CHAPTER IV
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IV. Reference Conditions

Description of reference conditions is the fourth step in the six-step process for ecosystem analysis at the watershed scale. The purpose of step 4 is to explain how ecological conditions have changed over time as a result of human influence and natural disturbances. A reference or benchmark is developed for later comparison with current conditions and with key management plan objectives (Regional Ecosystem Office 1995).

Watershed Hydrology

Reference conditions provide a measure of watershed potential, unfortunately, few records of past conditions are available for comparison. Historic changes in North Fork Desolation meadow were observed on sequential aerial photographs; changes in road location, development of drainage ditches, and change in vegetation composition provide evidence of historic change in the hydrology and morphology of the meadow. Pre-development (1930's) - the channel was probably narrower and more sinuous, with vegetated banks. The water holding capacity in the meadow was greater; with shallow subsurface storage, cooler water, and higher baseflows.

1958 streamflow information includes the following:

Average annual discharge: 101 cubic feet per second (cfs)
Unit discharge, a measure of unit area runoff: 0.9 cfs per square mile
Average annual water yields for the same period: 73,142 acre feet

Role of beaver - John Week's 1832 journal did not report any beaver trapped in the North Fork John Day on a Hudson's Bay-sponsored expedition through the region. Lack of reference to beaver, an important part of the Hudson Bay Company's fur trade, indicates either that beaver had already been trapped out by the time of Weeks's journey, or there were few to begin with (Haines 1971). Beaver may have played a role in the formation and maintenance of meadows in the Desolation watershed. Beaver recolonization may have been prevented in part by development of the domestic livestock industry.

The South Fork Desolation subwatershed is a reference area for watershed response to fire in the absence of land use impacts. Summer storms in 1997 in the headwaters accelerated upland erosion and channel sedimentation rates. Increased storm-generated peak flows resulted in stream channel changes, overbank flows, deposition of bars, and bank erosion. Water temperatures do not appear to be increased by loss of streamside shade. Increased summer baseflows caused by decreased evapotranspiration rates (tree mortality) may be offsetting shade loss.

Compared to other nearby NFJD watersheds, some areas of Desolation Creek watershed have generally better streamflows, channel conditions and water quality. This is in part because of higher elevations and the greater water-holding capacity of recently glaciated landforms in headwater basins. Fewer land use impacts also occur in some tributaries, and overall cumulative effects from logging and roads are at lower levels than other similar-sized watersheds, for example Camas Creek and Wall Creek.

Forest Overstory Vegetation

Forest Cover Types

Previous EAWS efforts used historical cover-type mapping to characterize reference conditions (USDA Forest Service 1937). Historically, forest cover types were often named for an economically important species (such as ponderosa pine) that might be present at a fairly low level of abundance, ignoring a more abundant but less valuable species. For that reason, aerial photography was used to derive unbiased information about historical cover types for the Desolation watershed.

Table 40 summarizes historical forest cover types for the Desolation ecosystem analysis area. The predominant forest cover type in 1939 was lodgepole pine (37% of the analysis area), followed by Douglas-fir (19%), grand fir (17%) and subalpine fir (11%). Forests dominated by whitebark pine or western juniper were less common in 1939 than in 1997, since neither forest type was identified on the historical aerial photography.

Table 40. Forest cover types of the Desolation ecosystem analysis area (1939).

CODE	COVER TYPE DESCRIPTION	ACRES	PERCENT
CA	Forests with a predominance of subalpine fir trees	8,003	11
CB	Forests with a predominance of whitebark pine trees	0	0
CD	Forests with a predominance of Douglas-fir trees	12,916	19
CE	Forests with a predominance of Engelmann spruce trees	485	1
CJ	Forests with a predominance of western juniper trees	0	0
CL	Forests with a predominance of lodgepole pine trees	25,624	37
CP	Forests with a predominance of ponderosa pine trees	3,620	5
CT	Forests with a predominance of western larch trees	1,509	2
CW	Forests with a predominance of grand fir trees	12,021	17
CX	Forests with a mixed composition; less than 50% of one species	2,391	3
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,084	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area. Forest cover types are based on a plurality of stocking and are seldom pure – the grand fir type (CW), for example, has a predominance of grand fir trees (50% or more) but also contains minor proportions of ponderosa pine, Douglas-fir and other species.

Sediments collected from Lost Lake, which is located in the upper (southeastern) portion of the analysis area, indicate that forest composition has remained remarkably stable in the Desolation watershed. Fossil and pollen evidence showed that lodgepole pine, western larch, Douglas-fir, grand fir, subalpine fir, and Engelmann spruce were common conifers after the Mount Mazama volcano erupted about 7,600 years ago. White pines, however, were not common in the fossil/pollen record. About 4,000 years ago, a moist climatic regime apparently prevailed and lodgepole pine, spruce, and firs were abundant. Dwarf mistletoe pollen was also present in the sediments; dwarf mistletoe was probably parasitizing lodgepole pines (Mehringer 1997).

Canopy Cover

Table 41 summarizes historical canopy cover for forests of the Desolation ecosystem analysis area. It shows that the predominant situation in 1939 was very high-density forest (>70% canopy cover; 59% of the analysis area), followed by high density (56-70% cover; 23%) and then low-density (≤40% cover; 8%). Moderate-density forest (41-55% canopy cover) was relatively uncommon in 1939, occupying only 6 percent of the analysis area.

Table 41. Forest canopy cover classes of the Desolation ecosystem analysis area (1939).

CODE	CANOPY COVER DESCRIPTION	ACRES	PERCENT
≤40	Live canopy (crown) cover of trees is 40 percent or less	5,284	8
41-55	Live canopy cover of trees is between 41 and 55 percent	4,108	6
56-70	Live canopy cover of trees is between 56 and 70 percent	16,329	23
>70	Live canopy cover of trees is greater than 70 percent	40,848	59
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,085	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area.

Canopy Layers

Table 42 summarizes historical forest canopy layers for the Desolation ecosystem analysis area. It shows that the predominant situation in 1939 was a two-layer stand structure (64% of the analysis area), followed by single-layer forest (25%). A highly-complex layer structure (three or more canopy layers) was relatively uncommon, occupying only 6 percent of the analysis area.

Table 42. Forest canopy layers of the Desolation ecosystem analysis area (1939).

CODE	CANOPY LAYER DESCRIPTION	ACRES	PERCENT
1	Live canopy (crown) cover of trees occurs in l layer (stratum)	17,531	25
2	Live canopy cover of trees occurs in 2 layers or strata	44,830	64
3	Live canopy cover of trees occurs in 3 or more layers or strata	4,208	6
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,085	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area.

Forest Size Classes

Table 43 summarizes historical forest size classes for the Desolation ecosystem analysis area. The predominant overstory size class in 1939 was a mixture of small and medium trees ranging from 9 to 32 inches in diameter (50% of the analysis area), followed by medium trees (21 to 32 inches DBH; 20%) and then small trees ranging from 9 to 21 inches in diameter (15%). Forest overstories dominated by seedlings (trees less than 1 inch DBH), saplings (trees from 1 to 5 inches in diameter) or poles (5 to 9 inches in diameter) were rare, occupying less than 8 percent of the analysis area in aggregate.

Table 43. Forest size classes of the Desolation ecosystem analysis area (1939).

CODE	SIZE CLASS DESCRIPTION	ACRES	PERCENT
1	Seedlings; trees less than 1 inch in diameter	0	0
2	Seedlings and saplings mixed	30	<1
3	Saplings; trees from 1 to 4.9 inches in diameter	1,722	2
4	Saplings and poles mixed	1,746	2
5	Poles; trees from 5 to 8.9 inches in diameter	2,272	3
6	Poles and small trees mixed	1,356	2
77	Small trees; trees from 9 to 14.9 inches in diameter	5,355	8
88	Small trees; trees from 15 to 20.9 inches in diameter	4,897	7
8	Small trees and medium trees mixed	35,029	50
9	Medium trees from 21 to 31.9 inches in diameter	13,856	20
10	Medium and large trees mixed	307	<1
11	Large trees from 32 to 47.9 inches in diameter	0	0
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,085	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area. Forest size classes are based on the predominant situation and are seldom pure – the pole size class (5), for example, has a predominance of pole-sized trees (50% or more) but may also contain minor proportions of other size classes. For multi-layered stands, this information pertains to the overstory layer (tallest stratum) only.

Forest Structural Stages

Table 44 summarizes historical forest structural stages for the Desolation watershed. It shows that the predominant structural stage in 1939 was old forest (49% of the analysis area consisted of either of the two old forest structural stages), followed by stem exclusion closed canopy (18%), young forest multi strata (16%) and then stand initiation (16%). The understory reinitiation and stem exclusion open canopy structural stages were rare, occupying 2 percent or less of the area.

Table 44. Forest structural stages of the Desolation ecosystem analysis area (1939).

CODE	STRUCTURAL STAGE DESCRIPTION	ACRES	PERCENT
OFMS	Old Forest Multi Strata structural stage	15,390	22
OFSS	Old Forest Single Stratum structural stage	18,946	27
SECC	Stem Exclusion Closed Canopy structural stage	12,641	18
SEOC	Stem Exclusion Open Canopy structural stage	72	<1
SI	Stand Initiation structural stage	7,427	11
UR	Understory Reinitiation structural stage	1,184	2
YFMS	Young Forest Multi Strata structural stage	10,909	16
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,085	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area. See Veg Table 8 for information about structural stages.

Landscape Patches

Table 45 summarizes patch characteristics for historical cover types and structural stages for the Desolation analysis area. Douglas-fir had the most cover type patches in the Desolation landscape, followed by grand fir and then lodgepole pine. The largest patches, however, were those comprised of lodgepole pine, averaging 434 acres in size and ranging up to 18,126 acres. In terms of cover type characterization, lodgepole pine forest would be considered the "matrix" forest type.

Table 45 shows that the *stand initiation* structural stage accounted for the largest *number* of forest patches in the Desolation watershed in 1939, followed by *old forest single stratum* and then *young forest multi strata*. However, the *largest* patches were those comprised of old forest (*old forest multi strata* and *old forest single stratum*), averaging 214-223 acres in size and ranging up to 4,840-6,271 acres. In terms of landscape characterization, *old forest* would be considered the "matrix".

Table 45. Patch analysis for the Desolation analysis area (1939 conditions).

	Patch Type	Number of Patches	Minimum Patch Size	Average Patch Size	Maximum Patch Size
Cover Type	CA	23	1	348	6,400
	CB	0	0	0	0
	CD	85	3	152	3,087
	CE	10	3	48	273
	CJ	0	0	0	0
	CL	59	1	434	18,126
	CP	35	4	103	1,421
	CT	22	5	68	502
	CW	80	6	150	2,027
	CX	20	12	119	471
	Total	334			
Structural Stage	NF	85	1	36	589
	OFMS	72	9	214	6,271
	OFSS	85	3	223	4,840
	SECC	69	1	183	2,815
	SEOC	3	19	24	31
	SI	117	1	63	838
	UR	12	11	98	423
	YFMS	73	1	149	2,009
	Total	516			

Sources/Notes: Based on information contained in the 39veg database (see appendix 1 for more information), including private land located within the analysis area. Refer to Veg Table 16 for a description of the cover type codes; refer to Veg Table 19 for a description of the structural stage codes. Patches were calculated using the UTOOLS program (Ager 1997).

Forest Disturbances

Table 46 summarizes historical forest disturbances for the Desolation watershed. It shows that the analysis area had little or no evidence of recent disturbance in 1939, or at least none that could be distinguished on the historical aerial photography. Although the effects of long-past wildfire were evident in the landscape pattern of the watershed (the distribution and configuration of

lodgepole pine patches, for instance), there was no recent disturbance other than a minor amount of timber harvest (<1% of the analysis area affected by partial cutting). Although insects and diseases were not specifically noted, they were important disturbance agents historically (Veg Table 14).

Table 46. Forest disturbances of the Desolation ecosystem analysis area (1939).

CODE	DISTURBANCE DESCRIPTION	ACRES	PERCENT
CC	Recent clearcut timber harvest	0	0
CR	Old clearcut, now regenerated	0	0
FI	Evidence of recent fire	0	0
PC	Recent partial cutting timber harvest (selection, seed-tree, etc.)	182	<1
PR	Old partial cut, now regenerated	0	0
SS	Evidence of sanitation/salvage timber harvest	0	0
TH	Evidence of a thinning silvicultural treatment	0	0
Blank	No discernible evidence of disturbance (on aerial photographs)	66,387	95
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,085	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area.

What impact did disturbances have on tree mortality in the Desolation watershed? Table 47 summarizes overstory mortality for the Desolation area. Not unexpectedly, it shows that disturbances had little or no impact on forest conditions, as least when using overstory tree mortality as a criterion of impact. Ninety-six percent of the analysis area had forests with low overstory mortality (10 or fewer dead trees per acre) in 1939 – which includes all of the forested area, since the remaining 4 percent of the Desolation watershed was not forested.

Table 47. Forest overstory mortality of the Desolation ecosystem analysis area (1939).

CODE	OVERSTORY MORTALITY DESCRIPTION	ACRES	PERCENT
L	Low overstory mortality; 10 or fewer dead trees per acre	66,569	96
M	Moderate overstory mortality; 11-20 dead trees per acre	0	0
H	High overstory mortality; 21-60 dead trees per acre	0	0
V	Very high overstory mortality; greater than 60 dead trees/acre	0	0
Other	Non-vegetated and non-forested cover types (see appendix 1)	3,085	4

Sources/Notes: Summarized from the 39veg database (see appendix 1 for more information). Acreage figures include private land located within the analysis area.

Fire and Fuels

To determine how a future forested setting may react to disturbance, a basic understanding is needed of the disturbances with which vegetation evolved. In the case of fire, we need to know what is the natural fire disturbance regime. Fire regimes are generally defined by some combination of fire intensity and frequency. For natural fire regimes, this is defined in a historical sense, generally pre-1900's (Agee, 1996). Agee (1996) identifies a generalized system for classifying fire regimes into high, mixed, and low categories of fire severity (although this system uses similar naming structure, it is not the same system as

defined by the Burned Area Emergency Rehabilitation process). Low severity fire regimes typically had low intensity, frequent fires. High severity fire regimes had infrequent but stand replacing fires, and the mixed severity fire regimes (also called mixed severity) had complex combinations of high, low, and mixed severity fires.

A strong correlation exists between Potential Vegetation Groups and the natural (historic) fire regimes, due to the relative constancy of climatic conditions and physical characteristics of the sites, as well as the plant species likely to occur by seral stage. The three PVGs of forested vegetation display the three generalized fire regimes discussed above. Historically, low severity fire regimes probably dominated the Dry Forest Potential Vegetation Group, high severity fire regimes were prevalent in the Cold Forest Potential Vegetation Groups, and Moist Forest Potential Vegetation Group were subject to the more complex, mixed severity fire regime. Historic Fire Regimes and related acreages are summarized in Table 48.

Table 48. Summary of Historic Fire Regimes for Forest Potential Vegetation Groups.

PVG	FIRE SEVERITY REGIME	AVERAGE FIRE RETURN INTERVAL (YEARS)	ACRES
Dry Forest	Low	3-20 yrs.	16,936
Moist Forest	Mixed	25-250 yrs.	24,918
Cold Forest	High	75-300 yrs.	23,429

The low severity fire regime for the Desolation analysis area is expected to have naturally been present on 16,936 acres or 26 percent of the area. A fire history study done in the Blue Mountains in 1994 specifically identifying sites in the warm/dry potential vegetation groups, located a study plot near the Desolation Analysis Area. This study indicated a mean fire return interval of 9.9 years, in a Douglas-fir/pinegrass plant association, with a fire return interval range of 3-20 years (Maruoka, 1994).

The mixed severity fire regime for the Desolation Analysis Area is expected to have naturally occurred on 24,918 acres or 38 percent of the area. The more complex mixed fire regime results in a wide variation in the range of years in the mean fire return interval. Arno (1980) indicated a range of 25-250 years in the grand fir stands in the northern Rocky Mountains. In a fire history study closer to the Desolation Analysis Area, Bork (unpublished) found mean return intervals of 50-200 years in grand fir stands. The wide variation is generally considered to be a result of topographic settings and aspect which modify the fire regime within these more mesic sites. The likely result in this fire regime is a mosaic of seral stages, stand compositions and stand densities. Although many stands within this group would be highly susceptible to crown fire, a natural variation in stand structure and composition would limit the extent of these events.

The high severity fire regimes for the Desolation analysis area are expected to have naturally occurred on approximately 23,429 acres or 36 percent of the area. These areas are likely to be the least impacted due to past management practices. As the fire return intervals were naturally long, extending the interval between fire events through fire suppression would have lesser effects in these areas. Other management activities, such as timber harvest, have occurred to a lesser extent in these areas. When fire did occur naturally in this regime area, it was often stand replacing, even if the fire intensities were not that great, because of the low resistance to fire in the tree species found in these areas, e.g. subalpine fir, lodgepole pine, and Engelmann spruce. Mean fire return intervals of 75-300 years are likely, and a wide variety of age classes in areas discernible across the landscape are likely to result.

Understory and Non-Forest Botanical Resources

Floristic Richness

A comparison of introduced species between the Desolation Watershed and other areas on the Umatilla National Forest shows:

Ratio Native:Introduced Species in Desolation Watershed:	7.49 : 1
Ratio Native:Introduced Species on the NFJD Ranger District:	7.16 : 1
Ratio Native:Introduced Species on the Umatilla National Forest:	5.65 : 1

(1997 plant numbers)

The Desolation watershed has a larger proportion of natives to introduced plants than the North Fork John Day Ranger District or the Forest as a whole. This indicates that the watershed is still in a more "pristine" condition as far as current species composition is concerned. The Botanical Resources Program started tracking relative cover after most of the surveys in this watershed were completed, so the cover proportions of natives to introduced plant species is not known.

No baseline data exists for the community composition and plant species present before white settlement. The earliest reference available is photo interpretation from 1939 aerial photos, which is approximately 110 years after the first significant impacts from Euro-American encroachment (removal of beaver) and well after the worst of the grazing degradation. These are of only limited use. While stand composition can be estimated, and any recent fires, road building, or logging can be detected, it is impossible to determine the cover or composition at the scale of shrubs, forbs, or grasses.

Occasional mention of plants is made in the General Land Office survey notes, settler's and early explorer's diaries, and other historic documents, but these sources are widely scattered, and thus not readily available. Very few of these authors were botanists, so what mention of plants there is tends to be of the larger, showier, and namable plants (i.e., trees and shrubs), and the mention was by common rather than scientific (Latin) name. This makes it hard to interpret because many of the common names have changed in the last 100 years.

The best source of accurate historic data for plant species that were present is old herbarium records from the early explorers and botanists. These records are scattered across the United States and Europe, and it may be at least a decade or two before databases are in place to query plants for specific herbarium voucher locations.

The combination of logging and the exclusion of fire from the Blue Mountains has allowed the once open park-like stands of large ponderosa pines that the settlers so admired to progress to thick, overstocked stands of pine and fir or only fir, which are less drought tolerant and succumbs to insect attack during drought. Some areas have changed so much in the last 200 years that looking at them now gives no clue as to what they once were like. The loss of beaver by over-trapping by the early 1800s undoubtedly had extensive repercussions in plant community types, structure, and extent. Beaver dams, along with the riparian areas and meadows they helped create, slowed runoff, stored water, trapped sediment, stored nutrients for aquatic and later terrestrial life forms, and created important riparian habitat for wildlife that is otherwise in short supply in a region this dry.

Not only are the proportions of introduced grass species high (see Current Conditions), their overall cover is a large proportion of the total grass cover. It is not uncommon to find drier meadows composed of *Poa pratensis* (Kentucky bluegrass), and slightly moister ones completely dominated by *Alopecurus pratensis* (meadow foxtail), both introduced species.

When the Blue Mountains were first settled, the bunchgrasses were so thick that cattle could survive the winter without being fed hay. As more domestic ungulates were imported and the lower meadows were overgrazed, the high mountain meadows took on an increased importance as summer range. With the range open to all by law, competition led to races to be first up to the mountain meadows after snowmelt, and since occupation meant possession, herders and ranchers were unwilling to move their stock until nothing was left but dust and rock.

By the 1880's, the range was severely degraded, and by the mid to late 1890's, range wars broke out over control of grazing. By the 1930's one cattle owner commented "when the first settlers came to the country there was an abundance of fine grass. The valleys were covered with tall meadow grass that was cut and stored for winter feed. The open hillsides all had a heavy stand of bunchgrass and scarcely any sagebrush. Now, it was all cheatgrass and scablands" (Langston, 1995). The few native grasses that survived this onslaught have been further displaced by competition from non-native grasses used in attempts to revegetate the degraded areas.

The number of riparian obligate plants (including most of the many sedges) found in the watershed is very low, only 30 out of 723 species, or only a little over 4 percent. There are many odd aquatic plants that only show up in and along the edges of ponds, lakes, and creekside pools, and even the most common of these are either very rarely encountered or absent from the watershed. Some of these, such as *Sagittaria spp*. and many of the small "duckweeds", provide valuable wildlife food. Lack of habitat is part of the reason--with the loss of beaver dams, much of their habitat was also lost.

There is some potential habitat left, but the streamsides and pond edges are usually too unstable or trampled to support them: Lost Lake's margins and bottom have been altered with heavy machinery and bentonite. Most of these plants have tiny seeds designed to get caught in the mud on birds feet and be transported between potentially distant wet habitats, so if conditions are right they can spread into appropriate habitats. Without baseline data of plants present in pre- or early settlement times, it can't be absolutely shown that these plants were present, but it is highly likely that they were, and if so, they have been lost over time with changes in management.

So what was the historic variability in floristic biodiversity? How does present plant composition vary from this? With the available information these questions can't be fully answered.

Culturally Significant Plants

As mentioned above, there is virtually no written information available about what and how many plants were present in the Desolation watershed in pre-settlement times. There was, and probably still is, a rich oral tradition and intimate knowledge of the plants present among the Native American communities that have lived in this area for tens of thousands of years. Clues to pre-white settlement usage patterns of the areas can be found in archaeological sites present in the watershed, and by tentative extrapolation of what plants are present now, how widespread might they have been, and what uses are known for them.

One hundred and nine species of plants known from general references for food purposes are found within the watershed. This list does not include many "minor" plants which were supplementary to the Native Americans' diets because of small size of seed, fruit, or root, difficulty of collection, limited plant distribution, limited use, maturity at a time when a major food plant was being harvested, or simply because there is no written documentation that they used the plant for food.

Plants helped shape the cultures of the people and played a large part of the subsistence of Native Americans. On the Columbia plateau, 50-70 percent of food came from gathering roots, berries, and seeds (only 30-50 percent came from hunting and fishing: Hunn, 1981, in Ackerman, 1995). The Columbia plateau was a major trade area, linking the coastal, inland, and Great Plains people; surplus food, basketry and other handmade items were important trade commodities (Langston, 1995, Ackerman, 1995).

Plants also had uses other than food. Ethnographic data of traditional cultures shows that the people had some use for almost every plant that grew in their territory. Most plants had some medicinal use, and in cultures without stores, plants were also used for houses, mats, baskets, containers, tools, hunting equipment, clothing, fuel, personal hygiene, games, cordage, boats, and almost any other physical need or activity of the people. Plants often figured prominently in or were part of the religion and ceremonies.

Noxious Weeds

Since all but one of our noxious weeds are plant species introduced after settlement from other continents, and the one "native noxious weed" is only a problem with disturbance under ideal conditions (which aren't present within the watershed), there were essentially no noxious weeds in the watershed before white settlement.

Historically-listed and Presently-listed Sensitive Plant Species

The historic extent and frequency of our sensitive plant species is unknown. There is no baseline data to compare our current populations to, and virtually no scientific literature and very little anecdotal knowledge of the effects of management activities or changes in community composition on our presently or historically listed sensitive plant species. In addition, some plant species may have been extirpated from the area or became completely extinct before any plant surveys were done in the area.

Fish and Aquatic Habitat

Historical Data

The earliest data available at this writing came from surveys done by ODFW in 1963 & 1964. Information available includes area of spawning gravel, pool counts, and pool/riffle ratios (Table 49). Because the protocol used to gather the information is not known at this time, it is not now advisable to make direct numerical comparisons to more recently collected data. It might be feasible to compare ranking of streams, based on quality of habitat parameters, between these earlier and more recent surveys.

Table 49. Historical Stream Survey Data.

DESOLATION CREEK WATERSHED DATA FROM 1963 - 1964 ODFW SURVEYS		
STREAM	RIFFLE TO POOL RATIO (PERCENTAGE)	POOLS/MILE
Mainstem Desolation Creek	88 to 12	51.8
Kelsay Creek	89 to 11	68.8
Bruin Creek	93 to 7	54.0
Beeman Creek	88 to 12	96.0
Battle Creek	87 to 13	106.3
Sponge Creek	84 to 16	116.7
North Fork Desolation	71 to 29	118.8
South Fork Desolation	77 to 23	85.8

Comparison to Unmanaged Areas

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) assembled stream habitat survey data from a large number of sources and summarized this information by River Basin and by Ecological Reporting Units (ERU's) (McKinney et al, 1996). McKinney et. al. also broke down this information by three stream gradient categories and by management status (managed or unmanaged).

This has proven very useful, as it permits comparison of Desolation Watershed streams and reaches, by gradient category, to their unmanaged equivalents in the same general geographic area. The condition of an unmanaged reach is presumed by some to represent the optimum potential of the system.

A serious weakness of the ICBEMP summaries is that some gradient -- management categories are represented by only one, or very few, surveyed reaches. This is more often true for comparisons to the John Day River Basin than for ERU 6 (the Blue Mountains). For this reason, comparisons in this report most often utilize the ERU 6 values.

PACFISH

In 1995, the USDA Forest Service and the USDI Bureau of Land Management jointly and in consultation with the National Marine Fisheries Service produced a document commonly referred to as "PACFISH" which contains some standards for a variety of aquatic habitat parameters for streams bearing anadromous fish. PACFISH standards have the status of amendments to the Forest Plan, in effect are both Forest Plan and Regional standards.

PACFISH standards (called 'interim objectives" in the PACFISH document) for habitat parameters utilized in this report are reproduced below:

Pool Frequency

Table 50. PACFISH interim objectives for pool frequency (varies by channel width).*

Wetted Width in Feet	10	20	25	50	75	100	125	150
Number of Pools per Mile	96	56	47	26	23	18	14	12
*applies only to low-gradient (<=1%), C-type (Rosgen) channels.								

Large Woody Debris Frequency
Minimum of 20 pieces per mile of wood larger than 12 inches in diameter, and greater than 35 feet long.

Width/Depth Ratio
Maximum of 10, calculated as mean wetted width divided by mean depth. This could be converted to a depth/width ratio as presented in the data summaries produced by the ICBEMP (McKinney et al, 1996) as a minimum of 0.10. However, the Pacfish width/depth ratio was specified as measured in pools (USDA Forest Service, 1994), while the ICBEMP depth/width ratio is specified as measured in riffles. While the width/depth ratios of pools might be useful for evaluating fish habitat quality, the measurements in riffles are more useful from a hydrologic perspective. Stream survey records contain measurements of depth and wetted width of both pools and riffles, so either quality could be calculated, but since Pacfish standards are for low gradient (≤ 1%) C-type channels, they would not apply to most Desolation watershed streams.

Water Temperature
Criteria are:

a) No measurable increase in maximum water temperature.*

b) Maximum water temperatures* below 64° Fahrenheit within migration and rearing habitats, and below 60° Fahrenheit within spawning habitats of anadromous fish.

*Seven-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive seven-day period.

Terrestrial Wildlife

Habitats

Old Forest Habitat

In 1939, approximately 49 percent of the Desolation watershed supported stands of "old forest". Estimated acres of old forest for 1939 are presented in Table 51.

Table 51. Old Forest Acres, Desolation Watershed, 1939.

PVG	STRUCTURAL STAGE	TOTAL ACRES
Cold Upland Forest	OFMS	2,892
	OFSS	3,486
	Total	**6,378**
Dry Upland Forest	OFMS	8,480
	OFSS	6,754
	Total	**15,234**
Moist Upland	OFMS	4,017
	OFSS	8,706
	Total	**12,723**
Grand Total		**34,335**

Dead Standing and Down Wood Habitat
No quantitative information on snags or down wood exists for this area, however, "overstory mortality" was estimated through photo interpretation. All forest polygons were estimated to have "low overstory mortality" (where "low" = <10 trees/acre).

Wetland, Riparian, and Aspen Habitat
Riparian hardwoods may have been much more abundant historically than today, however, very little information on species composition or condition is available.

Roads
Aerial photos taken in 1939 show very few roads. Road impacts to big game and other wildlife were probably minimal until the 1970s, when road construction, associated with timber harvest and recreation intensified.

Big Game Species

Historic accounts of wildlife populations in the Blue Mountains are limited, and sometimes contradictory, particularly in regards to big game populations. Mule deer, elk, black and grizzly bear, pronghorn antelope, cougar and big horn sheep were native to the Blues (Irwin et al. 1994, Gildemeister 1992). Wild goats may have inhabited the steep canyons; but most biologists concur that the species is not probably native to the area. Oral histories collected by Gildemeister (1992) suggest that moose also occupied the area at one time (there was at one time a bag limit for moose in Oregon). Small numbers of bison bones have been recovered in the eastern Blue Mountains, but archaeologists suspect that these old bones got to the area as butchered carcasses via tribal hunting trips or by trade with Rocky Mountain tribes.

By the 1880s, big game populations in the Blues (particularly elk) were beginning to collapse under the combined pressures of market hunting, competition with domestic livestock, and habitat alteration (Irwin et al. 1994, Langston 1994). By the turn of the century, both elk and mule deer had been nearly extirpated from all of northeast Oregon (Skovlin 1991, Langston 1994 , ODFW 1936). In response, the newly organized Game Commission closed all elk hunting seasons, and imposed a $1000 fine for poaching (ODFW 1936, Irwin et al. 1994).

With hunting banned, The Commission then set about re-establishing elk in the Blues. Between 1910 and 1920, transplants of Rocky Mountain elk from Yellowstone National Park occurred in various areas of the Blue and Wallowa Mountains. Transplants met with varying degrees of success, but the infusion of new animals, along with the hunting closure, averted total extinction, and herds eventually began to increase. Elk occupying the Desolation area today are probably decendants of a small group of elk released in the Elkhorn Mountains (south and east of Desolation) and a remnant native herd that managed to survive the late 1800s in roughly the same area.

By 1933, elk numbers were rebounding. Upward population trends continued for elk and mule deer through the 40s, 50s and 60s. While increased numbers of huntable animals pleased sportsmen and tribal hunters, controversy quickly developed between game managers and local ranching communities (Irwin et al. 1994). The Game Commission was aware of the problem as early as 1936, when a report to the Governor stressed the need for both "sufficient winter range" for the elk and "equitable" methods of compensation to land owners for damage to their alfalfa and hay crops.

Competition between wild ungulates and domestic livestock, and conflict between public and private interests continued for decades, and eventually led to the establishment of the Bridge Creek Wildlife Management Area south of Ukiah, Oregon, in 1961. Situated south of Camas Prairie, on a very large open plain which falls off to form the headwaters of several North Fork John Day tributaries, the Management area provides almost 15,000 acres of winter habitat for elk and deer.

Other Game Species, Furbearers and Predators

Almost all other big game and fur-bearing species in northeastern Oregon (with a few noteable exceptions) have declined since the late 1880s. As early as 1936, researchers stated that "wild life is diminishing in Oregon in spite of the fact that the natural habitat, for the state as a whole, is capable of sustaining many times the present wild life population"

A review of census summaries from a 1936 Oregon Game Commission report shows low numbers for the Umatilla National Forest of many species known to occur in the Desolation drainage. Beaver, marten, otter and mink are mentioned as species whose numbers had substantially declined by 1936, (State Planning Board 1936). All of these species have historically occupied the Desolation area, and still do, although numbers, distribution and population health are largely unknown. Evidence of past and present beaver activity is found along the mainstem and a few tributaries of Desolation Creek.

The wolverine, although probably never abundant, most likely occurred within the Desolation drainage. Because the wolverine is largely a carrion eater, the decimation of big game herds in the late 1800s may have also led to declines in wolverine numbers by the turn of the century. Habitat alteration, and perhaps more importantly, increased human disturbance have resulted in continued habitat degradation for this species in the Blue and Wallowa Mountains.

Lynx may also have occurred in the western Blue Mountains, as evidenced by tracks found on the Malheur NF in the early 1990s. Like the wolverine, lynx are wide-ranging predators with very large territories and an aversion to humans. Unlike the wolverine, however, the lynx preys on smaller mammals, is not generally a carrion feeder, and is more likely to use young-forest habitats.

Grizzly bears and wolves occurred in the Blue Mountains into the early 1900s. The last confirmed grizzly shooting in northeastern Oregon occurred in the Wallowa Mountains in the 1930s (C. Puchy, ODFW, pers. comm. 1995). ODFW has considered the wolf extirpated from the Blues since the early 1900s; however wolf and wolf/hybrid sightings continue to be reported occasionally.

Mountain goats were released in the Elkhorn Mountains (southeast of Desolation) in the 1980s (ODFW, pers. comm.). There have been several sightings of goats since that time, including a confirmed sighting of two goats in the adjacent North Fork John Day Wilderness in August, 1994 (M. Hampton, Umatilla NF, pers. comm.). One goat was seen near Pearson Guard Station in August 1998, and two were seen in the North Fork John Day Wilderness in November, 1998 (K. Hancock, Umatilla NF, pers. comm., Aug. 1998).

The 1936 state report also included records of predators taken on and adjacent to the National Forests, for the years 1933-1935. For the Umatilla National Forest, 4,781 coyote, 31 bobcat, 138 black bear, and 2,196 porcupine were killed by government hunters, Forest Service personnel, and private land owners. Curiously, no mountain lion were reported taken on the Umatilla National Forest during that period (5 were reported taken on the Malheur, 1 on the Whitman) compared to more than 200 taken on Forests west of the Cascades during the same period.

Beaver
The British Hudson's Bay Company first established a monopoly on the beaver fur trade in the Northwest. Where the company controlled an area, beaver harvest occurred on a fairly sustainable basis, but with competition from the American's Northwest Company, both companies fiercely overtrapped. The Hudson's Bay Company decided on a policy of rapid overtrapping south of the Columbia River to create a "fur desert" to keep the Americans out. Within 30 years of the white traders first coming to the Blue Mountains, the beaver had nearly vanished (Langston, 1995).

Small Mammals, Birds, Reptiles and Amphibians

With the exception of Gildemeister's 1992 oral history accounts, little information is available on the occurrence or relative abundance of non-hunted vertebrate species. Henry Spaulding's 1839 accounts include references to occurrence of bald eagles in the Wallowas during the summer months, where the birds fed on spawning salmon. This summer presence suggests a nesting population. Information collected by biologists on the neighboring Ochoco NF included references to eagles and hawks being "common" around the turn of the century. Bounties were still being paid on golden eagles well into the 1900s.

Some records are available for upland game birds. Valley and mountain quail, ruffed, blue and sharp-tailed and sage grouse are native to the Blue Mountains, and all may have occurred in the Desolation drainage. Accounts in Gildemeister recall abundant populations, with market hunting prevalent. In 1910, for example, a dozen sharp-tail grouse brought $3.00 at the Union Hotel (Gildemeister 1992).

Market hunting in the late 1800s and early 1900s was responsible for enormous losses in upland gamebird populations in many parts of the US, and probably impacted species in the Blue Mountains. The sharptailed grouse was almost extinct by 1936 (State Planning Board 1936), and has since been extirpated from the Blue Mountains. Re-introductions were begun in the 1990s.

Historic information for other non-hunted birds, small mammals, reptiles and amphibians is almost totally anecdotal. As noted in the Ochoco NF Viable Ecosystems Management Guide (Ochoco NF, 1994), higher water tables, more extensive riparian vegetation and aspen groves, and more beaver activity no doubt provided more suitable habitat for amphibians, songbirds, and riparian-associated small mammals such as shrews and mink.

Threatened, Endangered, and Sensitive Species

Bald eagles were probably more common in the drainage historically, as large diameter trees and salmon were more abundant than today. Peregrine falcons were probably never common, as the limited amount of nesting habitat has not changed in availability or condition. Undisturbed riparian habitats no doubt supported higher densities of amphibians. Extensive stands of old forest, more aspen, and periodic fires would have contributed to higher (albeit dynamic and somewhat transitory) populations of the various woodpecker species now residing on the Sensitive list. More old forest and healthier riparian habitats probably supported higher densities of marten as well. Wolverine and lynx, at the southern limit of their ranges, were probably never “abundant” in this area. However, before roads, timber harvest livestock grazing, hunting and OHV use changed the character of the watershed, much of the Desolation drainage probably provided good foraging habitat for these wide-ranging carnivores.

Management Indicator Species

All Management Indicator Species were present historically, and with the exception of elk, were probably more abundant in 1939 than they are today, based on the comparison of potential habitats found in Synthesis and Interpretation.

Mining

Mining of placer gold deposits began in northeastern Oregon in 1862. The principal gold-mining regions of Oregon owe their discovery to the wave of prospectors that invaded California in 1849, and from there spread through all the mountain areas of the West.

Rangeland Resources

Both the Indian and Central Desolation allotment areas have been used for grazing domestic livestock since the early 1800s. From 1890 until about 1905, some 2000 horses ran yearlong on Case Ridge and in the Indian Creek drainage (immediately to the south of Desolation). About 6000 sheep and numerous cattle also grazed the area during the summer and early fall during the same period. These conditions prevailed until 1909 or 1910 when sheep use shifted to other areas and the horses were sold. The dual was extremely heavy, and the year-round use by horses contributed significantly to depleted range conditions, at least in the lower portions of the Desolation drainage. Severe overuse occurred again after the First World War.

Actual use figures are not available for the Indian Allotment prior to 1912, or prior to 1937 for Central Desolation.

Indian Allotment

The Indian Creek Cattle and Horse Association was recognized by the District Forester in Portland in 1913. The association grazed an area which are now the Bully and Indian Units (pastures). There was little change in management of the Indian allotment until a 1947/48 range inventory revealed overstocking and downward trends in most forage species. As a result of the survey, a new management plan was adopted by the Association in 1948. The same year, portions of Desolation Meadows, which had long been used by sheep, was opened to cattle on a temporary basis. The meadows were formally added to the allotment in 1950.

In 1962, a deferred rotation system of grazing and turn-on dates was determined by range readiness, and significant improvement in the condition of the range began. The Battle Creek Unit was transferred from Central Desolation to Indian Creek in 1966. In 1984 a 4-pasture rest rotation grazing system was adopted, meaning a different pasture was rested each year. In 1991, the grazing system was changed again with rotation from Bully/Indian Units to Battle/Meadows Units, then back to Bully/Indian Units ,with no rest and a modified deferment. The current system (see Current Conditions) was adopted in 1996.

Table 52. Summary of Use Records - Indian Creek Cattle Allotment

YEAR	NF AVERAGE CATTLE NUMBER	PRIVATE AVERAGE CATTLE NUMBER	SEASON	AVERAGE HEAD MONTHS (NF ONLY)	TOTAL ACRES
1912 - 1917	601	--	04/05-10/31	3,906	----
1918 - 1922	928	--	05/01-10/31	5,572	---
1923 -1949	868	57	05/16-10/31	4,757	56,986
1950 -1954	702	45	05/20-10/31	3,658	62,537
1955 - 1965	674	45	06/01-10/15	3,072	62,736
1966 - 1983	865	32	06/01-10/15	3,451	86,760
1984 - 1995	825	51	06/01-09/30	3,343	86,760
1996 - 1997	814	74	06/16-09/30	3,108	68,706

There are virtually no records for this allotment on condition and trend prior to a 1947 analysis, when a survey crew classified the allotment as follows:

- 80% of area in poor condition
- 19% of area in fair condition
- 1% of area in good condition
- 84% of entire usable range was trending downward; 16% trending upward (vegetation types trending downward were mostly open timber, grassland, and sagebrush types)
- 70% upward trend in the meadow type

The survey recommended a 40 percent reduction in cattle. The forest supervisor attempted to carry out the reduction in 1954 but permittees appealed. The two parties eventually compromised with a reduction in season and a full-time range rider. In 1949, Desolation Meadows, previously classed as good with an upward trend, was starting to show signs of a downward trend.

A 1953 allotment inspection reported most meadows at 100 percent utilization. In 1954, use in the Desolation Ridge and Creek areas was reported as extremely heavy.

Inspections for 1954 - 1956 reported that Kelsay Creek was under-used due to poor distribution.

In 1956, Battle Creek use was heavy but not to the extent of 1955, Lower Sponge Meadow was overused, and Desolation Meadows was considered underused.

A detailed inspection in 1958 reported on six creek/meadow areas within the Desolation watershed. Summarized results included the following:

- Summit Camp - Denuded desirable vegetation on adjacent dry areas, use on meadow beyond that considered proper.

- Upper South Fork Desolation Meadow - Adjacent hillsides denuded, heavy rains the past summer starting erosion channels.

- Sponge and Howard Creeks - Tufted hairgrass meadows along these streams from moderate to heavy.

- North Fork Desolation Meadow - Use is like in former years, the dry parts overused and the wet parts under used. There is active cutting on stream banks along creek in meadow.

- Big Spring Meadow - Less than 10% use. Lack of use difficult to explain.

- Starveout Creek - The lower meadows on waived land were heavily overused, upper meadows moderate to light.

As a result of the above inspection, water spreading was recommended in drier areas, and draining in wet areas of Desolation Meadows to increase forage production. Some water spreading ditches were built around 1961.

Based on an analysis conducted in 1961, the allotment was classified as follows:

- 6% of the area in very poor condition
- 18% of the area in poor condition
- 66% of the area in fair condition
- 10% of the area in good condition

Between 1960 and 1965, permittees cooperated in the construction and betterment of more than 50 miles of fence, and about 25 water developments. Several revegetation projects were also completed during this time including seeding on Sharps Ridge. In 1968, '69, and '70, 15-day extensions were approved. based on utilization data (the key areas were mostly upland sites). The extensions did not result in overuse of the forage resource.

In 1970, heavy use was reported on Desolation Creek outside of the Meadows, South Fork Desolation Creek below South Fork Meadows, Summit Camp, and in Kelsay Meadows as a result of poor distribution and late removal of cattle from units (moderate use overall). In 1973, overuse was again recorded on Kelsay Meadows. Reconnaissance utilization mapping in 1971, '73, and '74 showed heavy use on Desolation Creek and some areas of over-use.

Central Desolation Allotment

The Central Desolation Cattle Association was also formed in 1913. In addition to the land within the current allotment boundary, the area grazed from 1946 to 1966 included what is now Battle Unit of the Indian Creek, and most of the private land. Approximately half of the Desolation watershed is within this area. In 1946, 46,000 acres carrying four bands of sheep were added to the allotment, but records do not give the location. At the same time, the allotment was transferred from sheep to cattle. A 4-pasture deferred rotation system was adopted in 1966 (AMP). In 1981, a 5-pasture rest rotation system was established, which is still in effect today.

Table 53. Summary of Use Records - Central Desolation Allotment (NF & Private)

YEAR	AVERAGE NUMBER OF CATTLE	SEASON	AVERAGE HEAD MONTHS	USABLE ACRES
1937 - 1944	719	05/16-10/31	3,794	13,357
1946 - 1951	1,207	05/16-10/31	6,643	44,604
1952 - 1957	1,222	05/21-10/20	6,110	44,604
1958 - 1963	1,215	06/01-10/20	5,661	44,604
1964 - 1965	1,204	06/01-10/20	5,722	25,217
1966 - 1970	432	06/01-09/30	1,728	14,375
1971 - 1975	514	06/01-09/30	2,056	16,997
1976 - 1997	445	06/01-09/30	1,780	11,002

Within the Desolation Watershed, very little historic information exists on forage utilization, condition and trend, or improvements, since most of the Central Desolation Allotment was and is under private management.

In the 1951 AMP (may have been a 1946 analysis) a condition and trend analysis was conducted on the allotment. The results follow:

- Meadow type: 36% poor, 64% fair (62% up, 2% unchanged, 36% down)
- Open grassland type: 100% poor (30% up, 3% unchanged, 67% down)
- Browse type: 97% poor, 3% fair (77% up, 0% unchanged, 23% down)
- Open timber type: 69% poor, 31% fair (21% up, 66% unchanged, 13% down)

The problem indicated in the 1951 AMP was poor distribution. Concentration areas were used too heavily, while other areas showed under use. Lower Kelsay Creek, Kelsay Creek, Park Creek, Battle Creek, and Bruin Creek were under used. This was due mostly to inaccessibility. Cattle remained in many areas season long, including Jones Meadow, Park Meadow, and Lower Kelsay Meadow, giving the land no opportunity to improve.