Chapter 5
Presettlement and Existing Conditions

5.0 Introduction

This chapter describes reference conditions and processes (natural or pre-European settlement), existing conditions, and identifies important departures of condition or process in the assessment area. Key findings are also summarized in Chapter 6.

5.1 Aquatic Resources

5.1.1 Geology

The Slate Creek Watershed is underlain by the extrusive Columbia River basalts, intrusive andesitic basalts, and the intrusive granitics of the Idaho Batholith (see Map 3). The layered appearance of the canyon walls in Lower and Main Slate Canyon is a feature of the Columbia river basalt flows, as are the flat surfaces and deep basalt soil in the North Fork Slate Creek area.

A major area of geologic uplift comprises the main ridge extending from Slate Point to Nut Basin The ridge contains igneous and sedimentary substrates raised and metamorphosed by the collision of an oceanic plate and continental plate. The contact zone is commonly referred to as the suture zone. Unique to this zone is extended areas of limestone that represent a piece of an ancient coral reef rafted in on the oceanic plate. There are also major geologic faults and landslide derived terrain associated with the suture zone and the contacts between the limestone, basalt and metamorphic formations. Steep slopes also contribute to locally high landslide risk in Lower and Main Slate Canyon.

The eastern and southern portions of the Slate Creek watershed are situated on the intrusive granitics of the Idaho Batholith which contact the basalts near Rocky Bluff, and the metamorphic rocks along the west facing slopes of Little Slate Creek. Precambrian metamorphic rocks of the Belt Supergroup, mostly quartzite, occur in upper main Slate Creek.

Most mineralized areas in the Slate Creek watershed are associated with the granitic rocks of the Idaho Batholith. In many cases the mineralization occurs near contact zones between the batholith and other rock units. The placer golds of the Florence Basin area are believed to be associated with a contact between the ancient surface rocks and the batholith as the batholith pushed upwards. The older rocks are believed to have eroded away long ago. The Florence placers could have been the top of the system, with richer veins still existing beneath the surface or the remnants of the mineralized contact zone with most of the gold already extracted by the historical placer mining that occurred.

Numerous faults trend from southwest to northeast in the granitic zone. These are often the sites of stream channels and alluvial deposition. This has resulted in a low relief landscape of highly dissected rolling hills in the Florence basin. This low relief terrain with numerous alluvial valleys is unique within the lower Salmon River subbasin. Some of the gold found its way to these creeks and was transported and deposited in stream channels.

The first gold discovery and subsequent rush occurred in 1861. The rush was short lived, lasting less than five years. In the 1890s and the 1930s there were other small rushes that occurred in this area. All of these gold rushes combined to create significant disturbances of many stream valleys (See Map 14). Quartz veins around Florence were also worked for gold as early as 1872, but were not productive compared to the placer deposits.

Peat is an organic material that generally forms in marshes and swamps from the dead, and partly decomposed remains of the marsh vegetation. The swampy conditions create an anerobic environment that makes it

possible for the rate of accumulation to exceed the rate of decay. The Florence Basin was a suitable environment for the formation of peat. Peat deposits were extensive at one time in the Florence Basin. The amount of peat was greatly reduced by placer mining, including the drainage systems that were developed to dry out the wet areas to facilitate the mining. (Reed, 1939). Peat deposits are very rare within the lower Salmon River subbasin.

On gentle slopes, a layer of volcanic ash influenced loess overlies the residual soil substrate, derived from the eruption of Mt. Mazama about 7,000 years ago. This surface layer markedly improves soil permeability to water, and water and nutrient retention. On steep slopes this surface layer is mixed with underlying material or has been eroded away.

Landforms in the Slate Creek watershed reflect large-scale tectonic and erosional processes. The canyon breaklands are formed by erosion and stream downcutting. The high elevation ridges have been shaped by alpine glaciation and deep frost action. There are deposits of glacial till and gravels scattered throughout the watershed. The mid elevation uplands have been shaped by uplift and gradual erosion and deposition.

5.1.2 Climate

Climate is a basic element that affects soil development, streamflow regime, and vegetation dynamics. As in the rest of northern Idaho, the climate of the Slate Creek watershed is dominated by Pacific maritime air masses and prevailing westerly winds. Over 85 percent of the annual precipitation occurs during the fall, winter, and spring months. Cyclonic storms moving east from the Pacific Ocean produce long duration, low-intensity precipitation during this period of the year. During winter and spring, this precipitation is often in the form of rain at lower elevations and snow at mid to higher elevations, with persistent fog, cloudiness, and high humidity. The climate during the summer months is influenced by stationary high pressure systems over the northwest coast. These warm, dry systems result in only 10 to 15 percent of the annual precipitation falling during the summer. Elevations in Slate Creek range from about 1560 feet at the mouth to over 7900 feet at Umbrella Butte. Annual precipitation ranges from less than 20 inches at the lowest elevations to about 45 to 50 inches at higher elevations.

Stream and vegetation disturbances in Slate Creek are influenced by relatively short term weather events. Flood events at the scale of the entire watershed are most often associated with frontal rainstorms falling on snow. Such events can occur from December through May. Significant rain on snow events can be expected to occur on a return interval of about once in twenty years. Occasionally, rapid snowmelt in the absence of rain can also produce a flood event. In Slate Creek, this would typically occur in April to June, when air temperatures and warm wind can produce rapid melt. Smaller scale floods can occur in response to localized spring or summer thunderstorms. These events can produce landslides and debris torrents in the breakland streams. They can also result in surface erosion events in the uplands.

Fire frequency and severity are in large part determined by summer weather conditions, such as ignition by lightning, air temperature, humidity, and wind. The most severe and extensive fires occur after periods of prolonged hot, dry conditions. The passage of a dry cold front, with associated winds, can drastically alter fire behavior, increasing the severity of the disturbance. Aside from weather, vegetation conditions and topography also greatly influence fire behavior.

5.1.3 Soils

Soils are the biologically active zone at the interface of earth and atmosphere. Soils regulate movement and storage of energy, water and nutrients. Their physical properties, such as bulk density and texture, affect water holding capacity, hydrologic response, and surface stability. Soil erosion reduces soil productivity and the eroded material may be delivered as sediment to stream channels. Soil compaction alters

runoff patterns and soil water availability and can reduce vegetation growth potential.

Soil Erosion - Presettlement Processes
The dominant erosion processes that have shaped the analysis area have been influenced by geology, landform, and climate. The basalt geologic materials at the western end of the area typically weather into clays and large gravels or cobbles that do not erode readily, except during debris torrents and debris avalanches. The Belt and Suture Zone gneisses, schists, and quartzites that occur mostly in the north half of the area weather into moderately coarse textured soils that erode readily. The well weathered granitics of the Florence basin develop sandy conhesionless soils that are very highly erodible. The high density of streams in this area means that eroded material is usually delivered to a stream. And the low gradient of many channels means that sediment may reside in the channel a long time before moving far downstream. The surface layer of volcanic ash that occurs on gentle slopes does not erode readily.

Map 4 shows areas of high sediment hazard from surface erosion after severe fire or surface soil disturbance associated with logging. About 26,654 acres of this hazard occur, primarily in Lower Slate Canyon, Main Slate Canyon and the lower portions of the North Fork. This is about one third of the area and occurs mostly on steep south aspects that lack a volcanic ash surface layer. Presettlement surface erosion occurred when severe rainfall events, rain on snow, or snowmelt followed wildfire that exposed surface soil. On steep open south slopes, this might have occurred as often as every 5 to 15 years. On north slopes, bare soils were exposed less often because of lower fire frequency.

Map 5 shows areas of sediment hazard from roads or other disturbances that expose soil substrata. These areas erode readily and deliver eroded material to streams efficiently. About 40,431 acres of soils with high substratum sediment hazard occur in the area. This is almost half the assessment area, and is most concentrated in the Little Slate Creek subwatershed. Sediment from historic wildfires and more recent management disturbances is shown in Figure 5.14 for the analysis area. Erosion after fire dominantly affected surface soils, except where debris torrents scoured narrow valleys to bedrock.

Figure 5.15 displays sediment yield as a proportion of 6th code subwatersheds within two classes of percent over base (greater than and less than 30% over base). It shows that the large wildfires of 1889 and 1908 affected a large proportion of subwatersheds, but for relatively short time periods. Flood effects would be magnified when periods of flooding closely followed severe wildfires. Sediment sources were most often colluvium near steep channels that was mobilized in debris avalanches and debris torrents.

Beginning in 1960, road construction and timber harvest have affected a smaller proportion of subwatersheds at any one time, but the effects are modelled to be virtually continuous for the entire forty years since 1960. This is another illustration of the change in nature of sediment yield from a pulse to a press disturbance

Landslides, debris torrents and debris avalanches can deliver large amounts of rock, soil, and organic debris to a stream channel under both natural or managed disturbance regimes. Landslide prone areas and debris torrent prone areas are shown in Maps 6 and 7. Under natural conditions, landslides may be triggered by earthquakes or prolonged soil saturation on susceptible terrain. These are usually highly localized on steep slopes and lower slope positions, and where geologic contact zones create planes of weakness or soil moisture accumulation. The severe flood events that may occur about once in twenty years can trigger landslide activity on the most susceptible sites.

Landslide prone terrain was modeled and mapped on the basis of historic mass wasted slopes, field observations, and modeled relationships between slope steepness, soil properties, moisture regime, and slope failure risk. About 13,805 acres of landslide

prone terrain meet these preliminary model criteria.

Debris torrents scour channels and transport sediment, rock, and organic debris including whole trees down high gradient channels, where the deposits form terraces or fans, or are carried down the larger stream. In natural disturbance regimes, these are typically episodic events associated with severe storms or rain on snow, and may be more common after fire has killed vegetation. An average frequency of 20 years would be likely in the assessment area, primarily in the steep headwalls below about 4,000 feet elevation. They are often highly localized in response to individual storm cells. Areas of shallow soil on steep slopes are the usual initiation point for such torrents, because soils are rapidly saturated and deeply rooted vegetation may be scarce. About 12,478 acres include channels and headwalls subject to debris torrents.

Soil Erosion - Current Processes

Sediment regimes are the erosion processes most changed from presettlement times in the analysis area, primarily due to the extensive road network, and residual effects of extensive placer mining. Priority areas for decommissioning of roads and reduction of sediment sources from roads and mining areas are described in Chapter 7 and Appendix K.

Effects of placer mining on sediment regimes must have been severe in the Little Slate Creek portion of the assessment area and downstream, based on reports of the surface material excavated and washed downstream (Reed, 1939). These episodes occurred in the 1860s, 1890s, and 1930s. We have no data with which to more precisely estimate effects on sediment regimes. Map 14 shows where mining or other historic disturbance is thought to have most directly impacted streams. Evidence of placer mining effects can be seen on Photo 19 (page N-11 in the Appendix, Volume 2).

Effects of road building and harvest as predicted by NEZSED are shown in Tables 5.14 and 5.15. Road construction and harvest accelerated in the 1960s and have continued through the early 1990s. Effects of road building on sediment are largest during the first few years after construction, but continue through the life of the road. Effects are magnified when road cuts and fills and ditches do not revegetate, which is typical of the sterile subsoil in the Little Slate Creek subwatershed. The continuing production of sediment from roads is a press disturbance that is much different than the punctuated pulses of sediment from fire. Between 25-50 percent of subwatersheds have experienced continuously elevated sediment yields for the last 20 years.

Strategies for reducing sediment from roads may consist of full decommissioning, partial decommissioning, improvements, maintenance, or regulation of season or type of use. Map 5 displays roads crossing areas of high sediment hazard. One hundred seventy five miles, or 62 percent of the total miles in the assessment area, cross lands of very high, high, or high-where-wet substratum sediment hazard. An example of surface erosion from roads is found on Photo 13, (page N-8 in the Appendix, Volume 2).

Landslides in recent history include both those occurring with climatic events and additional slides triggered often where roads have concentrated drainage or diverted road drainage onto unstable slopes. Mass wasted material from roads may have more fine sediments and less rock and large wood than under natural disturbance regimes. Mass wasted material from harvest units may have less large wood than under natural disturbance regimes. Road segments within landslide prone lands are shown in Map 7 and past harvest within landslide prone terrain is shown in Map 6. About 22 miles of road occur on landslide or debris torrent prone terrain, mostly in main Slate Canyon. Road 354 crosses toeslopes prone to both landslides and debris torrents, and this road accounts for much of this mileage. The road interrupts the flow of large debris to Slate Creek, but may itself contribute fine sediments where the road fails. More site specific field inventories will usually identify additional small areas of high landslide risk. About 744 acres of timber harvest have occurred on landslide prone

terrain, and 427 acres on debris torrent prone terrain. Some lands are susceptible to both types of mass wasting so some acres of harvest are here doubly accounted.

Some recent slope failures in the analysis area have been associated with poor road drainage and road fill failures. Road drainage systems that fail, or that concentrate water in areas that cannot absorb and transmit the water in the subsoil may increase the incidence of debris torrents above natural. These have occurred primarily in Main Slate Canyon and North Fork Slate Creek subwatersheds. An example of debris avalanches caused in part by road drainage is found on Photo 14 (page N-8 in the Appendix, Volume 2).

Large harvest units or areas of degraded vegetation, where annual grasses or shallow rooted plants have supplanted native communities, may also result in increased debris torrent hazard. The steepest south facing slopes on Lower Slate, Main Slate Canyon, Little Van Buren, and North Fork Slate Creek, may now be at greater risk of soil loss. Cheatgrass or other annuals or weeds are likely to have supplanted more deep rooted perennial species on steep southerly slopes at elevations below about 4,000 feet elevation. About 2,212 acres of this condition exist in the lower portion of the assessment area. See the disturbed grassland cover type on Map 40.

Soil Productivity - Presettlement Processes

Soil productivity is the ability of the soil to support the natural or desired plant communities, growth rates, stocking, and rates of recovery from disturbance. It includes soil physical, chemical, and biological properties.

Soil productivity in the Slate Creek area is highly influenced by the presence of a volcanic ash surface layer deposited about 7,000 years ago. This silt loam layer about 6-20 inches thick is important in holding moisture, organic matter, and nutrients. It is highly permeable to water and is resistant to erosion where it does not overly impermeable subsoils. It is usually much more favorable for plant growth than the underlying subsoils. This surface layer is highly susceptible to compaction and displacement by heavy machinery.

Map 4 shows where the areas of compactible ash surface soils occur. About 37,128 acres occur, typically on gentler slopes or north aspects.

Soil productivity is also influenced by organic matter content which affect moisture and nutrient holding capacity and microbiological activity. Sources of organic matter in presettlement times included litterfall, snagfall, and root decay. Some soil organic matter recruitment occurred in seasonal pulses, and some at less frequent intervals after widfire or insect and disease epidemics. Trees killed by fire or pathogens and fallen to the ground and decayed provided important sites for mycorrhizal activity and nitrogen fixation, and amendment. In areas of frequent fire, soil wood was maintained at low levels. In areas of infrequent severe fire, soil wood levels fluctuated widely over time.

Soil Productivity - Current Processes

About 3,096 acres, or about 8 percent of the lands susceptible to compaction, have experienced tractor logging and/ or dozer piling of slash (see Map 4). Typically 20-40 percent of these harvest areas sustain significant compaction or displacement damage. Compacted skid trails are still evident in these areas. Reduced tree growth is a typical response to severe compaction. Soil compaction may also contribute to increased erosion in skid trails where ruts channel water.

About 283 miles of road occur in the analysis area. Additional undocumented roads from the mining era may exist. Unless they are obliterated, roads represent a permanent loss of productivity. This amounts to about 1,132 acres, or about a 1 percent loss.

Harvest that has removed most trees from a site has the potential to reduce the supply of soil wood, decreasing long term site productivity. Dozer piling and burning of slash can may also reduce woody debris over large areas below levels typical of most natural disturbance processes. About 7,540 acres, or about 9 percent of the area, have

been intensively harvested or dozer piled, with likely loss of historic levels of down wood. Total areas affected may be less than the cumulative effects of the wildfires that would have burned in the absence of fire suppression. Local effects may be more uniformly severe than might occur in a natural burn mosaic.

Fire suppression has resulted in local increases of soil productivity due to organic matter accumulations above historic levels. These areas are vulnerable to loss of organic matter and nutrients from uncharacteristically severe fire (Quigley et al. 1996). This situation exists over about 11,822 acres on dry habitat types where no fuel reduction through harvest or fire has occurred.

Cheatgrass or other annuals or weeds are likely to have supplanted more deep rooted perennial species on steep southerly slopes at elevations below about 4,000 feet elevation. About 2212 acres of this condition, or about 3 percent of the area, exist in the lower portion of the assessment area. See Disturbed Grassland cover type on Map 40. These areas may have lost soil productivity because of higher susceptibility to surface erosion, and lower organic matter production below ground.

5.1.4 Landforms

Aquatic landtype associations (ALTAs) are used to characterize landform and stream settings within the watershed. ALTAs consider both terrestrial and aquatic disturbance regimes, as well as landform, geology, and vegetation. They also incorporate elevation to account for the role of ground water temperature and base flows in limiting aquatic habitats, the relative significance of rain on snow at lower elevations, and the importance of sustained runoff from higher elevations. ALTAs are built from the component landforms, but also reflect the frequency of channel characteristics, in particular, their size and gradient. Within each ALTA, certain stream channel types predominate and interpretations can be made how these streams function.

Map 9 shows the eleven ALTA mapping units found in the Slate Creek watershed. ALTAs 3 and 7 are low to mid elevation breaklands asssociated with the Lower Canyon, Main Canyon, and parts of the North Fork subwatersheds. Erosional processes in these units are described above, but this is the most concentrated zone of landslide hazard in the watershed. Tributary streams are generally steep, confined in narrow valley bottoms, and subject to debris torrents. Main Slate Creek runs through these ALTAs and its channel characterisitics are much affected by the input of coarse sediment and woody debris from the steep sideslope processes. Photo 1 (page N-2 in the Appendix, Volume 2) shows ALTA 7 and Photo 2 (page N-2 in the Appendix, Volume 2) shows a typical stream segment within ALTA 7.

ALTA 9 is dissected granitic hills and occupies much of upper Little Slate Creek, along with lower Boulder and parts of Main Slate. It can be characterized as rolling uplands at mid elevations. Erosion processes are predominately surface erosion after disturbance or in-channel erosion. Stream channels are relatively low gradient and often have meadows interspersed with forested reaches. Photo 5 (page N-4 in the Appendix, Volume 2) shows ALTA 9 and Photo 6 (page N-4 in the Appendix, Volume 2) shows a typical stream segment within ALTA 9.

ALTAs 4 and 6 are found at mid elevations and are minor in extent. They have similar settings and interpretations as ALTA 9, but lower erosion rates. ALTA 15 units are relatively flat basalt plateaus found at mid to upper elevations.

The larger alluvial valleys, often containing meadows, are mapped as ALTA 18. This ALTA contains low gradient, meandering streams typified by high quality, diverse aquatic habitats. ALTA 18 is most prevalent embedded within ALTAs 1, 9 and 21.

ALTAs 1 and 2 are high elevation ridges and glaciated slopes. Erosion processes are dominated by surface and channel erosion, although landslide hazards exist on glacial trough walls. Stream channels are relatively

steep and confined, with high sediment transport capacity. ALTA 5 units are glacial trough bottoms contain lower gradient streams and meadows. ALTA 21 contains moderately steep slopes at relatively high elevations. Streams within this ALTA are relatively steep, coarse bedded, and characterized by cold water. Photo 3 (page N-3 in the Appendix, Volume 2) shows ALTAs 2 and 21 and Photo 4 (page N-3 in the Appendix, Volume 2) shows a typical stream segment within ALTA 5.

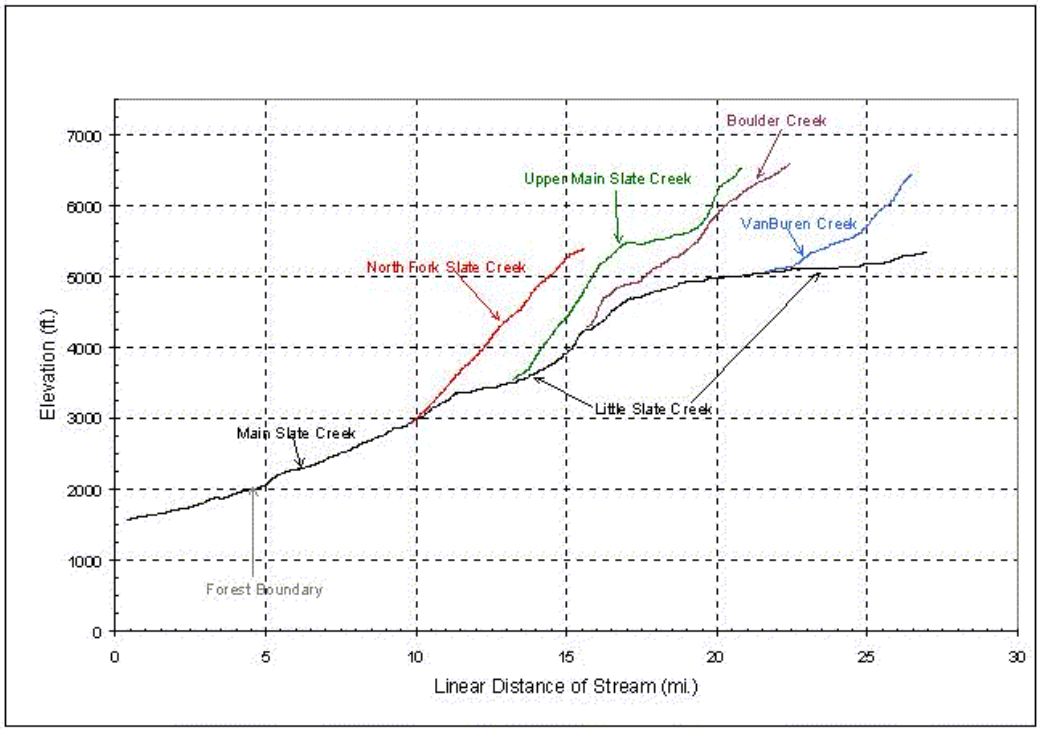
5.1.5. Channel Types

Streams can be classified according to a system proposed by Rosgen (1996). Channel types classify streams based on observable features that have process and functional implications. Basic characteristics that distinguish channel types include thread, entrenchment (access to floodplains), sinuosity, width to depth ratio, gradient, and substrate size (Rosgen, 1994). Channel types are significant in that various stream types process energy (i.e. water) and sediment in different ways. Channel types are further described and diagrammed in Appendix K. Channel types can be rated in terms of their sensitivity to disturbance, their resistance to physical changes induced by disturbance, and their resilience in terms of recovering from disturbance.

Map 11 show stream gradient and Map 12 shows channel types and sensitivity. These are stratified by reach, based on and derived from stream surveys. Associated with channel types are interpretations such as sensitivity, sediment supply, bank erosion, and recovery potential. (Rosgen, 1996).

Figure 5.10 show longitudinal profiles of Slate Creek and several key tributaries. These profiles show the channel gradients at distances from the mouth. Some key features can be noted along individual streams. For example, lower Slate Creek has a relatively consistent, moderate gradient. Relatively steep reaches occur in North Fork Slate, upper Main Slate, Boulder, Van Buren, and one section of Little Slate. The lowest gradient reaches (associated with meadows) occur in upper Little Slate and a section of upper Main Slate.

Figure 5.10 - Longitudinal Stream Profiles



Channel types are the result of interactions between climate, geology, landform, watershed size, and disturbance history. Streams tend to exist in a state of dynamic equilibrium with channel features remaining relatively consistent until some type of disturbance (natural or human-induced) changes one or more key variables. If the disturbance is large enough, the channel type itself may be changed.

Within the Slate Creek watershed, most channel types are probably currently the same as they were in presettlement periods. Natural disturbances may have occaisionally altered channel types from one state to another through erosional and depositional processes. An example of that would be a debris torrent that scours a channel to bedrock. In such a case, the channel type is changed until depositional processes once again refill the valley floor.

A recent example of an apparent natural channel change occurred in upper Main Slate Creek during a rain-on-snow flood in June, 1993. This storm event caused significant erosion and aggradation along several miles of the creek. Changes along the channel included a shift from single to multiple channels and a large amount of coarse bedload movement. Photo 7 (page N-5 in the Appendix, Volume 2) shows upper Slate Creek during the June, 1993 flood and Photo 8 (page N-5 in the Appendix, Volume 2) shows the same site after the flood. Photo 9 (page N-6 in the Appendix, Volume 2) shows lower Slate Creek and Road #354 during the same flood event.

Human disturbances have resulted in some channel type changes within the watershed. An example of this is a probable change from E4 to C4 channels in parts of Little Slate meadows as a result of past grazing damage. An example of the E4 channel is shown in Photo 6 (page N-4 in the

Appendix, Volume 2) and an example of an impacted C4 channel is shown in Photo 11 (page N-7 in the Appendix, Volume 2). Another example of human induced channel type changes are probable shifts from B4 to G4 in small streams subject to placer mining. In some cases, this resulted in straightening and downcutting of the channels, many of which are found in the Florence Basin. In general, the lower the gradient, the higher the aquatic habitat potential for spawning and rearing, although this varies by species and life stage.

Timber harvest which results in increased levels of ECA or maintains ECAs at high levels can impact water yield for a drainage. Elevated ECA levels can also increase peak flows.

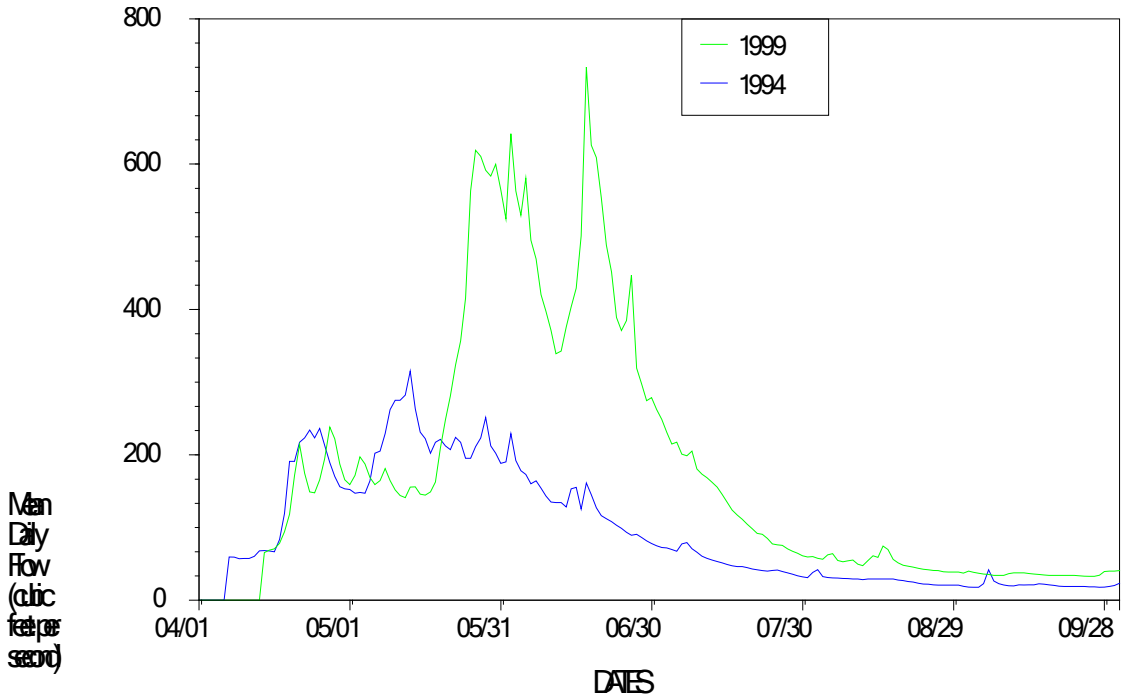
5.1.6 Watershed Conditions - Water and Sediment Yield

Introduction - Water Yield

Changes in the type or distribution of vegetation can affect snow accumulation and melt rates, as well as the amount of moisture returned to the atmosphere by evapotranspiration. Therefore, the vegetation on the landscape has an effect on the total amount of water that flows off the landscape (water yield), as well as how quickly it flows off the landscape (and therefore the magnitude of peak flows). Increased water yields may be associated with channel scour, bedload movement, or redistribution of sediment in depositional areas.

Figure 5.11 illustrates the hydrograph at the Little Slate Creek gaging station for parts of 1994 and 1999. Water year 1994 represents drought conditions and 1999 represents above-average streamflows. It can be seen in 1994, that the discharge peaked in mid-May and in 1999 it peaked twice, in early June and mid-June. This has implications for sediment yield and channel maintenance, with considerably more energy being routed through the channel system in 1999. The summer baseflow was almost twice as high in 1999 as in 1994. This has implications for water quality and fish habitat conditions, especially water temperature. Comparisons of water temperature between 1994 and 1999 at one station are presented in a later section.

Figure 5.11 - Little Slate Hydrograph



04/01

05/01

05/31

06/30

07/30

08/29

09/28

DATES

0

200

400

600

800

Mean Daily Flow

(cubic feet per second)

1999

1994

Water yield increases can be directly modeled, but equivalent clearcut area (ECA) is often used as a surrogate. ECA is usually expressed as a percent of watershed area. The index takes into account the initial percentage of crown removal and the recovery through regrowth of vegetation since the initial disturbance. Various thresholds of concern for ECA ranging from 15% to 30% have been in use since the 1970s. Application of these thresholds is highly judgmental and depends on watershed scale, vegetation types, runoff regime, and stream sensitivity.

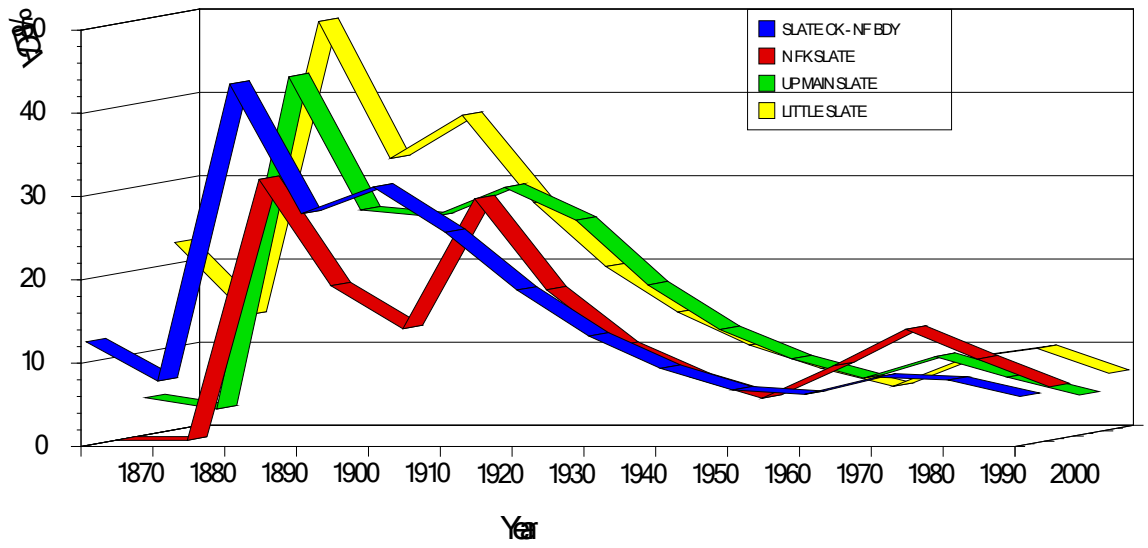
Water Yield Trends - 1870 to present

Figure 5.12 shows the history of ECA at selected points in the Slate Creek watershed from 1870 through the present. It clearly shows the effects of a series of large wildfires from 1880 through 1910. ECA values peaked in the range of 25% to 50% in these watersheds during this period. These values gradually declined with forest growth during the period of 1920 through 1960, when commercial timber harvest began in earnest. However, the ECA values produced by harvest were in the range of 6% to 11%, much less than those historically associated with large fires. ECA is currently on a general recovery trend throughout the watershed.

Figure 5.13 displays ECA as a proportion of 6th code subwatersheds (n=19) within certain classes. It illustrates a similar trend as the previous figure. Of particular note is the percent of subwatersheds with ECA exceeding 50% in the decades of 1890 through 1920, and to a lesser extent, 1970.

Although records are relatively good for the past 100 years, it is unkown to what extent ECA naturally varies over longer periods. The significance of the historic ECA analysis is that it is clear that streams within the Slate Creek Watershed sustained increased water yields considerably above current levels for much of the early 20th century. It is diffcult to assess what the effects were to stream channels as a result of the increased ECA. It is important to note that these channels were also undergoing direct impacts from mining and grazing during this period. Although recent ECA levels are considerably less, legacy channel impacts remain, along with the additional disruptions caused by roading and timber harvest.

Figure 5.12 - Percent Equivalent Clearcut Area (1870-2000)



1870

1880

1890

1900

1910

1920

1930

1940

1950

1960

1970

1980

1990

2000

Year

0

10

20

30

40

50

% ECA

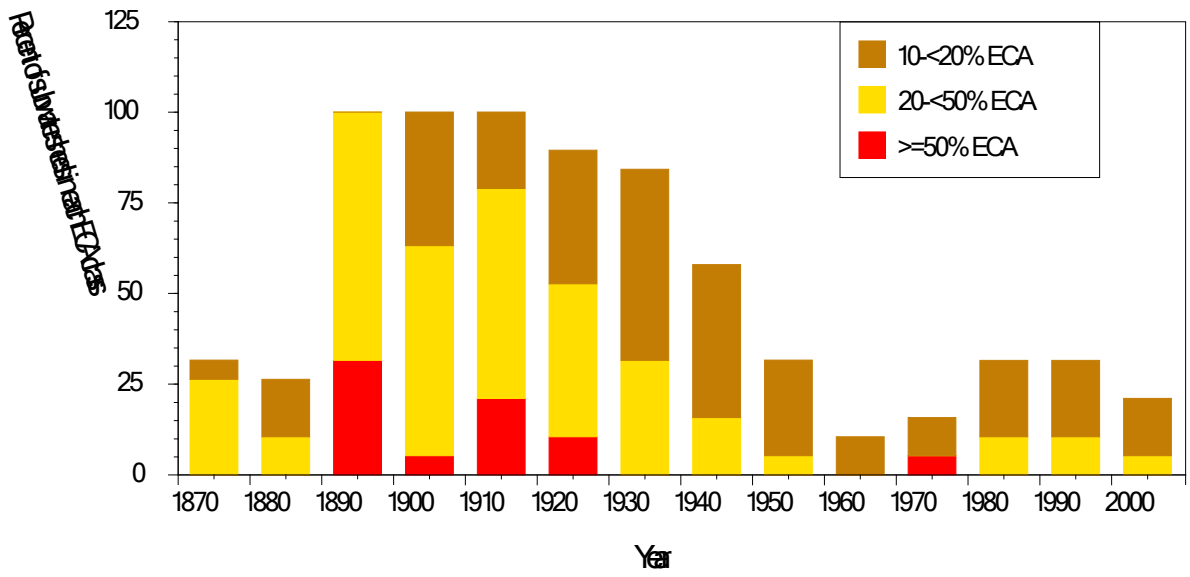
SLATE CK - NF BDY

N FK SLATE

UP MAIN SLATE

LITTLE SLATE

Figure 5.13 - Percent of 6th Code Subwatersheds by ECA Condition Class (1870-2000)



1870

1880

1890

1900

1910

1920

1930

1940

1950

1960

1970

1980

1990

2000

Year

0

25

50

75

100

125

Percent of subwatersheds in each ECA class

10-<20% ECA

20-<50% ECA

>=50% ECA

Introduction - Sediment Yield

The erosion of the landscape yields sediment to streams. The rates of erosion are dictated by climate, geology, physiography, and land cover conditions. The morphology of stream channels (width, depth, slope, substrate, etc.) is the result of the balance between the timing and amount of water yield and the amount of sediment yield, transport, and deposition.

In the Slate Creek watershed, the transport of sediment through the stream network is at its highest during peak flows, usually occurring in late spring.

If changes occur in the amount of sediment or magnitude of peak flows, the shift in the balance between water yield and sediment yield can lead to changes in channel morphology. For instance, an increase in water yield without an increase in sediment

yield may lead to scouring the stream bed and the channel downcutting, and conversely, increases in sediment yield without an increase in water yield can lead to excessive deposition of sediment in the stream channel.

The stream system is a connected network, and therefore changes in the physical processes upstream have effects in downstream reaches. A common occurrence is the accumulation of sediment in mainstem reaches downstream of high-gradient headwater reaches where increased sediment inputs are actually occurring.

Sediment yield can be modelled using an approach developed by research scientists and hydrologists in the Northern and Intermountain Regions (USDA Forest Service, 1981). From these guidelines, the Nez Perce National Forest produced the NEZSED model. This model estimates the average annual natural or base rate of sediment yield, and surface erosion sediment yield produced from roads, logging, and fire. The model is limited in that it does not consider the effects of activities on mass erosion greater than 10 cubic yards or the effects of grazing on streambank erosion. Though the model shows annual variations in response to land use, it does not attempt to estimate annual variation due to climate or weather events.

Sediment Yield Trends - 1860 to Present

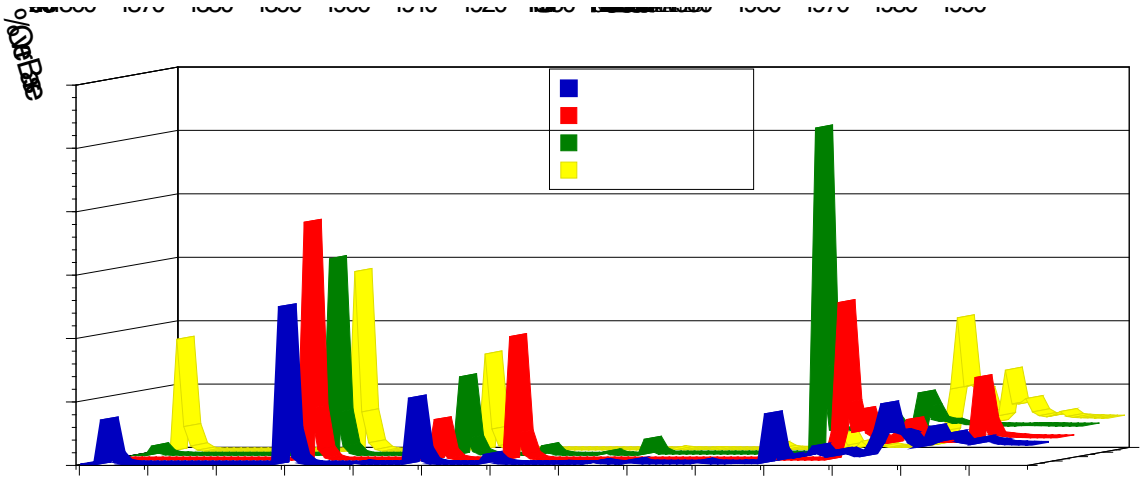
Using the NEZSED model, Figure 5.14 shows the history of sediment yield at selected points in the Slate Creek watershed from 1860 through the present. The effects of large wildfires in 1889 and 1908 can be seen. The model suggests that these fires showed peak sediment yields in the range of 25% to 35% over base, followed by recovery within a few years. Percent over base peaks would have been larger in smaller subwatersheds. The effects of mining on sediment yield are not reflected in the NEZSED model. From 1930 through about 1960, there were no major fires or other sediment-producing disturbances modelled.

Beginning in 1960, the effects of road construction and timber harvest can be seen on Figure 5.14. The sediment peaks result largely from road construction and are similar or larger in magnitude to the earlier fire peaks. The road construction peaks from 1960 through about 1980 are probably underestimated, since no adjustment was made for sediment mitigation practices used during this earlier period, relative to today's mitigation practices. Newly consturcted roads built during the 1960s and 1970s probably had mitigation levels of 0% to 40% of potential erosion. Current mitigation levels are typically estimated in the range of 60% to 80%.

Another important interpretation is that the recovery of sediment yield from roads is not as complete as that from fires. Thus, roads represent more of a continuous press sediment disturbance, rather than the episodic pulse disturbance associated with fire.

Figure 5.15 displays sediment yield as a proportion of 6th code subwatersheds (n=19) within certain classes of percent over base. It shows that the large wildfires of 1889 and 1908 affected a large proportion of subwatersheds, but for relatively short time periods. Beginning in 1960, road construction and timber harvest have affected a smaller proportion of subwatersheds at any one time, but the effects are modelled to be virtually continuous for the entire forty years since 1960. This is another illustration of the change in nature of sediment yield from a pulse to a press disturbance.

Figure 5.14 - Percent Over Base Sediment Yield Using NEZSED (1860-2000)



1860

1870

1880

1890

1900

1910

1920

1930

1940

1950

1960

1970

1980

1990

Year

0

10

20

30

40

50

60

% Over Base

Nezsed

SLATE CK - NF BDY

N FK SLATE

UP MAIN SLATE

LITTLE SLATE

Current Watershed Conditions

Watershed condition can be discussed in terms of disturbance indicators (road density, % timber harvest, % equivalent clearcut area), estimates of sediment yield (% over natural), and narratively for other impacts. Disturbance indicators are used to index watershed condition based on their effects on runoff or erosional processes. For example, roads affect runoff processes through creation of impervious surfaces and disruption of subsurface flow paths. Roads also expose soil and change slope conditions, which nearly always results in increased surface erosion and can result in accelerated rates of mass erosion, relative to natural conditions. Timber harvest effects are generally not as severe on a per unit area basis as roads, but generally result in increased runoff

Figure 5.15 - Percent of 6th Code Subwatersheds by Sediment Condition Class (1860-2000)

T ?

1860

1870

1880

1890

1900

1910

1920

1930

1940

1950

1960

1970

1980

1990

Year

0

20

40

60

80

100

Percent of subwatersheds in each sediment condition class

pct wtsds 10-<30% over base

pct wtsds >=30% over base

and erosion. The magnitude of timber harvest effects (aside from roads) are similar to fire, although substantial differences exists between timber harvest and fire effects.

Other human impacts that are significant in Slate Creek, such as grazing and mining, will be discussed narratively. Quantitative disturbance indicators are not readily available nor commonly used for these activities.

Table 5.11 on the next page summarizes road density, timber harvest, and equivalent clearcut area (ECA) for the 6th code subwatersheds within Slate Creek. These same disturbance indicators are summarized by the EAWS subwatersheds and cumulative effects watersheds in Tables 5.12 and 5.13, respectively. Road densities relative to watershed condition have been rated on various scales, depending on the study and its assumptions. In the 1992 Nez Perce National Forest coarse filter analysis, the road density scale was as follows:

- <1 mi/ sq mi was rated "low"
- 1-3 mi/ sq mi was rated "moderate"
- >3 mi/ sq mi was rated "high"

In the Upper Columbia River Basin Science Assessment, a slightly different road density scale was used:

- <0.7 mi/ sq mi was "low"
- 0.7-1.7 mi/ sq mi was "moderate"
- 1.7-4.7 mi/ sq mi was "high"

- >4.7 mi/ sq mi was "very high"

ECA thresholds of concern have varied considerably, but typically range between 15% and 30% of watershed area. Current criteria under ESA consultation have focused on 15% ECA as a trigger for further analysis in high priority anadromous watersheds such as Slate Creek

Current Conditions - Sediment Yield

The Nez Perce National Forest has monitored sediment in Little Slate Creek since 1986. Comparison of NEZSED model predictions to field-sampled sediment yield data for Little SlateCreek indicates that the model is a reasonably good predictor of sediment yield in average runoff years, but tends to underestimate sediment yield in high runoff years (Gloss,1994). Sediment yield contributed to Lower Slate Creek from tributaries below Little Slate Creek has not been measured.

Table 5.11 - Watershed Condition Indicators by 6th Code Subwatershed

6th Code Subwatershed	Wsd #	Area (acres)	Rd Density (mi/mi²)	Harvest (acres)	Harvest (%)	ECA (acres)	ECA (%)
North Fork Slate	01	8,442	2.26	1,277	15	633	8
Waterspout	02	1,840	0.56	0	0	7	<1
Upper Main Slate	03	10,654	1.54	660	6	653	6
Big Boulder	04	8,896	1.39	511	6	544	6
Lower Little Slate	05	3,205	3.49	454	14	249	8
Mid Little Slate	06	4,916	2.56	667	16	415	8
Upper Little Slate	07	6,966	3.41	1,160	17	774	11
Turnbull	08	1,287	3.88	485	38	253	20
Van Buren	09	5,273	1.13	221	4	251	5
Deadhorse	10	3,755	0.97	142	4	202	5
Little Van Buren	11	3,612	2.46	214	6	270	8
Bear Gulch	12	1,704	7.40	232	14	181	11
No Business	13	1,279	0.30	10	1	34	3
Willow	17	539	2.49	58	11	28	5
Trough	18	514	1.87	110	21	45	9
Hurley	19	609	1.89	239	39	171	28
Slide	20	1,664	.12	0	0	1	<1
Rubie	21	6,088	3.23	975	16	778	13
Lower Main Slate	22	6,981	1.57	199	3	198	3
Lowest Main Slate	25	4,888	2.64	NA	NA	NA	NA

Table 5.12 - Watershed Condition Indicators by EAWS Subwatersheds

EAWS Subwatershed	Wsd #	Area (acres)	Rd Density (mi/mi²)	Harvest (acres)	Harvest (%)	ECA (acres)	ECA (%)
Lower Slate Canyon	1	4,888	2.64	NA	NA	NA	NA
Main Slate Canyon	2	18,335	2.08	1,302	7	914	5

Little Van Buren	3	3,612	2.46	214	6	270	8
Deadhorse	4	3,755	0.97	142	4	202	5
North Fork Slate	5	8,442	2.26	1,277	15	633	8
Upper Main Slate	6	10,654	1.54	660	6	653	6
Big Boulder	7	8,896	1.39	511	6	544	6
Little Slate	8	19,257	3.22	3,257	17	2,220	12
Van Buren	9	5,273	1.13	221	4	251	5

Table 5.13 - Watershed Condition Indicators by Cumulative Effects Watershed

Cumulative Effects Watershed	Wsd #	Area (acres)	Rd Density (mi/mi²)	Harvest (acres)	Harvest (%)	ECA (acres)	ECA (%)
Little Slate @mouth	NA	40,386	2.29	4,615	11	3,467	9
Slate @Forest Bdy	NA	78,224	2.16	7,614	10	5,689	7
Slate @mouth	NA	83,112	2.16	NA	NA	NA	NA

Background Information for Tables 5.11, 5.12 and 5.13:

- **Road Density:** data taken from Infrastructure Database as of 1/ 00
- **Harvest Acres:** data taken from Watershed Database as of 12/ 11/ 97
- **ECA (Equivalent Clearcut Area):** data taken from Watershed Database as of 1/ 13/ 98 (the ECA calculations include roads, timber harvest, and fire)
- **NA:** information is not available due to lack of data on private lands

Little Slate Creek is assumed to be the most significant contributor of sediment yield to Lower Slate Creek, partially because of its large area, but also because of geology and the degree of watershed disturbance. The well-weathered granodiorite that is characteristic of ALTA 9 is easily eroded when exposed, producing sands and small gravels. Once introduced to a stream, fine-grained material (silt and fine sand) tends to transport quickly as suspended sediment, and the coarser-grained material is often stored in low gradient reaches for relatively long periods of time.

Although monitoring data suggest that bedload sediment composes only about ten percent of the total sediment yield in Little Slate Creek, it has serious implications for salmonid survival partially because of its relatively long-term effect on fish habitat. Although first and second order high energy streams may move the sediment fairly rapidly at times, low gradient reaches and higher order streams may store bedload for extended periods of time.

Human impacts to sediment yield in the watershed have occurred from roads, trails, grazing, timber harvest and mining. Erosion from roads is perhaps the biggest current source of human-caused suspended and deposited sediment in Little Slate Creek. Roads in the Little Slate Creek watershed have resulted in significantly elevated sediment yields in many of the tributary streams and in Little Slate Creek. Unsurfaced roads, cutslopes, fillslopes and ditches are easily eroded, forming rills and gullies which further concentrate water. In many locations the cutslopes and ditches have not revegetated due to the unproductive soils and hence provide an ongoing source of sediment to streams. Map 15 shows roads within streamside zones where sediment is most likely to be delivered to streams.

In the Florence area, mining disturbances have historically produced large quantities of sediment. Recent field surveys suggest that significant gully and channel erosion is still occurring from some of these

disturbances. These disturbances contribute to the relatively high levels of fine sediment found in streams in this area.

The Florence area encompasses about 19,000 acres of the Little Slate watershed, with the most mining activity taking place in Miller, Rubie, Little French, and Gold Lake Creeks. Map 14 shows areas of mining activity taken from local records or which were evident on aerial photos from the 1930s. Impacts to stream channels included dredging, ditching, straightening, rerouting, and interbasin water transfers. Upland impacts included hydraulic placer mining and the road system used to access mining claims.

Grazing has contributed to sediment yield and stream temperature increases through reduction in bank shrub and grass cover, physical damage to streambanks, increases in sediment delivery and deposition, and increases in width/depth ratio. ALTAs 5 and 18 are some of the areas most susceptible to grazing impacts to streams. Streams and riparian areas considered to be impacted by grazing are shown in Map 14.

Tables 5.14 and 5.15 show the results of NEZSED runs from 1986 through 1995 at selected points in the watershed. Sediment yield conditions, as modelled by NEZSED have remained relatively steady since 1995. The model responds to changes in timing of disturbances such as roads, timber harvest, and fire, but does not account for variations in climate and weather. The results suggest that Forest Plan sediment yield and entry frequency guidelines at the selected points have not been exceeded in the past decade. The Forest Plan fish/water quality objectives, sediment yield guidelines, and entry frequency guidelines are found in Chapter 1.

Table 5.14 - 1995 NEZSED Sediment Yield

Watershed	Area (acres)	Base Sediment Yield (tons)	1995 Activity Sediment Yield (tons)	1995 Percent over Base
N Fk Slate	8,442	258	14	5
Little Slate	40,386	754	84	11
Upper Slate	10,654	313	24	8
Slate @Forest Boundary	78,250	1,551	116	8

Table 5.15 - 1986-1994 NEZSED Sediment Yield (percent over base)

Watershed	1986	1987	1988	1989	1990	1991	1992	1993	1994
N Fk Slate	4	21	6	6	6	6	6	6	6
Little Slate	16	18	13	12	11	12	13	12	11
Upper Slate	9	12	8	8	8	8	8	8	8
Slate @Bdy	9	12	8	8	7	10	9	8	7

5.1.7 Water Temperature

Introduction

Water temperature is important in that fish and other organisms are affected and highly adapted to it fluctuations. Water temperature varies over time and longitudinally along the stream channel network. Temporal variations occur on a daily, seasonal, and annual basis. Spatial variation most commonly occurs from the

headwaters of a watershed to its mouth. There are a numerous factors affecting water temperature. However in any given reach along
headwaters of a watershed to its mouth. There are a numerous factors affecting water temperature. However in any given reach along
a stream, water temperature is dependent primarily on the water temperature coming into the reach, the volume of discharge, channel morphology, weather, and shading. This section describes variations in water temperature within the Slate Creek watershed and interprets current conditions in terms of meeting standards and the causative factors contributing to those conditions.

Water Temperature Criteria

Water temperature criteria which currently apply to Slate Creek come from six sources:

1) Idaho Water Quality Standards;

2) Environmental Protection Agency Rules;

3) Forest Plan Desired Future Condition (DFC) Tables

4) PACFISH Interim Riparian Management Objectives (RMOs);

5) Matrix of Pathways and Indicators of Watershed Condition (from ESA); and

6) Interior Columbia Basin Supplemental Draft Environmental Impact Statement.

The various criteria from these sources are paraphrased below:

Idaho Water Quality Standards: Under the current Idaho Water Quality Standards, there are three sets of water temperature criteria that apply in Slate Creek. The criteria for cold water biota are not to exceed 22° C, with a maximum daily average no greater than 19° C. The criteria for salmonid spawning are not to exceed 13° C with a maximum daily average no greater than 9° C during the spawning and incubation period. The criteria for bull trout are not to exceed a 7-day moving average of 12° C based on daily average water temperature or not to exceed a 7-day moving average of 15° C based on daily maximum water temperatures. The bull trout criteria apply during July, August, and September.

Environmental Protection Agency Rules: In 1997, the Environmental Protection Agency promulgated a rule establishing a water temperature criterion for bull trout spawning and rearing in Idaho. The EPA criterion is not to exceed a 7-day moving average of 10° C, based on daily maximum water temperature, during July, August, and September. Thus, the EPA bull trout criterion is 5° C cooler than the analogous State of Idaho criterion.

Forest Plan DFC Tables: The Nez Perce National Forest Plan (USDA Forest Service, 1987) established Fish/Water Quality Objectives and associated DFCs (USDA Forest Service, 1992). The Idaho State Water Quality Standard for salmonid spawning of not to exceed 13° C was adopted for all species. The DFC tables also established water temperature criteria for rearing by species and objective level. The rearing criteria are premised on temperatures not to be exceeded for a duration of 6 hours each day between 1200 and 1800.

For chinook salmon and steelhead trout, the DFC rearing criterion for 100% of habitat potential is 10° C, for 80% and 90% is 15° C, and for 70% is 18° C. For bull trout, the DFC rearing criterion for 100% of habitat potential is 9° C, for 90% is 12° C, and for 70% and 80% is 14°C. For westslope cutthroat trout, the DFC rearing criterion for 100% of habitat potential is 10° C, for 80% and 90% is 14° C, and for 70% is 16° C.

PACFISH Interim Riparian Management Objectives: Water Temperature criteria under the PACFISH Interim RMOs are not to exceed 18° C within migration and rearing habitats and not to exceed 16° C within spawning habitats. There is no seasonality specified.

ESA Matrix of Pathways and Indicators of Watershed Condition: The steelhead/bull

trout Matrix of Pathways and Indicators of Watershed Condition are a series of criteria developed by federal agencies for use in Endangered Species Act consultations. They are used to help establish existing habitat conditions. The matrix rates condition according to high, moderate, and low quality habitat. The high and low quality criteria are described here (the moderate criteria can be inferred). The criteria are calculated using a 7-day moving average of daily maximum temperatures.

In the matrix, for steelhead spawning (February 1-July 15), high quality conditions are <14° C and low quality conditions are >15.5° C. For steelhead rearing and migration (all year), high quality conditions are <14° C and low quality conditions are >17.8° C. In the matrix for bull trout incubation, the high quality criterion is 2-5° C and low quality is <1 or >6° C. For bull trout rearing, the high quality criterion is 4-12° C and low quality is >15° C. For bull trout spawning, the high quality criterion is 4-9° C and low quality is <4 or >10° C. For bull trout adult migration, the high quality criterion is <15° C and the low quality criterion is that 15° C is regularly exceeded.

Interior Columbia Basin Supplemental DEIS: The ICRB Supplemental Draft Environmental Impact Statement (USDA Forest Service, 2000) proposes water temperature criteria under Riparian Management Objectives. For anadromous migration and rearing, temperatures are not to exceed 18° C. For anadromous spawning, temperatures are not to exceed 16 ° C. For adult bull trout holding, temperatures are not to exceed 15° C. For bull trout spawning and rearing, temperatures are not to exceed 9° C.

Presettlement Conditions

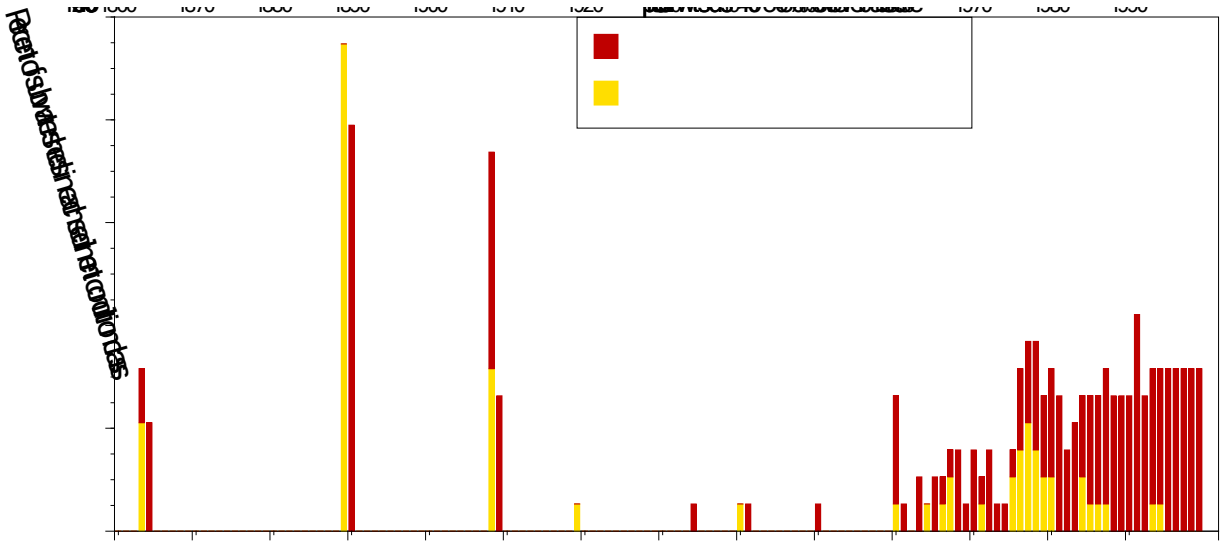
Since it is impossible to know what presettlement water temperature conditions were, this concept will be discussed below in terms of current conditions interpreted in the light of changes known to have happened from developments in the watershed.

Current Conditions

Figure 5.16 is an illustration of how water temperature varies at one site on a daily, seasonal, and annual basis. The site is main Slate Creek just above its confluence with Little Slate Creek). The data are from 1994 and 1999 from the months of July, August, and September. These two years were selected since 1994 was a relatively warm, dry summer and 1999 represents cooler, wetter overall conditions. The graph is a plot of hourly data, so that daily (diurnal) fluctuations can be seen. It can be seen that water temperatures were generally about 3° to 5° C warmer in 1994 than in 1999. The exceptions to this occurred in late August and late September. Seasonally, it can be seen that temperatures peaked in late July to early August in both years. However, in 1999 the temperatures rebounded again to another peak in late August and early September. The highest temperature in 1994 was about 18° C and in 1999 was about 15° C. Diurnal fluctuations in both years are in the range of 2° to 3° C.

From these two data sets, much can be learned about temporal fluctuations, but little can be said about possible effects of human disturbance. The between year and seasonal fluctuations are largely determined by weather conditions. The diurnal fluctuations are relatively small, suggesting that the reach is not unduly influenced by loss of shade due to removal of riparian vegetation or excess exposure due to changes in channel morphology.

Figure 5.16 - Water Temperature - Main Slate above Little Slate (1994 and 1999)



07/

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09/05

09/15

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15

20

25

Water Temperature (C)

Data Source: Aquatemp Database

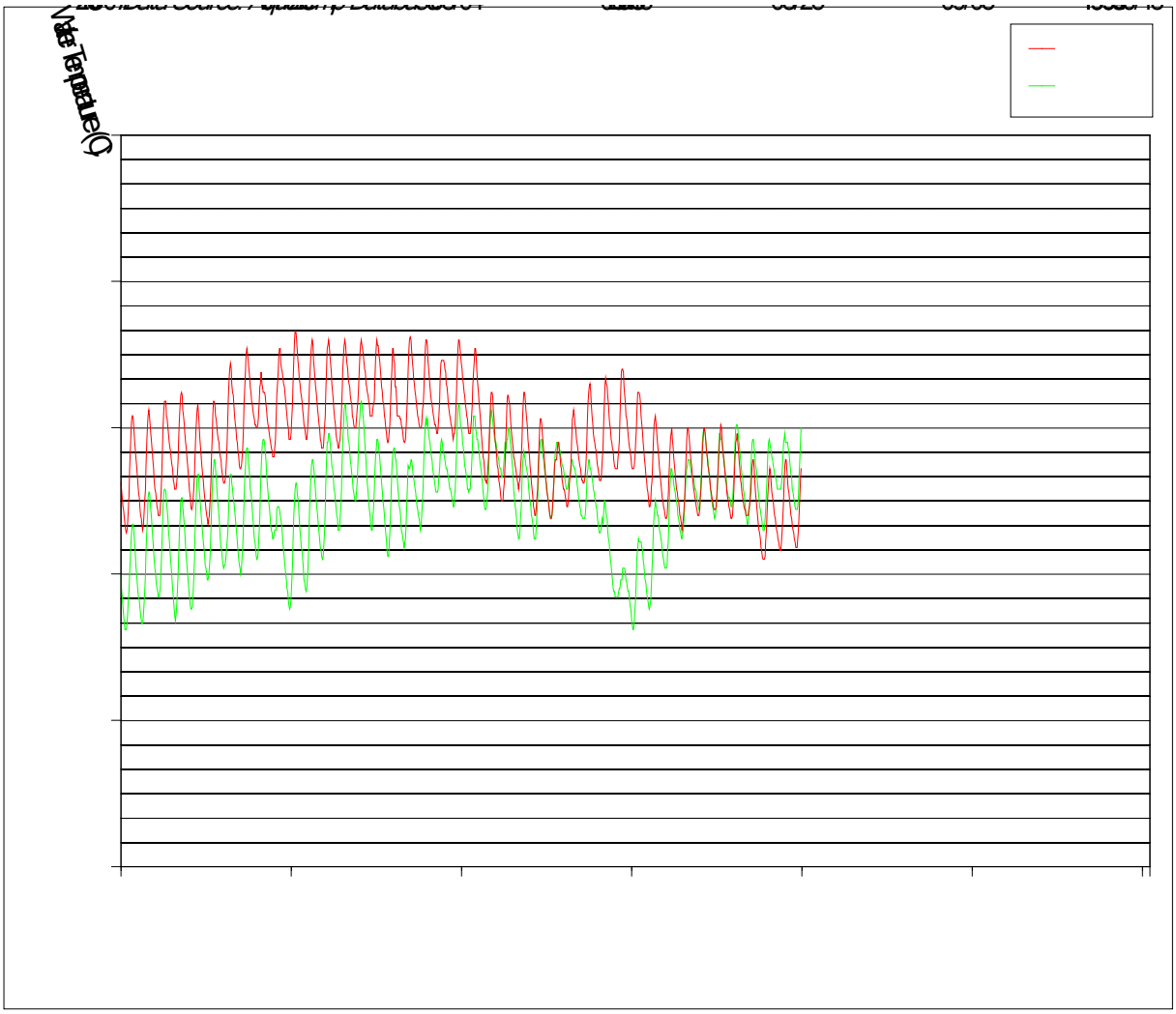
1994

1999

Figures 5.17 through 5.19 show variations in maximum daily water temperature at nine sites throughout the watershed during the summer months in 1999. Since these plots only indicate the highest temperature each day, they do not show diurnal fluctuations, but do show the seasonal variation. Figure 5.17 shows three sites along the mainstem of Slate Creek from the mouth to just above the confluence with Little Slate. It is apparent that temperatures are consistently warmest at the mouth, with progressive modest decreases upstream. Given the higher elevations and generally cooler ambient air temperatures upstream, this is what one would expect if channel and shade conditions are fairly constant. It can be seen that water temperatures at the mouth reached 20° C during the latter half of August, with peaks being about 2° C cooler at the Forest Boundary and about 5° C cooler above the confluence with Little Slate Creek.

Figure 5.18 shows three sites along Little Slate Creek. Contrary to the trend seen in the mainstem, the temperature at the mouth of Little Slate is cooler than several miles upstream above Van Buren Creek. This condition exists for two reasons. First, there are a number of cool water tributaries (Van Buren, Boulder, and Deadhorse) between the two sites. Second, the site above Van Buren Creek is within Little Slate

Figure 5.17 - Maximum Daily Water Temperature in Slate Creek at Selected Points (1999)



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08/22

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25

Water Temperature (C)

Data Source: Aquatemp Database

Slate Ck at the Mouth

Slate Ck at Forest Boundary

Slate Creek above the mouth of Little Slate Creek

Meadows where exposure to solar radiation is the greatest. It can also been seen that water temperature in Little Slate decreases again between the site above Van Buren and the site above Royal Creek. There is only a slight elevation increase between these two sites.

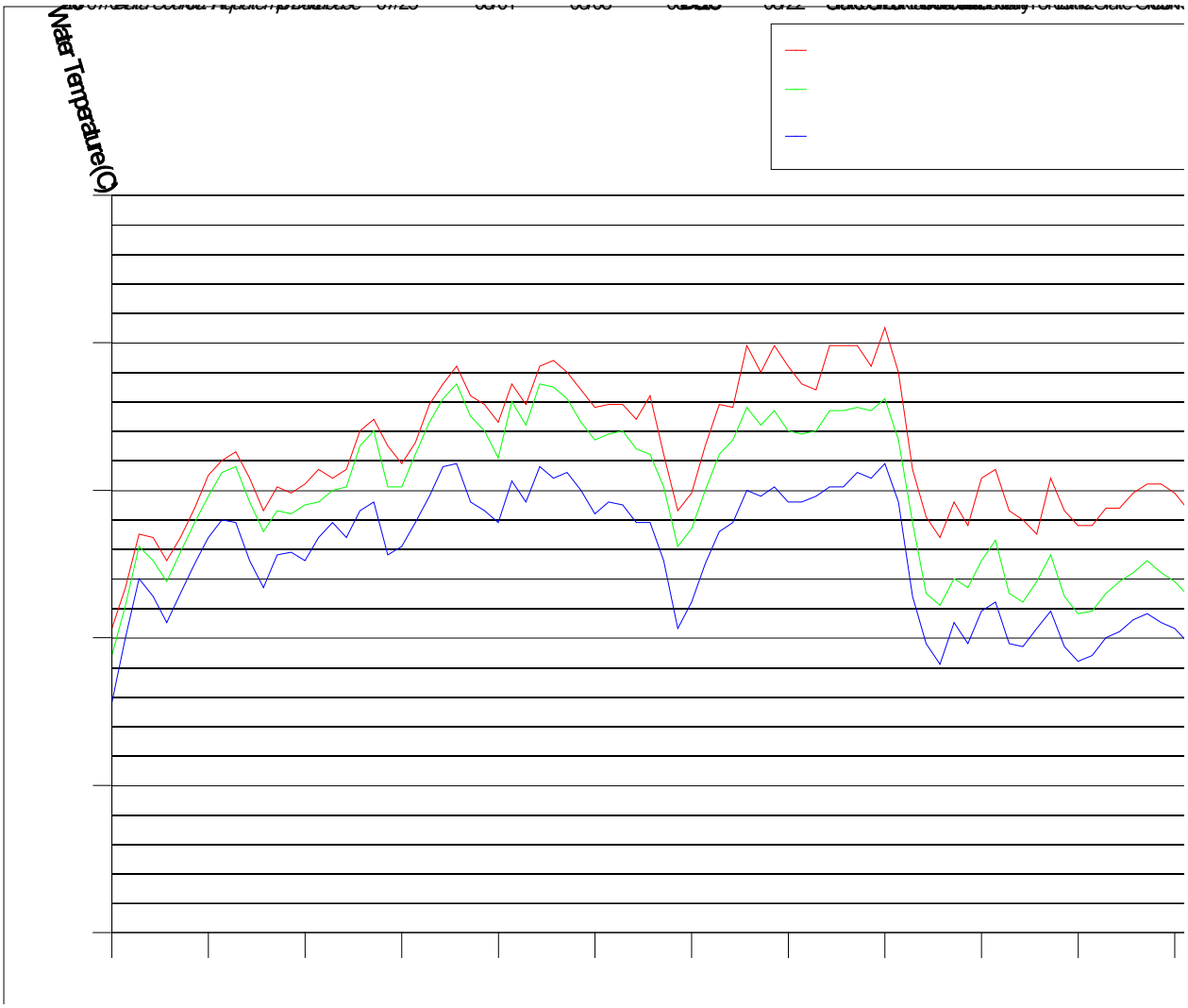
However, stream surveys have shown that the impacts of grazing on riparian and channel conditions are progressively worse from Royal Creek to Van Buren. It might be surmised that this results in greater exposure to solar radiation, thus an increase in water temperature beyond what might be expected under natural conditions.

Figure 5.19 compares sites on three tributaries. It is apparent that North Fork Slate Creek is consistently about 4° to 5° C higher than either Deadhorse or Van Buren Creeks. Deadhorse and Van Buren mirror each other very closely, typically being within about 1° C of each other. The reasons that the North Fork is warmer are probably mostly natural in origin. In addition tobeing slightly lower in elevation, the channel of the North Fork is probably less well shaded by topography and aspect than either Deadhorse or Van Buren Creeks. There are also moredisturbances within the North Fork watershed that removed riparian shade. It is also notable that Deadhorse and Van Buren are the coolest of all nine sites in these comparisons.

Compliance with Water Temperature Criteria

In order to check measured water temperature values against some of the criteria described earlier in this section, an analysis was done for two sites within the Slate Creek watershed. The two sites are Slate Creek at the mouth and Van Buren Creek at the mouth. These sites represent the high and low range of water temperature values within the watershed, at least for sites for which thermograph data are currently available. The data were evaluated for the months of July,

Figure 5.18 - Maximum Daily Water Temperature in Little Slate Creek at Selected Points (1999)



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15

20

25

Water Temperature (C)

Data Source: Aquatemp Database

Mouth of Little Slate Creek

Above Van Buren Ck

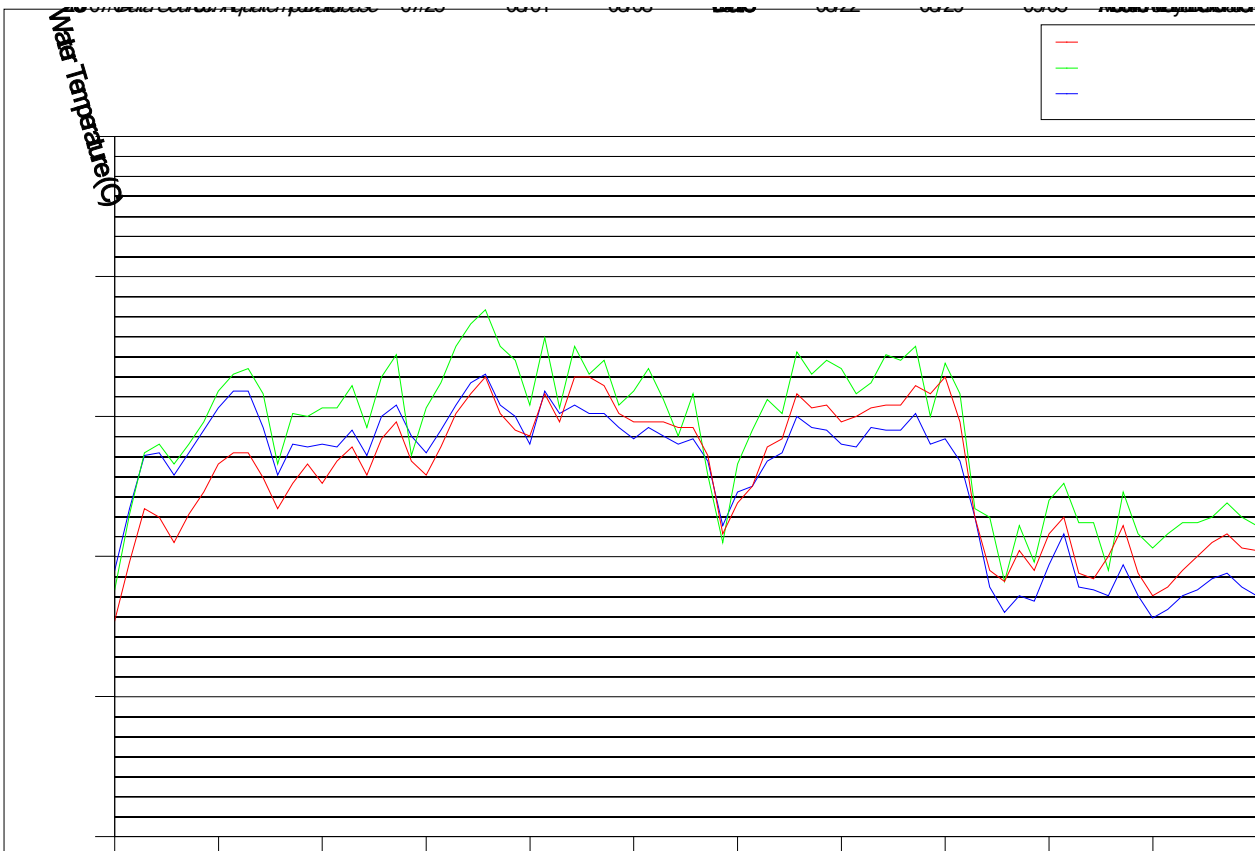
Above Royal Ck

August, and September, except for spawning criteria, which applied only fromthrough September 30. The analysis was conducted for the years 1998 and 1999. These two years were selected since they represent a relatively warm and cool summer. Although 1994 was summer with warmer water temperatures, data were not available for these two sites for that year. The results of this analysis are reported as % of days during the analysis period that the specified criteria were exceeded.

For Slate Creek at the mouth, the State salmonid spawning criterion was exceeded 96% of the time, the State cold water biota criterion was exceeded 5% of the time, the State bull trout criterion was exceeded 74% of the time, the EPA bull trout criterion was exceeded 100% of the time, the PACFISH spawning criterion was exceeded 48% of the time, and the PACFISH migration and rearing criterion was exceeded 43% of the time.

For Van Buren Creek at the mouth, the State salmonid spawning criterion was exceeded 18% of the time, the State cold water biota criterion was exceeded 0% of the time, the State bull trout criterion was exceeded 0% of the time, the EPA bull trout criterion was exceeded 74% of the time, the PACFISH spawning criterion was exceeded 0% of the time, and the PACFISH migration and rearing criterion was exceeded 0% of the time.

Figure 5.19 - Maximum Daily Water Temperature in Selected Slate Creek Tributaries (1999)



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Date

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20

25

Water Temperature (C)

Data Source: Aquatemp Database

North Fork Slate Ck

Deadhorse Ck

Van Buren Ck

It is apparent that the two sites vary greatly in their compliance with these water temperature criteria. Five of the six criteria presented are commonly exceeded in July, August, and September at the mouth of Slate Creek. At the mouth of Van Buren Creek, exceedences during the period analyzed were restricted to the State salmonid spawning criterion and the EPA bull trout criterion. Temperature measurements in the watershed at sites between these locations are not presented here, but are expected to have exceedance periods intermediate to these. No sites in the watershed are expected to have exceedance periods longer than the mouth of Slate Creek. Unless exposed in openings, most higher elevation streams probably have exceedence periods less than those at the mouth of Van Buren Creek.

5.1.8 Other Water Quality Parameters

Introduction

In addition to sediment and water temperature, there are a number of water quality parameters that are commonly used for characterization. Sampling of some parameters has been conducted at Little Slate Creek and North Fork Slate Creek. Those that have a direct influence on aquatic productivity are described below. Additional water quality parameters are discussed as data gaps in Appendix O.

Little Slate Creek

At Little Slate Creek 54 samples of specific conductance were collected from 1972 through 1982. These showed a mean of 17 micromhos, with a range of 2 to 31. These are very low values, indicative of good water quality, but also associated with low biological productivity. These values are also commonly associated with granitic geology. At the same site, 29 alkalinity samples averaged 11.5 mg/l and 54 hardness samples averaged 14.4 mg/l. These are also very low values, with similar interpretations as specific conductance. Sixty-two samples of pH averaged 7.1, with a range of 6.5 to 7.6. This is indicative of near-neutral waters.

North Fork Slate Creek

At North Fork Slate Creek 36 samples of specific conductance were collected from 1974 through 1979. These showed a mean of 63 micromhos, with a range of 25 to 128. These are relatively high values for streams on the Nez Perce National Forest, but still in the low to moderate range universally. These values are higher than Little Slate due largely to a more complex geology, including considerable basalt and metamorphic parent materials. They also suggest somewhat higher overall aquatic productivity than Little Slate. Also in the North Fork, 30 alkalinity samples averaged 32.2 mg/l and 35 hardness samples averaged 34.1 mg/l. These values have similar interpretations as specific conductance. Sixteen samples of pH averaged 7.3, with a range of 6.7 to 8.5,

indicating somewhat more basic waters than Little Slate.

Lower Slate Creek
Water quality in lower Slate Creek would largely reflect a weighted average of the conditions described for Little Slate and North Fork Slate. However, there is a substantial component of limestone geology, which would tend to increase the specific conductance, alkalinity, and hardness. This condition would tend to enhance aquatic productivity.

5.1.9 Riparian Areas and Floodplains

Riparian areas and floodplains play an important role in how material (e.g. sediment and wood) and energy (e.g. flowing water and solar radiation) are processed within the aquatic system. Riparian areas support vegetation that either seasonally or continuously require standing or flowing water. They include streamside areas, lakeside areas, wetlands, and areas with high groundwater tables. The term Riparian Habitat Conservation Areas (RHCAs) was introduced through PACFISH to establish special management direction (USDA Forest Service, 1994). RHCAs are primarily delineated used fixed widths relative to physically-defined features. In addition to riparian areas, wetlands, and floodplains, the full delineation of RHCAs includes landslide-prone areas.

Riparian vegetation provides bank stability and shading along most streams. The degree to which this is important depends on stream size, channel type, and valley form. Floodplains are low areas adjacent to streams that are periodically inundated when flows exceed bankfull stage. This is typically expected to occur about every one to two years. Floodplains provide important functions of energy dissipation, affect channel morphology, and also support riparian vegetation. Riparian areas and floodplains are disproportionately important to aquatic and terrestrial biota.

Natural Processes
The density and role of riparian areas, wetlands, and floodplains can best be discussed relative to groups of ALTAs. Map 13 depicts the streamside RHCAs in the watershed. The confined canyons of ALTAs 3 and 7 contain relatively low densities of these features. They are however very important in providing a buffer against material and energy transport from the steep hillslopes into stream channels. Natural debris torrents episodically occur in the steep tributary streams. These scour the tributary channels, but are an important source of coarse sediment and large woody debris to Slate Creek. Riparian vegetation is extremely important along lower Slate Creek in providing bank stability, shade, and as a source of recruitment of large woody debris. The discontinuous floodplains along lower Slate Creek provide areas where stream energy is dissipated that would otherwise be expended within the relatiively confined channel. The interplay between the channel, riparian vegetation, and floodplains provides the habitat diversity upon which aquatic species depend.

ALTAs 4, 6, 9, and 21, the rolling uplands, contain the highest densities of riparian areas, wetlands, and floodplains. Most of the larger valley floors are separately mapped as ALTA 18, with the glaciated valley floors mapped as ALTA 5. The wide, flat valley floors are often occupied by meandering channels and wet meadows. Floodplains occur along a relatively high proportion of stream length. These are areas of high diversity of aquatic, riparian, and terrestrial habitats. The more confined valleys are typically forested and have a smaller extent of riparian, wetland, and floodplain features. They are also important in terms of how they affect channel morphology, water quality, and aquatic habitats.

Current Conditions
Map 14 depicts human disturbances affecting streamside areas. Along the lower mainstem of Slate Creek, the greatest single human disturbance is the encroachment of Road #354. This road has increased sediment yield to the stream, reduced woody debris recruitment, and reduced the amount of floodplain accessible by the stream. The road has also affected shading,

but probably not to a large degree since it is located on the north side of the stream. The road has also interrupted how tributaries deliver material to Slate Creek. For example, some woody debris that would have been delivered in debris torrents is captured by the road and prevented from entering Slate Creek.

Along tributaries to lower Slate Creek, the main riparian impacts have been road crossings and timber harvest. In upper North Fork Slate Creek, several meadows containing headwater streams have been damaged by grazing. Several debris torrents associated with roads and timber harvest have occured within the past twenty years along lower Slate Creek.

Streamside disturbances in upper Little Slate Creek and tributaries have included mining and grazing, in addition to roads and timber harvest. In some reaches, these impacts have seriously disrupted natural riparian and floodplain processes. Examples include trampled banks, reduction in riparian vegetation and shading, channel straightening, and entrenchment. Some wet meadows mined decades ago continue to erode through the process of stream headcutting. Although ongoing stresses have been reduced in recent years, the results of historic activities continue to affect riparian and floodplain processes.

Table 5.16 shows a number of streamside condition indicators by subwatershed. The highest percent of streamside areas are found in Big Boulder and Little Slate Creeks and the lowest are in the low elevation breakland canyons. The highest streamside road densities are found in Lower Slate Canyon, Main Slate Canyon, and Little Slate Creek, and the lowest are found in Deadhorse and Van Buren Creeks. The highest numbers of road crossings of streams are found in Little Slate Creek and Main Slate Canyon, and the lowest are found in Deadhorse and Van Buren Creeks. The highest streamside harvest densities are found in Little Van Buren and Little Slate Creeks, and the lowest are found in Deadhorse and Van Buren Creeks.

5.1.10 Lakes

There are three lakes in the Slate Creek watershed, all of them occurring in the high elevation landtypes (ALTA 2), and often referred to as high mountain lakes. Lower Slate Lake and Upper Slate Lake at located in the headwaters of the Upper Main subwatershed. Nut Basin Lake is located in the upper portion of Van Buren Subwatershed.

5.1.11 Aquatic Species Habitat

Introduction

The physical template and processes discussed in this aquatic section combine to create the physical habitat for aquatic species. Habitat is a location in the ecosystem that contains specific biological, chemical, and physical characteristics that meet the life requirements of food, water, and cover or shelter for an organism, population, or community (Armantrout, 1998). Aquatic habitat is assessed in the following steps.

The ***overview*** provides a summary of the physical template or setting of aquatic habitat across the watershed, addressing the characteristics that change slowly.

A ***methods*** section describes the process of information collection and assessment. The dynamic parts of aquatic habitat are then assessed in a section on aquatic habitat components. The current condition of the aquatic habitat and habitat forming processes are summarized using an integrity rating in Section 5.1.12.

Aquatic Habitat Overview

Aquatic habitat can be viewed by separating the components of habitat into two general groups: elements that are fairly stable, and the elements of aquatic habitat that are relatively dynamic.

An example of the first group is stream gradient. Large woody debris is an example of a habitat component in the second group. It is the combination of these two groups that create the capability of the habitat to meet the aquatic species life history requirements, resulting in species survival and growth. The dynamic components of

aquatic habitat are assessed with

Table 5.16 - Streamside Condition Indicators by EAWS Subwatersheds

EAWS Subwatershed	Wsd #	Wsd Area (acres)	Streamside % of Subwsd	Streamside Roads (mi)	Streamside Road Density (mi/mi2)	Number of Road Crossings	Streamside harvest (%)
Lower Slate Canyon	1	4,888	18%	4.7	3.4	18	NA
Main Slate Canyon	2	18,335	19%	17.2	3.2	47	6%
Little Van Buren	3	3,612	13%	0.8	1.0	4	11%
Deadhorse	4	3,755	24%	0.7	0.5	2	0
North Fork Slate	5	8,442	25%	5.1	1.6	11	7%
Upper Main Slate	6	10,654	23%	4.4	1.2	10	3%
Big Boulder	7	8,896	34%	5.2	1.1	10	4%
Little Slate	8	19,257	37%	23.3	2.0	54	11%
Van Buren	9	5,273	27%	1.6	0.7	3	1%
Total for Slate Creek		83,112		63.0		159	
Mean for Slate Creek			26%		1.8		7%

Background Information for Table 5.16:

- **Road Density:** data taken from Infrastructure Database as of 1/ 00
- **Harvest Acres:** data taken from Watershed Database as of 12/ 11/ 97
- **ECA (Equivalent Clearcut Area):** data taken from Watershed Database as of 1/ 13/ 98 (the ECA calculations include roads, timber harvest, and fire)
- **NA:** information is not available due to lack of data on private lands

respect to historic and current status in the Aquatic Habitat Components section that follows. The more stable, inherent characteristics of aquatic habitat are assessed in this section, to assist the reader in understanding both the inherent potential of the watershed, along with the consequences of the changes discussed later. The elements are not discussed in a historic versus current context. Generally, previous discussions about the physical attributes of the watershed are interpreted with respect to their contribution to aquatic species habitat.
The overview of aquatic habitat includes the following: how stream gradient is distributed across the watershed and how it relates to habitat potential, particular unconfined stream valley bottoms that provide for increased aquatic habitat, and the occurrence of general habitat elements across the watershed.

Stream Gradient
Section 5.1.5 presents an overview of the streams in Slate Creek, including the display of stream gradients in Map 11 and longitudinal profiles in Figure 5.10.

In general, the lower the gradient, the higher the aquatic habitat potential, although this varies by species and life stage.

Stream gradients less than 2% generally have high inherent potential for both spawning and rearing for most species, and include C, E, and F channel types. These are usually depositional channels with a riffle/ pool structure, with the degree of sinuosity related to the confinement. Channels are often relatively stable,

including gravels and large woody debris. Due to the low gradient, these channels are more susceptible to fine sediment deposition. In Slate Creek these streams are found in association with alluvial and glaciated valleybottoms (ALTA 18 & 5), and in low relief landscapes (ALTA 4 & 9). Large sections of stream in this gradient class are found throughout Little Slate, the middle section of Upper Main, upper North Fork, and the mouth of Slate Creek. These streams are well suited to chinook, where they are accessible, and support a wide range of resident species. Westslope cutthroat trout and bull trout are often found in higher gradients.

Streams with gradients between 2% and 4% generally have moderate to high inherent aquatic habitat potential for spawning and rearing, and are generally B and G channels. With a higher gradient these streams generally have higher stream energy, and spawning gravels that are patchy or discontinous. These streams are more suited to steelhead than chinook, for the anadromous fish. For resident fish, these streams generally provide high potential spawning and rearing, especially for westslope and bull trout. Most of mainstem Slate Creek is in this gradient class. Many of the stream reaches in Van Buren and Little Slate also have this gradient.

Streams with gradients between 4% and 10% are considered to have moderate habitat potential. These are generally plunge/ pool or step/ pool in structure, and usually A channels. Use by anadromous fish is fairly limited for spawning. There is more use of these channels by resident fish for spawning, particularly westslope, rearing. Lower Little Slate, and much of Boulder Creek and North Fork Slate have streams in this gradient class.

Streams over 10% generally provide limited rearing and very little spawning habitat for salmonids. Channels with this gradient often restrict movement of fish species. Many of the unsurveyed tributaries to mainstem Slate Creek are in this gradient class, along with much of lower Upper Main Slate, and sections of Boulder Creek.

In summary, Slate Creek contains a considerable amount of low gradient streams (less than 4%), that provide for high inherent potential to support fish species. Large streams in the lower watershedcommonly have gradients of between 2% and 4%. Most of the less than 2% gradient streams are found in the low relief landtypes in the upper watershed

Stream Valley Bottoms

The inherent aquatic habitat potential of streams is related to the valley bottom setting, or confinement, of the channel. Generally, the less confinement of a stream channel, the higher the aquatic habitat potential, due to the increased amount of sinuosity and meandering of the stream. Channel sinuosity can create high quality aquatic habitat through the formation of pools and undercut banks.

Alluvial valleys and glacial trough bottoms (ALTA 18 and 5) are unconfined valley bottoms which generally represent increased aquatic habitat potential. Small reaches of stream in this landtype often account for a high percentage of the aquatic habitat potential in a watershed. Map 9 displays these landtype features for Slate Creek. These unconfined valley bottoms occur at a relatively high level in Slate Creek, distributed across the watershed, compared to other watersheds in the lower Salmon.

The mouth of Slate Creek contains a narrow alluvial valley landtype (ALTA 18), along with other scattered sections along the mainstem. Little Slate and Boulder contain much of this landtype, with important small occurrences in upper North Fork, upper Deadhorse, and the lower part of Van Buren.

Most glacial trough valleys (ALTA 5) are found in Upper Main and Boulder subwatersheds. Van Buren contains a small but important section of this landtype.

Small alluvial valley bottoms are often not identified in the landtype mapping procedure. As with the larger alluvial valleys, these landtypes generally have increased aquatic habitat potential. These unmappable features generally occur in low

relief landtypes (ALTA 4 & 9), and add to the aquatic habitat potential of these areas.

In summary, Slate Creek contains a relatively large amount of unconfined valley bottoms which have increased inherent aquatic habitat potential, due to factors such as increased stream sinuosity.

General Habitat Elements

Aquatic habitat can be classified into general habitat types, including: riffles, pools, glides, pocket water, and side channels. These habitat types are created by both the setting and processes influencing a stream reach. The percentage of pool habitat is expected to vary more than the other general habitat elements, in response to disturbance events, and is addressed in more detail in the section on Aquatic Habitat Components. The percentages of the other habitat elements are expected to remain relatively stable.

Riffles are shallow, turbulent fast-water areas. Pocket water are small pools behind obstructions in swiftly flowing water. Side channels are areas off the main channel that typically has reduced velocities. Pools are slow-water areas of a reach that are deeper and wider than the surrounding units. Glides are nonturbulent areas, deeper than average in the reach, but with higher velocities than pools.

The streams in the breakland landtypes (ALTA 3 & 7) are characterized by a high percentage of riffle (up to 90% of a reach), and pocket water habitat (up to 60% in some reaches). There is also a relatively high amount of side channel habitat in the breakland reaches of Slate Creek, over 20% in some reaches. The amount of pool habitat is comparitively low (5-20%).

The streams in the low relief hills (ALTA 4 & 9) are characterized by the high percentage of glide habitat (up to 60%), and the relatively low percentage of riffle (less than 10% in some reaches). There is a moderate amount of pool habitat (10-40%), with little or no pocket water or side channel habitat. Lower Little Slate is an exception to this general character, due to both increased size and gradient.

The streams in the high elevation uplands (ALTA 1, 2, 5, & 21) vary considerably in habitat composition. In unconstrained valley bottoms, streams are characterized by a high percentage of glide (up to 50%), and side channel (up to 15 %). Across the entire area, the percentage of riffle is generally moderate (30-70%), and there is generally little side channel or pocket water. The percentage of pool habitat in this landtype varies, with comparatively high levels in Van Buren (up to 30%), and low levels in Boulder (generally less than 5%), as might be expected based on LWD levels.

In summary, the percentage of general habitat types vary across the Slate Creek watershed, generally in response to the landtype association. The percentage of pool habitat is not as consistent and varies more in response to local disturbance events. This habitat element is discussed in more detail later.

Methods

This section summarizes the information and procedures used to inventory and assess the aquatic habitat components in Slate Creek. The inventory methods are first described, followed by a discussion of the assessment methods used.

Stream surveys are used to inventory stream reach parameters and conditions, both physical and biological. Two types of stream surveys have been completed in Slate Creek, a basinwide stream survey (bws) and a reconnaissance (recon) survey.

The basinwide streams survey combines measured and estimated parameters using a three-stage sampling design that was developed by Hankin and Reeves (1988). The Nez Perce National Forest Basinwide Survey Methodology incorporates the basic methodology developed by Hankin and Reeves (1998) for estimating habitat areas, uses Hankin and Reeves and IDFG protocols to estimate fish abundance, and uses ratings developed by Platts et al. (1983, 1987) and Espinosa (1989) to evaluate the condition of other important fish habitat variables. This stream survey technique is intended to provide habitat unit scale information needed to evaluate the current condition of

forest streams. This information is summarized by streamsurvey reach.

The reconnaissance survey is a reach based survey using a Nez Perce Forest adaptation of the Hankin and Reeves Basinwide Stream Survey. The recon survey is based on visual estimates of stream habitat and riparain existing conditions. Fish distribution data is collected to describe species distribution through and across subwatersheds. This survey is less intensive than the basinwide survey and provides more generalized information at the stream reach scale.

Map 17 displays the surveys completed in Slate Creek, along with the year in which the survey was accomplished. It is recognized that based on the date of the stream survey, some aspects of the stream may have changed. As an example, it appears that fine sediment levels in the mainstem Slate Creek have changed since the survey in 1990. It is recognized that different survey crews may have introduced inconsistencies in survey methods. Additionally, the survey methods have changed over time, and data for specific analyses many not be available from all surveys. Where these inconsistencies are relevant, they are discussed in the applicable section.

The current conditions of the aquatic habitat components in Slate Creek are evaluated using one of two methods, in comparison to surveyed conditions across the Nez Perce Forest, or in comparison to established rankings, such as DFC or objective conditions.

Most habitat components are shown ranked against the stream conditions surveyed on the Nez Perce Forest. This allows for a display of condition based on a broader perspective than just Slate Creek. The component data for the surveyed reaches on the Forest are grouped into 5 quantiles (groups with an equal number of samples), to represent the range of conditions seen on the Forest. This survey data includes about 1,100 reaches, although this number varies by data item. This allows for an understanding of the habitat component both in terms of variation throughout the Slate Creek watershed, and in a broader context, within Slate Creek with respect to the range of conditions seen across the Forest.

Ideally, these component rankings should be ecologically stratified so that they are ranked against surveyed conditons in similar ecological settings. This stratification could include ALTA's, valley bottom types, or stream channeltypes. This comparison could be further refined to include levels of management activity, to allow comparison to 'reference' or undisturbed conditions. The completion of this ecological stratification is beyond the scope of this assessment, and has not been completed. However, in general, the ranking of conditions in Slate Creek, as compared to the surveyed streams on the Forest, are consistent with the professional understanding of the conditions by the fisheries biologists involved in this assessment.

Some habitat components are shown ranked against generally recognized levels, or established DFC or objective values. The ranking of stream gradient and fine sediment levels use a generally recongized ranking of these variables. The specific method used to rank a habitat variable is identified in the narrative discussion of that component.

Aquatic Habitat Components

Some components of aquatic habitat change in response to natural and human events. These can be important contributors to the quality or condition of the aquatic habitat. Aquatic habitat components assessed include; large woody debris, pools, substrate, and temperature. Large woody debris and pool habitat are assessed in detail, while substrate and temperature are briefly discussed, based on the previous discussion of these elements. For habitat components not previously discussed (LWD and pools), the link between physical regimes (ie sediment) and the quality or condition of aquatic habitat is assessed in the following steps; the historic process and condition is discussed, the events and factors contributing to change in the historic status are identified, and the current process and condition of the habitat component is

evaluated. For habitat components closely related to previous discussions (substrate and temperature), a short discussion of the aquatic habitat consequences of the physical conditons is provided.

Large Woody Debris

Large woody debris (LWD) is an important element of aquatic ecosystems, integral to the structure and function of streams, and providing habitat for salmonid. Based on this importance, LWD has been selected as one component of aquatic species habitat assessed in this EAWS. To understand this component, the historic LWD recruitement process, changes that have occurred in LWD levels, changes that have occurred in the LWD recruitement process, and the current levels of acting and potential LWD will be assessed. Synthesis of this information is provided in terms of summary findings and management recommendations. Acting LWD is large woody material present in the stream channel. Potential LWD is trees and snags that exist outside the stream and have the potential to be recruited to the stream.

Historic Process and Conditions: The historic LWD recruitement process varied by stream and landscape setting, but generally involved the riparian areas, upslope disturbance processes, and movement downstream. In the high elevation aquatic landtype associations (ALTA 1, 2, 5, and 21) infrequent lethal fires played a dominant role in the recruitement of LWD, both from nearstream and upslope areas (in association with snow avalanches or other mass movement events). These large infrequent pulses were augmented by the more constant recuitement of riparian trees due to other factors, such as channel meander and insect and desease mortality. In the low relief aquatic landtype associations (ALTA 4, 9, and 18), the nearstream recruitement of LWD played a dominant role, due to the flatter terrain, with these inputs often pulsed in response to large lethal fires. In the breakland aquatic landtype associations (ALTA 3 and 7) the upslope and nearstream environments contributed significant amounts of LWD based on their active nature. The upslope recruitement of LWD was associated with debris torrents and slope failures. The movement of LWD downstream was more of a factor in this landscape, due to the incised, high energy of these channels. This often resulted in the LWD being piled up in large logjams.

Events and Factors Contributing to Changes: Factors that have significantly changed the levels of acting LWD include: the probable removal of instream wood during the early mining period, removal of instream wood as a fisheries enhancement project in section of Main Slate, and North Fork Slate Creek as outlined in a November 17, 1964 project proposal; "Slate Creek Rehabilitation Project". Following the 1964 flood event, thirty debris jams were removed from the lower North Fork (USFS 1999). Letters of record located in the Salmon River Ranger District office indicate that debris jams in North Fork Slate were removed by a five-man hand crews using power saws and a power saw winch. Other plans for Main Slate included skidding logs from the stream channel with a heel-boom jammer equipped with 250 feet of cable.

Factors that have influenced the levels of potential (future) LWD include; streamside harvest, principally in Little Slate. Factors that have changed the LWD recruitement process include; the change in fire disturbances, development of streamside roads, and enhancement of LWD levels through human placement.

Current Process and Conditions: Map 20 displays the current levels of acting LWD in surveyed streams. The values are the number of pieces of stable LWD per 100 meters of stream length, grouped into 5 classes to display a relative ranking. The 5 classes (and corresponding colors) are quantiles (even number of samples per group) of LWD survey data from across the Nez Perce Forest (1147 stream survey reaches). Consequently, the relative ranking of LWD levels displayed is in comparison to the levels of LWD from all basinwide surveys, not just within Slate Creek. As can be seen from Map 20, the levels of acting LWD is high in upper Little Slate, Van Buren, and most surveyed sections of

Deadhorse and Upper Main. There are moderate levels of acting LWD in Boulder, North Fork, and lower Little Slate. The levels of acting LWD in mainstem Slate Creek are very low. There is a general relationship between the levels of acting LWD and stream gradient and energy. The exceptions to this include; higher than expected levels in meadow reaches of Little Slate from human placement, the higher than expected levels in Van Buren, and the lower than expected levels in upper North Fork. Beacuse mainstem Slate Creek has high stream energy, one would expect this would have resulted in large logjams scattered along this stream and a patchy distribution of the LWD, instead of the current low levels along the entire length of stream.

Map 21 displays the current levels of potential LWD in surveyed streams. The values are the number of pieces of potential LWD (along both banks) per 100 meters of stream length, grouped into 5 classes to display a relative ranking. The 5 classes (and corresponding colors) are quantiles (even number of samples per group) of survey data from across the Nez Perce Foreest (1147 stream survey reaches). Consequently, the relative ranking of potential LWD levels displayed is in comparison to the levels of LWD from all basinwide surveys, not just within Slate Creek. Potential LWD is an indicator of nearstream recruitement potential, and does not include an estimate of the amount or contribution of upslope recruitement. As can be seen from Map 21, the levels of potential LWD are high in Van Buren, Boulder, Deadhorse, and lower Little Slate. In all of these areas, upslope recruitement plays a significant role. There are moderate levels of potential LWD in Upper Main, North Fork, and upper Little Slate. Upslope recruitement does not play a significant role in upper Little Slate. There are low levels of potential LWD along much of mainstem Slate Creek. Presence of the 354 road along Slate Creek is a factor in this value. Additionally, while upslope recruitement would be expected to play a significant role in this canyon environment, primarily through debris torrents, this process is also influenced by the presence of the 354 road on the one side of the stream.

Discussion: Expected future levels of LWD may be indicated by combining information on the current acting and potential levels of LWD, and changes in the LWD recruitement process. Most areas of the watershed have either high levels of acting or potential LWD except North Fork and mainstem Slate Creek. Introduction and allowance for more fires in the watershed should only benefit the recruitement of LWD. However, given the current acting and potential levels, and the change in recruitement process associated with the streamside road, mainstem Slate Creek is likely to continue to have low levels of LWD. While recognizing that the LWD in this stream functions differently than in the conventional sense of a lower energy stream, and would be more clumped into large logjams, the reduction of the LWD in this section of stream is important to aquatic species. Lower Slate Creek may be expected to have less active LWD because of larger stream size, higher peak flows and higher energy. Consequently, it may also be expected that lower mainstem Slate Creek would historically have less LWD compared to other tributaries in the watershed. The loss of habitat quality in mainstem Slate, including deep pools associated with logjams, is significant at the watershed level for most aquatic species.

Summary Findings:

- LWD recruitement process varies by stream and landscape disturbance setting. The historic recruitement process has been changed primarily by the change in fire disturbance, and to a less degree by the construction of streamside roads.

- Current levels of acting LWD are likely reduced from historic levels due to removal, from both the historic mining period and more recent activities.

- Current levels of acting LWD, in comparison to LWD levels surveyed across the Forest, range from high in Van Buren, and portions of Little Slate and Upper Main, to low in mainstem Slate Creek.

- Current levels of potential LWD, in comparison to potential LWD levels surveyed across the Forest, range from high in Van Buren, Boulder, and Deadhorse, to low along most of mainstem Slate Creek.

- Mainstem Slate Creek is the only area of the watershed where LWD is a large problem. Due to changes in recruitement process, specifically presence of the 354 road, and the current acting and potential LWD levels, mainstem Slate Creek can be expected to have reduced aquatic habitat condition associated with LWD. In this high energy stream, most of the LWD and associated aquatic habitat would likely be in large infrequent logjams.

- Human occupation and facilities along mainstem Slate, particularly in the Lower Canyon, will limit the acceptable risks associated with addressing this habitat loss.

Pools

Pools are fundamental aspects of fish habitat, providing rearing habitat for juvenile fish, resting places, overwintering areas, and refugia from floods, drought, and extreme temperatures (Quigley et. al. ICRB, 1997). Pool habitat represents an important element for all life stages of aquatic species, providing for summer rearing, winter rearing, and spawning (in tailout sections). The quality of aquatic habitat is generally correlated to the amount of pools. The processes of pool development, complexity, and maintenance is often more susceptible to distruption than other aquatic habitat elements. The loss of pools, especially deep pools, substantially and adversely affects fish habitat (Quigley et. al. ICRB, 1997).

To assess the status of pool habitat in Slate Creek, the ALTA's are used to discuss the historic pool forming processes, along with the kinds and amount of pool habitat. The events and factors that have altered the processes of pool formation and maintenance are discussed, and related to the current situation, both in terms of pool forming processes and the overall amount and condition of pools in the Slate Creek watershed.

Historic Process and Condition: The natural processes of streams result in the development and maintenance of pools through a variety of mechanisms. These mechanisms can be grouped by two general categories of channel morphology, riffle-pool and step-pool, that allow for a general discussion of the processes of pool formation. The cascade-pool morphology used by others (Province of British Columbia, 1996), has been included in the riffle-pool group in this assessment. Riffle-pool channels are streams with lower gradient, where the horizontal meander sequence is the principal pool forming process, generally associated with the outside of the stream meander. Wood is an important factor in influencing the formation of pools in all types of channels, but especially in riffle-pool channels in unconfined valleybottoms (Quigley et. al. ICRB, 1997). Step-pool channels are streams with higher gradients, where the vertical drops over channel elements, such as boulders, is the principle pool forming process.

Historic amounts and types of pool habitat, along with the processes that create pools, varied by the stream and landscape setting.

In the high elevation landtypes (ALTAs 1, 2, and 21), not including ALTA 5, streams are generally of step-pool morphology with the predominate types of pools being plunge, underscour, and glide pools. These pools are generally formed through the hydrologic processes of water plunging over boulder, bedrock, and stable pieces of LWD. Glide pools often are created as water is "backed up" behind boulders and LWD, often times forming a transitional habitat between other aquatic habitat types. The pools in these landtypes are generally smaller, with the presence of LWD being highly influential, particularly in the lower gradient reaches.

In the low relief landtype associations (ALTAs 4, 6, 9, and 18), and ALTA 5, streams are generally low gradient riffle-pool channels, with the predominate pools being dammed, lateral scour, and glide pools. Stream types are often C and E

channels. The stream meander process and LWD are important processes of pool formation. LWD being important for the complexity as well as the amount of pool habitat. The presence of bedrock in these channels often contributes to the formation of large pools. Channel equilibrium is an important factor in the maintenance of pool habitat. Stable channels may have 50-70% of the area in pools, while aggradded or degraded reaches may have only 15% of the area in pools (Province of British Columbia 1996).

In the breakland landtype associations (ALTAs 3 and 7) the expected Rosgen channel type of the larger streams is generally B, with stream gradients ranging from 2% to 10%. These channels are a mix of riffle-pool and step-pool morphology. Tributary streams are generaly higher gradient A channels, with step-pool morphology. Pool types expected in these stream channel types would include plunge, underscour, trench, and to a lesser extent glide pools. Bedrock, boulders, and LWD are important pool forming elements, with the LWD often being concentrated in logjams that create large, complex pools.

Events and Factors Contributing to Changes: The events and factors that may have altered the amount and type of pool habitat in Slate Creek include changes in pool forming processes, and changes in the stream processes that maintain pool habitat. These are discussed by the broad landtype areas.

In the high elevation landtypes, there has been the least effect on the processes of pool formation and the amount of pool habitat. Fire suppression has reduced the large inputs of LWD into these streams, however, fire is infrequent in these areas, therefore, the effect of this suppression has been less. The maintenance of pool habitat through stream and sediment regimes has also been the least altered in the watershed. Stream reaches in ALTA 5, in particular in Upper Main and Van Buren, have been affected by nearstream and instream activities that have probably reduced the amount and type of pool habitat. In Upper Main the nearstream trail and grazing activities appear to have reduced the amount of pool habitat. In Van Buren, dredge mining in the ALTA 5 landtype in this subwatershed, appears to have altered the type of pools formed in this riffle-pool channel.

In the low relief landtypes, there has been alteration of the processes that form and maintain pool habitat. The conversion of C and E channels to G and F channels, from historic grazing and mining activities, has substantially altered the process of pool formation in these riffle-pool channels. The lowering of the water elevation, and the associated increases in stream energy, as a result of the loss of floodplain connection, from these channel changes, dramatically affects the pool forming processes and pool habitat quality. Additionally, the change in sediment regime in this landtype is thought to have significantly altered the maintenance of pool habitat, through the process of pool filling.

In the breakland landtypes, there have been important changes in the processes of pool formation and maintenance. Fire suppression in this landscape has reduced the input of LWD and large boulders into streams, through reduction in the debris torrent process. Nearstream and instream activities have reduced the amount of LWD, and the LWD recruitement process. The loss of the number of occasional logjams in these breakland channels is thought to have had a large effect on the number of large, highly complex pools. There has been less effect on the pools created by bedrock and boulders. The changes in the sediment regime in this area, both from the upstream effects and the activities on areas with mass wasting sensitivity, are believed to have influenced the amount, volume, and quality of the pool habitat in this landscape, through channel aggregation and fine sediment embedding of pool substrates.

In summary, the factors that have influenced the development, complexity, and maintenace of pool habitat include: changes in water yield, sediment yield, and direct stream channel effects. These changes are a result of mining, grazing, road and trail

development and maintenance, timber harvest, and changes in fire disturbance. Pools formed from channel meander processes, and LWD are probably the most altered in the watershed. The reduction in channel meander processes have occurred principally in the low relief landtypes where water elevations have been lowered. The change in LWD recruitment is discussed in the previous section. Changes in the sediment regime has likely altered the amount and quality of pool habitat.

Current Process and Conditions: Map 22 displays the current percent of pool area by reach, as well as, the dominant pool forming process (pool creator) within the reach. The percent of pool habitat is ranked into 3 broad classes. All pool habitat, except pocket water, is included in this percentage, while only the dominant pool forming process is identified. There are likely to be other types of pool habitat creators that contribute to the amount of pool habitat shown, besides the one displayed for a reach.

Most LWD formed pools are found in Van Buren and in sections of Little Slate adjacent to Van Buren. The high levels of acting LWD in Van Buren account for the pools in that subwatershed, despite the higher stream gradients. The lack of pool habitat in the lower end of Van Buren appears to be related to human impacts on that reach, given the low gradient C channel type and unconfined valleybottom in that area. The sections of Little Slate are predominately C channels, with the LWD playing the central role expected in these reaches. Both of these areas have high levels of acting LWD (Map 20). Upper little Slate is an area with high levels of acting LWD where the dominant pool forming process is not LWD, as discusssed below. The glaciated valley bottom in Upper Main Slate and one reach in lower Main Slate are also dominated by LWD formed pools. While the level of acting LWD is high in the ALTA 5 setion of Upper Main, the amount of pool habitat found in most of this area is unexpectedly low. While LWD is not expected to play the dominant role in pool formation in the breaklands, it is thought that there should be more pools formed from LWD in this area, particularly in the unconstrained sections of ALTA 18 that occur along the mainstem.

The occurrence of meander created pools in Slate Creek are in upper Little Slate, Little Boulder, and upper North Fork. Upper Little Slate has high levels of acting LWD, however, the pools in this area are generally formed from stream meander process, as would be expected for the E channels in this area. The G and F channels in this area, an artifact of human disturbance, still display a high amount of meander formed pools. The meander formed pools in upper North Fork are an expected feature of the E channels in this area. The unconfined valley bottom of Little Boulder would likely be dominated by LWD formed pools if the level of acting LWD were higher, given the higher gradients in this area. The lack of expected meander formed pools in the unconfined valley bottom, and E channel type, of Upper Main Slate is likely related to the nearstream impacts in this stream reach.

Boulders are the dominant pool forming process for most of the breakland streams, as expected. As mentioned earlier, it is the pools created by logjams in these channels that appear to be missing. In general, the unconfined valley bottoms (ALTA 18) in the breaklands have a high amount of pool habitat. Mainstem Slate in the Lower Canyon subwatershed is the principal exception to this relationship. Lower Deadhorse is the other subwatershed where the amount of pool habitat is lower than expected. One section of Van Buren is dominated by boulder created pools. This reach is in a glaciated valley bottom, and the nature of the pools in this reach may due to the position of this reach in the watershed, or related to the historic mining activities in this reach.

It is likely that there has been a decrease in the overall amount of pools in Slate Creek, although data on historic amounts of pool habitat is not available. Studies have shown that there have been major decreases in the amount of pool habitat in the Columbia River basin from human activities (Quigley

et. al. ICRB, 1997). The losses appear to be the greatest in the lower-gradient streams most disturbed by humans (Quigley et. al. ICRB, 1997). The managed portions of Slate Creek fit the criteria of places where decreases in pool habitat have occurred, although probably to a somewhat lesser degree due to the confinement in the breakland valleybottoms of the watershed.

Summary Findings:

- In general, the dominant process forming the pool habitat in Slate Creek is as expected, given the stream gradient and type, and the landtype setting. Stream reaches that appear to be an exceptions to this include unconfined reaches in mid Van Buren, and Little Boulder. It is possible that LWD would be the dominant pool forming process in these reaches, under different circumstances.

- While not expected to be the dominant process in the breaklands, it is thought that there is a lack of pools associated with LWD in the breakland streams, particularly mainstem Slate Creek. The analysis of similar breakland reference conditions, to define the expected frequency of LWD created pools, was not completed to verify this belief.

- The amount of pool habitat in Slate Creek is moderate to high in most reaches. Information to determine historic amounts of pool habitat are not available. Stream reaches with low amounts of pool habitat, that are likely reduced from historic levels, include: sections of mainstem Slate (including reaches in the Lower Canyon), lower Deadhorse, reaches in Upper Main Slate, and lower Van Buren.

- It is likely that there has been an overall reduction in the amount of pool habitat in Slate Creek, from disruption of pool forming and maintenance processes. The most significant changes in pool forming processes are likely to be: the reduction in the recruitement, and levels of acting, LWD from nearstream and instream activities, and changes in the fire regime, and modification of stream and riparian processes due to direct channel impacts. The changes in sediment regime in the watershed has likely resulted in a decrease in the amount and quality of pool habitat .

Substrate

Stream substrate composition is an important aspect of aquatic species habitat. Fine sediment levels in stream substrate may fluctuate in response to events, while the stream remains in dynamic equilibrium, and generally represent the quality of the aquatic habitat. High levels of fine sediment affect the quality of the habitat for both spawning/ incubation and rearing. For spawning, elevated levels of fine sediment adversely affect salmonid embryo survival by impeding intergravel flow and reducing oxygen in redds (Quigley et. al. ICRB, 1997). Rearing, and particularly winter rearing, is adversely affected by high levels of fine sediment that reduce the amount of inter-gravel space used by juvenile fish seeking refuge from high flows or winter conditions. While other aspects of substrate condition are important for aquatic species, this assessment is limited to an assessment of the fine sediment levels, due to their importance and responsiveness.

Section 5.1.6 addresses sediment, including erosion processes, watershed condition indicators, and current conditions. This section addresses the instream sediment transport process and the current percentage of fine sediment in the substrate (Map 18).

Map 19 displays the cobble embeddedness of substrate for the Slate Creek watershed. This evaluation of habitat condition is used, in addition to the percentage of fine sediment in Map 18, to evaluate the consequences of recent fine sediment levels. Cobble embeddedness represents the degreee to which fine sediment has been encorporated into the substrate over time, with the corresponding effect on the amount of interstitial space in the substrate. It is thought to represent a somewhat longer view of fine sediment levels.

Sediment and substrate composition are known to change over time, in response to disturbance events or the lack of such events. There are indications that the fine sediment levels in mainstem Slate Creek observed during the stream survey (1990)

have since decreased. This assumption of improved fine sediment conditions is likely to also apply to the cobble embeddedness levels, although to a somewhat lesser degree, based on the previous discussion about timing.

In general, the cobble embeddedness levels in Slate Creek are high. The range of percentages displayed on Map 19 are considerably higher than the objective conditions established in various documents. As an example, the biological opinion on the Nez Perce Forest Plan for Snake River chinook establishes a guideline for cobble embeddedness in rearing habitat of less than 30 percent. The highest levels of cobble embeddedness are observed in Little Slate, North Fork, and mainstem Slate Creek. This is not unexpected given the stream and landtype setting, and management histories, in these areas.

The information on cobble embeddedness (Map 19) corresponds well to the information on the fine sediment levels in the substrate (Map 18), in terms of the statial distribution of conditions across Slate Creek. The difference in percentage classes between these indicators of substrate condition may be related to technique or the aspects of fine sediment processing discussed above.

In summary, the streams in Slate Creek, particularly Little Slate, North Fork, and mainstem Slate Creek, have high levels of cobble embeddedness. These levels are not unexpected given the long history of human disturbance in this watershed. Decrease in winter rearing capability for juvenile fish has likely been the most signficant effect of this condition, with incubation success also being reduced.

Temperature

Stream temperature is an important aspect of aquatic species habitat. Very high or low temperatures have been documented to adversely affect species survival and behavior. This assessment considers the possible effect of elevated stream temperatures on aquatic species. High stream temperatures are known to effect species survival, migration, and growth.

Section 5.1.7 assesses the water temperature conditions in Slate Creek, including temperature differences between parts of the watershed, and actual temperatures relative to water temperature criteria. The summary of this analysis includes: the water temperatures in Deadhorse and Van Buren are the coolest of the measured sites in the watershed; stream tempertures are increased in the middle section of Little Slate, probably more than historically due to activity impacts on this section of stream; temperatures in mainstem Slate Creek increase as you move downstream to the mouth. Overall, the water temperatures in Slate Creek (particularly in the mainstem), exceed established temperature criteria much of the time.

Analysis of water temperatures in Slate Creek, and the possible role of human impacts on the temperature, can be synthesized into 3 areas of concern or consideration related to aquatic species. The area believed to have the greatest influence from human activities is Little Slate.

The high temperatures in middle Little Slate are a concern with respect to bull trout migration, in addition to the contribution to downstream temperatures for all species. Movement of bull trout into the Van Buren subwatershed may be affected by the high temperatures in Little Slate. To the degree that these temperatures are a result of riparian and stream conditions due to human disturbances, which can only be surmised, efforts should be made to restore these conditions. Connectivity of the bull trout population in the Van Buren subwatershed with other parts of Slate Creek is a high priority aquatic objective, both in terms of persistence of the population in Van Buren Creek, as well as the rebuilding of populations elsewhere in the watershed.

Stream temperatures in North Fork may be elevated due to riparian and stream conditions in the upper subwatershed resulting from human disturbance. This is an important subwatershed, due to both the aquatic species in North Fork, and its contribution to downstream aquatic

conditions. Restoration of riparian and stream conditions in upper North Fork should be evaluated in light of the possible contribution to stream temperature improvement.

Mainstem Slate Creek, particularly near the mouth, has stream temperatures that exceed established criteria. While it is recognized that natural conditions are responsible for much of this situation, it is possible that nearstream human impacts have contributed to this condition. The temperatures in this stream have the potential to cause adverse affects to the at-risk aquatic species in this stream, including effects on migration of bull trout and spring chinook. The riparian and instream conditions of the mainstem should be evaluated to identify restoration opportunities that may contribute to improvement in stream temperatures.

In summary, it is possible that stream temperatures in Slate Creek have been elevated from human impacts on the nearstream and instream conditions, particularly in Little Slate. While the effect on stream temperature can only be surmised, restoration should be prioritized to contribute, to the extent possible, to improvement in water temperatures in Slate Creek.

5.1.12 Aquatic Condition Summary

The current condition of the aquatic habitat and habitat forming processes in Slate Creek have been integrated into a summary of the current status, using a rating of integrity. Map 23 displays the current aquatic integrity for Slate Creek.

Given the inherent dynamic nature of ecosystems, the concept of ecological integrity is used to describe the state of ecological systems, including components and processes. The rating of integrity is the relationship between the current state and the unimpaired or natural state. It is intended to display the amount of departure for an area from the reference state.

The rating of low integrity is intended to identify significant departure from historic processes along with permanent changes in process or conditon, a press type disturbnace. The rating of moderate integrity is intended to identify a signficant but less degree of departure from historic processes. This rating generally includes pulse type disturbances, where the frequency or magnitude may have changed, but this change is not considered permanent and likely to return to roughly historic levels or frequencies over time.

The integrity ratings used for this assessment are not directly comparable to the integrity ratings used in other assessments, including Quigley et. al. ICRB, 1997. The rating of low integrity in Slate Creek in this assessment is likely to be considered as moderate when compared to a broader range of conditions, such as in Quigley et. al. ICRB, 1997. This rating of integrity is meant to stratify the condition within Slate Creek, but should not be construed to mean that the watersehd processes are on the low end of the range across broader areas.

The rating of integrity is intended to describe both the current condition as well as the current status of the processes. Integrity is inversely related to the amount of departure in both conditon and processes from historic. The rating of integrity is also related to the PFC (properly functioning condition) ranking of ecosystem function. High integrity is comparable to a rating of properly functioning. Moderate integrity is comparable to the functioning at risk rating. Low integrity should not be equated to non-functioning (or functioning at unacceptable risk). The rating of low integrity is probably equivilent to a PFC rating of "functioning at a higher risk" than the moderate integrity rating.

The aquatic condition integrity rating was developed from a rating of upland and nearstream condition. These two ratings were combined to create the overall rating shown in Map 23. The lower of the two ratings was assigned to an area when the rating of upland and nearstream integrity was different.

The upland condition rating included a consideration of the status of regimes (fire

and sediment), the level of human activity, and the sensitivity of the landscape.

The nearstream/instream integrity rating considered activities with effects on the nearstream or instream environment, the downstream translation of upstream effects, and the sensitivity and resilience of the streams.

As can be seen from Map 23, the aquatic condition in Slate Creek varies spatially, with roughly a third of the basin in each category.

The large blocks of area rated as having high integrity are located principally in the high elevation landscapes of the watershed, on the East and Western edge. These are areas of low road development (see Map 15), with the longest disturbance intervals. The fire regimes in these areas are the least departed in the watershed. An area of high integrity is located in lower Little Slate, at the transition between the breaklands and the rolling uplands. The upland sediment regime in this area is unchanged, the fire regime in this area has a greater degree of departure than the other areas in this integrity class.

Within the large blocks of area with high integrity, some of the major stream reaches are rated as having moderate to low integrity. The stream in Upper Main Slate is rated as having moderate integrity due to the nearstream effects from the trail and cattle affects on the stream in this area (see Map 14). In Little Slate, the stream in the area with high upland integrity has protions rated both moderate and low. The area rated low includes areas with direct impacts from historic mining and grazing, and stream reaches with increased sensitivity to the sediment regimes effects from upstream. The stream reaches rated moderate have had little direct effects from activities and have higher resilience to the upstream sediment effects, due to higher stream gradient and energy along with the degree of stream confinement. This same moderate rating has been assigned to the portion of lower Boulder Creek that is surrounded by an upland integrity rating of high for similar reasons.

The rating of low integrity has been assigned to one large block in the upper watershed, and to smaller blocks and stream reaches throughout the rest of the watershed. The large block, principally in Little Slate, was assigned a rating of low integrity due to both upland and nearstream conditions. This area represents the highly erodible cold rolling uplands in the watershed (ALTA 9). The upland rating is based on the erodibility of the area, the level of historic and recent activity in this area, and the high departure in disturbance pattern from these activities (see Map 5). The nearstream rating of low integrity is based on: the erodibility of this landscape, the level of steam dissection (see Map 13), the sensitivity of the stream channels, the direct stream effects of historic mining and grazing (see Map 14), and the amount and streamside proximity of road and harvest activites (see Map 16). This area assigned a rating of low integrity based on this rational extends over most of Little Slate, across the lower ends of Van Buren and Boulder Creeks, and into the upper end of the Lower Canyon subwatershed. Other areas assigned a rating of low integrity included both upland areas and stream reaches throughout the breaklands landscapes of the watershed. The larger blocks of low integrity in the breaklands are areas of concentrated roads on landscapes with high mass movement sensitivity (see Maps 7 and 16). These areas are located in lower Upper Main, lower North Fork, a small portion of lower Deadhorse, and several areas in the Main Canyon. The stream reaches assigned a low integrity rating include; a meadow area in upper North Fork affected by historic grazing (see Map 14), the lower portion of Upper Main Slate that has a very high level of instability and bedload movement (likely as the result of a natural event), and several portions of lower Little Slate and Main Slate (in the Main Canyon and Lower Canyon subwatersheds) directly affected by streamside roads (see Map 16) and other historic and recent streamside activities.

Most areas assigned a moderate integrity rating are located in the breakland portion of the watershed, with the exception of the

Western edge of Little Slate. These are areas where there has been some departure from historic processes and conditions, but not to the extent in the low integrity class. The rating of moderate integrity was assigned to the Western portion of Little Slate based on the less amount of: direct stream effects from historic mining and grazing, stream sensitivity, and landscape erodibility. The assignment of a moderate upland integrity rating to most of the breaklands was based on the departure in fire regimes and the road and harvest activities on areas with less than high mass movement risk. The roads on the Southern end of the Lower Canyon subwatershed across to the top of the Little Van Buren subwatershed represent the highest level of departure still considered to be in the moderate class (see Maps 7 & 16). The nearstream rating of moderate integrity was based on the level of direct effects (see Map 14), and less sensitivity (see Map 12). The portion of mainstem Slate Creek assigned the moderate integrity rating includes a portion of the stream where the road is not as close, and the stream has a higher gradient, level of confinement, and resilience.

In summary, Map 23 displays a rating of the current integrity of the aquatic processes and condition in the Slate Creek watershed that integrates the physical landscape and activities assessed in this aquatic section.

5.1.13 Aquatic Species

Introduction

Aquatic species are those vertebrate and invertebrate animals that are closely associated with the streams, lakes, and wetlands. For the purpose of this assessment, this includes principally fish and amphibians. The salmonid fish receive most of the attention in this assessment, due to available information, resource limitations, and the at-risk status of these fish.

Six fish species are assessed in detail in Appendix Q, Volume 2. This includes: spring chinook salmon, steelhead trout, redband trout, westslope cutthroat trout, bull trout, and brook trout. The first five are included based on their at-risk status. Brook trout, a introduced non-native, is assessed based on the possible risk to other species, and its value as a sportfish. A summary of the assessment findings for these six species is provided in this chapter. The other fish species and amphibians presnet in the watershed are briefly discussed following the summary findings for these six species.

Before the species specific discussions, the methods used to collect and assessment species information is summarized, and the species specific information is integrated into a summary of the fish assemblages that occur in Slate Creek. Following this section, information on aquatic species is summarized in a species integrity rating.

Methods

Information on species occurrence comes from stream surveys completed by the Forest Service, BLM, IDFG, and others, IDFG fish stocking and fish population sampling data, and other data and information sources.

All sources of data have been used to describe the distribution of species. This information is displayed on the species maps as dotted lines. This information includes stream reaches where the species has been found (observed), as well as stream reaches surveyed where the species was not found. Not all stream reaches have been surveyed. Fish are known to occur in some of these unsurveyed streams in addition to those identified.

Fish distribution is coded by EPA reaches, which are fairly large sections of streams. Fish may not occur throughout the entire length of reaches identified.

It should not be assumed that a species does not or will not occur in the stream reaches where it was not found. Intensive survey methods necessary to determine the presence of fish at low densities were not used in these surveys. Additonally, fish move, and may be present in areas following sampling, particularly migratory fish. The distribution data identifies the general extent of the current species range.

The species distribution data also identifies whether the stream provides spawning and rearing habitat for the species, or rearing and migration habitat. This information is principally based on stream size, and does not attempt to sepearate reaches based on the occurrence of specific spawning features, such as gravel size and availability. This identification of spawning areas is a coarse descriptor.

The relative densities displayed for a species, the solid lines in the species maps, are calculated from the basinwide stream surveys (see description in section 5.1.11, Methods). Fish occurrence, by size class, is collected by habitat unit in this survey. This data is summarized for the stream survey reach, weighted by area. The relative density is displayed as the average number of fish per 100 square meters of stream surface in the stream survey reach. Because these density values are aggregated for the entire reach, they are not directly comparable to individual habitat unit densities, and in general will be less than the densities measured in specific high quality habitat units, such as pools.

The fish densities displayed are relative densities from a single measurement, either electrofishing or snorkeling. Because they are not based on repeated observations, such as multiple pass removal methods, they should not be considered an estimate of the actual fish population. Instead, these densities are useful to compare the relative population abundance between reaches.

The fish densities are grouped into 5 classes to provide a relative ranking of the population level from high to low. This ranking is displayed as the color of the solid line on the species maps, with a ramping from yellow (low density) to red (high density). The 5 classes of densities are species specific groups based on all available stream survey reach densities across the Nez Perce Forest, about 1100 reaches. This data is grouped into 5 quantiles (equal number of samples in each group) to represent the range of species specific densities that have been observed across the Forest. This allows the relative densities within Slate Creek to be assessed in a larger context.

The combination of the fish distribution data and the relative density data, where available, provides a understanding of the species status across the watershed. This information paints a fairly clear picture of the current distribution of populations, or areas with large numbers of fish. But is thought to have less resolution for identification of areas with low densities, or infrequently occurring individuals.

Fish Assemblages

The consolidation of individual aquatic species into fish assemblages provides an integrated view of species distribution and population strength. Fish assemblages are a description of the collection of species that occur together in a stream reach. The assemblages used for this assessment are based on species occurrence, and the dominant species in a reach, from relative densities.

The fish assemblages presented are intended to describe the pattern of aquatic species distribution, the biological interactions occurring between species, and the management context of an area relative to aquatic species. Others have developed species assemblages focusing on ecological community processes (Quigley et. al. ICRB, 1997). The assemblages presented here are intended as a descriptive tool, were not developed using strict analysis methods, and are not assumed to represent unique ecological groupings.

Map 24 displays the fish assemblages for Slate Creek. The fish assemblages used to characterize the aquatic species in Slate Creek are described further in Appendix F.

The fish assemblages are a coarse description of species occurrence and relative density and are not expected to precisely represent the conditons within every reach. The classification of fish assemblages is limited to where stream surveys have been completed. Fish are known to occur outside the areas displayed on Map 24.

There are some stream reaches where fish assimblages are displayed that do not correspond with the individual species distribution maps. In most cases this was a result of using 1999 survey data to describe fish assemblages that was not yet available for distribution mapping.

Due to the complexity of seperating steelhead and sympatric redband (residualized steelhead) populations, in areas where steelhead are present, redband are not listed seperately.

In general for Slate Creek, only a single species occurs at moderate to high densities for a given reach. The only significant exception to this is in portion of mainstem Slate Creek where the spring chinook and steelhead densities are both moderate to high (in comparison to other surveyed reaches, not in a historic context). This situation probably does not represents the historic condition, and historically it was probably more common to have several species present at moderate to high densities within a given reach.

It is also generally true for Slate Creek that within a given reach there is a species that occurs at moderate to high densities. The exceptions to this are portions of Upper Main Slate, where brook trout occur at realtively low densities, and the Eastern portion of Little Slate, where redband trout are present at low densities.

A correlation is suggested between the fish assemblages and the ALTA's, although no statistical analysis was conducted. The anadromous fish occupy the breakland portions of the watershed (ALTA 3 & 7). Bull trout populations are found in association with the high elevation landtypes (ALTA 1, 2, 5, & 21), although only on the Western side of the watershed. And the other resident trout (westslope, redband, and introduced brook trout) are found in the low relief landscapes (ALTA 4, 6 & 9), and the high elevation landtypes on the Eastern side of the watershed.

The Eastern high elevation landtypes (Upper Main and boulder subwatersehds) present a bit of a puzzle, given the current brook trout presence, the lack of bull trout, and no native species in Upper Main. It is unknown if native species were ever present in Upper Main, and extirpated, or if this area was historically fishless. While this area appears to contain suitable habitat for bull trout, their absence is likely due to the patchy nature of their distribution.

Given the fish assemblages in comparison to the current aquatic management direction (Forest Plan fish/ water quality objectives), the assigned objectives may not always correlate with current species status and conservation objectives. Recommendations regarding these objectives are presented in Section 6.2.3, Aquatic Management Direction.

Spring Chinook Salmon

Summary Findings

- Slate Creek contains a small but important, unique spring chinook population at the downstream edge of the species' distribution in the Salmon River.

- The inherent habitat potential of Slate Creek to support spring chinook salmon is moderate, given the breaklands setting of the streams with suitable habitat.

- Historic and current distribution of spring chinook salmon in Slate Creek are thought to be equivalent.

- Genetic integrity of this stock may be reduced by past hatchery supplementation and current straying of Rapid River hatchery adults.

- Current population abundance is reduced from historic by a variety of downstream and instream effects. The current strength of the spring chinook population in Slate Creek is "weak, depressed, etc", and exists at a high risk of extinction.

- Within Slate Creek, the most important factor related to spring chinook salmon status and potential recovery is habitat degradation. The loss of deep pools, associated with occasional logjams, and an increase in substrate embeddedness, as a result of altered sediment regimes, are

thought to be the elements most altered. Juvenile survival is likely the element most affected by these changes.

- Downstream factors are likely the most influencial in the current status of the species and potential future recovery.

Steelhead Trout

Summary Findings

- While not unique within the lower Salmon, Slate Creek supports an important local population of steelhead trout, with inherently high habitat potential and relatively high current population numbers.

- The inherent habitat potential of Slate Creek to support steelhead trout is very high. The larger breakland streams of Slate Creek provide optimum habitat for steelhead trout.

- Historic and current distribution of steelhead trout in Slate Creek are probably similar. When adult escapement was higher and more adults returned to Slate Creek, the historic distribution may have been wider.

- Genetic integrity of this stock may be reduced by past hatchery supplementation.

- Current population abundance is reduced from historic by a variety of downstream and instream effects. The current population is at moderate risk of extinction.

- Within Slate Creek, an important factor related to steelhead trout status and potential recovery is habitat degradation. The loss of deep pools, associated with occasional logjams, and an increase in substrate embeddedness, as a result of altered sediment regimes, are thought to be the elements most altered. Juvenile survival is likely the element most affected by these changes.

- Legal juvenile harvest and illegal or incidental harvest of wild/natural adults may reduce adult returns to Slate Creek.

- Downstream factors are likely the most influential factor in the current status of the species and potential future recovery.

Redband Trout

Summary Findings

- While not unique in the Lower Salmon subbasin, Slate Creek supports a potentially important local population of redband trout, which exist both in sympatry with anadromous steelhead (in Main Slate) and in allopatry (middle and upper reaches of Little Slate). Most of the higher order streams in the watershed support habitat with high to very high potential for redband trout.

- The upper reaches of Little Slate Creek and tributaries support moderate to high numbers of allopatric resident redband trout which are functionally isolated from the rest of the watershed.

- Historic and current distribution of redband trout are probably similar. Historic relative proportion of steelhead (the anadromous component of the population) was probably higher in areas where both forms occurred.

- Genetic integrity of redband trout in Main Slate may be reduced by past hatchery supplementation.

- Introduction of brook trout to Lower Slate Lake, with subsequent downstream encroachment, may have eliminated redband trout from the upper reaches of Main Slate Creek through competitive displacement.

Westslope Cutthroat Trout

Summary Findings

- Slate Creek contains important populations of westslope cutthroat trout, within the context of the Lower Salmon subbasin. While these populations are not unique, they represent a significant number of the known populations.

- Slate Creek contains aquatic habitat with high inherent potential to support westslope cutthroat trout.

- The current distribution of westslope cutthroat trout in Slate Creek is limited, principally to North Fork Slate and Boulder Creek. It is unknown if this distribuiton represents the historic distribution, or not.

- The current populations of westslope cutthroat trout are functionally isolated, with the migratory life history component very limited. It is felt that this component of the population has been reduced from historic conditions.

- The genetic integrity of the westslope cutthroat trout is thought to be high.

- Habitat disruption is a key factor in the current status and future trend of westslope cutthroat trout, along with angling. In Boulder Creek, the interaction with non-native brook trout represents a possible threat that should be monitored.

Bull Trout

Summary Findings

- Slate Creek is a unique, very important watershed for bull trout in the context of the lower Salmon. Slate Creek contains a large amount of high elevation landtypes (ALTA's 1, 2, 5 and 9), and high potential migratory habitat.

- Bull trout are widespread throughout the Slate Creek watershed. Their current distribution may be reduced from historic, if areas of suitable habitat were historically occupied. But it may be that these areas were never colonized and their current distribution reflects their historic distribution.

- The population strength, or densities, of bull trout in Slate Creek are generally low, and are believed to be reduced from historic. The strong local population in Van Buren is an exception. The reduction in the number of anadromous juveniles in the watershed, an important preybase for fluvial bull trout, is expected to be a significant factor in this decline.

- Both resident and fluvial life history forms are present in the watershed. The number and distribution of fluvial bull trout is not well understood.

- Connectivity with the Salmon River has been reduced due to habitat conditions. Connectivity within the watershed is similar to historic conditions, which includes several natural restrictions.

- The genetic integrity of the bull trout in Slate Creek is thought to be high.

Brook Trout

Summary Findings

- Populations of brook trout have been established in Upper Main and Boulder Creek subwatersheds. In Upper Main brook trout are the only salmonid present. In Boulder Creek brook trout co-exist with a relatively healthy westslope cutthroat trout population. Individual brook trout are occasionally observed in mainstem Slate Creek and Little Slate in the vicinity of these two tributary subwatersheds.

- In Boulder Creek, it is likely that the westslope cutthroat trout will outcompete the brook trout, given the higher gradient streams in this subwatershed. It is likely that the current ratio between these species is static, given the length of time they have co-existed.

- In Upper Main, it is not known if the brook trout extirpated a native fish species, or occupied vacant habitat. It is unlikely that brook trout could be removed from this sbuwatershed, although it does appear that there is the opportunity to remove them from Lower Slate Lake, with immigration back into the lake being prevented by stream gradients.

Other Fish Species

Slate Creek supports mountain whitefish, which have been documented in the mainstem downstream from the confluence of Main Slate and Little Slate Creeks and in Little Slate Creek upstream about two or three miles from the mouth. Sculpins, suckers, and dace are also found in Slate Creek. The species of sculpin is unknown although visual appearance suggests they are shorthead sculpin. Also unknown is if there is more than one species of sculpin. Sculpins were observed throughout every surveyed reach in the Slate Creek watershed. Dace (unknown species) were observed in the mainstem in the lower reaches of Slate Creek.

Amphibians

Numerous amphibians have also been documented in the Slate Creek watershed. Species identified include tailed frogs, Pacific giant salamanders, and Pacific tree frogs. Tailed frogs and Pacific giant salamanders were documented in the greatest numbers in lower Little Slate and Deadhorse Creeks.

5.1.14 Aquatic Species Status Summary

The current condition of the aquatic species in Slate Creek can be summarized as a rating of integrity, or comparison to the historic situation. The distribution, abundance, presence of life history forms, species composition and genetic integrity were components of species condition that were included in the species condition summary.

Map 30a displays the current aquatic species integrity rating for the species assessed in Slate Creek. This rating is a summary for the species within a locations. In general, this rating has been applied to a subwatershed, or portion of a subwatershed. This rating may not accurately describe the specific conditions in a reach.

The areas that have a high integrity rating for aquatic species conditions include; Van Buren, Little Slate, and upper North Fork. All of these areas support strong populations, thought to have high genetic integrity.

The areas that have been assigned a moderate integrity rating for aquatic species condition include; Lower Canyon, Main Canyon, Little Van Buren, Deadhorse, lower North Fork, lower Upper Main, and Boulder. All but Boulder Creek were rated based on the reduction in steelhead abundance and loss of genetic integrity from stocking. These factors also apply to spring chinook integrity in Lower Canyon and Main Canyon. The loss or reduction in migratory westslope cutthroat in mainstem Slate Creek was an additional factor in the moderate rating. Boulder Creek was rated as moderate integrity based on the presence of brook trout along with the westslope cutthroat trout. Given the current population levels of these two species, and the thought that the westslope will likely outcompete the brook trout in this higher gradient system, this subwatershed was not given a low rating.

The area of the watershed rated as low aquatic species integrity was upper Upper Main. This ranking was based on the presence of only brook trout in this area. It is unknown if a native fish species ever occupied these streams or not. Regardless, the current aquatic species assemblage in this area is highly departed from historic.

In combination with the aquatic habitat condition summary presented in section 5.1.12, this summary of aquatic species condition has been used to develop the management recommendations presented in Chapter 6 and 7.

5.2 Terrestrial Resources - Vegetation

5.2.1 Summary: Plant community composition, structure and process

The landscape in the Slate Creek area has changed in the last 60 years of record in response to direct changes in composition and structure, and profound alteration of disturbance processes (see Tables 5.17 through 5.22). Succession, timber harvest, fire suppression, grazing, and introduction of non-native species have been important causes of change. Major changes have occurred in nonforest and forest cover types, size class, canopy density, and patch size. The number of canopy layers has also probably increased, along with canopy cover, but the data in Slate Creek are inadequate to assess this.

Succession and fire suppression have resulted in increased area in medium (9-21 inch diameter) trees, and decreases in pole and sapling stands. Area in large trees has increased as well. Forest has encroached on areas formerly in grassland, montane parkland, or wet meadows. Shrubs have encroached on grassland.

Species tolerant of shade have increased, including grand fir in the mixed conifer class. Apparent increases in larch and

ponderosa pine may be due to mapping inconsistencies, and these species may have actually declined. Timber harvest has removed older pine and larch from many stands, while natural fire would more often have thinned fir from below the pine and larch. Introduction of blister rust has contributed, with fire suppression and mountain pine beetle activity, to a serious decline in whitebark pine.

Large patches of pole size or larger snags have probably declined because of fire suppression, although increased stand density and aging stands have probably increased mortality due to insects, disease, and drought. Snags may be more widely distributed in the landscape.

Timber harvest has created uniform openings dispersed in a closed forest matrix. These openings lack presettlement levels of snags and down wood, and sometimes residual overstory trees. Patch size has decreased in early seral and nonforest communities, and patch size has increased dramatically in closed canopy mid seral forest. This shift means that the landscape once distinguished by a generally young forest, with a diversity of patch size and shape and juxtapostion, has moved to a forest dominated by a uniform matrix of mid-size trees with small, uniformly spaced generally clearcut openings. The change to larger size classes could be appropriate in landscapes with very infrequent large fires, but is unsuited to the Slate Creek area as a whole, which appeared to experience large fires at least every twenty years somewhere in the watershed.

Old growth has perhaps increased from presettlement levels, although whitebark pine has decreased and open pine old forest has declined, while subalpine and mixed conifer, densely canopied old growth has increased. Total potential existing old growth is about 25 percent of the watershed, based on evaluation of cover type, size, lack of harvest activity, and years since last fire.

Grazing and introduction of nonnative herbs has resulted in shifts of bunchgrass communities to disturbed grasslands that are less diverse and more prone to erosion.

Table 5.17 - Changes in Vegetation (1930-1991) by Size Class

Size Class	1930s Acres	1991 Acres	Percent Change
Nonforest	11,052	10,209	-7
Seedling/ Sapling	26,431	7,298	-72
Pole (5-9 inch DBH)	24,055	7,251	-70
9-21 inch DBH	16,288	49,640	+205
21+ inch DBH	5,689	9,527	+68

Table 5.18 - Changes in Vegetation (1930-1991) by Cover Type

Cover Type	1930s acres	1991 acres	Percent change
Farmland	21	9	-57
Bare clearcut	5	27	+440

Cover Type	1930s acres	1991 acres	Percent change
Herbaceous clearcut	0	1,644	++
Barren land	52	840	+1,515
Whitebark pine	3,731	827	-78
Spruce/ fir	21,648	20,626	-5
Lodgepole pine	15,424	13,042	-15
Mixed conifer	20,014	25,654	+28
Ponderosa pine / Douglas-fir	11,524	13,566	+18
Montane park	2,831	789	-72
Foothills grassland	5,826	1,160	-72
Disturbed grassland	0	2,184	++
Shrub	1,408	3,406	+142
Wet meadows	651	54	-92
Riparian forest	36	0	-
Riparian hardwoods	86	0	-

Table 5.19 - Changes in Vegetation (1930-1991) by Tree Canopy Cover

Canopy Cover	1930s acres	1991 acres	Percent change
Low	11,931	9,510	-20
Moderate	50,009	50,644	+1
High	10,523	13,561	+29

Table 5.20 - Changes in Vegetation (1930-1991) by Patch Size

Patch size	1930 mean & range (acs)	1991 mean & range (acs)	Percent change
Early seral, closed canopy	422 <1 - 38,926	31 <1 - 1605	-93
Nonforest/ open early seral	70 <1 - 3971	34 <1 - 2670	-51
Mid seral closed canopy forest	122 2 - 11,630	167 <1 - 29,337	+37
Mid seral open canopy forest	36 <1 - 309	30 <1 - 1274	-16
Late seral closed canopy forest	112 3 - 487	23 <1 - 1092	-79
Late seral open canopy forest	47 1 - 515	31 <1 - 259	-34

Table 5.21 - Changes in Vegetation (1930-1991) for Old Growth

Old Growth	1930 acres	1991 acres	Likely trend from historic
Whitebark pine/ subalpine fir	Not available	64	Decrease
Engelmann spruce/ subalpine fir	Not available	5,170	Increase
Lodgepole pine	Not available	4,042	Increase
Ponderosa pine/ Douglas-fir	Not available	4,511	Decline in pine, increase in Douglas-fir
Mixed conifer	Not available	6,947	Increase

Table 5.22 - Changes in Vegetation (1930-1991) for Snag Patches[1]

Snag Patches	1930 acres	1991 acres	Percent Change
Low density (10-50 per acre)	1,072	501	-53
Moderate density (50-100 per acre)	1,342	197	-85
High (>100 per acre)	15	0	-100

1 These numbers are a relative index only, based on aerial photo interpretation

5.2.2 Assessment by Vegetation Response Unit

Plant communities in the Slate Creek watershed appear as a mosaic of patches that change in composition, structure, and pattern in the landscape over time. Wildlife and human uses respond to the existing pattern of vegetation. Processes like plant community succession, fire, insect and disease activity, drought and grazing, all change the pattern that exists at any one time. Features like climate, soil, slope, aspect and elevation, control the bounds within which patterns can change. Vegetation Response Units (VRUs) and Habitat Type Groups (HTGs) within VRUs were used to describe these bounds. VRUs and Habitat Type Groups within VRUs are shown in Maps 31 and 32. Within these delineations, climate and disturbances, including fire and insect and disease activity, were likely to operate within predictable ranges. VRUs have similar patterns of successional processes. Understanding how these disturbance regimes worked, and the pattern of vegetation change, is fundamental to ecosystem management in the watershed. This understanding can be used to design management systems that sustain patterns of vegetation and the scale, frequency, and kind of change to which native species are adapted.

Patterns of plant community composition, age class structure, and patch size will tend to fall within certain ranges for each VRU when evaluated across large areas. The Slate Creek area consists of VRUs 1, 2, 3, 4, 6, 9, and 12. Detailed tables of presettlement and existing vegetation condition by VRU are found in Appendix G. Maps 37-44 show 1930s and 1991 cover types, size classes, tree canopy cover classes, and patch sizes.

VRU 1: Convex slopes, subalpine fir and grand fir habitat types - 18,112 acres

Presettlement Composition and Structure - This VRU is common in the Slate Creek watershed at mid and upper elevations. Grand fir and subalpine fir habitat types are dominant. Lodgepole pine was historically dominant in many settings. Engelmann spruce, western larch, Douglas-fir, and whitebark pine were less common. Large infrequent severe and mixed severity fires were typical of upland settings. Moist lower slopes were most prone to mixed fire. This VRU formerly was more important for whitebark pine than is indicated today. Wet meadows are important elements of this landscape. Relative proportion by size class was about 5-10 percent nonforest, 20-30 percent seedling/ sapling, 20-30 percent pole, 20-30 percent medium tree, and 5-15 percent large tree at any one time over this VRU at the subbasin scale. Old growth was typically limited to moist draw bottoms and north slopes, and usually comprised from 10 to 15 percent of the area.

Presettlement Process - About 60-80 percent of stands originated from stand replacing fire, and 20-40 percent from mixed severity fire. Lodgepole, western larch and Douglas-fir sometimes survived one or more fires to form a scattered overstory. Large blocks of pole and medium size fire killed trees (500 to 2000 acres) were typically present at any time within 10,000 acres of this VRU. Mountain pine beetle activity cycled with fire and lodgepole pine, and may have been important in developing fuel conditions that favored stand replacing fire.

This VRU historically provided habitat for sensitive species requiring relatively large home ranges, interior habitat and small mammal prey bases: wolverine, fisher, and boreal owl. This VRU is often adjacent to roadless or wilderness areas, which can increase effective interior habitat and provide additional buffering from human caused disturbance. In presettlement conditions, large blocks of burned area provided habitat for those species preferring mid to high elevation habitat. It provided summer range, but produced less forage than lower elevation, more productive VRUs.

Changes from presettlement - With advancing forest succession and fire suppression, seral lodgepole pine, western larch, and whitebark pine have declined, and more shade tolerant grand fir and subalpine fir have increased. In Slate Creek, the western delineation of this VRU is moderately roaded and affected by recent harvest. See map 52. Some 7 percent of this VRU has been harvested within the last 30 years, mostly in the headwaters of Little Slate Creek. Last major natural disturbances were the fires of 1863, 1889, and 1910, so few individual stands are outside the range of presettlement fire frequency. However, VRU 1 likely would have experienced some fire disturbance in the last 90 years under natural conditions. Currently there is less early seral herbaceous, shrub, sapling, and pole stands, and much more mid-seral medium tree and later seral large tree classes than in the 1930s. Old growth is currently estimated at 22 percent of the potential forested acres of this VRU. The forest is now largely a matrix of medium tree stands perforated with clearcut openings. Natural openings are fewer than in presettlement times (see Appendix G). Recent harvest patterns have replaced large scale infrequent fire with frequent small harvest units more uniformly distributed across watersheds. The average harvest unit size is smaller than many presettlement burn patches and there is not as much diversity in frequency of structural stages within subwatersheds. Each watershed is more like other

watersheds in terms of the representation of structural stages. Fire suppression has curtailed creation of extensive snag patches.

Wildlife species affected by these changes include lynx that depend on snowshoe hare that rely heavily on early seral habitat. Denning habitat may have improved with development of more old stands, where canopy cover and down wood have increased.

VRU 2: Glaciated slopes, subalpine fir habitat types - 5,688 acres

Presettlement Composition and Structure - This VRU is uncommon in Slate Creek at upper elevations. Subalpine fir and whitebark pine habitat types are dominant. Lodgepole pine, Engelmann spruce, and subalpine fir were historically dominant on midslopes. Whitebark pine was important on ridges. Midslopes tended to experience stand replacing fire at infrequent intervals. Open ridges or moist valley bottoms were more prone to mixed severity fire. Rock outcrop, lakes and wetlands, and montane parklands were important elements of this landscape. Relative proportion by size class was about 10-25 percent nonforest, 10-30 percent seedling/sapling, 30-65 percent pole, 5-15 percent medium tree, and <10% large tree. Old growth was typically limited to moist trough bottoms and open ridges, and usually comprised less than 10 percent of the area.

Lodgepole dominated stands tended to be single age, but may have included older whitebark pine, Engelmann spruce, or Douglas-fir. Spruce-fir forests tended to be both horizontally and vertically complex. Patches of snags would not be as large, have as large trees, or occur as frequently in this VRU as in adjacent VRUs such as 1 or 6.

Presettlement Process **-** Midslopes tended to experience stand replacing fire at infrequent intervals. Open ridges or moist valley bottoms were more prone to mixed severity fire. Medium blocks of pole size fire killed trees (100 to 1000 acres) were often present at any time within 20,000 acres of this VRU.

This VRU provided habitat for species requiring diverse mosaics of forage and cover. Moose and elk summer range is usually an important use. Species that depend on remote interior habitat, especially riparian areas, use this VRU: fisher, marten, wolverine, and lynx. Forage for grizzly bear may be found in the diverse mosaic of forest, shrub, and herbaceous plant communities.

Changes from presettlement - Little harvest or road building has occurred in this VRU. With advancing forest succession and fire suppression, seral whitebark pine has declined. Blister rust has further reduced whitebark pine a total of more than 86 percent. More shade tolerant Engelmann spruce-fir forest has increased. Areas with low tree canopy cover have increased, probably due to mortality in whitebark pine stands. Advancing forest succession has resulted in a decline in nonforest openings, seedling and sapling, and pole stages, and a large increase in medium and large tree stages. Current potential old growth is estimated at 34 percent of this VRU. Fire suppression has also resulted in increased stand densities in Engelmann spruce-fir forests, as shade tolerant understories develop. The extensive snag patches once produced by lethal fires are no longer being created as a result of fire suppression.

Wildlife species affected by the changes in vegetation include Clark's nutcracker and red squirrels that depend on whitebark pine cone crops and small mammals and their predators that use early seral habitat.

VRU 3: Stream breaklands, Douglas-fir and grand fir habitat types - 29,478 acres

Presettlement Composition and Structure **-** This VRU is common at lower to mid elevations in canyons.

On south aspects, dry Douglas-fir habitat types are dominant. Open stands of large, often uneven age Douglas-fir and ponderosa pine were historically common. Ponderosa pine or mixed pine and Douglas-fir old growth occupied about 40 to 60 percent of these warm dry sites.

On north aspects, grand fir habitat types are dominant. Grand fir and Douglas-fir were common cover types, with ponderosa pine and western larch and sometimes Engelmann spruce or lodgepole pine. Pacific yew occurred on lower slopes. Twenty to 30 percent of stands included at least 10 trees per acre older than 150 years. Ponderosa pine, western larch, Douglas-fir, and grand fir formed the old overstory.

Small to medium blocks of pole to medium fire killed trees were abundant at any time within 10,000 acres of this VRU. Old growth pine and western larch, bunchgrass understories, and rock outcrop are important elements of this landscape. On the VRU as a whole, relative proportion by size class was about 5-20 percent nonforest, 5-30 percent seedling/ sapling, 10-20 percent pole, 20-40 percent medium tree, and 20-40 percent large tree. Steep slopes, high drainage dissection and sharp aspect changes favored diverse fire effects and a fine to moderate-grained spatial patchiness (stands of 10 to 100s of acres). Surface fires kept down wood and snags at low levels on steep south aspects, but the longevity of larch and pine snags provided continuity through time, and frequent fire maintained a steady, if low level of recruitment. See Photo #17 in Appendix N.

Presettlement Process - On south aspects, low and mixed severity fire at frequent intervals occurred. Here, 60-90 percent of stands showed evidence of survival through one to many fires.

Mixed severity fire at moderate intervals was common on north aspects. About 30-60 percent of stands retained 10 or more trees per acre through at least one fire.

This VRU provided habitat for sensitive species requiring relatively small home ranges and avian or insectivorous prey bases: goshawk, pileated woodpecker, flammulated owl, black-backed woodpecker, and white-headed woodpecker. Riparian areas provided habitat for fisher. Open south aspects were important winter range for ungulates.

Changes from presettlement - With advancing forest succession and fire suppression, ponderosa pine/ Douglas-fir forests have encroached on grassland and shrubland. Although these cover types have not decreased, stand density has increased substantially (see Photo #18 in Appendix N). Mortality in overstory pine and Douglas-fir is becoming apparent. About 8 percent of this VRU has been harvested. Annual grasslands and weedlands have increased, while areas of bunchgrass and upland shrub communities have decreased. Forest succession and fire suppression have resulted in a significant decline in seedling and sapling, and pole tree stages and an increase in medium and large tree stages. Current estimated old growth is 31 percent of potential forested acres in this VRU. However, more of the large trees are now in mixed conifer and less in open pine stands. The ratio of stand replacement harvest to mixed or low severity treatments treatments is higher than would have occurred under natural disturbance regimes. Historically extensive snag patches are no longer being created as a result of fire suppression.

The current condition appears to be far outside the likely presettlement range for stand density, stand structure, diversity of age classes (in moist habitat types), patch size, importance of ponderosa pine, and presence of scattered large old trees.

South Aspects - Harvest has been moderate in these habitat type groups, but has removed large trees, instead of thinning out shade tolerant trees. Patches of large old trees have become smaller, while stands with high canopy closure have increased.

Habitat for flammulated owl and white-headed woodpeckers has declined with increasing stand density.

North Aspects - On north aspects and moist lower slopes, diversity of age class representation has been reduced. Much more of the landscape is in closed stands of medium sized and large trees. Old growth is probably more extensive, but different in structure and composition. Grand fir and Douglas-fir cover types are

more common than historically. Ponderosa pine is less well represented today than historically. Two age stands or single age with old residuals are, through succession and insect and disease activity, becoming all-aged. Where harvest has occurred, it has not recreated any of the more complex structures or diversity of patch shape and size represented historically. Patch pattern has generally shifted from a wide array of patch sizes and complex shapes to a matrix of closed forest with smaller patches of older trees or new harvest.

Wildlife species affected by these changes include pileated woodpeckers and northern goshawks that benefit from increasing canopy closure. Forage for ungulates has declined while hiding and thermal cover have increased. Increasing stand density has resulted in declining habitat for whiteheaded woodpeckers.

VRU 4: Rolling hills, grand fir and Douglas-fir - 5840 acres

Presettlement Composition and Structure - This VRU is common in North Fork Slate Creek at mid elevations. Grand fir habitat types are dominant. Grand fir, Douglas-fir, ponderosa pine, and western larch were historically dominant species. Lodgepole pine and Engelmann spruce were less common. Historically, this VRU exhibited high diversity in patch composition and size. Ponderosa pine, western larch, Douglas-fir, and grand fir often survived mixed severity fires to form a scattered overstory of old large trees. Ten to 25 percent of stands included at least 10 trees per acre older than 150 years. Small to large blocks (100 to 2,000 acres) of pole to large fire killed trees were common at any time within 10,000 acres of this VRU. Old growth pine and western larch and meadow complexes are important elements of this landscape. Relative proportion by size class was about 5-10 percent nonforest, 5-50 percent seedling/ sapling, 10-30 percent pole, 20-30 percent medium tree, and 10-50 percent large tree at the subbasin scale.

Presettlement Process - Mixed and stand replacing fire occurred at moderate intervals. About 50-60 percent of stands originated from stand replacing fire and 40-50 percent from mixed and low severity fire.

This terrain was an important linkage for animals moving between the Salmon and South Fork Clearwater drainages.

Early seral shrub dominated communities provided habitat for snowshoe hare, that are the primary prey species for lynx and also prey for wolverine and fisher. Big game fawning and calving habitat was associated with meadow complexes or brushy draws. This VRU supported small to large patch sizes and diverse stand structures, from single story lodgepole to multistory larch, pine or mixed conifer stands. This provided habitat for species requiring smaller home ranges and avian or insectivorous prey bases: goshawk, pileated woodpecker, flammulated owl, black-backed woodpecker, and white-headed woodpecker.

Changes from presetttlement - With advancing forest succession and fire suppression, ponderosa pine/ Douglas-fir forests have not declined in extent but have increased in stand density and proportion of Douglas-fir. Grand fir/ Douglas-fir forest has increased, but this may be due to mapping inconsistencies with spruce/ fir forest. Herbaceous riparian communities, montane park, and sapling structural stages have declined. There are more medium and large tree structural classes. Current estimated old growth is14 percent of the potential forested acres of this VRU. Twenty six percent of this VRU has been harvested in Slate Creek, but has not created the range of patch sizes and stand structures represented in presettlement times. The greatest change is that early seral stages with snags are less well represented now, and canopy closure is higher in medium and large tree classes. Stands of large old trees are more abundant now than in 1930, because much of the area had burned in 1919. Patches created by harvest tend to be smaller and more uniform in size than under a natural disturbance regime. The ratio of stand replacement harvest to mixed or low severity treatments has been about 60

percent replacement to 40 percent less severe treatments. This is slightly more replacement than would have occurred under natural disturbance regime. Extensive snag patches are no longer being created as a result of fire suppression.

The current condition appears to be outside the likely presettlement range for stand density, diversity of patch size, and importance of ponderosa pine and large old trees in two story stands.

Wildlife species most affected by these changes include snag dependent species and species requiring stands with open understories.

VRU 6: Cold basins, subalpine fir and grand fir habitat types - 18,622 acres

Presettlement Composition and Structure - This VRU is common in the Slate Creek area, at mid elevations, in the headwatershed of Little Slate Creek. Grand fir and subalpine fir habitat types are dominant. Lodgepole pine was the dominant seral species. Western larch, Douglas-fir, and Engelmann spruce were important. Grand fir was important on mesic sites. Whitebark pine occurred occasionally. Five to 15 percent of stands included at least 10 trees per acre older than 150 years. Larch and Douglas-fir were more abundant in the mixed fire regime, and were present most commonly near the canyon-upland ecotone. Stands in mixed fire regimes were often horizontally and vertically patchy. Moderate to large blocks (500 to 1000 acres) of pole to medium fire killed trees were common at any time within 10,000 acres of this VRU. Large patch sizes (100s to 10,000s of acres) and meadow complexes were important elements of this landscape. Relative proportion by size class was 5-10 percent nonforest, 10-30 percent seedling/ sapling, 30-45 percent pole, 20-40 percent medium tree, and 5-20 percent large tree. See Photo #19 in Appendix N.

Presettlement Process - Medium to large stand replacing and mixed severity fires occurred at infrequent intervals. About 60-90 percent of stands originated from stand replacing fire and 10-40 percent had mixed severity fire.

This VRU provided important calving and early season forage for ungulates in the moist openings, and could provide denning and rendezvous sites for wolves. This VRU provided summer range, but produced less forage than lower elevation, more productive VRUs. Beargrass, grouse whortleberry, and blue huckleberry were widespread early seral and understory species. Menziesia provided moose browse on lower north slopes.

Changes from presettlement - With advancing forest succession and fire suppression, sapling and pole structural stages have decreased while herbaceous openings (clearcuts) have increased. Current estimated old growth is 26 percent of the potential forested acres of this VRU. Tree canopy density has declined. This might be due to natural thinning in lodgepole pine, or increased mortality in mixed conifer or lodgepole pine. Thinning activities have not been extensive. Mixed conifer and spruce-fir cover types have increased, while lodgepole pine dominance has decreased. Whitebark pine has essentially disappeared as even a minor component. Harvest within the last 50 years has occurred on 19 percent of the acres of this VRU dispersed over the area and highly dispersed over time. Riparian meadows appear to have declined due to forest encroachment. The ratio of stand replacement harvest to mixed or low severity treatments has been about 70 percent replacement to 30 percent less severe treatments. This is probably within the range of what would have occurred under natural disturbance regimes. However, extensive snag patches are no longer present.

The current condition appears to be far outside the likely presettlement range of disturbance frequency and patch size diversity, canopy density, age class diversity, and dead wood elements. Harvest and fire suppression have produced an uncharacteristic uniform forest medium tree matrix with evenly dispersed,

mostly clearcut holes, with little down wood and few snags. See Photo #20 in Appendix N. The total area of recent disturbance is probably within the presettlement range, but its uniform distribution across a large matrix, and its uniform lack of internal complexity are not within presettlement ranges.

Wildlife species most affected by these changes include species requiring early seral conifer habitat, like lynx, and extensive snag patches, like black backed woodpecker.

VRU 9: High elevation ridges, whitebark pine and subalpine fir habitat types - 2,010 acres

Presettlement Composition and Structure - This VRU is rare in the watershed, at highest elevations in the Nut Basin area and around Marten Hill and Umbrella Butte. Cold subalpine fir and whitebark pine habitat types are dominant. This was the major stronghold of whitebark pine. Subalpine fir, Engelmann spruce, and lodgepole pine were common. Mixed severity fire occurred at moderate and infrequent intervals. About 40-60 percent of stands originated from mixed severity fire and 40-60 percent from stand replacing fire. Small to moderate (50-200) acres of fire killed trees were common at any one time in 10,000 acres of this VRU. Old whitebark pine or lodgepole pine were common on rock outcrop and open ridges and about 5-15 percent of stands had 10 or more trees per acre older than 150 years. See Photo #21 in Appendix N.

Other important elements were open ridges where heath plants like alpine heath or the rare Idaho Douglasia can occur. Relative proportion by size class was 30-40 percent nonforest, 10-30 percent seedling/ sapling, 15-60 percent pole, 1-10 percent medium tree, and 1 percent or less medium tree at the subbasin scale.

Presettlement Process **-** This VRU provided habitat for species using whitebark pine seed: grizzly bear, black bear, Clark's nutcracker, and red squirrels. Mixed stands of Engelmann spruce, subalpine fir, and lodgepole pine on habitat type groups 9 and 10 provided summer thermal cover for ungulates and foraging for insect gleaning birds.

Changes from presettlement - With advancing forest succession, fire suppression, and blister rust, whitebark pine has seriously declined, and more shade tolerant spruce-fir forests have increased. Decreased canopy density is also probably associated with loss of whitebark pine. Montane park has declined with forest encroachment. Advancing forest succession has resulted in reductions in seedling/ sapling, and pole stages, and a large increase in medium tree stages. Current estimated old growth is 3 percent of the potential forested acres of this VRU. Very little harvest has occurred. Once common snag patches are no longer being created as a result of fire suppression, but whitebark pine snags are much more abundant. See Photo #22 in Appendix N.

The current condition appears to be far outside the likely presettlement range for importance of whitebark pine, stand density, and to a lesser degree, nonforest openings. Fuel continuity has increased throughout the adjacent area so that remaining whitebark are at greater risk of stand replacing fire (see fire risk discussion). However, in order to restore fire and whitebark pine, rust resistant trees must be identified in the field and protected from fire mortality to improve chances of restoring this species.

Wildlife species affected by these changes include black bear, red squirrel, and Clark's nutcracker, because of the decline in whitebark pine. Grizzly bear are no longer found in the area.

VRU 12: Stream breaklands, bunchgrass and shrublands - 4,184 acres

Presettlement Composition and Structure - This VRU occurs at lowest elevations in the Slate Creek canyon, generally on steep south aspects. Nonforest habitat types dominate this VRU: Warm and dry grassland steppe (bluebunch wheatgrass, common snowberry-rose, mountain mahogany, hackberry,and Douglas hawthorn). Mixed hardwoods and black cottonwood were

along the main valley bottom. Bluebunch wheatgrass once dominated most grassland sites. Sandberg bluegrass, prairie junegrass, and Idaho fescue occurred less commonly (Tisdale 1979, Johnson and Simon 1987). A large number of perennial forbs occurred, more abundantly on Idaho fescue than bluebunch habitat type groups. Dwarf cryptogams and moderate to dense litter provided ground cover. On south aspects, bluebunch and forb understories were common. On north aspects, shrub dominance could virtually exclude herbaceous perennials.

Presettlement Process **-** Low severity fires at frequent intervals (5-25 years) occurred in bluebunch habitat type groups. Shrub and hardwood communities probably burned at less frequent intervals within this range, because of higher fuel moistures. Fire severity in hardwood and shrub communities probably varied, but rapid recovery through resprouting was typical. On most upland sites, resprouting was the primary mechanism to recover from disturbance, although bluebunch recovery through seeding could occur. In these settings, strategies of both resprouting and reseeding were important to recolonize disturbed sites. Bluebunch and forbs could dominate shrub communities for a few years after fire. Bottomlands along larger streams were least frequently but most severely impacted by occasional fire, especially if followed by severe flooding. These disturbances favored the persistence of cottonwood, white alder, and other early seral species.

Herbivory by ungulates, small mammals and birds was important in maintaining the relative importance of grassland and shrubland. This VRU provided habitat for a highly diverse population of microtine mammals, reptiles, migratory birds, and their predators. Populations fluctuated moderately with drought and occasional fire. It was important winter range for ungulates. Brushy draws and stream bottoms were important sources of forage, cover, and water in this landscape. These habitats are disproportionately important because of their relative rarity within the Slate Creek assessment area.

Changes from presettlement - Currently there is less native grassland and more disturbed grassland, shrub, and forest. The current condition appears to be far outside the likely presettlement range for species and community composition.

This VRU has changed in ways more basic and difficult to restore than any other. See Photo #16 in Appendix N. Much of VRU 12 is in private ownership and restoration on Forest lands will need to be coordinated with other landowners. More than 70 percent of the bunchgrass habitat type has shifted to dominance by annual bromes or annual forbs, or to shrub and conifer encroachment. Yellow starthistle is established over about 600 acres. Other noxious weeds account for 400 acres. See weed discussion in section 5.2.7. Heavy sheep grazing in the early part of the century appears to have affected shrub dominance more than bunchgrass. But by the 1950s, cheatgrass was well established at low elevations. Johnson and Simon (1987) indicate that fire cannot be used to convert annual brome stands back to native bunchgrass; nor does elimination of disturbance lead to recovery except possibly over very long time frames (hundreds of years). Abundant seed of undesirable nonnatives adapted to fire disturbance is available to colonize any burned areas. With the shift in vegetation to annuals, productivity and diversity of animal populations has declined. Both herbivores and predators have been affected; both above ground and belowground processes have been simplified. Basic biochemical processes like organic matter production, accumulation and nutrient cycling have been impacted with negative consequences for long term productivity.

Structural diversity in shrublands, especially brushy draws, has been impacted by grazing and trampling. There is often little ground cover, and little remaining of the herbaceous and low shrub growth beneath the tall shrub canopy. Fire suppression, grazing and residential development along lower Slate

Creek have decreased the species diversity and structural complexity of the tall shrub and hardwood communities in this setting. Black cottonwood, white alder, and other hardwood species are not regenerating. Undesirable nonnative species including teasel, thistle, bluegrass, mullein, knapweed, and goatweed, have increased in draw bottoms. Many of the changes observed in this VRU are also occurring in dry forest habitat types of VRU 3.

Wildlife species most affected by these changes include native ungulates because of loss of winter range, and predators including raptors and large mammals that prey on small mammals.

5.2.3 Rare and Important Plants and Plant Communities

The Slate Creek watershed provides habitat for many rare and regionally endemic plants. The sites for these important plants are micro-habitats of the VRUs discussed in the previous section. VRUs 12 and 3 contain grassland openings and pine savannas for low elevation, dry climate plant species. VRUs 1, 2, 4, and 6 contain mature lodgepole communities. VRU 6, and 9 contain high elevation parklands. Wetlands and small fens along headwater streams are common across VRUs 6, 4 and 9. Rare plants, which include threatened, endangered, and sensitive species, are discussed by grouping species together that have similar habitat requirements (see Map 48).

Grasslands and Pine Savannas Communities

Along the breaks of the Main Slate Canyon are dry rocky grassland and ponderosa pine communities. They consist of steep bluffy slopes, rocky ridge tops and small structural benches where the soils are shallow. In many areas the grassland community consist of small (1 acre) openings within the dry conifer zone. Typically the plant assemblage is similar to the Canyon Bunchgrass communities found along the Snake and Salmon Rivers. These relatively small areas provide habitat for many rare plants. Noteable Regional endemic and rare plants include puzzling Halimolobos (*Halimolobos perplexa var. perplexa*), broad-fruit mariposa lily (*Calochortus nitidus*) and bank monkeyflower (*Mimulus clivicola*). These and other species have evolved with high frequency/ low intensity fires, where mineral soil is exposed but not greatly disturbed.

Puzzling Halimolobos is endemic to west central Idaho. Locations are mostly known from Adams and Idaho counties in the vicinity of Little Salmon River and Riggins, Idaho (Steele et al. 1981). This species is a short-lived perennial or biennial, generally one to several stems, with small white to pinkish flowers that bloom from May through July. Most populations contain anywhere from sixteen to 2000 individuals.

In north central Idaho, puzzling halimolobos habitat is typically comprised of coarse textured soils with exposed boulders and a sparse graminoid layer and open overstory ponderosa pine. Habitat types that contain puzzling halimolobos include ponderosa pine (*Pinus ponderosa*), Idaho fescue (*Festuca idahoensis*), and bluebunch wheatgrass (*Agropyron spicatum*) communities (Hitchcock et al. 1964, USDA, no date). These habitats are relatively xeric and contain granitic soils. The Slate Creek drainage contains approximately 319 acres of potential habitat in Slate Canyon.

Bank Monkeyflower is found on steep slopes and soils derived from decomposed schist or gneiss of open ponderosa pine, Douglas-fir, and grand fir habitats with a grass or shrub understory (USDA Forest Service, 1993). The Salmon and Snake River drainages are on the southern edge of its range. The Slate Creek drainage contains 5,662 acres of potential habitat mainly in Slate Canyon.

Broad-fruit Mariposa Lily is endemic to eastern Washington and northern Idaho. This species also inhabits grassy ridgecrests, canyon rims, and upper slopes or openings in dry coniferous forests along the Salmon, Snake, and Clearwater Rivers which are the most southern and eastern edge of its range. Soils are usually shallow and derived from volcanic substrates. Plants occur on flat to gentle or occasionally steep slopes, on all aspects, and mostly between 3,500-5,500 feet

elevation (Caicco 1992, Mancuso 1996). Habitats are characterized by an open overstory of ponderosa pine and Douglas-fir with a bluebunch wheatgrass, snowberry, or Idaho fescue understory, as well as grassland habitats. This species has been found within the Slate Creek drainage in North Fork Slate Creek and Slate Canyon on open grassy benches among steep, coniferous forests. The Slate Creek drainage provides approximately 1,900 acres of suitable habitat in Main Slate Canyon and North Fork Slate Creek subwatersheds.

Comparison to Historic - The extent of healthy grasslands and open pine stands has declined due to fire exclusions, livestock grazing, and the increase of invasive weeds. The fire regime has been altered from high frequency/ low intensity to low frequency/ high intensity. Conifer canopy cover has increased reducing suitable habitat along the edges of grassland openings. Soil surface disturbance has increased with livestock grazing, big game populations and vehicle use.

Mature Lodgepole Pine Communities

In the southeast edge of the assessment area along the boundary of VRU 1 and 6 are rolling uplands of lodgepole pine. These plant communities are found on well drained coarse textured soils of low productivity at upper elevations of the montane zone. The sites are cold rolling hills or basins that recieve heavy snows in the winter and rain in the spring, but turning droughty in the summer and fall. The lodgepole stands are seral to subalpine fir and grand fir. The understory is open with grouse whortleberry and scattered beargrass. Plant diversity is relatively low. However, mature lodgepole communities that develop a sparse but sheltered understory provides suitable habitat for candystick (*Allotropa virgata*) a rare plant in the northern Rocky Mountains and a Regional Sensitive Species (Lichthardt and Mancuso 1991, Lichthardt 1992). It also provides substrate to a rare granite moss (*Andreaea spp.*).

Candystick is a non-chlorophyllous plant that forms a three-way relationship (tripartate symbiosis) with lodgepole pine, occasionally with grand fir or subalpine fir, and mycorrihial fungi. Candystick prefers mature lodgepole stands where the community is functionally climax or a persistent sere. Understory is typically sparse with grouse whortleberry the dominant. Large woody debris from decaying logs and buried decomposed wood are important in maintaining moisture on the well drained sites for both the fungi and candystick. The species forms a complex relationship with fungi and lodgepole pine. It is not known if this species can switch hosts as lodgepole is replaced by subalpine fir, or how long it takes this species to recolonize disturbed sites. There is approximately 5,241 acres of potential habitat primarily in the Little Slate Creek, Boulder Creek subbasins.

Andreaea is a granite moss found on acid rocks in subalpine to alpine zones. The genus is circumpolar in the northern hemisphere. Andreaea rupestris is scattered in the subalpine and alpine zones of Idaho. Andreaea heinemanii has recently been found on the edge of the Slate Creek Watershed. It is considered rare in North America and is the only known population in Idaho. Andreaea heinemanii is found on granite rock at the soil surface within rolling cold hills shaded by lodgepole pine.

Comparison to Historic - Only one occurence has been found of both rare plants on the edge of the Slate Creek watershed. Both occupy habitats with large stand replacing fires and the current stand conditions are a result of past fires. Compared to historic condition the lodgepole are mature and approaching conditions where a stand replacing fire is likely. The extent of unoccupied suitable habitat may suggest slow re-colonization after large stand replacing fires. If long range dispersal was limiting, recolonization may have been facilitated historically by unburned patches from which Alltropa could readily disperse once stand conditions become suitable. The stand replacing fire at the turn of the century may have been severe enough to eliminate lodgepole and Allotropa over an extensive area. This

could have eliminated recolonization in the Slate Creek watershed for a relatively extended period of time.

High Elevation Subalpine Communities
Whitebark Pine is a tree that occurs in high elevation environments. Whitebark persists as a climax species near timberline and is scattered in closed canopy forests of subalpine fir, Engelmann spruce, and lodgepole pine (Murdock 1991). In whitebark pine forests, fires occurring every 30 to 300 years have been important for the survival and regeneration of this species and is a key process affecting whitebark pine forest structure and composition (Morgan et al. 1994). Both low intensity and stand replacing fires provide openings for regeneration and areas for wildlife species to cache seeds. Many wildlife species depend on whitebark pine as a valuable food source (Clark's nutcracker, red squirrel, and grizzly bears), as well as areas to roost and nest. Over the past few decades whitebark pine has declined in abundance over most of its range (Murdock 1991, Morgan et al. 1994). In the absence of major disturbances, whitebark pine is becoming replaced by more shade tolerant species of subalpine fir and Engelmann spruce. White pine blister rust and the mountain pine beetle has been attributed to whitebark pine declines which reduces cone production and kills mature trees (Morgan et al. 1994). The decline in whitebark pine abundance also threatens the availability of seeds that many species rely on as a food source.

Idaho douglasia (*Douglasia idahoensis*) grows in high elevation subalpine habitats in VRU 9. It is a regional endemic of the central mountains of Idaho. Douglasia prefers open subalpine ridges, summits and adjacent slopes on north to northeast aspects with gravely soils and scree of recently decomposed granite. Vegetation is typically sparse, with widely spaced plants. The Slate Creek drainage does contain a fairly extensive, isolated population of Idaho Douglasia in the Gospel Hump Wilderness. There are approximately 1,080 acres of potential habitat on northerly aspects of which 105 acres occur on the preferred northeast aspects.

High Elevation Herblands
High elevation grasslands and forb dominated communities occur in the Slate Creek watershed. However, the extent of these small isolated communities is not completely known. These herblands may provide habitat for rare plant communities, as well as provide forage for domestic and wild animals. There is some encroachment on the grasslands by conifers.

Wetlands and Fen Communities
Riparian zones within the Slate Creek drainage are quite diverse. They range from low elevation dry grassland/ shrubby draws to high elevation wet meadows. Riparian zones provide cover, forage, and breeding habitats for many wildlife species, are natural migration routes or travel corridors, and serve as old growth habitat forests that connect otherwise isolated patches of discontinuous habitats. Wetland/ fen complexes are limited in extent but fairly prominent in the upper subwatersheds of Little Slate Creek, Boulder Creek and Upper Slate Creek. The Wetland and fens may be dominanted by wet sedges or Sphagnum and other mosses. These small wetlands may develop peat or organic soils as result of anerobic conidtion that make it possible for the rate of organic accumulation to exceed the rate of decay. Wet meadows and seeps along streams provide habitat for moonworts (*Botrychium* spp.), sitka clubmoss (*Diphasiatrum sitchense*), and tall swamp onion (*Allium validum*). Fens in the upper drainages provide habitat for *Sphagnum mendocinum* and *Helodium blandowii*. Both are rare bryophytes and are designated as Regional Sensitive Species.

There is some encroachment on the wet meadow by conifers. Dry to moist meadows provide a readily available source of forage for both domestic and wild animals. Several meadows in the Little Slate Creek headwaters and Van Buren Creek have been grazed heavily in the past and are now in a state of recovery. The meadows in North Fork of Slate Creek are currently being grazed and monitored for utilization. These meadows receive use by off-highway vehicles (OHVs).

5.2.4 Unique Elements

No Business Research Natural Area
The Slate Creek drainage contains a research natural area (RNA) in the No Business Creek watershed (approximately 1,360 acres). See Map 1b. The objective of the RNA is to preserve in an undisturbed (by man) condition the forest, shrubland, and aquatic resources (USDA Forest Service 1988). The RNA will serve as a reference area and as a baseline for determining long-term ecological changes. It contains a great diversity of plant communities (especially grand fir/ maidenhair fern - a unique type for the area since maidenhair is near the southern limit of its range), geology (limestone and granitics), and water chemistry (high pH). Elevations range from 2520 feet on Slate Creek near the mouth of No Business Creek to 7200 feet near Slate Point, for an elevational difference of 4680 feet within the RNA. The current management of this area is to not allow any disturbance. However, fire has been a key process that occurred in this landscape. The management of the No Business Research Natural Area needs to be re-evaluated in light of the large scale fire processes that occur in the Slate Creek drainage of which the Research Natural Area is part.

Main Slate Canyon
Along the lower reaches of Slate Creek from the forest boundary upstream to the North Fork of Slate Creek, is a zone of high plant diversity. This zone includes the valley bottom, terraces and toe slopes of the main canyon and side drainages to approximately 3,000 feet elevation. The mild moist micro-climate along with a high diversity of aspects, substrates, rock types and community structural stages provides a mixing zone for a number of vascular and non-vascular plants. Moist and dry basalt, limestone and granite outcrops are found along the canyon. Bryophytes with coastal afinities can be found growing a few feet from xeric plants. Epiphytic lichens and mosses are common on alder, cottonwood and Pacific yew found along the riparian zone.

A notable sensitive plant is Henderson sedge (*Carex hendersonii*). Henderson sedge, a coastal disjunct, is typically associated with western red cedar on river terraces and lower slopes in moist fern-dominated understory. Across the northern Rockies it is considered an indicator of maritime conditions. In the assessment area, Henderson sedge is associated with ferns and moss carpets under grand fir, Pacific yew or Douglas hawthorn along toe slopes and terraces. The occurences along lower Slate Creek is the most southern population extension in the northern Rocky Mountains.

Tripterocladium leucocladulum, a small yellow-green mosss, also occurs in the lower canyon. the moss prefers low-elevation moist canyons and grows on sheltered rock or tree bases. Typically it is found along the coast from British Columbia to northern California. It is relatively rare in Idaho and is found in only a few locations across the Northern Rockies. The occurence along Slate Creek is the most southern population in Idaho.

Comparison to Historic - The Slate Creek Road, administrative sites and campgrounds have altered terraces and toe slopes. In many places the road has opened the overstory canopy which decreases humidity and increases solar exposure. Administrative sites have convert a few terraces to pastures with introduced forage grasses.

Basalt Bluffs
The analysis area contains 1,643 acres of basalt bluffs/ cliffs and an additional 209 and 593 acres of rock outcrops and talus slopes in the lower elevation grassland/ ponderosa pine habitats. These habitats provide small cracks and ledges as escape cover, denning or nesting habitat, and foraging habitat for birds, small mammals, and reptiles. These habitats are fairly undisturbed and fairly common along the Salmon River Canyon its tributaries.

Limestone
The Slate Creek drainage contains approximately 5,800 acres of limestone rock outcrops and soils along the lower reaches of Slate Creek. This area includes the No

Business Research Natural Area and provides relatively rare conditions and substrate for plants including bryophytes and lichens. Rare Species like the giant helleborine orchid (*Epipactis gigantea*), a Region 1 sensitive plan have been found growing on moist limestone outcrops where minerotrophic water is readily avialable.

5.2.5 Terrestrial Disturbance Regimes and their Alteration

Insects and Disease

An index of forest health is its capacity for renewing itself (Leopold 1949). This assessment has used the comparison of historic and current pattern and process as the most appropriate measure of ecosystem health. A landscape that retains critical elements (communities, processes, and patterns) is considered to have the most likelihood of being able to renew itself after stress and to retain its productive potential (Hahn and Hagle 1993). The following discussion addresses one aspect of forest health: the changes that have occurred in forest vegetation, and how this is likely to affect susceptibility to some insect and disease organisms. Sue Hagle, Regional pathologist, compared 1930's and current susceptibility of the area to several insect and disease agents.

A common defoliating insect in the watershed is western spruce budworm (Carlson 1993). Outbreaks seem to be sporadic and cause some mortality or susceptibility to bark beetle attack in susceptible tree species. In the Slate Creek area, outbreaks have occurred at about 25 year intervals. Host species are later seral species like grand fir, subalpine fir, Engelmann spruce, and Douglas-fir, all of which have increased with fire suppression. Trees stressed by overcrowding or other sources of drought, and multistory stands of susceptible trees, also increase the severity of attacks. Natural controlling agents are predators and parasites including wasps, flies, birds, ants, spiders, and beetles. Changes in vegetation in the watershed suggest that potential for more severe budworm outbreaks may have increased over historic levels, because of changes in tree species composition and stand density, mostly at mid and low elevations. However, actual changes in activity levels have not been observed, perhaps due to the sporadic nature of budworm outbreaks, and their dependence on other climatic factors.

Mountain pine beetles can attack ponderosa pine, lodgepole pine, and whitebark pine in the Slate Creek area. They select larger (usually older) trees and trees stressed by drought or other agents. The cycle in which older lodgepole pine (Amman 1991) are killed by beetle activity, are replaced by fire, and regenerate to lodgepole pine, is widely recognized.

There has been a significant increase in probability of mountain pine beetle activity from presettlement conditions to present, due to the aging of lodgepole pine stands. Forty five percent of the lodgepole pine cover type is now rated as highly susceptible to mountain pine beetle, while only 7 percent was highly susceptible in the 1930's.

The potential for bark beetle in ponderosa pine has declined as ponderosa pine has declined as a cover type in the large tree size class.

Mountain pine beetle has probably always been an important factor in whitebark pine forests. Loss of whitebark pine from blister rust and fire suppression greatly limit the potential to replace the trees that may be killed by beetle activity. While over half of the whitebark type historically had a moderate potential for significant mountain pine beetle effects, there was no threat from blister rust. Under current conditions, almost 90 percent of that type has high potential for significant effects from both mountain pine beetle and white pine blister rust. This, together with fire exclusion, threatens to eliminate whitebark pine as a forest type in the area.

Douglas-fir is a host for Douglas-fir beetle. This insect has probably always been a significant factor in forest dynamics in the Slate Creek area, but its potential has also increased somewhat from the 1930's. The

number of acres considered to have a moderate to high potential for change in cover type or structure as a result of beetle activity has increased about 30 percent from the 1930's. With fire suppression, more Douglas-fir has grown into larger size classes, susceptible to beetles. Nematodes, fungi, flies, beetles, birds, and cold temperatures are important controls on beetle populations. Beetle activity levels were historically strongly linked to patterns of fire and drought. Fire weakened or drought stressed trees, or wind or snow damaged trees are most susceptible. Large patches of post-fire stressed trees used to occur periodically. Today, larger, continuous areas of older and more closed canopy Douglas-fir are now present in the watershed in VRU 3, 4, and 6. Whitebark pine has been impacted already in VRUs 1 and 9. The possibility exists for larger epidemic outbreaks of some bark beetles.

Blister rust is an exotic pathogen that was introduced to the United States in 1909 (Monnig and Byler 1992). Whitebark pine are highly susceptible. Whitebark pine has suffered high mortality in many areas in VRUs 1,2 and 9. Whitebark pine is being replaced in the watershed by subalpine fir, Engelmann spruce, or lodgepole pine.

Root diseases are fungi that can affect all sizes, ages and species of tree (Hagle, Tunnock, Gibson, and Gilligan 1987). In the watershed, grand fir and Douglas-fir are most highly susceptible and the prevailing root pathogens affecting them are armillaria and annosus root rots. Root disease has probably increased a small amount in average severity, as the proportions of stands with moderate or severe ratings have increased slightly. The older stands become and the more they shift toward Douglas-fir and grand fir, the more severe root disease will be. Root disease will be an increasingly important influence on how the forest will change in the future. It will affect the canopy cover, species composition, size, and age distribution of trees, and timber productivity. The effects have been to create forest openings, favoring shrubs and regeneration of more susceptible grand fir or increased dominance by less susceptible species. Levels of inoculum have probably increased in some areas. At very high levels, more tree species become susceptible. These changes have been most evident in VRUs 3, 4, and 6. Fire tends to decrease root rot by favoring species like pine or western larch that are more resistant to root rots.

Overall, dwarf mistletoes affect a relatively small proportion of the Slate Creek assessment area. They are parasites with limited ability to colonize new areas, so they are slow to spread. There are roughly 2000-3000 acres that have moderate to high potential for Douglas-fir dwarf mistletoe. Most of the infested stands have been Douglas-fir cover types for long periods. Residual large trees have protected the dwarf mistletoe plants from the effects of low intensity fires, because infestations in the crowns survive such fires. The characteristic witch's brooms indicative of mistletoe provide hiding cover and resting areas for birds and small mammals. Mistletoe decreases tree vigor. It increases with development of dense or two story stands in which the plant parasite is spread more readily, These changes are likely to have occurred in many low and mid elevation Douglas-fir stands in VRU 3. Lodgepole pine dwarf mistletoe probably has less utility for wildlife because the brooms are loose and retain needles poorly. Potential for lodgepole pine dwarf mistletoe has increased as trees have shifted toward larger tree classes. Compared to mountain pine beetle, the effects of dwarf mistletoe in lodgepole pine are likely to be minor. Stand replacing fire historically could eliminate mistletoe from the affected area for a short while.

Fire

This section addresses fire history in the Slate Creek watershed, presettlement fire regimes, presettlement and current fuel accumulations, and fire risk. Fire has been a keystone process of nutrient cycling and plant community dynamics for millions of years. Changes in fire regimes have consequences for both terrestrial and aquatic ecosystems. Factors considered in assessing current risk of wildfires compared to presettlement conditions are existing fuels

compared to presettlement fuels, changes in vegetation structure, number of fire intervals missed, and likelihood of ignition.

Fire History - Large fires of more than 1,000 acres occurred in the watershed about every 20 years, based on analysis of tree age data from the 1700s to the 1930s. Fire history from about 1830 to the present is shown in Map 33. Of the National Forest area where fire history is known, about 1,321 acres burned annually on average, from 1860 to 1935, when fire suppression became effective. This amounted to about 1.7% of the area annually. Most of these acres burned in a few severe fire years: 1863, 1889, 1910 and 1919. From 1935 to the present, a total of 179 acres have burned, or less than 3 acres annually. This is more than a 99 percent decline.

Fire Regimes - For millions of years, lightning has ignited fires and changed the pattern and composition of communities and habitats in the landscape. Most native species have evolved in an environment of characteristic frequency, severity, and scale of wildfire. Presettlement fire regimes are described by their characteristic severity (nonlethal, mixed severity, lethal) and frequencies (very frequent: 5-25 years, frequent: 25-75 years, infrequent: 75-150 years, and very infrequent: 150-300 years (Morgan et. al. 1996). They are inferred from habitat type group and terrain setting. Fire regimes are shown in Map 34. Since fire has been such a prevalent agent of change and pattern in the landscape, understanding fire regimes is useful in interpreting existing condition and in designing activities that provide the array of communities and habitats historically represented.

Table 5.23 - Fire Regimes in the Watershed

Fire Regime	Area (acres)	Percent of Watershed
Very frequent, nonlethal	16,611	20
Frequent, mixed	22,087	26
Infrequent, lethal	30,748	37
Infrequent, mixed and lethal	12,801	15
Very infrequent, mixed and lethal	1,444	2

Fuels - Wildland fuels provide the energy source for fire. Fuels consist of both living and dead vegetation, the latter in various stages of decay. Fuels occur in three fairly distinct strata: ground, surface, and aerial. A fire can burn in one, two, or all three strata at once, or change the layer in which it is burning as fuels and environmental conditions change throughout an area.

Fuels vary across the landscape and over time in their quantity, flammability, vertical distribution and spatial distribution. Quantity increases with increasing biomass or accumulation of dead material on a site. As stands age, they accumulate both living and dead material. Flammability is controlled largely by moisture content and plant phenology. Vertical connection of fuels (ladder fuels) tend to increase with succession as young trees grow up underneath older trees. Spatial distribution changes with time and environments. A landscape that has experienced infrequent large disturbances and is now uniformly old forest will likely have continuous fuel accumulations. A landscape naturally fragmented by contrasting environments or patchy disturbances will likely have a patchy pattern of fuel conditions.

Patterns of fuels in the 1930s contrast strongly with those that occur today. Table 5.24 shows how fuel models (described in Appendix I) have changed. Areas of grassland and open forest with grassy understories prone to low severity surface fires have declined (fire behavior model 2). Areas of shrubs, seedlings, and saplings have declined (fire behavior model 5), while areas of mature forest with greater fuel accumulations and connection of ground fuels to the tree crowns have increased (model 8 and 10). Areas of fuel model 10 are prone to severe crown fires when conditions are both dry and windy.

Table 5.24 - Changes In Fuel Models

Fuels Models	1930s acres	Present acres	Percent Change
Fuel Model 1: grasslands	5,847	3,353	-43
Fuel Model 2: open pine and grassy understory	344	240	-30
Fuel Model 3: moist meadow	651	54	-92
Fuel Model 5: shrubs and saplings moist during much of the growing season	30,670	13,137	-57
Fuel Model 8: pole and medium trees with relatively low fuel accumulations	38,554	48,808	+26
Fuel Model 10: medium and large trees with relatively high fuel accumulations and ladder fuels	6,833	17,370	+154

Changes in Fire Regimes - With fire exclusion, the interval between fires has increased, most markedly in the very frequent and frequent fire regimes. Where this interval has increased, the potential severity of fires has increased because over longer intervals, more fuels accumulate. To evaluate where this has occurred, we assumed that if the last fire or harvest disturbance has occurred within the range of presettlement fire free interval, potential fire severity would be within presettlement range. Map 35 shows where the disturbance interval and expected fire severity have increased over presettlement times. This can be used to help prioritize areas for vegetation restoration through harvest, other vegetation treatment, or use of fire. Typically, areas of frequent and very frequent fire in presettlement times are highly departed from their fire regimes. It is likely that fuels in these areas are increased in quantity and ability to carry fire into the tree crowns and have the potential to burn with greater lethality and effects to plant communities and watershed condition, than under presettlement disturbance regimes. Areas of infrequent fire are little departed from their presettlement fire intervals, considered stand by stand, but are departed at the landscape scale, because of the increasing dominance of structural stages more prone to severe fire behavior under certain weather conditions (increase of fire behavior models 8 and 10).

Ignition Risk - Where missed disturbance intervals or high fuel accumulations coincide with high natural fire ignition rates, actions to reduce fuel quantity or connectivity are appropriate. Map 35 shows areas of departure from fire regimes, and subwatersheds with relatively high ignition rates (more than 1 fire start per square mile per decade). Little Van Buren, Main Canyon, and the lower elevation areas of Upper Main Slate are probably most at risk under normal to severe weather conditions. Boulder Creek, Van Buren Creek, and upper portions of Upper Main Slate would likely be at risk under severe weather conditions. Conditions in the Lower Canyon cannot be assessed because fire history and management history are not available. Ignition risk from human causes will likely increase along low elevation travel routes, as visitor use increases.

Prescribed and Natural Fire Management - Prescribed fires have been to used to reduce fuels or improve forage since 1984. An average of 368 acres has been burned annually, usually in the spring and in low elevation dry environments. This is still far less than historic levels of fire disturbance,

and the season and severity of disturbance have not simulated presettlement processes.

Mid and high elevation areas with little road

Table 5.25 - Departures from Presettlement Fire Regimes[1]

Fire Regime	Percent of Area within Disturbance Interval	Percent of Area Missing one Interval	Percent of Area Missing two Intervals	Percent of Area Missing 3 Intervals	Percent of Area Missing 4 or More Intervals
Very frequent, low severity	26	2	0	37	34
Frequent, mixed severity	16	82	2	0	0
Infrequent, lethal	91[2]	9	0	0	0
Infrequent, mixed	88[3]	12	0	0	0
Very infrequent, mixed	100	0	0	0	0

1 No data are available for areas in private ownership, mostly in the Lower Canyon

2 58 percent are within 50 years of their 150 year maximum interval

3 66 percent are within 50 years of their 150 year maximum interval

development occur in Upper Main Slate, Boulder Creek, and Van Buren Creek, and other areas along Nut Basin ridge. Timber harvest in these areas is often not economically or ecologically cost effective. The need to provide sites for whitebark pine establishment is high. Use of prescribed fire or natural fire in the nonwilderness areas could both accomplish fuel reductions, restoration of presettlement plant communities, and reduce fuel continuity in an area buffering the west side of the Gospel Hump wilderness. This would provide more opportunities for natural fire use in that area of the wilderness. This is discussed further in Chapter 6, Section 6.33, (Vegetative Management Recommendations).

Timber Harvest

Timber harvest is another kind of plant community disturbance that can alter species composition, size class, tree density, pattern of communities in the landscape, successional pathways, and susceptibility to fire and insect and disease activity. This section will address to what degree timber harvest kind, extent, and timing, have simulated natural fire processes that have been suppressed. Past timber harvest areas are shown in Map 52.

Severity of Disturbance - Table 5.26 compares typical levels of fire severity to harvest activities by Vegetation Response Unit. Clearcut harvest and overstory removals are considered severe treatments, as are fires that kill more than 70 percent of the stand. Thinning, and preliminary shelterwood or seed tree cuts are considered of low to moderate severity. It appears that severe harvest treatments in VRU 3 do not replicate the low and mixed severity fire once typical of the canyons. In low relief terrain (VRUs 1 and 6) harvest treatments have not simulated the severity of presettlement fire. In VRU 4 the relative frequency of severe and intermediate treatments is within the range of natural variation. Clearcuts do not simulate fire in several other ways, including the heterogeneous spatial patterns of mortality caused by fire, the removal of wood as part

of harvest, or the ground disturbance associated with harvest.

Table 5.26 - Comparison of Fire and Harvest Severity

VRU	Fire Ratio of Severe to Intermediate Disturbance	Harvest Ratio of Severe to Intermediate Disturbance
1	70:30	23:77
2	70:30	100:0
3	50:50	93:7
3	50:50	93:7
4	50:50	43:57
6	75:25	24:76

Disturbance Frequency - Disturbance frequency affects watershed dynamics, wildlife sensitive to disturbance, patterns of plant colonization and succession, and species persistence. Table 5.27 compares frequency of fire and harvest disturbance by subwatershed in the Slate Creek watershed. Road construction as a disturbance is not included here, but it is clear that even in the watersheds once dominated by high frequency fire, the frequency of management disturbance has been much higher during the period from 1960 to the present than a natural disturbance regime.

Table 5.27 - Comparison of Fire and Harvest Frequency by Subwatershed

Subwatershed	Fire Frequency per 100 Years	Harvest Frequency Adjusted to 100 Year Basis
North Fork	3	22
Main Canyon	5	42
Boulde Creek	4	20
Little Slate	7	24
Van Buren	4	5
Little Van Buren	2	11
Upper Main	5	20
Deadhorse	3	2

Disturbance Extent - Disturbance size affects watershed response, landscape pattern, wildlife use of openings, colonization rates and species, and time required for plant community reestablishment. Table 30 compares size of fire disturbance as a percent of the subwatershed to size of harvest acitivities in the same subwatershed. Large scale disturbances were not uncommon under presettlement fire regimes in most settings. The much more frequent, but uniformly small scale harvest disturbances do not replicate the variation in disturbance patch size that occurred with natural fire, or the longer periods of subwatershed recovery from disturbance.

Table 5.28 - Comparison of Fire and Harvest Scale by Subwatershed

Subwatershed	Fire Size as Percent of Subwatershed	Harvest Size as Percent of Subwatershed
North Fork	7-54	<1-5
Main Canyon	<1-55	<1-2
Boulder Creek	5-79	<1-1
Little Slate	2-40	<1-5
Van Buren	1-57	<1-3
Little Van Buren	7-76	<1-5
Upper Main	13-55	<1-3
Deadhorse	<1-95	1-3

5.2.6 Air Quality

Introduction

Air quality associated with the Slate Creek analysis area is generally considered good to excellent most of the year. Local adverse effects result from occasional wildfires during the summer and fall, and prescribed burning of natural fuels and logging residue in surrounding areas during spring and fall.

The Aleutian Low and the Pacific High are weather systems that strongly influence local climates. This maritime air is carried eastward on prevailing westerly winds. The

Aleutian Low dominates the winter months, bringing periods of heavy precipitation in the form of snow and spring rains. The Pacific High dominates during the summer, resulting in hot and dry weather. Low-intensity, long duration frontal storms occur commonly in fall, winter and spring. High intensity, short duration thunderstorms accompanied by locally high winds occur between May and October.

Smoke from wildland fires and prescribed fires usually drifts eastward and eventually into Montana. Restrictions on prescribed burning on the Nez Perce National Forest have been imposed in the past because of adverse effects on air quality in parts of western Montana. Smoke produced by wildland fires and prescribed fires in upwind airsheds including southern Idaho and eastern Oregon has impacted this analysis area in the past.

Locally, all major canyons are subject to temperature inversions which trap smoke. These inversions may occur and affect smoke dispersal in topographic basins such as the Salmon River Canyon or the Slate Creek Canyon. Temperature inversions can occur anytime during the year, but are most common in the fall. On the Nez Perce National Forest, prescribed broadcast burns and underburns are generally implemented during the late spring/ early summer and late summer/ early fall.

Historic

Based on fire history information, the range of natural variability in the analysis area probably ranged from very clear and clean during non-fire months (November to May) to hazy and smoky for extended periods during the fire months (June to October).

Current

Current air quality in the analysis area during non-fire months is probably close to the range of natural variability, while during the fire months, air quality is probably outside the natural range (i.e.. clearer and cleaner), except when large wildland fires are burning in the vicinity. This is because under current policy, most wildland fires are suppressed, and therefore the amount of smoke has been greatly reduced from previous historical levels.

Management Direction

The Clean Air act amendments of 1977 set up a process which included designation of Class I, II, and III areas for air quality management. The Selway Bitterroot Wilderness to the northeast of the assessment area and Hell's Canyon to the west are designated Class I. This designation was assigned to certain wilderness areas, parks and reservations that were in place at the time of the 1977 amendments. The Gospel-Hump Wilderness, the Frank Church River of No Return Wilderness and other adjacent forest lands are designated Class II.

The primary differences between Class I and Class II areas are in the protection and processes provided for in the 1977 amendments. Class I areas receive the highest level of protection under the Prevention of Significant Deterioration (PSD) program. This program protects air quality in these areas through application of numerical criteria for specific pollutants and use of best available control technologies. The numerical criteria are more restrictive for Class I than Class II areas.

The 1977 amendments also provide a process which requires designation of Air Quality Related Values (AQRV's) to be protected in Class I areas. AQRV's have been developed and adopted for the Selway Bitterroot Wilderness under the Regional Air Resource Management Program.

The Clean Air Act of 1963 requires the Environmental Protection Agency (EPA) to identify pollutants that have adverse effects on public health and welfare and to establish air quality standards for each pollutant. Each state is also required to develop an implementation plan to maintain air quality.

To date, the EPA has set national ambient air quality standards (NAAQS) for six criteria pollutants: sulfur dioxide, inhalable particulate matter, carbon monoxide, ozone, nitrogen oxides and lead.

Currently, the standard that applies to prescribed burning is particulate matter. These standards are based on the amount of particulate matter (PM) of a particular size, PM10 (less than or equal to 10 microns), produced by a given activity, averaged over a 24 hour period. PM2.5 has been accepted by EPA as a new standard but states have yet to adopt this standard. PM2.5 represents approximately 80% of the PM10 produced by prescribed burning.

There are two standards currently accepted for particulate matter production, NAAQS for overall air quality and Prevention of Significant Deterioration (PSD) to prevent deterioration of air quality in attainment areas.

The Nez Perce National Forest is a party to the North Idaho Smoke Management Memorandum of Agreement, which identifies procedures to regulate the amount of smoke produced by prescribed burning. This agreement also identifies the area most affected by activities in the Slate Creek vicinity as Airshed 13. When discussing air quality, particulate matter produced, significant deterioration, and impacts to visibility are the current standards used.

Table 5.29 - National Ambient Air Quality Standards for Region 1 (In μg/m³ unless otherwise stated)

Pollutant	Average Time	Federal Std.	Mt. Std.	Id. Std.
PM10	Annual	50	50	50
PM10	24 hour	150	150	150
PM2.5	Annual	15	N/A	N/A
PM2.5	24 hour	65	N/A	N/A

Table 5.30 - Prevention of Significant Air Deterioration Standards (In μg/m³ PSD Increments)

Pollutant	Average Time	Class I Airshed	Class II Airshed
PM10	Annual	4	17
PM10	24 hour	8	30

Note: Tables 5.29 and 5.30 taken from *A Desk Reference for NEPA Air Quality Analysis, CH2M Hill, 3/95).*

Prescribed Fire vs. Wildfire

Using prescribed fire to treat an area with natural fuels will reduce impacts to air quality when compared to the same area being burned by a naturally occurring fire. By monitoring fuel and weather conditions a window can be identified to implement the prescribed burn when smoke dispersal is optimal, and the number of acres consumed can be controlled as well as limiting the portion of fuel consumed.

Under wildland fire burning conditions, nature selects the weather and fuel conditions under which the burn takes place. Often more fuel is consumed, because the fuel conditions are drier, and wildland fires often last for extended periods. As a result impacts to air quality can last for extended periods with greater volumes of smoke.

Since these condition occur during the warmest and driest months of the year (June to October), this is also when the Pacific high dominates the weather patterns during which temperature inversions are common providing an opportunity for smoke to pool in topographic basins.

5.2.7 Noxious Weeds and Exotic Plants

Introduction

Exotic plant species are an important ecosystem attribute to consider when assessing watershed conditions and vegetation objectives. Invasive exotic plants have the potential to affect native species richness and frequency (Forcella and Harvey, 1990) erosion rates (Lacey et. al., 1989), ecological processes (Whisenant, 1990, Vitousek,1986) and rare plants (Rosentreter, 1994). Bedunnah (1992) noted that exotic plants may alter ecological equilibrium to a point where the change is permanent.

Significantly higher rates of sedimentation from runoff in knapweed dominated sites has been documented in Montana (Lacey et.

al., 1989). Cheatgrass and medusahead have altered fire frequencies in many areas of the Great Basin and intermountain region (Whisenant, 1990; Young 1992). Purple loosestrife has significantly changed wetland vegetation structure in eastern North America, and the Pacific Northwest. Plant community structure along many canyon slopes in the Snake and Salmon River basins has shifted from a fibrous rooted bunchgrass community to one dominated by tap-rooted weedy forbs, affecting habitat for chukar and other grassland birds.

Invasive exotic plants can expand following man caused or natural disturbances, and colonize degraded as well as intact habitats (Tausch et. al., 1994; Watson et. al. 1989; Willard et. al. 1988; Belcher and Wilson 1989). Forcella and Harvey (1983) documented Eurasian weeds dominating relatively undisturbed grasslands in Montana. Tyser and Key (1988) reported that spotted knapweed invaded and reproduced in rough fescue communities in Glacier National Park. Sulfur cinquefoil has been found as a co-dominate in an otherwise good condition bunchgrass community.

Many weeds found in the intermountain west were accidentally or intentionally introduced into North America between 1880's and 1920's. Without their natural predators and pathogens, the weeds have continued to expand. In many places the weeds are the dominant species of the existing plant community. Spotted knapweed has expanded in Montana to over four million acres (Lacey et. al. 1995). Since 1977 yellow starthistle infestations in northern California have spread from one million acres to over ten million acres. This species also infests millions of acres in Oregon and Washington. In Idaho over 500,000 acres are infested, with the plant increasing at a rate of 6-60% per year (Callihan and Lass, 1996). Rush skeletonweed in Idaho has expanded from 40 acres in the early 1960's to over four million acres.

Present Situation

Weed colonization is an active process influencing many habitats in the Salmon River and Slate Creek drainages. Invasive exotic plants are a serious threat to the biodiversity and other resource values within the Salmon River subbasin and the Slate Creek Watershed. Many weeds currently found in the Slate Creek drainage have the potential to spread into adjacent susceptible habitats and disperse along the transportation network. In addition new weeds first introduced in other parts of North America are now reaching the intermountain region and the Salmon River Basin. These new weeds present an additional threat to the habitats within the Slate Creek drainage.

Field surveys conducted the past several years have revealed 13 noxious weeds or exotic species of concern occupying over 1,000 acres within the Slate Creek analysis area. Individual infestations range in size from a few square-feet to hundreds of acres with the most common infestation covering approximately 1 1/ 2 acres. Even though the entire watershed has not been thoroughly surveyed, sufficient suitable locations including travel corridors, dispersed and developed campsites, and past timber treatments have been surveyed to indicate an undesirable situation has developed. It appears, from field observations, that the established weeds in the Slate Creek drainage continue to spread into previously uninfested sites.

The majority of the identified infestations occur along the main roads and drainages. Yellow starthistle and cheatgrass have become firmly established in grasslands outside the transportation corridors. Canada thistle is common in the mid-elevation harvest units on the National Forest. Yellow starthistle is the most abundant weed in the Slate Creek drainage followed by Canada thistle, spotted knapweed, hoary cress, dalmatian toadflax, Scotch thistle, and matgrass. Other common weeds present in the drainage, but with no estimate of infestation extent, include St. johnswort, sulfur cinquefoil, cheatgrass, medusahead, common mullein and houndstongue. Ninety percent of the known infestations in the Slate Creek drainage are located in the

lower watershed, within the Main Slate Canyon subwatershed.

Table 5.31 - Current and Potential Invasive Weeds of the Slate Creek Drainage

Invasive Weeds present in Slate Creek Watershed	Potential Weeds
Yellow starthistle	Jointed goatgrass
Spotted knapweed	Leafy spurge
Hoary cress	Toothed spurge
Dalmatian toadflax	Common crupina
Scotch thistle	Diffuse knapweed
Matgrass	Russian knapweed
Canada thistle	Dyer's woad
St Johnswort	Rush skeletonweed
Sulfur cinquefoil	Yellow toadflax
Cheatgrass	Purple loosestrife
Medusahead	Meadow hawkweed
Orange hawkweed	

Yellow starthistle currently occupies over 30,000 acres within the adjacent Salmon River canyon (private and public lands) between Slate Creek and White Bird summit, along the Whitebird, Skookumchuck, and Deer Creek drainages. Starthistle has been spreading south over the last 15 years. Small isolated infestations are being discovered annually in the other drainages. Spotted knapweed has established along the main transportation corridors and the beaches of the Salmon River. It has been steadily spreading north and to higher elevations over the last 20 years.

Habitat Susceptible to Weed Colonization

All plant communities are subject to invasion or colonization, but vary in their susceptibility to exotic plants. Both native and exotic plants establish where resources are available. Where light, space, water, and nutrient requirements can be met, plants may disperse and occupy areas within existing plant communities. Exotic plants can be expected to colonize those sites or habitats that provide the necessary requirements to complete their life cycle. Those habitats that lack the necessary resources for specific weeds are not considered susceptible to colonization. Habitat Type Groups (HTG) found within the Slate Creek analysis area have been rated for their susceptibility to exotic plants and noxious weeds guilds found in the Salmon River subbasin. The following ratings were used to classify habitat susceptibility:

Closed: Habitat is effectively closed to weed colonization due to elevation, climate, substrate or existing plant community structure.

Low: Habitat is slightly susceptible to weed invasion. Existing community structure and or site characteristics limit weeds from exhibiting invasive behavior. Species may colonize highly disturbed sites and waste places but acts as ruderal species in the plant community.

Moderate: Habitat is moderately susceptible to weed invasion. Sites provide characteristics where species can invade the herbaceous layer and become a common element across the plant community in the absence of intense and frequent disturbance.

High: Habitat is highly susceptible to weed invasion. Site characteristics and plant community structure is such that species can colonize and dominate the herbaceous layer even in the absence of intense and frequent disturbance.

Weed Guilds

Weed guilds are groups of exotic plants or noxious weeds that share common growing requirements and generally colonize and affect similar habitats. Many weeds are capable of growing across a greater range of environmental conditions. However, weeds have been placed in the guild for which they the have the greatest potential to impact the existing plant community.

Steppe/Savannas Weeds: The group of exotic plants that have the greatest impact on hot and dry steppe grasslands and open dry Ponderosa pine savannas. Habitats tend to be southerly aspects, relatively open vegetation structure with rocky shallow soils. Weed species include yellow

starthistle, scotch thistle, dyers woad, rush skeletonweed, dalmation toadflax, cheatgrass, common crupina, diffuse knapweed, and medusahead.

***Montane Weeds*:** The group of exotic plants that are capable of colonizing and becoming a member of warm and moist plant communities. Weed species include leafy spurge, sulphur cinquefoil, spotted knapweed, orange hawkweed, and Canada thistle. HTG2 and HTG 3, and drier portions of meadows (HTG 60) are often susceptible to these species.

***Wetland/Meadow Weeds*:** The group of exotic plants that are capable of affecting meadows, riparian areas and wetlands. Weed species include meadow hawkweed, common tansy, hoary cress, purple loosestrife, and matgrass. Not all wet meadows are delineated at the scale of this assessment. Largest areas subject to invasion are in the meadows of upper Slate Creek.

Table 5.32 below shows the habitat type groups that are vulnerable to the three noxious weed guilds.

Table 5.32 Susceptable Weed Habitats

Noxious weed & Exotic Plant Guilds	HTG 15 Bunchgrass	HTG 30 Dry Shrub	HTG 60 Bottom-lands	HTG 1 Dry P. Pine	HTG 2 Doug-Fir	HTG 3 Dry Grand-Fir	HTG 4 W/M GF	HTG 7/8/9 Subalpine Fir	HTG 10/11
Steppe/ Savanna	High	High	Low	High	Mod	Low	Low	Closed	Closed
Montane	Mod	High	Moderate	High	High	Moderate	Low	Closed	Closed
Wetland/ Meadow	Closed	Low	High	Closed	Low	Low	Closed	Closed	Closed

As noted in the Terrestrial section under vegetation, 12 habitat type groups exist within this analysis area. Approximately 42,000 acres across five habitat type groups are rated as moderately to highly susceptible to weed invasion (see Map 46). The highly susceptible acres are concentrated in the Main Slate Canyon Subwatershed (50%), Lower Canyon Subwatershed (27%) and the North Fork Slate Creek Subwatershed (18%). Map 46 shows areas susceptible to weed invasion from the Montane Weed Guild in the analysis area. Habitat Type Group 1 (warm/ dry ponderosa pine), Habitat Type Group 2 (warm/ dry Douglas-fir) Habitat Type Group 15 (hot/ dry bunchgrass) and HTG 60 (Mtn. Bottomland) are susceptible habitats that specific weeds can colonize and dominate without intense human caused or natural disturbances.

Noxious weeds can also be found along the edges and openings of habitats that are not inherently susceptible to weed invasion. These weeds may not represent a risk to the existing plant community or pose a threat to ecosystem process and function, but can act as a seed/ propagule reservoir for future dispersal into more suitable sites. Most weeds do not spread across a landscape by a single advancing front. Rather, weeds establish from many small disjunct patches from independent populations (Moody and Mack 1988). In many cases, these outlying small patches become the founding population for further dispersal. With time and available suitable habitat, these patches may expand and coalesce into an apparently single infestation. Small infestations that do not pose a current threat to the existing plant community may still contribute to the spread of the species by acting as a founder population for new disjunct patches.

Risk of Weed Expansion

Weed expansion in the analysis area is greatly influenced by habitat susceptibility, seed availability, seed or propagule dispersal, and habitat disturbance. The probability that weeds will expand in the analysis area depends on the interaction of these four factors. Weed expansion begins with the dispersal of seed from existing weed infestations adjacent to uninfested areas. Roads and trails are the primary means by which people and their equipment interact with the environment and therefore are an important spread

vector. These linear corridors act as dispersal networks for exotic plants. In addition, road and trail management creates sustained levels of soil disturbance that promotes exotic plant densities there by increasing seed for ongoing dispersal into adjacent areas. The majority of documented infestations within the analysis area are along the transportation corridors.

Disturbance creates spatial and temporal openings where sites become suitable for plant establishment, where usable light, space, water and nutrients are available to meet the specific growing requirements of the plant. Disturbance may increase the susceptibility of an otherwise intact plant community to weed invasion by increasing the availability of a limited resource. Natural or human caused fires along with timber harvest and grazing are broad scale disturbances that influence the amount of available habitat for weed establishment.

Table 5.33 - Probability of Weed Expansion

Spread Components				
Habitat Suscept.	Seed Source	Site Disturbance	Spread Vector	Expansion Probability
Rating	Weeds Present or Adjacent	Fire, harvest and Grazing	Adjacent Roads and trails	Rating
High	Yes	Yes	Yes	Extreme
			No	High
		No	Yes	
			No	
	No	Yes	Yes	
			No	Moderate
		No	Yes	
			No	
Moderate	Yes	Yes	Yes	High
			No	Moderate
		No	Yes	
			No	
	No	Yes	Yes	High
			No	Moderate
		No	Yes	
			No	Low

Weed expansion risk in the analysis area was determined by assessing the susceptibility of habitat type groups, the presences of weed infestations (seed source), the amount of burned and harvested area with less than 40% canopy cover (site disturbance), and the density of roads (spread vector). Table 5.33. summarizes the rating matrix that determined the probability of expansion for invasive montane weeds.

Table 5.34 - Weed Risk Rating Summary

Expansion Probability (Risk Rating)	Acres within the Analysis Area
Extreme	10,215
High	21875
Moderate	4,038
Low	47,920

Table 5.34 summarizes the probability rating that invasive weeds would expand within the analysis area. Approximately 32,000 acres in the Slate Creek drainage were rated as having a high or extreme probability of invasive plant expansion. Map 47 displays the spatial arrangement of the moderate, high and extreme probability zones. These zones contain moderately to highly susceptible habitats, frequent disturbances and high road densities. The interaction of these three factors create conditions very conducive to weed establishment and dispersal. Areas were rated as Extreme if weed infestations were found within or adjacent to high probability zones. Extreme risk of spread suggests that all factors that contribute to weed expansion (habitats, seed source, disturbance, spread vector) are present over a relatively small area.

5.2.8 Wildlife

Introduction

Fire and vegetative succession result in constantly evolving conditions. Succession results in a continuous change in an areas plant community and can also cause a change in some of the wildlife species found in an area. Many wildlife species are

adapted to specific successional stages and their associated plant communities. One successional stage may provide all the habitat requirements for one particular species, while some wildlife species may require different successional stages, each of which meets specific habitat requirements (such as foraging and reproduction). This often means that an area which initially provided early successional habitat after a fire (i.e. snowshoe hare), could end up providing late successional habitat through time (i.e. pileated woodpecker) as a result of succession.

Some wildlife species have evolved to where they are dependant on other specific wildlife species for their survival. The size of the home range for various wildlife species may vary from several acres to hundreds of square miles, therefore the Slate Creek watershed may only meet a portion of the habitat requirements for some species with a large home range. In addition, the Slate Creek watershed may only provide suitable habitat for some species only during specific times of the year. While the quality, quantity, and distribution of habitat has decreased for some wildlife species, it has increased for others. For instance, both mid- and late-seral lodgepole pine, spruce/ fir, and mixed conifer forests have increased in the watershed since presettlement times. Habitat for fisher and marten has increased at the expense of providing early-seral foraging habitat for lynx and their prey.

Habitat and wildlife security are the two main elements being focused on in this document. Vegetative guilds have been developed to display habitats that are important to wildlife species. These guilds are important because these are the habitats that have changed considerably over time and/ or are habitats that seem to be limiting across the landscape. Cover types, size classes, canopy cover classes, and patches sizes were used in interpreting what attributes of wildlife habitat has changed over time. Maps 37-43 and Appendices G and I display these differences between the 1930's and 1991. These changes from historic were used to interpret how this would potential affect wildlife species that use these habitats in terms of the extent of these broadly defined habitats, their distribution, patch size, and connectivity at the watershed and subwatershed level. Habitats evaluated to have changed most significantly from historic conditions are early-seral communities, post-fire communities, open ponderosa pine forests, and late-seral or old growth forests. Security for wildlife species has also changed with road building in association with timber harvest and mining activities.

Historic conditions were based on photo interpretation at a specific point in time (1930's). Existing conditions were based on remote sensing classifications and photo interpretation. Both have inherent limitations associated with them which precludes absolute precision. However, understanding how disturbance and succession work within a landscape is fundamental in interpreting how and where habitat for any given number of species may or may not be available. With this in mind, the results are intended to only show basic trends in terms of the changes in canopy cover, size classes or successional stages, and vegetative cover.

Early-seral Communities

Early-seral habitats provide not only foraging areas for most wildlife, they add diversity and heterogeneity to an otherwise continuous landscape. Low elevation breaklands provide important winter forage and browse for big game. They also provide forage and nesting habitat for mountain quail. Mid to high elevation communities of montane wetlands, shrubs, and sapling vegetative communities provide forage and cover for big game and forage for lynx.

Historic Process and Conditions - Fires have played an important role in providing early successional habitats. Low severity fires at frequent intervals in low elevations tended to maintain early-seral communities. Rapid recovery of shrubs through resprouting was typical. Mid to high elevation areas were more susceptible to stand replacing fires and provided large blocks of early-seral conifer habitats. The low severity fires occurred more in steep canyons in VRU's 3 and 4 and

created small to moderated sized openings. Fires in mid to high elevation communities in VRU's 1, 6, 2, and 9 were either mixed or high severity at moderately frequent to infrequent intervals.

Historically, a large percentage of the watershed was in an early-seral vegetative structure. Patches sizes tended to be fairly large, peaking at 5000 acres in nonforest habitats and 5000 to 40,000 acres in mid to higher elevation coniferous forests. Typically, patches sizes for both open and closed canopies ranged from 10-50 acres and peaked around 25 acres. A few 1000-5000 acre blocks in closed canopy were more common in the higher elevations.

Grasslands - At lower elevations, in VRU's 3, 4, and 12, frequent, low severity fires maintained bluebunch wheatgrass communities. These habitats occurred in a large block on the north side of Slate Creek in Lower and Main Canyon up to Slide Creek. Infrequent, high severity fire occurred in high elevation montane parklands in VRU's 2 and 9 and sedge/ wet meadows in VRU's 4 and 6. These communities mainly occurred in Boulder, Deadhorse, and Van Buren subwatersheds, and North Fork and Little Slate subwatersheds, respectively.

Shrubs - Shrub habitats were maintained by frequent, low severity fires in the lower elevations in VRU's 12, 3, and 4 of Lower and Main Canyon subwatersheds. Patch sizes were fairly small to moderate in size and somewhat isolated along streams or north aspects in Lower Canyon and small, incidental patches in Main Canyon and North Fork.

Seedling/Sapling and Pole-Sized Forests - Historically, seedling/ sapling- and pole-sized conifer forests of moderate to dense canopies were abundant in the lower elevations on north aspects (VRU's 3 and 4) and mid to high elevations in VRU's 1, 2, 4, 6, and 9. The patches occurred in large blocks and were fairly continuous across the drainage. The early-seral forest communities were commonly associated with frequent, mixed severity fires in the lower to mid elevations on north aspects, and infrequent, lethal or mixed severity fires at mid to high elevations. These habitats can be found in all subwatersheds, except Lower Canyon and south aspects of Main Canyon.

Events and Factors Contributing to Change **-** Fire suppression and succession have played a major role in influencing the amount, distribution, and quality of early-seral habitats.

Grasslands - Low elevation grassland communities have been encroached on by shrubs and conifers, thus decreasing the amount and distribution of these habitats. Weedy annuals and noxious weeds have also invaded the grasslands at the expense of native species. Patch sizes have become smaller, more fragmented, and less continuous. Upper elevation montane parklands and sedge/ wet meadows have been encroached on by conifers due to fire suppression and succession.

Shrubs - With fire suppression and succession, shrub communities have become decadent. Conifers have been encroached on these habitats, as well. With the shift in domestic ungulates from sheep to cattle, along with the change in position of the slopes that were/ are grazed and the forage species consumed, may also contribute to an increase in shrub communities.

Seedling/Sapling- and Pole-Sized Forests - Without large scale, stand replacing fires, succession progressed and created large blocks of mid-seral, closed canopy forests. Today, early-seral forest habitats are created either by small fires that tend to be suppressed quickly or regeneration harvest. This creates small, isolated openings amongst mid-seral habitats and at times do not replicate the variation in structure, patch size, distribution of patches, or species composition.

Current Process and Conditions - The amount of nonforest and seedling/ sapling/ pole habitats have decreased by seven and seventy-two percent, respectively Table 5.17. This can be attributed to encroachment of conifers on grasslands and shrub communities and fire

suppression/ succession in both nonforest and forest communities.

Current patch sizes in early-seral habitats have tended to shift to smaller sizes. The variability in patches sizes has been lost in both open (<40%) and closed (>40%) canopies. Open canopied, early-seral habitats use to be fairly diverse in VRUs 12, 2, 9, 1, and 6. In VRUs 3 and 4, open canopied patches sizes tended to be smaller, 5-50 acres with a few 500 acre patches. Closed canopied early-seral habitats in VRUs 12, 2, 9, 1, and 6 used to be fairly large, over 10,000 acres. Now patches range from 5-100 acres in size, peaking about 25 acres. In VRUs 12, 3, and 4, patch sizes in closed canopy, early-seral habitat tended to be smaller than the higher elevation communities, ranging from 10-100 acres in VRU 12 and 5-200 acres in VRUs 3 and 4. Now patches sizes in the lower elevations tend to be in the 5-50 acre range in VRU 12 and 10-25 acres in VRUs 3 and 4.

Grasslands - Both grasslands and montane parklands have decreased from historic levels by eighty and seventy-two percent, respectively. Sedge/ wet meadow communities have declined as well by ninety-two percent. Table 5.35 shows the change in amount of grassland habitats within the Slate Creek drainage. Appendix G and H also provide changes by VRU and subwatershed, respectively.

The amount of undisturbed grasslands has decreased considerably from historic in Lower and Main Slate Canyons. Grazing and the introduction of nonnative species (weedy annuals and noxious weeds) have resulted in shifts from bunchgrass communities to disturbed grasslands that tend to be less diverse. The majority of the undisturbed grassland occurs in small, isolated patches amongst the nonnative vegetation. At low elevations, conifers and shrubs have encroached on the grassland communities. The private land contains many of the weedy species while the Forest lands have mainly been encroached on by conifers. The quality and nutritional value of nesting and foraging habitat for wildlife species that use these habitat have declined.

Table 5.35 - Changes in Grassland Vegetation (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
Foothills grassland	5,822	1,157	-80
Disturbed grassland	0	2,186	+
Montane park	2,826	787	-72
Sedge/ wet meadows	649	53	-92

Shrubs - Shrub communities have increased by 141% from historic. However, the size and arrangement of the patches have changed. Patches have become larger and more continuous due to the lack of frequent fires in the grasslands of Lower and Main Canyon and North Fork subwatersheds. In some instances, patches have become smaller and more fragmented due to fire suppression and succession. Shrubs have also become more apparent in Upper Main and Little Slate. This can be attributed to mapping inaccuracies in identifying shrub cover types between historic and existing conditions. Table 5.36 shows the change in amount of shrub habitat within the Slate Creek drainage. Appendix G and H also provide changes by VRU and subwatershed, respectively.

Table 5.36 - Changes in Shrub Vegetation (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
Cool shrub	32	504	+1457
Dry shrub	123	112	-9
Mesic shrub	1,246	2,779	+123
Total	1,401	3,379	+141

The nutritional value of the shrubs to big game has declined due to fire suppression. Shrubs are getting decadent and the tender young shoots are out of reach of browsing animals. In some cases, shrubs are becoming hedged and provide little in terms of vertical diversity. The quality of cover for ground nesters may also be in question.

Seedling/Sapling- and Pole-Sized Forests - Early-seral conifer sapling habitat has decreased considerably from historic in Main Slate Canyon, Little Van Buren, Deadhorse, North Fork, Upper Main, Boulder, Little Slate, and Van Buren Creeks. Fire suppression is the main contributor to this decline. Historically, early-seral conifer habitats were abundant and commonly associated with stand replacing fires. Mixed to high severity fires at moderate to infrequent intervals favored more lodgepole, spruce/fir, or mixed species habitats. Infrequent, high severity fires dominated the landscape that created large patches of early-seral sapling vegetative communities that may or may not have contained snags depending the severity of the fire. Table 5.37 shows the change in amount of early-seral forest communities within the Slate Creek drainage. Appendix G and I also provided changes by VRU and subwatershed, respectively.

With the advent of fire suppression, early-seral habitats have progressed into mid-seral forest communities. Patch sizes of mid-seral habitats tended to be on the small side. Open canopies of mid-seral forest historically ranged from 5-10 acres in VRU 12, 10-100 acres in VRUs 3 and 4, 5-10 acres in VRUs 2 and 9, and 5-75 acres in VRUs 1 and 6, with a few 200 acre patches. Currently, patches in VRUs 2 and 9 have increased in size, peaking around 25 acres on up to 5,000 acres. In VRUs 1, 3, 4, and 6, patches sizes of mid-seral forests have decreased in size, ranging from 5-50 acres.

Closed canopy, mid-seral forests are similar to open canopy communities in that patch sizes tend to be smaller in VRUs 2, 3, 4, and 9 than historically existed. This can be attributed to loss of whitebark pine in VRUs 2 and 9, and harvest activities in VRUs 3 and 4. Mid-seral patches in VRUs 12, 1, and 6 tended to increase in size.

The main contributor of early-seral conifer habitat today is timber harvest. However, the availability of snag habitat in these areas is basically nil. The size and connectivity of seedling/ sapling and pole patches have also drastically decreased. Timber harvest units basically leave scattered, small, isolated patches or openings with little standing dead material in what is otherwise a contiguous, homogeneous patch of mid- to late-seral forests consisting of moderate to dense canopies. Timber harvest may tend to mimic the processes that fire create, but the patches do not provide the proper size, arrangement, structure, and species composition of live and dead material.

Post-fire Communities/Snag Habitat

Fire plays an important role in shaping ecosystems. Fires not only create early-seral herbaceous or shrub habitats, they also create a mosaic of burned and unburned patches. Post-fire communities that create snags or that defoliate trees, scorch or burn the bark, but do not burn or dry out the inner bark provide suitable habitat for

insects. Many woodpeckers, like the black-backed woodpecker, utilize old burns, blowdown areas, and insect infested areas where insects are more abundant.

Table 5.37 - Changes in Seedling/Sapling/Pole Vegetation (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
Lodgepole seedling/ sapling	6,452	1,087	-83
Lodgepole pole	7,765	634	-92
Subtotal	14,217	1,721	-88
Spruce/ fir seed/ sap	7,928	714	-91
Spruce/ fir pole	8,960	1,222	-86
Subtotal	16,888	1,936	-89
Mixed conifer seed/ sap	6,711	2,669	-60
Mixed conifer pole	3,393	3,787	+12
Subtotal	10,104	6,456	-36
Grand Total	41,209	10,113	-75

Table 5.38 - Changes in Mid-seral Vegetation (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
Lodgepole	1,170	10,397	+789
Spruce fir	4,522	17,573	+289
Mixed conifer	7,345	15,370	+109
Total	13,037	43,340	+232

Historic Process and Conditions - Between 1860 and 1935, approximately 99,075 acres or 128% of the Slate Creek watershed (Forest Service administered lands) burned creating habitat for species like the black-backed woodpecker. This equates to an area burning about once every 58 years. Snags were mainly concentrated in the Main Canyon and North Fork Slate Creek (VRU's 3 and 4), either as individuals or in clumps. The rest of the area (VRU's 1, 2, 6, and 9) burned several times and probably provided little in terms of snags. The extent of available snags historically depended on the severity of the fire and how often the same piece of ground burned at fairly intense, frequent intervals. Historically, patches of diseased trees were uncommon due to fires

maintaining seral species which were less susceptible to diseases. Insect outbreaks were considered to be relatively common.

Events and Factors Contributing to Change **-** Historically, fires have been the main contributing factor of providing snags. Warm, dry habitats had nonlethal, frequent fires that provided snags as individuals or in small clumps. More moist and cooler habitats tended to stand replace and provided snags in large blocks depending on the severity of the fire. Areas that were stand replaced by fires were quickly salvaged logged.

With the advent of fire suppression efforts, the size and the frequency of stand replacing fires have decreased, reducing the amount of fire killed snag habitat for insectivorous wildlife species. Succession has also played a role in creating dense stands of mid-sized and larger trees of susceptible host species that harbor favorable conditions for insects and diseases. Presently, snags are created by disease, drought stress, insects, and on a much smaller scale by fires which tend to get quickly suppressed.

In the past, areas that have had insect or disease problems have been harvest using regeneration type methods (clear cuts). These openings had very little left in terms of standing material either dead or alive. Snags were and still are being felled due to safety reasons.

Firewood cutting also contributes to losses in the larger and longer-lived snags along roadways, especially western larch, Douglas-fir, and ponderosa pine which are also the most desired tree species for primary and secondary cavity nesters.

Current Process and Conditions - During the period from 1940 to 1996, fires were suppressed and kept relatively small, less than 5 acres in size. Less than one percent of the area has burned during this period.

Fire suppression and succession has created dense forests of mid- to late-seral climax tree species which foster many insects and diseases, and in turn provides habitat for insectivorous wildlife species, but on a much smaller scale than stand replacing fires.

Seral lodgepole pine stands are currently at risk of insect outbreaks due to past fire suppression efforts creating favorable conditions. Trees are larger and stressed by drought or other agents. These pockets of insect and diseased stands are targeted for timber harvest which reduces habitat for further pest and disease problems and habitat for insectivorous wildlife species. However, if fires were to occur in areas where tree densities and fuel levels are uncharacteristically dense or in pockets of dead and/ or dying stands, they tend to be quickly suppressed and are smaller in scale than historically existed, or due to current fuel accumulations cannot be quickly suppressed and become mid to large stand replacing events. They also tend to be more severe and may or may not provide the right conditions for insects or their predators.

Older Douglas-fir trees in the lower elevations of Main Canyon and North Fork are currently being attacked by Douglas-fir bark beetle. With older, dense forests being more prevalent than historically occurred, these stands are becoming stressed due to drought, competition for resources, or other agents, and are becoming more susceptible to insects. Firewood cutters are already removing these large dead or dying Douglas-fir along Slate Creek which are the most preferred tree species for primary and secondary cavity nesters.

Open Ponderosa Pine Communities

Open ponderosa pine forests with grass or shrubby understories provide habitat for many wildlife species, insects, insectivorous bird species, small mammals, and wild ungulates. Ponderosa pine forests are not unique to Slate Creek, nor the Salmon River basin, but they are important ecologically in providing diversity to the Nez Perce Forest and is highly preferred by many of our sensitive wildlife species.

Historic Process and Conditions - These habitats are characterized by open canopied, mature to old growth ponderosa pine forests. Such forests contain a discontinuous overstory of scattered large ponderosa pines

with a diverse understory community of perennial grasses, forbs, and/ or shrubs where tree canopies and densities are low (Morgan 1994). These plant communities are maintained by frequent, nonlethal ground fires or frequent, mixed severity fires more common on north aspects. VRU 3 is vital in providing this habitat, as well portions of VRU 4.

This forest community is most abundant in Main Canyon and to a lesser extent North Fork, Boulder, Little Van Buren, Deadhorse, Upper Main, Little Slate, and north aspects of Lower Canyon. This habitat occurred in a fairly large, continuous block along both side of Slate Creek and the lower reaches of Little Slate. Dense canopies of medium and larger sized trees occurred on south aspects and low to moderately dense canopies of younger trees on north aspects.

Events and Factors Contributing to Change **-** Fire suppression, forest succession, and timber harvest have created uncharacteristic conditions. Both the overstory and understory has become more dense with young pines and firs, losses have occurred in the large pine, and patches of open, large pine forests have become smaller and more fragmented.

Encroachment by shade tolerant Douglas-fir and grand fir have created stands with more closed canopies, more vertical structure, and more stress induced susceptibility to insect activity and diseases, especially in the larger trees. Younger pines have also encroached on grassland and shrub habitats, thus shrinking those communities.

Timber harvest has also contributed to the loss of larger ponderosa pine. Instead of thinning a stand, harvest has been more of a regenerative type in these warm, dry forest communities.

Current Process and Conditions **-** Ponderosa pine/ Douglas-fir forests consisting of large trees have increased by 27% from historic (Wildlife Technical Report). However, open stands (<40 canopy closure) of pure ponderosa pine, mixed ponderosa pine and Douglas-fir, or pure Douglas-fir consisting of large and medium trees have decreased considerably from historic. (See Tables 5.39 and 5.40). Canopies have increased mainly to the moderate canopy class. Patches of open canopied, large tree pine stands have become smaller and somewhat isolated, especially in the lower elevation on south aspects along Slate Creek. Pure stands of ponderosa pine have become younger, more dense, and contain more Douglas-fir than historically existed.

Open canopied, medium tree and pole-sized forests have declined as well and developed into more moderately dense, medium-sized forests consisting of Douglas-fir. Patches sizes of medium-sized trees have increased at the expense of the large tree overstory component. On the other hand, low canopied, sapling-sized stands have increased. This can be attributed to the encroachment of pines on grass and shrub habitats.

All of the changes mentioned above can be attributed to fire suppression and succession. Very little disturbance has occurred in this habitat in the last 75 or more years. These areas are susceptible to stand-replacing fires due to current fuel levels, which is outside the norm and the large pine that exist are at risk and may not survive a fire due to drought stress, competition for resource, and other possible agents.

Table 5.39 - Changes in Large Tree, Low Canopy Ponderosa Pine, Mixed Pine/Fir or Douglas-fir Vegetation (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
PP/ low canopy	786	139	-82
Mix/ low canopy	824	398	-52

Cover Type	1930s acres	1991 acres	Percent change
DF/ low canopy	217	0	-
Subtotal	1,827	537	-71

Table 5.40 - Changes in Medium Tree, Low Canopy Ponderosa Pine, Mixed Pine/Fir, or Douglas-fir Vegetation (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
PP/ low canopy	525	383	-27
Mix/ low canopy	873	209	-76
DF/ low canopy	212	5	-98
Subtotal	1,610	597	-63

In areas that have had disturbance, typically timber harvest, the large overstory ponderosa pines have been removed which favors the development of dense mid-seral conifer stands. This changes the structure and composition of forest stands which are less resistant to stand replacing fires. Regeneration harvest was more typical versus thinning of the understory which is more natural for these type of warm, dry forest communities.

Both overstory and understory canopy cover has increased from historic. Douglas-fir has also become a major component in both the overstory and understory, as well as grand fir in the understory. Historically, patches were larger in size and showed more continuity on south facing slopes along Slate Creek. Patches of large old trees have become smaller and scattered, while stands with medium-sized tree of moderate to high canopy closure have increased.

The dense stands of younger trees in the understory do not produce favorable conditions for wildlife species dependent on open forest canopies containing large trees for foraging or nesting. Flammulated owls are not able to forage efficiently in the thick midstory and understory vegetation, it interferes with the owl's ability to capture prey. This type of condition may not provide favorable conditions for prey species, either. White-headed woodpeckers are not found in young, dense ponderosa pine/ Douglas-fir forests because they do not provide the seed source that larger pine trees do. Foraging habitat for big game has declined in both quality and quantity.

The removal of large early-seral trees with regenerative type harvests reduces the amount of nesting habitat for flammulated owls, especially if they contain cavities. Forage for white-headed woodpeckers is reduced due to the loss of large pines that produce seed which this species forages on.

Late-seral/Old Growth Forest Communities
Late-seral forests are typically associated with infrequent, mixed, or high severity fire regimes (Quigley et al., 1996). However, this is not the case in Slate Creek. Slate Creek is more characterized by pondersoa pine/ Douglas-fir old growth in low severity, maintenance regimes. Key characteristics of late-seral/ old growth forests include overstory species, canopy cover, dead and down material, decadence, and age.

Late-seral forests occur in all habitat type groups, but they differ in their structure and composition depending on the disturbance regimes (fire). Many wildlife species depend on late-seral or older forests and the diversity that they provide for denning,

resting, and foraging habitat, and thermal and escape cover. Goshawks and pileated woodpeckers prefer closed canopy, mixed coniferous forests containing early-seral tree species in the overstory. Lynx, fisher, and marten prefer closed canopy, later successional mesic forests of Engelmann spruce, subalpine fir, lodgepole, and grand fir. Forest riparian areas, ridges, and saddles are important travel routes.

Historic Process and Conditions - Historically, large tree structure was fairly rare in the watershed. Where it did occur, it was mainly in ecotonal areas associated with canyons and streams.

Frequent, low intensity fires associated with VRU 3 maintained fairly open canopied, single-storied ponderosa pine old growth communities on south aspects and ridges or mixed, two-storied stands of ponderosa pine/ Douglas-fir on northerly aspects and along streams. This large tree structure tended to occur in a somewhat continuous block along Slate Creek and the lower reaches of Little Slate Creek. Small isolated patches occurred along streams or ridgetops in Little Slate, Little Van Buren, Boulder, and Deadhorse that survived large, infrequent, mixed severity and lethal fires.

Events and Factors Contributing to Change - According to Quigley et al., late-seral forests have declined while mid-seral forests have increased. In the lower elevations of Slate Creek drainage, this is the case, especially in the true ponderosa pine forest type.

Both late-seral and mid-seral forests have increased in the Slate Creek drainage as a result of fire suppression and succession. Vertical and horizontal structure, as well as the species composition has changed. In VRUs 3 and 4, single-storied, late-seral ponderosa pine forests have progressed to dense, multi-layered mixed pine and fir forests. In VRUs 1, 2, 6, and 9, late-seral, old growth communities have also become more extensive, which historically was basically nonexistent.

Very little disturbance has occurred in the late-seral habitats in the last 75 years or more. In the lower elevations, disturbance was more likely to be from timber harvest which tended to remove the large, early-seral tree species through regenerative type harvests instead of thinning out the shade tolerant species. Harvest in the mid to high elevations were either thinnings or clearcuts but mainly of more medium-sized trees. Very little standing dead or live material was left in the harvest units.

Current Process and Conditions - The amount of large tree structure in the Slate Creek drainage has increased from historic by 67% (see Table 5.41). However, not all subwatersheds have increased. Little Van Buren and Deadhorse have decreased, and Van Buren has not changed much. Instead of being in somewhat contiguous blocks, the late-successional forest patches have become smaller, more fragmented, isolated, and scattered across the watershed (VRUs 1, 6, 3, and 4). In VRUs 3 and 4, the larger patch sizes, >5000 acres are now averaging 10-100, with a few 500 acre patches. In VRU 12, patch size have expanded where formily they were small, <5 acres.

Patches of pure ponderosa pine and whitebark pine have declined and are at risk of being completely lost. This is especially true for the whitebark pine due to white pine blister rust. Pure stands of ponderosa pine patches in Main Canyon, North Fork, Little Van Buren, Lower Canyon, Deadhorse, and Upper Main have been encroached on by shade tolerant species and both the overstory and understory canopies have become more dense. Species composition in some of these patches has changed to more of a mixed pine/ fir community.

The late-seral patches in Boulder and Little Slate have become more extensive and fragmented in its distribution in the lower elevations towards the mouth of Little Slate Creek, this can be attributed to fire suppression and succession. The patch in Little Van Buren has moved higher in the drainage. The patches in Little Slate and Deadhorse have become very small, isolated patches scattered across the subwatersheds. Some of these changes may also be

attributed to inconsistencies in identifying size classes between historic and existing, photo interpretation versus satellite imagery.

Table 5.41 - Changes in Large Tree/Late-Seral Structure (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
Spruce/ fir	207	1,085	+424
Lodgepole	12	898	+7383
Mixed conifer	2,516	3,759	+49
Ponderosa pine/ Douglas-fir	2,932	3,739	+28
Whitebark pine	0	5	+
Total	5,667	9,486	+67

Late successional habitats have increased from historic for many wildlife species. VRU's 3 and 4 provide late-seral forests that are either open ponderosa pine, two storied larch overstory with grand fir/ Douglas-fir understory, or all-aged grand fir/ Douglas-fir in draws. Flammulated owls and white-headed woodpeckers prefer fairly open, mature ponderosa pine habitats found in VRU 3 and sometimes 4. Pileated woodpeckers and northern goshawks inhabit dense, mixed conifer forests found in VRU's 3 and 4 and possibly more xeric portions of VRU's 1, 2, and 6. VRU's 1, 2, 6, and 4 at higher elevations provide more mesic grand fir, spruce, and subalpine fir habitats for species like pine marten, fisher, and lynx.

There are approximately 3,759 acres of late successional, mixed conifer forests for goshawks and pileated woodpeckers to use as nesting habitat (this does not account for the differences in canopy closure, of which both prefer dense stands to nest in). Goshawks are more likely to use north aspects and more gentle slopes. Areas potentially containing habitat for these two species include North Fork, Main Canyon, Little Van Buren, Deadhorse, lower reaches of Upper Main, Little Slate, and Van Buren.

Table 5.42 - Changes in Medium Tree Structure (1930-1991)

Cover Type	1930s acres	1991 acres	Percent change
Spruce/ fir	4,522	17,573	+289
Lodgepole	1,170	10,397	+789
Mixed conifer	7,345	15,370	+109
Ponderosa pine/ Douglas-fir	2,798	5,931	+112
Whitebark pine	401	317	-21
Total	16,236	49,588	+205

Late successional, spruce/ fir and lodgepole pine amount to 1085 and 898 acres, respectively for fisher, marten, and lynx. There are also approximately 17,573 and 10,397 acres of medium tree spruce/ fir and lodgepole forests, as well as 3759 acres of

late successional and 15,370 acres of medium tree, mixed coniferous forests. (This does not account for the differences in canopy closures; these species will not use forest with less than 30% cover). Subwatersheds most likely to contain habitat for fisher, marten, and lynx are North Fork, south side Main Canyon, Upper Main, Little Slate, Deadhorse, and Van Buren.

Areas that have the best potential to provide mesic late-seral or old growth characteristics for furbearers are those stands that are in habitat type groups 4, 7, and 8. These habitat type groups also provide good ground cover after a disturbance.

Corridors/Landscape linkages - Riparian corridors seem to be adequate. Based on PACFISH buffer guidelines, anywhere from 13 to 36 percent of the subwatershed are considered streamside habitats. Little Van Buren, Lower Canyon, and Main Canyon have the lowest riparian landbase, while Boulder and Little Slate have the highest. Riparian corridors, for the most part, seem to be in either mid- or late-seral, closed canopy forests.

Ridgetop corridors seem to be adequate in providing either mid- or late-seral, closed canopy forests. However, the ridges tend to be more open than riparian corridors in nature, especially in the lower, grassland communities and higher alpine areas. These open areas are also in an early-seral structure.

Old Growth - To develop a basis for estimating the possible amount and location of potential old growth, an evaluation of tree size, cover type, lack of harvest activity, and years since the last fire, areas were mapped that could potentially contain old growth. Many of the stands that were fairly large trees in the 1930's and 1940's would probably be considered old growth today using the North Idaho Old Growth criteria (Green et. al, 1992). Using the above definitions, old growth within the Slate Creek watershed amounts to approximately 26%.

Appendices G and H depict by VRU and subwatershed the percent by cover type of potential old growth areas. Those areas identified as more mesic mixed conifer, lodgepole pine, spruce/ fir, and whitebark pine need to be surveyed to see if they do in fact contain old growth characteristics.

Old growth standards and guidelines outlined in the current Forest Plan do not consider differences in old growth type, natural patterns, and disturbance regimes that sustained certain old growth types, like open ponderosa pine. The extent, distribution, and types of old growth resulting from minimum compliance with existing Forest Plan old growth standards fall below historic levels for certain old growth types. Restoration of the disturbance regimes that maintained certain types of old growth (low and mixed severity fire) is needed. Timber harvest may sometimes be compatible with restoration of certain types of old growth. The restoration of ponderosa pine falls into this category. Timber harvest in more mesic old growth communities is not compatible.

Management of old growth forests is addressed in the Nez Perce Forest Plan, specifically in Forestwide Management Direction (pg. II-6) it states that "at least 10 percent of the forest acres across the Forest that are suitable old growth habitat will be managed as old growth habitat". Appendix N of the Forest Plan assigns a minimum 10 percent of the forest acres of each prescription watershed for old growth management and block sizes. Appendix D of the Nez Perce Forest Plan describes the allocation process involved in assigning acres within Capability Areas. A Capability Area may have one to several Management Areas assigned. The Management Area allocations were not specific to a certain location within Capability Areas.

An interdisciplinary team was assigned to validate management area allocations for this and other areas on the District in 1991. This team was particularly concerned with old growth allocations since stands having old growth characteristics are often subject to timber harvest and were thought to be in limited supply on the District. The team was following direction provided in the

Forest Plan (Appendix N) that states that the quality, amount and distribution of existing and replacement old growth habitat will be verified as part of project planning.

Validation of Forest Plan management areas was accomplished using aerial photos, stand exam information, previous land uses and personal knowledge of stand conditions. Sixth code watersheds were combined for analysis which allowed the team to analyze the old growth resource on a broader scale that approached the landscape level. Several sixth code watersheds have areas set aside to be recommended as old growth under management area 20, others do not (Little Slate and Van Buren subwatersheds).

Those areas that were identified as part of this Forest Plan management area validation exercise can be found in Map 51 and are labeled as "Existing and Replacement Old Growth". The areas identified as "Existing and Replacement Old Growth" overlay well with the potential old growth identified by cover type that was identified during this Slate Creek planning process in Little Van Buren and portions of Main Slate. Areas identified as "Existing and Replacement Old Growth" in Upper Main, Boulder, Deadhorse, and south side of Main Canyon do not overlay well with the other potential old growth by cover type. Those areas that are recommended as Forest Plan old growth areas may need to be reexamined and incorporate the North Idaho Old Growth criteria.

Wildlife Security

Access into the Slate Creek watershed began in the 1860s for mining purposes. Additional access was developed in the 1930s. Road construction associated with timber harvest began in the 1960s and continued until the early 1990s. Currently, there are approximately 280 miles of road within the Slate Creek watershed resulting in a road density of 2.2 miles per square mile. Table 5.43 shows road miles and densities by subwatershed. Road miles range from 5.2 to over 100 and road densities range from 0.9 to 3.2. Deadhorse and Van Buren subwatersheds have the lowest, while Little Slate has the greatest.

Existing open road densities are considered low to high, but that depends on the species that may inhabit the area and how susceptible they are to harassment and human-induced mortality. The degree of impact to wildlife species to disturbance and displacement depends on where the roads are in relation to key habitats, such as meadows, calving/ denning/ nesting habitat, drainage headwaters, travel routes such as saddles, low divides, ridges, and streams, and winter/ summer habitat.

Roads can directly impact animals and affect populations by displacing individuals, reducing the amount of suitable habitat, or altering the behavior and habitat use patterns. Roads increase human access which renders animals more susceptible to disturbance and more vulnerable to harassment and human-induced mortality, such as hunting and trapping. Several wildlife species prefer areas isolated rom high levels of human activity. Most such species ones that are either hunted or trapped. Many wildlife species, like the gray wolf, wolverine, lynx, fisher, marten, and elk are more likely to be associated with large or fairly remote/ undisturbed tracts of land rather than disturbed ones. The sensitivity of each species varies widely however, and even varies between individuals. The type, amount, durations, and season of disturbance affect the ultimate impact of human activity on wildlife populations.

Table 5.43 - Existing Road Miles and Densities by Subwatershed (Miles/Densities).

Subwatershed	Open	Seasonally Open(1)	Seasonally Closed(2)	Yearlong Open(3)	Yearlong Closed(4)	Total

Boulder	2.89/ 0.2	10.6/ 0.8	1.9/ 0.1	0.0/ 0.0	3.7/ 0.3	19.1/ 1.4
Deadhorse	0.02/ 0.0	3.4/ 0.6	0.0/ 0.0	0.0/ 0.0	1.8/ 0.3	5.2/ 0.9
Little Slate	14.8/ 0.5	43.5/ 1.4	3.7/ 0.1	6.0/ 0.2	32.4/ 1.0	100.4/ 3.2
Little Van Buren	3.3/ 0.6	6.5/ 1.2	1.4/ 0.3	0.0/ 0.0	1.9/ 0.3	13.2/ 2.3
Lower Canyon	17.3/ 2.3	0.0/ 0.0	0.0/ 0.0	0.9/ 0.1	2.4/ 0.3	20.6/ 2.7
Main Canyon	12.1/ 0.4	20.4/ 0.7	4.0/ 0.1	0.3/ 0.0	21.4/ 0.8	59.9/ 2.1
North Fork	2.7/ 0.2	13.7/ 1.0	3.3/ 0.3	0.0/ 0.0	11.7/ 0.9	31.4/ 2.4
Upper Main	5.1/ 0.3	11.4/ 0.7	3.0/ 0.2	0.0/ 0.0	5.8/ 0.4	25.2/ 1.5
Van Buren	3.7/ 0.5	0.0/ 0.0	0.0/ 0.0	1.1/ 0.1	3.2/ 0.4	8.0/ 1.0
Total	61.9/ 0.5	109.5/ 0.8	17.4/ 0.1	8.3/ 0.1	84.2/ 0.6	283/ 2.2

1 - Open for use during the summer and allows snowmobile or OHV use during the restricted period.
2 - Open for use during the summer, but does not allow snowmobile or OHV use during the restricted period.
3 - Closed yearlong to highway vehicles, but allows snowmobile and OHV use.
4 - Closed yearlong to all motorized traffic.

Big Game - Elk are most sensitive to human disturbance during calving season (mid May to mid June), hunting season (late August to late October), and winter (especially January to March). In general, at least 20% of an area should provide wildlife security, defined as areas larger then 250 acres that are more than 0.5 miles from an open road (Leege 1984). An open road for purposes of this discussion is defined as any road that allows any motorized vehicle.

Map 50 (wildlife security) displays areas that are greater than 0.5 miles from an open road. Currently, 36% of the Slate Creek watershed (not including private land) is considered as secure. This amounts to approximately 27,700 acres. The integrity of some of these areas is compromised due to motorized trails used by OHV's, especially in North Fork, the southern half of Main Canyon, the eastern edge of Little Van Buren, Little Slate, and the boundaries of Deadhorse and Van Buren subwatersheds. Van Buren and Deadhorse subwatersheds provide the greatest amount of wildlife security. However, with open OHV trails along the edges of these areas, security is being reduced, especially during the fall hunting season.

Fall hunting season is when elk and other big game animals are most vulnerable. Many of the roads are restricted to highway vehicles during the fall and winter/ spring months to provide secrity during critical times. However, many of the roads allow either OHVs or snowmobiles during the restricted period. In addition, OHV trails bisect roads that are restricted during the fall. Because of this security is being greatly reduced and in jeopardy. In the Little Slate and North Fork subwatersheds, gentle rolling topography makes it ideal conditions for OHV's to roam across the landscape without being on a road or trail. In certain areas of Little Slate, OHV unauthorized trails are being established by OHV users.

Motorized access in big game winter range is not a problem due to the steep breaklands, as well as this area does not have any motorized trails or open roads accessing the area, except along the edges.

In general, wildlife security available for elk in the watershed is sufficient. However, localized problems do exist, especially in Little Slate and the northern portion of North Fork. The integrity of some of the security areas is in question due to OHV use during critical time periods and when wildlife are most vulnerable to human disturbance.

Furbearers - Management guidelines have been developed for American marten, fisher, and lynx habitats (Idaho State Conservation Efforts 1995). Currently, Boulder, Deadhorse, Upper Main, and Van Buren subwatersheds are at a moderate risk of vulnerability to trapping (road densities of 0.25-1.0 miles/ square mile) and Little Slate, Little Van Buren, Main Canyon, and North

Fork are at a high risk (>1.0 miles/ square mile). Lower Canyon is not considered habitat. As defined here, open roads are those that allow motorized travel during the trapping season (November-January). If work was implemented on the road identified for decommission and evaluate for decommission, Boulder, Deadhorse, Main Canyon, Upper Main, and Van Buren would remain at 0.25-1.0 miles of road/ square mile, and Little Slate, Little Van Buren, and North Fork would still have greater than 1.0 miles of road/ square mile.

In reviewing Map 50 (security areas), Boulder, Deadhorse, Upper Main, and Van Buren has greater than 40% of the subwatershed in a low risk rating for trapping vulnerability. Main Canyon has greater than 30% of the subwatershed in a low risk rating, and Little Slate, Little Van Buren, and North Fork have less than 30% of the subwatershed as low risk. Lower Canyon is not considered habitat. If open roads (identified as allowing motorized travel during the trapping season) were not buffered by 1/ 2 mile, the percentage of a subwatershed that has a low risk rating to trapping would increase. It is assumed that both Little Van Buren and Little Slate would still have less than 30% of the subwatershed in a low risk rating.

In summary, Deadhorse and Van Buren subwatersheds provide the greatest amount of security within the Slate Creek watershed. Little Slate basically has no security for wildlife species. Access on roads and trail in the watershed should be reviewed and access prescription on roads and trails need to be in conjunction with each other.

5.3 Human Uses and Values

5.3.1 Recent Trends in Land Use and Social Values

Population density, economic resiliency, and lifestyle diversity appear to vary directly with each other (Quigley et al. 1996). The north Idaho region has grown at a slower rate than the state as a whole, but unincorporated areas of Idaho County have grown faster than Riggins, Whitebird, or Grangeville from 1970 to 1994 (Clearwate Economic Development Association 1996). Many of the people relocating to rural areas are self-employed or retirees on fixed incomes. Former ranchlands in the vicinity of Slate Creek watershed are being subdivided into smaller parcels, increasing the local human density, with subsequent demands for forest uses including recreation opportunities expected to increase.

Little local information is available on trends in demands for uses of National Forest Lands. For the Central Idaho Mountains, Quigley et al. (1996) estimated that, of the value provided society by Forest Service lands, the existence of unroaded areas is ranked currently the highest (47 percent) and that value will decline only slightly over the next 50 years. Recreation has the next highest value (41 percent), and that value will increase over the next 50 years. Timber provides 11 percent and 5 in the future; and range provides less than 1 percent at both times.

Net economic values of recreational activities (willingness to pay) are highest for fishing, hunting, and day use recreation across the Interior Columbia Basin. Interest expressed at local meetings suggests that recreational use is increasing in the Slate Creek area, and demands for off-highway vehicle use, snowmobile use, motor viewing and viewing wildlife are all increasing.

5.3.2 Nez Perce Tribe

Native American ties to the Slate Creek watershed date to prehistoric times, with ancient lowland and upland campsites present on the main stem of Slate Creek.

The Nez Perce Tribe has long-term ties to the Slate Creek watershed as traditional fishing and hunting grounds, as well as ties to specific features in the watershed that are important to traditional tribal spiritual values. Tribal treaty rights endow certain land uses of the Slate Creek watershed to the Nez Perce Tribe in perpetuity. Extended camping at traditional sites by Nez Perce

family groups, and subsistence hunting and gathering in Slate Creek by members of the Nez Perce Tribe continues today, and tribal ties to Patrol Point and other prominent natural features in the watershed are still maintained..

5.3.3 Heritage Resources

Historic

Prehistorically, the Slate Creek drainage has been used by Native American Indian groups (mostly ancestral Nez Perce) for perhaps the past 10,000 years. Evidence of Native American use dates to at least 7,000 years ago along Slate Creek. The other tributaries were also utilized during their seasonal movements. Seasonal camps for hunting, fishing, and other food or resource gathering were located within the Slate Creek watershed. The first trails were created by these groups who traveled along the many streams and mountain slopes in this area, to hunting and gathering zones in upland settings or to other locations adjacent to the Slate Creek drainage.

The first Euroamericans to establish a presence in the region were fur trappers in the 1830s. Later, in the 1860s when gold was discovered in the Florence area, thousands of miners flocked to the area in hopes of striking it rich. These miners concentrated their efforts on placer gravels which they worked by hand until profits became too small. At that time, Chinese miners came in and reworked the supposedly "played out" gravels and recovered additional quantities of gold. Later, near the end of the of the 19th Century, a second wave of mineral exploration came to this region. New techniques of underground mining (shafts and tunnels) were being used to extract gold formerly not reachable in the placer deposits. With this influx of people, some of the old prehistoric trails were improved and new roads and trails were constructed to access the gold fields. Several small towns were established, and later, fell into disrepair as the miners left for other strikes.

When the gold fever subsided, farmers, ranchers, and other homesteaders came to the region. These people constructed various buildings and other improvements to the land which they occupied on a year-round basis. In some cases, this evidence can still be seen on the ground today.

The Forest Service made its presence known nearly 100 years ago. The construction of ranger stations, forest fire lookouts, and other administrative facilities (including roads, trails, telephone lines, etc.) further modified the landscape to accomplish that agency's mission.

After World War II, the logging industry and associated activities were established in this region. Various areas within the Slate Creek watershed have witnessed varying degrees of logging practices from clearcuts to thinning. This logging activity has continued up until recent times.

Current

Within the boundaries of the Slate Creek watershed, both prehistoric and historic sites are present. These sites (many of which are eligible for inclusion in the National Register of Historic Places, [NRHP]), represent all the activities people have undertaken over the past 7,000-10,000 years they have occupied the Slate Creek drainage. The site types represented include Native American camping, religious, and other resource gathering areas, trails, roads, mining cabins, a Forest Service ranger station, and other administrative facilities.

There have been numerous archaeological surveys performed within the analysis area over the past 20 years. All of the subsequent compliance reports have been submitted to the Idaho State Historic Preservation Officer (SHPO) for their review, comments, and concurrence. Many of the above mentioned sites were first located and documented during one of these surveys. These surveys have been conducted for timber sales, minerals operations, prescribed fires, special use permits, road obliteration, and range improvement projects. The surveys were conducted in areas which may be considered both higher and lower probability areas where cultural sites are likely to be encountered.

The desired future condition regarding the cultural/ heritage resource sites within the analysis area is that they all could be preserved and protected for future study. Very little subsurface excavation of sites has been performed and as such, there remains an unknown amount of information that these sites contain. This as yet untapped wealth of data could contain significant information relating to soil, landform, and geologic processes, plant and animal populations and distributions, fire histories, etc. could be revealed by performing additional fieldwork in this drainage. Additional archaeological surveys and excavations need to be conducted in order to fully understand and document the past use of this area by its prehistoric and historic occupants and how they interacted with the resources within the Slate Creek Watershed. These surveys would also address how any proposed activity would impact the known cultural resource properties. Recommendations would also be provided on how best to preserve and protect those sites from being disturbed or destroyed.

There are many opportunities to interpret the past of the Slate Creek Analysis Area for the public. This education effort would help insure that the past is not forgotten and that much can be learned from studying the events which took place in this unique environmental setting within the Nez Perce National Forest.

5.3.4 Transportation Management

Introduction

The existing transportation system is comprised of both a trail network and a road network. Each of these networks have been developed, or in some cases, redeveloped through time. Consequently, the current systems have areas of overlap and interaction. The existing road system is shown in Map 70..

Development History

The first road construction into the Slate creek watershed occurred in the 1860's to gain access to the mineralized zone associated with Florence Basin for mining purposes. This access came from the northfrom Grangeville and was known as the Milner Trail, a toll road. Additional local access to individual mining claims as well as access to the Salmon river to the south was constructed subsequent to this period. Access was developed up Slate creek (road 354) and over Nut Basin (road 441) in the 1930's. The Nut Basin road was originally constructed by the Civilian Conservtion Corps. Road construction associated with timber harvest began in the northern portions of the watershed in the 1960's (road 398) and proceeded southerly with local subsystems in the 1970's and 1980's. Much of this system developed for timber sales occurs in the Little Slate subwatershed and overlays portions of the previously developed mineral access routes. The Grangeville Salmon Road (Road 221) developed as a main forest arterial during this period. It currently provides connection from the city of Grangeville in the north to the Salmon river and the city of Riggins in the south. Road development for timber harvest continued into the early 1990s with the construction of portions of the No Business system (road 2038) in the Main Canyon subwatershed below Slate Point.

Road System Characterization

There are approximately 280 miles of existing road within the Slate Creek watershed resulting in an overall density of about 2.2 miles per square mile (Infrastructure database, 1999). Of this figure approximately 260 miles are on the National Forest and administered by the Forest Service. The remaining miles are located primarily in the lower canyon subwatershed and are under the jurisdiction of Idaho County, The Bureau of Land Management, or private individuals.

To gain an understanding of the relative status for the Forest Service portion of the system, assigned road maintenance levels are useful.

As can be seen in table 5.44 approximately 30 percent (79.7 miles) of the road miles in the Slate Creek watershed receive maintenance level I, basic custodial care. At this maintenance level (corresponding to a closed travel managemnet prescription)

efforts are made to inspect drainage structures and to keep surface drainage functional. Efforts are not expended to brush roads or to keep the roads passable to hghway vehicles, consequently many of these roads are grown in with vegetation to varying degrees. Many of the roads in this category are terminal local facilities. Preliminary transportation planning indicates a portion of these roads may be excess to the transportation system.

Table 5.44 - Road Maintenance Levels and Miles

Maintenance Level	Miles	Description
0- Maintenance not applicable	4.2	Obliterated/ Decommissio ned roads
1- Basic custodial Care	79.7	Closed Yearlong/ many of these roads are grown in by brush.
2- High Clearance Vehicles	114.1	Open to highway vehicles seasonally or generally requiring a high clearance vehicle to negotiate.
3- Suitable for passenger vehicles	54.0	Usually gravel surface, single lane.
5- High degree of user comfort	8.3	Portions of road 221. Asphalt surface.

Source: Infrastructure database)

Another 21 percent (54 miles) are maintained at level 3, suitable for passenger vehicles. These miles comprise much of the core of the transportation system in the Slate Creek Watershed (see Map 57). The Gospel road (#444) is maintained at level 3 in accord with the Gospel Hump management plan. Additional important routes include the Grangeville Salmon road (221), Slate Creek road (354), and Nut Basin Road (441).

Fourty-four percent (114.1 miles) is maintained at level 2. Some of these miles are roads that are seasonally restricted to highway vehicles and were typically constructed for timber access. Examples include the Little Boulder system (road 9315) and the Huckelberry system (road 9321). Another set of these roads consist of dirt surface roads originally constructed for mineral access, particularly in the southern portions of the Little Slate subwatershed.

Potential Road System Effects

Roads are an element in the landscape that pose unique complexities. The effects of roads can be linked to a great many resource areas. The extent and intensity of these effects vary with site specific factors and with scale of evaluation. The watershed scale is useful in providing rationale for managing specific road segments.

Road densities have been used as effects indices in order to evaluate the effects of roads and as proxies to evaluate the effects not directly attributed to the roads themselves. The pathways of these effects vary by resource area and in many resource areas, levels of effect are estimated by broad correlations.

Roads have both negative ecological effects and effects that are beneficial, providing access for a variety of uses including recreation, vegetation management, fire suppression and commerce. Road system management must reflect an interdisciplinary analysis of resource benefits and consequences. Road management objectives are used to define objectives for a given road, its uses, maintenance schedule, and operating life. A summary of the potential effect of roads on several key resources is highlighted below.

Effects upon Aquatic Resources - Effects of roads on aquatic resources can occur through on-site sedimentation delivered to streams, movement or migration blockages at stream crossings, floodplain and riparian alteration from streamside roads, and slope hydrology effects through subsurface flow interception. The degree to which these impacts occur depends greatly upon site specific factors such as proximity to streams, soils factors, road uses, and road grades. Proper and timely road maintenance is very important in preserving drainage function and minimizing sedimentation and road failure risks.

Effects upon Terrestrial Resources - Effects of roads on terrestrial resources

can take many forms. Roads allow for increased human activity and therefore can affect disturbance-sensitive species. Roads act as a conduit for noxious weed spread. Roads form barriers to migration and propagation of some plants and animals as well as causing direct soil compaction and soil disturbance of the roadway itself.

Effects upon Social Resources - Roads can facilitate certain types of wildland and developed recreation, provide access for vegetation management and the administration of the land, and provide access to mineral claims, grazing allotments, and private ownerships. Roads can also induce adverse effects upon such things as scenic resources and unroaded recreation opportunities. Roads also increase the potential for vandalism and poaching.

The above effects summaries suggest how roads are linked to a great many resource areas and effects pathways. Recommendations from the ICRB Science Assessment (Quigley et.al, 1996) suggest reducing the adverse effects of roads. Throughout the watershed this is an overarching objective that cannot be overemphasized. The means to achieve reductions in adverse road effects lie in road management that evaluates effects within their ecological context, and prescribes management and treatments to address those effects.

Road System Distribution

Roads in the Slate Creek watershed are not uniformly distributed. Map 16 displays areas of low road development in the watershed.

Travel Management Overview

Travel on the Forest Service portions of the road system is heavily restricted. These restrictions are in response to both resource concerns and to address potential use conflicts between seasonal uses (i.e. to protect groomed snow trail system). There are no area restrictions in effect, all restrictions are placed upon the designated routes.

Table 5.45 - Travel Summary (Source Infrastructure database)

Travel Classification	Miles	Description
Impassable	35.2	Obliterated or brush is severe.
Seasonal Restriction	125.1	Motor vehicle use(s) are restricted at times of the year.
Yearlong Restriction	49.3	Motor vehicle use(s) restrictions are in place throughout the year.
Open	44.3	Open.

Travel management decisions have often been made as development occurred through time and usually associated with an individual project development that was limited in areal extent. Consequently there are areas where travel management could be adjusted to improve consistency in travel prescriptions, particularly the interface between road and motorized trail systems. Some of the specific areas include the 9315 road system and the 9307 road system.

The groomed snowmobile routes map (see Map 69) highlights groomed winter routes (usually roads) that are in use. These routes are cooperatively managed by the Forest Service, Sno-Drifters snowmachine club and Idaho Department of Parks and Recreation. These routes in the Slate Creek watershed show portions of the snowtrail system whose trailheads are at Fish Creek Meadows near Grangeville and in Allison Creek, upstream from Riggins along the Salmon River.

The requested motorized trails map (see Map 67) highlights routes that have been requested to be maintained for motorized trail vehicles by members of the High Mountain Trail Machines Club. This display is considered to be a reference point in developing and managing motorized trail systems in the Slate Creek drainage rather than a recommendation by the assessment team. Routes and management of these routes need to be integrated with aquatic resource needs and concerns, especially

sediment, as well as big game habitat security.

5.3.5 Land Uses from the Mining Era to the Present

Mining

The Upper Little Slate area has had an active mining history which continues to the present day. Gold was first discovered in the Florence area in September 1861. By the summer of 1862, the population of Florence had grown to an estimated 8,000 people. While much of the area intensively mined in the 1860's and 1890's is now stabilized and revegetated, the effects of historic mining are still evident as remaining exposed surfaces continue to erode, altered or relocated stream channels continue to headcut, and former meadows and channels still display unvegetated cobble and altered water tables. Map 14 shows where historic mining activity significant enough to alter stream channel and valley attributes has occurred.

Watersheds in Little Slate Creek affected by mining include Miller, Rubie, Little French, and Gold Lake Creeks, and Baboon Gulch. These drainages contain extensive mining-caused modifications to terrain, soil, and streams covering approximately 6,400 acres.

Management Situation - Current mining activity in the Florence area is limited primarily to small scale mining activities. Most mining activity occurs within the primary mineralized zone on sites that were previously disturbed. There are approximately 100 active gold placer and lode claims in the Slate Creek watershed and prospecting, small-scale sampling and panning occurs annually. Mining claim access needs over the existing mining road network is expected to remain consistent with the number of active mining claims. Probability of large-scale mining development is low, but there is some potential for long-term small-scale development and operation. The level of activity fluctuates with gold values, but is expected to remain somewhat active at a small scale into the near future.

There are about 20 limestone mine claims in the watershed, and their application for patent has been withdrawn recently. These are in the lower canyon on both sides of Slate Creek. See Map 3 that shows areas underlain by limestone.

Mining Claim Roads - A network of user-constructed roads was developed to access the primary mineral activity areas making up the Florence and Bungalow Mining Districts in the Upper Little Slate subwatershed. The mining-access road network includes former public routes which predate the Forest Service by as much as 30 years. A number of mining routes qualify for consideration under Revised Statute 2477. Most of the mining access roads were primitive routes following gentle ridges and meadow edges. Due to age and minimum construction, the average mining route has a very low erodable cross-section of exposed soil surface, with well-established surface vegetation due to low usage, and are often impassable unless cleared of downfall.

The system of old routes in the Florence Mining District is adequate to access most current and anticipated claim activities without construction of new roads. Current management emphasizes use and improvement of existing routes rather than new construction, since the use and upgrading of the old route is usually less impactive to surface resources than the disturbance of new construction.. The pattern of repeated entry and activity on the same former claims effectively perpetuates the need for many old routes. Because of the separate access authorities provided under the 1872 Act, road decommissioning actions on some mining roads may be nullified by future claim access needs and actions.

Current trends on the old road system indicate less use by larger 4WD vehicles, since most mining activity has adopted the use of ATV's. A number of old roads formerly passlable to highway vehicles have not received enough use from highway vehicles to maintain compaction or width-clearing, and are becoming impassable to

highway vehicles. The use of ATV's has downscaled the size of surface impacts and mudholing. The old claim access road network, however, is popular with ATV recreationists who use them to tour and view the historic mining district and its old structures and equipment.

Mining Activity Management - Mining activities on the National Forest are regulated by separate law that normally functions independently of many Forest authorities. Mining activities occur and proceed independently of Forest projects and may act individually or cumulatively to constrain other planned activities in the same watershed.

Current emphasis is to design both mining operations and subsequent reclamation actions to limit site impacts as well as to restore site conditions, using offsite mitigations if necessary. Reclamation after current mining operations may also include reclamation of other existing untreated impacts. Over the past two years five small mining projects have been conducted, and the sites reclaimed after mining. In the past two years, erosion control and drainage was installed on a half-mile of mining access road in the watershed, and a mining-related channel obstruction was removed.

Livestock Grazing

Historical Conditions: Historically, grazing varied with wild animal populations and forage levels that changed with plant communities, climate, and predator populations. Presettlement grazing could be locally high, but seldom of long duration. In contrast, season-long early twentieth century grazing by large numbers of domestic livestock ocurred across extensive areas of grasslands and transitory range. As a result of livestock grazing, changes to plant community composition have occurred on streamside meadows and bunchgrass habitats.

Livestock grazing in the Slate Creek area probably began with Nez Perce Tribal horse herds as early as the 17th century. With the discovery of gold in 1860 in the Florence area, grazing of pack stock and domestic livestock began. The population of the Florence area peaked in 1862 at approximately 9,000 people. Slate Creek was one of the main transportation routes to the Florence area. A large number of pack animals were used to service the mining camps, other businesses in the basin and residents. These animals, no doubt, grazed and travelled across the meadows and open areas of the basin. It is likely that livestock such as dairy cows, sheep and hogs were also summered in the area to supply the growing population.

Resident livestock ranches began to develop near the mouth of Slate Creek in the 1860's. More livestock operations were begun following the Nez Perce Indian War of 1877. Much of the spring and summer feed required by these ranching operations was supplied from the open buchgrass slopes, timbered range, and meadows of the Slate Creek basin and adjacent drainages. Livestock grazing remained unregulated until 1908. With the establishment of the Nez Perce National Forest in 1908, the grazing use was placed under permit. Cattle and sheep grazing within the Slate Creek drainage peaked in the late 1920's. Sheep were brought in to utilize the early seral vegetation as result of forest fires at the turn of the century. By the late 1920's approximately 4,500 sheep (11,500 head months) and 550 cattle (3,000 head months) were grazing within the basin. Generally, the sheep were permitted on the higher elevation slopes and ridge tops, while cattle grazed the meadows and the drier ponderosa pine/ bunchgrass slopes.

In the mid-1940's, much of the sheep range was converted to cattle. Approximately 900 cattle (3800 head months) were permitted in the basin in 1946. There has been a steady reduction in the number of livestock and head months permitted, since the peak of the 1920's. By the 1960's, permitted livestock numbers had dropped to 660 cattle. Currently, 244 cattle (774 head months) are permitted to graze portions of the Slate Creek drainage. The number of permittees and active allotments has followed a similiar decline. In the 1930's, seventeen ranchers were permitted to graze across seven active allotments. Today, there are two permittees

and two active allotments within the Slate Creek drainage. Even though exact numbers are not available prior to the creation of the Nez Perce National Forest, it is likely that the current livestock numbers are the lowest since before the turn of the century.

The reasons for this change in general stocking levels are varied. There has been change in vegetation structure and condition. Understory grasses and shrubs from ponderosa pine/ Douglas fir/ grand fir habitat types furnished approximately three-fourths of the summer forage supply for livestock. As a result of reduced fire frequencies, both early seral vegetation and understory forage have declined in the basin. Over the past 50 years, increased tree densities on forested ranges have substantially reduced understory forage formerly available for livestock use. This decline in livestock forage was temporarily offset by new transitory forage supplies created by timber harvest. However, transitory forage has also decreased as forest regeneration occurs on harvested areas.

In addition to the changes in the forage base, operational expenses have increased as the cost of public land grazing increased. With rising land values and decreasing beef prices many of the historic grazing areas became uneconomical. Other reasons for decreasing stocking include tighter grazing management requirements, and increasing sensitivity and concerns for the effects of livestock grazing on other resources.

Existing Conditions: Grazing Capability Capable grazing lands are areas within the Slate Creek drainage with physical and biological characteristics conducive to livestock grazing. Capability is related to the potential of an area to produce adequate forage and exhibits physical features that will allow livestock grazing. Examples of areas which are not capable include excessively steep slopes, rock outcrops, habitats with inherently low potential for forage production, and fragile, highly erodible soils.

For the Slate Creek landscape analysis, potential forage production by habitat type groups, slope classes, canopy cover and landtype associations were used to delineate areas that have the potential to produce forage and are accessible to livestock. Forest lands that currently produce more than 200 lbs of useable forage as a result of timber harvest or fire were considered capable. These areas are considered transitory range. Forage would be only transitory until canopy closure was reestablished, about 20 to 40 years after disturbance. The same habitat with an intact tree canopy may produce less than 200 lbs of useable forage and would therefore, be classified as uncapable. The following characteristics were used to identify general areas that are non-capable grazing lands:

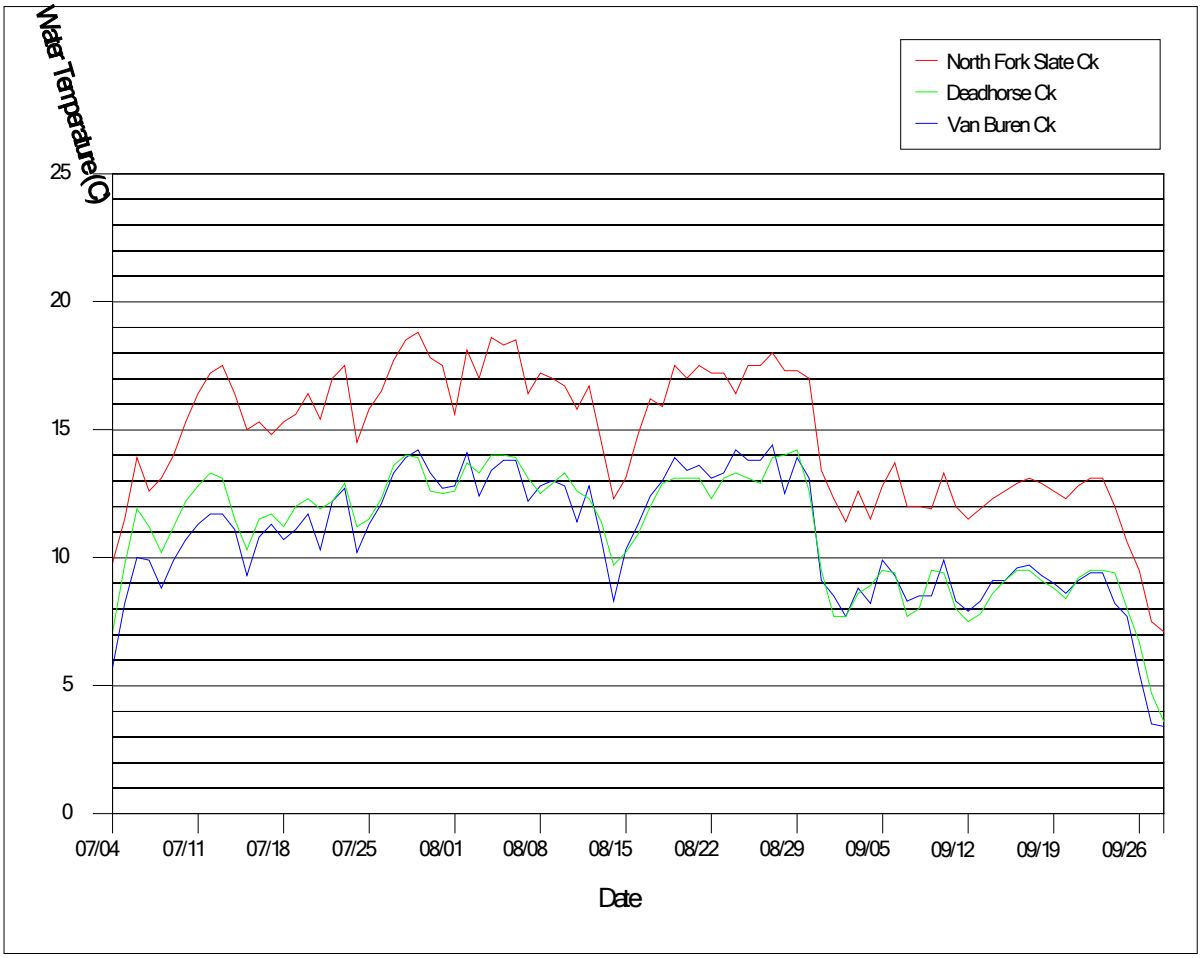
- Slopes greater than 60%
- Habitat Type Groups (HTG) with the inherent potential to produce less than 200 lbs of usable forage per acre.
- Forest stands within HTG 3, 4, 7, 8, and 9 with canopy cover greater than 40%.
- High elevation/ fragile soils.

Table 5.46 below displays the estimated forage production potential by habitat type group (see Appendix G) used to determine capable grazing lands within the Slate Creek Watershed. This assumes forest canopy is removed.

Existing Conditions: Grazing Suitability - Suitability suggests that forage is not only available and accessible, but that grazing is compatible with other resource values including maintenance of native plant and animal communities, native plant diversity and stability, soil and water resource protection, recovery of aquatic habitats, and recreational or other human uses. Grazing suitability varies between management alternative and changes as a result of emphasis and direction. Since this assessment does not develop a set of management alternatives, suitable areas for livestock grazing were calculated from capable and available lands where grazing was determined to be consistent with resource conditions, habitat sensitivity, and

subwatershed themes and priorities. The suitable acres within the Slate Creek Watershed reflects the general extent of lands that could be grazed without serious conflict with management emphasis and resource sensitivity.

Figure 5.21 - Slate Creek Grazing History



1930

1938

1946

1954

1964

1974

1984

1994

Year

0

3000

6000

9000

12000

15000

Slate Creek Watershed

Grazing History

Numbers

Head Months

AUMs

The amount of suitable grazing lands may vary with future assessments, the scale of future analysis or the development of management alternatives.

Table 5.46 - Potential Forage Production by Habitat Type Group

Habitat Type Group (HTG)	Forage Production lbs/Ac
1	600
2	400
3	300
4	300
7	200
8	200
9	300
10	200
11	200
15	700
30	400
60	1000

The assessment used habitat type group, existing vegetation, slope, wetlands map, and landtype maps to identify areas of grazing suitability. Suitability issues are identified in Table 5.47 below.

Table 5.47 - Grazing Suitability Issue Identifiers

Suitability Issue	Identifier
Degraded grasslands	Annual Grasslands with slopes >45%
Rare plant communities vulnerable to trampling	Veg type 3102 (mtn. meadows)
High elevation parklands with sensitive soils	HTG 7,9 > 45% slope above 6,000 ft.
Sensitive riparian areas and wetlands with a restoration emphasis	Wetland inventory & subwatersheds

The following is a summary of the Grazing Capability-Suitability analysis for the 83,034 acre Slate Creek Watershed:

Noncapable: 56,940
Capable: 26,094
Unsuitable: 8,102
Private/ BLM: 5,834

There is a total of 12,158 acres of capable and suitable lands for livestock grazing in the Slate Creek watershed.

Timber Harvest

Timber harvest has occurred on all of the 20 prescription watersheds in Slate Creek. Harvest has occurred since the 1860s, but has been well documented only since about 1950 on National Forest lands. Of the 76,815 acres of potentially forested National Forest lands in the Slate Creek drainage, timber harvest activities has occurred on approximately 8,204 acres (11 percent) from 1955 through 1999. Map 52 shows timber harvest for this period. Harvest activity peaked in 1979 when 1,878 acres were harvested in Main Slate Canyon, Upper Main Slate, Boulder Creek and Little Slate Creek.

The percent of National Forest lands in the watershed affected by harvest per decade has varied from less than one to 3 percent. This is equivalent to a 330 to 1,000 year rotation for the watershed, which is much longer than the natural fire return interval in which 16 percent of acres burned per decade.

The pattern of timber harvest compared to presettlement, natural fire patterns has been more uniformly distributed across the landscape, in small patches (compare Maps 33 and 52, and see Photos 19 and 20 in Appendix N).

Roads

There are currently about 260 miles of roads in the Slate Creek drainage, for a road density of 2.0 miles per square mile. See Map 56 and Table 5.49. This density is regarded as high (Quigley et al. 1996).

Of this total, approximately 234 miles are National Forest roads and 27 miles are non-National Forest roads. This represents about 1.9 miles per square mile on National Forest lands (includes roads on private lands within National Forest boundary) and 2.9 miles per square mile on non-National Forest lands. National Forest roads include roads used for administrative purposes (those needed for implementation of the Forest Plan,) and others (approximately 54 miles) which preliminary planning indicate may not be necessary for administrative purposes (see Maps 58-66). These other National Forest roads are either not traversable by other than off-highway vehicles, not traversable due to brush, or have been obliterated but are still carried on the inventory. Non-National Forest roads are those owned, managed, and/ or maintained by other individuals and/ or county, state, and federal agencies.

Forest Road 354 runs next to Slate Creek from near the mouth of the stream to the confluence of Main Slate and Little Slate Creeks. It is a single lane road with limited turnouts, and is a primary recreation/ administration route. It is not a timber haul route.

Table 5.48 - Existing Road Density by Subwatershed

Watershed	Total Road Density (Mi/Mi2)	Open Yearlong	Seasonally Open to a Motorized Vehicle
Upper Little Slate	3.41	1.88	2.92
Turnbull	3.88	1.00	1.30
Rubie	3.23	1.56	2.65
North Fork Slate	2.26	.38	1.40
Van Buren	1.13	.40	.61
Main Slate	1.54	.86	1.18
Little Boulder	1.39	.50	1.09
Waterspout	.56	.00	.45
Lower Little Slate	3.49	1.34	2.52
Mid Little Slate	2.56	.65	1.53
Deadhorse	.97	.00	.46
Little Van Buren	2.46	.66	2.03

Bear Gulch	7.40	.41	2.13
No Business	.30	.05	.30
Willow	2.49	.12	.60
Trough	1.87	.13	1.88
Hurley	1.89	.11	.11
Slide	.12	.04	.04
Lower Main Slate	1.57	1.56	2.65
Total	2.16	.83	1.50

5.3.6 Recreation and Trails

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) describes recreation settings and opportunities, and is used to evaluate an areas recreation potential. The Nez Perce National Forest ROS inventory is described in the Forest Plan EIS (see Chapter III, pp. 8-9). The Slate Creek watershed has been inventoried and divided into four classes: Primitive, Semiprimitive Nonmotorized, Semiprimitive Motorized and Roaded Natural.

Primitive areas are greater than 5,000 acres and greater than 3 miles from roads and trails with motorized use. The location of areas classified as "Primitive" lie within or adjacent to the Gospel-Hump Wilderness in Upper Main Slate and Boulder Creek subwatersheds.

Semiprimitive non-motorizd and semiprimative motorized areas are greater than 2,500 acres and greater than 1/ 2 mile from all roads and trails with motorized use. "Semiprimative Non-motorized" classified lands lie within the Gospel-Hump Wilderness in Upper Main Slate Creek subwatershed. Areas classified as "Semiprimative Motorized" are found in Main Canyon, North Fork, Deadhorse, VanBuren, and a small portion of Little Slate subwatersheds.

Roaded Natural are any areas within 1/ 2 mile of a road. They are natural appearing settings that may have modifications that range from being easily noticed to strongly dominant to the observers within the area (however, from sensitivity level 1 and 2 travel routes, these alterations would remain unnoticed or visually subordinate). Designed roads or highways may be common. People are frequent.

Recreational use within the Slate Creek watershed is heavily influenced by the presence of the existing transportation system (roads and trails) and long history of resource management. Both roads and an extensive system of motorized trails dominate the watershed. Ninty percent of the area is classified as either "Roaded Natural " and "Semiprimitive Motorized". Table 5.50 provides a listing of ROS classes by subwatersheds and Map 54 presents a spatial representation of the data within the table. The ROS assignments are from the Forest Plan and will require refinement at project level analysis.

Visual Resources

Visual Quality Objectives (VQOs) define a desired level of scenic quality and diversity of natural features. Interim VQO's for the Slate Creek watershed were inventoried and mapped as part of the Forest planning process. VQO's for extremely sensitive areas were adopted with the Forest Plan, and interim VQOs were established for specific management areas (MA) in combination with other resource objectives. Decisions on adopted VQO's were deferred until Forest Plan implementation. Then, adopted VQO'swill become Forest Plan standards (Forest Plan, page II-16, as amended by Forest Plan Amendment #4).

Table 5.49 - Recreation Opportunity Spectrum (ROS) by Subwatershed

Subwatershed	ROS Classification	Acreage
Lower Slate Canyon	Semiprimitive Motorized	91
	Roaded Natural	12
Main Slate Canyon	Semiprimitive Motorized	5,669
	Roaded Natural	12,089
Little VanBuren Ck	Roaded Natural	3,610
Deadhorse Ck	Semiprimitive Motorized	3,155
	Roaded Natural	614
North Fk Slate Ck	Semiprimitive Motorized	2,910

	Roaded Natural	5,515
Upper Main Slate	Primitive	1,873
	Semiprimitive Non-motorized	2,601
	Semiprimitive Motorized	1,520
	Roaded Natural	4,634
Boulder	Primative	3,827
	Semiprimative Motorized	86
	Roaded Natural	4,988
Little Slate	Semiprimative Motorized	2,556
	Roaded Natural	17,624
VanBuren	Semiprimative Motorized	4,049
	Roaded Natural	1,230

The interim VQOs for the Slate Creek watershed range from Preservation to Maximum Modification. The interim VQOs by subwatershed are listed in Table 5.50 and spatially represented on Map 55. A Preservation VQO applies to wilderness trails within the Gospel-Hump Wilderness. A VQO of Retention applies to the upper portions of the Boulder Creek subwatershed adjacent to the Wilderness, along Trails 310 and 332. Partial Rention areas are located primarily in the Boulder Creek subwatershed, along ridges, slopes and drainages, as viewed from Trails 310 and 332 and Road 221. Additional locations of Partial Retention VQO include the area surrounding the developed sites at Nork Fork and Rocky Bluff Campgrounds. The balance of the watershed is a mosaic of Modification and Maximum Modification VQOs.

Wild and Scenic Rivers

Background - In 1987 nineteen miles of Slate Creek were determined to eligible for designation under the Wild and Scenic Rivers Act by the Nez Perce Forest Plan. The segment of Slate Creek from the headwater at Slate Lakes to the wilderness boundary (upper 5 miles) was defined as eligible for Wild classifcation and the segment from the wilderness boundary to the confluence with the Salmon River (lower 14 miles) was identified for Recreational classification. The Wild & Scenic River Act(Section 2(b) specifies three classification categories: Wild ,Scenic, and Recreational. The potential classification of an eligible river is based on the condition of the river and the adjacent lands as they exist at the time of assessment determination (Forest Plan in this case). The following table defines classification criteria for Wild and Recreational Rivers (Scenic criterea are not included as none of Slate Creek was defined as Scenic).

Table 5.50 Interim Visual Quality Objectives (VQO) (acres by classification by subwatershed)

Subwatershed	Maximum Modification	Modification	Partial Retention	Retention	Preservation
Lower Slate Canyon	0	29	0	0	0
Main Slate Canyon	4,830	12,375	300	0	0
Little Van Buren Ck	2,573	1,038	0	0	0
Deadhorse Ck	4	3,765	0	0	0
North Fk Slate Ck	1,488	6,895	42	0	0
Upper Main Slate Ck	912	3,199	122	1921	4473
Boulder Ck	131	3,092	3,771	1,315	592
Little Slate Ck	5,075	15,105	0	0	0
Van Buren Ck	1,012	4,219	47	0	0

Table 5.51 - Attributes of Recreational and Wild Rivers

ATTRIBUTE	WILD	RECREATIONAL
Water Resource Development	Free of Impoundment	Some existing impoundment or diversion
Shoreline Development	The presence of a few inconspicuous sturctures, particularly those of historic or cultural value. A limited amount of domestic grazing or hay production. Little or no evidence of past timber harvest. No ongoing timber harvest.	Some development. Substantial evidence of human activity. The presence of residential development. Lands may have been developed for the full range of agricultural uses. May show evidence of past and ongoing harvest.
Accessibility	Generally inaccessible except by trail. No roads within the river corridor. A few existing roads leading to the boundary of river.	Readily accessible by road. The existence of parallel roads on one or both banks as well as bridge crossings and other river access points.
Water Quality	Meets or exceeds Federal criteria or state standards for aesthetics, for propagation of fish and wildlife, and for recreation(swimming) except where exceeded by natural conditions.	No criteria prescribed by the W&S Rivers Act. Rivers will not be precluded from classification because of water quality provided a water quality improvement plan exists which is in compliance with applicable Federal and State laws.

An eligible river is defined as "free flowing and possess natural and/ or cultural features which are judged to be Outstanding Remarkable Values. Outstanding Resource Values must be unique, rare, or exlemplary features that are significant at a comparative regional or national scale. The Outstanding Resource Values considered should;

a) be located in the river or on its immediate shorelands (within 1/ 4 mile on either side of the river

b) contribute substantially to the functioning of the river ecosytem or;

c) owe their location or existence to the presence of the river.

The primary Outstanding Resource Values that are examined when evaluating rivers for Wild and Scenic designation include (but are not limited to): scenic, recreational, geological, fisheries, wildlife, pre-historic and, historic resources, and T&E species and habitat.

Outstanding Resource Values determined to be unique to Slate Creek were scenic, fisheries, geologic, recreation, and cultural.

Commercial Recreation

Commercial recreation services in the Slate Creek watershed are currently limited to outfitting and guiding services for big game hunting with outfitter big game hunting territories located in the lower Slate-main Slate canyon area and in upper main Slate unit.

General increases in most categories of motorized recreational uses in the watershed would indicate that some expansion of commercial recreation services would be needed to serve future recreation demands in all seasonal categories. Some of the commercial recreation services that are expected to be needed include recreation site management and maintenance services, waste management services, commercial tours and guiding, and RV facilities.

Existing Recreation Use, Improvements and Features

Recreational activities within the Slate Creek Watershed include motorized sight-seeing, touring, hiking, horseback riding and packing, camping, mountain biking, photography, berry picking, mushrooming, and State-licensed hunting and fishing activities. Winter snow sports such as cross-country skiing and snowmobiling are

increasing in popularity and occur in headwater areas in the watershed. Groomed snowmobile routes follow some of the major upland road corridors including the Grangeville-Salmon and the Gospel-Hump Corridor Roads. Motorized recreation using motorbikes and off highway vehicles occurs along the ridge routes and primitive roadways in the watershed and along a few streamside trails. Although overall motorized recreation use levels are currently low to moderate, use levels are increasing.

Primary areas of recreation use in the Slate Creek drainage are along Lower Slate Creek and the well-roaded upland Forest portions of the watershed. These areas are accessible to the public on a year-long or seasonal basis. Public access is restricted on private lands in the lower part of the watershed below the National Forest. On the National Forest portions of the watershed, the period of lowest recreational activity is in the spring and early summer. The peak period of recreation use occurs with the fall hunting season, with highest recreational use of dispersed campsites, trails, and roads occurring at this time.

Recreational access to riparian areas along Slate Creek is available from turnouts on the Slate Creek Road #354 and from roadside dispersed campsites at Hurley Creek, Slide Creek, Trough Creek and the confluence of Little Slate and Main Slate Creeks.

Developed Recreation Sites

The North Fork Campground is located at the mouth of North Fork Slate Creek within the Main Canyon subwatershed. The campground is adjacent to Road 354 approximately 10 miles from its junction with Highway 95. North Fork Campground is used from early April through the fall hunting season. The heaviest use is generally in the spring and fall. The site is situated on a flat bench between Road 354 and Slate Creek, within the riparian zone. The facilities include five campsites with parking spurs, picnic tables and firerings. An older, wood frame, vault toilet that serves the campground. In addition, the campground serves as the trailhead for Trails 320, 323, 324, 326 and 349. Management activities for this site are custodial in nature. This facility is included in the Forest Capital Investment Program for 2005. The proposed improvements would enhance the facilities to meet accessibility standards and for user safety. At some sites the parking spurs would be lengthened, widened and hardened. New accessible facilities (tables, firerings, SST toilet) as well as new campground signing (entrance sign, site signs and bulletin board) will be installed. Development of a vegetation management plan is needed to direct long term vegetation needs including hazard tree removal and replacement.

Rocky Bluff Campground is located in Upper Main Slate Creek subwatershed along the Grangeville-Salmon Road (#221). Use at this campground is heaviest during the summer and fall. Because of its higher elevation location, it provides a unique opportunity for the public to escape the heat in the valleys and on the praire. This campground is also located within the riparian zone of Slate Creek which adds to it's allure. The campground includes five campsites and a group firering with benchs. Each campsite has parking, a picnic table and a firering. Management activities for this facility are custodial in nature. A recent improvement (1995) project upgraded an old vault toilet to an SST toilet. This facility is included in the Forest Capital Investment Program for 2004. The proposed improvements would enhance the facilities to meet accessibility standards and for user safety. At some sites the parking spurs would be lengthened, widened and hardened. New accessible facilities (tables, firerings, SST toilet) as well as new campground signing (entrance sign, site signs and bulletin board) will be installed. Development of a vegetation management plan is needed to direct long term vegetation needs including hazard tree removal and replacement.

The Florence Cemetary serves as a popular day use interpretive site. Part of the once thriving mining community, this interpretive site, reveals some of the rich history of the Florence Basin. The facilities at the Florence Cemetary Interpretive Site

include public parking, an information kiosk, picnic tables and an SST toilet. The cemetary is fenced as well. See Ma 68 for locations of developed sites within the watershed.

Windy Camp, an improved dispersed camp, located adjacent to the Gospel Hump Road provides rustic facilities in the high country. The site improvements include an old latrine, hitchrail and information board.

Special Recreation Features

Main Slate Canyon - This area is important for the developed camping at North Fork campground. Slate Creek road 354 was built by the Civilian Conservation Corps, and has been a favorite area for roadside dispersed camping by both tribal and local residents.

North Fork Slate Creek **-** This area contains special interest areas for the Nez Perce Tribe including prehistoric upland village sites and the religious and culturally-significant features of Patrol Point and Dairy Mountain. Trails within the subwatershed are popular motorized routes, maintained annually by local motorcycle club members.

Upper Main Slate and Boulder Creek - Two of the early historic travel routes in Idaho occur in this area on the Milner toll road to Florence (now part of the Idaho Centennial Trail West), and the Hump Wagon Road to Buffalo Hump. Two historic way stations along the Hump Wagon Road and an old cow camp provide additional historic interest. Much of Upper Slate Creek is within the Gospel-Hump Wilderness and retains its primitive character. The Slate Lakes are a popular for fishing and dayhiking. Rocky Bluff Campground is located in the subwatershed.

Little Slate Creek - The historic Florence and Bungalow mining districts are places people associate with this subwatershed. Numerous historic remains and routes still exist. The historic Florence Cemetary is a popular destination. Recreational mining has become a way of revisiting history for many people, and camping and sightseeing brings the colorful history of the area alive for many visitors.

Van Buren Creek - The Nut Basin Lookout site is a popular vista point in this drainage. A historic mining development at Bungalow and two former family cow camps are located near the mouth of Van Buren Creek. Nut Basin Lake is a one of the few cirque basin lakes outside of wilderness on the Nez Perce National Forest.

Dispersed Recreation

Dispersed recreation is defined as recreation use which occurs outside of developed sites in the roaded and unroaded forest environment. This can include camping, fishing, hunting, driving for pleasure and berry picking, to name a few. Dispersed recreation sites are usually situated on flat areas and gentle terrain at trailheads, road closure gate sites, or road ends, adjacent to or accessed by various classes of roads. Sites used for dispersed recreation usually do not have any constructed facilities (picnic tables, firerings, etc.) and generally do not have hardened surfaces. Improvements are often user-made structures, like campfire circles made with rocks. Restroom facilities are lacking and human waste is normally disposed of in the areas adjacent to the dispersed site. With repeated use of sites impact zones develop as a result of soil compaction and vegetation loss.

The majority of use within the Slate Creek Watershed is dispersed recreation. High use areas for dispersed recreation are concentrated along roadways and streams. In the past decade, the use of campers/ trailers/ motorhomes has greatly increased, primarily due to the improved access over Road 221. Use of campers has reduced the consumptive use of poles and fuelwood around dispersed sites, but improved turnouts, access lanes, and site-hardening are needed to provide separation of camping activity from travelways and road traffic.

Within the watershed, dispersed camping sites that receive repeated use can be found along Forest Service Roads #221, #354, #398, #441, #444 and #2002. Additional sites are located at the closure gates located on Roads 9305, 9308, 9310, 9314, 9315, 9318, and 9321

where hunter camps are placed in the fall. These sites need to be evaluated for resource impacts and corrective action implemented. when needed.

Continued growth of dispersed recreation use within and adjacent to the watershed increases the need for the management of human waste, particularly to handle dumping of holding tanks in campers and RV's. Development of additional facilities to handle human waste may be needed along major routes and in the general forest area in the future.

A slightly improved dispersed site is known as Windy Camp and is located along the Gospel-Hump Corridor Road (#444). The site has a primitive toilet and recently installed hitch rail and information board

Trails

Approximately 94 miles of National Forest system trails are located in the Slate Creek watershed (see Map 68). Of these trails, approximately 57 miles (60 percent) serve as the primary transportation systewithin unroaded areas of the watershed. The remainder of the trail system provides access to smaller unroaded areas and interconnects with the road system. Part of the statewide north-south Idaho Centennial Trail (West) motorized trail route crosses the upper parts of the Slate Creek watershed, primarily utilizinging existing historic mining access roads and trail routes.

Approximately 32 percent of the trails in the Slate Creek watershed are classified as mainline and secondary trails. Use levels range from low to moderate (more than 30 users per year). Maintenance is scheduled regularly on these trails to keep them open for use, clear obstacles, maintain erosion control, and repair damage.

Approximately 68 percent of the trails in the Slate Creek watershed are classified as trails with very low levels of use (less than 30 travelers/ yr). These trails provide the only established travel routes for infrequent administrative access to remote or unroaded areas. Low levels of recreational use occur on these trails, especially during the fall hunting season. About one-third of the trail system in Slate Creek receives light levels of motorized use at least once a year and is maintained with motorized equipment. The remainder of the trail system is of a design or condition unsuitable for motorized travel. Low-use trails have a low maintenance requirement and often may be cleared only when needed. A secondary trail (#357) to Slate Lake is a short access trail receiving heavy summertime use (more than 300 travelers/ year). Reconstruction is planned to alleviate and rehabilitate user impacts. Reconstruction is also planned to address resource problems associated with the historic Hump Wagon Road or Ragg Station Trail (#313) located in Upper Main Slate Creek in the Gospel-Hump Wilderness. Reconstruction work on 14.1 miles of the Centennial Trail is expected to be completed during the summer 2000. Reconstruction activities included improved surface drainage and stabilization, particularly where the trail is located within the riparian zone.

Approximately 24 miles of system mainline, secondary, and low use trails are located within 300 feet of streams in the Slate Creek watershed. These trail segments will be highlighted for upgrading or relocation to mitigate any adverse effects.

Presently, deferred maintenance surveys are being conducted by the Nez perce National Forest on trails at a rate of about 20 percent per year. During 1998 and 1999 approximately 53 miles of trail were surveyed within the Slate Creek Watershed for resource problems, maintenance and reconstruction needs. There are 21 miles scheduled for survey during the summer of 2000. Where recommendations from these surveys have been developed they are included in Appendix K.

Groomed Snowmobile Routes

There are approximately 20 miles of groomed snowmobile routes within the watershed. Trails are groomed under a co-operative agreement between the Forest Service, the State of Idaho Department of Parks and Recreaction, and the Snowdrifters Snowmobile Club. The Forest Service provides the location, the State provides the

equipment and funding, and the Club provide the labor to accomplish the grooming. The Slate Creek Watereshed portion is part of a network of groomed routes totaling over 100 miles locally. The groomed routes generally follow the larger system roads and include Roads #221, #243, #394, and # 444. Grooming typically occurs between December and April.