & down logs; 60% lodgepole-30% Doug-fir; 10% aspen	**40**	Open large tree/shrub-grass; 80% w/ no snags-down logs; 20% w/ large snags-down logs; 70% lodgepole-30% Doug-fir	**15**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 20% lodgepole-70% Doug-fir; 10% aspen	**5**	.025	**40**	.018	70	.007	**30**
Douglas-fir-lodgepole > 30% slope PVT 75	IV – Infre-quent Replace-ment	Shrub-grass-forb-tree seedling; 20% w/ no snags; 80% w/ scattered snags – pole & sapling	**30**	Closed pole-sapling/ shrub/ litter-duff; scattered pole snags –more sapling snags; 60% lodgepole-20% Doug-fir; 20% aspen	**35**	Open pole-sapling/ shrub-grass; 60% w/ few snags-down logs; 40% with pole & sapling snags & down logs; 60% lodgepole-30% Doug-fir; 10% aspen	**20**	Open large tree/shrub-grass; 80% w/ few snags-down logs; 20% w/ large snags-down logs; 30% lodgepole-70% Doug-fir	**10**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 20% lodgepole-70% Doug-fir; 10% aspen	**5**	.025	**40**	.006	25	.019	**75**
Subalpine fir dry ≤ 30% slope PVT 66	III – Infre-quent Mixed	Shrub-grass-forb-tree seedling; 20% w/ no snags; 80% w/ scattered snags – mature, pole, & sapling	**10**	Closed pole-sapling/ shrub/ litter-duff; scattered pole snags –more sapling snags; 40% lodgepole-20% Doug-fir; 20% spruce; 20% aspen	**35**	Open pole-sapling/ shrub-grass; 60% w/ no snags-down logs; 40% with pole & sapling snags & down logs; 80% lodgepole-20% Doug-fir	**40**	Open large tree/shrub-grass; 80% w/ no snags-down logs; 20% w/ large snags-down logs; 70% lodgepole-30% Doug-fir	**5**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 40% lodgepole-30% Doug-fir; 30% spruce	**10**	.02	**50**	.012	60	.008	**40**
Subalpine fir dry > 30% slope PVT 68	IV – Infre-quent Replace-ment	Shrub-grass-forb-tree seedling; 20% w/ no snags; 80% w/ scattered snags – pole & sapling	**25**	Closed pole-sapling/ shrub/ litter-duff; scattered pole snags –more sapling snags; 40% lodgepole 20% Doug-fir 20% spruce; 20% aspen	**40**	Open pole-sapling/ shrub-grass; 60% w/ few snags-down logs; 40% with pole & sapling snags & down logs; 80% lodgepole 20% Doug-fir	**10**	Open large tree/shrub-grass; 80% w/ few snags-down logs; 20% w/ large snags-down logs; 20% lodgepole-80% Doug-fir	**5**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 20% lodgepole-20% Doug-fir; 60% spruce	**20**	.02	**50**	.003	15	.0`7	**85**

PVT	Fire Regime Group	A		B		C		D		E		All Natural Fire		Surface or Mosaic Fire		Stand Replace ment Fire	
Name		Name	%	Name	%	Name	%	Name	%	Name	%	Prob	Frq (yrs)	Prob	%	Prob	%
Subalpine fir moist PVT 69	IV – Infre-quent Replace-ment	Shrub-grass-forb-tree seedling; 20% w/ no snags; 80% w/ scattered snags – pole & sapling	**15**	Closed pole-sapling/ shrub/ litter-duff; scattered pole snags –more sapling snags; 30% lodgepole 20% Doug-fir 40% spruce; 10% aspen	**45**	Open pole-sapling/ shrub-grass; 60% w/ few snags-down logs; 40% with pole & sapling snags & down logs; 90% lodgepole 10% Doug-fir	**10**	Open large tree/shrub-grass; 80% w/ few snags-down logs; 20% w/ large snags-down logs; 10% lodgepole-90% Doug-fir	**5**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 10% lodgepole-10% Doug-fir; 80% spruce	**25**	.015	**70**	.004	25	.011	**75**
Subalpine fir-whitebark pine (+ whitebark pine-subalpine fir) PVT 71, 70	IV – Infre-quent Mixed	Shrub-grass-forb-tree seedling; 20% w/ no snags; 80% w/ scattered snags – pole & sapling	**20**	Closed pole-sapling/ shrub/ litter-duff; scattered pole snags –more sapling snags; 30% lodgepole 40% whitebark 20% spruce 10% subalpine	**20**	Open pole-sapling/ shrub-grass; 60% w/ few snags-down logs; 40% with pole & sapling snags & down logs; 30% lodgepole 20% whitebark 30% spruce 20% subalpine	**30**	Open large tree/shrub-grass; 80% w/ few snags-down logs; 20% w/ large snags-down logs; 50% lodgepole-50% whitebark	**15**	Closed large-pole-sapling tree/ shrub litter-duff; large snags & down logs; 80% spruce 20% subalpine	**15**	.016	**60**	.006	35	.01	**65**
Riparian shrub-herb (riparian herb + riparian shrub) PVT 119, 124	IV-Infre-quent Mixed	Sedge-grass-forb-shrub sprouts	**10**	Young shrubs/ sedge-grass-forb	**45**	Young shrubs/ sedge-grass-forb	**20**	Old shrubs/sedge-grass	**5**	Old shrubs/sedge-grass	**20**	.013	**75**	.007	55	..006	**45**
Riparian cottonwood PVT 110	IV – Infre-quent Mixed	Sedge-grass-forb-cottonwood-aspen sprouts/ shrub sprouts; scattered residual large cottonwood-aspen	**5**	Pole-sap cottonwood-aspen/ young shrubs/ sedge-grass-forb	**45**	Pole-sap cottonwood-aspen/ young shrubs/ sedge-grass-forb	**10**	Mature cottonwood-aspen/ old shrubs / sedge-grass	**5**	Mature cottonwood-aspen/ old shrubs / sedge-grass	**35**	.015	**65**	.010	65	.005	**35**
Irrigated Pasture																	
Rock																	
Water																	

Closed shrub = > 15% line intercept canopy cover; open shrub = ≤ 15% line intercept canopy cover
Closed forest = > 40% canopy cover; open forest = ≤ 40% canopy cover
Young shrub – y-shaped growth form, grass around base rather than litter, lack of dead material accumulation in crown
Mature shrub – mushroom shaped growth form, litter & scattered grass around base, dead material accumulation in crown.

Box Model Discussion

Columns A through E refer to seral stages or classes within the box model diagram.

Box A: Early seral. Structural stages include stand initiation (si), open herbland (oh), and closed herbland (ch).
Box B: Mid seral closed. Structural stages include stem exclusion closed canopy (secc), understory reinitiation (ur), young forest multi-strata (yfms), closed tall shrub (cts), closed mid shrub (cms), closed low shrub (cls). Shrubs are young in age.
Box C: Mid seral open. Structural stages include stem exclusion open canopy (seoc), open mid shrub (oms), open low shrub (ols), open tall shrub (ots). Shrubs are young in age.
Box D: Late seral open. Structural stages include old forest single strata (ofss), open tall shrub (ots), open mid shrub (oms), open low shrub (ols), open tall shrub (ots). Shrubs are mature in age.
Box E: Late seral closed. Structural stages include old forest multi strata (ofms), closed tall shrub (cts), closed mid shrub (cms), closed low shrub (cls). Shrubs are mature in age.

Fire Probability and Frequency

The six columns on the far right of the table describe the statistical modeling from the VDDT. It shows the frequency (in years) of a natural fire occurring and the distribution (in % area) between a mosaic (fatal and non-fatal) fire and a stand replacing fire.

CURRENT CONDITION

Columbia River Basin
Forested vegetation within the analysis area is grouped into potential vegetation groups (PVG), cold, dry and moist forest.

Dry Forest Type
The dry forest type is limited by low moisture availability and is found at lower elevations on south or west aspects within the analysis area. Since the implementation of fire suppression and traditional silvicultural practices, the dry forest PVG generally shifted to a predominance of mid-seral structures occuping approximately 55 percent of the landscape. In the current period, much of the dry forest PVG is dominated by a higher density of smaller-diameter trees due to the lack of thinning fires that accelerated the growth rates of fire survivors. The current period areal extent of the late-seral multi-layer structure (OFMS) was at the upper end of its historical range (approximately 16% composition). During the current period, early-seral forest structures generally occurred within their historical range, but areas that had been harvested were missing the scattered, large-diameter trees and snags. Current landscapes have a mixed composition rather than dominated by shade intolerant species. Fire intervals range from 40 to 80 years. (Hann et.al. 1997).

Table 1. Current Distribution of Dry Forest PVG

Subwatershed	Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Multi Story	Old Multi Story	Old Single Story
Analysis Area 66859ac	10191ac	465ac	15192ac	10692ac	25365ac	4100ac
Arnett 5068ac	2545ac	25ac	1380ac	657ac	366ac	89ac
Jesse 3983ac	152ac	134ac	1132ac	754ac	1527ac	243ac
Lake 3747ac	419ac	33ac	467ac	856ac	1481ac	416ac
Lower Napias 7157ac	1792ac	26ac	1666ac	886ac	2457ac	238ac
Napias Phelan 8515ac	612ac	45ac	2703ac	822ac	4129ac	67ac
Salmon Fenster 3415ac	686ac	3ac	741ac	775ac	859ac	340ac
Salmon Henry 2126ac	151ac	0	251ac	438ac	993ac	258ac
Salmon Perreau 6864ac	694ac	52ac	976ac	1782ac	2827ac	488ac

Salmon Wagonhammer 4175ac	111ac	0	366ac	430ac	2726ac	494ac
Salmon Wallace 5610ac	1103ac	7ac	665ac	829ac	2350ac	588ac
Twelvemile 5821ac	394ac	88ac	1391ac	926ac	2622ac	364ac
Upper Napias 5592ac	1136ac	52ac	2227ac	849ac	1204ac	107ac
Williams 4786ac	397ac	0	1229ac	690ac	1823ac	407ac

Cold Forest Type
The cold forest type is found at higher elevations and is limited by short growing seasons. Many late seral multi layer forests have been harvested. The extent of late seral single layer forests did not change, but reduction in whitebark pine due to blister rust altered the compostition. Early seral forests increased as a result of timber harvest which also removed much of the snag component. Mid seral forests are within the range of natural variability. Early seral and mid seral shade tolerant forests have increased from historical condition and shade intolerant mid seral forests have decreased. The ratio of shade tolerant to shade intolerant species in late seral forests has not changed dramatically from historical condition. Much of the cold forest is highly susceptible to tree mortality from fires, stress, insects and disease. Fire frequency interval is 75 to 300 years. (Hann, et. al. 1997)

Vegetation in the forested areas consists mainly of conifer cover types, Douglas fir, lodgepole pine, subalpine fir, ponderosa pine, Englemann spruce and whitebark pine. Deciduous cover types are represented in the watershed by quacking aspen and black cottonwood. This discussion will be presented at two different scales, the analysis area and subwatershed (6^{th} code HUC).

Table 2. Current Distribution of Cold Forest PVG

Subwatershed	Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Multi Story	Old Multi Story	Old Single Story
Analysis Area 52286ac	5313ac	220ac	25131ac	6706ac	12897ac	22ac
Arnett 6893ac	1919ac	6ac	2879ac	801ac	1259ac	0
Jesse 5234ac	588ac	79ac	2565ac	752ac	1124ac	0
Lake 3583ac	413ac	53ac	1514ac	566ac	878ac	0
Lower Napias 3161ac	86ac	0	1793ac	45ac	1207ac	0

Napias Phelan 8822ac	158ac	15ac	5380ac	981ac	2212ac	0
Salmon Fenster 1107ac	126ac	0	411ac	201ac	259ac	0
Salmon Henry 1074ac	54ac	0	639ac	169ac	186ac	0
Salmon Perreau 2867ac	478ac	22ac	1019ac	587ac	506ac	0
Salmon Wagonhammer 343ac	2ac	0	205ac	27ac	109ac	0
Salmon Wallace 2152ac	92ac	0	1338ac	309ac	379ac	22ac
Twelvemile 4429ac	390ac	6ac	1342ac	807ac	1793ac	0
Upper Napias 8129ac	589ac	28ac	4658ac	805ac	1957ac	0
Williams 4481ac	418ac	11ac	1390ac	657ac	1028ac	0

Douglas Fir Cover Type

Douglas fir is found in every subwatershed in the analysis area. Potential vegetation groups associated with Douglas fir are cold, dry forest, dry grass or woodland. All structural stages are represented, but not in every subwatershed. Depending on location, Douglas fir is an early seral, mid seral or climax species in this watershed. At lower elevations, Douglas fir is in pure stands or mixed with ponderosa pine and sagebrush. At mid elevations, it is mixed with lodgepole pine. More moist sites contain higher density trees than the drier south facing sites. Habitat types range from PSME FEID (Douglas fir/Idaho fescue) on the dry sites to and PSME VAGL (Douglas fir/blue huckleberry) on the moist sites. PSME CARU (Douglas fir/pinegrass) habitat type is common in the analysis area. Open canopies and slow growth are characteristic of Douglas fir stands on dry sites. These sites are usually adjacent to a nonforest community (Steele, et.al. 1981).

Table 3 represents Douglas fir structural stages by PVT in the watershed and Douglas fir structural stages by PVT in the subwatersheds is displayed in Table 4.

Table 3. Douglas fir structural stages within the analysis area

	POTENTIAL VEGETATION TYPES				
STRUCTURAL STAGE	Dry Doug fir	Doug fir Lodgepole	Dry Subalpine Fir	Aspen/Conifer	Moist Subalpine Fir
Stand Initiation	2346ac 4%	6403ac 12%	0%	0%	

Stem Exclusion	53ac 0.1%	302ac 0.5%	0%	0%	
Understory Reinitiation	1582ac 3%	6296ac 12%	27ac 0.05%	0%	26ac 0.05%
Young Forest Multi Story	3947ac 8%	5825ac 11%	0%	0%	
Old Multi Story	14,746ac 28%	7379ac 14%	15ac 0.05%	157 ac 3%	29ac 0.05%
Old Single Story	3757ac 7%	342ac 0.6%	0%	0%	
Total Acres 51,668	26,425	26,460	66	157	55ac

Table 4. Douglas fir structural stages within subwatersheds

		POTENTIAL VEGETATION TYPES				
SUB WATERSHED	**STRUCTURAL STAGE**	Dry Doug fir	Doug fir Lodgepole	Dry Subalpine Fir	Subalpine Fir Moist	Aspen/Conifer
Arnett 12,100 Ac	Stand Initiation	111ac 4%	1329ac 51%	0%	0%	0%
	Stem Exclusion	5ac 0.2%	0%	0%	0%	0%
	Understory Reinitiation	22ac 0.8%	356ac 14%	0%	0%	0%
Total Douglas Fir Acres 2616	Young Forest Multi Story	121ac 5%	338ac 13%	0%	0%	0%
	Old Multi Story	106ac 4%	137ac 5%	1ac 0.04%	0%	0%
	Old Single Story	21ac 0.8%	67ac 3%	0%	0%	0%
Jesse 13,021 Ac	Stand Initiation	86ac 3%	66ac 2%	0%	0%	1ac 0.03%
	Stem Exclusion	9ac 0.3%	118ac 4%	0%	0%	0%
	Understory Reinitiation	53ac 2%	482ac 15%	20ac 0.6%	0%	0%
Total Douglas Fir Acres 3174	Young Forest Multi Story	361ac 11%	365ac 12%	0%	0%	0%
	Old Multi Story	1084ac 34%	271ac 9%	15ac 0.5%	0%	0%
	Old Single Story	243ac 8%	0%	0%	0%	0%

Lake 12,913 Ac	Stand Initiation	157ac 5%	262ac 8%	0%	0%	9ac 0.3%
	Stem Exclusion	13ac 0.4%	0%	0%	0%	0%
	Understory Reinitiation	73ac 2%	180ac 0.3%	0%	0%	0%
	Young Forest Multi Story	445ac 13%	381ac 11%	0%	0%	0%
Total Douglas Fir Acres 3344	Old Multi Story	1194ac 36%	208ac 6%	0%	6ac 0.2%	0%
	Old Single Story	409ac 12%	7ac 0.2%	0%	0%	0%
Lower Napias 11,319 Ac	Stand Initiation	470ac 9%	1227ac 22%	0%	0%	
	Stem Exclusion	14ac 0.3%	0%	0%	0%	0%
	Understory Reinitiation	23ac 0.4%	819ac 15%	0%	0%	0%
	Young Forest Multi Story	176ac 3%	561ac 10%	0%	0%	0%
Total Douglas Fir Acres 5493	Old Multi Story	883ac 16%	1080ac 20%	0%	0%	0%
	Old Single Story	135ac 3%	103ac 2%	0%	0%	0%
Napias Phelan 19,009 Ac	Stand Initiation	125ac 2%	435ac 8%	0%	0%	
	Stem Exclusion	0%	34ac 0.6%	0%	0%	0%
	Understory Reinitiation	89ac 2%	771ac 14%	0%	5ac 0.1%	0%
	Young Forest Multi Story	266ac 5%	424ac 8%	0%	0%	0%
Total Douglas Fir Acres 5519	Old Multi Story	747ac 14%	2469ac 45%	0%	22ac 0.4%	65ac 1%
	Old Single Story	35ac 0.6%	33ac 0.5%	0%	0%	0%
Salmon Fenster 13,847 Ac	Stand Initiation	176ac 6%	510ac 18%	0%	0%	4ac 0.1%
	Stem Exclusion	0%	3ac 0.1%	0%	0%	0%
	Understory Reinitiation	19ac 0.7%	307ac 11%	0%	0%	0%
	Young Forest Multi Story	356ac 12%	389ac 13%	0%	0%	0%
Total Douglas	Old Multi Story	597ac 21%	197ac 7%	0%	0%	0%

Fir Acres 2898	Old Single Story	315ac 11%	25ac 0.9%	0%	0%	0%
Salmon Henry 14,699 Ac	Stand Initiation	11ac 0.6%	141ac 7%	0%	0%	15ac 0.7%
	Stem Exclusion	0%	0%	0%	0%	0%
	Understory Reinitiation	62ac 3%	172ac 9%	0%	0%	0%
	Young Forest Multi Story	148ac 7%	259ac 13%	0%	0%	0%
Total Douglas Fir Acres 2012	Old Multi Story	919ac 46%	27ac 1%	0%	0%	0%
	Old Single Story	258ac	0%	0%	0%	0%
Salmon Perreau 36,869 Ac	Stand Initiation	188ac 3%	506ac 8%	0%	0%	15ac 0.2%
	Stem Exclusion	12ac 0.2%	40ac 0.6%	0%	0%	0%
	Understory Reinitiation	196ac 3%	451ac 7%	0%	7ac 0.1%	0%
	Young Forest Multi Story	768ac 12%	987ac 16%	0%	0%	0%
Total Douglas Fir Acres 6199	Old Multi Story	1857ac 30%	684ac 11%	0%	0%	0%
	Old Single Story	488ac 8%	0%	0%	0%	0%
Salmon Wagonhammer 10,565 Ac	Stand Initiation	93ac 2%	18ac 0.4%	0%	0%	3ac 0.08%
	Stem Exclusion	0%	0%	0%	0%	0%
	Understory Reinitiation	206ac 5%	61ac 2%	0%	0%	0%
	Young Forest Multi Story	368ac 9%	57ac 1%	0%	0%	0%
Total Douglas Fir Acres 4026	Old Multi Story	2663ac 66%	63ac 2%	0%	0%	0%
	Old Single Story	494ac 12%	0%	0%	0%	0%
Salmon Wallace 14,828 Ac	Stand Initiation	661ac 15%	442ac 10%	0%	0%	0%
	Stem Exclusion	0%	0%	0%	0%	0%
	Understory Reinitiation	35ac 0.7%	246ac 5%	4ac 0.09%	13ac 0.3%	0%
	Young Forest Multi Story	249ac 5%	471ac 10%	3ac 0.04%	0%	0%
Total Douglas Fir Acres 4779	Old Multi Story	1580ac 35%	470ac 10%	9ac 0.2%	0%	0%
	Old Single Story	588ac 13%	0%	0%	0%	0%

Twelvemile 14,267 Ac	Stand Initiation	183ac 3%	212ac 4%	0%	0%	6ac 0.1%
	Stem Exclusion	0%	67ac 1%	0%	0%	0%
	Understory Reinitiation	456ac 9%	514ac 10%	2ac 0.04%	2ac 0.04%	0%
	Young Forest Multi Story	387ac 7%	511ac 10%	0%	0%	0%
Total Douglas Fir Acres 5251	Old Multi Story	1717ac 33%	832ac 16%	0%	0%	0%
	Old Single Story	362ac 7%	0%	0%	0%	0%
Upper Napias 13,963 Ac	Stand Initiation	25ac 0.6%	926ac 24%	0%	0%	8ac 0.2%
	Stem Exclusion	0%	39ac 1%	0%	0%	0%
	Understory Reinitiation	0%	1387ac 36%	0%	0%	0%
	Young Forest Multi Story	54ac 1%	698ac 18%	10ac 0.3%	0%	0%
Total Douglas Fir Acres 3858	Old Multi Story	71ac 2%	530ac 14%	3ac 0.08%	0%	8ac 0.2%
	Old Single Story	0%	107ac 3%	0%	0%	0%
Williams 18,056 Ac	Stand Initiation	58ac 2%	339ac 8%	0%	0%	21ac 0.5%
	Stem Exclusion	0%	0%	0%	0%	0%
	Understory Reinitiation	350ac 9%	462ac 12%	0%	0%	0%
	Young Forest Multi Story	247ac 6%	383ac 10%	0%	0%	0%
Total Douglas Fir Acres 4003	Old Multi Story	1328ac 33%	407ac 10%	0%	0%	0%
	Old Single Story	408ac 10%	0%	0%	0%	0%

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity in all potential vegetation types. Small (less than 100 acres) fires have burned within the analysis area and were stand replacing or mixed severity. Mixed severity surface fires are not frequent. Extensive, intensive livestock grazing in the early and mid 1900s decreased the fine fuels such as grass and forbs.

Logging by early settlers and miners occurred in minor amounts and probably at lower elevations where the timber was more accessible; Douglas fir was not highly desired by the early loggers (Work 1913). Most of the logging within this cover type occurred from the 1950's to the 1980's and concentrated on larger diameter Douglas fir. Some of the cut areas were regenerated to Douglas fir. The silvicultural systems were clearcuts (10%) and shelterwood cuts (90%). Most of the slash was lopped and scattered and in some areas piled and burned.

Insects and disease associated with Douglas fir in the analysis area are western spruce budworm, Douglas fir beetle and mistletoe. An outbreak of western spruce budworm occurred in most drainages east of Ridge Road in 1991 and 1992, defoliating most of the Douglas fir and reducing its growth. A miner outbreak was experienced in 2002. Douglas fir beetle is present in endemic amounts, killing a few trees throughout the drainages. Mistletoe is present throughout this cover type, the worst being along the ecotone with sagebrush. Lack of fire has lead to an increase in dwarf mistletoe infestations

Lodgepole Pine Cover Type

Lodgepole pine, an early seral species is abundant in the analysis area. It is found in each subwatershed, in all structural stages and cold, dry, moist PVGs. Lodgepole is in pure stands as well as mixed with Douglas fir, whitebark pine and subalpine fir at mid and high elevations. Habitat types are PSME CARU (Douglas fir/pinegrass) at mid elevations, ABLA VASC (subalpine fir/grouse whortleberry) and ABLA CARU (subalpine fir/pinegrass) located at mid and higher elevations. Tables 3 and 4 depict lodgepole pine structural stages by PVT in the analysis area and subwatersheds.

Table 5. Lodgepole pine within the analysis area

	POTENTIAL VEGETATION TYPES			
STRUCTURAL STAGE	Douglas Fir Lodgepole	Subalpine Fir Dry	Subalpine Fir Moist	Subalpine Fir Whitebark Pine
Stand Initiation	1437ac 3%	4467ac 8%	0%	0%
Stem Exclusion	111ac 0.2%	220ac 0.4%	0%	0%
Understory Reinitiation	7405ac 14%	24,842ac 46%	9ac 0.01%	46ac 0.08%
Young Forest Multi Story	921ac 2%	5256ac 10%	20ac 0.04%	73ac 0.1%
Old Multi Story	3245ac 6%	6580ac 10%	2ac	11ac 0.02%
Old Single Story	0%	0%	0%	0%
Total Acres 54,644	13,118	41,366	30	129

Table 6. Lodgepole pine within subwatersheds

SUB WATERSHED	**STRUCTURAL STAGE**	Douglas fir Lodgepole	Subalpine Fir Dry	Subalpine Fir Moist	Subalpine Fir Whitebark Pine

Arnett 12,100 Ac Total Lodgepole Acres 8323	Stand Initiation	1105ac 13%	1796ac 22%	0%	0%
	Stem Exclusion	19ac 0.2%	6ac 0.07%	0%	0%
	Understory Reinitiation	1001ac 12%	2878ac 35%	1ac 0.01%	0%
	Young Forest Multi Story	198ac 0.2%	661ac 8%	0%	55ac 0.7%
	Old Multi Story	124ac 1.5%	479ac 5.8%	0%	0%
	Old Single Story	0%	0%	0%	0%
Jesse 13,021 Ac Total Lodgepole Acres 5187	Stand Initiation	0%	477ac 9%	0%	0%
	Stem Exclusion	8ac 0.2%	79ac 0.1%	0%	0%
	Understory Reinitiation	597ac 12%	2537ac 49%	0%	0%
	Young Forest Multi Story	28ac 0.5%	664ac 13%	0%	0%
	Old Multi Story	172ac 3%	625ac 12%	0%	0%
	Old Single Story	0%	0%	0%	0%
Lake 12,913 Ac Total Lodgepole Acres 2968	Stand Initiation	0%	268ac 9%	0%	0%
	Stem Exclusion	20ac 0.7%	53ac 2%	0%	0%
	Understory Reinitiation	215ac 7%	1500ac 51%	0%	13ac 0.4%
	Young Forest Multi Story	30ac 1%	382ac 13%	0%	0%
	Old Multi Story	79ac 3%	408ac 14%	0%	0%
	Old Single Story	0%	0%	0%	0%
Lower Napias 11,319 Ac Total Lodgepole Acres 3808	Stand Initiation	95ac 2.5	71ac 2%	0%	0%
	Stem Exclusion	12ac 0.3%	0%	0%	0%
	Understory Reinitiation	825ac 22%	1793ac 47%	0%	0%
	Young Forest Multi Story	150ac 4%	38ac 1%	0%	0%
	Old Multi Story	493ac 13%	333ac 9%	0%	0%
	Old Single Story	0%	0%	0%	0%
Napias Phelan 19,009 Ac	Stand Initiation	52ac 0.5%	142ac 1%	0%	0%

Total Lodgepole Acres 10,926	Stem Exclusion	11ac 0.1%	15ac 0.1%	0%	0%
	Understory Reinitiation	1843ac 17%	5374ac 49%	0%	0%
	Young Forest Multi Story	132ac 1%	830ac 8%	0%	0%
	Old Multi Story	915ac 8%	1613ac 15%	0%	0%
	Old Single Story	0%	0%	0%	0%
Salmon Fenster 13,847 Ac	Stand Initiation	0%	91ac 7%	0%	0%
	Stem Exclusion	0%	0%	0%	0%
Total Lodgepole Acres 1239	Understory Reinitiation	415ac 34%	380ac 31%	0%	0%
	Young Forest Multi Story	30ac 2%	185ac 15%	0%	0%
	Old Multi Story	65ac 5%	73ac 6%	0%	0%
	Old Single Story	0%	0%	0%	0%
Salmon Henry 14,699 Ac	Stand Initiation	0%	39ac 5%	0%	0%
	Stem Exclusion	0%	0%	0%	0%
Total Lodgepole Acres 849	Understory Reinitiation	17ac 2%	606ac 71%	0%	0%
	Young Forest Multi Story	30ac 4%	91ac 11%	0%	0%
	Old Multi Story	48ac 6%	18ac 2%	0%	0%
	Old Single Story	0%	0%	0%	0%
Salmon Perreau 36,869 Ac	Stand Initiation	0%	369ac 13%	0%	0%
	Stem Exclusion	0%	26ac 1%	0%	0%
Total Lodgepole Acres 2819	Understory Reinitiation	329ac 12%	1012ac 36%	0%	0%
	Young Forest Multi Story	27ac 1%	412ac 15%	0%	0%
	Old Multi Story	287ac 10%	357ac 13%	0%	0%
	Old Single Story	0%	0%	0%	0%
Salmon Wagonhammer 10,565 Ac	Stand Initiation	0%	2ac 0.5%	0%	0%
	Stem Exclusion	0%	0%	0%	0%
	Understory Reinitiation	100ac 25%	205ac 52%	0%	0%

Total Lodgepole Acres 393	Young Forest Multi Story	4ac 1%	27ac	0%	0%
	Old Multi Story	0%	55ac 14%	0%	0%
	Old Single Story	0%	0%	0%	0%
Salmon Wallace 14,828 Ac	Stand Initiation	0%	69ac 3%	0%	0%
	Stem Exclusion	7ac 0.3%	0%	0%	0%
Total Lodgepole Acres 2367	Understory Reinitiation	379ac 16%	1080ac 46%	0%	4ac 0.2%
	Young Forest Multi Story	109ac 5%	115ac 5%	0%	0%
	Old Multi Story	300ac 13%	52ac 2%	0%	0%
	Old Single Story	0%	0%	0%	0%
Twelvemile 14,267 Ac	Stand Initiation	0%	258ac 6%	0%	0%
	Stem Exclusion	21ac 0.5%	6ac 0.1%	0%	0%
Total Lodgepole Acres 4294	Understory Reinitiation	422ac 10%	1335ac 31%	3ac 0.06%	0%
	Young Forest Multi Story	28ac 0.6%	649ac 2%	0%	5ac 0.1%
	Old Multi Story	73ac 2%	1494ac 35%	0%	0%
	Old Single Story	0%	0%	0%	0%
Upper Napias 13,963 Ac	Stand Initiation	185ac 2%	540ac 7%	0%	0%
	Stem Exclusion	14ac 0.2%	28ac 0.4%	0%	0%
Total Lodgepole Acres 7913	Understory Reinitiation	839ac 10%	4600ac 58%	5ac 0.06%	4ac 0.05%
	Young Forest Multi Story	97ac 1%	652ac 8%	0%	9ac 0.1%
	Old Multi Story	602ac 8%	335ac 4%	2ac 0.03%	0%
	Old Single Story	0%	0%	0%	0%
Williams 18,056 Ac	Stand Initiation	0%	345ac 10%	0%	0%
	Stem Exclusion	0%	11ac 0.3%	0%	0%
Total Lodgepole Acres 3566	Understory Reinitiation	418ac 12%	1390ac 39%	0%	0%
	Young Forest Multi Story	59ac 2%	497ac 14%	20ac 0.6%	0%

	Old Multi Story	88ac 3%	738ac 21%	0%	0%
	Old Single Story	0%	0%	0%	0%

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity in all potential vegetation types. Small (less than 100 acres) fires have burned within the analysis area and were stand replacing or mixed severity. Mixed severity surface fires are not frequent.

Logging began in lodepole pine in the late 1860s with the discovery of gold. Trees were cut to meet local needs. Most logging occurred after 1950 for house logs, sawtimber, post and poles and firewood. Clearcuts are the main silviculture system; most of the slash was piled and burned.

Mountain pine beetle is the primary insect associated with lodgepole pine; infestations have been endemic. Mountain pine beetle activity within the analysis area could accelerate to epidemic conditions due to recent droughts, maturity and size of the timber and epidemic infestations nearby. Mistletoe is the most prevalent disease in this cover type and is present in varying amounts throughout the analysis area.

Spruce/Fir Cover Type
This cover type is found in every subwatershed in the analysis area in minor amounts on north facing, moist sites at higher elevations. Subalpine fir is a climax species associated with lodgepole pine, whitebark pine and Douglas fir cover types. Abundant subalpine fir is present throughout the mid and upper elevations of the analysis area. Engelmann spruce is a mid seral species. Spruce/fir structural stages are mature and represented by cold and moist PVGs. Habitat types are ABLA STAM (subalpine fir/twisted stalk) in the very moist areas, usually dominated by Englemann spruce and ABLA LIBO (subalpine fir/twinflower). Tables 5 and 6 display spruce fir structural stages as they relate to potential vegetation in the analysis area and subwatershed.

Table 7. Spruce/fir within the analysis area

	POTENTIAL VEGETATION		
STRUCTURAL STAGE	Subalpine Fir Dry	Subalpine Fir Moist	Subalpine Fir Whitebark Pine
Stand Initiation	783ac 10%	63ac 0.8%	0%
Stem Exclusion	0%	0%	0%
Understory Reinitiation	19ac 0.2%	4ac 0.05%	140ac 2%
Young Forest Multi Story	271ac 4%	25ac 0.3%	289ac 4%
Old Multi Story	4306ac 55%	1818ac 23%	70ac 1%
Old Single Story	0%	0%	0%
Total acres 7772	5365	1908	500

Table 8. Spruce/fir within subwatersheds

SUB WATERSHED	**STRUCTURAL STAGE**	Subalpine Fir Dry	Subalpine Fir Moist	Subalpine Fir Whitebark Pine
Arnett 12,100 Ac	Stand Initiation	74ac 8%	50ac 5%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%		0%
Total Spruce/Fir Acres 975	Young Forest Multi Story	31ac 3%	15ac 2%	40ac 3%
	Old Multi Story	626ac 64%	153ac 16%	0%
	Old Single Story	0%	0%	0%
Jesse 13,021 Ac	Stand Initiation	111ac 18%	0%	0%
	Stem Exclusion	0%	0%	0%
Total Spruce/Fir Acres 625	Understory Reinitiation	6ac 1%	1ac 0.2%	0%
	Young Forest Multi Story	7ac 1%	0%	15ac 2%
	Old Multi Story	272ac 44%	213ac 34%	0%
	Old Single Story	0%	0%	0%
Lake 12,913 Ac	Stand Initiation	145ac 26%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 555	Young Forest Multi Story	0%	0%	1ac 0.2%
	Old Multi Story	180ac 32%	229ac 41%	0%
	Old Single Story	0%	0%	0%
Lower Napias 11,319 Ac	Stand Initiation	16ac 2%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 896	Young Forest Multi Story	0%	7ac 0.8%	0%
	Old Multi Story	807ac 90%	66ac 7%	0%
	Old Single Story	0%	0%	0%

Napias Phelan 19,009 Ac	Stand Initiation	17ac 3%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 594	Young Forest Multi Story	0%	0%	0%
	Old Multi Story	360ac 61%	217ac 37%	0%
	Old Single Story	0%	0%	0%
Salmon Fenster 13,847 Ac	Stand Initiation	36ac 13%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	32ac 12%
Total Spruce/Fir Acres 270	Young Forest Multi Story	7ac 3%	0%	9ac 3%
	Old Multi Story	24ac 9%	162ac 60%	0%
	Old Single Story	0%	0%	0%
Salmon Henry 14,699 Ac	Stand Initiation	14ac 6%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 230	Young Forest Multi Story	0%	0%	48ac 21%
	Old Multi Story	137ac 60%	27ac 12%	4ac 2%
	Old Single Story	0%	0%	0%
Salmon Perreau 36,869 Ac	Stand Initiation	109ac 37%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 297	Young Forest Multi Story	0%	0%	39ac 13%
	Old Multi Story	95ac 32%	54ac 18%	0%
	Old Single Story	0%	0%	0%
Salmon Wagonhammer 10,565 Ac	Stand Initiation	0%	0%	
	Stem Exclusion	0%	0%	
	Understory Reinitiation	0%	0%	

Total Spruce/Fir Acres 54	Young Forest Multi Story	0%	0%	
	Old Multi Story	45ac 83%	9ac 17%	
	Old Single Story	0%	0%	
Salmon Wallace 14,828 Ac	Stand Initiation	20ac 4%	3ac 0.6%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	60ac 11%
Total Spruce/Fir Acres 525	Young Forest Multi Story	96ac 18%	0%	38ac 7%
	Old Multi Story	180ac 34%	147 28%	46ac 9%
	Old Single Story	0%	0%	0%
Twelvemile 14,267 Ac	Stand Initiation	132ac 27%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 492	Young Forest Multi Story	0%	0%	60ac 13%
	Old Multi Story	147ac 30%	153ac 31%	0%
	Old Single Story	0%	0%	0%
Upper Napias 13,963 Ac	Stand Initiation	36ac 2%	11ac 0.6%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	49ac 3%
Total Spruce/Fir Acres 1848	Young Forest Multi Story	130ac 7%	4ac 0.2%	0%
	Old Multi Story	1405ac 76%	193ac 10%	20ac 1%
	Old Single Story	0%	0%	0%
Williams 18,056 Ac	Stand Initiation	73ac 18%	0%	0%
	Stem Exclusion	0%	0%	0%
	Understory Reinitiation	0%	0%	0%
Total Spruce/Fir Acres 403	Young Forest Multi Story	0%	0%	40ac 10%
	Old Multi Story	93ac 23%	197ac 49%	0%
	Old Single Story	0%	0%	0%

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity. Small (less than 100 acres) fires have burned within the analysis area and were stand replacing or mixed severity. Fuel accumulations are moderate to high due to lack of fire. Fire intervals are within the historic range. Fire suppression has increased subalpine fir across the landscape because any fire would kill subalpine fir and regenerate lodgepole pine or Douglas fir.

Incidental logging in early European history occurred in this cover type.

Predominant insects associated with spruce/fir are western spruce budworm, subalpine fir complex and western balsam beetle. These occur in endemic amounts throughout the analysis area. The western spruce budworm epidemic in 1991 and 1992 defoliated these trees and decreased growth. The subalpine fir complex is killing pockets of trees at high elevations throughout the watersheds.

Ponderosa Pine Cover Type

Ponderosa pine is found in minor amounts in three subwatersheds on dry sites at low elevation. It is an early seral species and is associated with Douglas fir. PVGs are dry forest and dry grass and most structural stages are found. Representative habitat types are PSME CARU and PSME PHMA.

Table 9. Ponderosa pine within the assessment area

STRUCTURAL STAGE	Ponderosa Pine Grassland
Stand Initiation	30ac 3%
Stem Exclusion	13ac 1%
Young Forest Multi Story	166 ac 16%
Old Multi Story	550 ac 52%
Old Single Story	298 ac 28%
Total Acres	1057

Table 10. Ponderosa Pine within subwatersheds

SUB WATERSHED	**STRUCTURAL STAGE**	Ponderosa Pine Grassland
Salmon Wallace	Stand Initiation	30ac 6%
	Stem Exclusion	13ac 3%

Total Ponderosa Acres 501	Young Forest Multi Story	124 ac 25%
	Old Multi Story	238 ac 48%
	Old Single Story	96 ac 19%
Salmon Wagonhammer	Stand Initiation	0%
	Understory Reinitiation	0%
Total Ponderosa Acres 556	Young Forest Multi Story	42 ac 8%
	Old Multi Story	312 ac 56%
	Old Single Story	202 ac 36%

Fire return intervals are frequent and large fires (greater than100 acres) that have occurred were of low or mixed severity. Small (less than 100 acres) fires have burned within the analysis area and were mixed severity. Frequent mixed severity surface fires maintained a mosaic of age classes. Extensive, intensive livestock grazing in the early and mid 1900s decreased the fine fuels such as grass and forbs.

Logging occurred within this cover type, cutting most of the large diameter trees. Selection logging took place during early settlement and clearcuts occurred in the 1980s. Some areas were planted with ponderosa pine.

Mountain pine beetle has infected single and groups of trees within the analysis area. No epidemic has occurred.

Whitebark Pine Cover Type

Whitebark pine is a minor component of the high elevation forested vegetation in the analysis area. It is an early seral species found in half of the subwatersheds in cold forest PVG and old single and multi strata forests and young multi strata forest. Some pure stands exist, but most whitebark pine is associated with subalpine fir or lodgepole pine. Habitat types are ABLA CAGE (subalpine fir elksedge) and PIAL ABLA (whitebark pine/subalpine fir). Trees at the highest elevations are often smaller, deformed and in scattered patches (Steele et. al. 1981).

Table 11. Whitebark pine in analysis area and subwatersheds

Watershed	Total Acres	Old Single Strata Forest	Old Multi Strata Forest	Young Multi Strata Forest	Understory Reinitiation
Analysis Area	870	22ac 3%	56 ac 6%	759 ac 87%	34 ac 4%

Jesse Creek	66	0%	0%	66 ac 100%	0%
Lake Creek	239	0%	55 ac 23%	183 ac 77%	1 ac 0.4%
Napias Phelan	150	0%	0%	150 ac 100%	0%
Salmon Henry	63	0%	0%	30 ac 48%	33 ac 52%
Salmon Perreau	137	0%	0%	137 ac 100%	0%
Salmon Wallace	22	22 ac 100%	0%	0%	0%
Twelvemile	92	0%	0%	92 ac 100%	0%
Wlliams	100	0%	0%	100 ac 100%	0%

Fire return intervals are greater than 100 years and large fires (greater than100 acres) that have occurred are stand replacing or mixed severity. Small (less than 100 acres) fires were stand replacing or mixed severity. Fuel accumulations are light and there is an increase in ladder fuels. (Crane, et. al. 1986)

Firewood gathering in the last decade or so has occurred in this cover type.

The primary insect infecting whitebark pine is mountain pine beetle. The last outbreak was in the 1930s; old remnants are visible on the landscape. Mountain pine beetle has not infected the analysis area yet, but the potential is there for a similar outbreak that kills most of the trees because of drought and stress from blister rust. The key disease infecting whitebark pine is white pine blister rust, an exotic species. All of the stands in the watershed have blister rust although some trees are not infected.

This cover type will continue to decline because of white pine blister rust, mountain pine beetle, or suppression by subalpine fir. Establishment of new stands is not occurring due to the lack of fire.

Quaking Aspen Cover Type

Aspen is found in moist pockets within most of the subwatersheds in minor amounts. It is within the Woodland PVG and is in stand initiation, understory reinitiation structural stages. It is always associated with Douglas fir, subalpine fir or lodgepole pine and is an early seral species. Habitat types are PSME CAGE SYOR (Douglas fir/elk sedge/mountain snowberry), PSME LIBO (Douglas fir/twinflower), PSME SPBE (Douglas fir/white spirea), PSME SYAL (Douglas fir/common snowberry). Aspen sites are rich and diverse. Table 8 indicates the distribution of structural stages in the analysis area and subwatersheds.

Table 12. Quaking aspen structural stages in assessment area and subwatersheds.

Watershed	Understory Reinitiation	Stand Initiation
Analysis Area	595 ac 98%	10ac 2%
Jesse Creek	5 ac 100%	
Lake Creek	32 ac 100%	
Lower Napias	17 ac 100%	
Napias Phelan	131 ac 94%	8ac 6%
Salmon Fenster	33 ac 100%	
Salmon Henry	17 ac 100%	
Salmon Perreau	13 ac 100%	
Salmon Wagonhammer	24 ac 97%	2 ac 3%
Salmon Wallace	75 ac 100%	
Twelvemile	26 ac 100%	
Upper Napias	6 ac 100%	
Williams	226 ac 100%	

Fire suppression has removed frequent fires, mixed severity from the landscape. Fire return intervals are greater than 100 years. Natural disturbances no longer rejuvenate aspen stands. Extensive, intensive livestock grazing in the early and mid 1900s decreased the fine fuels such as grass and forbs.

Extensive logging has not occurred in this cover type. Pockets of aspen and associated conifers have been cut in Moccasin, Napias and Phelan Creeks to regenerate aspen and increase patch sizes.

Numerous insects and diseases, none of which are prevalent in the analysis area, plague aspen. Domestic ungulates have altered age structure and understory diversity from the natural condition.

Trend

Without fire or other disturbance, quaking aspen will continue to decline, eventually replaced by conifers. Aspen treatments in Moccasin and Phelan Creeks will convert 905 acres of mature aspen mixed with conifer to aspen seedlings.

Black Cottonwood Cover Type

Cottonwood is a minor component of the forested vegetation found along streams and in very moist areas. It is an early seral species dependent on disturbance such as floods to regenerate. It is in the woodland PVG and is found only in mature structural stages within the subwatersheds. Table 9 shows the distribution of structural stages in the subwatersheds and the analysis area.

Table 13. Black Cottonwood structural stages

Watershed	Total Acres	Stem Exclusion	Old Multi Story
Analysis Area	2606	56% 1466 ac	44% 1140ac
Jesse Creek	54	63% 34 ac	37% 20ac
Lake Creek	51	86% 44 ac	14% 7ac
Salmon Fenster	581	52% 306 ac	47% 275ac
Salmon Henry	284	40% 113 ac	60% 171ac
Salmon Perreau	920	57% 527 ac	43% 393ac
Salmon Wagonhammer	294	61% 179 ac	39% 115ac
Salmon Wallace	196	72% 141 ac	28% 55ac
Twelvemile	72	25% 18 ac	75% 54ac
Williams Creek	154	68% 104 ac	32% 50ac

Infrequent mixed severity or stand replacing fires have occurred within this cover type. Fire return interval is greater than 100 years. Extensive, intensive livestock grazing in the early and mid 1900s decreased the fine fuels such as grass and forbs.

Logging has not occurred within this cover type

Several insects and diseases attack black cottonwood, but none are prevalent in the analysis area.

General Disturbances

Logging has occurred in every subwatershed except Jesse Creek and Salmon Henry. It began at the time of European settlement for personal or mining needs. Selection cuts were the choice of the early settlers removing material for construction, firewood or other ranching needs. Most of the major logging started in the late 1960s through the present. Douglas fir was the major species removed. Logging systems were tractor, jammer, skyline or helicopter. Clearcuts were common as well as shelterwood cuts and individual tree removal. Most of the logged areas were planted with Douglas fir. In the lodgepole cover type, lodgepole was regenerated naturally or planted. Approximately 16,345 acres or 8 percent of the analysis area were harvested.

Fire was the primary natural disturbance in the analysis area. Since settlement, fires were suppressed to protect the timber resource. Several large fires (greater than 100 acres) burned in the analysis area since 1900. Clear Creek Fire burned 17,904 acres within Arnett, Upper Napias, Napias Phelan and Lower Napias subwatersheds. Fenster Fire (2,864 acres) burned within Salmon Wallace subwatershed. Twelve Mile fire burned 120 acres in Twelve Mile subwatershed. Two fires in Williams Creek subwatershed burned 4,489 and 613 acres. A fire in Salmon Perreau subwatershed burned 1,026 acres. Two fires burned 688 and 210 acres within Jesse Creek watershed. A fire in Salmon Fenster watershed burned 1,043 acres and a fire in Salmon Waggonhamer burned 858 acres. Numerous (326) small fires have started within the analysis area since 1900.

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HISTORIC CONDITION

Columbia River Basin

Dry Forest Type

In native systems, small tree mortality was common due to fire insects, disease and competition. A constant unchanging pattern of open communities was maintained. The early seral forest was dominated by shade intolerant species, the mid seral forests were composed of shade tolerant and shade intolerant species and late seral forests were dominated by shade intolerant species. Fire intervals ranged from 20 to 70 years. (Hann, et. al. 1997)

Moist Forest Type

In the native system, early seral forests were dominated by shade intolerant species, mid seral and late seral single layer forests were dominated by shade intolerant species. A mix of shade tolerant and shade intolerant species composed the late seral multi layer forests. Fire regimes varied. Non lethal underburns had a frequency of 15-25 years on benches and ridges. Lethal crown fires occurred in the upland slopes across 25 percent of the PVG with a frequency of 20 to 150 years. The mixed fire regime had variable intervals ranging from 20 to 150 years and up to 300 years. The mixed regime affected 40 to 45 percent of the PVG. (Hann, et. al. 1997)

Cold Forest Type

Early seral and mid seral forests were dominated by shade intolerant species. Shade intolerant species dominated the late seral single layer forests. Late seral multi layer forests were composed primarily of shade tolerant species and lesser amounts of shade intolerant species. Native cold forest systems maintained a high composition of late seral multi layer structure in areas where fire rarely burned. Underburning fires maintained later seral single layer structure on benches and ridges dominated by whitebark pine and lodgepole pine. Moist, steep slopes burned with lethal crown fires at intervals that allowed development of early to mid seral structures. Trees were thinned by mortality from stress, insects and disease. Fire intervals were highly variable and correlated with landforms. The non lethal underburns had an interval of 30 to 100 years and comprised 10 percent of the landscape. The lethal crown fire regime had a fire return interval of 25 to 300 years and occurred across 25 to 30 percent of the landscape. The mixed fire regime was intermingled with other regimes and occurred across 60 percent of the cold forest type. The fire return interval was 25 to 300 years. (Hann, et. al. 1997)

Table 14 shows the historic distribution of structural stages within the PVGs.

Table 14. Historic distribution of PVGs

Structural Stages	Cold Forest	Dry Forest	Moist Forest	Dry Grass	Woodland
Stand Initiation	23-25%	10-20%	20-30%	0%	5%

Stem Exclusion	44-53%	25-30%	40-50%	0%	15%
Understory Reinitiation	44-53%	25-30%	40-50%	0%	15%
Young Forest Multi Story	0%	0%	0%	0%	0%
Old Multi Story	15-24%	10-15%	20-30%	0%	1-3%
Old Single Story	6-8%	20-50%	5-10%	0%	5%

Forested vegetation was predominately conifer with patches of quaking aspen and black cottonwood in moist areas. The forested ecosystems were resilient and responded predictably to disturbance (USFS 1996, Hann et.al. 1997). This discussion will be presented at the landscape scale because that is the level of the best information and then applied to the subwatersheds where the cover types are present. I used information presented in Properly Functioning Condition (1996), An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume II (1997) and Wendel Hann's fire condition class ratings and extrapolated it to the cover types found in the assessment area.

Douglas Fir Cover Type

Douglas fir in the dry forest type had densities less than the other PVGs. The stands were more open, park-like. The mid seral and late seral stages had less subalpine fir and Dougals fir in the understory. Douglas fir would not have succeeded into sagebrush/grass areas. Where it was mixed with ponderosa pine and lodgepole pine, the pines dominated the area. The habitat types were similar to current condition.

Table 2. Distribution of Douglas fir Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
15-30%	10-30%	20-40%	0%	5-10%	10-40%

Fire

Dry Douglas fir habitat types are in Fire Group Two and Fire Regime Group I: warm dry habitat types that support open forests of Douglas fir. Fire intervals ranged from zero to 35 years and were frequent mixed severity creating a mosaic of different age classes. Fuel loads were usually light (less than five tons per acre). The most abundant ground fuel was grass. Fire maintained open stands of Douglas fir. Periodic fires created unevenaged stands. (Crane, et. al. 1986, McNicoll et. al. 2002)

Fire Group Four: cool dry Douglas fir habitat types had light fuel loads usually less than 13 tons per acre. Fine fuels and ladder fuels were not very abundant. Fire frequencies averaged 41 years. (Crane, et. al. 1986)

Douglas fir lodgepole pine potential vegetation types on slopes less than 30 percent were classified in Fire Regime Group III. Fire intervals ranged from 35 to 100 years and were infrequent mixed severity creating patches of mixed age classes. Douglas fir lodgepole pine potential vegetation types on slopes greater than 30 percent were classified in Fire Regime Group IV. Fires burned infrequently at intervals ranging from 35 to 100 years and were severe enough to replace the stand creating large patches of similar aged trees. (McNicoll et. al. 2002)

No logging occurred. Natural disturbances included endemic levels of bark beetles, western spruce budworm and mistletoe. Douglas fir dwarf mistletoe infestations were reduced or eliminated as were the understory ladder fuels by frequent fires.

Lodgepole Pine Cover Type

Stands were dominated by lodgepole pine with less Douglas fir and subalpine fir in the understory. Habitat types were comparable to those mentioned in current condition.

Table 3. Distribution of Lodgepole Pine Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
10-25%	30-40%	20-30%	0%	5-20%	5-10%

Fire was the main disturbance affecting structural stages. Lodgepole pine associated with Douglas fir habitat types experienced a range of fire intensities depending on slope (see discussion in Douglas fir Cover Type) and fire frequency ranged from five to 67 years. Fuels were light ranging from five to 20 tons per acre with large amounts of fuels less than three inches. Large stand replacing fires were common in higher elevations maintaining lodgepole on the landscape. Subalpine fir in the understory provided a ladder for fire to reach the crowns. High fuel accumulations occurred where mountain pine beetle killed the over story providing fuels for stand replacing fires. (Crane, et. al. 1986) Stand replacing fires cleansed the stands of mistletoe. Moderate severity fires maintained mistletoe within the stands and perpetuated growth of shade tolerant species.

Fire frequencies in subalpine fir potential vegetation types were dependent on slope. Areas with less than 30 percent slope experienced mixed severity fires every 35 to 100 years creating a mosaic of different age classes in smaller patches. In areas with slopes greater than 30 percent, fire frequencies ranged from 35 to 100 years with high severity replacing the burned stands creating large patches (greater than 100 acres) of similar age classes. (McNicoll et. al. 2002) High fuel accumulations composed of larger diameter material were common due to lack of frequent fires. High severity fires within this group supported lodgepole pine.

Epidemic mountain pine beetle infestations removed mature trees from the landscape initiating early seral stages. Mistletoe was not as prevalent on the landscape.

Spruce/Fir Cover Type

This type was found across the watershed in moist areas and higher elevation. There was less subalpine fir in the understories of other cover types due to more mixed severity fires. Habitat types would be similar to those described in current condition.

Table 4. Distribution of Spruce/Fir Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
10-15%	20-45%	10-20%	0%	25-35%	5%

Fire frequency in Fire Group Eight and Fire Regime Group IV is very variable. Fire frequencies ranged from 35 to 200 years with high severity replacing the stand. Large patches of similar age classes were created. (McNicoll, et. al. 2002) High fuel accumulations composed of larger diameter material were common due to lack of frequent fires. Low severity fires supported subalpine fir types. Total domination of subalpine fir was rare because eventually the area would burn. (Crane, et. al. 1986)

The natural disturbances consisted of endemic populations of western spruce budworm, subalpine fir complex would not be prevalent on the landscape.

Ponderosa Pine Cover Type

Ponderosa pine occurred in minor amounts at low elevations. Douglas fir was not in the understory due to the frequent fires and patch sizes were larger than in current condition. Habitat types would be similar to those described in current condition.

Table 5. Distribution of Ponderosa Pine Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
10-20%	10-20%	20%	0%	5-10%	35-40%

Ponderosa pine is within Fire Group Two and Fire Regime Group I: warm dry habitat types that support open forests of ponderosa pine or Douglas fir. Fire intervals ranged from three to 35 years. Frequent mixed severity fires maintained a mosaic of age classes. (McNicoll, et. al. 2002) Fuel loads were usually light (less than five tons per acre). The most abundant ground fuel was grass. Fire maintained open stands of ponderosa pine or Douglas fir. Periodic fires created unevenaged stands. (Crane, et. al. 1986)

Logging would not have removed the large diameter trees. Endemic levels of mountain pine beetle infected larger trees.

Whitebark Pine Cover Type

Whitebark pine seedlings and saplings occurred in disturbed areas at high elevations. The trees were widely spaced with less subalpine fir in the stand. Habitat types would be similar to those described in current condition.

Table 6. Distribution of Whitebark Pine Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
10%-20%	20%-50%	30%-50%	0%	15%	15-30%

Fire Regime Group IV experienced infrequent mixed severity fires ranging from 35 to 300 years (McNicoll, et. al. 2002). Stand replacing fires were common during extended periods of drought. Fuel loads were low (14 tons per acre) composed primarily of large diameter material. Small fires burned many little patches of timber eliminating subalpine fir in those areas and creating a seedbed for whitebark pine. (Crane, et. al. 1986)

White pine blister rust was not present and periodic epidemics of mountain pine beetle killed the mature stressed trees.

Quaking Aspen Cover Type

Aspen stands would be healthy and thriving. Patch sizes would be larger than currently found in the watershed. Conifers would not be as prevalent in the stands especially in the areas adjacent to mixed fire regimes. The understory would be more diverse.

Table 7. Distribution of Aspen Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
40%	20%	10%	0%	5%	25%

Fire regimes were dependent on surrounding cover types and their associated fire frequencies. Fire Regime Group I experienced frequent mixed severity fires ranging from zero to 35 years dominated by a mosaic of different age classes (McNicoll, et. al. 2002). Frequent fire maintained evenaged stands of aspen on the landscape with diverse understory vegetation. Frequent fire reduced conifers within the stands.

Natural disturbances like insects and disease would be at endemic levels. Wild ungulate grazing would decrease suckers in some of the seedling acres.

Black Cottonwood Cover Type

Cottonwood would have grown along streams and in moist areas within the analysis area. Natural disturbances would have maintained a portion of the stands in stand initiation stage. Wild ungulate populations would have reduced seedlings, but the grazing would not have been concentrated all growing season.

Table 8. Distribution of Cottonwood Structural stages over the landscape

Stand Initiation	Stem Exclusion	Understory Reinitiation	Young Forest Multi Story	Old Multi Story	Old Single Story
5%	45%	55%	0%	35%	5%

Fire Regime Group IV experienced infrequent mixed severity fires ranging from 35 to 200 years creating large patches of similar age classes. Fire severity and frequency were dependent on surrounding vegetation types.

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Appendix E

Non-Forested Vegetation Access Database Queries

Acres by PVT/CT/SS

Acres by Subwatershed of Potential Vegetation Group (PVG), Risk, and Abundance

Acres by Subwatershed of Potential Vegetation Group (PVG) and Vegetation Departure

Draft - Last edited: 02/19/2003 08:30.

Resource Report for
Salmon Interface EAWS:

Resource: Fire ecology/landscape ecology.
Prepared by: Lynn Bennett, Fire Ecologist, Salmon-Challis National Forest

Key Questions:
1. How has fire suppression, fire exclusion, timber harvest, silvicultural practices and grazing affected vegetation structure, composition and ecosystem process of forested and non-forested vegetation?

Current Vegetative Structure:

Structural stage for Dry Forest Potential Vegetation Group

Columbia River Basin: In the dry forest ecosystems, 1991 data shows forest vegetative structural stage (SS) combinations as follows: 7% in OFSS; 23 % in OFMS; 47 % in a mixture of 2, 3, 4, and/or 5; 22% in SS1; and 1% in non-forest (Hann *et al* 1997, pg 485).

The composition of late-seral single-layer (OFSS) shade-intolerant (ie, ponderosa pine) forest had declined by 25 percent from historical amounts. In addition, current period landscapes had a mixed composition rather than being dominated by shade-intolerant species. This was particularly true in areas that had been actively harvested and in areas where fire suppression has been effective. (Hann et al 1997, page 487).

> **Forest litter and duff:** Historically, ponderosa pine and ponderosa pine-mixed conifer forests which experienced frequent low severity fires supported forest floor quantities of litter and duff in a range of one to four tons per acre. Currently, quantities in the Northern Rockies now average 12 tons per acre. Also, in most stands, duff probably averaged only about half an inch (Brown 2000, page 100).

Central Idaho (ERU 13): In the dry forest ecosystems, 1991 data shows forest vegetative structural stages (SS) combinations as follows: 2% in OFSS, 19 % in OFMS, 46 % in a mixture of 2, 3, 4, and/or 5, 33% in SS1 (Hann *et al* 1997, pg 565).

Dr. Hann describes the current condition as follows, *"For the dry forest PVG, the late-seral single-layer forest type* (OFSS) *was well below the HRV* (historical*), whereas the late-seral multi-layer forest type* (OFMS) *occurred at the upper limit of the HRV. The late-seral single-layer forest type* (OFSS) *largely converted into the mid-seral* (SECC,

UR, and YFMS) *forest type because of insect, disease, and stress mortalities in the overstory layer, and growth of shade-tolerant layers in the understory.*
The aforementioned transitions occurred primarily as a result of fire exclusion. Fire exclusion substantially reduced the extent of the non-lethal and mixed fire regimes that maintained late-seral single-layer types, and that thinned shade-tolerant tree species in early-, mid-, and late-seral multi-layer types. Timber harvest activities largely occurred in the peripheral areas of the Central Idaho ERU, where the larger, shade-intolerant tree species were those primarily selected for harvest. These trees were more resistant to insect, disease, and stress mortality. Clearcutting and seed tree timber harvest activities commonly created small patches of early-seral structures containing few live or dead-standing trees, and high down fuel accumulations." (Hann et al 1997, pg 563).

Dry Forest sites on adjacent Forests: In the Salmon Interface area, much of the historical dry forest PVG (our dry Douglas-fir sites) were similar in structure and disturbance regimes as the Ponderosa pine/Douglas-fir sites on the north end of the Salmon-Challis and in the Bitterroot Valley.

There has be substantial change in small tree stocking densities per acre in these sites. In the OFMS and UR stands, high numbers of seedling, sapling, and pole size trees can often be in patches or clumps. As fire exclusion has continued, these clumps of heavily stocked smaller trees continue to expand and occupy more and more of the area resulting in a substantial increase in the average number of small trees per acre.

Three old growth sites in the BRV were included in a study to compare the number of small trees per acre of historical stands vs. the number of small trees per acre in current dry forest conditions. These three sites have similar habitat type classification and fire regimes as much of the dry forest PVG on the salmon-Challis National Forest. All three study plots showed a substantial increase in small trees (less-than 5 inches DBH) per acre between 1900 and 1991 (Arno. 1995). The following chart summarizes the findings on the three plots with similar historical fire regimes:

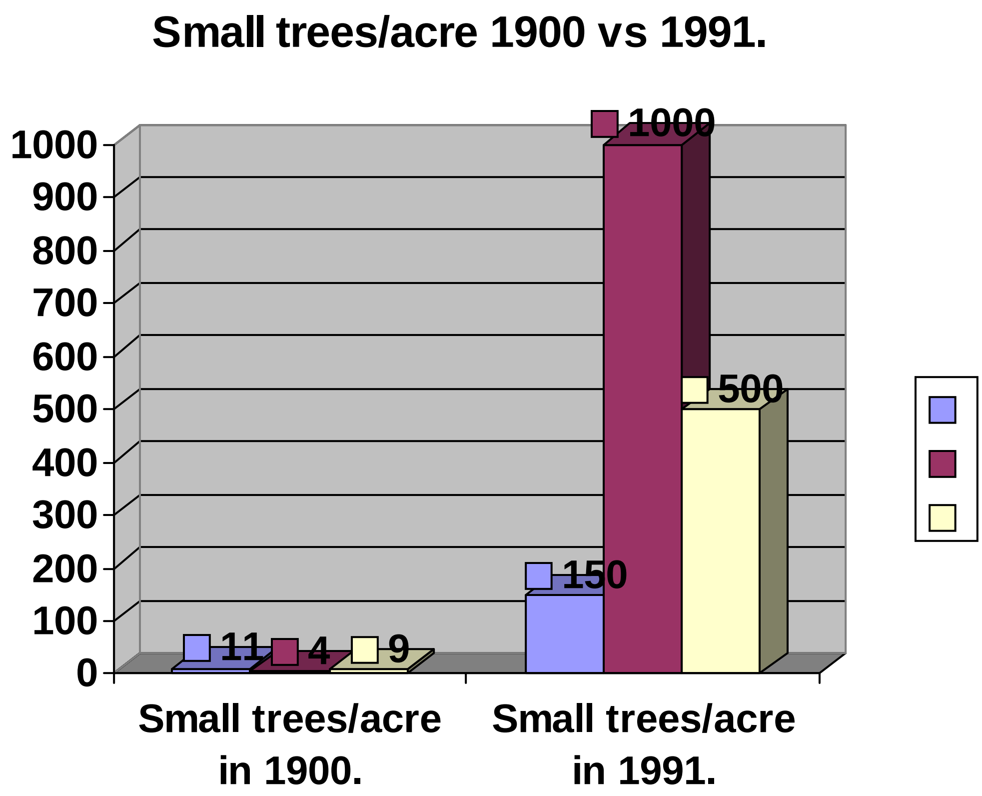


Chart summary:

On Bitterroot Plot 1:

In year **1900** there were approximately 11 trees per acre in the five inch or less diameter class.

In year 1991: after decades of fire exclusion (most recent fire occurred in 1889). There were approximately 150 trees per acre in the five inch or less diameter class.

Bitterroot Plot 2:

In year **1900** there were approximately 4 trees per acre in the five inch or less diameter class.

In year 1991: after decades of fire exclusion (most recent fire occurred in 1889). There were approximately 1,000 trees per acre in the five inch or less diameter class.

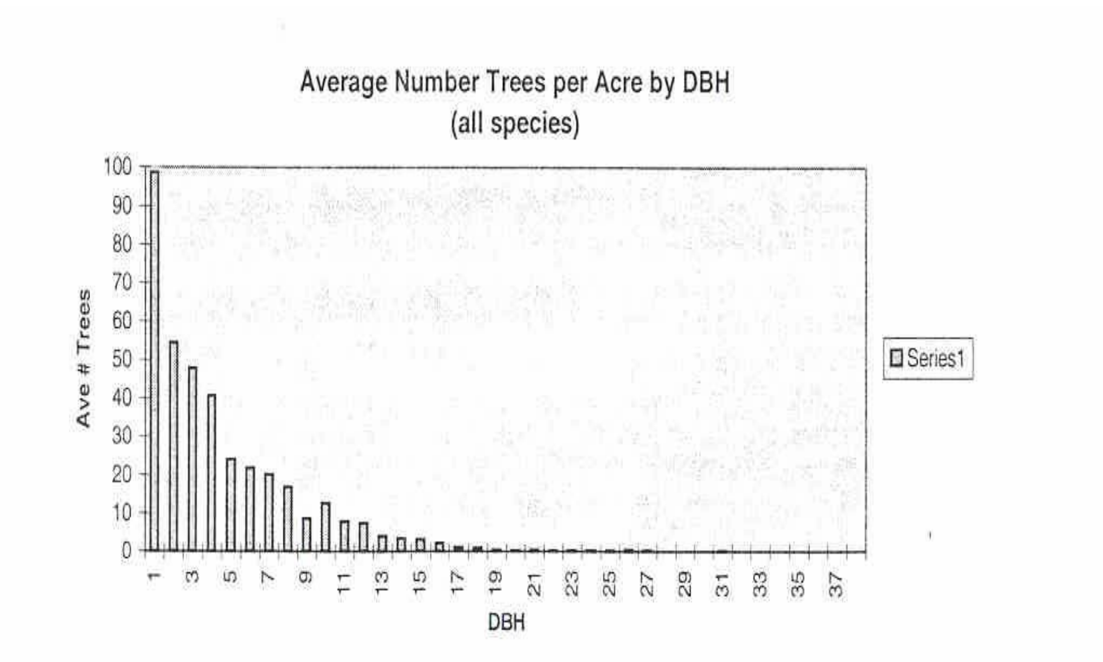
Bitterroot Plot 3:

In year **1900**) there were approximately 9 trees per acre in the five inch or less diameter class.

In year 1991: after decades of fire exclusion (most recent fire occurred in 1889). There were approximately 500 trees per acre in the five inch or less diameter class.

All together, Arno's analysis of historical trees per acre in frequent surface fire regime ecosystems include four plots in the Bitterroot Valley, two plots on the Flathead National Forest, and three plots on the Lolo National Forest. Even in the wetter more productive sites on the Lolo and Flathead locations, the year 1900 stocking of trees 5 inches or less diameter was fifteen or fewer trees per acre.

Studies on the North Fork District (Salmon-Challis National Forest) reflect similar finding as those in the research for the Bitterroot Valley plots discussed above. Tree data gathered in the dry forest types Gibbonsville area (USDA 2000, pg 14) displayed the same trend of substantial increases in small diameter trees per acre as demonstrated for the study plots in the Bitterroot Valley (Arno 1995). The average number of all size class trees per acre was approximately 384 trees, 260 trees per acre were 5 inches or less in diameter (USDA 2000). The following chart reflect this information:



Today, these smaller diameter trees are the ladder fuels that now allow surface fires to climb (ladder) up into the overstory trees crowns and facilitate crown fires. The ladder fuels ranged up to 30 feet or more in height. Regarding the study around Gibbonsville, Hoyt stated, "Ladder fuel height is probably the most significant single factor found in the survey that will affect the potential fire behavior in any of the project stands."(USDA 2000, pg 14).

Salmon Interface area: The OFMS averaged around **10% in the historical** Salmon Interface landscape. In the current Salmon Interface landscape the OFMS occupies **38%** of the dry forest type. OFSS averaged around **15 to 40% in the historical** Salmon Interface landscape. In the current Salmon Interface landscape the OFMS occupies **6%** of the dry forest type.

These changes in forest structure have greatly increased the area in which ladder fuels may promote crown fires. The two forest structures that contain the most ladder fuels and increase the risk of crown fire are OFMS and UR. Combined, they make up 61% of the dry forest PVG.

The changes have also greatly reduced the area where ladder fuels are not available and basically eliminating the natural crown fire fuel breaks that used to occur on the landscape.

Structural stage for Cold Forest PVG

Columbia River Basin: In the Cold forest ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 9% in OFSS, 9 % in OFMS, 47 % in a mixture of 2, 3, 4, and/or 5, and 35% in SS1 (Hann *et al* 1997, pg 485).

Central Idaho (ERU 13): In the Cold forest ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 14% in OFSS, 12 % in OFMS, 34 % in a mixture of 2, 3, 4, and/or 5, and 39% in SS1 (Hann *et al* 1997, pg 570).

Salmon Interface area:

High crown fire risk structural stages- The OFMS averaged around 5-25% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the OFMS occupies 25% of the cold forest type. The UR and other mid-seral SS averaged around 20-40% in the historical Salmon Interface landscape. In the current Salmon Interface landscape the UR alone occupies 48% of the cold forest type.

SS that are fuel breaks regarding crown fires - The SI averaged around 1**5-30% in the historical** Salmon Interface landscape. In the current Salmon Interface landscape the SI occupies only **10%** of the dry forest type. OFSS averaged around **10% in the historical** Salmon Interface landscape. In the current Salmon Interface landscape the OFMS occupies **<1%** of the cold forest type.

These changes in forest structure have greatly increased the area in which ladder fuels may promote crown fires. The two forest structures that contain the most ladder fuels and increase the risk of crown fire are OFMS and UR. Combined, they make up 73% of the cold forest PVG.

The changes have also greatly reduced the area where ladder fuels are not available and basically eliminating the natural crown fire fuel breaks that used to occur on the landscape. These SS are represented in the SI and OFSS, combined in the current cold forest PVG they occupy only 10% of the landscape.

Please see the forested vegetation discussion for a detailed break down of SS by cover type and PVG.

Structural stage for Cool Shrub PVG

Columbia River Basin: In the Cool Shrub ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 3% Exotic Herbland; 4% Upland Herbland; 75% in Upland shrubland; and 18% in Upland Woodland (Hann *et al* 1997, pg 506).

Central Idaho (ERU 13): In the Cool Shrub ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 9% Exotic Herbland; 10% Upland Herbland; and 79% in Upland shrubland (Hann *et al* 1997, pg 564).

Salmon Interface area: Please see the non-forested vegetation discussion for a detailed break down of SS by cover type and PVG.

Structural stage for Dry Shrub PVG

Columbia River Basin: In the Dry Shrub ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 6% Exotic Herbland; 4% Upland Herbland; and 90% in Upland shrubland (Hann *et al* 1997, pg 503).

Central Idaho (ERU 13): In the Dry Shrub ecosystems (PVG), 1991 data shows forest vegetative structural stages (SS) combinations as follows: 10% Exotic Herbland; 8% Upland Herbland; and 82% in Upland shrubland (Hann *et al* 1997, pg 563).

Salmon Interface area: Please see the non-forested vegetation discussion for a detailed break down of SS by cover type and PVG.

Fire Frequency

Livestock grazing and the start of fire exclusion:

On the Salmon National Forest the changing of wildfire frequency in both grass/shrub and forested ecosystems began with heavy livestock grazing and marked the onset of the fire exclusion process. The livestock grazing removed much of the grasses that historically covered the forest floor (Losensky 1996, pg 5 and pg 18) and were a primary fuel base for fire spread. Cured grasses are considered a fine fuel, and it is the fine fuel category (less than ¼ inch) that contributes greatly to a fires ability to spread and influences the fires rate of spread (Rothermel 1983, pg 14).

Within the bounds of what was to become the Salmon – Challis National Forest, in the late 1800s livestock ranged widely year round with little fencing and no stored feed. Livestock herds were large enough that excess where available for shipment to more populated areas. In 1876, George L. Shoup shipped 800 head to mature steers to Chicago. In 1880, one thousand one hundred (1,100) cattle were shipped, and in 1882, several thousand cattle were delivered to contract buyers. In the late 1880s grazing was becoming depleted (Smith 1969, pg 44).

Stock and saddle horses were also in great number during these times. In an 1890 report of the Lemhi County assessor the following horse statistics included: 1,000 grade horses and 2,390 head of range horses. Range horses ranged at will and there was significant increase in the horse population. Soon the ranchers were exporting the extra horses to central and southern states (Smith, 1969, pg 44).

Regarding sheep grazing on the Salmon National Forest, Smith states, sheep raising came later than the cattle when some cattleman turned to raising sheep after the severe winters of the 1880s and the mortality to cattle, and with little control of grazing the depletion of the range grew more rapid (Smith, 1969, page 44). In 1911 there was an estimated 27,993 sheep on the Salmon National Forest (Smith, 1969, pg 100).

Early residence of the Salmon River area were aware that livestock grazing could reduce the spread of wildfire. In 1916, C. N. Woods warned of the fire danger on several districts of the Salmon National Forest because they had not been grazed enough, suggesting that when the accessible forage was fully utilized it would be a big step in saving the timber from possible destruction by fire (Smith, 1969, pg 101, emphasis added).

On the Salmon National Forest the permitted livestock numbers peaked in 1918, with 17,317 cattle and horses, and 129,830 sheep and goats, and the ranges of the area suffered from the high numbers of livestock. Trespass livestock was also a major problem in the area, since most of the ranges were filled to carrying capacity with permitted cattle and horses, trespass livestock presented a serious problem of overgrazing (Smith, 1969, pg 101).

As livestock continued to consume the natural fine fuels (grasses) the spread of fire would become restricted when compared to pre-European settlement times. With the reduction of the spread of fires, less and less area would be burnt via surface fires and this reduction of fire activity would allow large numbers of conifer seedlings to survive and grow rapidly in the very open stand conditions where they naturally had been controlled by frequent ground fires (Brown 2000, pg 100).

Fire Frequency and severity:

Interior Columbia River Basin: For both the regional and landscape level the current areal extent of wildfires is approaching those experienced in the early 1900s, when technology and resources were less available than today. Fuel loadings have steadily increased as a result of suppression efforts and the subsequent decline of fire frequencies. As a result, fire severity has increased, as have suppression costs and the associated hazards to life and property. The average costs of wildfire suppression, number of firefighter fatalities, and areal extent of high-intensity fires during the last 25 years have exceeded the corresponding levels that occurred between 1910 and 1970 (Hann et al 1997, pg 901).

Columbia River Basin and Central Idaho (ERU 13): In general, wildfires of low severity occur less frequent today than in the historical regimes. Wildfires of lethal and mix-lethal severity occur more frequently than in the historical situation. During drought years, the trend for acres burned by mixed lethal and lethal severity fires is increasing (Barrett et al. 1997).

Central Idaho (ERU 13): There have been substantial changes in the Central Idaho Mountains ERU fire regimes primarily as a result of fire exclusion. Fire severity generally shifted from non-lethal or mixed to lethal, and non-lethal to mixed lethal in the forest PVGs. This shift was caused by longer fire-return intervals. In the non-forest PVGs, fire severity generally shifted from mixed to lethal, and fire intervals increased due to fire exclusion, the removal of fine fuels by livestock grazing, and conifer encroachment. (Hann et al 1997, pg 556).

> **Central Idaho**: **Fire Severity & Structure -** "For Central Idaho (ERU 13) fire exclusion substantially reduced the extent of the non-lethal and mixed fire regimes that maintained late-seral single-layer types, and that thinned shade-tolerant tree species in early-, mid-, and late-seral multi-layer types." (Hann et al 1997, pg 563).

Salmon Interface area: From 1919 to year 1985 Relatively few acres burnt in the area when compared to historical fire regimes. In 1985, there was the Lake Mountain Fire, approximately ______ acres. Then in year there where three; Pepper Ridge Fire; Fenster Fire; and a portion of the Clear Creek Fire burnt into the area. The area burnt in 2000 was the largest number of burnt acres recorded in the analysis area since the Forest Service has been keeping fire records starting in 1919. The acres burnt in 1985 and 2000, exceed all acres burnt in other years since 1919. These trends are reflective of trends across the western United States, showing significant increase in burnt acres from wildfire in the decade or two.

Fire severity Near Salmon Interface Area: The fires that occurred under extreme fire condition in recent times have burned with substantial amounts of high severity fire in the dry and cold forest PVGs. The Clear Creek Fire Complex of year 2000, southwest by 25 miles, burned large areas of the dry forest type with lethal and mixed lethal fire severity. Due to extreme fire conditions, multiple fires burned in the same general area, and some fires actually burned together. The final burn perimeter was 400,000 acres. It is note worthy that Clear Creek Fire made a fire run in July that approximated 12 miles long and covered over 20,000 acres in one afternoon.

Dry Forest PVG

Regarding the dry forest type, Arno states “exclusion of low-intensity fires virtually assures eventual occurrence of large high-severity fires that kill most trees.” (Arno 1996). Barrett concluded, “Since the late 1970’s, there has been a marked increase in annual acreage burned by wildfires in the western United States, including large areas of high intensity burning in ponderosa pine forests where pre-1900 fires were mostly of low intensity” (Barrett et al, 1997).

Last edited: 2/16/2003 09:30.

Salmon Interface EAWS:

Fire ecology/landscape ecology
Prepared by: Lynn Bennett, Fire Ecologist.

Key Questions:

1. How has fire suppression, fire exclusion, timber harvest, silvicultural practices and grazing affected vegetation structure, composition and ecosystem process of forested and non-forested vegetation?

Historical Vegetative Structure for Dry Forest, Clod Forest, Dry Shrub, and Cool Shrub Potential Vegetation Groups (PVG):

Structural stage for Dry Forest Potential Vegetation Group (PVG)

Columbia River Basin: The dry forest ecosystems would have forest vegetative structural stages (SS) in combinations as follows: 20 to 50% in OFSS, 10 to 15 % in OFMS, 25 to 30 % in a mixture of 2, 3, 4, and/or 5, 10 to 20% in SS1, and 0 to 15% in non-forest (Hann *et al* 1997, pg 481).

> **Forest litter and duff:** Historically, ponderosa pine and ponderosa pine-mixed conifer forests which experienced frequent low severity fires supported forest floor quantities of litter and duff in a range of one to four tons per acre. Currently, quantities in the Northern Rockies now average 12 tons per acre. Also, in most stands, duff probably averaged only about half an inch (Brown 2000, page 100).

Central Idaho (ERU 13): The dry forest would have SS combinations as follows: 13 to 43% in OFSS, 12 to 16 % in OFMS, 31 to 37 % in a mixture of 2, 3, 4, and/or 5, 10 to 21% in SS1, and 0 to 15% in non-forest (Hann *et al* 1997, table 3.60, page 565).

Dry Forest sites (comparing historical vs current trees per acre): In drainages of the Bitterroot Valley, adjacent to the Salmon-Challis National Forest and on sites with similar fire regimes (dry forest types), Arno found a significant increase in small diameter trees. Comparing the number of trees per acre and their diameter size distribution, Arno found that the historical structure of the forest was that of mostly large diameter overstory trees with few small size trees per acre. For trees five inches in diameter and smaller the following comparisons were made for three plots: plot 1, there were approximately 11 trees per acre in the year 1900, in 1991 there were approximately 158 trees per acre. Plot 2, there were approximately 4 trees per acre in the year 1900, in 1991 there were approximately 1,072 trees per acre. Plot 3, there were approximately 9 trees per acre in the year 1900, in 1991 there were approximately 532 trees per acre (Arno *et al*, 1995, page 17).

East portion of the Salmon Interface – (Eastern portion of the Salmon National Forest and adjacent eastern forested areas in southwestern Montana (section M322E)): The dry forest type would have been made up of the Ponderosa pine and Douglas-fir cover types: SI 9-17 %, SEO= 15-28 %, SEC=0-28. %, OFMS= 12 - 19 %, and OFSS= 12 - 56%. (Losensky 1994).

West portion of the Salmon Interface – (Western portion of the Salmon National Forest and adjacent eastern forested areas in Central Idaho (section M322A)): The dry forest type would have been made up of the Ponderosa pine and Douglas-fir cover types: SI 7-21 %, SEO= 30 -35 %, SEC= 0- 31 %, OFMS= 9 – 29%, and OFSS= 18 – 58%. (Losensky 1994).

Salmon Interface area: For the dry forest PVG (pvt = 52, 53, 75 (pvt 74 as of 1/14/2003), 132, and 133), would have SS combinations as follows: 15 to 40% in OFSS, 20 to 40% in SEOC, 5 to 10 % in OFMS, 10 to 25% in a mixture of SECC/UR/YFMS, 15 to 20% in SI (see VDDT / historical composition tables for Salmon Interface).

Structural stage for Cold Forest PVG

Columbia River Basin: For the cold forest PVG, would have SS combinations as follows: 6 to 8% in OFSS, 15 to 24 % in OFMS, 44 to 53 % in a mixture of 2, 3, 4, and/or 5, 23 to 25% in SS1 (Hann *et al* 1997, table 3.36, page 494).

Central Idaho (ERU 13): For the *cold forest* PVG, would have SS combinations as follows: 8 to 12% in OFSS, 10 to 24 % in OFMS, 42 to 50 % in a mixture of 2, 3, 4, and/or 5; 24 to 28 % in SS1 (Hann *et al* 1997, table 3.64, page 570).

East portion of the Salmon Interface – (Eastern portion of the Salmon National Forest and adjacent eastern forested areas in southwestern Montana (section M322E)): The cold forest type would have been made up of the Lodgepolepine and Subalpine cover types (no structural data is given for the Subalpine): SI 31 %, SEC= 60 %, UR = 6%; YFMS = 2%; OFMS= 1% (Losensky 1994).

West portion of the Salmon Interface – (Western portion of the Salmon National Forest and adjacent eastern forested areas in Central Idaho (section M322A)): The cold forest type would have been made up of the Lodgepolepine and Subalpine cover types (no structural data is given for the Subalpine): 35 %, SEC= 52 %, UR = 3%; YFMS = 2%; OFMS= 2% (Losensky 1994).

Salmon Interface area: For the cold forest PVG (pvt = 56, 66, 68, 69, 70, 71, 73, 75), would have SS combinations as follows: 5 to 15% in OFSS, 10 to 40% in SEOC, 5 to 25

% in OFMS, 20 to 45% in a mixture of SECC/UR/YFMS, 15 to 30% in SI (see VDDT / historical composition tables for Salmon Interface).

Table 3—Structural stages often used to describe changes in forest vegetation structure over time.

Structural Stage	Definition	Also Referred to As:
Stand initiation	When land is reoccupied by trees following a stand-replacing disturbance.	Early-successional Early-seral Regeneration
Stem exclusion-open canopy	Forested areas where the occurrence of new trees is predominantly limited by moisture.	Mid-successional Mid-seral Young forest
Stem exclusion-closed canopy	Forested areas where the occurrence of new trees is predominantly limited by light.	Mid-successional Mid-seral Young forest
Understory reinitiation	When a second generation of trees is established under an older, typically seral, overstory.	Mid-successional Mid-seral Young forest
Young forest multi-story	Stand development resulting from frequent harvest or lethal disturbance to the overstory.	Mid-successional Mid-seral Young forest
Old multi-story	Forested areas lacking frequent disturbance to understory vegetation.	Late-successional multi-story Late-seral multi-story Old forest multi-story
Old single-story	Forested areas resulting from frequent non-lethal prescribed or natural underburning, or other management	Late-successional single-story Late-seral single-story Old forest single-story

(USDA 1996, Table 3, page 81.)

Structural stage for Dry Shrub PVG

Columbia River Basin: The dry shrub would have SS combinations as follows: 10 to 60% in Upland Herbland, and 40 to 90% in Upland Shrubland (Hann *et al* 1997, table 3.36, page 502).

Central Idaho (ERU 13): The dry shrub would have SS combinations as follows: 20 to 40% in Upland Herbland, and 60 to 80% in Upland Shrubland (Hann *et al* 1997, table 3.36, page 563).

East portion of the Salmon Interface and West portion of the Salmon Interface: See the following discussion under Cool Shrub.

Salmon Interface area: The dry shrub PVG would have SS combinations as follows: Grass-forb = 20%; Closed grass-forb with 5-15% shrub cover = 2%; Closed shrub (>15% cover shrub) = 3%; Young Open grass-forb with 5-15% shrub cover = 20%; and Old Open grass-forb with 5-15% shrub cover = 50% (see VDDT / historical composition tables for Salmon Interface).

Structural stage for Cool Shrub PVG

Columbia River Basin: The cool shrub would have SS combinations as follows: 10 to 40% in Upland Herbland; 60 to 80% in Upland Shrubland; and 5 to 10% in Upland Woodland (Hann *et al* 1997, table 3.36, page 506).

Central Idaho (ERU 13): The cool shrub would have SS combinations as follows: 40 to 60% in Upland Herbland, and 40 to 60% in Upland Shrubland (Hann *et al* 1997, table 3.36, page 564).

East portion of the Salmon Interface (this reference combined the Dry and Cool Shrub PVGs) **–** (Eastern portion of the Salmon National Forest and adjacent eastern forested areas in southwestern Montana (section M322E)): The dry and cool shrub PVG would have been made up of the Sage-Grass, Wheat-Fescue, and Wheat-Blue cover types (Losensky. 1994):
Sage-Grass cover type = 70% in Open Herbland, 10% in Closed Herbland , and 20% in Open-low-medium-shrub .
Wheat-Fescue cover type =80% in Open Herbland, and 20% in Closed Herbland.
Wheat-Blue cover type =80% in Open Herbland, and 20% in Closed Herbland.

West portion of the Salmon Interface – (this reference combined the Dry and Cool Shrub PVGs) - (Western portion of the Salmon National Forest and adjacent eastern forested areas in Central Idaho (section M322A)): The dry and cool shrub PVG would have been made up of the Sage-Grass and Wheat-Blue cover types (Losensky. 1994):
Sage-Grass cover type = 90% in Open Herbland, and 10% in Open-low-medium-shrub .
Wheat-Blue cover type =80% in Open Herbland, and 20% in Closed Herbland.

Salmon Interface area: The cool shrub PVG would have SS combinations as follows: Grass-forb = 20%; Closed young grass-forb with 5-15% shrub cover = 30%; Closed old shrub (>15% cover shrub) = 5%; Young Open grass-forb with 5-15% shrub cover = 35%; and Old Open grass-forb with 5-15% shrub cover = 10% (see VDDT / historical composition tables for Salmon Interface).

Historical Fire Frequency for Forested PVGs

Historical Fire Frequency for Dry Forest PVG

Columbia river Basin: The dry forest, would have ranged from 20 to 70 years (Hann *et al* 1997, page 484).

Central Idaho The Columbia River Basin assessment found fire frequencies in Central Idaho **(**ERU 13) of 20 to 70 years for the dry forest PVG (Hann *et al.* 1997). Also, Crane and Fischer presented the following ranges for fire frequency for the dry forest PVG, which included fire groups 2,3, 4, and 5. Fire Group 2 had a range of 3 to 30 years (page

28). Fire group 3 had a range of 10 to 22 years grading from dryer to moist sites (page 35). Fire group 4 was not well defined and only one example was given with a 41 years frequency (page 42). Fire group 5 had a range of 5 to 67 years with a mean of 25 years (page 45) (Crane 1986).

Losensky found fire return intervals in the dry forest PVG to be 5 to 25 years in the Ponderosa pine cover type, and to ranged from 15 to 60 years in the Douglas-fir cover type (Losensky 1994, page 6).

Colsen Creek fire history study site: Approximately 15 miles northwest of the Salmon Interface area, research by Steve Barrett shows that in the dry forest type, fires over 1,000 acres in size had a fire return interval of 21 years. Smaller fires generally ranged from five to 28 years between fires (Barrett 1988).

Salmon Interface area: the dry forest PVG includes fire regime groups I and III (cohesive strategy 2002, Hann et al ………..), with a mixture of 0 to 35+ years of surface fires and 35 to 100+ years of mixed severity fires.

Fire Frequency for Cold Forest PVG

Columbia River Basin: For the cold forest PVG, (Hann *et al* 1997, page 492):
Historically, fire intervals in the cold forest PVG were highly variable and correlated with landforms. The non-lethal under burning regime that maintained the late-seral single-layer and some mid-seral physiognomic types, generally comprised approximately 10 percent of these landscapes, and typically occurred on ridges and flat benches. The fire-return interval on these landforms varied from 30 to 100 years. The lethal crown-fire regime generally occurred across 25 to 30 percent of the cold forest PVG, and had a fire-return interval which varied from 25 to 300 years. Shorter intervals generally occurred on steeper slopes recycling mid-seral to early-seral physiognomic types. Longer intervals occurred in wet bottoms and basins, which typically supported the late-seral multi-layer physiognomic type. The mixed-fire regime was most common and occurred throughout 60 percent of the PVG; mixed-fire return intervals varied from 25 to 300 years. The mixed-fire regime was often intermingled with the other regimes, either during one fire event or through a series of fire events. The cold forest PVG had a relatively short fire season, generally only lasting for the month of August. Most fires were very small, but a few occasionally grew very large.

Salmon Interface area: the cold forest PVG includes fire regime groups III and IV (cohesive strategy 2002, Hann et al ………..), with a mixture of 35 to 100+ years of mixed severity fires and replacement severity fires.

Historical Fire severity for Forested PVGs

Fire severity for Dry Forest PVG

Columbia River Basin: The dry forest would have been 80% non-lethal underburning fires, 5% mixed lethal, and 15% crown fires (lethal) (Hann *et al* 1997, page 484**).**

Central Idaho (ERU 13): The dry forest would have been 80% non-lethal underburning fires, 5% mixed lethal, and 15% crown fires (lethal) (Hann *et al* 1997, page 484**).** Losensky found fire severity in the dry forest PVG (includes pure ponderosa pine, Douglas-fir and ponderosa pine mix, and mostly Douglas-fir mixed conifer cover types) to have a fire severity ranged from low underburn severity to partial burns and stand replacement events. (Losensky 1994).

Salmon Interface area: The dry forest had 70% of its landscape would have sustained a surface or mosaic fire, and 30% would have been a replacement fire severity (see Salmon Interface VDDT model assumptions, 2002).

Fire severity for Cold Forest PVG

Columbia River Basin: The Cold forest would have been 10% non-lethal under-burning fires occurring mostly on ridges and flat benches, 60% mixed lethal, and 25-30% crown fires (lethal) (Hann *et al* 1997, page 493**).**

Central Idaho: Losensky described fire severity in the Lodgepole pine cover type (cold forest PVG) as follows, underburning on a 50-year cycle with stand replacements at 75 to 150 years (Losensky 1994). Morgan reported a mixed lethal regime on the cool dry and warm dry sites in these ecosystems and a lethal fire severity on the cool moist sites (P. Morgan et al. 1996 Final Report RJVA-INT94913.).

Salmon Interface area: The cold forest PVG had 15-35% of its landscape would have sustained a surface or mosaic fire, and 65-85% would have been a replacement fire severity (see Salmon Interface VDDT model assumptions, 2002).

Historical fire frequency and severity for the dry and cool shrub PVGs

Fire frequency and severity for the dry shrub PVG

Columbia River Basin and Central Idaho (ERU 13): The dry shrub PVG typically burned with a mixture of non-lethal fires in areas dominated by upland herbs, and lethal fires in areas dominated by shrubs. The dry shrub would have 90% of the PVG in a lethal fire regime with intervals of 15 to 100 years. A non-lethal fire regime would occur on 10% of the area at intervals of 5 to 10 years (Hann *et al* .1997**).**

Salmon Interface area: The dry shrub PVG had a mean fire interval of 40 years, and the following mix of lethal and surface or mosaic fires: Surface or mosaic fires = 40% of the PVG; lethal fires = 60% of the PVG (see VDDT / historical composition tables for Salmon Interface).

Fire frequency and severity for the cool shrub PVG

Columbia River Basin and Central Idaho (ERU 13): The cool shrub PVG typically burned with a mixture of non-lethal fires in areas dominated by upland herbs, a mixed lethal fires in mosaics, and lethal fires in areas dominated by shrubs and trees. The cool shrub would have 75% of the PVG in a lethal fire regime with intervals of 25 to 75 years. The mixed lethal fires occurred on about 10 of the ara with intervals similar to the lethal. A non-lethal fire regime would occur on 10 to 15% of the area at intervals of 15 to 25 years (Hann *et al* .1997**).**

Salmon Interface area: The cool shrub PVG had a mean fire interval of 25 years, and the following mix of lethal and surface or mosaic fires: Surface or mosaic fires = 50% of the PVG; lethal fires = 50% of the PVG (see VDDT / historical composition tables for Salmon Interface).

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Fire Ecology Resource Report for
Salmon Interface EAWS:

Resource: Fire ecology/landscape ecology = Forest Health.
Prepared by: Lynn Bennett, Fire Ecologist, Salmon-Challis National Forest.

Key Questions:

2. How has the change in forested and non-forested vegetation structure and composition affected the risk associated with wide spread wild fire and the ability to suppress forest fires adjacent to human developments (urban interface) and to protect the municipal watershed?

Two important results from the change in vegetation structure are the increased risk of high severity (lethal) wildfire, and the risk of very large wildfires.

Risk of lethal wildfire: To fully understand the implications of the risks of wildfire associated with the change in vegetation structure, we must address the wildfire setting that exists in the Salmon Interface landscape. The wildfire setting include multiple factors including:

Fuel structure:
Crown fire factors:
Fire season weather parameters.
Human safety related to wildfire
Probability of ignition.
Wind and its effect on fire movement.

Fuel structure: Fuel structure has an important influence on the behavior of wildfire. The availability of a fuel structure to burn is greatly controlled by climatic trends, fire weather condition, and topographic features. Generally fuel structures include:

Duff and litter: Duff and litter are the partly decomposed plant material and the shed leaves and small twigs from the overstory plants. Duff and litter are considered part of the ground fuel profile and have tended to increase in accumulation due to fire exclusion. Steve Arno explains that duff is often overlooked as an important fuel factor in wildfire effects and can result in severe damage to trees, understory plants, and soil organisms (Brown 2000, pg 100):

"Frequent low-intensity surface fires perpetuated open stands of trees whose lower branches were killed by fire. With fire suppression, accumulated fuels support higher intensity fire including torching and crowning behavior and longer periods of burnout. The increased burn severity results in greater mortality to plants and soil organisms. Managers can easily over-look the significance of forest floor fuels; the upper layer (litter) and part of the middle (fermentation) layer provide the highly combustible surface fuel for flaming combustion and extreme fire behavior during severe fire weather. The lower part of the fermentation layer and the humus layer make up the ground fuel that generally burns as glowing combustion. A substantial amount of forest floor material can remain after an area is initially burned (Sackett and Haase 1996)".

Duff accumulations sampled in the Gibbonsville area: Forest floor duff accumulations in the Gibbonsville area have markedly increased compared to the historical baseline of half an inch depth in many of the dry forest type stands (Brown 2000, pg 100). The fuels data collected by Hoyt for the Gibbonsville Fuels assessment project (USDA 2000) shows that the mean duff depth was 1.24 inches, an almost 150% increase over the suggested baseline (Brown. 2000). Out of 35 stands sampled, only four were at or below the suggested historical baseline of half an inch duff depth. Twenty of the 35 stands had duff thickness one inch or more, which would be double or more the historical baseline. These trends would be the same for the Salmon Interface dry forest PVG areas.

Dead surface fuels: Dead surface fuels are those that the layer person commonly expects to be the main source of fuel for wildfire, they are the dead grass, shrubs, tree limbs, and logs laying on or near the ground. They are an important factor in fire spread and fire intensity. Arno address the accumulation of fuels in the western dry forest types, and states the following (Brown 2000, pg 100):

"During periods of high fire frequency, fuels were primarily herbaceous material and forest floor litter. After fire suppression became effective, forest floor duff and live fuels such as shrubs and conifer regeneration accumulated. Measurements in recent decades (Brown 1970; Brown and Bevins 1986; Sackett 1979) show that litter typically ranges from 0.6 to 1.4 tons/acre (1.3 to 3.1 t/ha) and the entire forest floor of litter and duff averages about 12 tons/acre (27 t/ha) in both Arizona and Northern Rocky Mountain areas. Forest floor quantities as high as 40 tons/acre (90 t/ha) have been measured (Harrington 1987b). During periods of frequent fire, forest floor quantities would typically range from 1 to 4 tons/acre (2.2 to 9.0 t/ha). Herbaceous fuels range from practically none in dense stands to as much as 0.5 tons/acre (1.1 t/ha) in open stands on productive sites."

For the Interior Columbia River Basin as a whole, fuel loading increased significantly ($P< 0.2$), resulting in significant increases in potential wildfire fuel consumption, wildfire smoke production, fireline intensity, crown fire potential, rate of spread, and flame length (Hann et al 1997, pg 906).

Surface live fuels – grass/forbs/shrubs: These fuels are the live vegetation that grows on or near the ground surface. Many of these plants cure-out in mid-summer and the vegetation becomes dry enough to burn. Other plants may not dry enough to burn during normal summers, but may dry and become available as fuel during droughts or periods of high temperatures and low relative humidity.

Crown fire fuels (transition and sustainable spread): Crown fire fuels is a complex topic. Basically, crown fire fuels are that portion of the fuel profile that allows fire to transition from a surface fire into shrubs, seedling, saplings, pole-size trees, and overstory trees. These transition fuels are referred to as ladder fuels, allowing fire to climb into the crowns of the overstory vegetation.

Ladder fuels and crown fire potential: While ladder fuels are a key component of the OFMS, they are also part of the UR and YFMS classes. These three forest structural classes are prone to high levels of ladder fuels and currently represent the majority of the forested area of the Salmon Interface landscape area and the trend is increasing. The ladder fuels in the multistory forests are the avenues that fire use to climb into the canopy of the overstory forests. When the crowns of the overstory trees continue to carry the fire, then a crown fire is in progress. Crown fires result in high severity (Morgan et al 1996) fire effects to forested ecosystems.

Historically, the dry forest type was characterized by frequent nonlethal under burning fires for approximately 80% of the landscape (Hann et al 1997, pg 484), and the open forest structure (absence of ladder fuels) would act as fuel breaks for crown fires, restricting the size of crown fires in any given landscape.

The current high amount of ladder fuels, as represented in the multistory forest structures (UR, YFMS, and OFMS), will place the Salmon Interface area at higher risk of potentially large high severity wildfires during high fire danger situations. As ladder fuels are allowed to continue to grow, the risk of large high severity fires will continue to increase

Crown fire spread: OFMS and to varying extents UR, SECC and YFMS forest structures have the characteristics to generally support crown fire spread under high fire danger conditions if winds are associated with the fire. The amount of wind needed to facilitate crown fire spread varies with the fuel type/condition and other fire behavior factors such as topography and weather conditions. Little or no wind may be necessary under certain conditions, and strong winds may be needed for other conditions. In either case, in the local region surrounding Salmon Interface, winds during high fire danger conditions are not unusual. Fires often have the ability to generate their own strong winds that are associated with the hot air rising from the fire.

In Rothermel's publication *Predicting behavior and size of crown fires in the Northern Rocky Mountains*, he states *"Favorable conditions for a crown fire include:* (Rothermel 1991, pg 2).

* *Dry fuels*
* *Low humidity and high temperatures*
* *Heavy accumulations of dead and down litter*
* *Conifer reproduction (seedlings, saplings, pole size trees) and other ladder fuels*
* *Steep slopes*
* *Strong winds*
* *Unstable atmosphere*

* *Continuous forest of conifer trees"*

Of the 8 factors favorable for a crown fire to occur (listed above), only 3 of them can be changed through vegetation management: heavy accumulations of dead and down litter; conifer reproduction (seedlings, saplings, pole size trees) and other ladder fuels; and continuous forest of conifer trees. The other five factors listed occur commonly on the Salmon-Challis NF, but are beyond human control.

Much of the area in the current OFMS supports the attributes listed by Rothermel that facilitate crown fire and crown fire spread (Rothermel 1991, pg 2):

- Heavy accumulations of dead and down litter.
- Conifer reproduction (seedlings, saplings, pole size trees) and other ladder fuels.
- Continuous forest of conifer trees.

In contrast to the OFMS, in the historical open forest single story structure (OFSS) conditions of heavy accumulations of dead and down litter were <u>un</u>common; conifer reproduction (seedlings, saplings, pole size trees) and other ladder fuels were in <u>low</u> numbers, and much of the OFSS did <u>not</u> have overstory trees with crowns close enough together to allow for crown fires to spread across a continuous forest for large portions of the landscape. Much of the open old forests were basically fuel breaks for crown fires.

Human safety related to wildfire: Crown fires will result in increased risk to fire fighters and the public, and high severity damage to forest resources and private property values. One of the obvious resources lost from crown fires is the presence of large trees.

Prevailing winds and fire movement direction: During the normal fire season, winds predominantly blow form the south, southwest, or west. When winds coincide with the valleys or canyon alignment, fire behavior can become extreme resulting in rapid fire spread.

The extreme fire behavior displayed in the fire season of 2000 showed that fire movement was often associated with winds from the southwest, pushing fires in an east or northeast direction. The Salmon Interface is in the valley bottom of the Salmon River. Lightning storms and strong winds often track up the Salmon River canyon from the west, and then proceed over the mountains to the community of Salmon. Because of weather patterns, topographic conditions, fuel accumulations, ignition probabilities in and surrounding the Salmon Interface landscape, as displayed in 2000, Salmon Interface sets in an environment of increasing risk for large high severity wildfire risk.

Natural fire ignitions: Lightning caused fires, both historically and currently, are very much a part of the ecosystems of the Salmon-Challis National Forest. Compared to many other regions of the Western United States, the Salmon-Challis National Forest receives a high amount of wildfires from of lightning. The west and north portions of the Salmon-Challis National Forest receive an extreme amount of wildfire starts from lightning.

Human caused wildfires are a small percentage of the wildfires on this Forest. Fire suppression efforts have generally been very effectives from the 1940s to the 1980s.

Risk of Uncharacteristic wildfires:

Drought Influence on Fire Regimes and high severity fires: Central Idaho and the Salmon Interface Area.

From a regional-scale perspective, although the Central Idaho Mountains ERU has little area that receives less than 30 centimeters of annual precipitation (map 3.24), 15 percent of the years between 1895 and 1994 were drought years (table 3.38; climate division: Idaho Central Mountains). This level of drought frequency was nearly indistinguishable from other ERUs that are more dominated by arid, non-forest PVGs. Consequently, although the Central Idaho Mountains ERU received more precipitation in the fall-winter period compared with the ERUs dominated by arid, non-forest PVGs (45 cm; table 3.38), drought frequently affected both the forested and non-forested PVGs. At the landscape scale, the break landforms have a high component of areas that are steep with southerly exposures. These areas have high drought risks. (Hann et al 1997, pg 556).

Extreme fire danger weather conditions and cycles: The weather pattern for the Salmon Interface area during fire seasons are those with typical summer time drought conditions, hot days, little precipitation in July and August, and low relative humidity. Weather conditions associated with extreme wildfire danger and wildfire behavior are not uncommon on the Salmon-Challis National Forest.

In the fire danger rating system, energy release component and burning index are two indices that are useful for evaluating potential fire danger. When comparing the ERC and BI values for the landmark fire seasons of 1985, 1988, 1994, and 2000 against the 19 years of collected data, we see periods when the fire danger indices values are in the upper ranges. Using 1985, 1988, 1994, and 2000 as landmark fire behavior years, weather data from the Indy RAWS station indicates that weather conditions that could support extreme fire behavior have occurred on an average of 4.5 years in the last 19 years. This 4.5 year average for high fire danger indices is within the time frames to be considered reasonably foreseeable regarding potential effects for this analysis.

Energy release component (ERC) is an expression of the amount of heat (BTUs) a fire will generate and is a good indicator of the overall fire danger resulting from local fuel moisture conditions. This component is useful in tracking seasonal trends or communicating expected fire danger to local fire suppression teams who have familiarity that allows them to associate the numeric values with real life experiences in the area

(Web site, Fire Danger Working Team, famweb.nwcg.gov/ pocketcards/guidelines, 4/25/2002).

Burning index (BI) reflects changes in fine fuel moisture content and wind speed and is highly variable from day to day. The BI can loosely be translated into the expected flame length by dividing the BI by 10. BI may be more appropriate for short-term reference to fire danger such as a fire suppression action plan briefing (Web site, Fire Danger Working Team, famweb.nwcg.gov/ pocketcards/guidelines, 4/25/2002).

Using the Fire Family Plus software we have graphed the ERC and BI figures for the nineteen-year period between 1982 and 2001. The year 1982 was the beginning of the available data for the Indy weather station. The data used to support these indices was taken from the Indy remote automated weather collection station (RAWS) located to the northwest of Salmon Interface. The Indy RAWS is located in the Salmon River canyon near the Indianola Forest Service Guard Station. In addition to plotting the 19-year average, maximum, and minimum ERC and BI values, we have plotted the values that were specific to the fire seasons of 1985, 1988, 1994, and 2000.

These four years have been noted for their extreme fire seasons as related to the Idaho and Montana regions. In 1985 the Long Tom Fire Complex burned in an area approximately 35 miles northwest of Salmon and produced extreme fire behavior that resulted in the entrapment of more than 70 fire fighters. The fire season of 1988 displayed extreme fire behavior in many locations across Idaho, Montana, and Wyoming, including the infamous Yellowstone Park Fires. In 1994, there were very large fires on the Payette and Boise National Forest, which are the adjacent National Forests to the west and south of the Salmon-Challis National Forest.

Most recently, in the fire season of 2000, extreme fire behavior was displayed locally in the Bitterroot Valley Fires that burned many homes, and the Clear Creek Fire Complex that burnt vast acreages just west of Salmon. In the Bitterroot Valley fires, during this one fire season, approximately 59% of the dry forest stands within the burn sustained high severity (killing almost all of the trees) fire damage, these ecosystems historically were characterized by low severity (killing very few large trees) fire effects.

The Clear Creek Fire burned from early July until the fall snowstorms stopped the fires advancement. The final fire size was approximately 193,000 acres. On July 13, 2000, the Clear Creek fire was approximately 693 acres burning in the upper portion of the Clear Creek drainage. There were three 20-person fire fighting crews working on the fire. In the afternoon of July 14 the fire began to behave with extreme fire activity, including torching of conifers and sustained crown fire runs. The fire fighter crews were forced to pull back into safety areas to protect themselves from the intense fire activity. That afternoon and early evening the fire displayed extreme fire behavior and raced down the Clear Creek drainage and across Panther Creek and then up the other side of Panther Creek to the head of Hot Springs Creek. At the same time the fire also spread north to the confluence area of Panther Creek and the Salmon River. It is estimated that within that 24-hour period the fire traveled approximately 10 miles in a northeast direction and increased in size from approximately 700 acres to 25,000 acres. The fire had a sustained width of approximately three and one half miles wide with one area measuring a width of 6 miles wide.

Probability of high severity wildfire ignition: Probability of high severity wildfires was classified for the Interior Columbia River Basin, and ranked in low, moderate or high (Hann et al 1997, pg 544, map 3.31). Per that probability ranking effort, it is important to note that the Salmon-Challis National Forest is dominated by a mixture of both high and moderate rankings. Portions of the Salmon Interface area are ranked as high probability. This mosaic of high/moderate fire probability rankings, coupled with the continuous nature of forest multistory fuels that now exist, is a dangerous situation regarding the probability of large high severity wildfires in the Salmon Interface area.

Putting these rankings in context, the large high severity fires of the Bitterroot Valley in year 2000 occurred in areas dominated by moderate rankings. The Clear Creek Fire Complex occurred in areas with a mix of both high and moderate rankings.

High potential for crown fire: Interior Columbia Basin Ecosystem Management Project (ICBEMP) classified the northern portion of the Salmon Interface area in a high potential crown fire situation for the dry forest types. This ranking is based on the relative high risk of contiguous fuels, wildfire ignition, severe fire-weather conditions, stressed environments, and ladder fuels that exacerbate crown fire potential in these environments (Hann et al 1997, pg 545, map 3.32). This ranking for crown fire potential was published in 1996, and characterized both the north end of Salmon-Challis National Forest and the lower elevations of the Bitterroot Valley in this high potential crown fire ranking. The fire season of 2000 showed these rankings to be very accurate in identifying areas of high severity fire (crown fire).

Based on the local data gathered for the Salmon area, the majority of the forested landscape is in multistory forest structure (including OFMS, YFMS, and UR) that contributes to the risk of high severity fire. There has been a dramatic increase in the amount of the landscape that is in a multistory forest structure. This increase in area that now has more ladder fuels available (OFMS) to support high severity fires and has come at the cost of the single story forest structure (OFSS) that has a low risk of crown fire.

Relative Wildland Fire Risk – State of Idaho: The Salmon Interface area is classified as a "high risk from wildland fire" by the State Of Idaho (Interim Wildland Relative Risk by County, June 6, 2002).

Fire Regime Condition Class and predicting risk to Wildland Urban Interface (WUI): Fire Regime Condition Class and related values (risk of sustainability and abundance of ecosystem structure) were calculated for the Salmon Interface area. These values are important as related to wildfire behavior, especially wildfire burning under high or extreme fire weather conditions.

Fire Regime Condition Class is a calculated value for a particular ecosystem in a given drainage. It is not a value that can be assigned to a given stand of forest or small patch of shrub ecosystem. As such, it is reflective of the current condition of the ecosystem (vegetation/fuel characteristics) in the context of the surrounding landscape. Context combined with current structure is exactly what influences extreme fire behavior.

Fire Regime Condition Class provides us with a picture of potential fire behavior under high or extreme fire weather conditions because it considers the context of the surrounding vegetation/fuel structure that would contribute to uncharacteristic fire behavior (e.g. amassing of extreme heat or winds).

The Dry Forest PVG throughout the Salmon Interface area were classed as follows: 0% in Condition Class 1; 60% Condition Class 2; and 40% in Condition Class 3. These values have been heavily influenced by the significant increase in multi-story forest structures that have multi-storied fuel profiles (ladder fuels). Noticeable trends include:

> All of the dry forest PVG in the municipal watershed for the town of Salmon were classed in Condition Class 3.
>
> All of the dry forest PVG in the Spring and Perreau Creek watersheds were classed in Condition Class 3.
>
> All of the dry forest PVG in the Twelve Mile Creek watersheds was classed in Condition Class 3.
>
> Most of the dry forest PVG in the Williams Creek watersheds were classed in Condition Class 3.
>
> All of the Dry Forest PVG was assigned a Condition Class 2 value for the area around Williams Lake.

The condition class 3 areas mentioned above include the lower elevations and these areas are of the highest concentrations of Wildland Urban Interface (WUI) regarding forested ecosystems in the Salmon Interface. As seen in the fire of 2000, these fuel situations have the capability to burn with extreme/un-stoppable fire behavior and produce fire-spotting miles out ahead of the main fire. It should be noted that Condition Class 2 also has similar capability for extreme fire behavior when fire weather conditions become high or extreme and topographic features line up with wind patterns allowing a wildfire to be pushed by high wind conditions generated from a large fire or high wind event. Such is the potential for the Williams Lake WUI.

Draft: last edited by l.b. 2/19/03 9:00

Salmon Interface EAWS:

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Fire ecology report:

Synthesis and recommendations: Questions 1 & 2 require discussion regarding risks to social and ecological elements due to altered vegetation structure and fire behavior. These topics are inseparable for the synthesis process, therefore the fire ecology synthesis discussion will combine questions 1 and 2.

1. How has fire suppression, fire exclusion, timber harvest, silvicultural practices affected vegetative structure, composition and ecosystem processes of forested vegetation?

2. How does the change in forested vegetation structure and composition affect the ability to suppress forest fires adjacent to human developments (urban interface) and protect the municipal watershed?

The synthesis discussion will address the following topics:

- Summary of high-risk crown fire SS.
- Fire Regime Condition Class (see discussion Key Question 2, Fire Regime Condition Class).
- FRCC –Risk of sustainability.
- FRCC –Abundance of ecosystem components.
- Wildfire summary, by Congressional Research Service, Library of Congress.

Summary of high-risk crown fire initiation fuel profiles: In both the dry forest and cold forest PVGs, the amount of forest area with high-risk crown fire fuel profile has increased from the historical landscape. High-risk crown fire initiation fuel profiles are those forest structural stages with a closed forest canopy and abundant ladder fuels (seedlings, saplings, and pole size trees), in particular the OFMS and UR. The stem exclusion closed canopy structural stage has a closed canopy and is at high risk for crown fire spread, but lacks the ladder fuels for a crown fire to generally initiate within those stands. Therefore, it will not be included in this discussion of high risk crown fire initiation fuel profiles.

Sixty to 70% of the forested landscape in the Salmon Interface area have high risk crown fire initiation fuel profiles (multi-layer forest canopy (ladder fuels) structural stages). This equates to more than 78,000 acres of high-risk crown fire fuel profile forest condition. This high concentration of potential crown fire fuels is located in a landscape on the windward side of the community of Salmon, Idaho and its surrounding population. Due to the regularly experienced high fire danger weather conditions, prevailing wind patterns, steep mountain topography, and canyons that line-up with fire season wind direction, risk to WUI, and risks for sustaining ecosystems the wildland urban interface is at increased risk of wildfire due to altered forest structure.

FRCC –Risk of sustainability: The FRCC Risk of Sustainability classification provides an indication of the landscape's probability of sustaining uncharacteristic wildfire behavior (rapid rates of spread, resistance to initial attack and containment, crown fire, potential blowup fire behavior, mass firebrands and long distance spotting). For the Salmon Interface area, in the forest-PVGs: 25% of the area is low risk; 58% of the area is moderate risk; and 17% of the area is in high risk. Most of the high risk forest PVG tends to be at the lower elevation forest zones which also are the forested zones closest to WUI. These high risk areas are intermixed with both low and moderate risk areas, mostly moderate risk.

The moderate risk areas have a "lesser" probability of initiating uncharacteristic fire behavior, but have a strong probability of being able to sustain extreme fire behavior once it is in progress. This was demonstrated time and time again during the fire season of 2000 in Idaho and Montana, and in Colorado, Oregon, and New Mexico in 2002.

The two largest concentrations of low risk forest PVG occur at the west edge of the Salmon Interface analysis area and are in areas of the lowest WUI concentrations. These areas are partly a reflection of the areas that burnt in the Clear Creek Wildfire of 2000. Small patches of low risk are scattered throughout the forest PVG, but appear in such small amounts that it is unlikely that they would significantly influence fire behavior once a fire blowup occurs.

Due to the high amount (75%) of high to moderate risk area in the forest PVG, any wildfire blowups are most likely to be controlled by topographic and weather situations, low risk forest PVG areas are so limited, they will play a small part in influencing extreme fire behavior. Much of the higher elevation forest PVG area burnt in the 2000 Clear Creek Wildfire was in moderate risk classification, and this wildfire was un-stoppable even with two Type I fire fighting teams, thousands of personnel, many miles of bull dozer constructed fire line, and many helicopters dropping fire retardant. The amount of low risk forest PVG area can have a significant influence on the resulting wildfire behavior, suppression efforts, and post fire ecological impacts.

FRCC –Abundance of ecosystem components:

Recommendation: fire ecology.

Location of treatments for WUI: Treatments for WUI must take into consideration the complete context of fuels in the landscape surrounding the WUI when extreme fire conditions are experienced. It is not logical to assume that creating narrow defensible space around structures or reducing ladder fuels within ¼ to ½ mile from structures will adequately protect them from an uncharacteristic high severity fast moving wildfires sending out uncountable fire brands up to 2 miles ahead of its self. Depending on the width of the flaming front (Clear Creek Fire - July 14 run was 4 to 5 miles wide) and the WUI width, no reasonable amount of fire suppression crews/equipment could offset the onslaught of such extreme fire behavior without undue risk to personal safety.

Fuels treatment focused only on WUI are not an effective solutions: For WUI areas located within the path of extreme fire behavior and treated with only "doughnut hole" style defensible space treatments, the high risk from an oncoming extreme fire event would not be effectively mitigated. In such a situation fire suppression crews would be unable to attack this wildfire at the head even if the urban interface buffer areas had been treated for crown fire and fuel risk reduction, because of the mass fire brands raining into the area and fire jumping lines constructed by dozer or hand crews. Mass firebrands would potentially ignite many vulnerable structures causing most of the suppression resources to focus on protecting structures rather than on fire suppression (Hann and Strohm, 2002).

Landscape focus for reducing risk to WUI: Dr. Hann suggests an excellent approach to reducing wildfire risk to WUI areas. Most of the following discussion has been adapted from Hann and Strohm, 2002.

There is a landscape design fuels treatment option that can reduce wildfire risk to WUI and have the added benefit of reducing risk to ecosystems at landscape scales. This type of design would involve treatment and maintenance to achieve the condition class 1 landscape objective across a watershed to change large wildfire behavior and effects. Essentially focusing on treatment of high departure polygons throughout the watersheds in a pattern most effective at changing large wildfire behavior and effects (Finney and Cohen 2002; Hann and Bunnell 2001). The first set of treated polygons would focus on mechanical and prescribed fire treatment of operationally accessible high departure polygons and maintenance of low departure polygons that are in the zone of wildfire influence to the WUI areas (Hann and Strohm, 2002).

The second set of treatments would tie in the intermingled less operationally accessible high departure polygons through use of hand cutting and prescribed fire by being able to anchor into the first set of treatments. In addition, prescribed fire with minimal mechanical or hand treatment could be used at the higher elevations and in areas where fuel breaks (natural or human made) currently exist and in the roadless areas, to reduce the potential for uncharacteristic fire spreading from or to that area. In addition, the design could take into account ecosystem objectives for reducing risks to air, water, native species habitats, and sustainability; in essence achieving risk reduction for multiple benefits at the same cost (Hann and Strohm, 2002).

This landscape approach to treatment would substantially change the behavior and effects of a large wildfire run originating from within the Salmon Interface watersheds or from adjacent landscapes. Wildfire from any of these sources would still spread fairly rapidly in grass and shrub surface fuels, but would have low risk of torching and spotting and little risk of sustaining a running crown fire. Initial attack would have a much higher chance of containing the fire and if the fire escaped initial attack suppression efforts could contain the fire using retardant lines or hand or dozer lines anchored across strategic areas. There would be little spotting into urban interface structures, thus reducing risk to both vulnerable and non-vulnerable structures. It is reminded that the vulnerability of structures primarily exists within the narrow zone of the structure and surrounding area that typically is in the ownership of the structure owner (Cohen 2002, Finney and Cohen 2002). However, by substantially reducing firebrands and changing fire behavior from crown to surface, the risk even to vulnerable structures becomes less. We have generally found that even in communities with high awareness of wildfire risks and ability of structure owners to reduce these risks with mitigation of structure vulnerability and fuel management, there is at best only about half of the structure owners that will take action. This type of wildfire behavior could be managed within the availability of typical suppression resources without having to redirect most of the resources to protection of structures. Some redirection would probably be necessary to protect vulnerable structures in areas with torching, but this would be for a small number of areas compared to the WUI wide vulnerability that exists under the no treatment or WUI focus options. Costs of suppression would be much less under this scenario than the no treatment or WUI focus scenario and damage to resources would be minimal (Hann and Strohm, 2002).

Location of treatments for ecosystem condition class 2 & 3 restoration: One of the first steps for identifying priority treatment locations will be to identify the overlap of the FRCC high abundance and FRCC high risk for sustainability layers. Then these locations for treatment should be evaluated in light of reducing WUI risk, reducing risk of losing ecosystem components, sustaining T&E habitat, and cost effectiveness. Other factors will need to be considered.

Minimum area to treat to restore the PVTs to a condition class 1: Using the method outlined by Hann (Hann and Strohm, 2002) the following estimated acres are the minimum need to <u>restore</u> the PVTs to the mid-point (departure value FRCC = 0.16) Fire Regime Condition Class 1: ([Veg departure – mid-point value] * acres pvt = acres needing treatment).

PVT	Vegetative departure.*	PVT acres.	**<u>Minimum</u>** acres to treat.
Dry Douglas-fir (PVT 52)	0.44	26,000	7,280
Douglas-fir & Lodgepole pine (PVT = 74, 75)	0.58	40,000	16,800
Dry Subalpine fir	0.34	46,000	8,280

Total **minimum** acres to treat:			32,360 acres.

***** Figures are from early data estimates and may need to be recalculated with current data.

The estimated minimum needed acres to treat to <u>restore</u> the PVTs to the mid-point value for Fire Regime Condition Class 1 do not include the minimum number of acres needed to treat to maintain areas that are currently in appropriate structure and disturbance regimes but will need maintenance to stay in FRCC 1.

Location of treatments for ecosystem condition class maintenance:

Reducing fire severity: Pollet and Omi studied the effects of wildfire on forest stands that had a variety of fuel treatments before the stands were burnt by a wildfire. Pollet and Omi studied fuels treatment that included prescribed broadcast burning, thinning and under burning, and whole tree removal and concluded that fire severity and crown scorch were significantly lower in the treated stands (Pollet 2002, page 2).

In the Salmon Interface analysis we have used forest structural stages to address forest structural characteristics (e.g. crown closure, tree diameters, and the relative vertical/spatial arrangement of trees) (Hessburg 1999, pg 46-47). Fewer trees/acre will result in less continuous crowns and ladder fuels. Also, larger Douglas-fir trees will have thicker bark which increases fire resistance, and will generally have live branches higher above the ground. Fuels treatment activities can provide an increase in fire resistance characteristics. Pollet and Omi found “the benefits of treated stands are lower potential for crown fire initiation and propagation, and less severe fire effects” (Pollet and Omi, 2002, pg 8).

It has been suggested that opening forests may result in a drier microclimate compared to a closed stand (ground fuels are more exposed to wind and solar heat), and more severe fires may result. Graham addressed this topic and stated (Graham et al 1999, pg 18):

> *Thinnings in general will lower crown bulk densities and redistribute fuel loads significantly, thus decreasing fire intensities* ***if the surface fuels are treated*** *(Agee 1993, Alexander 1988, Alexander and Yancik 1977). These removals have been shown to be effective in reducing crown fire potential, especially around homes (Coulter 1980, Dennis 1983, Rothermel 1991, Schmidt and Wakimoto 1988). Because of drier fuels (fuels are more exposed to wind and heat) and increased wind speeds that occur in thinned stands, it is critical that they be treated to minimize fire intensity. In California, plantations where surface fuels were treated*

had substantially less damage from wildfires compared to untreated plantations that burned completely and severely (Weatherspoon and Skinner 1995).

Regarding opening up forested stands, Pollet and Omi found in their study of four wildfire locations that had burned-over fuels treatment areas, the more open stands (treated) had significantly lower fire severity impacts compared to the more densely stocked untreated stands. They stated,” *removing small diameter trees from a ponderosa pine stand reduced subsequent wildfire severity. At the four sites, the fuel reduction overcomes any microclimate effects on fire behavior resulting from a more open stand*.” (Pollet 2002, pg 8).

Thinning smaller trees and understory trees as a tool to reduce fire severity:

Benefits of fuels treatment: After a study of four wildfire locations, Pollet and Omi stated, ”based on statistical results and field reconnaissance, sites with mechanical fuel treatment appeared to have more dramatically reduced fire severity compared to the site with prescribed fire only” (Pollet 2002, pg 6). After an in-depth research in to a wide range of thinning methods, Graham made the following statements (Graham et al 1999, page 20):

Fire intensity in thinned stands is greatly reduced if thinning is accompanied by reducing the surface fuels created by the cutting….

Thinning and other thinning-like stand treatments can substantially influence subsequent fire behavior at the stand level by either increasing or decreasing fire intensity and associated severity of effects. Depending on intensity, thinning from below and possibly free thinning can most effectively alter fire behavior by reducing crown bulk density, increasing crown base height, and changing species composition to lighter crowned and fire-adapted species. Such intermediate treatments can reduce the severity and intensity of wildfires for a given set of physical and weather variables.

Thinning from below will have a direct effect on the height of live limbs that may become available fuel for fires in high fire danger situations. These live lower limbs are the fuels (ladder fuels) that allow fire to climb into the forest canopy and result in high severity crown fires.

Omi and Martinson found that crown bulk density was not the variable that had the strongest correlation to fire severity, based on their study of wildfire effects, it was height to live crown that had the strongest correlation to fire severity (Omi 2002, pg 20). Stand density and height to live crowns can be greatly modified by thinning-from-below treatments. It is the height to live crown that determines crown fire initiation rather than crown fire propagation (Omi 2002, pg 22). Scott and Reinhardt stated that thinnings designed to reduce crown fire hazard will usually raise the effective canopy base height (CBH) which is a function of the amount and height of lower live limbs on the trees in a stand (Scott 2001, page 31).

Reducing upper level crown fuels: The ladder fuel profile is important in the context of crown fire initiation, propagation, and crown fire spread. When considering multistoried stands, the higher up into the ladder fuel profile where dense canopies can be treated to open the stand, the greater the opportunity to reduce the risk of crown fire. Maximum reduction in crown fire risk will be accomplished by treating the entire ladder fuel profile (Omi 2002, pg 23; Fiedler 2001, pg 17). Stand density and basal area were found to be important descriptors of fire severity, the lower the basal area and the lower the stand density, the lower the fire severity indicators (Pollet 2002).

Fuel treatment benefit summary: Both surface and canopy fuels play an important factor in the risk of high severity wildfires. By fuel treatment activity type, we can expect the following effects to crown torching and crown fire indicators in multistory stands (Scott 2001, pg 31):

Fuel Treatment:	Surface fuel load (SFL).	Canopy base height (CBH).	Canopy bulk density (CBD).
Understory removal with pile or broadcast burning.	Decrease SFL.*	Increases CBH (height of live fuels from the ground).*	Decrease or no effect to CBD.*
Overstory thinning – with pile burning, or broadcast burning, or whole tree yarding.	Decrease SFL.*	Increase or no effect to CBH.*	Decrease CBD.*
Slash pile burning.	Decrease SFL.*		
Broadcast burning.	Decrease SFL.*	Increase or no effect to CBH.*	

* - Indicates a positive effect on reducing risk of high severity fire effects to ponderosa pine and Douglas-fir dry forest type ecosystems.

Effects of thinning on presettlement ponderosa pine:

Much of the dry forest type in the Salmon Interface area has changed from historically open low density forest stands to closed, high density forest stands. The increase in the number of trees per acre (density) has had an adverse effect on the old growth trees that were established prior to European settlement (presettlement) of this area. The Salmon-Challis National Forest has a typical summer season that is dominated by drought characteristics during the growing season. Water is a primary limiting growth factor in the dry forest ecosystems.

Thinning from below will reduce tree stocking density and will reduce the number of trees drawing soil moisture from the growing sites, allowing fewer trees to compete for the same amount of water. This reallocation of soil moisture to the remaining trees will be beneficial to the remaining trees. Many of the old growth trees within the treatment areas will have more soil moisture available and are likely to respond with a visible increase in tree vigor.

Stone studied the effects of thinning out competing trees from presettlement ponderosa pine in Northern Arizona (Stone 1999). The presettlement trees referred to by Stone et al were those ponderosa pine trees established prior to 1876 (trees greater than 120 years in age). This definition of presettlement trees fits well for the Salmon Interface area and the findings of Stone et al have a direct correlation to the thinning effects expected on the old growth Douglas-fir in the area.

Stone used canopy growth, and the uptake of essential resources (carbon, nitrogen, phosphorus, and water) to measure tree vigor. Thinning treatment removed most post settlement trees to emulate the more open stand conditions of the historical stands resulting in an average of 370 leave trees per acres after thinning. The study showed that thinning resulted in the following **improvements** for the old growth trees: up take of water; greater nitrogen uptake that resulted in an increase in needle surface area and mass; increase in carbon up-take; longer needles; and a substantial increase in photosynthetic capacity which contributed to greater canopy growth. Stone et al's synthesis of related research and their own study conclude that thinning would improve the vigor of ancient, presettlement ponderosa pine trees (Stone 1999) and these results could also be expected on Douglas-fir trees.

An increase in tree vigor for the old growth trees may increase their ability to withstand disturbances such as insect attack, disease attack, and increase their resistance to wildfire damage. In addition, an increase in tree vigor can prolong the old growth trees life expectancy.

Forest duff accumulations:

Prescribed broadcast burn treatment would allow a low severity fire to burn across the designated treatment areas. A burn prescription would include parameters of wind speed, relative humidity, fuel condition and arrangement, and other important environmental factors which influence fire behavior. The low severity fire would reduce the accumulation of duff, forest floor litter, and bark flake accumulations, as well as logs and branches. By reducing the duff layer with a fire that burns under conditions that produce a low severity burn, generally a surface fire, damage to large diameter trees will be minimized.

The prescribed fire will be conducted with objectives of reducing duff layers, not totally removing duff or other ground cover layers throughout the treatment areas. A low severity fire which does not remove all the duff layers will damage tree root systems much less than the fire effects of a high severity fire.

Ladder fuels reduction and reduction of crown fire potential:

Killing smaller trees: Smaller trees can be thinned (killed) via cutting or the use of broadcast burning (fire).

Prescribed fire: Low severity broadcast burns will result in less heat damage to larger fire resistant trees than to smaller seedling/sapling and pole size trees. Ponderosa pine and Douglas-fir's ability to resist heat damage to the bole of the tree is a function of bark thickness. The thicker the bark, the more heat resistance the tree has. Bark thickness is related to tree diameter, the large the diameter, the thicker the tree's bark. Small diameter trees will be at higher risk of receiving lethal burn damage from the prescribed fire than large trees. An objective of the broadcast burn is to assist in thinning out the overstocked component of tree seedlings, saplings, and pole size trees. In the smaller size classes, Douglas-fir is more susceptible to fire damage from heating at the base of the tree than ponderosa pine.

Thinning via tree cutting actually lays the killed trees on the ground, broadcast burning will kill the thinned trees, but they will remain standing. Leaving the dead trees standing will not contribute to the risk of crown fire transition and propagation. Broadcast burning will decrease the risk of crown fire initiation and propagation. On a stand basis broadcast burning will immediately reduce the surface ground fuels and will consume the fine fuels (live and dead) in the lower portion of the ladder fuel profile, often increasing the crown base height (Scott 2001, pg 31).

The killed smaller diameter trees (sapling and poles size) will not fall in a single year, but will come down over a period of about 5 to 10 years after their root systems have rotted. Periodic fuels treatment activities on a 15 to 25 year cycle will keep down woody fuel accumulations within a non-hazardous condition.

Thinning using broadcast burning will reduce the risk of crown fire initiation, crown fire propagation, and to some extent crown fire spread in the overstory. Surface fuels will be reduced. Risk of crown fire initiation and propagation fuels will be reduced for the next 20 to 30 year period, as influenced by tree stocking density and height to live crowns. Risk of crown fire spread, fire moving from one overstory tree to another, is not likely to be greatly reduce, since it is correlated to reduction in basal area (Pollet 2002), and the thinning of only small diameter trees (understory) has less impact on basal area or overstory crown density.

Cutting smaller trees (up to 8 inch dbh) with follow-up slash treatment: All thinning actions should treat the slash generated from the tree cutting.

All tree cutting activities should be accomplished with a thin-from-below treatment. Treating the ladder fuels by cutting allows for a more controlled thinning of the overstocked small tree component. It allows for more control in ensuring that larger trees that are more fire resistant are left. It also allows for more control when reducing ladder fuels around other high value resources (e.g. old-growth trees, cultural resources, etc…).

Thinning up to 8 inch dbh in combination with slash treatment will reduce the risk of crown fire transition, crown fire propagation, and to some extent crown fire spread. Surface fuels will be reduced, crown fire initiation and propagation fuels will be reduced (influenced by tree stocking density and height to live crowns), and crown fire spread rate may be reduces with some reduction in basal area.

Slash treatment will be accomplished within one year after the cutting, so any increase in high severity fire risk due to generated slash will be short duration. The thinning activity will remove the cut trees from the ladder fuel profile that reached up into the multistory stands. Until the slash is treated, ground fuel levels will temporarily increase, but ladder fuel continuity will have been reduced immediately.

Cutting smaller trees (including trees greater than 8 inch dbh), removing some wood products, and burning hazardous fuels: Treatment areas that thin-from-below and that remove commercial products would be cutting trees both smaller and larger than 8 inch dbh that are in the smaller component of the current stand structure. These reatment should occur in areas that are currently supporting tree biomass and vertical structure arrangements that exceed the crown density needed to sustain a crown fire.

By thinning small trees, and removing some trees that are larger than 8 inches dbh, and leaving the largest trees in the stand, risk of crown fire initiation, propagation, and spread will be reduced. Cut trees larger than 8 inches will reduce ladder fuels in the upper portions of the ladder fuel profile and will reduce risk of crown fire propagation and crown fire spread.

Thinning trees from seedling size to trees greater than 8 inches dbh will be displayed by a reduction of basal area, a reduction in stocking density, and an increase of height to live crown (and crown base height). Also, the resulting stand will have a greater average diameter and a higher percentage of ponderosa pine (where the species was still present in the larger diameters). Larger diameter Douglas-fir trees have high fire resistance than smaller diameter trees. Also, areas that are treated with a broadcast burn will have duff accumulations reduced, reducing the risk of lethal damage to large diameter ponderosa pine and Douglas-fir from surface wildfires.

Understory plant vigor and plant species diversity: The trend of high levels of competition for water, nutrients, and sunlight will be reversed on areas with commercial and precommercial thinning.

Important grasses and forbs that are adapted to frequent low severity fire regimes and open forest canopy conditions will be allowed to reoccupy the understory of these dry forest type stands when low severity fire becomes a part of the disturbance regime again. The broadcast burns will prepared seedbeds, cycled nutrients, and stimulated plant species that sprout.

Open forest conditions allowed more sunlight to reach the forest floor, some understory plants need these conditions. When forests are open, Douglas-fir seedlings are able to grow rapidly and gain a thicker bark layer to protect them from surface fires.

Open forest conditions have less living tree biomass per acre than exists on the areas currently in OFMS, and UR, SECC. In areas of lower levels of living tree biomass, there is low competition for water and nutrients. Low levels of competition for water and nutrients will result in increased plant vigor and growth. Understory plants will have light, nutrients, and moisture available if forest canopy or tree stocking levels are low. Low levels of competition for needed resources will result in high plant vigor. Higher vigor plants will generally be able to produce more viable seeds or vegetative reproductive starts than plants of poor vigor. This will increase the understory plant community's ability to respond to wildfire and provide for rapid soil cover for stabilization.

Wildfire Summary:

The following are quotes from a wildfire summary report developed by Ross W. Grote, Natural Resource Economics and Senior Policy Analyst for the Congressional Research Service, Library of Congress, Washington, D.C. (Ross 2000):

> * *The spread of housing into forests and other wildlands, combined with various ecosystem health problems, has substantially increased the risks to life and property from wildfire. Wildfires seem more common than in the past, with severe fire seasons in 1988, 1990, 1996, 1999, and 2000.*
>
> * *Concerns about unnatural fuel loads were being raised in the 1990s. Following the 1988 fires in Yellowstone, Congress established the National Commission on Wildfire Disasters, whose 1994 report described a situation of dangerously high fuel accumulations.*
>
> * *Concerns about historically unnatural fuel loads and their threat to communities persist. In 1998 and 1999, the General Accounting Office (GAO) testified on these continuing threats three times, and issued two reports recommending a cohesive wildfire protection strategy for the Forest Service ….*
>
> * *… people have increasingly been building their houses and subdivisions in forests and other wildlands, and this expanding "urban-wildland interface" has increased the wildfire threat to people and houses. Also, a century of using wildlands and suppressing wildfires has significantly*

increased fuel loads and led to historically unnatural vegetative species and structures; many believe that these forest and rangeland "health" problems have exacerbated wildfire threats.

** It is widely recognized that fire suppression has greatly exacerbated these ecological problems. Most grass ecosystems and many forest ecosystems (such as the southern yellow pines and Ponderosa (western yellow) pine) evolved with frequent surface fires that burned grasses, pine needles, and other small fuels every 5 to 25 years, depending on the site and plant species. Surface fires reduce fuel loads by mineralizing biomass in typically dry areas that may take decades for the biomass to rot, and thus provide a flush of nutrients to stimulate new plant growth.*

** The historically unnatural fuel loads in forest ecosystems can lead to stand replacement fires in ecosystems adapted to frequent surface fires ("frequent-fire ecosystems"). In particular, small trees and dense undergrowth can create a "fuel ladder" that allows surface fires to spread upward into the forest canopy.*

** Damages are almost certainly greater from stand replacement fires than from surface fires. Stand replacement fires burn more fuel, and thus burn hotter (more intensely) than surface fires. Stand replacement fires kill many plants in the burned area, making natural recovery slower and increasing the potential for erosion and landslides. Also, because they burn hotter, stand replacement fires are generally more difficult to suppress, raising risks to firefighters and to structures. Finally, stand replacement fires generate substantial quantities of smoke, which can directly affect people's health and well-being.*

** Wildfires cause damages, killing some plants and occasionally animals. Firefighters have been injured or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of significant erosion and landslides.*

** Wildfires, especially conflagrations, can also have significant local economic effects, both short-term and long-term, with larger fires generally having greater and* *longer-term impacts. Wildfires, and even extreme fire danger, may directly curtail recreation and tourism in and near the fires. Extensive fire damage to trees can significantly alter the timber supply, both through a short-term glut from timber salvage and a longer-term decline while the trees regrow. Water supplies can be degraded by post-fire erosion and stream sedimentation. If an area's aesthetics are impaired, local property values can decline.*

Appendix G

Treatment Recommendations and Priority
Access Database Queries

Summary of Recommended Treatment Units

Treatment Units with High and Moderate Restoration Priorities

Appendix H. Fire Regime Condition Class (FRCC) Attribute Definitions

Fire Regime

Natural (historical) fire regime groups from Hardy et al. (2001) and Schmidt et al. (2002) as interpreted by the author for modeling landscape dynamics at project and watershed scales.

Fire Regime Group	Frequency (Fire Return Interval)	Severity	Modeling Assumptions
I	0 – 35+ years, Frequent	Surface	Open forest or savannah structures maintained by frequent fire; also includes frequent mixed severity fires that create a mosaic of different age post-fire open forest, early to mid-seral forest structural stages, and shrub or herb dominated patches (generally < 40 hectares (100 acres)). Interval can range up to 50.
II	0 – 35+ years, Frequent	Replace-ment	Shrub or grasslands maintained or cycled by frequent fire; fires kill non-sprouting shrubs such as sagebrush which typically regenerate and become dominant within 10-15 years; fires remove tops of sprouting shrubs such as mesquite and chaparral, which typically resprout and dominate within 5 years; fires typically kill most tree regeneration such as juniper, pinyon pine, ponderosa pine, Douglas-fir, or lodgepole pine. Interval can range up to 50.
III	35 – 100+ years, Infrequent	Mixed	Mosaic of different age post-fire open forest, early to mid-seral forest structural stages, and shrub or herb dominated patches (generally < 40 hectares (100 acres)) maintained or cycled by infrequent fire. Interval can range up to 200.
IV	35 – 100+ years, Less Infrequent	Replace-ment	Large patches (generally > 40 hectares (100 acres)) of similar age post-fire shrub or herb dominated structures, or early to mid-seral forest cycled by infrequent fire. Interval can range up to 200.
V	> 100-200 years, Rare	Replace-ment	Large patches (generally > 40 hectares (100 acres)) of similar age post-fire shrub or herb dominated structures, or early to mid to late seral forest cycled by infrequent fire.

Fire Regime Condition Class

Condition Classes from Hardy et al. (2001) and Schmidt et al. (2002) as interpreted by the author for modeling landscape dynamics and departure from historical (natural) range of variability at project and watershed scales. Historical Range of Variability (HRV) is the variability of regional or landscape composition, structure, and disturbances, during a period of time of several cycles of the common disturbance intervals, and similar environmental gradients, referring, for the United States, to a period prior to extensive agricultural or industrial development. Natural Range of Variability (NRV) - the ecological conditions and processes within a specified area, period of time, and climate, and the variation in these conditions that would occur without substantial influence from mechanized equipment (synthesized from Hann and others 1997a, Landres and others 1999, Morgan and others 1994, Swetnam and others 1999, Swanson and others 1994).

Class	NRV or HRV Departure	Description
Condition Class 1	None, Minimal, Low	Vegetation composition, structure, and fuels are similar to those of the historic regime and do not pre-dispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the historical fire regime behavior, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are within the historical range of variability. Smoke production potential is low in volume.
Condition Class 2	Moderate	Vegetation composition, structure, and fuels have moderate departure from the historic regime and predispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the historical fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are outside the historical range of variability. Smoke production potential has increased moderately in volume and duration.
Condition Class 3	High	Vegetation composition, structure, and fuels have high departure from the historic regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the historical fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are substantially outside the historical range of variability. Smoke production potential has increased with risks of high volume production of long duration.

FRCC Sustainability Risk

Class	NRV or HRV Departure	Description
Low	< ± 25% of Natural Regime	Patch or stand vegetation composition, structure, fuels, snags, down logs, and ground cover are similar to those of the natural regime and do not pre-dispose the system to risk of loss of key ecosystem components. Wildland fires effects, behavior, and patterns are characteristic of the natural fire regime. Disturbance agents, native species habitats, herbivory, and hydrologic functions are characteristic of the natural regime. Smoke production is characteristic of the natural regime.
Moderate	> ± 25% and < ± 75% of Natural Regime	Patch or stand vegetation composition, structure, fuels, snags, down logs, and ground cover are moderately departed from the natural regime and predispose the system to risk of loss of key ecosystem components. Wildland fires effects, behavior, and patterns are moderately departed in comparison to the natural fire regime, generally resulting in more severe fire effects. Disturbance agents, native species habitats, herbivory, and hydrologic functions are outside the natural range and variability, but uncharacteristic conditions do not dominate. Invasive plants, insects, or pathogens do not dominate processes. Smoke production potential has increased moderately in volume and duration.
High	> ± 25% or Uncharacteristic of Natural Regime	Patch or stand vegetation composition, structure, fuels, snags, down logs, and ground cover are in high departure from the historic regime and predispose the system to high risk of loss of key ecosystem components. Components, such as large trees, native grasses, and soil, are at risk to loss even without fire as a result of stress, competition, and loss of soil cover. Wildland fire effects, behavior, and patterns are in high departure and typically dominated by uncharacteristic conditions compared to the natural fire regime, resulting in severe fire effects. Disturbance agents, native species habitats, and hydrologic functions are substantially outside the natural range and variability and typically result in uncharacteristic and often irreversible conditions. Invasive plants, insects, or pathogens may dominate processes. Smoke production potential has increased with risks of high volume production of long duration.

FRCC Abundance Classes

Class	NRV or HRV Departure	Description
Low	< - 25% of Natural Regime	Vegetation patch or stand with ecosystem characteristics (vegetation composition, structure, fuels, snags, down logs, and/or ground cover) that are in low or rare abundance compared to the natural regime for the project or watershed landscape. Typically, these types should be considered for maintenance or protection while recruiting more of this type in other patches or stands that support a type that is high in abundance.
Similar	Within ± 25% of Natural Regime	Vegetation patch or stand with ecosystem characteristics (vegetation composition, structure, fuels, snags, down logs, and/or ground cover) similar in abundance compared to the natural regime for the project or watershed landscape. Typically, these types should be considered for maintenance.
High	> 25% of Natural Regime or Uncharacteristic	Vegetation patch or stand with ecosystem characteristics (vegetation composition, structure, fuels, snags, down logs, and/or ground cover) that are high in abundance compared to the natural regime for the project or watershed landscape. Typically, these types should be considered for restoration or fire use activities in order to restore or maintain types that are in low or similar abundance.


Vicinity Map
Salmon-Challis NF
Project Area
Salmon
Challis
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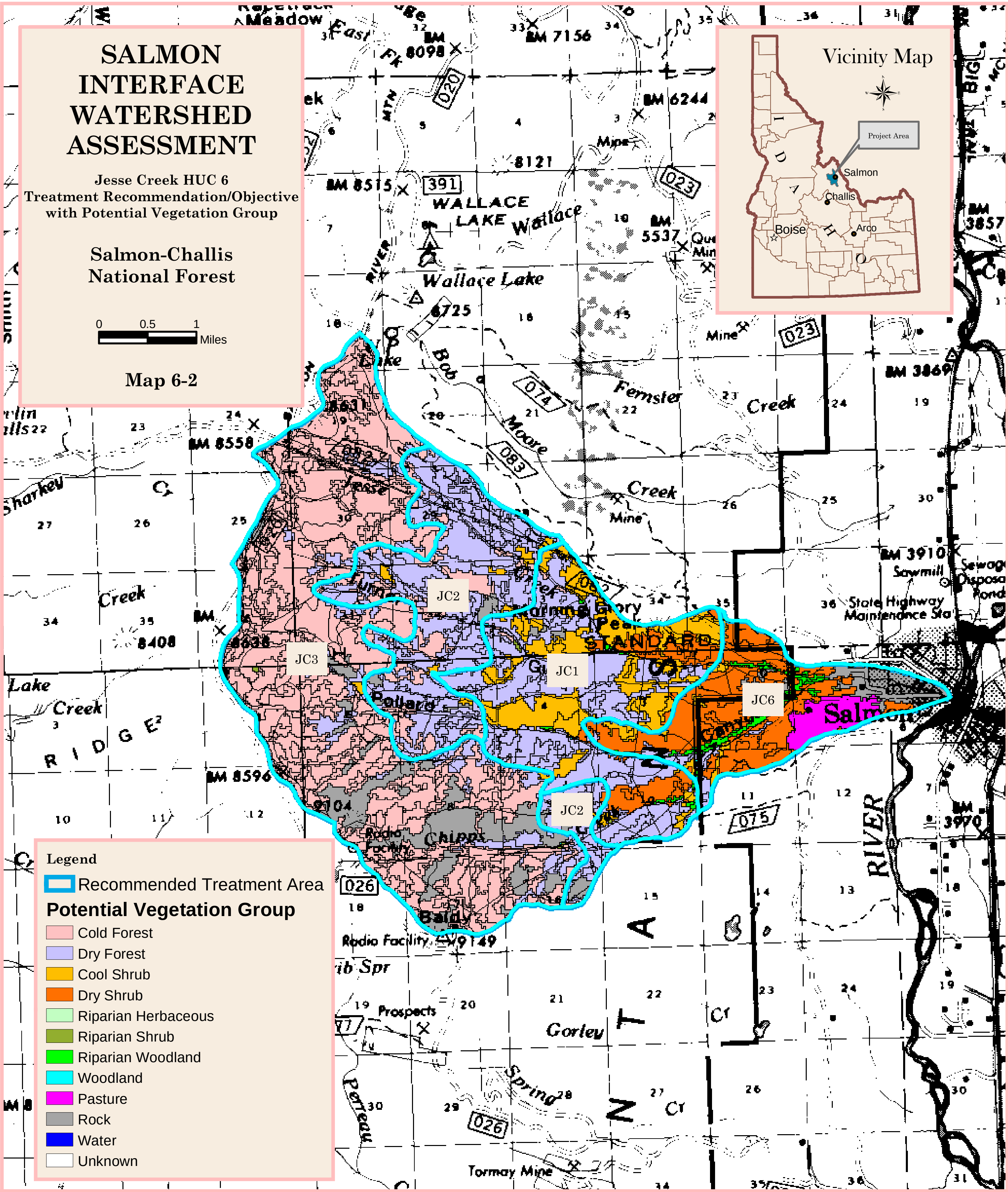

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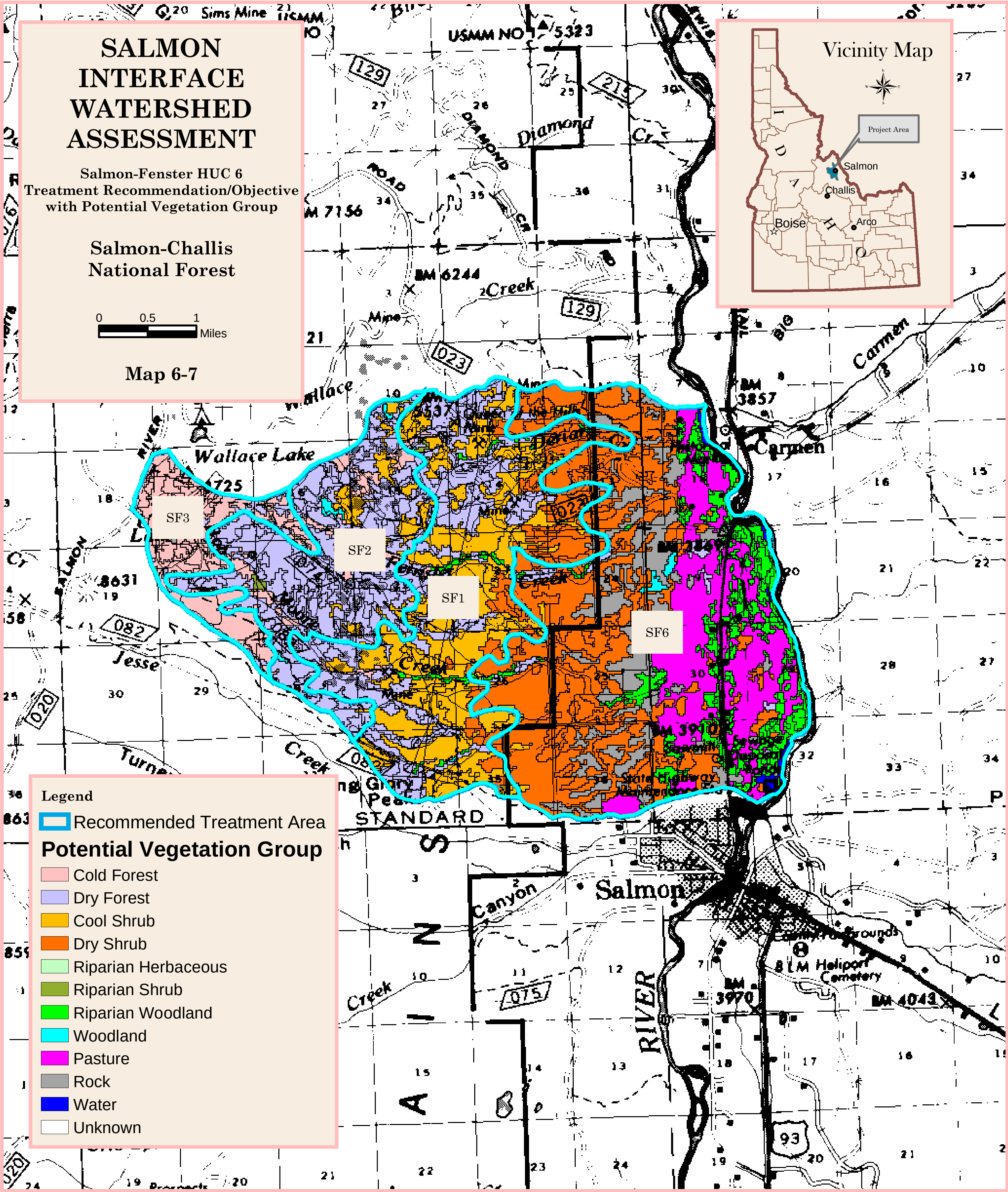

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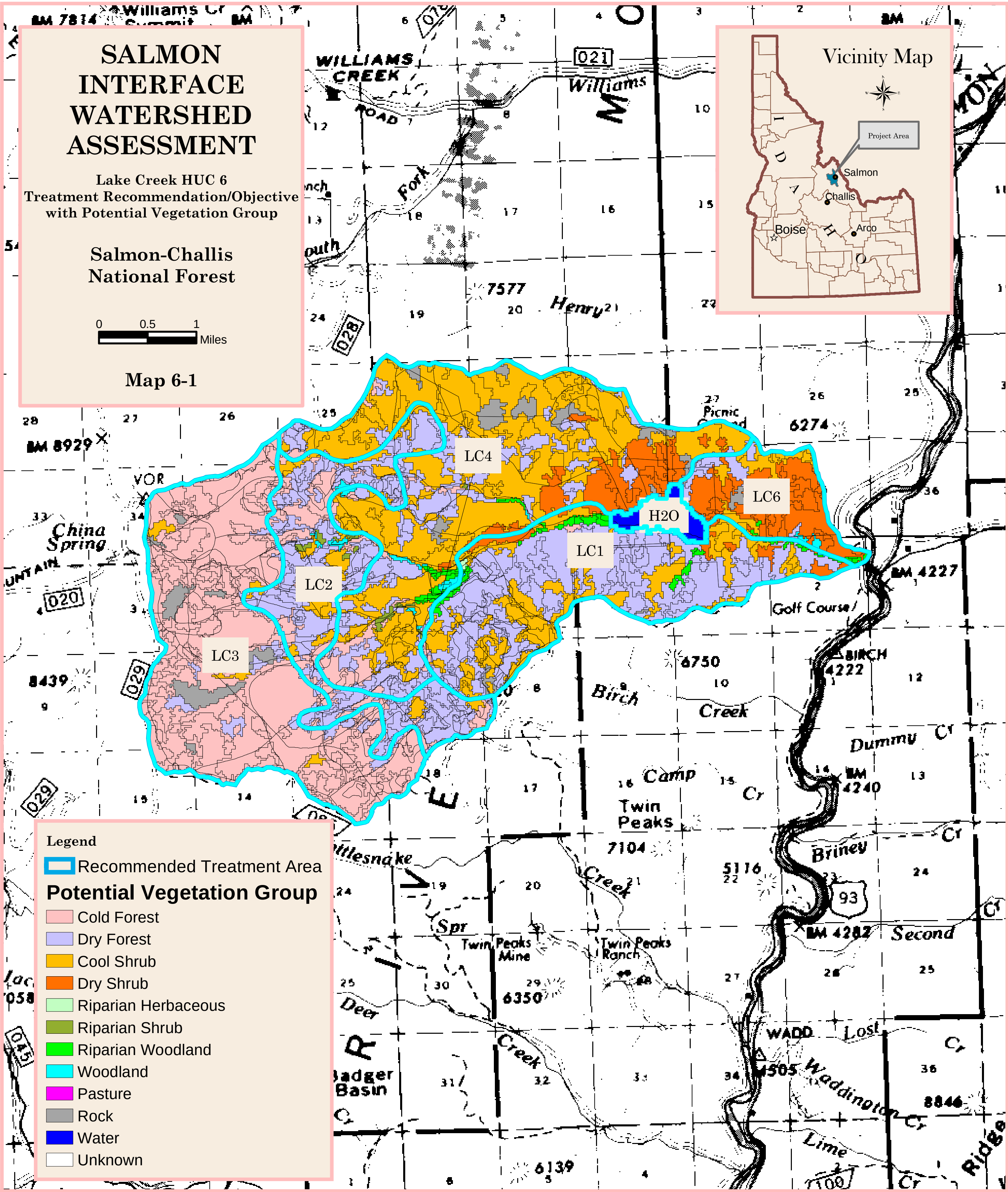

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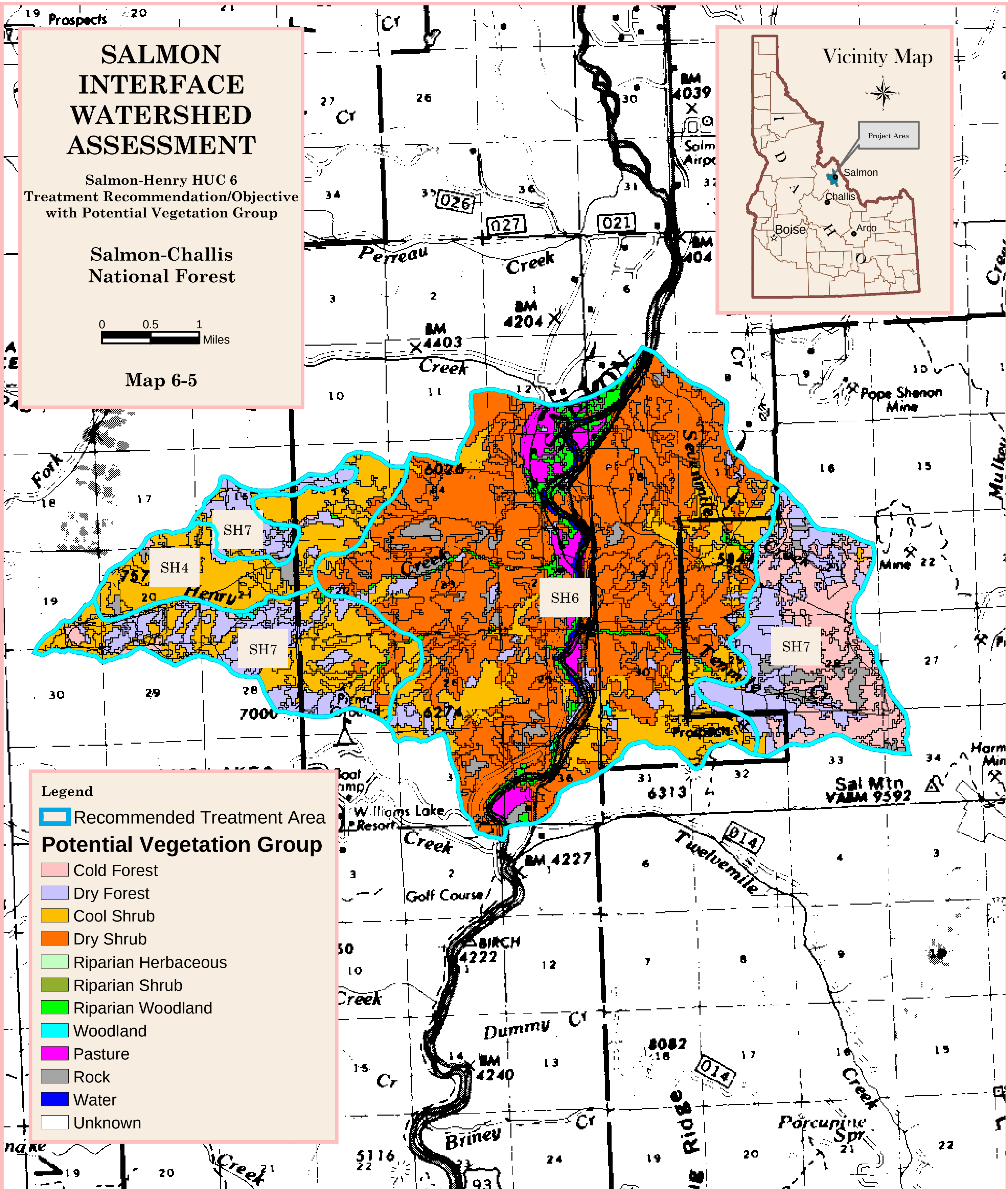

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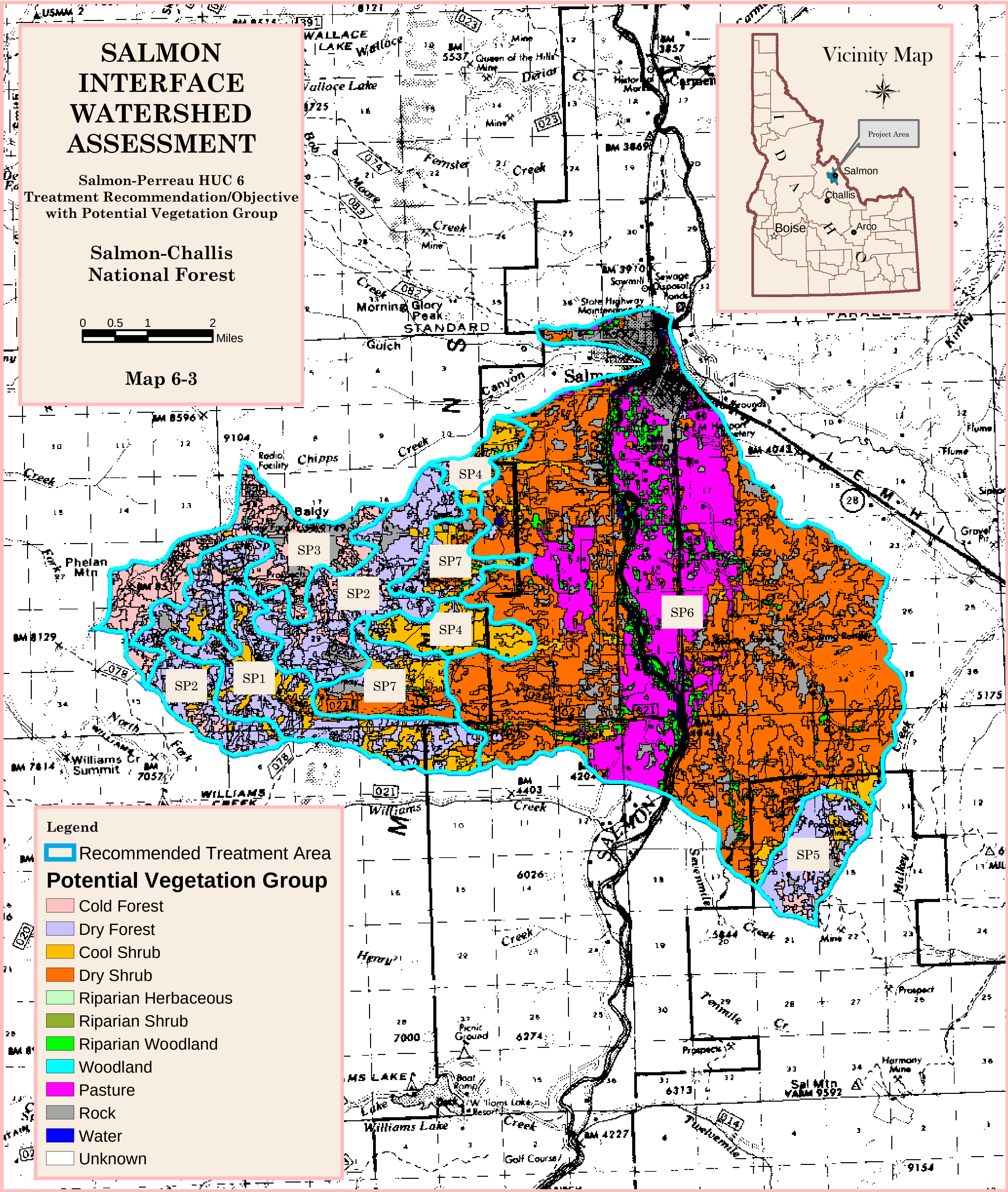

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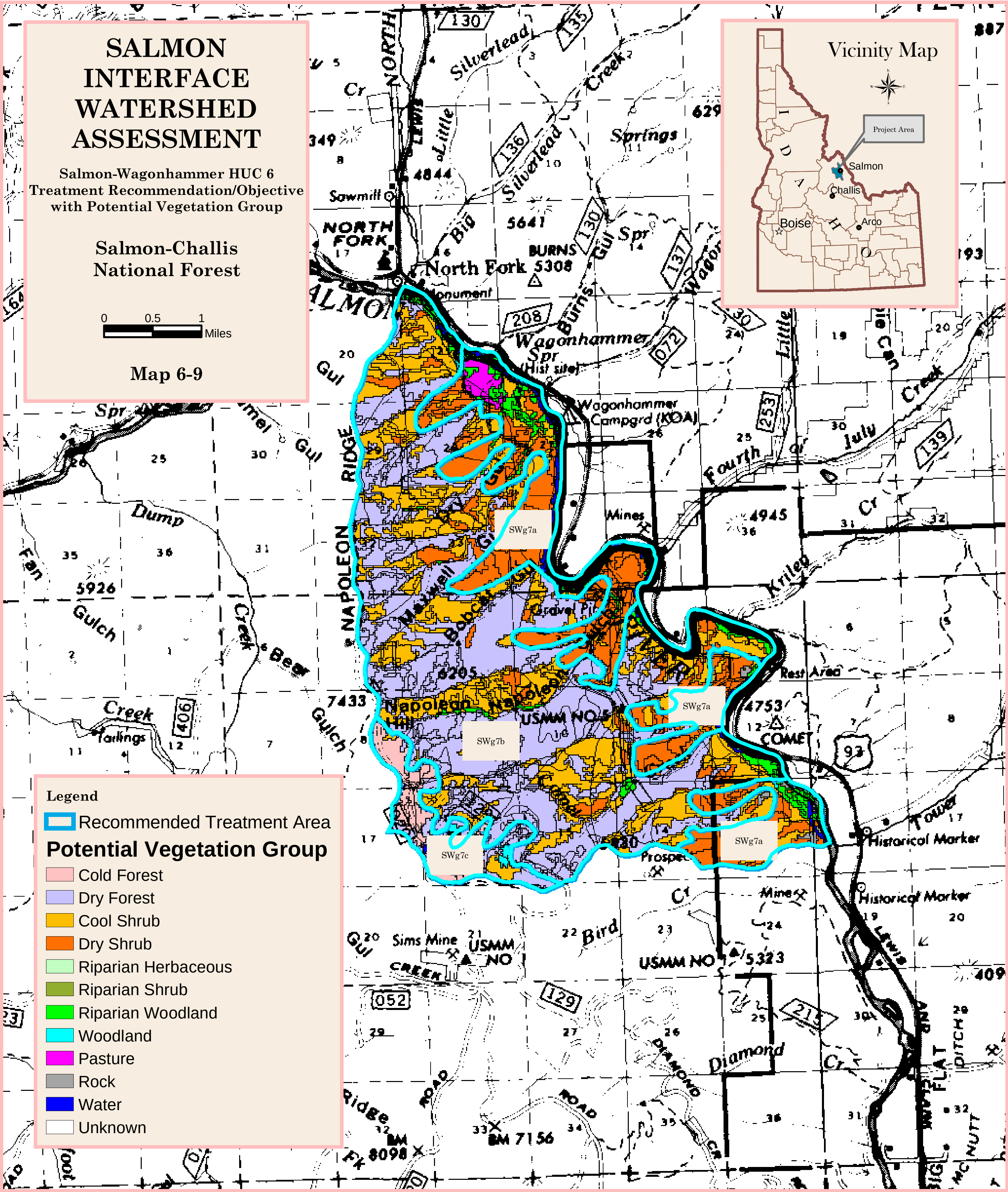

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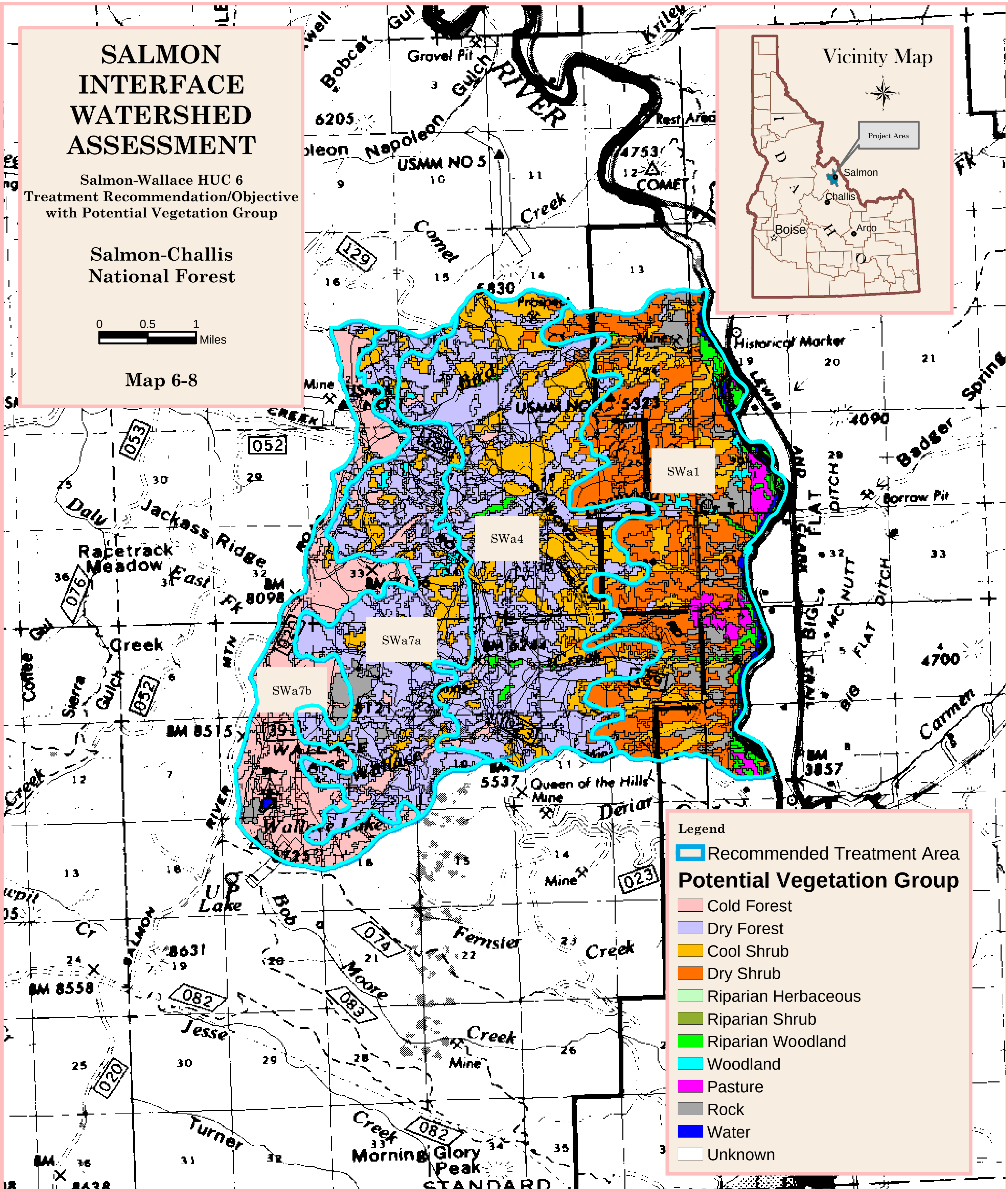
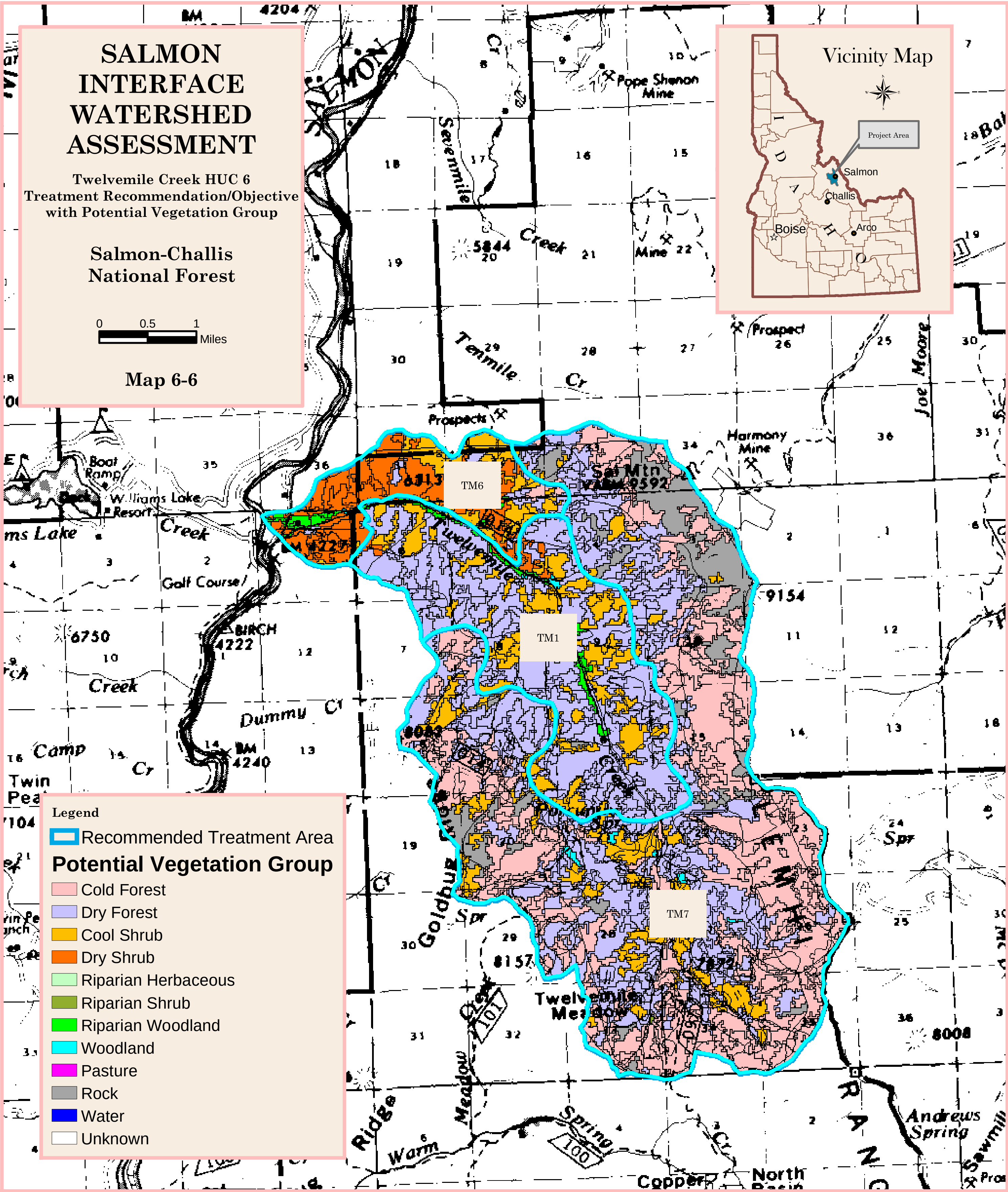

SALMON INTERFACE WATERSHED ASSESSMENT
Salmon-Wallace HUC 6
Treatment Recommendation/Objective with Potential Vegetation Group
Salmon-Challis National Forest
0 0.5 1 Miles
Map 6-8
Vicinity Map
IDAHO
Project Area
Salmon
Challis
Boise
Arco
SWa1
SWa4
SWa7a
SWa7b
Legend
Recommended Treatment Area
Potential Vegetation Group
Cold Forest
Dry Forest
Cool Shrub
Dry Shrub
Riparian Herbaceous
Riparian Shrub
Riparian Woodland
Woodland
Pasture
Rock
Water
Unknown



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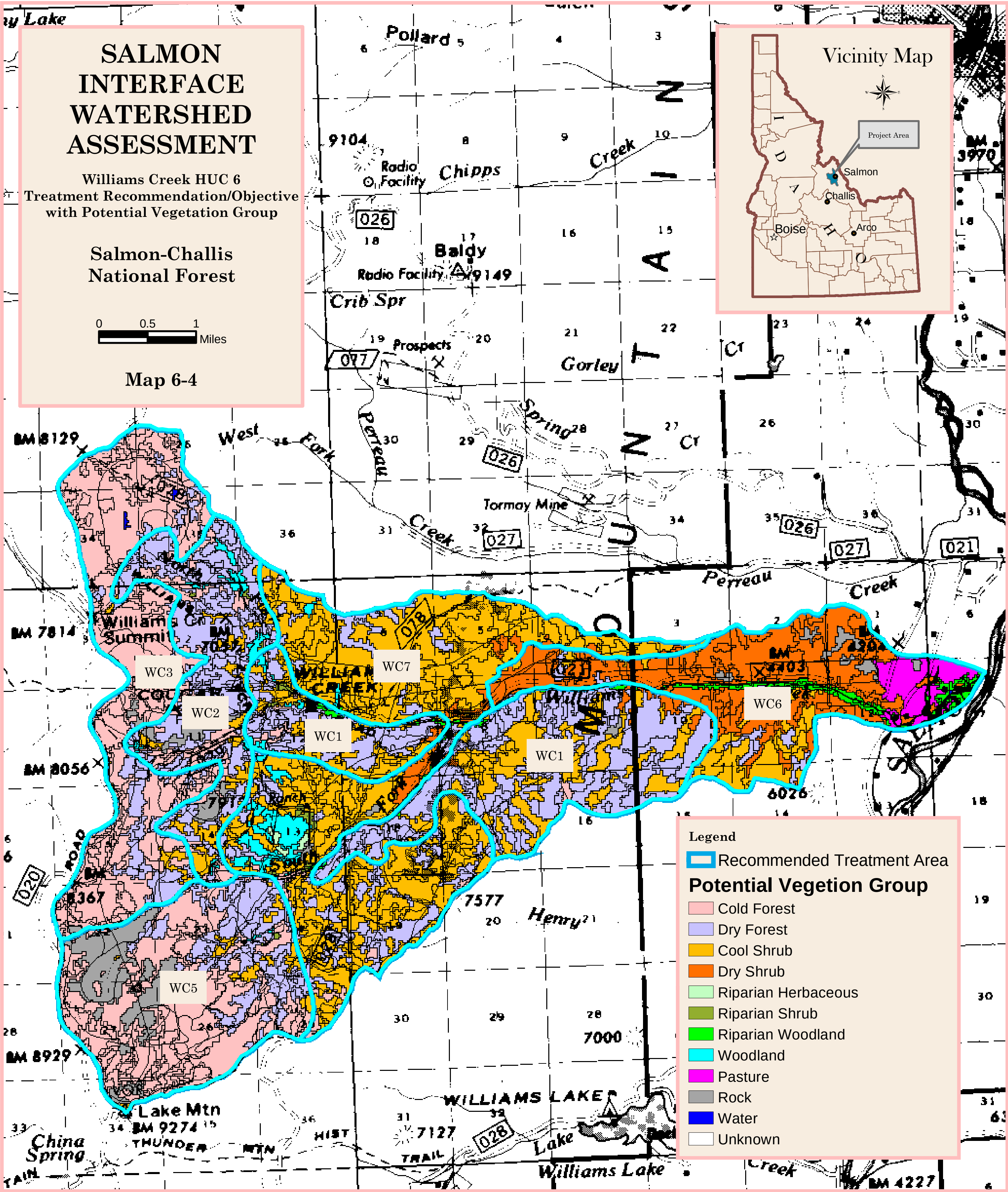
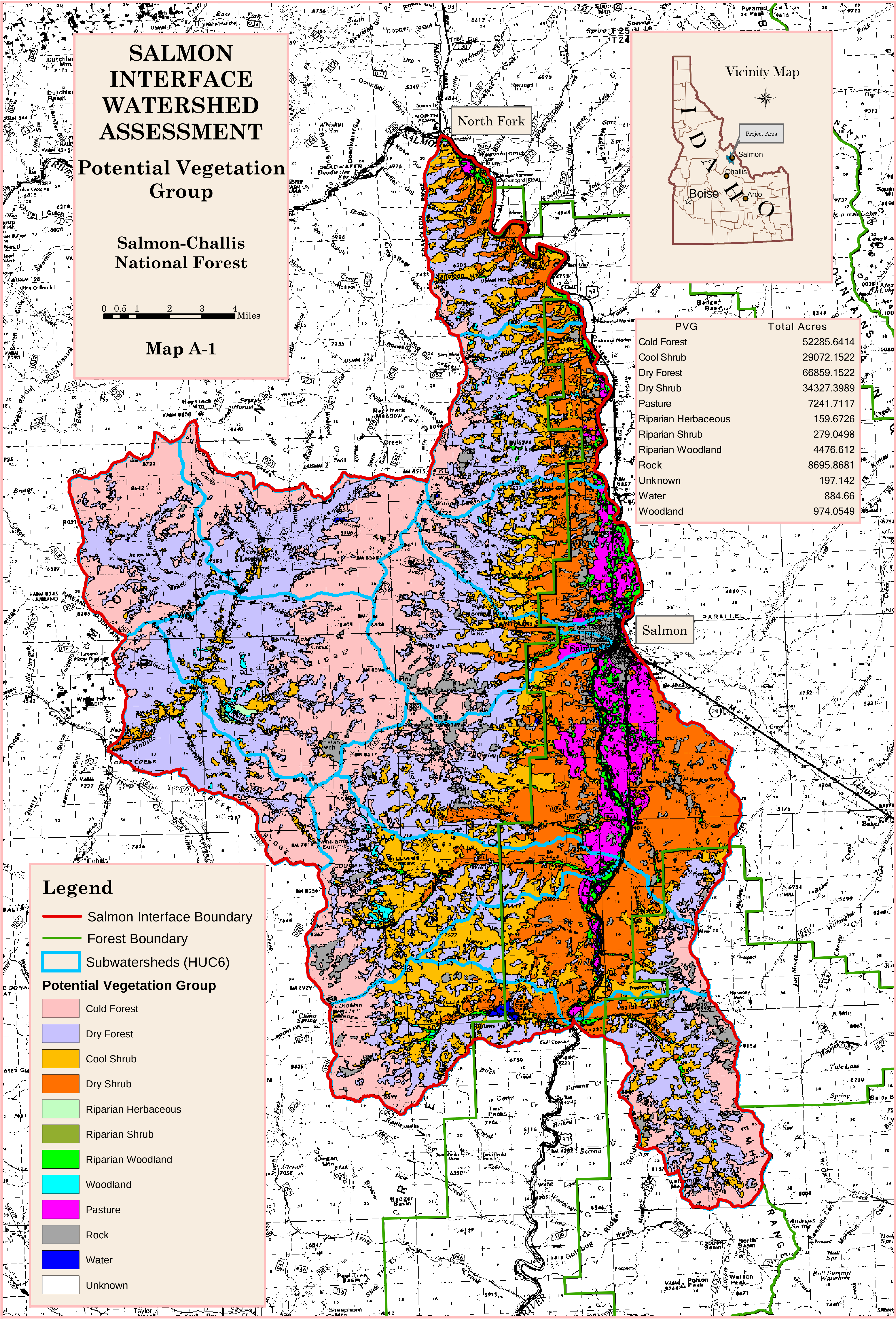

SALMON INTERFACE WATERSHED ASSESSMENT
Williams Creek HUC 6
Treatment Recommendation/Objective with Potential Vegetation Group
Salmon-Challis National Forest
0 0.5 1 Miles
Map 6-4
Vicinity Map
Project Area
Salmon
Challis
Boise
Arco
IDAHO
WC1
WC2
WC3
WC5
WC6
WC7
Legend
Recommended Treatment Area
Potential Vegetion Group
Cold Forest
Dry Forest
Cool Shrub
Dry Shrub
Riparian Herbaceous
Riparian Shrub
Riparian Woodland
Woodland
Pasture
Rock
Water
Unknown



PVG	Total Acres
Cold Forest	52285.6414
Cool Shrub	29072.1522
Dry Forest	66859.1522
Dry Shrub	34327.3989
Pasture	7241.7117
Riparian Herbaceous	159.6726
Riparian Shrub	279.0498
Riparian Woodland	4476.612
Rock	8695.8681
Unknown	197.142
Water	884.66
Woodland	974.0549

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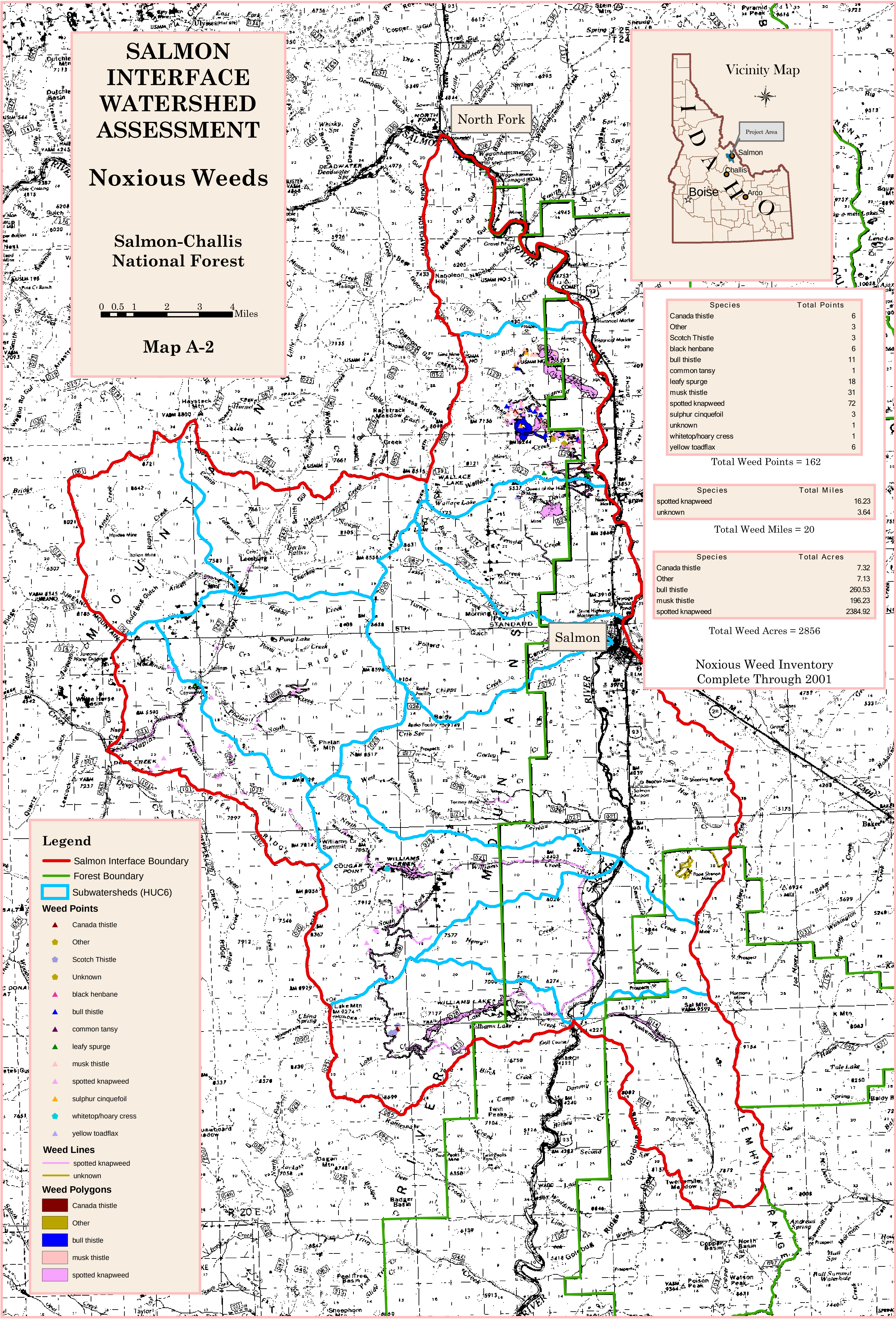

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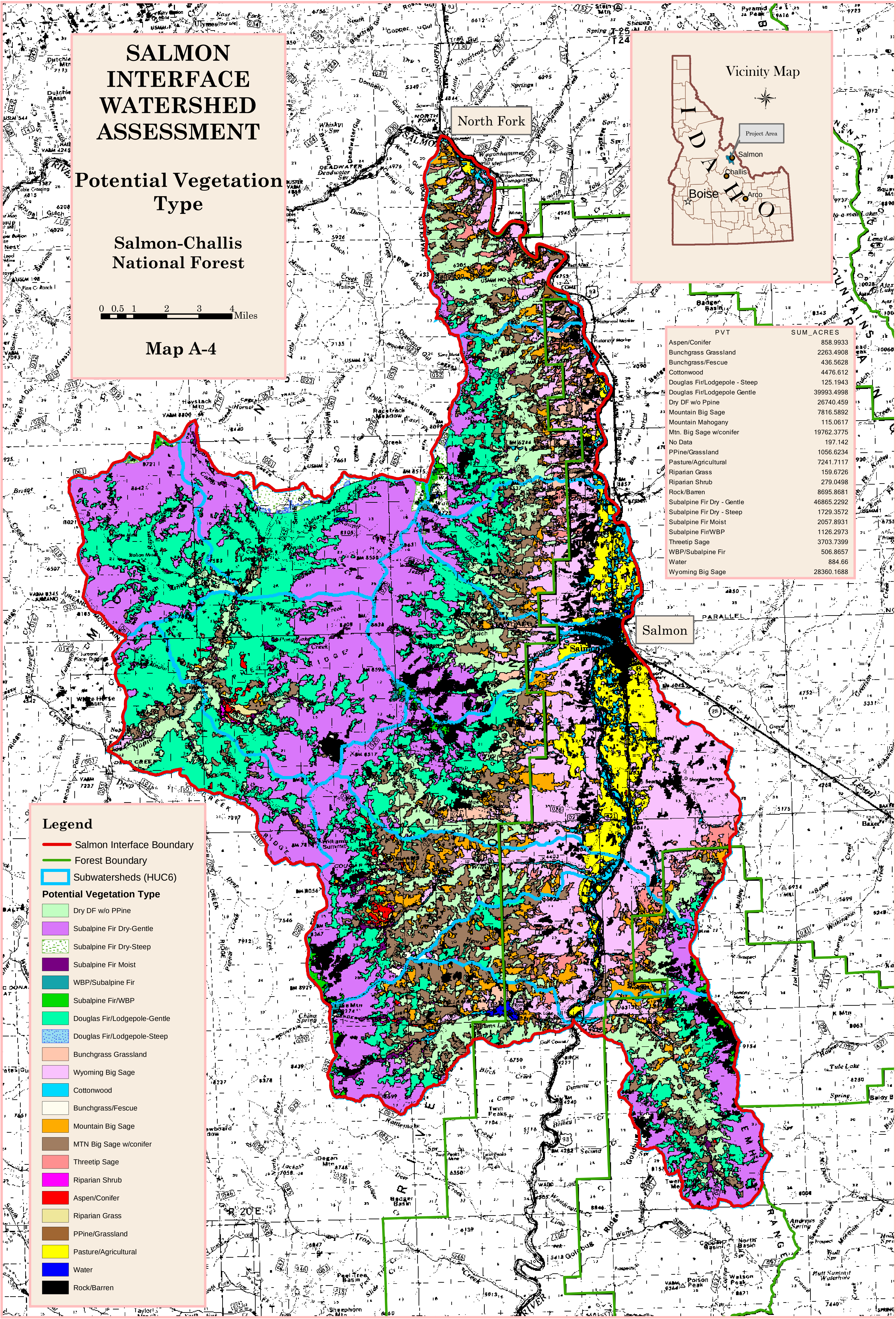

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