Environmental Assessment

of the Forest Management Plan (FMP)

It shall be the policy of the Nez Perce Tribe to prioritize the holistic stewardship of our natural and cultural resources to sustain and enhance opportunities for traditional cultural practices and the exercise of our Treaty-reserved rights.

Nez Perce Tribal Lands – Lapwai, Idaho
Federal Agency: Bureau of Indian Affairs (BIA)
Preparing Entity: Nez Perce Tribe – PO Box 365, Lapwai, Idaho

Draft – August 2025

This Page Intentionally Left Blank

Table of Contents

1 INTRODUCTION

This Programmatic Environmental Assessment (EA) has been prepared pursuant to the National Environmental Policy Act (NEPA) to assess any potential environmental effects from alternatives developed in the Forest Management Plan (FMP).

The primary purpose of forest management is to maintain the health and productivity of the Tribal Forest resource with a secondary objective of producing revenue necessary to provide essential government services for the Nez Perce people. The Nez Perce forestlands are an important historic, religious, and cultural tie to the forebearers of the present Nez Perce people. Forest management decisions will recognize the intrinsic and less easily measured values of forest resources other than timber. The timber resource is only one component of the forest resource and as such, the health and productivity of the timber resource is ultimately dependent upon maintaining the overall health and productivity of the forest ecosystem.

1.1 PURPOSE AND NEED FOR THE PROPOSAL

1.1.1 Purpose

The purpose of this report is to implement forest management activities in compliance with the requirements of the 1990 National Indian Forest Resources Management Act (NIFRMA), forestry regulations of 25 CFR § 163, Tribal laws and Tribal management goals and objectives for trust forest lands. Further, it is the purpose of this report to ensure that management of Tribal Forest lands promotes conditions that move the forest towards the Tribe's stated vision and desired future conditions (DFCs) of natural resources as described herein and can be found in detail in the 2023 Integrated Resource Management Plan (IRMP).

The purpose of this report is to analyze the environmental consequences of the management alternatives being considered in the Forest Management Plan revision. In July 1993, the Nez Perce Tribal Executive Committee (NPTEC) passed an administrative action requesting the departments/programs of Fisheries, Water Resources, Forest Products Enterprise, Cultural Resources, Forestry, Wildlife, and Land Services to each include professional staff on the Forest Management Planning Interdisciplinary Team. In following Tribal direction and the mandates of the National Environmental Policy Act (NEPA), the process of developing the alternatives has been done with interdisciplinary input.

The general area where the proposed management would occur is depicted in Figure 6-1 (section 6.1). Refer to sections 1.1 (Location & Setting) and 2.1 (Forest Land Base) in the FMP for more information about the affected area.

1.1.2 Need

The characteristics of the forest resource on the Reservation have changed dramatically since the Reservation was established. Land use change, past timber harvesting, fire suppression, and forest protection practices are some of the factors that have influenced the current condition of the forest resource and have compromised ecosystem function and adaptive capacity. Around the turn of the century most of the forest lands within the boundaries of the 1863 Reservation were cleared for dryland agricultural purposes, which is currently the dominant land use. Generally, the most productive soils have been dedicated to agriculture, which often yield a higher economic return than forest management. The extent of the forest resource on the Reservation has diminished accordingly. Compared to historic conditions, approximately 39% of the allotted land area remains in forest cover as compared to 80% of Tribal trust lands being forested.

Since 1986, The Nez Perce Tribe has been purchasing forest lands within and adjacent to the 1863 Treaty Reservation, and a portion of these lands on the Reservation have been brought into trust status. Acquired lands are often in poor condition as previous stewardship objectives often prioritized economic benefits over ecosystem health. Restoration efforts are costly and will take generations to realize a healthy and resilient landscape. Historically, forests on the Reservation are presumed to have been relatively open stands dominated by ponderosa pine (*Pinus ponderosa*) and Douglas-fir (P*seudosuga menziesii*) with western larch (*Larix occidentalis*) and western white pine (*Pinus monticola*) in some areas. Grand fir (*Abies grandis*) cover types were typically confined to northern slopes and cool moist sites indicative of effective soil moisture and decreased air temperatures. Removal of higher value overstory trees and fire suppression were standard forestry practices. As a result of these practices, stands became crowded with younger Douglas-fir and grand fir secondary growth. If forest health concerns are not addressed, the forest will be at greater risk of loss, disease and insect outbreaks, undesired species composition, and impact commercial harvests. The FMP provides implementation guidance to promote a healthy resilient forest ecosystem; provide a fire safe environment; produce forest products, income, employment opportunities; and to provide educational and information services to meet the requirements of the Nez Perce People, Tribe, and other owners of trust allotments within and adjacent to the Nez Perce Reservation.

The previous management techniques and goals have resulted in the development of newfound techniques and alternatives, identified in the FMP that will address the need to:

- restore previously lost or degraded natural resources,
- incorporate newly acquired forest lands into the Forest Management Plan (FMP),
- include trust, fee, and allotments in the FMP,
- create a diversity of fish and wildlife habitats across the landscape,
- enhance the health and vigor of these forested stands,
- manage for a fire safe environment,
- maintain and enhance cultural resource values,
- continue the forest on a trajectory to meet the DFCs and accomplish FMP goals and objectives,
- comply with applicable Tribal, federal, and state laws and regulations, and
- generate revenue from harvest activities to sustain active management and provide revenue to the Nez Perce Tribe.

1.2 PUBLIC SCOPING

The development of this plan involved a public scoping period as per NEPA requirement under statue § 46.235. During this period, a survey went out to Tribal Members. The purpose of this survey was to address any Tribal concerns regarding the resource specific to timber management and land use. This survey also gave insight into who uses Tribal lands and what activities those individuals participate in when on Tribal lands. Information from this survey assisted in the development of alternatives will also serve to guide Forestry and Fire in determining proper management techniques.

The survey was sent out on December 10th, 2019, and was open until January 17th, 2020. Notices were posted at community centers in Lapwai, Orofino, and Kamiah. A press release was printed in the December issue (volume 1, Issue 24) of the Nimiipuu Tribal Tribune newsletter. The survey was open to enrolled Nez Perce Tribal members. Individuals who received the mailing were provided the opportunity to fill out the paper copy and send it back or complete the online survey. A total of 2,837 surveys were mailed out to Tribal Members, 173 of those surveys were returned to sender, 2,664 were successfully delivered, and a total of 261 total responses were received.

Public scoping survey results are on file with the Tribe and are available upon request.

2 ALTERNATIVES

2.1 PREFERRED ACTION ALTERNATIVE

The preferred forest management alternative, Alternative D – Forest Health & Resilience (slow pace – 4.8 MMBF/Year), recommended by the FMP interdisciplinary team (IDT) and adopted by the Nez Perce Tribal Executive Committee (NPTEC) (NPXX-XXX), provides a strategic and transparent pathway towards desired future conditions (DFCs). The implementation strategy identifies forest restoration and maintenance needs as an "acres in need" identification that translates to 4.8million board feet (MMBF) timber volume annually or 69 MMBF in total over the 15-year planning period. Acres-in-need is the total area, at a given point in time, that needs to be treated to achieve desired future conditions. It includes all treatments and forest management strategies that count toward the AAC.

It is important to note that the following alternatives pertain to Trust Lands (Tribal Trust and Allotments) only. Tribal Fee lands will follow the preferred alternative management strategy but will, instead, follow a different harvest schedule identified by the Harvest Schedule report.

2.2 DEFINED

2.2.1 Alternative A

Alternative A is the "no action alternative". The current Forest Management Plan (1999 – present) was adopted by NPTEC Resolution No. 98-339 on July 14, 1998 and approved by the Bureau of Indian Affairs on January 11, 1999. Alternative A (No-Action or Status Quo) is designed for the purposes of:

- Providing a baseline alternative for comparative analysis with other alternative management strategies defined within this assessment.
- Determining if the 'No Action' alternative is the desired management strategy for the next planning period.

Under a status quo alternative, this forest management strategy would not change from the 1999 Forest Management Plan.

2.2.2 Alternatives C, D, E

These management alternatives aim to enhance forest health, resiliency, and sustainability through silvicultural treatments that incrementally return the dry mixed-conifer forested ecosystem to a resilient condition common with historically frequent low-intensity fire disturbances. Forest treatments would assist climate change mitigation and adaptive capacity efforts related to drought, wind damage, and high severity wildfires. This type of management includes a broad spectrum of silvicultural treatments designed to include "ecological fidelity" (structural/compositional replication, functional success, and durability) that induce mutually beneficial human-wildland interactions (Higgs, 1997; Figure 6-3 in section 6.2) across the Nez Perce Tribe's forested landholdings. As determined in the IRMP, this strategy would include both project and landscape level planning and incorporate a mixture of silvicultural treatments (even age and multi-cohort).

Historically, the pre-settlement land management tool, in the northwest, was 'Native American initiated' or 'unmanaged lightning-caused' fires. Fire improved grazing conditions for horses as well as improved land and forest level conditions for growing and gathering first foods. The dry mixed conifer forested area was a mosaic of predominately large sized, fire adapted, shade-intolerant, early seral coniferous species (e.g., ponderosa pine, western white pine, and western larch) that was spatially dynamic (vertically and horizontally). Frequent low intensity fires pruned lower tree branches which reduced down and dead woody debris that limited high severity, stand replacing wildfire. These series of events typically produced a 'park-like' landscape with large, clumped ponderosa pine adjacent to irregular shaped openings (Figure 6-4 in section 6.2).

2.3 Silvicultural Practices

2.3.1 Alternative A

The preferred silvicultural regime in this alternative is a shelterwood system with residuals. Overstory trees are planned to be left in seed tree or shelterwood silvicultural systems into the subsequent rotation rather than being completely removed when the forested stand is regenerated.

2.3.2 Alternatives C, D, E

The preferred silvicultural system for Alternatives C, D, and E is based on a melding of even-aged and multi-aged strategies that sustain an increased level of resistance to high-severity wildfire; insect and pathogen outbreaks; and drought while generating both natural, intrinsic, and monetary values. The initial focus is to restore forests that have uncharacteristic density, species composition, wildfire risk, and wildfire suppression directives. Even-aged plantations established due to wildfire, insect or disease infestation, afforestation objectives, natural or planted trees within a shelterwood/seed tree silvicultural regime; or related to prior land management objectives that were economic centric (e.g., high graded fee lands) would require several silvicultural treatments that migrate the stand from homogenous, even-aged conditions towards a heterogeneous, fire-resistant, and fire-resilient structure. Active management strategies would then focus on multi-aged treatments for long term management and maintenance of forest health typical of low-severity fire disturbance patterns within a dry mixed conifer forest.

2.4 Timber Harvest

In general, management alternatives are differentiated by AAC. To help describe the impact that each alternative would have on forest growth and development, AAC is also reported as a percentage of current forest growth. Current forest growth totals approximately 20 MMBF annually. Refer to the Nez Perce Tribe FMP for more information about forest growth.

- **Alternative A: AAC – 4.8 MMBF/Year; 24% of forest growth.**
- **Alternative C: AAC – 6.7 MMBF/Year; 34% of forest growth.**
- **Alternative D: AAC – 4.8MMBF/Year; 23% of forest growth.**
- **Alternative E: AAC – 8.2 MMBF/Year; 41% of forest growth.**

2.4.1 Alternative A

No action alternative: AAC – 4.8 MMBF/Year; 24% of forest growth

The level of timber harvest, Annual Allowable Cut (AAC), for this planning period would remain at 4.8 MMBF. Rather than increasing harvest levels due to the measured increase in growth rates and an increase in the trust forest land base, harvest levels would not be increased until the next planning review (~2037).

2.4.2 Alternative B

Updated Status Quo: AAC – 4.8MMBF/Year

This alternative was not evaluated in detail. Refer to section 2.5 (Dismissed Alternatives).

2.4.3 Alternative C

AAC – 6.7 MMBF/Year; 34% of forest growth

Due to unpredictable pressures on the forested ecosystems (e.g., fire, drought, wind, insect and disease, invasive species, and increased human use), this alternative would employ a moderate management pace that is strategically and effectively designed to treat Tribal forested properties within the next management cycle (15-year period) without compromising cultural values and ecosystem integrity.

The AAC for this scenario would use the AAC determination in the FIA, 2019 report. According to the 2019 FIA report, the calculated AAC for Tribal lands is 6.7 MMBF/YR (245 BF/Ac/Yr) on trust lands (27,370 acres) and 1.4 MMBF/YR (279 BF/Ac/Yr) on tribal allotments (5,051 acres). The AAC for this alternative would increase from the 1999 AAC of 4.8 MMBF/YR to 6.7 MMBF/YR to accommodate a moderate management pace needed to adapt the forestlands to drought and wildfire risks projected with climate change issues and concerns. Project level implementation strategies would comply with IRMP sideboards (e.g., DFCs and the preferred management alternative). Allotments would be assessed individually to meet landowner's objectives that follow the defined alternative strategies.

The primary DFC within this alternative is to move the forest landholdings toward reference conditions that mimic the pre-settlement conditions (e.g., early seral composition and structure) and adaptive to future and uncharacteristic climate conditions. The preferred forest condition is a fire, insect & disease, and pathogen resistant condition that includes a multi-cohort and structurally diverse condition. To guide the implementation of this management strategy, work from Powell (1999) would be used to define upper and lower management zone densities as well as Powell (2020) and Schmitt et.al. (2012) to define desired species compositions, forest structural stages, forest canopy layering, and stand densities across all Tribal forests (e.g., landscape level).

2.4.4 Alternative D

AAC – 4.8MMBF/Year; 23% of forest growth

The difference with Alternative D is to employ a slower paced ecological management strategy, relative to Alternative C (6.7 MMBF), that maintains the harvest levels defined in the 1999 management plan's AAC calculation of 4.8MMBF/YR. A slower pace would entail maintaining the status quo target harvest volume regardless of ongoing stressors (e.g., climate change, wildfire risk, insect & disease, noxious & invasive weeds) and past/current economic and workforce limitations. A slower pace would also include longer periods between entries (multiple planning periods) to achieve DFCs and the RAC. At a slower pace, DFCs, particularly those concerning desired stand densities, would not be achieved within most management zones over the first planning period. Multiple planning periods would be required before DFCs are achieved.

2.4.5 Alternative E

AAC – 8.2 MMBF/Year; 41% of forest growth

The difference with Alternative E is to employ an accelerated management strategy, relative to Alternative C (6.7 MMBF), based on the maximum AAC of 8.2 MMBF/YR, to address the unprecedented occurrences of large, high-severity wildfires (associated with drier and warmer conditions that have been observed and predicted outcomes of climate change) occurring in the region. These changing weather patterns connected with current forest conditions (e.g., fire intolerant species and structures) threaten the Tribe's forested resources. Due to economic impacts related to past recessions (2001, 2007-2009, 2020) forest management has been limited to wildfire preventative maintenance vs. continued forest wide harvest scheduling practices. To ameliorate potential and adverse climate stressors to the forested ecosystem, it would be prudent to review an accelerated management pace across the Tribe's forested landholdings. An accelerated management pace should maintain an ecological focus but increase forest treatment accomplishments ('acres in need') to mitigate past management deficits, including those related to poor economic conditions and workforce limitations.

2.5 DISMISSED ALTERNATIVES

2.5.1 Custodial Management

Defined: Under a "custodial" alternative, forest management by anthropogenic methodologies would largely cease. Forest, timber, and fire management would follow natural processes with minimal active management. Tribal members have considered themselves one with the land and therefore are a part of the ecosystem's function.

Purpose: The purpose for this alternative is to return forest management back to natural processes (which include the Nez Perce historical use of fire) governed by anthropogenic influenced climatic conditions. Under historic climatic conditions and restricted anthropogenic influences, the forested landscape would not likely return to pre-European settlement conditions over an extended period due to invasive species, the need for fire suppression and lack of fire rehabilitation treatments. There are Tribal members that believe forest management should be a natural process that is not governed by people (i.e., passive management). However, historical information has shown that tribal members managed the land with fire to improve wildlife habitat and livestock grazing; therefore, active management of some form has always been a prevalent cultural value.

Modeling Decision: This alternative will not be selected for further modeling and review due to the need for active management strategies to repair past anthropogenic changes that have occurred since the European settlement. With potential impacts due to climate change, spread of noxious and invasive species; and uncharacteristic wildfire, the forest ecosystem requires prudent active management tactics. A custodial management strategy would clearly incur significant negative impacts to the forest ecosystem and its function. This alternative also does not meet BIA requirements defined in the 638 agreements nor does it meet the purpose and need for this planning project.

2.5.2 Carbon Management

Defined: The carbon management discussion was an attempt at including a more climate friendly strategy focusing on the sequestration of atmospheric carbon and marketing carbon credits as an avenue to produce income to the Nez Perce Tribe. Maximizing carbon must be constrained with wildland fire protection and forest health. This strategy would mimic historic conditions by implementing longer rotation periods with most of the carbon retained in the larger tree size classes.

Purpose: The purpose for this alternative is to maximize carbon stock on the landscape in support of climate change initiatives. The Tribe and tribal members are sensitive to the potential impacts of climate change to their forest ecosystem. The Nez Perce Tribe's land holdings are small and fragmented when considering the global requirements needed to curb climate degradations; however, this management strategy would invoke silvicultural systems that return the forested landscape back to historic (pre-European settlement) conditions while prioritizing and maximizing carbon sequestration strategies that result in positive income streams.

Modeling Decision: This alternative will not be selected for further modeling and review. Many of the intended results of this alternative are like those in Alternative C: Forest Health & Resilience. Carbon management would be a component of the forest management plan (i.e., individual chapter) and would be defined and implemented upon Tribal approval based on ideal economical returns and concurrence with defined DFCs.

2.5.3 Maximize Timber Revenue

Defined: The constrained economics alternative would focus on the maximum economic return allowed while meeting management objectives and DFCs for both the forested landscape and timber stands. Various silvicultural regimes would be employed to maximize revenue while not exceeding the level of measured forest growth. An annual allowable cut (AAC) would be determined through FVS or FPS modeling under this management scenario.

- The timber harvest level (Annual Allowable Cut) would not exceed the measured and projected growth of the forest. Harvest levels would not increase or decrease until changes in growth and stocking warrant AAC modifications; thereby initiating an FMP revision.
- The preferred silvicultural regime in this alternative is to employ a larger emphasis on even-age management strategies with a smaller component of uneven-age treatments.
- The AAC for this alternative would likely increase during this planning period and would be determined by FVS or FPS software.
- Timber management strategies would be adjusted to include three (3) management zones (Dry ponderosa pine sites; Douglas-fir/ponderosa pine mix sites; and mesic grand fir/Douglas-fir sites).
- Existing Riparian Buffer Zone dimensions would be reviewed.
- Existing Snag guidelines would remain unchanged.
- Existing DDWD (CWD) would remain unchanged.

Purpose: The purpose for this alternative is to determine the net present value (dollars) of the forest by implementing various silvicultural treatments that meet forest management objectives and forest management DFCs. This exercise would provide land value (cash value) potential through timber production and economics. This alternative would provide insight as to how other management strategies measure in value (dollars) to this strategy.

Modeling Decision: This alternative will not be selected for further modeling and review. Tribal member surveys indicate maximizing timber revenue at the cost of a healthy and diverse forest ecosystem would be less than desirable. Furthermore, this is not the current management direction of the Tribal Agency to achieve defined DFCs, it does not meet the purpose and need for this planning project, and it is not consistent with the IRMP.

2.5.4 Updated Status Quo

Defined: The updated status quo is designed for the purpose of corresponding to current commercial forest management strategies employed by the Nez Perce Tribe while incorporating updated BMPs defined by best available science. Updates would include adding acquired forest lands into the plan as well as adjusting harvest levels to current stocking levels and growth rates measured and reported in the Forest Inventory Analysis Report. The FIA Report is designed to monitor forest conditions under current management to ensure meeting the Forest Plan objective of sustained yield.

Under the updated status quo alternative, a forest management strategy would follow the existing 1999 FMP strategy with updates to include current and approved Best Management Practices (BMPs) to achieve defined DFCs within three (3) fire groups described by General Technical Report INT-GTR-363. These fire groups are as follows:

- Warm, Dry Douglas-fir and Ponderosa Pine (Group One)
- Warm, Dry to Moderate Douglas-fir, Grand fir, and Ponderosa Pine (Group Two)
- Moderate and Moist Grand Fir (Group Seven)

Purpose: The purpose of this alternative is to be an identical but scientifically revised and updated version of Alternative A (status quo). This alternative would incorporate the most recent scientific findings into the management strategies described within Alternative A. BMPs would also be reviewed and updated accordingly.

Modeling Decision: This alternative will not be selected for further modeling and review. The IDT determined that, under Alternative A, Tribal Forest management practices and BMPs would continue to be reviewed and updated based on new recommendations and scientific findings. The inclusion of this alternative would be redundant considering the conclusions reached by IDT.

3 EXISTING CONDITIONS

This chapter presents information on environmental resources in their current condition. The resources that would be affected by and/or would affect the implementation of the proposed alternatives are described in detail. Other resources that are not addressed by the issue statements are excluded. Based on the Bureau of Indian Affairs (BIA) 59 IAM 3-H NEPA Guidebook, Table 3-1 lists all resources that were considered for inclusion in this document and indicates which resources would be affected by the implementation of the proposed alternatives. Those affected resources will be included in the effects analyses in Chapter 4.

Table 3-1) Environmental resources that were considered for the environmental impacts analysis. Those resources that will be affected and, therefore, included in the effects analysis in Chapter 5 are indicated by a "yes" response in the Effects Analysis column.

Environmental Resource		**Effects Analysis**
Land Resources	Topography	No
	Soils	**Yes**
	Geology, Mineral, and Paleontological Resources	No
Water Resources	Streams	**Yes**
	Impoundments	No
	Wetland/Riparian Zones	**Yes**
	Groundwater	**Yes**
Air Resources	Achievement	No
	Pollutants	**Yes**
Biological Resources	Wildlife Resources	**Yes**
	Plant Resources	**Yes**
	Ecosystems & Biological Communities	**Yes**
	Agriculture	**Yes**
Cultural Resources	Historic and Archeological Resources	**Yes**
	Cultural, Sacred and Traditional Cultural Properties	**Yes**
Socioeconomic Conditions	Employment and Income	**Yes**
	Demographic Trends	No
	Lifestyle and Cultural Values	No
	Community Infrastructure	No
	Environmental Justice	No
Resource Use Patterns	Hunting, Fishing, Gathering	**Yes**
	Timber Harvesting	**Yes**
	Agriculture	**Yes**
	Rock & Mineral Extraction	No
	Recreation	**Yes**
	Transportation Networks	**Yes**
	Land Use Plans	**Yes**
Other Values	Wilderness	No
	Noise and Light	**Yes**
	Visual	**Yes**
	Public Health and Safety	No
	Climate Change	**Yes**
	Hazardous Materials	**Yes**

3.1 LAND RESOURCES

3.1.1 Soils

Soils across the Reservation are classified as either slightly fragile, moderately fragile, or fragile. Slightly fragile soils represent nearly 65% of the total analysis area while moderately fragile and fragile soils account for approximately 35% and 0.2% of the total area, respectively. The distribution of soils, as they are classified in the Fragile Soil Index, is depicted in section 3.6 of the FMP.

Another important characteristic of soils across the Reservation is the presence of an ash cap. Soils formed in volcanic ash influence the composition of plant communities, as well as forest productivity, in the Pacific Northwest. However, ash-cap soils can be highly susceptible to water and wind erosion when they are disturbed which has implications for any ground-disturbing activities associated with forest management operations (Arnalds et al. 2001; Kimble et al. 2000 as cited in Gier et al. 2018).

3.2 WATER RESOURCES

3.2.1 Streams

The Clearwater River flows westerly 75 miles across the Reservation, entering near Kooskia and leaving near Lewiston, Idaho. All streams and tributaries on the Reservation eventually feed into the Clearwater River System. Major tributaries on the Reservation are:

- Mission Creek
- Lapwai Creek
- Sweetwater Creek
- Potlatch River
- Cottonwood Creek (Nez Perce County)
- Bedrock Creek
- Jacks Creek
- Big Canyon Creek
- North Fork Clearwater River
- Orofino
- Jim Ford
- Lolo Creek
- Sixmile Creek
- Lawyer Creek
- South Fork Clearwater River
- Cottonwood Creek (Idaho County)
- Threemile Creek
- Sixmile Creek
- Middle Fork Clearwater River
- Clear Creek

Tributary streams draining from the Camas Prairie have headwaters in the forested Craig Mountain region along the southern border of the Reservation. These waters consist of first and second order streams originating from springs, seeps, and snow melt, which flow through confined steep slopes until reaching the prairie. The streams then meander across rich farmlands of the prairie before dropping down deeply incised, forested canyons. The steep, narrow canyons open to bottom farmland where streams then enter the Clearwater River.

Flow

The regional hydrologic cycle is shifting from a spring snowmelt-dominated cycle to a fall/winter rainfall-dominated cycle. Shorter periods of snow accumulation and increased summer temperatures facilitate pronounced low flow periods in area stream systems, followed by rain-on-snow events in winter and early spring that supplies brief high flow and flooding events. Temperature is a major factor for spring discharge rates. Chinook winds bring warm rains, which can melt snowpack in a matter of days and increase flows by a magnitude of one hundred (100) or more. Most tributary runoff occurs between mid-March to early May, with flows peaking in April, and regressing to base flows by July. These patterns cause fluctuations in annual stream discharge and employ a level of difficulty in estimating year-to-year base flow relationships.

Hydrographs of Lapwai Creek from USGS gage data illustrates seasonal and annual stream fluctuations on the Reservation (Figure 6-5 and Figure 6-6 in section 6.2).

Water Quality

Many Reservation streams and impoundments have impaired water quality from cumulative watershed effects. Past and present land uses have degraded riparian habitats and stream channel morphology, limiting important hydrologic functions. Diminished water quality during spring and summer limit beneficial uses of Reservation streams, further reducing the ability of Tribal members to safely use water for subsistence-based lifestyle and spiritual practices.

The Tribe's contribution to seasonally impaired water quality is small. Most surface water originates on and flows through private land holdings, the prevalent ownership of land area on the Reservation. However, the Tribe is responsible for maintaining water quality within its holdings and for managing Reservation waters (Clean Water Act, Treaty 1855). The Nez Perce Tribe applied for Treatment in a Manner Similar to a State (TAS) in the early 1990s and has been actively developing and administering water quality programs since 1993.

Draft Water Quality Standards have been created by the NPT Water Resources Division (WRD) and were sent to the EPA for review. However, the EPA recently (January 2025) withdrew the proposed ruled titled "Federal Baseline Water Quality Standards for Indian Reservations". The Nez Perce Tribe Water Resources Division (NPT WRD) will continue working with Idaho Department of Environmental Quality (IDEQ) to uphold state defined water quality standards and work towards defining water quality standards within the Reservation under the Clean Water Act's Tribal Authority Status (TAS) provision. Current water quality targets are listed in Table 6-1 (section 6.3).

3.2.2 Wetland and Riparian Areas

Wetlands and riparian areas occur across the Reservation and play essential roles in maintaining watershed health. Wetlands and riparian areas improve water quality, reduce flooding, raise the water table, supplement stream flows, support culturally important plant and wildlife communities, provide recreational opportunities, and support aesthetic values. Wetlands and riparian zones are defined as:

- **Wetlands:** transitional areas between aquatic and terrestrial ecosystems that are inundated or saturated for periods long enough to produce hydric soils and support hydrophytic vegetation (Helms 1998).
- **Riparian Areas:** *transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines (National Research Council, 2002)*.

More specific to forest management activities, the following factors have also had a negative impact on wetland and riparian areas:

Roads: Other than agriculture, roads are the second most prominent impact to wetlands on the Reservation. Wetlands generally occupy low lying areas of the landscape, which are also convenient transportation routes. Roads that border wetlands can impact water quality by contributing to dust and storm water runoff. These carry sediment, nitrogen, phosphorus, biological oxygen demand, heavy metals, oil, and other contaminants directly to the adjacent water body. Traffic noise and disturbance also negatively affects the use of wetlands by wildlife. Additionally, roads that intersect wetland areas act as dikes, dividing otherwise contiguous wetlands and altering the hydrology by concentrating water upstream from the road, and impeding flow to the downstream section of the wetland.

Invasive and Non-Native Species: Throughout the Reservation, wetlands and riparian areas are overwhelmed with invasive weed species. The problem is especially severe at lower elevations, where the mild climate favors expansion of weeds. Streams and rivers provide a dispersal mechanism for weed seeds and propagules, increasing the prevalence of weeds along stream corridors such as the lower Lapwai Creek valley. The most prevalent invasive weed species along riparian areas and around wetlands are poison hemlock (*Conium maculatum*), Himalayan blackberry (*Rubus procerus*), Canada thistle (*Cirsium arvense*), reed canarygrass (*Phalaris arundinacea*), Fuller's teasel (*Dipsacus fullonum*), and in some areas, Japanese knotweed (*Polygonum cuspidatum*). American bullfrogs (*Rana catesbeiana*), a voracious non-native predator of native amphibians and other wildlife, are present in some Reservation ponds as well.

Timber Harvest: Wetlands in forested areas of the Reservation generally consist of wet meadows surrounded by or adjacent to forest stands. Logging operations impact these wetlands mainly through the placement of hauling roads near sensitive zones, using the vicinity as a staging area and as a location for piling slash. During active logging operations, destruction of the understory vegetation, soil compaction by heavy equipment, and the establishment of invasive weeds can all lead to terrestrial degradation and may result in increased runoff to adjacent wetlands.

Additional Impacts: Climate change is expected to strongly impact the quantity and function of wetlands on the Reservation. Other impacts to wetlands on the Reservation include dikes, dams, and other water control structures that result in changes to the hydrology of the affected area. Some wetlands are impacted by waste disposal sites, other land-disturbing activities, off-road vehicle use, and impervious surfaces (e.g., asphalt) associated with human developments.

3.2.3 Groundwater

Groundwater serves as the primary source of drinking water for the Reservation. Groundwater resources within the Reservation occur in both regional and local flow systems, under both confined and unconfined conditions. The Grande Ronde Basalt and the overlying Wanapum and Saddle Mountains Basalt compose most of the aquifer system and are often referred to as the Clearwater Uplands and Clearwater Plateau aquifer systems (Graham & Campbell, 1981). The Grande Ronde and Wanapum Basalt aquifers have the potential to yield large quantities of water to wells where an adequate source of recharge exists, while the Lewiston Syncline has the potential to produce significant quantities of groundwater. The Lewiston Syncline also provides the geologic trap that hosts the very important Lewiston Sole-Source Aquifer designation under the Safe Drinking Water Act (SDWA).

3.2.3.1 Pollutants and Sources

The steep canyons of the tributaries on the Reservation are made of hard impervious parent rock with shallow soils creating high runoff characteristics. Groundwater recharge is from downward percolation of precipitation, snowmelt from surrounding uplands, and seepage from the Clearwater River and its tributaries. Groundwater is available to water wells from most of the crystalline rock units underlying the Nez Perce Indian Reservation. Most private wells access smaller perched aquifers, but the most extensive and important sources of groundwater within the Reservation are the aquifers of the Columbia River Basalt. The recharge zone for the Lewiston basin reaches up the Clearwater River approximately 15 miles and up Lapwai Creek by 5 miles. Most of the recharge to groundwater is considered vulnerable to surface water pollution.

The quality of groundwater on the Reservation is generally suitable for domestic use, although testing by the Idaho State Department of Agriculture (ISDA) from 2001 to 2007 indicate that some areas show water quality degradation due to nitrate and pesticides (Carlson & Atlakson, 2007). The IDEQ has designated the Clearwater Plateau as a groundwater Nitrate Priority Area, with 25% of the groundwater monitoring sites showing levels of nitrate at one-half the maximum contaminant level for drinking water. In addition, levels of dissolved cadmium and lead occasionally exceeded primary drinking water standards in the Clearwater Plateau, and concentrations of dissolved manganese were occasionally elevated in both the Clearwater Plateau and Clearwater Uplands (Graham & Campbell, 1981).

3.3 AIR RESOURCES

It should be noted that the term "Achievement" describes efforts by the Nez Perce Tribe to regulate actions that affect air quality, is used in this section, as well as in Table 3-1*, as it is one of the environmental components listed in the Bureau of Indian Affairs (BIA) 59 IAM 3-H NEPA Guidebook that should be considered in an EA.*

3.3.1 Pollutants

To protect public health and welfare nationwide, the Clean Air Act requires EPA to establish National Ambient Air Quality Standards (NAAQS) for six common air pollutants also known as "criteria" air pollutants. The pollutants are particulate matter, ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide and lead. Pollution measurements are summarized, scaled, and reported using the Air Quality Index (AQI) to inform the public of potential health hazards. The higher the level of air pollution, the higher the AQI and the greater the health concern.

On the 1863 Nez Perce Reservation, particulate matter less than 2.5 micrometers in diameter (PM2.5) and ozone are measured. Real time air quality data is collected from instruments operated by the NPT Air Quality Program (AQP) staff. There are year-round PM2.5 monitoring stations at Kamiah and Lapwai and seasonally operated (July - October) stations at Orofino, Reubens, and Nez Perce. There is also a year-round EPA ozone monitoring station near Kamiah.

AQI Data for PM2.5 from the monitoring stations at Kamiah and Lapwai for 2019-2022 are displayed in Figure 6-7 (section 6.2). Air quality was the poorest during the months of July, August, and September with USG, Unhealthy, Very Unhealthy, and Hazardous conditions due to wildfire smoke. Moderate conditions during July to mid-October are due to wildfire smoke or agricultural burning. Moderate conditions during other months of the year are due to prescribed burning or wood stove smoke. Descriptions of AQI classifications are included in Table 6-2 (section 6.3).

3.4 BIOLOGICAL RESOURCES

3.4.1 Wildlife Resources

3.4.1.1 Habitat Diversity

To date, comprehensive inventories of wildlife species on the Reservation have not been conducted for many taxonomic groups (e.g. most invertebrates). Consequently, only general qualitative descriptive information is available for providing input to forest management activities.

Wildlife habitat on the Reservation can be categorized into three broad types: plateau, canyon, and mountain. Forestlands are highly fragmented throughout the Reservation and often consist of small (5 to 3,000 acre) isolated patches of predominantly ponderosa pine and Douglas-fir stands. Patches of forest habitat are generally located on level to gently rolling terrain on the plateau above the Clearwater Rivers and are surrounded by an extensive matrix of agricultural lands. Plateau habitats are interconnected to varying degrees by canyon habitats of tributaries to the Clearwater River. Tributary canyons are steep and rocky supporting a mosaic of drier habitats ranging from open pine stands to dense fir stringers depending on aspect, brush fields, and open grassland-dominated slopes. Because of the highly fragmented nature of Reservation forestlands, canyon habitats are important to wildlife in providing movement corridors and habitat connectivity between plateau habitats, as well as providing year-round habitats for many resident wildlife species.

The largest tracts (4,600 to 8,000 acres) of contiguous forestlands owned by the Tribe are located within the Sweetwater Creek and Maloney Creek watersheds and adjacent to the southwest corner of the Reservation along higher elevations of Craig Mountain (a long ridge (Wapshilla) between the Salmon and Snake Rivers). These mountain habitats consist mainly of Douglas-fir, grand fir and mixed conifer forest stands which are more diverse and mesic than either the plateau or canyon habitats.

3.4.1.2 Species Inventory

In combination with the few wildlife inventories that have been conducted by the Tribe, inventories for adjacent ownerships are valuable for aiding management decisions. Based on available information, it is estimated that at least 9,300 animal species occur within the Nez Perce homeland (Nez Perce Tribe 2019). This is a first approximation based on a combination of known occurrences, predicted distributions, and diversity estimates guided by the size and location of the Nez Perce homeland. The actual number occurring within the region is likely much higher, as most taxa have not yet been fully assessed. Of these 9,300 species, insects and arachnids (spiders and mites) account for 52.2% and 27.1% of total estimated diversity, respectively, or 79.3% of all animal diversity within the Nez Perce homeland. Vertebrate species (n = 485) account for only 5.2% of total estimated animal diversity and are mostly comprised of bird species:

- Birds: 339 species (3.6%)
- Mammals: 78 species (0.8%)
- Fish: 38 species (0.4%)
- Reptiles: 17 species (0.2%)
- Amphibians: 13 species (0.1%)

Large Mammals: The most prominent wildlife species within the Nez Perce homeland are undoubtedly large mammal (‘big game’) species, including elk (wisé·w), mule deer (té·wisi·n), white-tailed deer (tapì·tawisi·n), moose (sá·slaqs), and Rocky Mountain Big Horn Sheep (tińú·n). Other large mammals present include mountain lion, black bear, and gray wolves (*hímiin*; *Canis lupus*). Historically, the grizzly bear (*x̣áx̣aac*; *Ursus arctos*) is known to have occurred extensively within the Nez Perce homeland as well but have since become extirpated (locally extinct). Most large mammals in the region are currently managed intensively to provide hunting opportunities (most herbivores) or to minimize impacts to hunted species (most carnivores).

Medium- and Small-sized Mammals: A variety of medium- and small-sized mammals occupy the Nez Perce homeland, including coyote, northern river otter (*qiláasx*; *Lutra canadensis*), bobcat (*qéhep*; *Lynx rufus*), badger (*síiki’*; *Taxidea taxis*), raccoon (*k’ayk’áyoc*; *Procyon lotor*), striped skunk (*tísqe’*; *Mephitis mephitis*), and both long- (*Mustela frenata*) and short-tailed (*Mustela erminea*) weasels (collectively *c’ílilee*). A diversity of voles, shrews, bats, and Sciurid species (squirrels and chipmunks) are present as well. Several of these species, particularly bats (*‘úuc’uc*), are of conservation concern.

Birds: Several hundred bird species are present within the Nez Perce homeland, including a diversity of waterfowl, shorebirds, upland game birds, neotropical songbirds, birds of prey, woodpeckers, and gulls. Several of these species are of regional conservation concern.

Reptiles & Amphibians: Over a dozen species of frogs, toads, salamanders, lizards, and snakes are known or predicted to occur within the Nez Perce homeland. The distribution of most of these species is poorly known, and several are of conservation concern.

Invertebrates: Several thousand terrestrial and aquatic invertebrate species are known or predicted to occur within the Nez Perce homeland, including a wide diversity of insects, spiders, clams and mussels, snails and slugs, and microscopic organisms. Many of these species play essential roles in maintaining the ecological health of the plant, wildlife, and fish resources of the region as well as broader ecosystem integrity, yet the conservation status of virtually all these species is unknown.

Non-Native Species: At least 27 non-native wildlife species are known to be present within the Nez Perce homeland (Nez Perce Tribe 2019). In many cases, these species have been intentionally introduced to provide recreational opportunities for hunters and anglers. Though their ecological effects generally receive less attention than those of invasive plants, introduced animal species can significantly destabilize ecosystems and eliminate entire guilds of species from some habitats. Non-native fish and wildlife species can prey upon native species, displace native species from foraging and breeding sites, and directly interfere with native species through aggression.

3.4.1.3 Forest Habitat Resources

Refer to the following sections of the Nez Perce Tribe FMP for an overview of forest habitat resources:

- *Section 1 – Forest Description*
- *Section 2 – Forest Inventory*
- *Section 8.4 – Wildlife Management*

3.4.1.4 Threatened and Endangered Aquatic and Wildlife Species

Select surveys for Federally ESA-listed species have been conducted on the Reservation. Surveys are conducted on the Clearwater River with traps to monitor all fish species, including those that are listed under "Fish" in Table 6-3 (section 6.3). The western bumble bee was also documented on the Reservation through survey efforts. Where data is insufficient, or species have not been observed, federal and state resources have been used previously to compile lists of threatened, endangered, and rare species that may exist or utilize habitat on the Reservation. Currently, the Tribal Code concerning the identification of threatened and endangered wildlife species is being updated. The threatened and endangered wildlife species listed in Table 6-3 will be supplemented with other rare species or species of concern once the update process is complete. Refer to §3-1-49 (g): Types of Animals Defined in the Nez Perce Tribal Code for the most current list of threatened and endangered species recognized by the Nez Perce Tribe.

3.4.1.5 Fisheries

There are approximately 87 miles of the Clearwater River, including portions of the mainstem, North Fork, South Fork and Middle Fork Clearwater which run through the Nez Perce Reservation. In addition, there are some 2,531 miles of streams flowing within the Reservation that are tributaries to these rivers. There are four reservoirs contained within the Reservation: Mann's Lake, Talmaks, Mud Springs and Lapwai Lake that have been stocked with rainbow trout and provide recreational fisheries. Approximately 2,400 acres of Dworshak Reservoir are also located within the Nez Perce Reservation; bull trout (Nimiipuu name - islam; scientific name - *Salvelinus confluentus*), westslope cutthroat trout (wawá·łam; *Oncorhynchus clarki lewisi*), rainbow trout (héeyey; *Oncorhynchus mykiss*), kokanee (*Oncorhynchus nerka*), and smallmouth bass (lixli·ks; Micropterus dolomieu) currently appear to be the most environmentally and economically significant of the 21 fish species documented within this reservoir (Horton, W.D. 1980). Three salmon and steelhead hatcheries (Dworshak National Fish Hatchery, Nez Perce Tribal Hatchery – Cuy'eemnim Seepeepyimniwes, and Kooskia National Fish Hatchery) are located within the Reservation and are funded by the Army Corps of Engineers and the US Fish and Wildlife Service through the Lower Snake Compensation Office and Bonneville Power Administration. The Dworshak National Fish Hatchery is co-managed by the U.S. Fish and Wildlife Service and the Nez Perce Tribe. The Nez Perce Tribe own and operate the Cuy'eemnim Seepeepyimniwes (A place to cause fish to grow) hatchery along with acclimation sites located at: Newsome Cr., Yoosa/Camp Cr., Sweetwater Springs, Meadow Cr./Selway R., Luke's Gulch, NPTH, North Lapwai Valley, and Cedar Flats.

Previous Surveys: A variety of fish species have been documented to utilize streams within the Reservation (Table 6-4 in section 6.3). However, stream inventories conducted on the Reservation have not targeted specific portions of tribal trust or individual allotment lands. Information about fisheries resources within fee lands (lands purchased by the Nez Perce Tribe) is even more limited.

Stream inventories conducted in 1982, 2003 to 2006, and 2008 to 2012 report consistent issues limiting quality, and quantity, of fish habitat within the reservation. Because of the extensive amounts of private land within the Reservation, land management practices in the watersheds emphasize farming, grazing, and logging. Subsequent impacts to native grasslands, coniferous communities, riparian corridors, and wetlands have altered hydrological profiles throughout the reservation's watersheds, resulting in short-duration, high-intensity spring runoff events and diminished summer surface flows. The unnaturally "flashy" spring flows have destabilized streambeds throughout much of the reservation and resulted in further impacts to riparian corridor quality, bank stability, floodplain connection, groundwater retention, large woody debris retention, fine sediment input, and habitat complexity. Diminishment of channel stability, riparian condition, and floodplain connectivity further exacerbate impacts of low surface flows on fish habitat as water temperatures exceeding salmonid utilization thresholds are now commonly recorded within widened, shallowed, and unshaded stream reaches throughout the reservation.

Spawning and Migration: Additional species which were not detected in recent tributary surveys but are known to utilize the Clearwater River (mainstem and/or forks of) include bull trout, westslope cutthroat trout, Pacific lamprey (héesu; Lampetra tridentata), mountain whitefish (cimey; Prosopium williamsoni), and common carp (Cyprinus carpio). White sturgeon (qí·lex; Acipenser transmontanus) and sand rollers (Percopsis transmontana) have also been reported within the lower reaches of the mainstem Clearwater River.

Anadromous salmonid returns to the Clearwater River have exhibited extreme interannual variability in recent decades, but hatchery production supports a world-renowned steelhead fishery as well as a robust spring Chinook salmon fishery. Fall Chinook and coho salmon (ḱállay; Oncorhynchus kisutch) have also returned in sufficient numbers to support modest fisheries in recent years. The socioeconomic benefits these fisheries provide to the region are profound, while the cultural significance of adult salmon and steelhead returns to the Nez Perce Tribe is beyond measure. Notably, it is estimated that current tribal fish harvest is less than 1% of historic harvest levels prior to the 1850's (Nez Perce Tribe, unpublished data).

The mainstem Clearwater River is utilized by chinook salmon and steelhead throughout the year. Juvenile spring Chinook salmon and steelhead utilize the mainstem river corridor for overwinter rearing habitat from November until April or May. Adult spring Chinook are typically present in the river from May through June on their return to spawning streams further up in the drainage. Adult steelhead return to the Clearwater River as early as June on their return to the spawning streams located both within and beyond the Reservation boundaries. ESA listed fall Chinook salmon spawn within the lower Clearwater River from November through December. Their eggs are incubated in the river through the winter and young emerge in May where some rear for a short time until July and August to begin their outmigrations downstream; other juvenile fall Chinook will remain in either the mainstem Clearwater or the Snake River and outmigrate the following spring. Coho salmon were reintroduced to the Clearwater River basin in 1995 by the Nez Perce Tribe. Adult coho salmon typically begin to arrive in the Clearwater River in September, entering reservation tributaries to spawn in October and November. After overwinter incubation, coho fry emerge in the spring and rear for a year within reservation streams before out-migrating the following spring.

Among these anadromous salmonids, steelhead are most widespread throughout the reservation's rivers and streams. Snake River Basin steelhead were listed as Threatened under the Endangered Species Act in 1997; in 2005 the National Marine Fisheries Service designated the mainstems and most tributaries of the Clearwater, Middle Fork Clearwater and South Fork Clearwater rivers, as critical habitat for this species. Steelhead which inhabit the reservation are currently identified to be comprised of A-run and B-run fish, as differentiated by migration timing, ocean-age, and adult size. A-run steelhead spawn and rear within numerous streams throughout the Reservation, while the larger B-run fish primarily utilize the mainstem, Middle Fork, and South Fork Clearwater rivers for migration.

Steelhead typically move into the reservation tributaries to spawn beginning in February (Kucera and Johnson, 1986). They spawn in clean gravel to cobble sized substrates with ample interstitial spaces to allow stream flows to flush out accumulated waste and to provide oxygen. Eggs incubate during the spring and fry emerge in May or June. Juvenile steelhead display a great level of plasticity and may rear within a stream from one to three years before outmigration or, in rare cases, may residualize and adopt a residential life cycle. Those that do leave migrate to the ocean during the spring and typically spend one to two years at sea before returning to spawn in the streams they were born in.

Steelhead often occupy different habitats during their freshwater residency. They may migrate into intermittent streams when flows are abundant and transition back to the perennial stream tributary later in the summer. This within-stream migratory movement is also typical of the rainbow trout stocked in the lakes on the reservation. Steelhead are common inhabitants of riffle type habitat, stream side margins and the tail end of pools when they are very small. As they mature, steelhead occupy deeper pool areas where vegetative structure provides cover and shade.

3.4.2 Plant Resources

Approximately 170 families and 1,860 genera of flowering plants are known or predicted to occur within the Nez Perce homeland, comprising an estimated 22,500 species and intraspecific taxa (subspecies and varieties). In addition, approximately 108 families and 431 genera of fungi are known or predicted to occur within the Nez Perce homeland. As in many animal groups, the taxonomic status of many species and intraspecific taxa of plants and fungi is unresolved.

3.4.2.1 Threatened and Endangered Plant Species

Few inventories for threatened and endangered plant species have been conducted on the Reservation and any information collected during survey efforts, such as location, is kept securely within the NPT Wildlife program. Tribal Code includes a list of sensitive and rare species that are tracked and monitored across the Reservation by the Wildlife Division. This is a working list that is regularly updated as new information is obtained. The current list of sensitive and rare plants recognized by the Tribe is maintained by the Wildlife Division. Federally listed ESA species that do occur or could occur on the Reservation are listed in Table 6-5 (section 6.3).

3.4.2.2 Noxious Weeds

The Idaho State Department of Agriculture (ISDA) recognizes 67 ‘noxious’ weed species and 4 noxious genera (Cytisus, Genista, Spartium, and Chameacytisus) within the state of Idaho, the majority of which are present within the Nez Perce homeland. Currently, the management of noxious weeds by the Tribe occurs on a case-by-case basis as there is no comprehensive plan for the Reservation that specifically addresses and details the treatment of noxious weeds.

The most prevalent weed species include Canadian thistle (*Cirsium arvense*), common crupina (*Crupina vulgaris*), spotted knapweed (*Centaurea stoebe*), and yellow starthistle (*Centaurea solstitialis*). This information was collected and mapped by the University of Idaho, College of Agriculture from 2012 to 2014:

- **Common Crupina:** The majority of the Common Crupina can be found at the SE corner of the Reservation starting at Kamiah and running up Lawyers Canyon approximately 11 miles and straight south to the Reservation boundary and beyond.

- **Starthistle:** This species is found primarily on the steep canyon slopes of the entire Clearwater River Drainage starting down river from Lewiston and extending upriver past Stites. This extremely aggressive weed is present up the sub-drainages feeding the Clearwater River extending to the agriculture crop ground of the Camas Prairie.

Other noxious weeds found on the Reservation include but may not be limited to Canada Thistle (*Cirsium arvense)*, Dalmation Toadflax (*Linaria genistifolia*), Field Bindweed (*Convolvulus arvensis*), Hoary Cress (*Cardaria draba*), Leafy Spruge (*Euphorbia esula*), Poison Hemlock (*Conium maculatum*), Scotch Thistle (*Onopordum acanthium*), Spotted Knapweed (*Centaurea maculosa*), Yellow Toadflax (*Linaria vulgaris*), Puncturevine (*Tribulus terrestris),* Sweetbriar Rose *(Rosa rubiginosa),* Oxeye daisy, *(Leucanthemum vulgare),* Russian knapweed (*Rhaponticum repens),* and Ventenata (*Ventenata dubia*)*.*

Some invader weeds have been sighted on the Reservation, including but not limited: Japanese Bamboo (found in riparian zones, currently located along Clear Creek and upstream from the fish hatchery), Rush Skeletonweed (*Chondrilla juncea*), Perennial Peavine (*Lathyrus latifolius*), Sulfur cinquefoil, and Orange Hawkweed (*Hieracium aurantiacum*). Rush Skeletonweed is located around the Lenore area and Orange Hawkweed is located at the Talmaks Campground.

Most of the noxious weeds can be found along roadways and in and along natural drainages. Vehicles are the primary means that noxious weeds are spread across the Reservation. Once the weeds are established, they can easily be spread by other means such as wind, water, and animals.

Noxious weed establishment within forested lands decreases the productivity of desirable plant species, which include cultural plants, native grasses, and tree seedlings. Noxious weeds are extremely competitive for resources and can rapidly occupy sites (e.g., roads, skid trails, and landings) with exposed soils.

3.4.3 Ecosystems and Biological Communities

Refer to section 1.1.3 of the Nez Perce Tribe FMP for information about ecosystems and biological communities that overlap the 1863 Reservation.

3.4.4 Agriculture

Historically, the Nez Perce people gathered wild plants across what is now the Reservation. It was not until the 1700s that livestock arrived and the late 1800s and early 1900s that broad-scale cultivation of the land began in earnest. Today, farming is the largest land use within the 1863 Reservation, approximately 50% of which consists of cropland. Productive soils and abundant rainfall have contributed to the development of the Reservation and surrounding areas into one of the most fertile and productive farming regions in the world. As a result, the Tribe receives approximately $1,500,000 annually in revenue through crop and livestock leases on Tribal Trust and Fee Title lands. Beneficiaries in Individual Trust Allotments received a further estimated $3,000,000 in crop and livestock lease revenue as well. Despite declines in regional employment and cash receipts within this sector over recent decades, crop production continues to represent a major industry on the Reservation (Figure 6-2 in section 6.1).

3.4.4.1 Cultivated Crops

Approximately 385,227 acres, or 50%, of the 1863 Reservation's 770,470 acres are currently devoted to crop production. Of these, the Tribe retains management interest in approximately 36,372 cropland acres, including 7,442 acres under Tribal Trust, 2,567 acres under Tribal Fee Title, and 26,362 under Individual Trust Allotments (Nez Perce Tribe Land Services Division, unpublished data). Major crops grown on the Reservation include fall wheat, spring cereal, non-cereal, and hay. An estimated 15% of Tribal forests are immediately adjacent to the agricultural land cover type.

3.4.4.2 Livestock

The Tribe also retains management interest in approximately 50,300 acres of pastureland, including 19,820 acres under Tribal Trust, 22,875 acres under Tribal Fee Title, and 19,820 under Individual Trust Allotments (Nez Perce Tribe Land Services Division, unpublished data). Both Tribal Trust and Individual Trust Allotments are leased under the jurisdiction of the BIA. In 2018, the Tribe and BIA administered 577 agricultural leases (crop and grazing) on 655 separate parcels. In general, these lands are leased to non-Tribal operators under cash rent or crop share agreements. All leases are governed by individual management plans which detail the field or pasture acres, allowable crop and livestock types, and other details during the lease period (annually).

3.5 CULTURAL RESOURCES

The Nez Perce Tribe established the Cultural Resource Program (CRP) in 1989 to protect, preserve, and perpetuate *Niimíipuu* cultural values. The mission of the CRP is to promote the understanding and use of nimíipuu'neewit (traditional Nez Perce lifeways) as integral components of Tribal culture and regional management. The CRP fulfills its programmatic purpose by:

- Assisting Tribal Leadership in treaty rights protection,
- Documenting traditional and ancestral knowledge,
- Integrating *nimiipuutimpt* within the Tribal community and infrastructure, and
- Protecting sites, landscapes, and associated knowledge integral to the perpetuation of nimiipu'neewit through meaningful consultation.

Due to the sensitive nature of Tribal cultural resources, generalized information will be included in this section. Specific information is maintained within the Cultural Resource Program.

3.5.1 Historic and Archeological Resources

With some of the oldest documented archaeological sites in the state of Idaho, the lands of the Nez Perce Tribe exhibit a variety of cultural resources representing perhaps 10,000 years of human occupation. These resources generally take the forms of prehistoric, historic, and traditional use areas.

Prehistoric sites most often discovered within Nez Perce Tribal lands generally include camps, villages, and resource location and use areas. Camp sites are generally small and identified by features or other prehistoric artifacts related to a temporary, perhaps seasonal, occupation of a specific area. Village sites are generally much larger and are identified by features and artifacts related to the existence of long-term, permanent occupation of a specific area. Other prehistoric sites include locations of natural resources such as lithic sources, sources of vegetal products, and hunting and fishing sites. Due to natural decomposition processes, artificial material of wood, bone, hide, and other natural fibers generally decay, and as a result are infrequently found. Most prehistoric cultural components are represented by flaked stone tools of mixed lithology.

Historic sites within Nez Perce Tribal lands are diverse and representative of early logging, farming, and natural resource extraction techniques. Specific sites include homestead farming and ranching buildings, timber harvest and processing sites, and numerous other sites representing Native American and early settler interactions during the creation of the reservation. Along with specific locations, a large and diverse web of infrastructure was created to facilitate the movement and processing of the numerous natural resources from the Clearwater River and Camas Prairie regions. Remnants of this infrastructure are frequently encountered within reservation lands. These items include historic trails, wagon routes, tramways, logging, freight and passenger railroads, stage lines, communication lines, and other pieces of the infrastructure which existed throughout the region. While some of these routes have now been integrated into modern roadways and lines of communication, many of these sites still survive and work to preserve their integrity.

3.5.2 Cultural, Sacred and Traditional Cultural Properties

Through gathering, processing, and subsequent use of numerous diverse natural resources, the cultural identity of the Nez Perce people is inseparably linked to the natural environment. The vast array of vegetal materials utilized by the Nez Perce people include items used for food, fiber, medicinal, and religious purposes. Tribally owned lands also support populations of animal life that are utilized not only for food, but for numerous traditional uses. Without proper planning for the future, the loss of these traditional resources could cause irreparable damage to the cultural integrity of the Nez Perce Tribe.

3.6 Socioeconomic Conditions

3.6.1 Employment and Income

Employment within the Reservation is greatest within the education, health care, and social assistance industries. Compared to the Idaho and U.S. populations overall, a relatively high proportion of the employed population on the Reservation works in the natural resource and public administration fields. Conversely, a relatively low proportion of the employed population is employed in professional and scientific fields.

Timber harvesting has been an important source of revenue for the Nez Perce Tribe. Revenues generated from timber sales are used to provide essential governmental services and other tribal functions. Timber revenues in the past have generally accounted for 30 to 40% of the Tribe's annual income which provided for the approved budget. These funds support employment of essential personnel in the areas of NPTEC Office Support, Community Buildings, Plant Maintenance, and Information Technology. There are other timber related opportunities that exist for the employment of Tribal members, such as, staffing the Nez Perce Forestry & Fire Management division and employment of qualified Indian operators that bid on a proposed forest management activity. Tribal Employment Rights Office (TERO) regulations apply to all contracts within the Nez Perce Reservation boundary. Assessed TERO fees are used to ensure workforce training and employment to the Nez Perce citizens. Due to economic recessions, stagnated timber markets, limited qualified contractors, and increased forest management costs, timber revenue to the Tribe has decreased significantly. Currently, a priority for receiving timber revenue is to maintain pertinent forest transportation to the Tribal citizens and ongoing efforts to mitigate hazardous fuels while enhancing and conserving ecosystem services.

3.7 Resource Use Patterns

Land use patterns on the Reservation have changed dramatically since the Reservation was established. Around the turn of the century most of the forest lands were cleared for dryland agricultural purposes, which is currently the dominant land use. Generally, the most productive soils have been dedicated to agriculture, which often yield a higher economic return than forest management. The extent of the forest resource on the Reservation has diminished accordingly. Approximately 11.5% of the allotted land area remains in forest cover as compared to 60% of Tribal trust lands being forested.

3.7.1 Hunting, Fishing, Gathering

Over time, opportunities for hunting, fishing, and gathering have been reduced or lost due to changes in the distribution and quality of native habitat on the Reservation. Habitat conversion and fragmentation has decreased the total area available for Tribal members to participate in traditional hunting, fishing, and gathering practices. The introduction of non-native species, some of which were introduced as game species, has degraded native habitat and displaced native species. Although recent land acquisition has provided more opportunities for hunting and gathering, the loss of native and culturally important species has negatively affected hunted and gathering opportunities for Tribal members.

As of 2006 nearly 54% of the total wildlife habitat on the Reservation had been lost through conversion to non-habitat cover types devoted to human use (Nez Perce Tribe Wildlife Division, 2006 unpublished data). Habitat loss has primarily concerned the conversion of native prairie, forestlands, and, to a lesser degree, wet meadow complexes to agricultural lands. This type of land conversion has also led to the fragmented distribution of such native habitat types. For instance, Ponderosa pine (Pinus ponderosa) and Douglas-fir (Pseudotsuga menziesii) were once more widely distributed and provided important habitat linkages for forest carnivores, birds, and other species between Craig Mountain and the forests of the Northern Rockies (Nez Perce Tribe Forestry and Fire Management Division, unpublished data). Today, for many species, that connectivity has been lost as remnant forest patches are now widely spaced. The loss or displacement of wildlife species that use native habitat types has negatively impacted traditional hunting practices on the Reservation.

3.7.2 Timber Harvesting

Refer to the following sections of the Nez Perce Tribe FMP for an overview of timber resources and harvesting:

- *Section 1.4.2 – Historical Timber Harvest*
- *Section 2.1 – Forest Land Base*
- *Section 2.3 – Forest Growth*

3.7.3 Agriculture

The Tribal Agricultural Center (TAC) was established in 2013 with the mission of producing local, sustainable, and healthy food for the *Nimiipuu* and surrounding communities. It is developing guidelines for best agricultural management practices on tribal lands in coordination with USDA NRCS, monitoring compliance, evaluating agricultural impacts to resources and traditional gatherers on tribal lands, and developing restoration protocols for traditional food and fiber plants. For more information about agricultural practices on the Nez Perce Reservation refer to section 3.4.4 Agriculture.

3.7.4 Recreation

Refer to section 3.11 of the IRMP Environmental Impact Statement (EIS) for an overview of current recreational amenities and opportunities on the Reservation.

3.7.5 Transportation Networks

Refer to the following resources for an overview of current transportation networks and resources on the Reservation:

- *Section 3.8 of the IRMP Environmental Impact Statement (EIS)*
- *2022 Nez Perce Indian Reservation 20-Year Transportation Plan*

3.8 OTHER VALUES

3.8.1 Noise and Light

3.8.1.1 Noise

Noise is typically defined as an unwanted or disturbing sound. Health problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity (EPA, 2019a). Major sources of noise in the U.S. include road and rail traffic, air transportation, occupational and industrial activities, amplified music, recreational activities, and firearms (Hammer, Swinburn, & Neitzel, 2014). Agriculture activities are also a major source of rural noise (Humann, 2011). All these sources are present on the Reservation, although no comprehensive noise studies have been conducted to date.

Primary responsibility for addressing noise issues belongs to State and local governments. The EPA retains the authority to investigate and study noise and its effect, disseminate information to the public regarding noise pollution and its adverse health effects, respond to inquiries on matters related to noise, and evaluate the effectiveness of existing regulations for protecting the public health and welfare, pursuant to the Noise Control Act of 1972 and the Quiet Communities Act of 1978.

3.8.1.2 Shadow, Light, and Glare

Light pollution consists of unused or extraneous outdoor lighting and includes effects such as sky glow, light trespass, and glare. Light pollution is often correlated with population density. Light pollution maps of the Reservation show the highest concentrations of light pollution in Lapwai, Orofino, Nez Perce, and Kamiah, ID with very few effects elsewhere on the Reservation (Falchi et al., 2016). Light pollution can be damaging to human health, disrupting the ecosystem, and have negative impacts to the quality of life for residents (Dominoni et al., 2016).

3.8.2 Visual

Currently, timber harvest and other land management activities must consider the aesthetics of the forest and the landscape. Regarding forest management, aesthetics must be enhanced through silvicultural practices to support a healthy and resilient forest ecosystem. However, forest treatments create a temporary change in the visual quality of the forest. These visual impacts are perceived through varying lenses as either acceptable or unacceptable. Therefore, it is critical that the forest management planning process during project-level planning is transparent and relevant to the approved DFCs of the forest.

3.8.3 Climate Change

The Tribe has been working on climate change for decades, from sequestering carbon in forests to responding to the impacts of changing ocean conditions, stream temperatures, and flow on fish. The current climate change program started after the 2015 drought and fish kill. The climate team, headed by the Water Resources division of the Natural Resources department, is determined to have a meaningful, long-term adaptation program that helps the tribe assess, vision, plan, and mitigate the impacts of climate change. The Nez Perce Tribe has a published climate adaptation plan titled: “Nez Perce Tribe Clearwater River Subbasin Climate Change Adaptation Plan, (2011). In addition, the Nez Perce Tribe’s Forestry and Fire Management division is actively working the USDA Northwest Climate Hub and Western Wildland Environmental Threat Assessment Center of the Pacific Northwest Research Station, Portland, OR to enhance climate adaptation planning pertaining to forest resources.

3.8.4 Hazardous Materials

Hazardous materials are materials that pose a substantial threat to public health or the environment. Examples of hazardous materials include solvents used in cleaning and degreasing operations, petroleum products, pesticides, some pharmaceutical products, and other compounds which are highly ignitable, corrosive, reactive, or toxic. On the Reservation, petroleum fuels and agricultural chemicals, including fertilizers and pesticides, are the primary types of hazardous materials involved with spills and environmental contamination. In some rare cases, remnants from methamphetamine labs have been discovered on Tribal Forest lands.

3.8.4.1 Petroleum

Petroleum spills are the most common hazardous material and occur through transportation accidents and leaks from underground and aboveground storage tanks. If a leak or spill occurs adjacent to a waterway, the transport of petroleum through geologic media can take years to naturally attenuate, even with active remediation.

3.8.4.2 Agricultural Chemicals

Anhydrous ammonia is the most common agricultural chemical used on the Reservation, but no significant contamination incidents have been reported. As anhydrous ammonia volatilizes into the atmosphere, any significant leaks are likely to disperse in the atmosphere and may not result in a reportable incident. Ammonium polyphosphate is a liquid fertilizer which is occasionally reported to have spilled. Though not technically classified as hazardous, it would have significant detrimental effects if spilled into a waterway.

Pesticide pollution issues on the Reservation typically involve improper disposal. Major contamination generally results from dumping or disposal of pesticides into an Underground Injection Control Well (e.g., dry well) or at mixing areas at commercial distributors. Other sources of contamination are associated with aerial applicators (e.g., crop dusters) and individual farm operations.

Nitrate fertilizer contamination (levels exceeding federal drinking water standards) is documented on the Reservation periodically. Though shallow rural wells are the most vulnerable to this form of contamination, they are not subject to SDWA sampling and analysis requirements. It is therefore difficult to determine the full scope of groundwater contamination of this type. However, nitrate contamination can act as a surrogate for other types of water-soluble contaminants, suggesting that pesticide contamination of groundwater may also be a major issue for rural wells. Municipal wells supplying more than 25 people are subject to SDWA sampling and analytical requirements and are typically found to be very safe during routine testing. If routine sampling identifies contamination, the municipal utility is required by law to notify their customers of regulatory exceedances.

3.9 Desired Future Conditions

Refer to the Nez Perce Tribe FMP for descriptions of desired future conditions (section 3.1) for the following resources:

- *Section 3.2.1 – Forestlands*
- *Section 3.2.2 – Riparian Forests*
- *Section 3.2.3 – Wildland Fuels*

4 Environmental Consequences

In this section, environmental consequences are described for the Project Alternatives discussed in Section 2–Alternatives. Resource areas that are analyzed in this section include direct, indirect, and cumulative effects to land, water, air, biological, and cultural resources, socioeconomic conditions, resource use patterns, and various other values as detailed in Section 3–Existing Conditions. Direct effects are those that are caused by the action and occur at the same time and place while indirect effects are caused by the action and occur later in time or further in distance but are still reasonably foreseeable. Cumulative effects are those that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.1). Note that, consistent with the CEQ's NEPA Regulations Section 1508.8, the term "effects" is used synonymously with the term "impacts."

4.1 Methodology

The impacts addressed in an EA for an FMP that tiers to an IRMP reflect the environmental issues associated with the programmatic nature of an IRMP. Because these issues typically relate to environmental effects over a broad geographic area and time horizon, the depth and detail of impact analysis is expected to be broad and general. The effects analysis focuses on the major impacts that might result from forest management activities over the short and long term if an action alternative is implemented, especially on those resources or factors that would be adversely impacted.

For estimating the effects at a programmatic, Reservation-wide level, the assumption has been made that the type and amount of resource management activities described in the alternatives are reasonably foreseeable actions, intended to move towards or achieve the desired conditions and goals identified. Discussions here refer to the potential for the effect to occur and are in many cases based on estimates. The effects analyses are useful when considering the effects of forest management across the entire Reservation, but they are not intended to be applied directly to site-specific locations within the Reservation. Effects analyzed in this document are defined as follows:

- **Direct Effects:** Such effects are caused by an action and occur at the same time and location as the action being taken. Direct effects were not included in the IRMP EIS as the specific locations and timing for proposed actions are unknown. However, this document is specific to forest management so general direct effects that may result from such actions are addressed in this document.
- **Indirect Effects:** Indirect effects are caused by an action and occur later in time or are removed in distance. The effects of an FMP are generally indirect effects, therefore the possible indirect effects from forest management are also discussed in this document.
- **Cumulative Effects:** A cumulative effect is the effect of an action when added to the effects of other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes the action and who owns the land. Cumulative effects integrate actions and activities occurring on non-Tribal land within the Reservation as well as beyond the external boundaries of the Reservation. The cumulative effects area includes all lands within the Clearwater River basin as well as the landscape south and west of the Reservation within the lower Snake and Salmon River basins.

  Cumulative effects can also include those that result at the planning level. However, there are no other Tribal plans that include actionable measures for the resources described in this document. Other documents, such as the DFRM Management Plan, contain broad level management goals or they concern areas that do not overlap with the affected area described in the FMP. Therefore, no cumulative effects are expected to occur in conjunction with the FMP at the planning-level. However, with the approval of the Nez Perce Tribe IRMP in 2023 it is expected that new planning documents will be developed and tiered to the IRMP. Such documents may have cumulative effects with the FMP at the planning level.

Overall, only general effects from forest management under each alternative are discussed as the scale of this document is too broad to analyze specific effects. Site-specific analyses will be conducted at the project level once the timing and location of specific actions are determined. As specific impacts under each action alternative cannot be addressed, the action alternatives were evaluated relative to the status quo using the resource indicators from the IRMP EIS and the target harvest volumes described in Section 2–Alternatives.

As specific impacts at this scale are unknown, AAC was used as a basis to determine if potential impacts would be substantially different from those that have occurred under the previous forest management plan. In most cases, it was assumed that there would be no change in the types or severity of impacts or levels of risk to resource indicators if the AAC for an alternative matched the status quo. However, impacts from action alternatives with higher AACs are, in general, expected to be different from the status quo. It was assumed that, as total harvest volume increases, that increased levels of activity in managed forestlands could result in more widespread impacts, more severe impacts per unit area of land, prolonged disturbances, and increased levels of risk to resources as forest management operations expand in space and/or time.

The effectiveness of each alternative at addressing the resistance and resilience of Tribal forestlands to future disturbance was also considered. It was assumed that as harvest pace and scale increase, the resulting conditions, post-harvest, would be better adapted to future disturbances, such as wildfire, pest and pathogen outbreaks, and climate change, and that negative impacts would be less severe. These two aspects, effects during the action and effects after the action, are further described in the following sections.

During Action – Risk of Negative Impacts to Indicator: Relative to the other alternatives and based on available information, this is the perceived level of risk posed by the given alternative to the indicator during the implementation of the action. This is based on the scale and scope of the alternatives. In general, the greater the scope and intensity of annual harvest activities the greater the level of potential risk to those indicators that could be affected during implementation of the action. As each alternative presents some level of risk to those indicators, risk levels are represented by minus symbols in the table, with multiple minus symbols representing increased levels of risk (Table 4-1).

Table 4-1) Definitions of symbology used to evaluate impacts from alternatives "during the action." The "action" refers to timber harvest activities associated with each alternative. A summary of these ratings for each alternative by resource indicator is included at the beginning of each resource section in Chapter 4.

Symbol	Definition
–	The lowest level of risk associated with any of the alternatives.
– –	Intermediate level of risk that is somewhere between the lowest and highest levels of risk associated with other alternatives.
– – –	The highest level of risk associated with any of the alternatives.
NA	Indicates that the indicator could not be evaluated in this manner, either because the resource indicator will not be affected by the action, regardless of alternative, or it is better suited to evaluating the outcome of the action which could vary between alternatives.

After Action – Resilience of Indicator to Disturbance: Relative to the other alternatives, this is the perceived effectiveness of the given alternative at addressing the resistance and resilience of an indicator to disturbance after the action is complete. The term "disturbance" was used in reference to wildland fire, pest and pathogen outbreaks, and climate change. Assessing the effectiveness of an alternative at addressing forestland resilience and resistance to disturbance was based on the management objectives of each alternative. It was assumed that alternatives that were designed to return Tribal forestlands to pre-settlement conditions over a shorter period would be more effective at increasing the resilience and resistance of Tribal forestlands to disturbance and at mitigating against any severe impacts that may be the result of future disturbance. As each alternative will result in some level of improvement in forest resistance and resilience, improvement levels are represented by plus symbols in the table, with multiple plus symbols representing increased levels of improvement (Table 4-2).

Table 4-2) Definitions of symbology used to evaluate impacts from alternatives "after the action." The "action" refers to timber harvest activities associated with each alternative. A summary of these ratings for each alternative by resource indicator is included at the beginning of each resource section in Chapter 4.

Symbol	Definition
+	The lowest level of improvement in forest resistance and resilience to disturbance associated with any of the alternatives.
+ +	Intermediate level of improvement of forest resistance and resilience is somewhere between the lowest and highest levels of improvement associated with other alternatives.
+ + +	The highest level of improvement in forest resistance and resilience to disturbance is associated with any of the alternatives.
NA	Indicates that the indicator could not be evaluated in this manner, either because the resource indicator will not be affected by the action, regardless of alternative, or it is better suited to evaluating impacts that are expected to occur during the implementation of the alternatives.

4.2 ALTERNATIVE IMPACTS TO ENVIRONMENTAL RESOURCES

Given the broad scale of the proposed action, this document does not address the effects of any one action that is to occur at a specific time or location. Therefore, this section will focus on the general direct, indirect, and cumulative effects that forest management typically has on environmental resources and those effects will be discussed in terms of the indicators that were identified for each resource in the 2022 IRMP EIS. A summary of effects can be found at the beginning of each resource section.

4.2.1 Alternative Impacts on Land Resources

The general effects that the proposed alternatives are expected to have on land resources across the Nez Perce Reservation are summarized below in Table 4-3. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-3) A summary of the general effects that the proposed alternatives are expected to have on soil resource indicators. Refer to section 4.1 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF	Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF
Soils	**Soil Retention**	X	–	– –	–	– – –	+	+ +	+	+ + +
	Soil Development	X	–	– –	–	– – –	+	+ +	+	+ + +
	Soil Quality	X	–	– –	–	– – –	+	+ +	+	+ + +

4.2.1.1 Soils

Activities associated with forest management, specifically timber harvests, have a range of impacts on soil properties and various forest ecosystem components that are related to soil productivity. In general, these impacts often concern soil retention, development, and quality. Impacts to soils can range in severity depending on the type and scope of harvest activities implemented as well as the mitigation practices that are utilized to address such impacts. The proposed alternatives include similar harvest activities and practices, but some differ in scale and intensity, much like the impacts that each could have on soil resources.

4.2.1.1.1 Direct Effects

Soil quality can be directly affected by activities that result in mechanical damage, such as rutting and compaction. Rutting and compaction often occur during commercial timber harvests, but the risk for these impacts can be higher with tractor logging as soil can be severely disturbed by wheeled and tracked equipment. Across a harvest unit, rutting and compaction are most likely to occur where skidding, forwarding, and yarding activities are concentrated as well as where roads and landings are constructed. In some cases, up to one third of the harvest unit may be disturbed by such equipment. A study conducted in central Idaho found that crawler and rubber-tired tractors disturbed 29% and 34% of the total area within two different harvest units (Clayton 1990 as cited in Nyland 2002).

Consequently, forest management activities that involve timber harvesting are likely to result in some level of rutting, soil compaction, and erosion where harvest activities are focused. The severity of these impacts and risk for such impacts are expected to vary between alternatives because of differences in harvest intensity and scale. For instance, multiple studies have found that most compaction occurs, on previously undisturbed soils, during the first three passes by heavy equipment (Aust et al. 1993, McKee et al. 1995, and Guo and Karr 1989 as cited in Nyland 2002) with one study demonstrating that compaction may not be maximized until six or more passes occur (Guo and Karr 1989 as cited in Nyland 2002). Alternatives that entail more intense or extensive harvest operations would disturb soil over a larger area and increase impacts to soils in high use areas. Such impacts are likely to increase the risk of erosion, particularly in areas where erosion hazards are higher. Consequently, the risk of rutting, soil compaction, and erosion may be greater under alternatives that involve higher intensity timber harvests.

In addition to harvest method and land type, the severity of soil disturbances is further dictated by the presence of an ash-cap (Froehlich et al. 1985; Johnson et al. 2007 as cited in Gier et al. 2018). Ash-cap soils have a low bulk density which makes them highly susceptible to compaction. The use of tracked or wheeled tractors for the purposes of forest management may cause significant increases in ash-cap soil bulk density in moderately and heavily trafficked areas (Cullen et al. 1991 as cited in Gier et al. 2018). The low bulk density of ash-cap soils also makes them highly susceptible to wind and water erosion when vegetative cover is removed (Arnalds et al. 2001; Kimble et al. 2000 as cited in Grier et al. 2018). Issues with erosion stemming from forest management activities may be exacerbated in areas where ash-cap soils are present, and a site has been highly disturbed. This is also the case for soils that are more fragile or more susceptible to erosion, as discussed in section 3.1.1, as they may destabilize more rapidly as harvest activity levels increase.

Effects to soils that result from future harvest activities are not expected to be different from those that have already occurred on the Reservation as harvest activities would be conducted in a comparable manner. However, the risk of more severe impacts during harvest activities may be higher or lower depending on the pace and total volume removed under the selected alternative. For instance, risk may be the highest under Alternative E due to the fast pace and high harvest volume which would likely entail more entries and passes by heavy equipment while risk may be the lowest under Alternatives A and D because of the slow pace and lower harvest volume. Even though the risk for more severe impacts is variable between alternatives, such impacts to soils would likely be mitigated through the implementation of BMPs (BMPs for soils are included in *Section 9.3 of the Nez Perce FMP*).

4.2.1.1.2 Indirect Effects

Over time, soil retention can be negatively affected by timber harvest activities as skidding, yarding, and road construction can all become factors for soil loss from a harvest site by means of erosion. Wheeled and tracked logging equipment can remove the organic surface layer and disturb (churning, mixing, compacting, and displacing) underlying mineral soils (Nyland 2002). The exposure of mineral soils through mechanical disturbance increases the risk of soil erosion and loss from a harvest site. Soil compaction can also increase the risk of soil erosion. Compaction reduces infiltration and percolation which can result in increased rates of surface runoff and erosion (Nyland 2002). These effects can be exacerbated on steep slopes, in areas where mineral soil has been exposed, and in areas where fragile soils, more erodible soils, or ash-cap soils are present.

Soil development may be affected over time because of the influence that timber harvests can have on soil organic matter, coarse woody debris, and nutrient cycling. Depending on the stand conditions, harvest conditions, harvest method, and method of site preparation, impacts to soil organic matter, coarse woody debris, and nutrient availability can either be beneficial or detrimental and last from a few years to several decades.

Disturbances from timber harvest can have positive and negative effects on soil organic matter. Disturbances can increase the amount of soil organic matter within a harvest area for the first few years after harvest (Packer and Williams 1976, Cromack et al. 1979 as cited in Jurgensen et al. 1997). Elevated levels of soil organic matter decrease as the new stand develops (Kraemer and Hermann 1979, Durgin 1980 as cited in Jurgensen et al. 1997). Conversely, losses of organic matter from the forest floor and mineral soil following timber harvesting can also be accelerated due to increased levels of microbial activity (Hendrickson et al. 1982 as cited in Jurgensen et al. 1997). Increased microbial activity, which is often the result of increased soil moisture, temperature, and alkalinity after harvesting, increases the rate of organic matter decomposition, especially if fire is used to treat slash (Hungerford 1980, Jurgensen et al. 1981, 1982 as cited in Jurgensen et al. 1997).

Losses of organic matter and the use of fire for site preparation can also result in the removal of nitrogen from the soil. Nitrogen, which is required for tree growth, is usually the limiting nutrient in western forests (Binkley 1991, Miller et al. 1991, Moore et al. 1994 as cited in Jurgensen et al. 1997) and its presence in mineral soil is proportional to the quantity of soil organic matter. Any activity that results in losses of soil organic matter will also result in losses of soil nitrogen.

Soils that have been compacted during forest management operations may require decades to return to pre-disturbance levels (Froehlich et al. 1985; Sands et al. 1979; Tiarks and Haywood 1996 as cited in Gier et al. 2018). One factor that influences the rate of recovery for affected soils is the presence of an ash-cap (Froehlich et al. 1985; Johnson et al. 2007 as cited in Gier et al. 2018). Ash-cap soils have very low bulk densities which make them much more susceptible to compaction and slow to recover from such impacts (Grier et al. 2018). Through time, such impacts could contribute to increased puddling, increased rates of erosion, and decreased site productivity.

Ash-cap soils are also highly susceptible to wind and water erosion when vegetation is removed, or soils are disturbed (Arnalds et al. 2001; Kimble et al. 2000 as cited in Gier et al. 2018). Through time, erosion issues resulting from forest management activities may be more persistent or more sensitive on sites with ash-cap soils and risk for erosion is likely to increase as more vegetative cover is removed or as a greater portion of the litter layer is lost.

Through time, forest management practices can serve as a form of mitigation against negative impacts to soils from disturbance. For instance, a reduction in fuel loading can reduce the risk for high intensity wildfires which can cause long-term damage to soils. Elevated temperatures (> 120 °C) can result in the volatilization of nutrients, the break down in soil aggregate stability, an increase in bulk density, decreased water infiltration, increased erosion, and the destruction of soil biota (Agbeshie et al. 2022). A reduction in the risk for severe wildfire, through forest management, can improve the likelihood that soil quality and development would be maintained on a site and that soil losses after a fire, in the form of erosion from heavy precipitation, would be minimized.

Effects on soil resources are expected to be variable across alternatives. The risk for long-term negative impacts to soils resulting from harvest activities are expected to be higher under Alternatives with faster harvest paces and higher harvest volumes (Alternatives C and E). However, the long-term benefits to soils resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster pace Alternatives with higher harvest volumes are expected to serve as more effective forms of mitigation against severe impacts to soils from future disturbance events.

4.2.1.1.3 Cumulative Effects

Timber harvest activities would contribute to cumulative effects from other activities or projects that affect soil retention, development, and quality. Depending on the nature of other projects or activities that may overlap future timber harvests in time or space, effects from timber harvests may further exacerbate negative and/or positive effects to soil resources across the Reservation or they may be offset by other projects and activities that affect soil resources in other ways. For instance, contributions to negative soil cumulative effects may occur during the implementation of forest management activities (e.g., soil compaction, rutting, erosion, etc.) while contributions to positive cumulative effects may occur after forest management activities have been completed and risk to soils from severe negative impacts from disturbance has been reduced. Specific cumulative effects may be determined once the timing and location of forest management activities is scheduled and any projects that overlap those activities in time or space are identified.

Overall, contributions to cumulative effects are expected to be greater as harvest pace and target harvest volume increase. Alternatives A and D would be associated with the smallest contributions, Alternative C would be associated with a moderate increase in contributions, and Alternative E would be associated with the largest increase in contributions to cumulative effects.

4.2.2 Alternative Impacts on Water Resources

Activities associated with forest management can affect the quality of water resources that are within or adjacent to managed areas. Impacts on water resources can be detrimental, but the most harmful impacts are often mitigated through the implementation of Best Management Practices (BMPs). Forest management activities conducted by the Tribe adhere to BMPs which ensure an elevated level of resource protection. As such, the most severe impacts to water resources that would only occur outside of the guidance of BMPs will not be discussed.

The general effects that the proposed alternatives are expected to have on water resources, during the action and after the action, across the Nez Perce Reservation are summarized below in Table 4-4. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-4) A summary of the general effects that the proposed alternatives are expected to have on water resource indicators. Refer to section 4.2 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMB F	Alt C – 6.7 MMB F	Alt D – 4.8MMB F	Alt E – 8.2 MMB F	Alt A – 4.8 MMB F	Alt C – 6.7 MMB F	Alt D – 4.8MMB F	Alt E – 8.2 MMB F
Streams	**Surface Water Quality**	X	–	– –	–	– – –	+	+ +	+	+ + +
Wetland / Riparian Zones	**Wetland Function**	X	–	– –	–	– – –	+	+ +	+	+ + +
	Wetland Resilience to Climate Change	X	NA	NA	NA	NA	+	+ +	+	+ + +
Groundwater	**Ground Water Quality**	X	–	– –	–	– – –	+	+ +	+	+ + +

4.2.2.1 Streams

4.2.2.1.1 Direct Effects

Direct effects to stream water quality from forest management activities can include surface erosion, the introduction of debris into stream channels, and contamination from chemicals and hazardous materials. Surface erosion can occur when mineral soil is exposed or compacted because of harvest activities. The introduction of some woody debris in stream channels is beneficial for fish and other aquatic species, but the deposition of excessive amounts of woody debris and other organic matter into stream channels can cause blockages and subsequent flash flooding and erosion. Mechanized logging operations can also be a source for chemical and hazardous waste spills as much of the equipment used for harvesting requires the use of gas, diesel fuel, oil, and other hazardous chemicals.

Effects to streams from the proposed alternatives are not expected to be different from those that have already occurred on the Reservation from similar forest management practices. BMPs would be implemented, regardless of which alternative is selected, so it is expected that any impacts that do occur would be minimal in severity and scope. Additionally, buffers would also be established in stream corridors to further mitigate impacts from forest management. The risk for more severe impacts to streams from timber harvest operations may be higher or lower depending on the pace and total volume removed under the selected alternative. For instance, risk may be the lowest under Alternatives A and D because of the slow pace and lower harvest volume, risk may increase moderately under Alternative C as harvest scale and pace are intermediate, while risk may be the highest under Alternative E due to the fast pace and high harvest volume.

4.2.2.1.2 Indirect Effects

Indirect effects to stream water quality from forest management activities can include mineral sedimentation, the addition of solid materials, and changes in water temperature. Mineral sedimentation can include nutrient runoff from fertilizers or other chemicals applied to a site. The introduction of solid materials into waterways concerns products of erosion, including particulate and sediment, which can continue to enter a stream when the site is subjected to heavy runoff. The removal of trees, in excess, from along stream corridors can result in the long-term warming of affected streams. The warming of streams is associated with lower water quality, and those problems often persist until streamside vegetation recovers and begins to provide shade again which can take decades.

Effects to streams are expected to be variable across alternatives. The risk for long-term negative impacts to streams and surface water quality resulting from harvest activities are expected to be higher under Alternatives with faster harvest paces and higher harvest volumes (Alternatives C and E). However, the long-term benefits to streams resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster pace Alternatives with higher harvest volumes are expected to serve as more effective forms of mitigation against severe impacts on water resources from future disturbance events, such as high intensity wildfires.

4.2.2.1.3 Cumulative Effects

The proposed alternatives would contribute to cumulative effects from past, current, and future projects, both on and off the Reservation, that concern the distribution of vegetation. At the sub-watershed level, cumulative effects from such projects have the potential to alter peak flow, increase rates of stream sedimentation, influence water temperature, and alter the risk of future negative impacts to streams from disturbance events. However, the timing and location of other potential projects that may overlap the implementation of the proposed alternatives in time and space is unknown. Therefore, specific water resource cumulative effects that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown.

Overall, contributions to cumulative effects are expected to be greater as harvest pace and target harvest volume increase. Alternatives A and D would be associated with the smallest contributions, Alternative C would be associated with a moderate increase in contributions, and Alternative E would be associated with the largest increase in contributions to cumulative effects.

4.2.2.2 Wetland/Riparian Areas

4.2.2.2.1 Direct Effects

Direct effects to wetland/riparian areas from forest management activities can negatively affect water quality by reducing the functionality of such areas. The implementation of BMPs often minimizes the risk for such impacts, but forest management operations that occur in proximity to wetland/riparian can expose mineral soil near the water, disturb the bottoms and banks of adjacent streams and rivers, degrade vegetation, compact soils, and damage other features of ecologic importance (Nyland 2002). Such impacts can immediately impede the ability of a wetland/riparian area to temper the movement of water, solid materials, and nutrients into nearby water systems.

Conversely, forest management can be used to improve and establish buffers along wetland/riparian areas. Management activities can be used to promote the growth of desirable vegetation that shades and stabilizes areas that are adjacent to wetlands/riparian areas as well as treat or mitigate the effects of invasive species that may be detrimental to such areas.

As BMPs would be implemented regardless of which alternative is selected, effects to wetland/riparian areas from the proposed alternatives are not expected to be much different from those that have already occurred on the Reservation from similar forest management practices. Additionally, buffers would also be established in wetland/riparian areas to further mitigate impacts from forest management as harvest activities would be excluded from those areas. Consequently, any impacts that do occur are expected to be minimal in severity and scope.

The risk of more severe impacts may be higher or lower depending on the pace and total volume removed under the selected alternative. For instance, risk may be the highest under Alternative E due to the fast pace and higher harvest volume while risk may be the lowest under Alternatives A and D because of the slow pace and lower harvest volume. Even though the risk for more severe impacts, such as the disturbance of substrate and the degradation of vegetation, is variable between alternatives, such impacts would be mitigated through the implementation of BMPs.

4.2.2.2.2 Indirect Effects

Indirect effects to wetland/riparian areas from forest management activities largely concern the loss of function of such areas and the resulting impacts to water systems. Compacted soils, degraded vegetation, exposure of mineral soil, and the expansion of road systems within and adjacent to riparian/wetland areas can result in increased runoff and higher rates of sedimentation in adjacent water systems. The compaction of soils and loss of vegetation reduces rates of infiltration and transpiration, respectively, within riparian/wetland areas which can result in higher levels of surface runoff. Higher volumes of surface runoff and reduced levels of infiltration often result in more nutrients and solid materials entering nearby water systems. This can be particularly problematic in places where bare mineral soil has been exposed.

Impacts to wetland/riparian areas from forest management activities are mostly mitigated through the implementation of BMPs. However, some activities, such as road construction, can indirectly affect riparian/wetland areas by increasing the levels of soil disturbance, increasing surface runoff, and decreasing rates of infiltration within a watershed. Dense road systems can increase the total volume of surface runoff entering riparian/wetland areas and increases the risk for sedimentation in adjacent water systems.

Long term effects from forest management may also be beneficial to wetland/riparian areas. For instance, a reduction in fuel loading may serve to protect wetland/riparian areas from negative impacts that can result from severe wildfires. High intensity wildfires are often stand-replacing and elevated temperatures can cause damage to soil. Areas affected by high severity wildfires, in which vegetation mortality and soil damage are extensive, are often associated with high rates of surface runoff and erosion which can degrade wetland/riparian areas function through sedimentation and the introduction of other debris.

Effects to wetland/riparian areas are expected to be variable across alternatives. The risk for long-term negative impacts to wetland/riparian areas resulting from harvest activities are expected to be higher under Alternatives with faster harvest paces and higher harvest volumes (Alternatives C and E). However, the long-term benefits to wetlands/riparian areas resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster pace Alternatives with higher harvest volumes are expected to serve as more effective forms of mitigation against severe impacts to water resources from future disturbance events, such as high intensity wildfires.

4.2.2.2.3 Cumulative Effects

It is expected that the proposed alternatives would contribute minimally to cumulative effects from past, current, and future projects, both on and off the Reservation, that affect wetland/riparian areas. Forest management activities can have various direct and indirect effects on wetland/riparian areas, as described above, but such effects are often mitigated through the implementation of BMPs. Although cumulative effects cannot be described specifically, as it is unknown if any other projects would overlap the proposed alternatives in time and/or space, it is expected that contributions from the proposed alternatives would be minimal and not substantially different from those that have occurred because of past or current forest management practices.

Contributions from the proposed alternatives to wetland/riparian cumulative effects are expected to be similar, regarding both type and severity, from those that have already occurred on the Reservation because of recent forest management activities. Additionally, BMPs would be implemented under the selected alternative so any contributions from the proposed alternatives are not expected to be substantive. However, contributions could be greater under alternatives with higher target harvest volumes as the risk of more severe impacts would likely increase.

4.2.2.3 Groundwater

4.2.2.3.1 Direct Effects

It is unlikely that forest management activities would have any direct effects on groundwater, especially when BMPs are implemented. Potential impacts largely include indirect effects which concern the long-term effects of soil compaction, increased surface runoff, nutrient leaching, degraded conditions in wetland and riparian areas, and chemical leaching.

As BMPs would be implemented regardless of which alternative is selected, effects to groundwater from the proposed alternatives are not expected to be much different from those that have already occurred on the Reservation from similar forest management practices. Additionally, buffers would also be established in stream corridors to further mitigate impacts from forest management as harvest activities would be excluded from those areas. Consequently, any impacts that do occur are expected to be minimal in severity and scope.

The risk of more severe impacts may be higher or lower depending on the pace and total volume removed under the selected alternative. For instance, risk may be the highest under Alternative E due to the fast pace and high harvest volume while risk may be the lowest under Alternatives A and D because of the slow pace and lower harvest volume. Even though the risk for more severe impacts, such as the disturbance of substrate and the degradation of vegetation, is variable between alternatives, such impacts would be mitigated through the implementation of BMPs.

4.2.2.3.2 Indirect Effects

Forest management activities can indirectly affect groundwater quality through soil compaction, damage to riparian and wetland areas, and chemical leaching. Soil compaction can increase rates of surface runoff which can result in erosion and chemical leaching. Leached nutrients and chemicals then enter and pollute adjacent waterbodies and, subsequently, groundwater. Damage to riparian and wetland areas exacerbates this effect as these areas become less effective at tempering the movement of surface water and nutrients into water systems.

Forest management activities may also expose groundwater to hazardous chemicals through accidental spills and applications of herbicides. Chemicals that are spilled or applied to the site may enter the soil and leach into nearby water systems. However, these impacts can be mitigated through the implementation of BMPs which can dictate cleanup procedures for hazardous chemical spills as well as outline methods for herbicide application that minimize the exposure of water systems to chemicals.

Long term effects from forest management may also be beneficial to groundwater resources. For instance, a reduction in fuel loading may serve to protect streams, wetland/riparian areas, and other surface water from negative impacts that can result from severe wildfires. High intensity wildfires with often stand-replacing and elevated temperatures can damage soils. Areas affected by high severity wildfires, in which vegetation mortality and soil damage are extensive, are often associated with high rates of surface runoff and erosion which can degrade surface water and, subsequently, groundwater.

Effects on groundwater are expected to be variable across alternatives. The risk for long-term negative impacts to groundwater quality resulting from harvest activities is expected to be higher under Alternatives with faster harvest paces and higher harvest volumes (Alternatives C and E). However, the long-term benefits to groundwater quality resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster pace Alternatives with higher harvest volumes are expected to serve as more effective forms of mitigation against severe impacts on water resources from future disturbance events, such as high intensity wildfires.

4.2.2.3.3 Cumulative Effects:

It is expected that the proposed alternatives would contribute minimally to cumulative effects from past, current, and future projects, both on and off the Reservation, that affect groundwater resources. Effects on groundwater from forest management activities are often indirect, as described above, but such effects are often mitigated through the implementation of BMPs. Although cumulative effects cannot be described specifically, as it is unknown if any other projects would overlap the implementation of the proposed alternatives in time and/or space, it is expected that contributions from the proposed alternatives would be minimal and not substantially different from those that have occurred because of past or current forest management practices.

Contributions from the proposed alternatives to groundwater cumulative effects are expected to be similar, regarding both type and severity, from those that have already occurred on the Reservation because of recent forest management activities. Additionally, BMPs would be implemented so any contributions from the proposed alternatives are not expected to be substantive. However, contributions could be greater under alternatives with higher target harvest volumes as the risk of more severe impacts would likely increase.

4.2.3 Alternative Impacts on Air Resources

The magnitude of effects that the proposed alternatives are expected to have on air resources across the Nez Perce Reservation are summarized below in Table 4-5. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-5) A summary of the general effects that the proposed alternatives are expected to have on air resource indicators. Refer to section 4.2 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF	Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF
Pollutants	**PM2.5 and PM10**	X	–	– –	–	– – –	+	+ +	+	+ + +
	Ozone	NA	–	– –	–	– – –	+	+ +	+	+ + +
	Hazardous Air Pollutants (HAPS)	NA	–	– –	–	– – –	+	+ +	+	+ + +

4.2.3.1 Pollutants

4.2.3.1.1 Direct Effects

Forest management activities would directly affect air pollution levels on the Reservation through the release of emissions from prescribed burning, vehicles, and other equipment used to harvest, transport, and process timber. Prescribed burning would directly influence levels of PM2.5 emissions. Total emissions of PM2.5 would increase as the total volume of treated slash increases. Therefore, it is expected that Alternatives with higher target harvest volumes would be associated with higher total quantities of PM2.5 emissions. In addition to higher target harvest volumes, alternatives with accelerated prescribed burning schedules may also be associated with higher concentrations of emissions as more slash would be treated over a shorter period.

Under slower paced alternatives with lower annual target harvest volumes (Alternatives A and D) it is assumed that there would be little to no change in emissions from past forest management activities. Conversely, alternatives that concern the removal of more volume from forestlands over a shorter period (Alternatives C and E) would likely account for increased levels of emissions.

4.2.3.1.2 *Indirect Effects*

Forest management and the treatment of hazardous fuels can reduce the risk for catastrophic wildfires which degrade air quality to levels that are harmful to human populations. Long-term forest management strategies can contribute to efforts that concern the protection of local air quality through the mitigation of fuels that can become a source of pollutants when they are consumed by wildfire. Management activities, such as those described under each management alternative, reduce the volume of fuel that is available for wildfire consumption and potentially reduce the impact of emissions from local wildfires on the Reservation. This also has implications for climate change as prescribed burning treats understory fuels and promotes forest conditions that are conducive to low intensity surface fires and that reduce the likelihood of a substantial release of carbon because of catastrophic wildfire.

Through time, emissions from vehicles and prescribed burning could result in the production of ground-level ozone. Ground-level ozone is most likely to reach unhealthy levels on hot sunny days.

Although the total level of harvest-related emissions may be higher under faster paced alternatives with higher annual target harvest volumes, the long-term benefits to air quality resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) are expected to serve as more effective forms of mitigation against severe impacts to air quality from future disturbance events, such as high intensity wildfires, than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.3.1.3 *Cumulative Effects*

The proposed alternatives would likely contribute to air quality cumulative effects that concern emissions from prescribed fire, vehicles, facilities, and machinery as well as potential emissions release from high intensity or catastrophic wildfires on the Reservation. All vehicles, facilities, and machinery associated with the proposed alternatives would release emissions as timber resources are harvested and processed, with increased emissions under alternatives with higher target harvest volumes (Alternatives C and E). However, the proposed alternatives may also contribute to cumulative effects that protect future air quality by reducing the amount of available fuel for wildland fire and reducing the risk of substantive emissions release from high intensity or catastrophic wildfires.

The timing and location of other potential projects that may overlap the proposed alternatives in time and space are unknown. Therefore, specific air quality cumulative effects that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, the contribution to cumulative effects from forest management activities are expected to vary between action alternatives as some entail different levels of harvest intensity. It is assumed that there would be no change in contributions to vehicle, facility, and machinery emissions cumulative effects under alternatives with the lowest target harvest volumes (Alternatives A and D) while contributions are expected to increase under alternatives with higher target harvest volumes (Alternatives C and E).

Forest management that results in a reduction of available fuels may influence the effects of a future wildfire if it were to occur. A reduction in available fuels may reduce the risk of high intensity or catastrophic wildfires which can account for a substantial release of emissions over a short period of time. Therefore, the proposed alternatives may contribute to cumulative effects that concern the protection of future air quality.

4.2.4 Alternative Impacts on Biological Resources

The effects that the proposed alternatives are expected to have on biological resources across the Nez Perce Reservation are summarized below in Table 4-6. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-6) A summary of the general effects that each action alternative is expected to have on biological resource indicators. Refer to section 4.1 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF	Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF
Wildlife	Fish Special Status Species	X	–	– –	–	– – –	+	+ +	+	+ + +
	Fish Habitat Function	X	–	– –	–	– – –	+	+ +	+	+ + +
	Wildlife Special Status Species	X	–	– –	–	– – –	+	+ +	+	+ + +
	Wildlife Habitat Function	X	–	– –	–	– – –	+	+ +	+	+ + +
Vegetation	Plant Special Status Species	X	–	– –	–	– – –	+	+ +	+	+ + +
	Plant Habitat Function	X	–	– –	–	– – –	+	+ +	+	+ + +
Ecosystems & Biological Communities	Forest Health	NA	+	++	+	+++	+	+ +	+	+ + +
	Wildland Fire Management	NA	NA	NA	NA	NA	+	+ +	+	+ + +
Agriculture	Crop Production	X	–	–	–	–	NA	NA	NA	NA
	Forage Quality	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Grazing Opportunities	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2.4.1 Wildlife

Select wildlife species were chosen to be the focus of the analysis as the success of those species, post-action, is expected to be indicative of the condition of the affected habitat under each action alternative. These "indicator species" include species that are present when the forest habitat types found on the Reservation are intact and exhibit qualities that would be expected to develop under a regime of natural disturbances. As these species are affected by habitat quality it is also reasonable to assume that changes in habitat use by indicator species, post-action, is an indication that other species associated with the same forest types have also been affected. For instance, the continued success of an indicator species would suggest that the habitat is suitable for most species associated with that habitat type while declining populations or absence of indicator species would suggest that habitat quality has decreased, and that other species have likely been negatively affected as well.

The anticipated effects to indicator species from the proposed alternatives are described in this section. Indicator species and their associated habitat types are listed in Table 6-6 and a summary of the impacts of forest management under each alternative is included in Table 6-7. Detailed descriptions of each species and additional resources related to forest management practices are in section 6.4 (Wildlife Indicator Species).

4.2.4.1.1 Direct Effects

Direct effects to wildlife from forest management activities often concern disruptions to behaviors, changes in the ways that wildlife species interact with available habitat, and direct mortality during operations. Management activities that involve the use of vehicles, heavy equipment, chainsaws, or any other equipment or machines that generate noise or light can disrupt the behaviors of various wildlife species. These types of disruptions can be particularly problematic when they interfere with reproduction, or they encroach upon a nest, den, or other location that is used to rear offspring. Such effects are expected to vary across action alternatives as each entails different harvest levels that will produce noise, light, and other disruptions that are proportional to the scope and intensity of the methods used to achieve management objectives.

Additionally, forest management activities often have direct effects on wildlife through the manipulation of habitat. Forest management often entails the manipulation of vegetation to achieve objectives that concern resource conservation, economic gains, or a balance of both. Depending on the management strategies implemented, habitat may be immediately unavailable for use by wildlife, especially if habitat is removed from productivity in favor of an alternative use such as transportation. Other impacts may include the loss of cover, changes in the distribution of available forage, loss of functional habitat within a home range, the destruction of nests or other features used for shelter or reproduction, and other impacts that may immediately displace or disrupt wildlife. Although a certain level of disruption is expected to result from all types of forest management activities, immediate impacts to wildlife from the manipulation of vegetation would vary depending on the action alternative that is selected as some entail higher levels of timber harvest (Alternatives C and E). For instance, surface runoff may increase as more timber is removed from harvest areas which could result in higher levels of sedimentation in adjacent waterways and more substantive impacts to fish and fish habitat.

Forest management operations may also result in the direct mortality of wildlife. For example, mortality may occur as heavy equipment and vehicles maneuver within a harvest unit or as logs and other heavy objects are moved and manipulated. Prescribed fire may also result in the mortality of some individuals.

Direct effects to existing special status species are expected to be similar across all action alternatives due to existing federal laws. The Federal Endangered Species Act requires that all sensitive, threatened, and endangered species be considered, and, in some cases, efforts must be made to detect such species if it is reasonable to suspect that they may be affected by the proposed alternatives. Such protections/protocol may even extend to critical habitat types that support sensitive species.

Anticipated effects from the proposed alternatives, as described above, are expected to be variable across action alternatives. Effects to wildlife resources are expected to be similar to current levels under action alternatives with target harvest volumes that match the status quo (Alternatives A and D). Levels of disruptions to behaviors and manipulation of habitat are not expected to be significantly different from levels associated with previous forest management activities. However, as target harvest volume increases and more standing timber is removed from forested areas, it is likely that disruptions to behaviors would be prolonged and more widespread and changes to habitat would be more substantial (Alternatives C and E).

Direct and indirect effects to special status species from forest management activities are not expected to be detrimental as state and federal regulations are already in place that provide a standard level of protection to such species. However, risk to undetected individuals or populations could be variable across alternatives. Alternatives with higher target harvest volumes (Alternatives C and E) may present higher levels of risk concerning the loss or displacement of undetected special status species within the affected area. It is assumed that disturbances from the proposed alternatives would be prolonged and more widespread under alternatives with higher target harvest volumes.

4.2.4.1.2 Indirect Effects

Forest management activities often have indirect effects on wildlife as actions that manipulate vegetation also influence successional pathways and, therefore, the composition and quality of wildlife habitat. Through time, management activities would likely affect the way that wildlife species use and interact with their environment, which could be beneficial for some species and non-beneficial or detrimental for others. Across the reservation, habitat may become more or less suitable for different species of wildlife depending on the priorities of management objectives and the scope and intensity of habitat manipulation.

Management efforts focused on the restoration of forests and forest conditions conducive to the success of native species may have negative effects on wildlife initially, but the return of pre-settlement conditions is expected to be beneficial to native wildlife species, including the selected indicator species. Over time, changes in stand structure and species composition and the return of a historic fire regime should support DFCs and promote the success of desired wildlife species. Additionally, mitigation of future disturbances, specifically catastrophic wildfire, should help to maintain DFCs and protect habitat, both terrestrial and aquatic, that is essential to the sustainability of native wildlife populations.

Effects on wildlife are expected to be variable across alternatives. The risk for negative impacts to wildlife resulting from harvest activities are expected to be higher under Alternatives with faster harvest paces and higher harvest volumes (Alternatives C and E). However, the long-term benefits to wildlife resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster paced Alternatives with higher target harvest volumes are expected to serve as more effective forms of forest restoration and mitigation against severe impacts to wildlife from future disturbance events. Mitigation of high-impact disturbances, such as catastrophic wildfire, would be conducive to the maintenance of pre-settlement conditions as well as habitat for wildlife species as those communities would be sustained by frequent, low severity and mixed severity wildfires. This is also reflected in the indicator species assessment.

4.2.4.1.3 Cumulative Effects

In conjunction with any future projects that may overlap the proposed alternatives in time or space, the selected alternative would likely contribute to cumulative effects that include, but are not limited to, gains and losses of habitat, disruptions to wildlife behaviors, potential losses of individual organisms, mitigation of wildland fuels, and promotion of forest health. However, contributions to cumulative effects are expected to be variable across action alternatives as management strategies that entail higher intensity timber harvests would likely result in a greater level of disturbance to wildlife and greater contributions to cumulative effects.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to wildlife resources from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to wildlife resource cumulative effects from the proposed alternatives, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest target harvest volume (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management. While contributions, both desirable and undesirable, are expected to be greater under alternatives with higher target harvest volumes (Alternatives C and E). For instance, Alternatives C and E would result in more rapid changes to habitat and habitat distribution, increased disruptions to wildlife behavior, and increased risk of the loss of individual organisms, but may contribute to greater reductions of wildland fuels and present more opportunities for forest health improvements.

4.2.4.2 Vegetation

4.2.4.2.1 Direct Effects

Forest management activities have various direct effects on vegetation within and adjacent to affected areas. Vegetation is often damaged or destroyed by equipment or chemicals used to perform management activities and the distribution of vegetation across a site often changes as vegetation is removed, planted/seeded, or incidentally transported by vehicles, machinery, tools, clothing, shoes, etc. However, these effects tend to be negligible as they often concern common plant species that are found throughout the greater management area. However, such impacts can be substantial when they concern special status species such as those that are classified as sensitive, threatened, endangered, or invasive. Unless a site has been surveyed, forest management activities can inadvertently lead to the loss of sensitive, threatened, or endangered species and/or the spread and establishment of invasive species.

Anticipated effects from the proposed alternatives, as described above, are expected to be variable across action alternatives. Effects on vegetation are not expected to be much different from levels associated with previous forest management activities under action alternatives with the lowest target harvest volumes (Alternatives A and D). However, as target harvest volume increases and more standing timber is removed from forested areas, it is likely that disturbances would be more intense and widespread and that changes to the distribution and composition of vegetative communities could be more substantial (Alternatives C and E).

Effects to special status species are expected to be similar across action alternatives and similar to those associated with previous forest management practices because of existing state and federal laws. Such laws would ensure the standardization of measures taken to detect and address special status species as needed. However, it would be assumed that as the footprint of disturbed areas increases, the risk of damage to or loss of undetected groups or individuals belonging to special status species groups would also increase. Additionally, as more activity occurs within a harvest area, as would be expected under Alternatives with higher target harvest volumes (Alternatives C and E), the risk for the spread of invasive species would also increase.

4.2.4.2.2 Indirect Effects

Indirect effects to vegetation from forest management often concern changes in vertical and horizontal stand structure, species composition and distribution, and the prevalence of insects and diseases. When conducted appropriately, forest management often resembles natural disturbance and promotes forest function and health. However, such actions can also result in the loss of undetected sensitive, threatened, and endangered species and/or the spread of invasive species which can rapidly displace native species and degrade habitat. The loss of species diversity and changes in ecosystem function can have other far-reaching effects that concern other ecological components, such as wildlife, hydrology, and wildfire, which can further affect vegetative communities.

Indirect effects from forest management activities may also include desirable outcomes that support species diversity and ecosystem function through the protection of native species and special habitat-types. For instance, management activities may be aimed at the protection or creation of unique habitat-types through treatments that address invasive species or treatments that address overstocked conditions in the interest of mitigating risk of catastrophic wildfires.

Effects on vegetation are expected to be variable across alternatives. The risk for negative impacts to vegetation resulting from harvest activities are expected to be higher under Alternatives with faster harvest paces and higher harvest volumes (Alternatives C and E). However, the long-term benefits to vegetation resulting from the increase in forest resilience and resistance to disturbance are also expected to be higher. Faster paced Alternatives with higher target harvest volumes are expected to serve as more effective forms of mitigation against severe impacts to vegetation from future disturbance events. Mitigation of high-impact disturbances, such as catastrophic wildfire, would likely be conducive to maintaining desirable plant communities within Tribal forestlands as those communities would be sustained by frequent, low severity and mixed severity wildfires.

4.2.4.2.3 Cumulative Effects

Forest management activities often contribute to cumulative effects concerning the distribution of both desirable and undesirable vegetation at the landscape level. Contributions to cumulative effects are expected to be variable across action alternatives as management strategies that entail higher intensity timber harvests would be more likely to affect the distribution of vegetation across the landscape. The proposed alternatives, in conjunction with other potential actions, could exacerbate changes in the distribution of different vegetative communities across the Reservation. This could include the protection or loss of endangered, threatened, or sensitive species, the spread of invasive species, the distribution of species that are of cultural importance, and the rate at which these changes occur.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to vegetation from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to vegetation resource cumulative effects from the proposed alternatives, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest target harvest volumes (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management while contributions are expected to be more substantive under alternatives with higher target harvest volumes (Alternatives C and E). For instance, risk of negative impacts to sensitive species as well as risk for the spread of invasive species may be greater under Alternatives C and E as both alternatives entail higher levels of timber harvest, increased levels of heavy equipment activity, and more vehicle traffic.

4.2.4.3 Ecosystems and Biological Communities

4.2.4.3.1 Direct Effects

Forest management would directly affect forest ecosystems and biological communities as species composition, stand structure, and other stand characteristics are often altered to achieve management objectives. Additionally, forest management activities may also be implemented to address any concerns related to invasive species, forest health, and wildland fire.

Forest management activities are not expected to directly influence the distribution or general health of other ecosystems and biological communities at the landscape level. However, small inclusions or isolated patches of other ecosystem-types or biological communities within larger forested areas could be directly affected if management activities occur adjacent to other habitat types (e.g., meadows, waterbodies, rock outcrops, etc.).

Effects from the proposed alternatives to ecosystems and biological communities are expected to be variable across action alternatives. Although they would be realized incrementally as stands are treated, the effects to the resource during the action are expected to be immediately beneficial regarding improvements in forest health and reductions in wildland fire risk. Benefits associated with the alternatives with the lowest target harvest volume are not expected to be different than those associated with previous harvest activities. Action alternatives with higher target harvest volumes (Alternatives C and E) could have more substantive benefits.

4.2.4.3.2 Indirect Effects

Indirect effects to ecosystems and biological communities can include any long-term effects to the function of ecosystems and biological communities that result from forest management activities. This can include the treatment of insects and disease, the removal or buildup of wildland fuels, the creation or elimination of habitat for wildlife, and/or changes in stand growth and function. Of all possible indirect effects, wildland fire presents the greatest risk to ecosystems and biological communities at the landscape level. Forest management activities often alter the distribution of wildland fuels which can change the risk for ignitions as well as the spread of wildfire. Consequently, the continuity and distribution of fuels across the landscape can result in the spread of wildfire across ecosystems and biological communities.

Effects from the proposed alternatives to ecosystems and biological communities are expected to be variable across action alternatives. Effects associated with alternatives with the lowest target harvest volume (Alternatives A and D) are not expected to be different from those associated with previous harvest activities and current issues and concerns related to wildland fire, forest health, and climate change are likely to persist. Action alternatives with higher target harvest volumes (Alternatives C and E) could have more substantive effects on ecosystems and biological communities as the removal of more timber could affect successional pathways of forest ecosystems and have more indirect effects (e.g., increased runoff, decreased shading, decreased fire risk, improvements in vegetation condition, etc.) on adjacent ecosystems and biological communities.

4.2.4.3.3 Cumulative Effects

Cumulatively, forest management activities can alter the distribution of stand types and stand structure within forestlands at the landscape level. This can have consequences related to habitat availability, risk for wildland fire, the spread of diseases and pathogens, and the function of forestlands. Other types of management projects and activities within other ecosystems and biological communities can further exacerbate such effects. Similar to indirect effects, management activities that alter the distribution of fuels or alter fire regimes can, cumulatively, change the risk for wildland fire risk across the landscape.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to ecosystems and biological communities from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to ecosystem and biological community cumulative effects from the proposed alternatives, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest target harvest volumes (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management while contributions are expected to be more substantive under alternatives with higher target harvest volumes (Alternatives C and E).

4.2.4.4 Agriculture

4.2.4.4.1 Direct Effects

Access to some forest management areas may be inadequate and could require the construction of new or temporary roads to facilitate log hauling. Such roads may need to be constructed across agricultural lands resulting in either the temporary or long-term displacement of agriculturally productive land. Roads constructed across private agricultural fields, with landowner permission, are either demolished as soon as all associated forest management operations conclude, or they are left for private use should the landowner choose to keep the road. Agricultural lands are also directly affected by actions that involve afforestation. This results in the long-term conversion of agricultural lands which are planted and managed as forestland.

The effects of forest management on agricultural resources from the proposed alternatives are not expected to be much different from those of past forest management. It is assumed that forest access requirements and, consequently, impacts on agriculture would be similar across all alternatives.

4.2.4.4.2 Indirect Effects

Over time, construction of access roads across agricultural fields could result in the semi-permanent displacement of agriculturally productive land. This could result in a decrease in total agricultural area and an increase in road surface across the Reservation. However, these changes are expected to be minimal given the limited need to construct such access roads and the small area that is typically affected by such actions.

Over time, changes in forest resistance and resilience from management activities would not have any meaningful impact on agriculture resources across the Reservation.

4.2.4.4.3 Cumulative Effects

Cumulative effects to agricultural resources from the proposed alternatives and other actions that may occur on the Reservation largely concern the displacement of agriculturally productive land in favor of other uses. Over time, there could be a decrease in the total area designated for crop production or other uses related to crop production.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to agricultural resources that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to agricultural resource cumulative effects from the proposed alternatives are expected to be similar across action alternatives and to not be much different from the status quo and past forest management strategies.

4.2.5 Alternative Impacts on Cultural Resources

Given the numerous laws, regulations, and policies that govern the use and administration of cultural resources on the Nez Perce Tribal lands that would apply under any alternative, substantial differences in effects to cultural resources by any alternative are not expected. However, some level of risk of effects to cultural resources associated with management activities is present with each alternative. This level of risk varies in proportion to the level of management activities anticipated under each alternative.

This section includes a discussion of the impacts on cultural, sacred, and traditional cultural properties from timber management activities that are most likely to occur under the guidance of federal and state laws as well as Tribal policy and regulations. Additionally, Forest management activities conducted by the Tribe always adhere to BMPs which ensure a high level of resource protection. As such, the most severe impacts to historical properties that would only occur outside of existing laws, policy, regulations, and BMPs will not be discussed.

The effects that the proposed alternatives are expected to have on cultural resources across the Nez Perce Reservation are summarized below in Table 4-7. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-7) A summary of the general effects that the proposed alternatives are expected to have on cultural resource indicators. Refer to section 4.1 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF	Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF
Historic and Archeological Resources	Archeological Sites	X	–	– –	–	– – –	+	+ +	+	+ + +
	Burial & Sacred Sites	X	–	– –	–	– – –	+	+ +	+	+ + +
	Ethnographic Knowledge & Nez Perce Language	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cultural, Sacred and Traditional Cultural Properties	Historical Properties	NA	NA	NA	NA	NA	+	+ +	+	+ + +

4.2.5.1 Historic and Archeological Resources

4.2.5.1.1 Direct Effects

Direct effects on historic and archeological resources from forest management activities primarily include the physical disturbance of unknown or previously undetected culturally sensitive sites. Prior to all timber management activity, the proposed activity is reviewed by an Interdisciplinary Team that attempts to identify a variety of issues that could be encountered throughout the activity. Additionally, any survey data for the affected area that is more than 10 years old is updated. If known culturally sensitive sites occur within the project area, one of two things would happen: steps would be taken to mitigate the impacts to the site, or the project would not take place.

However, damages can unknowingly occur from forest management activities. This can occur when a previously undiscovered site is found once a forest management activity has begun. For example, the equipment used during forest management activities "uncovers" artifacts that were previously unknown to exist. Timber management activities can damage or displace the artifacts or damage the site itself.

Under current federal and state laws and Tribal policies and regulations, cultural resources receive certain protections from various types of activities, including those related to forest management. However, such actions do present risk to cultural resources that have not yet been detected. Therefore, it is expected that there would be no change in the level of risk posed to cultural resources under action alternatives with the slowest pace and lowest target harvest volumes (Alternatives A and D) and higher levels of risk associated with action alternatives with faster paces and higher harvest volumes (Alternatives C and E). It is assumed that increased harvest volumes involve more passes and entries by heavy equipment and a larger footprint of disturbed areas within managed forests.

4.2.5.1.2 Indirect Effects

Indirect effects on historic and archeological resources could occur from improved access due to forest management activities. As a result, increased unauthorized use could degrade culturally important sites through excessive OHV use, for example. Additionally, a reduction in fuel loads may reduce the risk to culturally important sites from future disturbances such as catastrophic wildfires.

Even though forest management may increase risk to culturally important resources through the expansion of access to areas with previously undetected cultural resources, changes in forest resistance and resilience to future disturbance may reduce the risk of negative impacts on such resources. For instance, forests that are more resistant and resilient to disturbance would likely present lower levels of risk to cultural resources, especially concerning damage or loss resulting from catastrophic wildfire. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) are expected to serve as more effective forms of mitigation against severe impacts to cultural resources from future disturbance events, such as high intensity wildfires, than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.5.1.3 Cumulative Effects

Cumulative effects over time can include loss of sites or resources prior to development of better research techniques, loss of interpretive values, and incremental loss of the cultural resource base.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to cultural resources that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, it is expected that the proposed alternatives would, at the very least, contribute to cultural resource cumulative effects by presenting additional risk to such resources during the action or by mitigating risk of resource damage or loss from disturbances such as wildfire. Contributions to cumulative effects are expected to be greater as harvest pace and target harvest volume increase. Alternatives A and D would be associated with the smallest contributions, Alternative C would be associated with a moderate increase in contributions, and Alternative E would be associated with the largest increase in contributions to cumulative effects.

4.2.5.2 Cultural, Sacred, and Traditional Cultural Properties

4.2.5.2.1 Direct Effects

Effects are the same as those described in section 4.2.5.1.1.

4.2.5.2.2 Indirect Effects
Effects are the same as those described in section 4.2.5.1.2

4.2.5.2.3 Cumulative Effects
Effects are the same as those described in Section 4.2.5.1.3

4.2.6 Alternative Impacts on Socioeconomic Conditions
The effects that the proposed alternatives are expected to have on socioeconomic resources across the Nez Perce Reservation are summarized below in Table 4-8. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-8) A summary of the general effects that the proposed alternatives are expected to have on socioeconomic resource indicators. Refer to section 4.1 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF	Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF
Employment and Income	Hospitality & Tourism Employment	NA	–	– –	–	– – –	+	+ +	+	+ + +
	Commercial & Industrial Employment	NA	– – –	– –	– – –	–	+	+ +	+	+ + +
	Sustainability of Resource Production	NA	–	– –	–	– – –	+	+ +	+	+ + +
	Employment Sustainability	NA	–	– –	–	– – –	+	+ +	+	+ + +

4.2.6.1 Employment & Income
4.2.6.1.1 Direct Effects
To fully implement the selected alternative, harvest operations will depend on both the local workforce to fill jobs and local industry to accept harvested timber and other potential forest by-products. Forest management activities would support existing employment in natural resource fields, which is an important sector locally, as well as service industries which provide opportunities for unskilled or previously unemployed workers. Thus, it is possible to see an immediate boost in both local employment rates and income with more employment opportunities created under higher intensity harvest schedules.

The effects of forest management on employment in the forest products industry and hospitality and tourism industries are expected to be inversely related to harvest intensity. Employment in all three sectors is expected to be similar to current levels under action alternatives with the lowest target harvest volumes (Alternatives A and D) and increase under alternatives with higher target harvest volumes (Alternatives C and E). However, as the target harvest volume increases and impacts on recreation and aesthetic resources increase, employment opportunities in the tourism and hospitality industries may decrease over time.

4.2.6.1.2 Indirect Effects
To fully implement all aspects of the selected alternative, especially the timber harvest component, workers will need to be available during all phases of the management process. Silviculture budgets rely heavily on timber sale revenues, as do post-harvest activities such as slash abatement and reforestation. Timber sale

revenue makes the hiring and paying of employees, tribal and private, possible. As highlighted in section 3.6.1, timber revenue not only provides jobs but also funding for tribal government activities and provides added need for support industries. Support industries will benefit from forest management operations as they, and the workers, will rely on local industries for services.

Over time, forest management activities may also negatively impact the local hospitality and tourism industries and result in a decrease in employment opportunities in both sectors. Forest management may contribute to a decline in tourism if recreational opportunities and amenities are restricted or closed during management operations. Additionally, forest management practices, especially those that include timber harvest, would also have visual impacts that could deter tourists from engaging in site-seeing or recreation. Such effects are expected to be exacerbated under alternatives with more intense harvest schedules.

Through time, disturbances, such as severe wildfires, are expected to have a reduced impact on the stability of employment in the hospitality and tourism and forest product industries under faster paced alternatives (Alternatives C and E). As forests become more resistant and resilient to disturbance it is assumed that substantive changes in employment levels resulting from sudden and widespread natural resource loss would become less likely. Conversely, as forests would be less resistant and resilient to disturbances under slower paced Alternatives (Alternatives A and D), more substantive reductions in employment may occur should there be a sudden and rapid decrease in the aesthetic quality of Tribal forests, the availability of recreational resources, and the abundance of standing timber.

4.2.6.1.3 Cumulative Effects

A working forest is a key component to the regional and tribal economy. Timber sale operations could provide short and long-term jobs, stimulate local support industries, and provide revenue to other tribal operations and objectives. Tribal programs to help tribal members gain skills and obtain employment would be enhanced by timber harvest revenues as well as the opportunities they bring for training and new jobs. The regulation and oversight required for timber harvest activities increases the need for other natural resource management activities thus expanding the need for those programs, such as fisheries, water resources, cultural resources, and others.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to socioeconomic conditions that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, it is assumed that there would be no change in contributions to socioeconomic cumulative effects under alternatives with the same harvest volume as the status quo while contributions, both negative and positive, are expected to be greater under alternatives with higher harvest volumes (Alternative C and E).

4.2.7 Alternative Impacts on Resource Use Patterns

The effects that the proposed alternatives are expected to have on resource use patterns across the Nez Perce Reservation are summarized below in Table 4-9. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-9) A summary of the general effects that the proposed alternatives are expected to have on resource use pattern indicators. Refer to section 4.1 for more information about effects ratings.

Resource	**Indicator**	**Mitigation**	**During Action: Risk of Negative Impact to Indicator**				**After Action: Resilience of Indicator to Disturbance**			
			Alt A – 4.8 MMBF	**Alt C – 6.7 MMBF**	**Alt D – 4.8MMBF**	**Alt E – 8.2 MMBF**	**Alt A – 4.8 MMBF**	**Alt C – 6.7 MMBF**	**Alt D – 4.8MMBF**	**Alt E – 8.2 MMBF**
	Hunting	NA	–	– –	–	– – –	+	+ +	+	+ + +

Hunting, Fishing, Gathering	Hunting Opportunities	NA	–	– –	–	– – –	+	+ +	+	+ + +
	Fishing	NA	–	– –	–	– – –	+	+ +	+	+ + +
	Fishing Opportunities	NA	–	– –	–	– – –	+	+ +	+	+ + +
	Plant Gathering Opportunities	NA	–	– –	–	– – –	+	+ +	+	+ + +
Timber Harvesting	Forest Products	NA	NA	NA	NA	NA	+	+ +	+	+ + +
	Sustainability of Resource Production	NA	–	– –	–	– – –	+	+ +	+	+ + +
Agriculture	Crop Production	X	–	–	–	–	NA	NA	NA	NA
	Forage Quality	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Grazing Opportunities	NA	NA	NA	NA	NA	NA	NA	NA	NA
Recreation	Camping & Picnicking	X	–	– –	–	– – –	+	+ +	+	+ + +
	Motorsports	X	–	– –	–	– – –	+	+ +	+	+ + +
	Wildlife Viewing	X	–	– –	–	– – –	+	+ +	+	+ + +
Transportation Networks	Public Road Access	X	–	– –	–	– – –	NA	NA	NA	NA
	Forest Roads	X	–	– –	–	– – –	NA	NA	NA	NA
	Transportation Management Costs	X	–	– –	–	– – –	NA	NA	NA	NA
	Transportation Maintenance Costs	X	–	– –	–	– – –	NA	NA	NA	NA

4.2.7.1 Hunting, Fishing, and Gathering

4.2.7.1.1 Direct Effects

Hunting, fishing, and gathering would be interrupted in the immediate area where timber harvest activities occur, and any closures would likely be enforced for the duration of management operations. Some post-harvest operations, such as slash abatement or reforestation practices, may also require the closure of hunting, fishing, and gathering sites. Road construction or temporary road closures related to timber harvest operations could also interrupt hunting, fishing, and gathering activities because of temporary access restrictions.

Forest Management would alter the landscape and significantly impact habitat for most game species which would directly affect hunting in the timber sale area. Harvest operations could impact migration corridors temporarily and disturb wildlife in areas adjacent to where forest management activities are taking place. This would likely result in temporary impacts on hunting in the greater area.

Fish habitat would not be directly disturbed by timber harvest operations as any fish-bearing streams would be protected by BMPs. Fishing opportunities in the greater area are not expected to be affected unless road closures prevent access to fishing sites.

Gathering in the immediate timber sale area would be directly affected by the removal of vegetation, disturbances to the soil and vegetation, and possible destruction of some desired forest products. One example includes damage to or the loss of huckleberry or service berry bushes from the movement of logging equipment within harvest areas.

Overall levels of disturbance to hunting, fishing, and gathering from the proposed alternatives are expected to be variable across action alternatives. Disturbance levels associated with alternatives with the lowest target harvest volume (Alternatives A and D) are not expected to be much different from disturbances associated with previous harvest activities. Action alternatives with higher target harvest volumes (Alternatives C and E) could produce higher levels of disturbance as the removal of more timber would likely increase the footprint of disturbed areas and prolong activities that disrupt hunting, fishing, and gathering.

4.2.7.1.2 Indirect Effects

Changes in the landscape after a timber harvest could result in short and long-term changes to game habitat and migration corridors. Species that were found in the area might have a diminished presence while other species, those that were less prominent, may become more common. Post-harvest silviculture activities, such as reforestation, could attract ungulates to browse planted seedlings. Newly opened canopies and thinned understories could make wildlife viewing and hunting easier in some circumstances, especially where dense canopy forest or dense understory provided impenetrable cover for game species. New road construction could improve access to hunting areas after timber harvest operations are completed.

Changes to the basal area within a watershed could affect streams and wetlands. There is also the potential for water contamination whenever an activity is undertaken near a stream. These effects are discussed in the Water Resources section (4.2.2). In any way that the streams or wetlands are impacted by timber harvest operations, those impacts could lead to indirect effects to fishing recreation in that area. New road construction could improve access to fishing streams after timber harvest operations are completed.

Physical disturbances to the soil and vegetation after timber harvests and post-harvest activities will probably have some indirect effect on gathering opportunities in the timber sale area. In most cases the effects will not be negative for gathering as the disturbances will increase production of desired gatherable materials. New road construction could improve access to gathering areas. However, some short-term interruptions to gathering in and near the timber sale area are also possible and could affect gathering there.

Even though forest management may disturb hunting, fishing, and gathering sites and activities, changes in forest resistance and resilience to future disturbance may reduce the risk of negative impacts to such resources. For instance, forests that are more resistant and resilient to disturbance would likely present lower levels of risk to hunting, fishing, and gathering. It is less likely that sites will be damaged or that activities will be disrupted by future disturbances such as wildland fire. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) are expected to serve as more effective forms of mitigation against severe impacts to hunting, fishing, and gathering sites and activities from future disturbance events than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.7.1.3 Cumulative Effects

Overall, forest health will have a substantive influence over cumulative effects on hunting, fishing, and gathering across the greater forest landscape. As a management mechanism, timber harvests and other management practices will maintain a healthy forest ecosystem by decreasing levels of forest pests and pathogens, thinning overgrown understories, and reducing wildfire hazards. Hunting patterns may change as habitats change and shift, but game species will still be present within a healthy forest. Healthy forest ecosystems also protect fish-bearing streams and foster the creation of fish habitat. Gathering will continue to be possible in and around timber sale areas long after timber harvests occur. Promoting forest health will be beneficial to gathering as gathering sites and opportunities are expected to expand over time once harvest activities conclude.

Road maintenance conducted during forest management operations may improve access for activities such as hunting, fishing, and gathering. While short-term interruptions will be the primary direct effect of forest management on hunting, fishing, and gathering, the cumulative effects should be long-term positive effects that preserve multiple generational ability to continue such activities.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to hunting, fishing, and gathering that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to hunting, fishing, and gathering cumulative effects from the proposed alternatives, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest target harvest volumes (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management while contributions, both desirable and undesirable, are expected to be greater under alternatives with higher target harvest volumes (Alternatives C and E).

4.2.7.2 Timber Harvesting

4.2.7.2.1 Direct Effects

Increases in harvesting would provide increased revenues for the Tribe's budget and increase the need for jobs within natural resource programs.

The generation of revenue, production of forest products, and risk of production loss due to wildfire and climate change are expected to remain the same under alternatives with the lowest target harvest volumes (Alternatives A and D). These effects are expected to change under alternatives with higher target harvest volumes (Alternatives C and E). The production of forest products and generation of revenue is expected to increase while the risk of production loss due to wildfire and climate change is expected to decrease because of lower total stand volumes.

4.2.7.2.2 Indirect Effects

Increased harvest levels would allow for less total volume to be carried across managed forests. Through time, higher target harvest volumes, and lower total stand volumes, would cater to the treatment of hazardous fuels and reduce risk related to wildland fire and climate change.

At minimum, the proposed alternatives would sustain the current level of production of timber products under Alternatives A and D. Under alternatives with higher target harvest volumes (Alternatives C and E) the level of production of forest products is expected to increase. The production of forest products may be more sustainable under Alternatives C and E as impacts to merchantable timber from future wildfires are likely to be less severe under alternatives with higher target harvest volumes.

Forests that are more resistant and resilient to disturbance would likely present lower levels of risk to timber resources. It is less likely that standing timber will be damaged or lost because of future disturbances such as wildland fire. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) are expected to serve as more effective forms of mitigation against severe impacts on timber resources from future disturbance events than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.7.2.3 Cumulative Effects

Managed forests with sustainable timber harvesting will decrease hazardous fuel loading and reduce the risk of catastrophic wildfires. However, this approach may also result in a decline in revenue from future timber harvests if harvest levels outpace forest regeneration. New opportunities to increase revenue from timber harvests would not be available until stands rotate through to harvest age again.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to timber resources that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to timber resource cumulative effects from the proposed alternatives, as described above, are expected to remain the same under alternatives with the lowest target harvest volumes (Alternatives A and D). Contributions to such effects are expected to increase under alternatives with higher target harvest volumes (Alternatives C and E).

4.2.7.3 Agriculture

The effects on agricultural resource use patterns from the proposed alternatives are not expected to be much different from that of the status quo or past forest management strategies. Given the total area of and the frequency at which agricultural resources are likely to be disturbed it is expected that any disruptions to agriculture would be minimal.

4.2.7.3.1 Direct Effects

Effects are the same as those described in section 4.2.4.4.1

4.2.7.3.2 Indirect Effects

Effects are the same as those described in section 4.2.4.4.2.

4.2.7.3.3 Cumulative Effects

Cumulative effects are the same as those described in section 4.2.4.4.3

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to agricultural resources that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to agriculture resource use pattern cumulative effects from the proposed alternatives are expected to be similar across action alternatives and to not be much different from the status quo and past forest management strategies. Such contributions are expected to be minimal.

4.2.7.4 Recreation

4.2.7.4.1 Direct Effects

Forest management operations could directly affect recreation through area closures and road closures. Tourism and recreation revenues could decrease during such disruptions, particularly if opposition from the public to such effects is substantial, but such changes are expected to be minimal as mitigation would occur at the project level. Any disruptions that do result would be temporary, and visitors would still be able to utilize other recreational areas.

Overall levels of disturbance to recreational activities are expected to be variable across action alternatives. Disturbance levels associated with alternatives with the lowest target harvest volume (Alternatives A and D) are not expected to be different from disturbances associated with previous harvest activities. Action alternatives with higher target harvest volumes (Alternatives C and E) could produce higher levels of disturbance as the removal of more timber could extend road, trail, and facility closures, produce more log truck and other vehicle traffic, generate more noise over longer periods, extend the footprint of harvested areas, and have a more substantive impact on aesthetics and other activities such as wildlife viewing.

4.2.7.4.2 Indirect Effects

Closures in and around areas where recreation is common could result in long-term changes to recreational use and could affect tourism revenue. Changes to the landscape and to forest composition could also result in similar changes. Although these effects are expected to be variable across alternatives, with greater effects occurring under alternatives with higher harvest paces, these effects are likely to be minimal as disruptions and closures would be short-term. Recreation and tourism would continue during forest management operations, but there could be some changes in the behaviors of forest visitors in where, how, and when they recreate on tribal lands.

Forests that are more resistant and resilient to disturbance would likely present lower levels of risk to recreational resources. It is less likely that recreational resources will be damaged or lost because of future disturbances such as wildland fire. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) are expected to serve as more effective forms of mitigation against severe impacts on recreational resources from future disturbance events than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.7.4.3 Cumulative Effects

Overall, forest health improvements promoted through timber harvesting and other silvicultural activities will be a net benefit for recreation and tourism on tribal lands. The reduction of hazardous fuels would help protect tribal lands from wildfire threat. Even though temporary closures and other changes may disrupt some recreation activities, the closures and resource destruction caused by catastrophic wildfires would be a greater disruption. Potential improvements in access for recreation, including road improvements, are another way forest management activities might affect recreation across the Reservation in the future.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to recreational use patterns that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to recreation cumulative effects are expected to be variable across action alternatives. Alternatives with the lowest target harvest volumes (Alternatives A and D) are expected to make similar contributions to recreational resource cumulative effects on the Reservation as previous forest management practices. This includes both positive cumulative effects (e.g., wildland fuel reduction) and negative effects (e.g., temporary closure of recreation areas). The contributions to such effects are expected to be greater under Alternatives with higher target harvest volumes (Alternatives C and E).

4.2.7.5 Transportation Networks

4.2.7.5.1 Direct Effects

Transportation networks on the Reservation could be affected by forest management activities, particularly timber harvesting, because of the increased presence of vehicles, including log trucks, on local roads. Forest roads used to access timber sale areas would likely be improved and receive increased levels of maintenance to handle higher volumes of log truck traffic. However, these same roads could be closed to non-essential traffic. Higher levels of heavy truck traffic would increase the potential for serious vehicle accidents, especially on road systems that would support both public traffic and traffic associated with forest management operations.

Road usage for forest management operations and associated maintenance costs are expected to be similar to current levels under alternatives with the lowest target harvest volumes (Alternatives A and D). Road usage and costs are expected to increase under alternatives with higher target harvest volumes (Alternatives C and E) as there would be more heavy vehicle traffic using roadways at a higher frequency.

4.2.7.5.2 Indirect Effects

Forest roads and infrastructure, including bridges and culverts, used to access timber sale areas would likely be improved prior to timber sale activities. Reservation transportation networks and infrastructure could be damaged because of heavy log truck use. Any damage incurred would likely be repaired but there could be a short-term disruption to the transportation network before such repairs occur.

Changes in forest resistance and resilience are unlikely to be beneficial to the transportation network. However, transportation networks within forests that are more resistant to disturbance may be safer to use during emergency situations, such as evacuating from or responding to a wildfire. Should improvements in safety be realized, it is expected that Alternatives with higher target harvest levels (Alternatives C and E) would be the more beneficial.

4.2.7.5.3 Cumulative Effects

Forest management activities are supported by an existing forest road network. Any expansion of the network would occur within the vicinity of the existing roadways where areas have already been disturbed and the environmental risk is relatively low. New development of transportation networks can affect natural and cultural resources and will be restricted to minimize or prevent effects on those resources. However, some effects may still occur and will require mitigation measures. Road improvements and maintenance activities are usually funded because of anticipated timber harvest revenues. An improved or maintained transportation network to support forest management operations will lead to an overall safer and more reliable transportation network for other uses.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects to the transportation network that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions from the proposed alternatives to transportation network cumulative effects are expected to be variable across action alternatives. Contributions are not expected to change under alternatives with the lowest target harvest volumes (Alternatives A and D). Because of the anticipated increase in heavy vehicle traffic, it is expected that contributions would be greater under alternatives with higher target harvest volumes (Alternatives C and E). Wear to road surfaces and other infrastructure features is expected to be greater under those alternatives, but it is likely that more resources would be available for repairs and maintenance.

4.2.8 Other Values

The effects that the proposed alternatives are expected to have on resource use patterns across the Nez Perce Reservation are summarized below in Table 4-10. Refer to section 4.1 Methodology for more information about how the anticipated impacts from each alternative were evaluated.

Table 4-10) A summary of the general effects that the proposed alternatives are expected to have on the resource indicators for other values. Refer to section 4.1 for more information about effects ratings.

Resource	Indicator	Mitigation	During Action: Risk of Negative Impact to Indicator				After Action: Resilience of Indicator to Disturbance			
			Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF	Alt A – 4.8 MMBF	Alt C – 6.7 MMBF	Alt D – 4.8MMBF	Alt E – 8.2 MMBF
Noise and Light	**Light, Noise, & Odor**	X	–	– –	–	– – –	NA	NA	NA	NA
Visual	**Scenic Resources**	NA	–	– –	–	– – –	+	+ +	+	+ + +
Climate Change	**Resiliency of Water Resources**	NA	NA	NA	NA	NA	+	+ +	+	+ + +
	Wetland Resilience to Climate Change	NA	NA	NA	NA	NA	+	+ +	+	+ + +
	Climate Change Pollutants (Greenhouse Gas Emissions)	NA	–	– –	–	– – –	+	+ +	+	+ + +
Hazardous Materials	**Illegal Dumping**	NA	–	–	–	–	NA	NA	NA	NA
	Hazardous Waste Spills	X	–	– –	–	– – –	NA	NA	NA	NA

4.2.8.1 Noise and Light

4.2.8.1.1 Direct Effects

Levels of noise and light will likely increase within and around areas where forest management activities are conducted. Although these effects would occur throughout the duration of a management project, they would be short-term. The extent of impacts from increased levels of noise and light would depend on the location of the project site and the features of the surrounding environment.

Total levels of noise and light are expected to be variable across action alternatives. Levels of noise and light associated with alternatives with the lowest target harvest volume (Alternatives A and D) are not expected to be much different from levels associated with previous harvest activities. Action alternatives with higher target harvest volumes (Alternatives C and E) are expected to produce more noise and light through time as the removal of more timber would likely prolong activities associated with such disruptions.

4.2.8.1.2 Indirect Effects

No indirect effects on levels of noise and light have been identified.

Changes in forest resistance and resilience would not have any meaningful impact on levels of noise and light across the Reservation.

4.2.8.1.3 Cumulative Effects

There would only be cumulative effects for noise and light levels if multiple timber management activities overlapped in time and/or space. There are private forest lands within and around the Reservation as well as state and federal lands that could host various forest management activities that overlap Tribal projects in time and/or space.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects concerning noise and light that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to noise and light cumulative effects, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest target harvest volumes (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management. Those contributions are expected to be greater under alternatives with higher target harvest volumes (Alternatives C and E).

4.2.8.2 Visual Resources

4.2.8.2.1 Direct Effects

Visual impacts to the affected viewshed would likely occur immediately as the result of forest management activities. For instance, any time that vegetation is removed, fuel is burned, or roads are built, there is going to be a visual difference to what people are accustomed to.

Impacts to visual resources from alternatives with the lowest target harvest volumes (Alternatives A and D) are not expected to be much different from levels associated with previous harvest activities. Action alternatives with higher target harvest volumes (Alternatives C and E) are expected to have more substantive effects on visual resources as more timber would be removed from harvest units.

4.2.8.2.2 Indirect Effects

Through time, the appearance of managed forest areas will continue to change as vegetation grows back and managed sites enter new successional stages.

Forests that are more resistant and resilient to disturbance would likely present lower levels of risk to visual resources. It is less likely that the quality of visual resources will be diminished because of future disturbances such as wildland fire. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) are expected to serve as more effective forms of mitigation against severe impacts to visual resources from future disturbance events than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.8.2.3 Cumulative Effects

There are private forest lands within and around the Reservation as well as state and federal lands that may host forest management activities that overlap Tribal projects in time and/or space. Depending on the type of management activities that take place, cumulative effects on visual resources could be substantive. However, such impacts would be lessened through time as vegetation begins to grow back in affected areas.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects concerning visual resources that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to visual resource cumulative effects, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest target harvest volumes (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management. Such contributions are expected to be greater under alternatives with higher target harvest volumes (Alternatives C and E).

4.2.8.3 Climate Change

4.2.8.3.1 Direct Effects

Direct effects to climate change from forest management activities usually concern the carbon sink/source dynamics of forestlands as well as the severity of the impacts that climate change has on other resources that benefit from functional forestlands. Depending on management objectives and the strategies that are implemented, these effects can be highly variable.

Forest management affects carbon cycling as some management activities can cause forestlands to become a carbon source while others can cause them to become a carbon sink. For instance, some forest management strategies can aid forestlands in becoming carbon sinks as carbon is captured through tree growth and the production of forest products. Conversely, other management strategies or practices can increase the risk that forestlands become a carbon source as they may, for example, make forests more susceptible to catastrophic wildfires which can release a substantial amount of carbon dioxide as well as other pollutants. Development, which results in the long-term displacement of forestlands, also results in forestlands serving as a carbon source because carbon can no longer be captured on the site through vegetative growth.

Forest management can also alter the way that climate change impacts other resources. For instance, the excessive removal of vegetation along riparian corridors can result in the exposure of streams and other waterways to direct sunlight which can degrade water quality. Aggressive management strategies can exacerbate the effects that climate change has on other resources as well. Conversely, other forest management strategies can mitigate the effects of climate change on environmental components, such as water, soils, and vegetation, as well as mitigate the effects of climate change on wildfire. For instance, some managed forests are less likely to be subjected to catastrophic wildfire which can cause severe damage to numerous environmental components.

Effects on various climate change factors are expected to be variable across action alternatives. Impacts to those factors, as described above, from alternatives with the lowest target harvest volume are not expected to differ much from those associated with previous harvest activities (Alternatives A and D). While action alternatives with higher target harvest volumes (Alternatives C and E) could do more to sequester carbon and reduce fuel for wildland fire, they may also release more emissions and put other environmental components, such as soils, sensitive plant communities, water resources, etc., at greater risk for loss or damage resulting from climate change.

4.2.8.3.2 Indirect Effects

Indirect effects to climate change from forest management activities include the long-term consequences of the direct effects described above. Depending on the management strategies that are implemented, forest management could, through time, mitigate the impacts of climate change on other environmental components or those impacts could be exacerbated.

Potential effects to climate change are expected to be variable across alternatives. Although the total level of harvest-related emissions may be higher under faster paced alternatives with higher annual target harvest volumes, the long-term benefits resulting from the manipulation of vegetation and increase in forest resilience and resistance to disturbance are also expected to be higher. Faster paced Alternatives with higher harvest volumes (Alternatives C and E) would likely be more effective at mitigating against impacts from climate change, such as drought and wildfire, than slower paced Alternatives with lower target harvest volumes (Alternatives A and D).

4.2.8.3.3 Cumulative Effects

The proposed alternatives would make contributions to cumulative effects in conjunction with any other projects that may occur at the same time or within the same space. Climate change dynamics are very complex, especially when examining multiple actions, but it is assumed that contributions to different aspects of climate change, including those that both mitigate and exacerbate such effects, would be made during the implementation of the proposed alternatives. For instance, the proposed alternatives would account for the release of emissions, but the actions described under each alternative would be used to address forest health and reduce wildfire risk.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects concerning climate change that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to climate change cumulative effects, as described above, are expected to be variable across action alternatives.

4.2.8.4 Hazardous Materials

4.2.8.4.1 Direct Effects

Direct effects on hazardous materials from forest management activities can include the dispersal and release of fuel, chemicals, and other hazardous substances into the environment. Any management activities that involve the use of vehicles, machinery, or tools that require fuel or chemicals to operate can become a source for spills or contamination in what are often undeveloped and remote areas. Additionally, the treatment of vegetation can also require the use of herbicides or other chemicals which can become a source of contamination if they are deposited in large quantities or high concentrations. Consequently, forest management can result in the almost continuous redistribution of hazardous materials within forested areas which can result in spills that contaminate soil, water, and other environmental components. However, hazardous materials must be transported in approved containers, and they are typically transferred from one vessel to another using appropriate equipment, as is often the case with oil and fuel, which minimizes the risk of spills. In cases where substances are poured by hand from one vessel into another, risk related to spills and contamination is often low because substances are typically handled in small quantities.

The rate of illegal dumping within managed forest areas on the Reservation is not expected to change. Individuals looking to dispose of garbage or hazardous materials will likely find a place to do so no matter which action alternative is selected.

The risk of hazardous materials spills is expected to be variable across action alternatives. It is assumed that risk would increase as levels of timber harvest activities or other management practices that involve vehicles or machinery also increase. Risk associated with alternatives with the lowest target harvest volume is not expected to be much different from risk associated with previous harvest activities (Alternatives A and D).

Action alternatives with higher target harvest volumes (Alternatives C and E) are expected to present higher levels of risk as those alternatives would require more machine operating hours (e.g., vehicles, chainsaws, heavy equipment, etc.) for implementation.

4.2.8.4.2 Indirect Effects

Over time, increased and/or improved access to forested areas may increase the rate of illegal dumping. Through time, people may use forest roads to access remote areas where unwanted materials, including garbage and hazardous waste, can be disposed of discreetly.

Indirect effects to hazardous materials from forest management activities often include the leaching of hazardous substances that have been spilled. Hazardous materials that have been spilled onto soils or into waterways can continue to spread into and contaminate adjacent areas long after a spill has occurred. Similarly, herbicides may also remain present in the environment after they are applied to a site. However, if hazardous materials, such as oil and fuel, are handled and transported properly or utilized appropriately, such as the application of herbicides, then the risk for leaching and subsequent environmental contamination is expected to be low.

Changes in forest resistance and resilience would not have any meaningful impact on risk associated with the release of hazardous materials into the environment.

4.2.8.4.3 Cumulative Effects

Forest management activities would likely contribute to cumulative effects from other actions or projects that affect the distribution and release of hazardous materials across the Reservation. Depending on the nature of other projects or actions that may overlap the proposed alternatives in time or space, the proposed alternatives may contribute to an increase in the distribution of hazardous materials across the Reservation as well as an increase in the volume of hazardous materials being transported to and handled in remote areas. Specific cumulative effects may be determined once the timing and location of specific management activities is scheduled and any projects that overlap harvests in time or space are identified.

It is unknown if other projects would overlap the proposed alternatives in time and/or space. Therefore, specific cumulative effects concerning hazardous materials that may result from the implementation of the proposed alternatives, as well as other potential actions, are unknown. However, contributions to hazardous materials cumulative effects, as described above, are expected to be variable across action alternatives. Under alternatives with the lowest harvest volumes (Alternatives A and D), additional contributions are expected to be similar to those that occurred from past forest management. Those contributions are expected to be greater under alternatives with higher target harvest volumes (Alternatives C and E).

5 BEST MANAGEMENT PRACTICES

Refer to section 9 in the Nez Perce FMP for recommended Best Management Practices (BMP). These practices are intended to limit or eliminate potential impacts from the proposed action. BMPs are included for the following resources:

- *Timber Harvesting*
- *Forest Roads*
- *Soil Protection and Management Guidelines*
- *Noxious Weeds*
- *Cultural Resources*
- *Water and Riparian Areas*
- *Dead & Down Woody Material & Snag Management*
- *Climate Change*

6 APPENDICES

6.1: Maps

6.2: Figures

6.3: Tables

6.4 Public Scoping Document (link)

6.1 MAPS

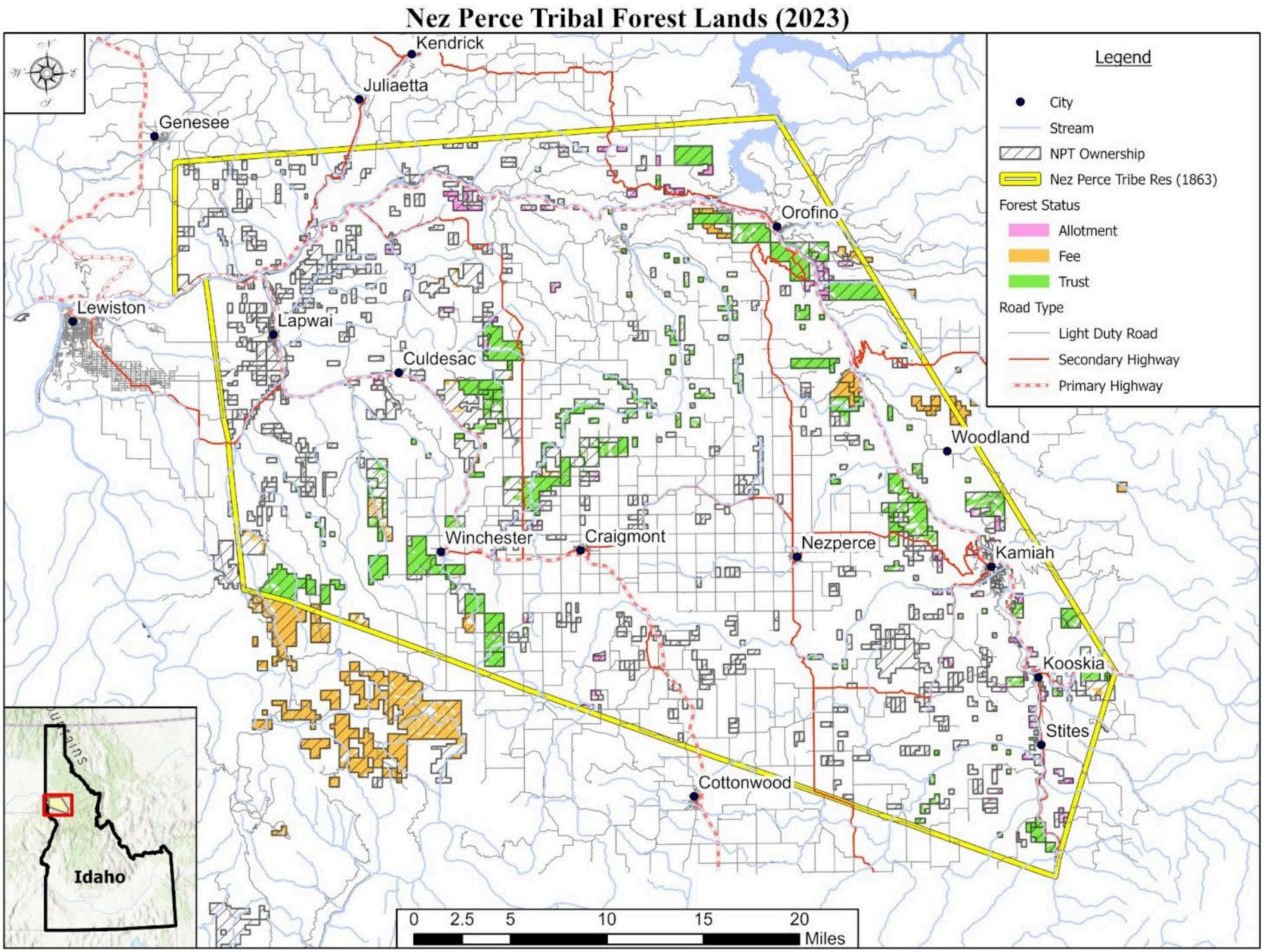

Figure 6-1) Map of Nez Perce Tribal forest lands.

MRLC Land Cover - 2019

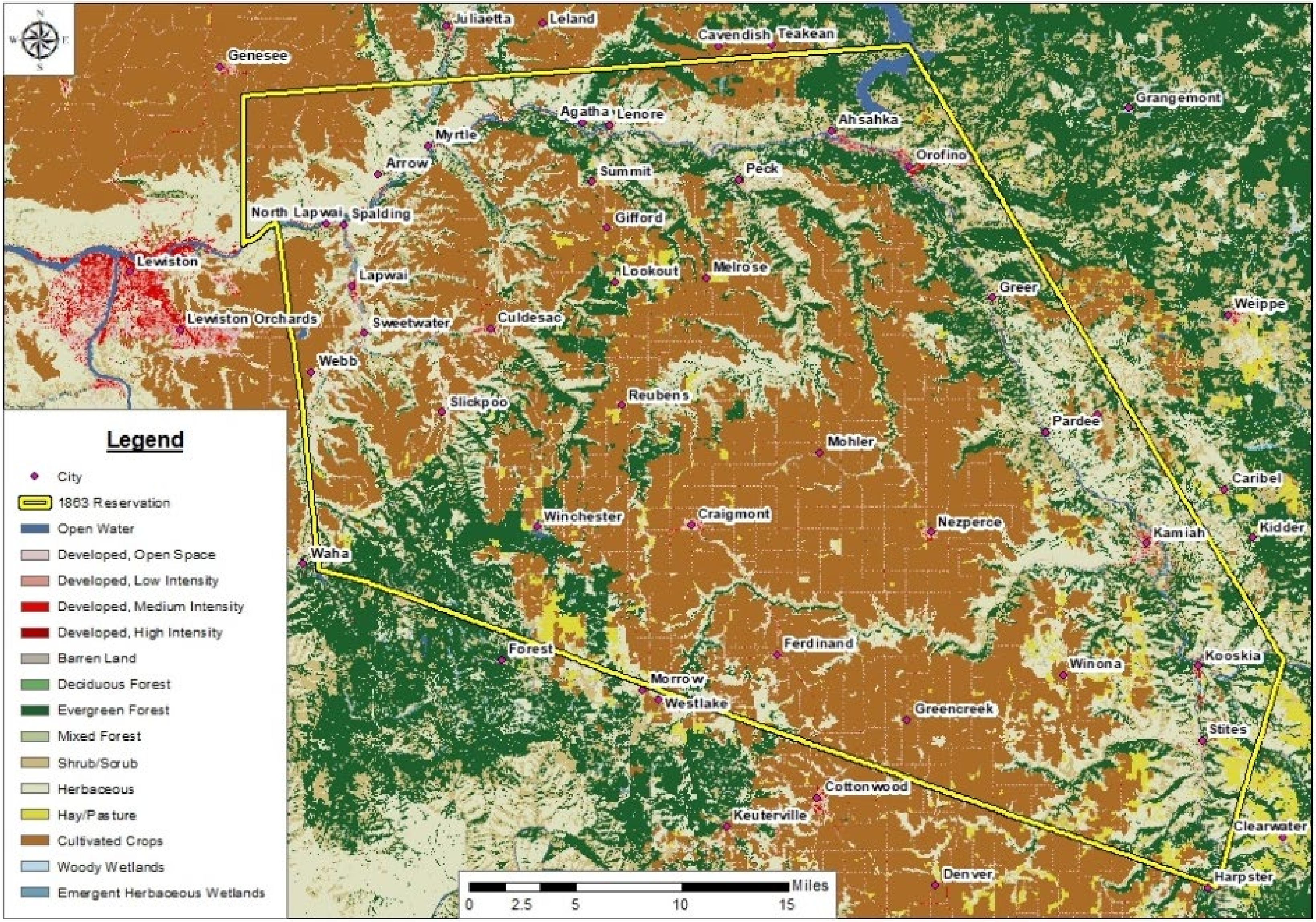

Figure 6-2) Distribution of land cover types across the Nez Perce Reservation.

6.2 FIGURES

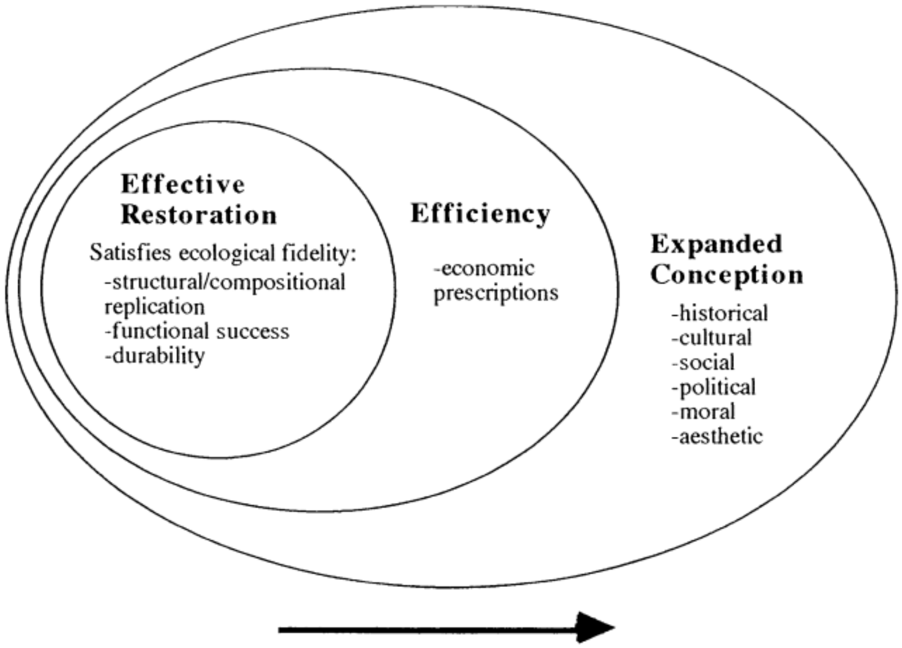

Figure 6-3) Ecological fidelity figure representing effective restoration objectives (Higgs, 1997).

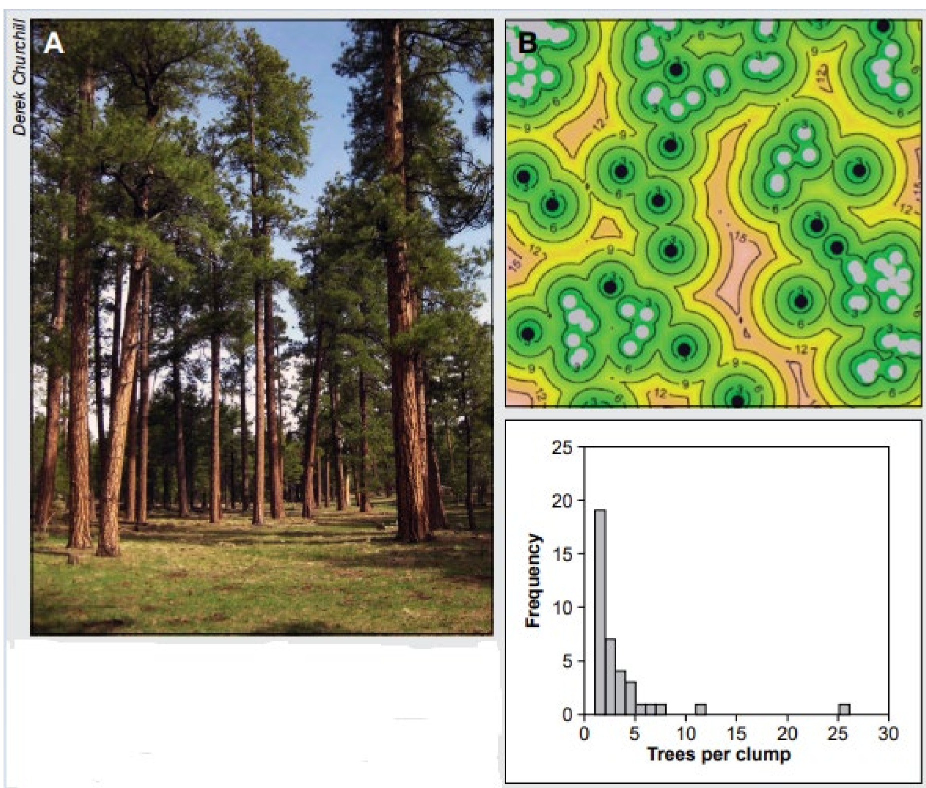

Figure 6-4) Example of a clumped and gapped spatial pattern (Hessburg et al. 2021)

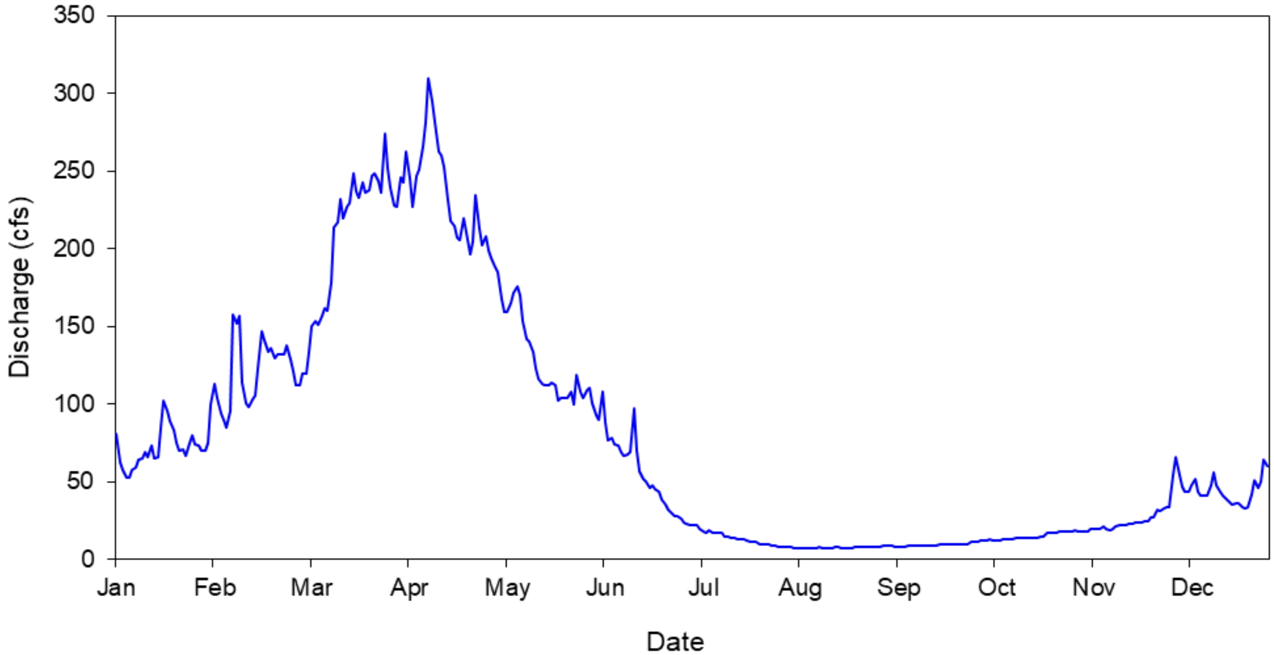

Figure 6-5) Annual daily mean discharge for USGS gage Lapwai Creek near Lapwai, ID (13342450) for years of operation, 1974-current.

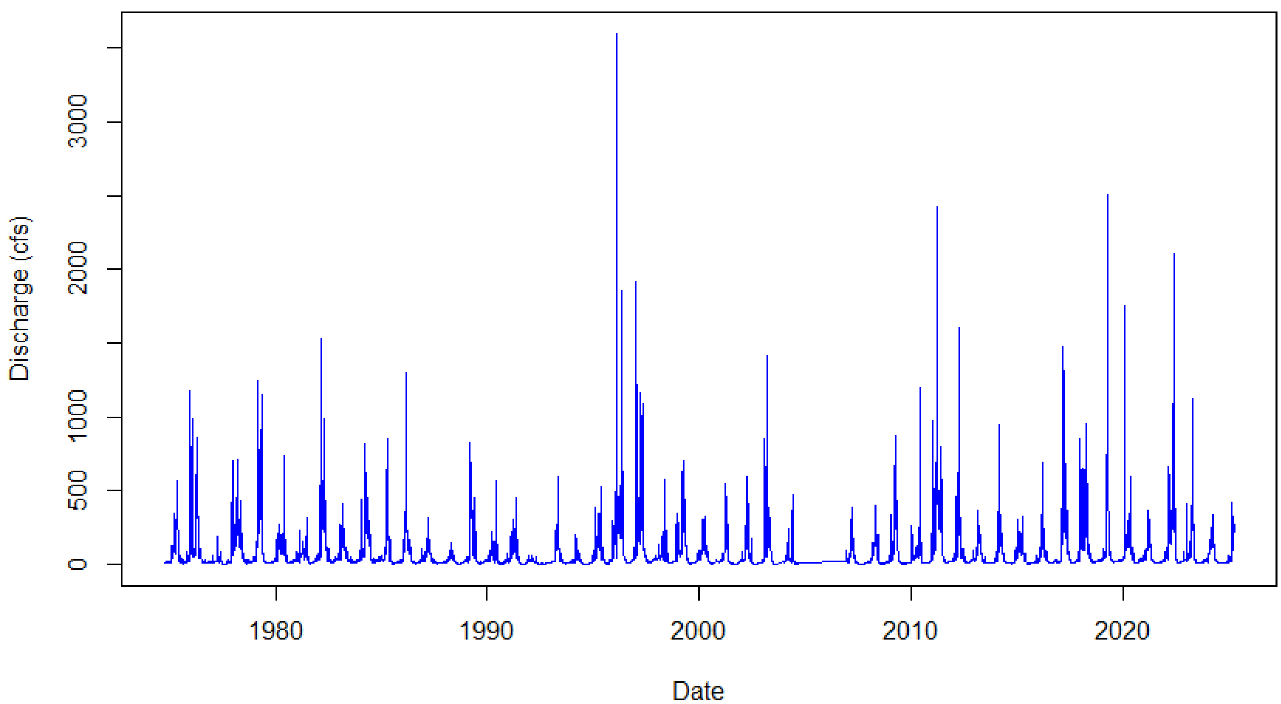

Figure 6-6) Hydrograph of Lapwai Creek discharge for the duration of the USGS Gage Lapwai Creek near Lapwai, ID (13342450), 1974-current.

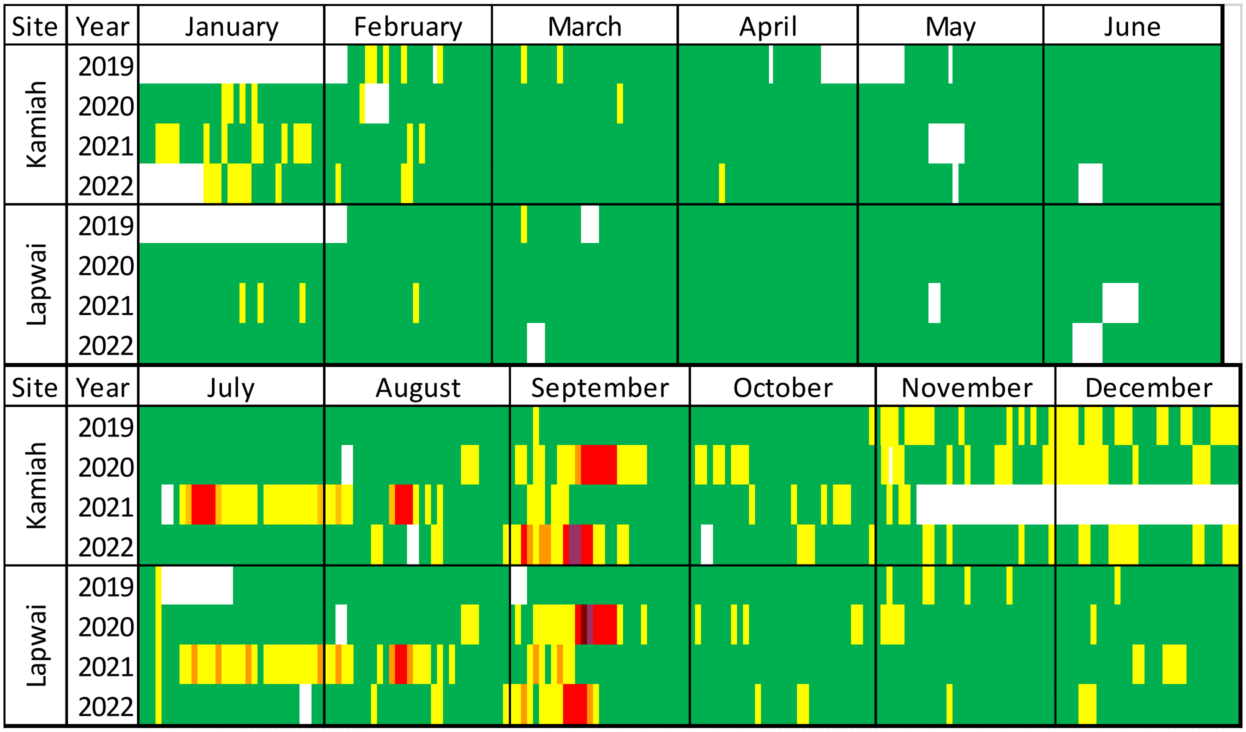

Figure 6-7) Air Quality Index (AQI) ratings for Kamiah and Lapwai, ID for the years 2019 to 2022. Ratings are based on PM2.5 measurements.

6.3 TABLES

Table 6-1) Water quality targets for the Nez Perce Reservation, ID.

Parameter	Designated Use	Benchmarks/Criteria	Citation
pH	CWAL	pH between 6.5 and 9.0	Idaho Administrative Code
Temperature	SS	13˚C or less daily max.; 9˚C or less daily avg.	Idaho Administrative Code
	CWAL	22˚C or less daily max.; 19˚C or less daily avg.	
Dissolved Oxygen	SS	> 8.0 mg/L, > 90% and < 110% of saturation	US EPA, 1986
	CWAL	> 6.0 mg/L, ≤ 110% saturation	Idaho Administrative Code
Turbidity	CWAL	≤ 51.45 NTU	US EPA, 2000; Idaho Administrative Code
Total Suspended Solids	CWAL	≤ 25 mg/L above background for short-term (e.g., < 24 hours)	DFO, 2000
Ammonia	CWAL	$\leq CMC = \frac{0.275}{1+10^{7.204-pH}} + \frac{39}{1+10^{pH-7.204}}$	Idaho Administrative Code
Total Phosphorus	CWAL	≤ 0.03 mg/L	US EPA, 1986
NO_3+NO_2	CWAL	≤ 0.072 mg/L	Cline, 1973
TKN	CWAL	≤ 0.288	US EPA, 2000
E. coli	PCR	≤ 410 cfu/ 100 mL instantaneous; 126 cfu/ 100 mL geometric mean*	Idaho Administrative Code

*Based on a minimum of five samples taken every three to eleven days over a forty-five-day period.

Table 6-2) Air Quality Index classifications and descriptions.

Daily AQI Color	Levels of Concern	Values of Index	PM2.5 (µg/m³)	Description of Air Quality
Green	Good	0 to 50	0-9.0	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	9.1-35.4	Air quality is acceptable. However, there may be a risk for some people.
Orange	Unhealthy for Sensitive Groups	101 to 150	35.5-55.4	Members of sensitive groups may experience health effects. The public is less likely to be affected.
Red	Unhealthy	151 to 200	55.5-125.4	Some members of the public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	125.5-225.4	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	>225.5	Health warning of emergency conditions: everyone is more likely to be affected.

Table 6-3) Threatened and endangered wildlife species.

Common	Species	Status
Fish		
Bull trout	*Salvelinus confluentus*	(T)
Snake River Basin steelhead trout	*Oncorhynchus mykiss*	(T)
Snake River fall-run chinook salmon	*Oncorhynchus tshawytscha*	(T)
Snake River spring/summer-run chinook salmon	*Oncorhynchus tshawytscha*	(T)
Snake River sockeye salmon	*Oncorhynchus nerka*	(E)
Mammals		
Canada lynx	*Lynx canadensis*	(T)
Grizzly bear	*Ursus arctos horribilis*	(T)
Northern Idaho ground squirrel	*Urocitellus brunneus*	(T)
Little brown bat	*Myotis lucifugus*	(Petitioned)
Birds		
Yellow-billed cuckoo	*Coccyzus americanus*	(T)
Invertebrates		
Monarch butterfly	*Danaus plexippus*	(C)
Suckley's cuckoo bumble bee	*Bombus suckleyi*	(under review)
Western bumble bee	*Bombus occidentalis*	(P)
Western ridged mussel	*Gonidea angulate*	(Under Review)
Columbia Oregonian	*Cryptomastix hendersoni*	(P)

(C): Federal ESA Candidate
(T): Threatened
(E): Endangered
(PR): Proposed
(P): Petitioned Wildlife and Plant Species

Table 6-4) Fish species sampled in streams within the boundaries of the Nez Perce Reservation from 2008 to 2012 (Chandler 2013).

Common Name	Nez Perce Name	Genus Species	Origin
Steelhead/Rainbow Trout	Hey'ey	*Oncorhynchus mykiss*	Native
Chinook Salmon	Nac'ox	*Oncorhynchus tshawytscha*	Native
Coho Salmon	K'a llay	*Oncorhynchus kisutch*	Reintroduced
Paiute Sculpin	Not available	*Cottus beldingii*	Native
Speckled Dace	Not available	*Rhinichthys osculus*	Native
Longnose Dace	Not available	*Rhinichthys cataractae*	Native
Bridgelip Sucker	Muq'uc	*Catostomus columbianus*	Native
Largescale Sucker	Muq'uc	*Catostomus macrocheilus*	Native
Redside Shiner	Té'tét	*Richardsonius balteatus*	Native
Northern Pike Minnow	Qiyex	*Ptychocheilus oregonensis*	Native
Chiselmouth	Tite'wxc	*Acrocheilus alutaceus*	Native
Pumpkinseed	Not available	*Lepomis gibbosus*	Exotic
Smallmouth Bass	Lixli•ks	*Micropterus dolomieu*	Exotic

Table 6-5) Threatened and Endangered Plant Species on and adjacent to the Nez Perce Reservation.

Common	Species	Status
Whitebark pine	Pinus albicaulis	(T)
Ute ladies' tresses	Spiranthes diluvialis	(T)
Spalding's catchfly	Silene spaldingii	(T)
Macfarlane's four o'clock	Mirabilis macfarlanei	(T)

(T): Threatened

Table 6-6) Wildlife indicator species associated with the forest habitat types found on the Nez Perce Reservation.

Common Name	Scientific Name	Reservation Forest Habitat Types	Indicates
White-headed Woodpecker	*Picoides albolarvatus*	Warm, Dry DF and PIPO	Open, mature dry forest conditions and large-diameter snags
Lewis's Woodpecker	*Melanerpes lewis*	Warm, dry DF and PIPO; Warm, dry to moderate DF, GF, and PIPO	Open, mature dry forest conditions; Burned mature dry forest conditions
Pileated Woodpecker	*Dryocopus pileatus*	Warm, dry to moderate DF, GF, and PIPO; Moderate and moist GF	Mature mesic forest conditions; late-successional forest
Willow Flycatcher	*Empidonax traillii*	Warm, dry DF and PIPO; Warm, dry to moderate DF, GF, and PIPO; Moderate and moist GF	Deciduous riparian shrub communities; insect abundance
Varied Thrush	*Ixoreus naevius*	Moderate and moist GF	Coniferous riparian forest communities; Mature mesic forest conditions
Native Pollinators	*[Various]*	Warm, dry DF and PIPO; Warm, dry to moderate DF, GF, and PIPO; Moderate and moist GF	Understory plant communities; dead and down woody debris and litter; forest type and stand age
Rocky Mountain Elk	*Cervus canadensis*	Warm, dry DF and PIPO; Warm, dry to moderate DF, GF, and PIPO; Moderate and moist GF	Ponderosa Pine and Western Larch; Habitat; Meadow and Riparian Habitat; Canyon Grassland Habitat

Table 6-7) Potential impacts to wildlife indicator species from forest management alternatives. Sources used to develop this table are included in section 6.4 (Wildlife Indicator Species).

Species	Harvest Practices	Habitat	Retention	Fire	R	Alt
White Headed Woodpecker	Negative: clear cuts, even-aged stand management, snag removal, salvage logging	Mature PP forest	Old, large PP, and snags	Habitat loss from stand replacing fires and loss of PP stands from fire suppression	1	E
					2	C
					3	D
					4	A
Lewis's Woodpecker	Positive: appears to benefit from salvage logging if nest trees are retained Negative: conversion of PP habitat to shade-tolerant habitat dominated by Douglas-fir	Open PP, open riparian CW, and logged or burned pine forests	Large diameter snags, particularly those with existing cavities and broken tops	Habitat loss from fire suppression and fuels treatments (understory vegetation removal), habitat improvement from scorched PP	1	E
					2	C
					3	D
					4	A
Pileated Woodpecker	Positive: retention of individual trees and patches of older forest mitigates the negative effects of timber harvest	Large-diameter WL, PP within mixed PP/DF groves, and cottonwood are recommended for retention patches where aspen is absent	Existing and potential cavity trees, and trees with broken tops; trees with visible signs of carpenter ants; coarse woody debris	Fire suppression limits the development of fire-killed snags; trees killed by fire are often excavated by woodpeckers and other primary cavity nesters.	1	A
					2	D
					3	C
					4	E
Willow Flycatcher	Negative: practices that results in the loss of brushy habitat in riparian areas	riparian habitat, particularly cottonwood and willow	Brush, including willow (salix spp.) and similar species	Habitat loss from stand replacing fires	1	E
					2	C
					3	D
					4	A
Varied Thrush	Negative: clear cuts, retention harvests, thinning	Old, wet, upland coniferous forests (DF/WH) and riparian buffers (>30 m); species is rarely observed in young, recently harvested stands (e.g., retention harvests)	Large conifers with low foliage density near the top, near water or drainages and on steep slopes (more local studies are needed)		1	A
					2	D
					3	C
					4	E
Native Pollinators	Positive: practices that increase habitat heterogeneity (e.g. bare ground for ground-nesting bees and the retention of dead pithy wood for cavity-nesting bees) could help increase bee populations	Forest edge habitat, down dead wood, snags, bare ground, abundant herbaceous species in the understory; heterogeneous habitat supports both cavity and ground nesting species	Down dead wood and snags; some intact stands	Fires that eliminate leaf litter are beneficial for ground nesting species; gaps created in the overstory by fire-caused tree mortality are beneficial as herbaceous cover increases	1	E
					2	C
					3	D
					4	A

Harvest Practices: Forest management practices that typically have a positive and/or negative impact on the species.
Habitat: Forest habitat conditions that are typically preferred by the species.
Retention: Characteristics of forest habitat that are beneficial to the species and should be retained when possible.
Fire: General effects that fire has on the species; this includes natural and/or altered fire regimes.
Rank (R): A ranking of the forest management alternatives from most beneficial (1) to least beneficial (4) to the species.

6.4 WILDLIFE INDICATOR SPECIES

This section includes supplemental information for the effects analysis for wildlife (section 4.2.4.1) as well as links to sources that were used to develop Table 6-7.

6.4.1 White-headed Woodpecker

The white-headed woodpecker (*Picoides albolarvatus*) is a medium-sized bird species that ranges from southern California to southern British Columbia and eastward into Idaho. White-headed woodpeckers are associated with mature dry forest types, including warm and dry Douglas-fir and ponderosa pine forest types within the Reservation. Important habitat conditions and elements for white-headed woodpecker include large-diameter ponderosa pines and snags as well as mostly open forest understories. White-headed woodpecker feed on pine seeds and insects, the latter obtained within needle clusters and by flaking away bark on mature trees. Nest cavities are excavated by both members of a pair within dead or partially dead pine or Douglas-fir trees. North American populations appear to be increasing, but this species is classified as a Species of Greatest Conservation Need in Idaho due to the loss of large-diameter ponderosa pines and snags, fire suppression, and even-age forest management practices.

Nature Serve Explorer: White-headed Woodpecker

https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.100448/Dryobates_albolarvatus

6.4.2 Lewis's Woodpecker

The Lewis's woodpecker (*Melanerpes lewis*) is a medium-sized bird species that ranges from southern California, Arizona, and New Mexico to southern British Columbia and eastward through Colorado. Lewis's woodpecker is associated with mature dry forest types, including warm and dry Douglas-fir and ponderosa pine and dry to moderately dry Douglas-fir, grand fir, and ponderosa pine forest types within the Reservation. Important habitat conditions and elements for Lewis's woodpecker include open ponderosa pines forests, living or burned, containing large numbers of large-diameter snags as well as open, mature cottonwood riparian forests and aspen groves. Lewis's woodpecker feed on insects, berries, fruit, acorns, and nuts, with insects often pursued in flight. Nest cavities are occasionally excavated, but most nests are in existing cavities or natural crevices of large, dead or decaying conifers or poplars (cottonwood and aspen). During the nonbreeding season, Lewis's woodpecker is often nomadic. North American populations appear to be declining, and this species is classified as a Species of Greatest Conservation Need in Idaho due to the loss of large-diameter ponderosa pines and snags, fire suppression, and even-age forest management practices.

FRI Research: Lewis's Woodpecker Forestry Fact Sheet

https://friresearch.ca/publications/lewiss-woodpecker-forestry-fact-sheet

6.4.3 Pileated Woodpecker

The pileated woodpecker (*Dryocopus pileatus*) is a medium-sized bird species that ranges, in the western United States, from the central California coast into British Columbia as well as north-central Idaho and northeastern Oregon. Pileated woodpecker is associated with deciduous and deciduous-coniferous forest types, including dry to moderately dry Douglas-fir, grand fir, and ponderosa pine and moderate and moist grand fir forest types within the Reservation. Important habitat conditions and elements for pileated woodpecker include large-diameter snags and down woody debris found in late-successional stands and humid conditions that promote fungal decay and associated insect communities. Pileated woodpecker feed on forest ant species as well as woodboring beetle larvae, termites, and other insects. Monogamous pairs are territorial. Nest and roost trees can differ in tree species, diameter, and degree of decay. Nest cavities are typically excavated in large-diameter dead or dying conifers, and roosts are often in large, live trees with multiple entrances. North American populations appear to be increasing. Major threats in Idaho include conversion of forest habitats to non-forest habitats, even-aged forest management practices, forest fragmentation, and removal of logging residue and downed wood.

FRI Research: Pileated Woodpecker Forestry Fact Sheet

https://friresearch.ca/publications/pileated-woodpecker-forestry-fact-sheet/#:~:text=Response%20to%20Forest%20Management,nesting%2C%20foraging%2C%20and%20roosting.&text=This%20species'%20response%20to%20retention%20harvesting%20has%20been%20mixed.

6.4.4 Willow Flycatcher

The willow flycatcher (*Empidonax traillii*) is a small songbird species that ranges from Central America northward into British Columbia, Alberta, and the Great Lakes region. Willow flycatcher in Idaho is associated with riparian areas and wet meadows and shrublands within a wide range of forest and non-forest land cover types; can also occur in dry, brushy uplands. Important habitat conditions and elements for willow flycatcher include the presence of willows and other shrub species as well as aquatic invertebrates. As their name implies, willow flycatcher feed on flying insects, particularly caddisflies, mayflies, and stoneflies. Nests are established within shrub thickets within or adjacent to open water. North American populations appear to be declining. Major threats in Idaho include degradation of riparian shrub communities due to livestock grazing, recreation and development pressure, and changes in hydrology.

Nature Serve Explorer: Willow Flycatcher

https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.103270/Empidonax_traillii

6.4.5 Varied Thrush

The varied thrush (*Ixoreus naevius*) is a medium-sized bird species that ranges from northern Baja California to Alaska and eastward into Idaho. Varied thrush is associated with mesic forest types, including moderate and moist grand fir forest types within the Reservation. Important habitat conditions and elements for varied thrush include mesic, mature, and old-growth forest conditions and arthropod-rich forest floors. Varied thrush feed on ground-dwelling insects and other arthropods in leaf litter as well as fruits, nuts, and berries. Nests are constructed off the ground and close to the trunk of small conifers. North American populations appear to be declining. Major threats in Idaho include loss and fragmentation of large patches of mature mesic forest.

FRI Research: Varied Thrush Forestry Fact Sheet

https://friresearch.ca/publications/varied-thrush-forestry-fact-sheet

6.4.6 Native Pollinators

Native pollinators encompass a wide range of insect orders, including Hymenoptera (bees, wasps, and ants), Lepidoptera (butterflies and months), Diptera (flies), and Coleoptera (beetles). All forest types within the Reservation can support one or more species of native pollinators. Forest management practices and related activities (travel management and herbicide use) have potential to influence pollinators in adverse and beneficial ways. Pollinators require overwintering, foraging, and nesting resources for each stage of their life cycle, and these resources can vary for each species. Some groups are specific in their habitat requirements (e.g., digger bees need bare ground). Bumble bees (genus *Bombus*) are opportunistic foragers (do not depend on any one flower type), however some plant species rely on bumble bees for pollination. Pollinator species in general are declining worldwide due to the pesticide use and degradation and loss of native plant communities, specifically habitat conversion for agricultural use, overutilization of remnant habitat by livestock, and competition with invasive species.

The pollination services of forests: A review of forest and landscape interventions to enhance their cross-sectoral benefits

https://www.uidaho.edu/-/media/uidaho-responsive/files/extension/county/kootenai/gardening/the-pollination-services-of-forests.pdf?la=en&rev=d93fdded849b44b1be033be6093587e5

7 Consultation and Coordination

Scoping and Public Participation

Nez Perce Tribal Enrollment conducted a scoping survey from December 10th, 2019, until January 17th, 2020. The survey helped determine who uses Tribal lands and what activities those individuals participate in when on Tribal lands. Surveys were sent out by mail and were also available as an online option.

The Draft EA was made available on the BIA National NEPA Register for a 30-day public review and comment period from March 2 to March 31, 2022. The comments received and responses can be found as a digital PDF at: Public Scoping Survey 2019

Upon review and finalization of the EA, a Finding of No Significant Impact (FONSI) / Decision Notice will be drafted and made available for review.

Summary of Consultation

Consultation was conducted with several federal agencies as well as internally with Tribal committees and departments. This included consultation with the following:

- BIA NW Regional Office, Portland, OR
- BIA Northern Idaho Agency, Lapwai, ID
- USDA Northwest Climate Hub, Forest Service, Portland, OR (climate change integration)
- Nez Perce Tribal Enrollment (scoping survey)
- Nez Perce Tribal Executive Committee, Lapwai, ID

8 List of Contributors

The following table includes all individuals who contributed to the development of this Environmental Assessment.

NAME	EXPERTISE or DISCIPLINE	PROGRAM or DIVISION
Nez Perce Tribe		
Aaron Miles Sr.	Manager of Natural Resources	Department of Natural Resources
Andrew Saralecos	Timber Sales Forester	Forestry and Fire Management
Brian Kummet	Special Projects Forester	Forestry & Fire Management
Emmit Taylor II	Director	Department of Fisheries Resource Management, Watershed Division
Howard L. Teasley Jr.	Director (interim), Forest Operations & Allotment Forester	Forestry & Fire Management
Jeff Cronce	Inventory & Planning Forester, Project Lead (Tribe)	Forestry & Fire Management
Jeff Handel	Fire Management Officer	Forestry & Fire Management
John DeGroot	Director (retired)	Forestry and Fire Management
Julie Simpson	Air Quality Program Coordinator	ERWM, Air Quality Program
Ken Clark	Director	Water Resources
Kerey K Barnowe-Meyer	Wildlife Biologist	Wildlife
Kim Cannon	Director	Land Services
Marcie Carter	Watershed Coordinator	Department of Fisheries Resource Management, Watershed Division
Mary Fauci	Environmental Specialist	ERWM, Air Quality Program
Mary Williams	Wildlife Planner	Wildlife
Patrick Baird	Historic Preservation Officer/Archaeologist	Cultural Resources
Robyn Armstrong	NEPA Coordinator	Department of Fisheries Resource Management, Watershed Division
Sierra Higheagle	Water Quality Program Coordinator	Water Resources
Tim Droegmiller	Fuels Planner	Forestry & Fire Management
Northwest Management Inc.		
Adam Herrenbruck	Manager	Environmental Planning
Eric Nelson	Planning Associate	Environmental Planning
Erica Wimme	Planning Associate	Environmental Planning
Mark Carrao	Project Lead (contractor)	Chief Innovation Officer
Vaiden Bloch	GIS Analyst	Management Services

9 LITERATURE CITED

Agbeshie, A.A., Abugre, S., Atta-Darkwa, T. et al. A review of the effects of forest fire on soil properties. J. For. Res. 33, 1419–1441 (2022). https://doi.org/10.1007/s11676-022-01475-4

Angima, S. D., & Terry, T. A. (Eds.). (2011). Best Management Practices for Maintaining Soil Productivity in the Douglas-fir Region (p. 44). OSU Extension Service, EM 9023. https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9023.pdf

Arnalds, O.; Gisladottir, F.O.; Sigurjonsson, H. 2001. Sandy deserts of Iceland. Journal of Arid Environments. 47: 359–371.

ASCE. (2018). *Report card for Idaho's infrastructure – 2018*. Retrieved from Reston, Virginia:

Aust, W.M., T.W. Reisinger, B.J. Stokes, and J.A. Burger. 1993. Tire Performance as a function of width and number of passes on soil bulk density and porosity in a minor stream bottom. In J.C. Brissette (Ed.), Proceedings of the Seventh Biennial Southern Silvicultural Research Conference, pp. 137-141. U.S. For. Serv. Gen. Tech. Rpt. SO-93.

Barrett, Justin. Craig Mountain Wildlife Management Area 2014 – 2023 Management Plan. Idaho Department of Fish and Game, Dec. 2014, https://idfg.idaho.gov/sites/default/files/2014-2023-CraigMtnWMA-Plan-Final.pdf. Accessed 24 Aug. 2023.

Brown, J.K., Reinhardt, E.D., and Kramer, K.A. (2003). *Coarse Woody Debris: Managing Benefits and Fire Hazard in the Recovering Forest.* RMRS-GTR-105. 16p.

Brown, H. G.; Lowenstein, H. 1978. Predicting site productivity of mixed conifer stands in northern Idaho from soil and topographic variables. Soil Science Society of America Journal. 48: 910-913.

Binkley, D. 1991. Connecting soils with forest productivity. P. 66-69 in Proc.-Management and productivity of Western-Montane forest soils USDA For. Serv. Gen. Tech. Rep. INT-280.

Bull, E.L. 2002. The value of coarse woody debris to vertebrates in the Pacific Northwest. p. 171–178 in Proceedings of the Symposium on the Ecology and Management of Dead Wood in Western Forests, W.F. Laudenslayer Jr., P.J. Shea, B.E. Valentine, C.P. Weatherspoon, and T.E. Lisle (eds.). General Technical Report PSW-GTR-181. Albany, CA: USDA Forest Service, Pacific Southwest Research Station.

Bütler, R., Lachat, T., Larrieu, L., & Paillet, Y. 2013. Habitat trees: key elements for forest biodiversity. In In Focus—Managing Forest in Europe (2.1).

Carlson, R., & Atlakson, J. 2007. *Regional ground water quality monitoring results for Idaho, Lewis, and Nez Perce Counties, Idaho, 2001-2007*. Boise, Idaho: Idaho State Department of Agriculture.

Chandler, C. 2013. Lower Clearwater River Subbasin Salmonid Distribution & Relative Abundance Monitoring. Nez Perce Tribe Department of Fisheries Resources Management Watershed Division. Lapwai, ID, 39 p. Accessed April 28 2021, https://www.cbfish.org/Document.mvc/Viewer/P133307

Clayton, J.L. 1990. Soil disturbance resulting from skidding logs on granitic soils in central Idaho. U.S. For. Serv. Res. Pap. INT-436.

Cromack, K., Jr., F.J. Swanson, and C.C. Grier. 1979. A comparison of harvesting methods and their impact on soils and environment in the Pacific Northwest. P. 445-476 in Forest soils and land use. Proc. 5th N. Am. Forest soils conf., Youngberg, C.T. (ed.). Colorado State Univ. Press, Fort Collins, CO.

Culbert, P. D., Radeloff, V. C., Flather, C. H., Kellndorfer, J. M., Rittenhouse, C. D., & Pidgeon, A. M. (2013). The influence of vertical and horizontal habitat structure on nationwide patterns of avian biodiversity. The Auk, 130(4), 656-665.

Cullen, S.J.; Montagne, C.; Ferguson, H. 1991. Timber harvest trafficking and soil compaction in western Montana. Soil Science Society of America Journal. 55: 1416–1421.

Dahlgren, R.A.; Saigusa, M.; Ugolini, F.C. 2004. The nature, properties, and management of volcanic soils. In: Advances in Agronomy, vol. 82. Amsterdam: Elsevier Academic Press: 113–182.

Dobkowski, A., and R. L. Heninger. 2002. Forest Soil Management Training Manual and Best Management Practices for Ground-Based Harvest Equipment. Forest Research Technical Note. Federal Way, WA: Weyerhaeuser Company.

Dominoni, D.M., Borniger, J.C., & Nelson, R.J. (2016). Light at night, clocks and health: from humans to wild organisms. Biology Letters, 12(2), 20160015. https://royalsocietypublishing.org/doi/10.1098/rsbl.2016.0015.

Durgin, P.B. 1980. Organic matter content of soil after logging of fir and redwood forests. USDA For. Serv. Res. Note PSW-346. 4 p.

EPA. (2019). EPA map of radon zones including state radon information and contacts. Retrieved from https://www.epa.gov/radon/epa-map-radon-zones.

Ertugrul, A. (1979). *Phase I: energy and minerals survey of Nez Perce Indian Reservation, Idaho.* Retrieved from Tulsa, Oklahoma:

Falchi, F., Cinzano, P., Duriscoe, D., Kyba, C.C.M., Elvidge, C.D., Baugh, K., Portnov, B.A., Rybinikova, N.A., and Furgoni, R. (2016). The new world atlas of artificial night sky brightness. Science Advances, 2(6).

Fox, T.R. 2000. Sustained productivity in intensively managed forest plantations. Forest Ecology and Management 138:187–202.

Fox Consulting Engineers and Geologists. (1981). *Evaluation of limestone deposits at the Mission Creek Quarry in Lewis County, Idaho, and Oriental Claim near Orofino in Clearwater County, Idaho*. Retrieved from Wheat Ridge, Colorado:

Froehlich, H.A.; Miles, D.W.R.; Robbins, R.W. 1985. Soil bulk density recovery on compacted skid trails in central Idaho. Soil Science Society of America Journal. 49: 1015–1017.

Garrison-Johnston, Mariann T.; Mika, Peter G.; Miller, Dan L.; Cannon, Phil; Johnson, Leonard R. 2007. Ash cap influences on site productivity and fertilizer response in forests of the Inland Northwest. In: Page-Dumroese, Deborah; Miller, Richard; Mital, Jim; McDaniel, Paul; Miller, Dan, tech. eds. 2007. Volcanic-Ash-Derived Forest Soils of the Inland Northwest: Properties and Implications for Management and Restoration. 9-10 November 2005; Coeur d Alene, ID. Proceedings RMRS-P-44; Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 137-163

Gier, John M.; Kindel, Kenneth M.; Page-Dumroese, Deborah S.; Kuennen, Louis J. 2018. Soil disturbance recovery on the Kootenai National Forest, Montana. Gen. Tech. Rep. RMRS-GTR-380. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 31 p.

Graham, W.G., & Campbell, L.J. (1981). *Groundwater resources of Idaho*. Boise, Idaho: Idaho Department of Water Resources.

Guo, Y., and B.J. Karr. 1989. Influence of trafficking and soil moisture on bulk density and porosity on Smithdale sandy loam in north-central Mississippi. In J.H. Miller (Ed.), *Proceedings of the Fifth Biennial Southern Silviculture Research Conference*, pp. 533-538. U.S. For. Serv. Gen. Tech. Rpt. SO-74.

Hammer, M.S., Swinburn, T.K., & Neitzel, R.L. (2014). Environmental Noise Pollution in the United States: Developing an Effective Public Health Response. Environmental Health Perspectives, 122(2), 115-119. https://ehp.niehs.nih.gov/doi/10.1289/ehp.1307272

Harmon, M.E., Woodall, C.W., Fasth, B., Sexton. J., Yatskov, M., (2011). Differences between Standing and Downed Dead Tree Wood Density Reduction Factors: A Comparison Across Decay Classes and Tree Species. Res. Pap. NRS-15. Newtown Square., PA: U.S. Department of Agriculture. Forest Service. Northern Research Station, 40p.

Harrington, T.B., and S.H. Schoenholtz. 2010. Effects of logging debris treatments on five-year development of competing vegetation and planted Douglas-fir. Canadian Journal of Forest Research 40:500–510.

Helms, J. A. (1998). The dictionary of forestry. Bethesda, MD: Society of American Foresters

Hendrickson, O.Q., J.B. Robinson, and L. Chatarpaul. 1982. The microbiology of forest soils. A literature review. Can. For. Serv. Inf. Rep. PI-X-19. Petawawa Nat. For. Inst., Chalk River, Ont. 75 p.

Higgs, E. S. (1997). What is Good Ecological Restoration? Conservation Biology, 11(2), 338–348. https://crrc.unh.edu/sites/default/files/migrated_unmanaged_files/human_dimensions/reading_materials/higgs_cons_bio_1997_restoration_endpts.pdf

Hsiang, S., Kopp, R., Jina, A., Rising, J., Delgado, M., Mohan, S., Rasmussen, D.J., Muir-Wood, R., Wilson, P., Oppenheimer, M., Larsen, K., and Houser, T. (2017). Estimating economic damage from climate change in the United States. Science, 356(6346), 1362-1369. https://www.science.org/doi/10.1126/science.aal4369

Humann, M.J. (2011). Hearing loss and task-based noise exposures among agricultural populations. (PhD), University of Iowa, Iowa City, Iowa. Retrieved from https://ir.uiowa.edu/cgi/viewcontent.cgi?article=2371&context=etd

Hungerford, R.D. 1980. Microenvironmental response to harvesting and residue management. P. 37-74 in Environmental consequences of timber harvesting in Rocky Mountain coniferous forests. USDA For. Serv. Gen Tech. Rep. INT-90.

Ilharde, B., E. S. Verry, and B. Polik. 1999. Defining riparian areas. In: *Riparian management in riparian forests of the continental eastern United States*, ed. E. S. Very, J. W. Hornbeck, and C. A. Dolloff, 23-42. Boca Raton, FL: Lewis Press.

ITD. (2017). *Idaho traffic crashes – 2017*. Retrieved from Boise, Idaho.

Johnson, L.R.; Page-Dumroese, D.S.; Han, H.S. 2007. Effects of machine traffic on physical properties of ash-cap soils. In: Volcanic-ash-derived forest soils of the Inland Northwest: properties and implications for management and restoration; symposium proceedings; 2008 Apr. 29–30; Denver, CO. Proceedings RMRS-P-44. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 69–82.

Jurgensen, M. F., Harvey, A. E., Graham, R. T., Page-Dumroese, D. S., Tonn, J. R., Larsen, M. J., & Jain, T. B. (1997). Impacts of timber harvesting on soil organic matter, nitrogen, productivity, and health of Inland Northwest forests. Forest Science, 43(2), 234-251.

Jurgensen, M.F., A.E. Harvey, And M.J. Larsen. 1981. Effects of prescribed fire on soil nitrogen levels in a cutover Douglas fir/western larch forest. USDA For. Serv. Res. Pap. INT-275. 6 p.

Jurgensen, M.F., A.E. Harvey, and M.J. Larsen. 1982. Soil microorganisms. P. 14-18 in Management consequences of alternative harvesting and residue treatment practices-lodgepole pine, Bensen, R.E. (ed.). USDA For. Serv. Gen. Tech. Rep. INT-132.

Kauffman, J.B., & Krueger, W.C. (1984). Livestock impacts on riparian ecosystems and streamside management implications… a review. *Journal of Range Management, 37*(5), 430-438.

Kimble, J.J.; Ping, C.L.; Sumner, M.E.; [et al.]. 2000. Andisols. In: Handbook of Soil Science. Boca Raton, FL: CRC Press: 209–224.

Kraemer, J.P., and R.K. Herman. 1979. Broadcast burning: 25-year effects on forest soils in the western flanks of the Cascade Mountains. For. Sci. 25:427-439.

Kucera, P. and D.B. Johnson. 1986. A biological and physical inventory of the streams within the Nez Perce Reservation: Juvenile Steelhead Survey and Factors that Affect Abundance in Selected Streams in the Lower Clearwater River Basin, Idaho. A final report submitted to the Bonneville Power Administration.

McKee, W.H., Jr., G.E. Hatchell, and A.E. Tiarks. 1985. *A Loblolly Pine Management Guide. Managing Site Damage from Logging*. U.S. For. Ser. Gen. Tech. Rpt. SE-32.

Miller, R.E., et al. 1991. Fertilizers and other means to maintain long-term productivity of western forests. P. 203-222 in Forest fertilization: Sustaining and improving nutrition and growth of western forests, Chappell, H.N., et al. (eds.). Univ. Wash. Coll. For. Contrib. 73, Seattle, WA.

Miller, R.E., E.L. Obermeyer, and H.W. Anderson. 1999. Comparative Effects of Precommercial Thinning, Urea Fertilizer and Red Alder in a Site II, Coast Douglas-fir Plantation. Research Paper PNWRP-513. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Miller, R.E., H.W. Anderson, M. Murray, and R. Leon. 2005. Comparative Effects of Urea Fertilizer and Red Alder in a Site III, Coast Douglas-fir Plantation in the Washington Cascade Range. Research Paper PNWRP-565. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Mital, J. M. 1995. Relating soil, vegetation, and site characteristics to Douglas-fir response to nitrogen fertilization in the Inland Northwest. Moscow, ID: University of Idaho. PhD Dissertation.

Moore, J.A., P.G. Mika, J.W. Schwandt, and T. Shaw. 1994. Nutrition and forest health. P. 173-176 in Interior cedar-hemlock-white pine forests: Ecology and management, symp. proc., Baumgartner, D.M, et al. (comps.). Coop. Extension Publ., Washington State Univ., Spokane, WA.

Nanzyo, M.; Shoji, S.; Dahlgren, R. 1993. Physical characteristics of volcanic ash soils. In: Volcanic ash soils—Genesis, properties, and utilization. Amsterdam: Elsevier: 189–207.

National Research Council. 2002. Riparian Areas: Functions and Strategies for Management. Washington, DC: The National Academies Press. https://doi.org/10.17226/10327.

Nez Perce Tribe. 2019. Plant & Wildlife Conservation Strategy of the Nimiipuu. Nez Perce Tribe, Department of Natural Resources, Wildlife Division. Lapwai, Idaho.

Nez Perce Tribe. 2023. Integrated Resource Management Plan.

Nyland, R.D. (2007). Silviculture: Concepts and applications, 2nd edition. Waveland Press, Inc., Long Grove, IL.

O'Hara, K. L., & Gersonde, R. F. (2004). Stocking control concepts in uneven-aged silviculture. Forestry, 77(2), 131-143.

Packer, P.E., and B.D. Williams. 1976. Logging and prescribed burning effects on the hydrologic and soil stability behavior of larch/Douglas-fir forests in the northern Rocky Mountains. Tall Timbers Fire Ecol. Conf. Proc. 14:465-479.

Page-Dumroese, Deborah; Miller, Richard; Mital, Jim; McDaniel, Paul; Miller, Dan, tech. eds. 2007. Volcanic-Ash-Derived Forest Soils of the Inland Northwest: Properties and Implications for Management and Restoration. 9-10 November 2005; Coeur d'Alene, ID. Proceedings RMRS-P-44; Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 220 p.

Palik, Brian J., Anthony W. D'Amato, Jerry F. Franklin, and K. Norman Johnson. *Ecological Silviculture: Foundations and Applications.* Long Grove, IL: Waveland Press, Inc., 2021.

Peterson, S. (2013). *The 2011 economic impacts of the Nez Perce Tribe on north-central Idaho counties.* Retrieved from Moscow, Idaho.

Powell, David C. (1999). Suggested Stocking Levels for Forest Stands In Northeastern Oregon and Southeastern Washington: An Implementation Guide for The Umatilla National Forest. USDA Forest Service, Pacific Northwest Region, Umatilla National Forest, F14-SO-TP-03-99. 300p.

Powell, David C. (2014). Range of Variation Recommendations for Dry, Moist, and Cold Forests. USDA Forest Service, Pacific Northwest Region, Umatilla National Forest White Paper F14-SO-WP-SILV-3. 60p.

Sands, R.; Greacen, E.L.; Gerard, C.J. 1979. Compaction of sandy soils in radiate pine forests. I A penetrometer study. Australian Journal of Soil Research. 17: 101–113.

Schnepf, C., Graham R.T., Kegley S., and Jain T.B. (2009). Managing Organic Debris for Forest Health. Reconciling fire hazard, bark beetles, wildlife, and forest nutrition needs. PNW 609 A Pacific Northwest Extension Publication. 66p.

Scott, W. 2007. A Soil Disturbance Classification System. Long-Term Site Productivity Paper no. 07-3. Federal Way, WA: Weyerhaeuser Company, Western Timberlands R&D. http://extension.oregonstate.edu/lincoln/sites/default/files/documents/soil_disturbance_classification_system.pdf.

Tews, J., Brose, U., Grimm, V., Tielbörger, K., Wichmann, M. C., Schwager, M., & Jeltsch, F. (2004). Animal species diversity driven by habitat heterogeneity/diversity: the importance of keystone structures. Journal of biogeography, 31(1), 79-92.

Thomas et al. 1979. Wildlife Habitats in Managed Forests, The Blue Mountains of Oregon & Washington. USDA, USFS, Agriculture Handbook #553.

Tiarks, A.E.; Haywood, J.D. 1996. Site preparation and fertilization effects on growth of slash pine for two rotations. Soil Science Society of America. 60(6): 1654–1663.

United States Army Corps of Engineers. Dworshak Reservoir Fisheries Investigations. By W.D. Horton. Idaho Department of Fish and Game. Boise, Idaho: 1980.

U.S. Census Bureau. (2010). American Factfinder. Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Climate Data. Located at https://www.usclimatedata.com/climate/winchester/idaho/united-states/usid0276 accessed on May 4th, 2021.

U.S. Geological Survey, 2022, Surface Water data for USA: USGS Surface-Water Daily Statistics, accessed March 15, 2022, at https://waterdata.usgs.gov/nwis/dvstat?

U.S. Global Change Research Program. (2018). *Impacts, risks, and adaptation in the United States: Fourth National Climate Assessment, Volume II*. Retrieved from Washington, D.C.:

Woudenberg, S.W., Conkling, B.L., O'Connell, B.M., LaPoint, E.B., Turner, J.A., and Waddell, K.L. (2010). The Forest Inventory and Analysis Database: Database Description and Users Manual Version 4.0 for Phase 2. USDA Forest Service Rocky Mountain Research Station. RMRS-GTR-245. 344p.