Forest Management Plan

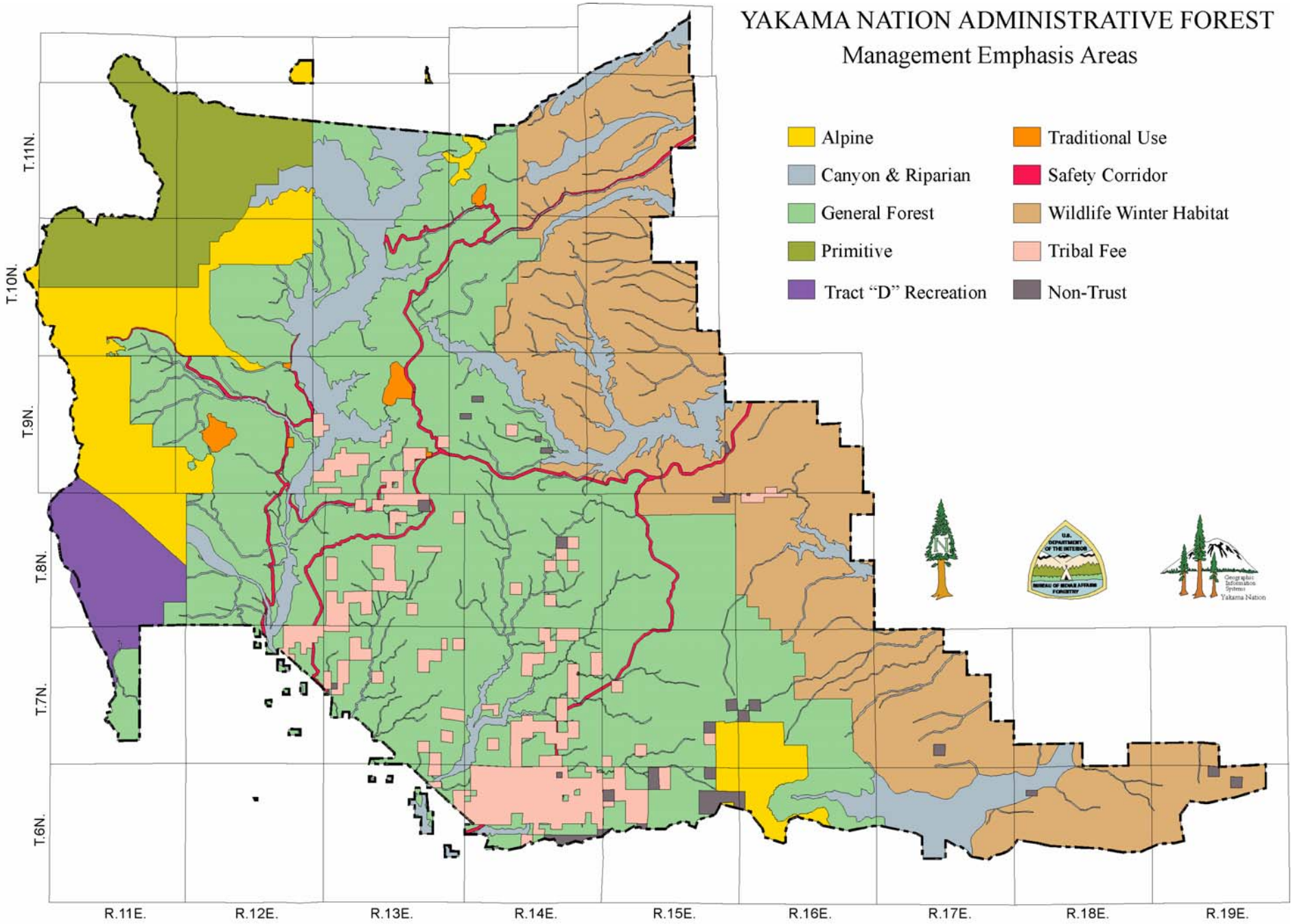
Yakama Reservation

United States Department of the Interior
Bureau of Indian Affairs
Yakama Agency Branch of Forestry
and the Yakama Nation
Toppenish, Washington

September 2005

YAKAMA NATION ADMINISTRATIVE FOREST

Management Emphasis Areas



Produced By Branch of Forestry GIS - November 07, 2006

Forest Management Plan

Yakama Reservation

Developed by the Yakama Nation
and the Bureau of Indian Affairs

Compiled by the Bureau of Indian Affairs
Yakama Agency Branch of Forestry
Forest Management Inventory and Planning Unit

September 2005

PER: # T-159-05

Approved:

Louis Cloud, Chairman
Yakama Tribal Council

9/15/2005
Date

Approved:

Acey Oberly, Superintendent
BIA Yakama Agency

11/07/05
Date

Confederated Tribes and Bands
of the Yakama Nation

Established by the
Treaty of June 9, 1855

RESOLUTION T-021-04

WHEREAS, the Yakama Nation is a federally recognized Nation pursuant to the Treaty of 1855 (12 Stat. 951), and

WHEREAS, the Yakama Tribal Council is the governing body of the Confederated Tribes and Bands of the Yakama Nation of the Yakama Reservation, by the authority delegated by Resolution T-38-56, and

WHEREAS, the Yakama Nation Tribal Council is charged with the duty and responsibility to protect and preserve the health, security, general welfare, resources, and Treaty rights of the Yakama Nation, and

WHEREAS, the harvest of timber is conducted according to the 2003 Revised Forest Management Plan, which was approved by Tribal Council Resolution T-066-03, and is about to expire on December 31, 2003, and

WHEREAS, the Yakama Nation Tribal Council chooses to continue to manage the health of the Yakama Reservation Forest by utilizing sound silvicultural practices and best management practices in the harvest of timber.

WHEREAS, a Forest Management Plan for the 2004-2013 planning period has been prepared by the BIA Yakama Agency, Branch of Forestry and the Yakama Nation.

NOW, THEREFORE, BE IT RESOLVED, by the Yakama Tribal Council meeting in regular session at the Governmental Headquarters of the Confederated Tribes and Bands of the Yakama Nation, Toppenish, Washington, with a quorum being present, the Yakama Tribal Council selects Alternative 4 of the 2004-2013 Forest Management Plan for the Yakama Reservation.

BE IT FURTHER RESOLVED, that the Yakama Nation does not waive, alter, or otherwise diminish its Sovereign Immunity, whether expressed or implied, by virtue of this contract for any and all administrative or legal action which may arise directly or indirectly from the same, nor does the Yakama Nation waive, alter, or otherwise diminish its rights, privileges, remedies or services guaranteed by the Treaty of 1855.

DONE AND DATED on this 4th day of November, 2003, by the Yakama Tribal Council by a vote of 7 for, 5 against, and 0 abstentions.

Ross K. Sockzehigh, Chairman
Yakama Tribal Council

ATTEST:

Virgil Lewis Sr.
Virgil Lewis, Sr., Secretary
Yakama Tribal Council

Post Office Box 151, Fort Road, Toppenish, WA 98948 (509) 865-5121

Confederated Tribes and Bands of the Yakama Nation

Established by the Treaty of June 9, 1855

RESOLUTION

T-159-05

WHEREAS, the Yakama Nation is a federally recognized Tribe pursuant to the Treaty of 1855 (12 Stat. 951), made with the United States of America, and

WHEREAS, the Yakama Tribal Council is the governing body of the Confederated Tribes and Bands of the Yakama Nation by the authority delegated by Resolution T-38-56, and

WHEREAS, the Yakama Tribal Council is charged with the duty and responsibility to protect and preserve the health, security, general welfare, resources, and Treaty rights of the Yakama Nation, and

WHEREAS, the Yakama Tribal Council chooses to manage the health of the Yakama Forest by utilizing sound silvicultural practices and best management practices to meet the Yakama Nation's present needs and values without compromising the management options of future generations, and

WHEREAS, the Yakama Forest is managed according to an approved Forest Management Plan, and

WHEREAS, the BIA Yakama Agency, Branch of Forestry and the Yakama Nation prepared a new Forest Management Plan for the period 2005 to 2014 to guide the restoration of forest health and achieve the goals and objectives of sustainable forest management on the Yakama Reservation.

NOW, THEREFORE, BE IT RESOLVED, by the Yakama Tribal Council, meeting in regular session at the Governmental Offices of the Confederated Tribes and Bands of the Yakama Nation, Toppenish, Washington, with a quorum being present, that the new Forest Management Plan for the Yakama Reservation is approved for implementation and will remain in effect until amended, revised, or replaced.

NOW BE IT FURTHER RESOLVED, that the Yakama Nation does not waive, alter, or otherwise diminish their sovereign immunity, whether expressed or implied, by virtue of enacting this resolution, nor does the Yakama Nation waive, alter, or otherwise diminish the rights, privileges, remedies, or services guaranteed by the Treaty of 1855.

DONE AND DATED on this 15th day of September 2005 by the Yakama Tribal Council by a vote of 10 for, 0 against, and 0 abstentions.

Louis Cloud, Chairman
Yakama Tribal Council

ATTEST:

LaRena B. Sohappy, Assistant-Secretary
Yakama Tribal Council

cc: TIMBER CA# 167-2005-1

Post Office Box 151, Fort Road, Toppenish, WA 98948 (509) 865-5121

Confederated Tribes and Bands of the Yakama Nation

Established by the Treaty of June 9, 1855

RESOLUTION GC-02-06

WHEREAS, the Yakama Nation is a federally recognized tribe pursuant to the Treaty of 1855 (12 Stat. 951) made with the United States of America, and

WHEREAS, the Yakama Nation General Council is the supreme governing authority of the Fourteen Confederated Tribes and Bands of the Yakama Nation, and

WHEREAS, the General Council decides matters of great importance, and

WHEREAS, the management of the Yakama Nation's forest resources is a matter of great importance, and

WHEREAS, the Yakama Nation's Land and Natural Resources Policies Plan states that a Forest Management Plan (FMP) shall be adopted, and

WHEREAS, a FMP was developed by the Yakama Nation and the BIA Yakama Agency Branch of Forestry for the period 2005-2014, and

WHEREAS, the Yakama Nation Tribal Council, being the governing body of the Fourteen Confederated Tribes and Bands of the Yakama Nation by the authority delegated by Resolution T-38-56, selected Alternative 4 of the Environmental Assessment for implementation in the FMP by Resolution T-02l-04, and

WHEREAS, the Tribal Council approved the FMP by Resolution T-159-05, and recommends ratification of the FMP by the General Council.

NOW, THEREFORE, BE IT RESOLVED by the General Council of the Fourteen Confederated Tribes and Bands of the Yakama Nation, meeting in this regular session with a quorum being present, that the new Forest Management Plan is hereby ratified and will remain in effect until amended, revised, or replaced.

BE IT FURTHER RESOLVED, that the Yakama Nation does not waive, alter, or otherwise diminish their sovereign immunity whether expressed or implied by enacting this resolution, nor does the Yakama Nation waive, alter, or otherwise diminish the rights, privileges, remedies, or services guaranteed by the Treaty of 1855.

DONE AND DATED this 16th day of March 2006 by the Yakama Nation General Council in regular session at the Toppenish Community Center by a vote of 110 for and 40 against 116 abstain.

Philip Olney, Chairman
Yakama Nation General Council

ATTEST:
Joe Jay Pinkham, Secretary
Yakama Nation General Council

Post Office Box 151, Fort Road, Toppenish, WA 98948 (509) 865-5121

Acknowledgements

This Forest Management Plan (FMP) is the result of the cooperative efforts of many people over an extended period of time, incorporating the outstanding talents and knowledge of personnel from the Yakama Nation and the Bureau of Indian Affairs, including the Yakama Nation Department of Natural Resources, Yakama Nation Land Enterprise, Yakama Forest Products, Yakama Agency Branch of Forestry, and Yakama Agency Natural Resources Program.

In addition, Yakama tribal members provided information and direction that was critical to the preparation of this Forest Management Plan. Achievement of their goals, desires, and visions for the future of the Yakama Forest was the basis for the development of the management directions in this document.

The leadership and advice of the Yakama Tribal Council, General Council Officers, the Yakama Agency Forest Manager, and the Yakama Agency Superintendent were significant to the development of the FMP. Particularly noteworthy was the assistance and encouragement provided by the Chairman and members of the Tribal Council Timber, Grazing, Overall Economic Development Committee.

Preface

This Forest Management Plan (FMP) for the Yakama Reservation was developed in coordination with the Yakama Nation to direct the management of the Yakama Nation's forest and woodlands.

The FMP was also prepared in accordance with the requirements of the Code of Federal Regulations (CFR) Title 25, Indians, Title 40, Protection of Environment, and Indian Affairs Manual (IAM) Part 53, Forestry. The FMP represents the implementation of Alternative 4 from the Environmental Assessment for the FMP, as identified and adopted by Yakama Tribal Council Resolutions T-021-04 and T-159-05.

The FMP will be reviewed periodically, and amended, revised, or replaced as necessary.

Additional information about forest management planning on the Yakama Reservation may be obtained by contacting:

Superintendent
BIA Yakama Agency
P. O. Box 632
Toppenish, WA 98948-0632

Phone: (509) 865-2255

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Summary

A new Forest Management Plan (FMP) was developed to guide the restoration of forest health and achieve the Yakama Nation's goals and objectives of sustainable forest management on the Yakama Reservation. The FMP describes the new management strategies to deal with the changes in forest conditions that have occurred over the last century.

The FMP is the result of the contributions of Yakama Nation and BIA natural resources programs. Programs that participated in the development of the plan include Archaeology and Cultural Resources, Environmental Quality, Fisheries, Forestry, Range, Roads, Soil, Vegetation, Water Code, Water Resources, and Wildlife Programs.

A number of issues, concerns, and opportunities were identified during the development of the FMP. The main topics, listed in alphabetical order and not in order of importance, included:

- Big-game habitat
- Forest health
- Old growth
- Revenue and employment
- Threatened and endangered species, and
- Water quality.

The 1.4-million-acre Yakama Reservation includes agricultural and rangelands in the east, and approximately 650,000 acres of forest and woodland in the west. There is a pronounced precipitation gradient across the reservation, which greatly affects the distribution and growth of vegetation. Annual precipitation ranges from 7 inches along the Yakima River to 100 inches along the Cascade Crest.

Four vegetation cover types make up 95% of the forest area:

- ponderosa pine (PP) = 25%
- pine-fir (pine and Douglas-fir [PF]) = 23%
- mixed conifer (grand fir, Douglas-fir, western larch, and other species [MC]) = 32%
- true fir-mountain hemlock (subalpine fir and mountain hemlock [FM]) = 15%
- The other 5% of the area has lodgepole pine, Engelmann spruce, western redcedar, and other minor species.

A number of changes in forest health have occurred over the last century on the Yakama Reservation—very similar to the changes that have occurred throughout the Inland West—mainly as a result of livestock grazing, fire exclusion, and selective timber harvesting. Livestock grazing changed the amount and species composition of ground vegetation. Less ground vegetation resulted in reduced amounts of fine fuels, which prevented surface fires from burning across the landscape, as they did historically. Suppression of natural fires also prevented fires from performing important ecosystem functions such as recycling nutrients, regulating species composition, and regulating forest stand densities. Selective timber harvesting removed large ponderosa pine trees and then grand fir and Douglas-fir often regenerated in place of the pines.

The 1934 and 1997 forest cover types provide references for how the forest has changed in recent times. In general, the three forest types, PP, PF, and MC, represent a gradient from open, low-density PP stands to closed canopy, high-density MC stands. A comparison of forest type acres shows a decrease in the number of ponderosa pine acres over time. Ponderosa pine stands decreased from 58% of the area in 1934 to 26% in 1997. As Douglas-fir became established beneath ponderosa pine, many of the pine stands converted to pine-fir while, at the same time, some of the pine-fir stands converted to mixed conifer stands.

Mixed conifer forest types increased from 8% of the area in 1934 to 32% in 1997. The 1934 forest cover types map also shows large areas that burned in the early 1900s, for example, the 1911 Clearwater Burn. Many of these areas have regenerated and are now classified as true fir-mountain hemlock timber types.

The 1934 forest inventory showed a standing volume of 4 billion board feet. Sixty-two years later stand densities increased and the standing volume increased to 11 billion BF, while in the same time period 6 billion BF was harvested from the reservation. The total growth over the period was 13 billion BF (not counting mortality).

As a result of the changes in species composition and increased stand densities, competition increased in many areas and tree vigor decreased. Forested landscapes became susceptible to outbreaks of defoliators, such as the western spruce budworm and the Douglas-fir tussock moth. Landscapes are also now susceptible to attack by bark beetles, such as the Douglas-fir beetle and the mountain pine beetle. In addition, as a result of hazardous fuels buildup, extensive areas are at risk of burning up in high-intensity fires.

The western spruce budworm is a native insect that prefers to eat grand fir and Douglas-fir foliage. Many stands of Douglas-fir were defoliated for several consecutive years, and then were attacked by Douglas-fir beetles, which resulted in high amounts of mortality. The large number of dead trees has greatly increased the fire hazard. The risk of fire is greatest during late summer when fuels are dry and lightning storms move across the area. Now there is a greater likelihood of high-intensity, stand-replacement fires occurring where there used to be low-intensity, surface fires.

The FMP will use an ecosystem management approach, which considers the sustainability of all resources. Emphasis will be on achieving management objectives at the scale of subbasins (basins within watersheds). Silvicultural prescriptions will be based on forest habitat types, which are used to classify land according to potential natural vegetation and productive capability. Habitat types within the Yakama Forest include: Oregon Oak; Ponderosa Pine; Douglas-fir; Grand Fir in Cedar Valley; Grand Fir, low elevation, dry; Grand Fir, high elevation, wet; Grand Fir, low elevation, wet; Pacific Silver Fir; and Subalpine Fir.

The silvicultural prescriptions will emphasize managing for appropriate tree species and stand densities with regard to the carrying capacity of the land. Management Emphasis Areas will provide for modified prescriptions in areas of special concern, such as riparian areas and canyons. The long-term goal will be to restore the forest to a sustainable condition.

Forest restoration implies that the forest will be returned to a prior condition. Nineteenth-century forest conditions on the Yakama Reservation appeared to be more sustainable than present conditions. For example, open pine stands were maintained in a healthy condition by frequent, low-intensity fires. The forestry program is using historic species composition and stand densities as references for the desired future stand conditions.

Forest health describes the ability of a forest ecosystem to remain productive and withstand disturbances over time. It is usually easy to recognize the differences between a healthy forest and an unhealthy forest. A healthy forest maintains a diversity of plants and animals, aesthetic appeal, and resource sustainability (that is, a dependable source of roots, huckleberries, clean water, fish, vigorous trees, forage for animals, and clean air). In addition, a healthy forest is resilient to periodic disturbances such as drought, insects, diseases, fires, climatic change, and management practices.

An unhealthy forest is characterized by high levels of insects and diseases. Pest epidemics cause increased tree mortality, reduced productivity, and create obstacles to achieving sustainability. Maintaining forest health is key to sustainable forestry.

Sustainable forest management links environmental protection, economic prosperity, and social well-being in the forest management planning and decision-making process. The goal of sustainable forest management is to meet the Yakama Nation's present needs and values without compromising the management options of future generations.

In the pursuit of sustainability, one must ask the basic question, "What do you want to sustain?" The primary goal of the FMP is to maintain the Yakama Forest in a healthy condition in order to sustain multiple resources, including cultural resources, such as camas and huckleberries, forests and woodlands, water quality, fish, and wildlife. Achieving these management goals will ensure that the forest will remain a source of spiritual renewal, food and medicinal plants, revenue for the Yakama Nation, and employment for tribal members.

These management goals were setback by a western spruce budworm epidemic that lasted two decades. Budworm populations began to increase in the southwest portion of the reservation in 1985 with a corresponding increase in defoliation of Douglas-firs and grand firs. Large numbers of trees died across the reservation as a result of defoliation. In 2000, defoliation was occurring on approximately 206,000 acres.

In 1998 a two-fold strategy was devised to deal with the budworm epidemic. The short-term strategy aimed to minimize economic losses by recovering the value of dead and dying trees, and reducing hazardous fuel loads. The long-term strategy aims to promote the development of a forest that will be more resilient to natural and human-caused disturbances.

Silvicultural treatments are being used to restore forest health. In general, pine and larch are favored over Douglas-fir and grand fir in planting and thinning operations. Timber sales were prioritized to treat areas that were most severely affected by the budworm. Between 1999 and 2003, silvicultural treatments were implemented on approximately 100,000 acres of budworm habitat. The treatments were prescribed to change the forest stand conditions that were favorable

for the spruce budworm. The budworm is a symptom of a bigger problem, which is a forest that has changed in species composition and density.

The number of acres affected by budworm increased steadily from 1985 to 1989. In 1990, 70,000 acres were treated with a biological control agent, *Bacillus thuringiensis* (Bt), and the budworm population crashed in 1991. However, the stand conditions were still favorable for the budworm and the population resurged in 1992 and continued to rise. Between 1999 and 2001, 97,000 acres were treated with Bt. The epidemic peaked in 2000 when the budworm defoliated trees on 206,000 acres. Defoliation then decreased dramatically, primarily as a result of silvicultural treatments. In 2002, 1,207 acres were defoliated. In 2004, defoliation increased to 6,572 acres—mainly in the Primitive Area.

Timber harvesting began on the Yakama Reservation in 1944 when about 5 million board feet (BF) of ponderosa pine was harvested on the Dry Creek Timber Sale. The sale was initiated because of a bark beetle epidemic. Altogether, approximately 10 million BF of ponderosa pine was salvaged. In 1949 harvesting began on the Summit Creek Sale, which was the first major commercial timber sale on the reservation.

The annual timber harvest level peaked at 226 million board feet in 1999 in response to the budworm epidemic and then decreased in the following years. In 2004, 150 million BF were harvested. The projected annual timber harvest for the next 10 years will start out at 158 million BF and then gradually drop down to 143 million BF by 2014.

The Allowable Annual Cut (AAC) during the last 10-year planning period was 143 million BF. Harvest levels remained below the AAC for the first half of the planning period. Harvesting was accelerated in the second half of the planning period to aggressively deal with the western spruce budworm epidemic.

The amount of pine harvested, as a percent of total volume harvested, has decreased in recent years while the amount of Douglas-fir and grand fir harvest has increased. This trend reflects the increased growth of Douglas-fir and grand fir, as well as the deliberate removal of these species because they are the budworm's preferred food.

Following commercial harvesting, precommercial thinning is done to regulate stand density and species composition. The Forest Development Program conducts thinning on 5000 acres per year, which provides jobs for tribal members. In some areas there is adequate natural regeneration of the desired species; however, if there is not a seed source then the areas will be planted with pine and larch to ensure future productivity. Forest Development plants 2000 acres per year, which provides additional jobs for tribal members. The Fuels Management Program conducts controlled burns on 1700 acres per year. Prescribed fire can be very beneficial by recycling nutrients, regulating species composition, and adjusting stand density.

The volume and species mix of future harvests is anticipated to change as a result of the increased planting of pine and larch, and as the emphasis of forest management shifts to establishing and maintaining uneven-aged stands of ponderosa pine.

The pathway to sustainable forestry requires proactive management. The long-term management goal is to restore forest health. This can be accomplished by promoting the development of more open forest stands composed of ponderosa pine and western larch.

Achieving the management goals of the FMP will ensure that the forest resource will be maintained as a source of spiritual renewal, food and medicinal plants, revenue for the Yakama Nation, and employment for tribal members.

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Chapter I. Purpose and Need

Purpose

The purpose and need for the Forest Management Plan (FMP) is to provide direction and guidance for forest management activities conducted by the Bureau of Indian Affairs (BIA), Yakama Agency, Branch of Forestry (BOF), and the Yakama Nation (YN) Department of Natural Resources (DNR) during the planning period. Congressional trust responsibilities for management of the Yakama Reservation forest resources have been delegated to the BIA Yakama Agency Superintendent. This FMP defines how trust responsibilities and YN forest management goals and objectives will be fulfilled.

Relationship to Other Documents

Environmental Assessment

An Environmental Assessment (EA) was completed for this Forest Management Plan according to NEPA requirements (BIA Yakama Agency 2005). The EA reviews a suite of five alternatives from which the Yakama Nation Tribal Council selected a preferred alternative described in Chapter IV that gives direction to this Forest Management Plan. In addition, the EA evaluates the environmental impacts, and describes mitigation and monitoring that will occur during the planning period.

Archaeological Overview

An archaeological overview, entitled *Timeball, A Story of the Yakima People and the Land* (Uebelacker 1984) was completed for the 1983–1992 Forest Management Plan and is still considered applicable for this Forest Management Plan. The "Timeball" document provides information on locating, evaluating, preserving, and enhancing prehistoric and historic resources.

A separate archaeological document has also been prepared as a confidential inventory-atlas for the Yakama Tribal Council. This inventory-atlas enables tribal officials to evaluate proposed forest management activities for potential impacts to these sites.

Forest History

The *Yakima Indian Nation Forest Heritage* (Williams and Babcock 1983) provides a history of forest management on the Yakima Reservation up to 1983. This document outlines previous YN and BIA management objectives, practices, accomplishments, and problems.

A History of Forest Management on the Yakima Indian Reservation 1983–1992 (Schuttler and Carmichael 1993) was prepared to provide a forest management history update from 1983 to 1991. The update continued the earlier history narrative and described increasing tribal autonomy and involvement in forest management. Another history update was prepared by William Babcock for the period from 1992 to 2003.

Forest Development Plan

The Forest Development Program became a tribal PL 93-638[1] contract program as of July 1, 1991. The Forest Development Program Implementation Plan, as shown in Chapter V of this document, presents the program's strategy for the planning period. This section in Chapter V is complemented by two additional documents not included in this FMP—they include the Annual Operations Plan (AOP) and an Operations Manual (OM). The AOP serves to identify individual projects and target levels on an annual basis. The OM outlines the technical guidelines for project implementation.

Forest Inventory Analysis

There are 1,286 Continuous Forest Inventory (CFI) plots that are remeasured at 10-year intervals to provide growth, mortality, volume, and trend information utilized by the Forest Management Plan. The permanent plots were measured in 1995–96 and remeasurement began in 2005. Analysis of the 1995 CFI data, which was utilized in this FMP, will be published in the Yakama Reservation Inventory Analysis.

Fire Management Plan

The Normal Year Fire Plan and the Yakama Reservation Fire Plan (BIA Yakama Agency 2004a and 2004b) combine to form the policy, training, prevention, and action plan for the fire organization. The Normal Year Fire Plan is used for work programming and budgeting. The Yakama Reservation Fire Plan specifies the manpower and equipment needs for each national fire danger rating class. Both documents are updated annually and are available at the Yakama Agency Branch of Forestry Fire Management Office.

Range Unit Plans

The Yakama Reservation has been divided into range units for planning purposes. The Range Section of the BIA, Yakama Agency Natural Resources Program, is responsible for range unit plans on the Yakama Forest.

Tribal Resolutions

The Yakama Nation transacts business through Tribal Council Resolutions, in accordance with a General Council Resolution dated February 18, 1944. Subsequent to that enactment, the Tribal Council approved proposed timber sales, Forest Management Plans, and a range of other forest management activities. Yakama Nation ordinances and standards are implemented in this manner.

The following Tribal Resolutions are pertinent to the conduct of forest management activities on the Yakama Reservation:

[1] Public Law 93-638: Indian Self-Determination and Education Assistance Act of 1975.

- T-92-87 (dated 5/7/1987)—Tribal Council Resolution approving and adopting the Land and Natural Resources Policies Plan. This tribal document is a multiple resources plan and includes direction for cultural resources, forestry, wildlife, fisheries, and water management.
- T-117-87 (dated 11/6/1987)—Tribal Council Resolution approving the 1983–1992 Forest Management Plan.
- T-67-88 (dated 3/15/1988)—Tribal Council resolution that establishes the harvest policy for minor forest products such as firewood, poles, and Christmas trees.
- T-25-91 (dated 12/10/1990)—Tribal Council Resolution that requires a tribal permit for the harvest of timber from non-Yakama land within the reservation boundaries. A major stipulation of the permit is the required adherence to the current Yakama Forest Management Plan.
- T-64-91 (dated 3/21/1991)—Tribal Council Resolution requesting an increase of Forest Management Deductions from 6 percent to 10 percent to pay for the costs of additional personnel to scale timber and conduct other required forest management activities.
- T-021-04 (dated 11/4/2003)—Tribal Council Resolution selecting Alternative 4 of the Environmental Assessment for this Forest Management Plan.
- T-159-05 (dated 9/15/2005)—Tribal Council Resolution approving this Forest Management Plan for implementation

Tribal Plans

Goals, policies, and appropriate uses of land and resources have been stated in the Land and Natural Resources Policies Plan (Yakima Indian Nation 1987), which was approved by Tribal Resolution T-92-87. The Policies Plan provides the framework for meeting Yakama Nation mandates. Practices that adhere to these policies have been incorporated into the Forest Management Plan.

Plans for specific tribal programs are in various stages of development. These plans will be recognized by and coordinated with the Branch of Forestry activities to assist in the effective management of the natural resources of the reservation.

Federal Regulations

In addition to the Indian Affairs Manual, there are a number of federal laws and Executive Orders that are applicable to timber harvest planning and implementation on the Yakama Reservation, including:

- Antiquities Act of 1906
- Historic Sites Act of 1935
- National Historical Preservation Act of 1966, as amended in 1980 and 2000
- National Environmental Policy Act of 1969, as amended
- Archaeological and Historic Preservation Act
- American Indian Religious Freedom Act
- Archaeological Resources Protection Act
- Native American Graves Protection and Repatriation Act
- National Indian Forest Resources Management Act of 1990
- Executive Order 11593, Preservation and Enhancement of the Cultural Environment
- Executive Order 13007, Indian Sacred Sites
- Executive Order 13084, Consultation and Coordination with Indian Tribal Governments

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Chapter II. Forest Management Mission, Goals, and Objectives

Land planning and management concepts continue to change over time. In the past, resource managers generally focused on the resources tied to their discipline, sometimes with little regard for the impacts their actions might have on other resources. As our understanding of the complex interrelationships in nature grows, management strategies, including those related to forest management planning, are changing in attempts to incorporate an ecosystem approach to natural resources management.

This Forest Management Plan has been prepared in conjunction with the Yakama Nation's Integrated Resource Management planning process. The process of developing an Integrated Resource Management Plan for the Yakama Reservation began in 1999; and though the plan has not been completed, a lot of useful resource information has been compiled.

Integrated resource management goes beyond the natural world and incorporates social, cultural, environmental, and economic aspects into the management scenario. It encourages active participation by those with a vested interest in the management of resources. Integrated resource management planning ties together all decisions that affect a particular area, in this case the Yakama Nation Administrative Forest (Yakama Forest), so that each decision impact can be compared with all others. It identifies conflicting and complementary management actions.

Directions for developing an Integrated Resource Management Plan (IRMP) are provided in the Guidelines for Integrated Resource Management Planning in Indian Country (BOFRP). The guidelines, developed with the participation of many tribes, points out that an IRMP is a tribe's strategic plan for the comprehensive management of a reservation's resources. The process by which IRMPs are developed is a mechanism for examining the relationships among natural resources and their various uses, economic trends, cultural needs, and social forces. The goal of the IRMP is to develop a natural resource management approach that reflects the social, cultural, economic, and natural resource values of Yakama Nation tribal members.

Forestry Program Mission

The Bureau of Indian Affairs, Branch of Forestry provides forestry services to the Yakama Nation in cooperation with tribal programs and other Agency branches. These services include (1) Forest Protection from insect, disease, and trespass; (2) Forest Management, including inventory, planning, geographic information systems (GIS), silviculture, engineering, and presale; (3) Technical Support for the YN PL 93-638 contracts and grants; (4) Timber Sales, including administration of timber sale contracts and permits, log scale and money records management, and forest patrol; (5) Fire Management, including prescribed burning, presuppression, and suppression; and (6) Program Administration, including federal and tribal budgets and finance, personnel actions, procurement, development of program policy and direction, Forest Management Deductions (FMD), and administrative functions.

Goals and Objectives

The Bureau of Indian Affairs is guided by the requirements of the National Indian Forest Resources Management Act of 1990 (US Code Title 25, Chapter 33) in the development of planning documents such as the Forest Management Plan. These requirements form a basis for establishing priorities and making decisions, and require that forestland practices be designed with the following goals and objectives under all alternatives:

1. The development, maintenance, and enhancement of Indian forest land in a perpetually productive state in accordance with the principles of sustained yield and with the standards and objectives set forth in a forest management plan by providing effective management and protection through the application of sound silvicultural and economic principles to the harvesting of forest products, forestation, timber stand improvement, and other forestry practices.
2. The regulation of Indian forest lands through the development and implementation, with the full and active consultation and participation of the appropriate Indian tribe, of forest management plans which are supported by written tribal objectives and forest marketing programs.
3. The regulation of Indian forest lands in a manner that will ensure the use of good methods and order in harvesting so as to make possible, on a sustained-yield basis, continuous productivity and a perpetual forest business.
4. The development of Indian forestlands and associated value-added industries by Indians and Indian tribes to promote self-sustaining communities, so that Indians may receive from their Indian forestland not only stumpage value, but also the benefit of all labor and profit that such Indian forestland is capable of yielding.
5. The retention of Indian forestland in its natural state when an Indian tribe determines that the recreational, cultural, aesthetic, or traditional values of the Indian forestland represents the highest and best use of the land.
6. The management and protection of forest resources to retain the beneficial effects to Indian forestlands of regulating water run-off and minimizing soil erosion.
7. The maintenance and improvement of timber productivity, grazing, wildlife, fisheries, recreation, aesthetic, cultural, and other traditional values.

To promote mutual understanding and involvement, the land and forest resource planning process must be directed by tribal desires and concerns. Accordingly, Yakama Nation members and tribal officials have identified the following Yakama Reservation-specific management goals and objectives:

1. The implementation of forest resources management activities in a manner that will be in accordance with the cultural heritage and unique lifestyles of the people of the Yakama Nation.
2. The application of prudent silvicultural treatments, emphasizing uneven-aged systems, but with the option to manage some forest types or certain conditions under even-aged systems.
3. The utilization of continuous training in order to maintain the most technically qualified staff possible.
4. The encouragement and education of Indian employees to assume greater responsibility in the management of the Yakama Forest.
5. The establishment and maintenance of a total resource information and reconnaissance system at a level necessary to carry out intensive forest management.
6. The protection and improvement of habitat for natural foods and medicinal plants.
7. The protection and preservation of cultural and traditional sites.

8. The application of cost-efficient, well-planned, and well-executed fire protection and fire use programs.
9. The utilization of the most current and technically sound methods for administration and management of the Yakama Nation forest resources.
10. The continuance of consultation and cooperation between Yakama Nation and Yakama Agency programs.
11. The protection of Yakama Nation forest resources from trespass, insects, disease, and fire.
12. The preservation of the integrity and support of the Yakama Nation PL 93-638 Contracts and Grants.

Forest Management Vision

Implementation of the Forest Management Plan will enhance and maintain a diversity of forest conditions, maintain sustainable production of commercial and noncommercial resources, and thereby maintain the forest resource as a dependable source of spiritual renewal, food and medicinal plants, revenue, and employment for the Yakama people.

Desired Future Conditions

Through the scoping process for this analysis, 15 desired future conditions (DFCs) for the Yakama Forest have been identified. The Forest Management Plan provides a process reflecting the membership's desire to move the Yakama Forest towards these desired future conditions.

1. Reservation and boundary surface and ground water are in sufficient quantity and distribution and of high quality to meet existing and desired future needs.
2. Hydrologic processes sustain the water, soil, and other resources.
3. Wetlands, riparian, and aquatic ecosystems continue to function as natural systems.
4. Culture, traditions, and practices remain in the personal, social, economic, spiritual, and political aspect of the lives of the reservation's membership.
5. The long-term productivity and stability of the reservation's soil resource is maintained.
6. Suitable habitat conditions for desirable native and non-native species (flora and fauna) exist to maintain biodiversity that includes the diversity of genes, species, and ecosystems, as well as the evolutionary processes that link them. Only native plant species are desirable, and will be managed with propagation and enhancement. Non-native invasive vegetation will be suppressed or eradicated.
7. Managed landscapes more closely resemble those created by the activities of historic disturbance agents such as fire (natural and human ignitions), wind, insects, disease, and animals.
8. Viable populations (numbers and distribution of reproductive individuals) of native and desired non-native species of wildlife, and their supporting habitats are maintained, while wildlife is provided in sufficient numbers to meet the cultural, subsistence, and recreational needs of Yakama tribal members.
9. An abundance of anadromous salmonids, non-anadromous salmonids, and other species the Nation desires continue in the waters of the reservation.
10. Tribal member's values are clearly stated and reflected in the management of their resources.
11. High air quality continues to exist on the reservation.
12. A mosaic of desirable rangeland plant communities within the Yakama Forest with diverse forbs, grasses, and shrubs that optimize ecosystem processes. Suppression and elimination of threatening, non-desirable rangeland plant communities that degrade ecosystem processes will continue.
13. The reservation is in a clean, green, and healthy condition pleasing to member's senses where man-made features and structures complement nature and meet the spiritual, cultural, social, and economic needs of the tribal membership.

14. The landscape is producing a viable short-term and long-term economic stability for the tribal membership.
15. Diverse year-round recreational opportunities are provided for all age groups and ability levels with an emphasis on tribal member utilization as well as resource protection.

Scope of the Proposed Action

The scope of the Forest Management Plan Environmental Assessment was determined through tribal membership scoping along with input from the staff of the Yakama Nation, Bureau of Indian Affairs, and Western Resources Analysis. The scope of the proposed action closely follows the direction and guidance provided by the Yakama Tribal Council, Yakama Nation Department of Natural Resources, and Bureau of Indian Affairs.

This plan will go into effect in 2005. Reasonable foreseeable future actions considered within the next 10 years include the following:

- Consistency in management direction for all forest and woodlands on the reservation
- An increase in the use of prescribed fire to bring the vegetation more in line with natural conditions
- An increase in demand for special forest products and traditional uses
- An increase in tribal population to be supported by the reservation's forest products.

Natural resource planning and management activities occur at two scales—a reservation-wide landscape scale and a project scale. The reservation-wide, landscape-planning process concentrates on identifying and prioritizing projects, and analyzing the relationship of each project to other projects and the overall goals of the Yakama Nation. Landscape planning begins with the programmatic Environmental Assessment and provides direction for project level activities. Project activities are coordinated to meet reservation-wide goals and objectives. The landscape planning process provides direction to each project as to the specific targets that must be achieved in order to move closer to the desired future conditions. It is anticipated that this direction will assist in eliminating some of the conflicts that might occur in projects because of differing goals, viewpoints, and agendas.

The project proposal process under the Forest Management Plan will operate under a modified form of the project proposal process that was being used on the reservation. The NEPA documents will include the programmatic EA and timber sale EAs for individual projects. Each timber sale EA will be accompanied by management directions, silvicultural prescriptions, road plans, and other requirements to be used on site-specific projects.

Chapter III. Current Forest Environment

Description of the Yakama Reservation

Location

The Yakama Reservation occupies portions of Yakima, Klickitat, and Lewis counties in south-central Washington State. The reservation lies between 120° 00' and 121° 30' west longitude, and between 45° 53' and 46° 33' north latitude (Figure III–1). Beginning in the southeast corner of the reservation, where the Yakima River meets the Horse Heaven Hills, the eastern boundary of the reservation follows the Yakima River north to Ahtanum Creek; the northern boundary runs along Ahtanum Creek west to the Goat Rocks; the western boundary follows the crest of the Cascade Mountains from the Goat Rocks south past Mt Adams to the Simcoe Mountains; and the southern boundary follows the crest of the Simcoe Mountains and Horse Heaven Hills east to the Yakima River. Eastern portions of the reservation are within the Columbia River Plateau geologic province and the western lands lie within the Cascade Mountain province.

The area of the present-day Yakama Reservation became part of Washington Territory in 1853. In 1889, Washington became the 42nd state of the United States of America.

People

Since time immemorial, the Yakama people and their ancestors dwelled along the Columbia, Wenatchee, and Yakima Rivers in what is now central Washington State. Their economy was based on fishing for salmon, gathering roots, berries, and nuts, hunting deer and elk, and extensive intertribal commerce. Goods produced in the Columbia Basin included a variety of fish products and other foods, oil, white talc, basketry, skins, furs, jewelry, artwork, cosmetics, feathers, dogs, and horses. The Yakama language belongs to the Sahaptin-Chinook branch of the Penutian linguistic stock and the Yakama culture is of the Plateau area (Schuster 1990).

In the Treaty of June 9, 1855 the Yakama, along with 13 other tribes and bands, ceded to the United States 11.5 million acres of territory from the Cascade Mountains to the Snake and Palus Rivers, and from Lake Chelan to the Columbia River. The 14 confederated tribes and bands that were settled on the 1.4-million-acre Yakama Reservation and formed into the Yakama Nation included the Kah-milt-pah, Klickitat, Klinquit, Kow-was-say-ee, Li-ay-was, Oche-chotes, Palouse, Pisquose, Se-ap-cat, Shyiks, Skinpah, Wenatshapam, Wishram, and Yakama.

Government

The Confederated Tribes and Bands of the Yakama Nation is a federally recognized sovereign tribe pursuant to the Treaty of 1855. The Yakama Tribal Council is the governing body of the Yakama Nation and is charged with the duty and responsibility to protect and preserve the health, security, general welfare, resources, and Treaty rights of the Yakama Nation. In 1933 the Yakamas first began to elect representatives of the 14 tribes and bands to make up the Yakama Tribal Council. Two members were selected from each of seven districts that were traditional

centers of tribal activity. The Yakamas began to formalize the tribal government in 1946 by establishing official rules and procedures to guide Tribal Council actions. Beginning in 1948, the tenure of Tribal Council members was changed from life terms to four-year terms and elections for half of the Council members began to be held every two years.

In 1946 the Yakamas also made rules for membership in the General Council. The General Council includes all tribal members over 18 years of age and comprises all eligible voters in Council elections. The Yakama Nation's official roll was begun in 1949 with 3,680 members; and membership has steadily increased to 9,778 enrolled members as of October 4, 2005[1]. The General Council determines tribal policy, rules, and procedures while the Tribal Council transacts tribal business. Day-to-day operations are conducted by the Executive Board of the Tribal Council, which consists of a Chairman, Vice-Chairman, and Secretary. Within the Tribal Council there are eight standing committees and five special committees to manage all of the diverse interests of the Yakama Nation.

The Bureau of Indian Affairs, Yakama Agency, Branch of Forestry coordinates with tribal organizations in providing forestry services to the Yakama Nation. The BIA operates under the Code of Federal Regulations and the Indian Affairs Manual, Part 53 in carrying out the trust responsibilities of the United States government. Trust responsibilities for management of the Yakama forest resource are delegated to the BIA Yakama Agency Superintendent. The Yakama Tribal Council oversees forest management activities and provides direction, usually through the Timber, Grazing, Overall Economic Development Committee, in the form of motions, committee actions, and resolutions. The Forest Management Plan defines how trust responsibilities and Yakama Nation objectives will be fulfilled.

Land Ownership

The Yakama Reservation comprises 45 percent of Yakima County and 11 percent of Klickitat County's land base. Approximately 300 acres in the northwest corner of the reservation are within Lewis County. Distribution of reservation land by ownership is shown in Table III–1.

Table III–1. Yakama Reservation Ownership

Ownership	Acreage	Percent
Tribal Trust	870,988	63
Individual Trust	248,039	18
Government Trust	22	<1
Non-trust (Fee) Lands	257,999	19
Total	1,377,048	100

[1] Yakama Nation Enrollment Office

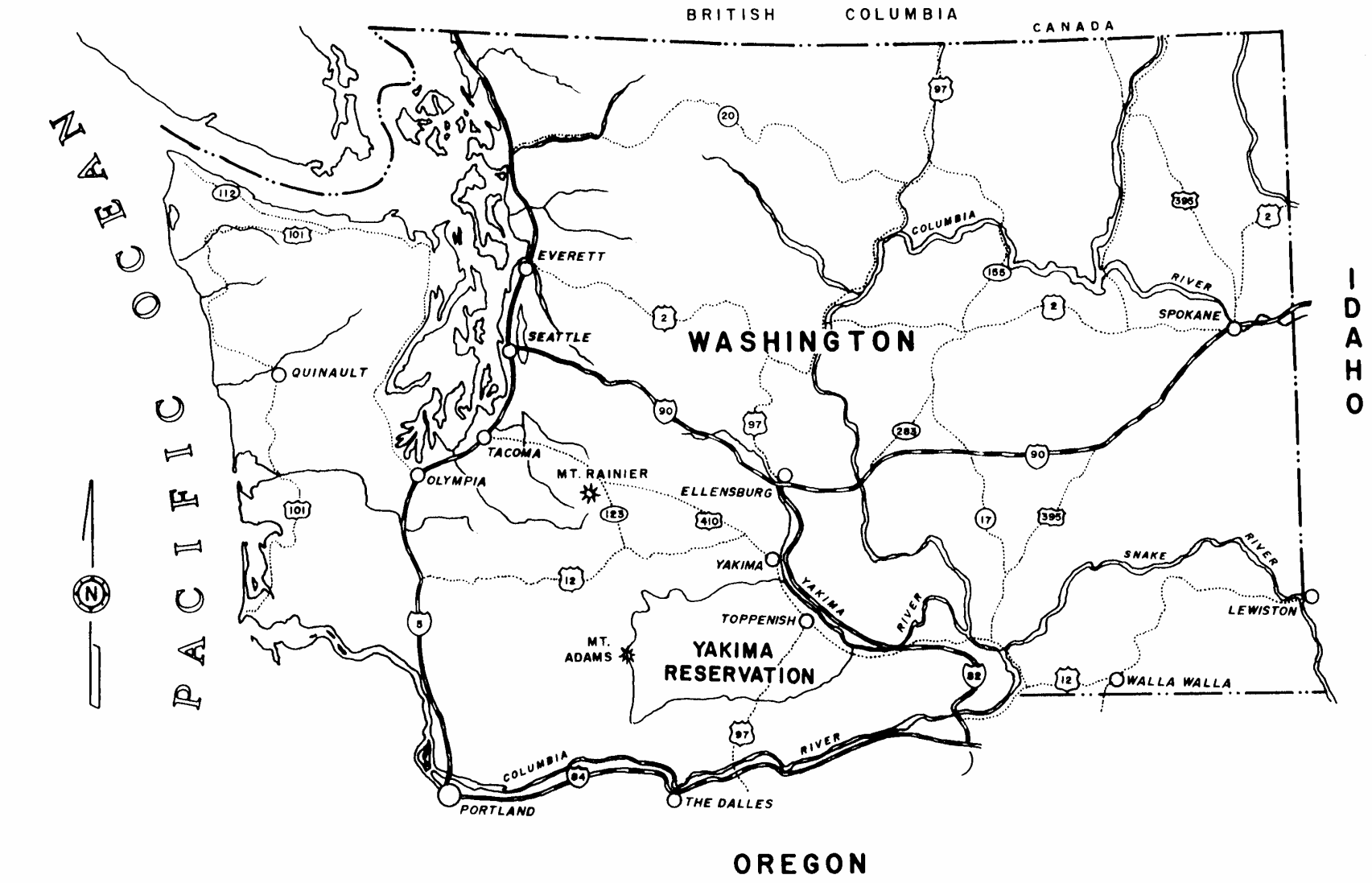

Figure III–1. Location of the Yakama Reservation in South-central Washington State

Land Acquisition

The Yakama Nation has a goal of acquiring 100 percent of all fee land (Figure III–2) within the Closed Area of the reservation, as stated in the Yakama Nation Strategic Plan (Yakama Nation 1997). Over the past several years, the Yakama Nation has aggressively pursued acquisition of fee lands.

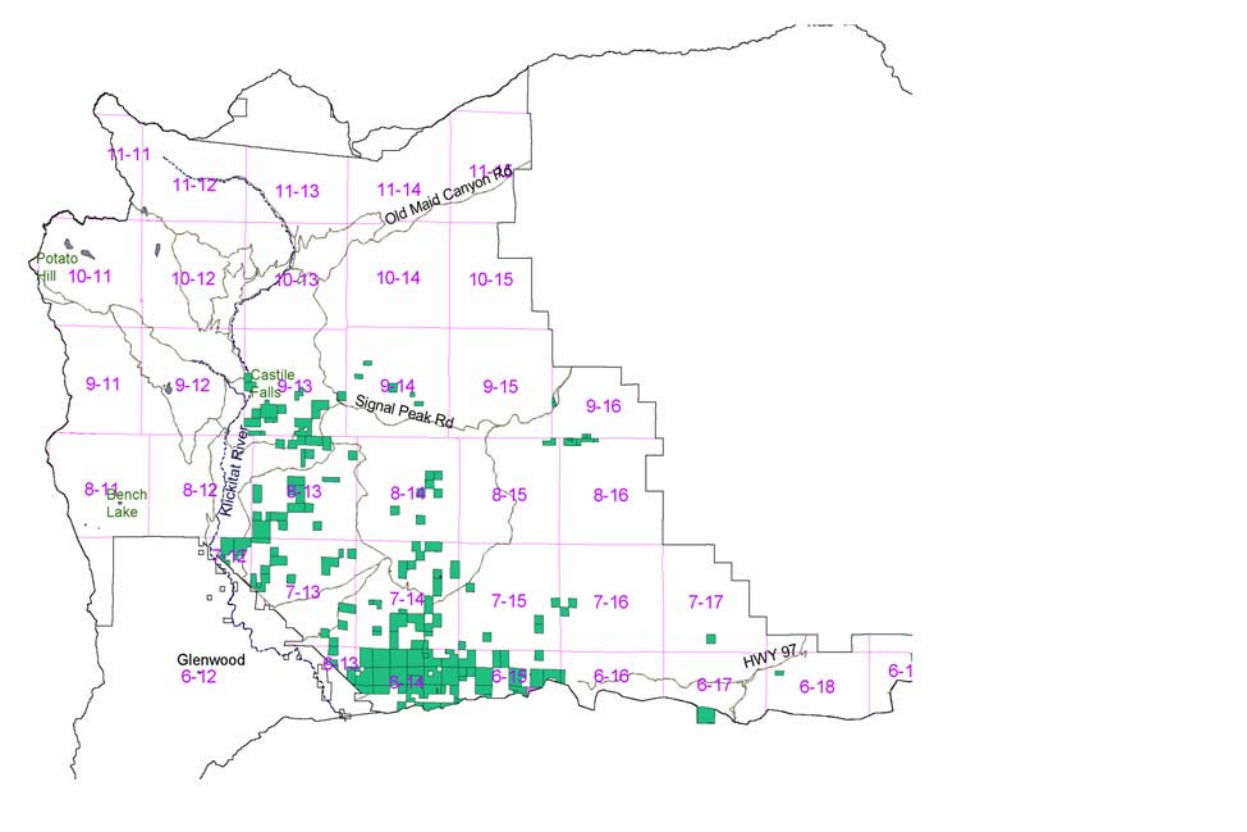

Figure III–2. Fee Land within the Yakama Forest

In 1990, approximately 36,000 acres of land within the Closed Area was identified as non-Indian owned. As of June 2001, the Yakama Nation acquired more than 31,000 acres of those lands. The Treaty of 1855 included a boundary description and a map; unfortunately, the map was lost in the Interior Department and was not found until 1930. The fee lands are the result of erroneous boundary surveys by the federal government that excluded vast tracts of Yakama Reservation lands. Federal legislation, such as the Homestead Act, allowed non-Indians to settle open and unclaimed lands. Other federal legislation, such as the Indian Allotment Act, allowed the transfer of parcels from individual Indians to non-Indians. The passage of the Act of 1904 adjusted the reservation boundary but by that time, thousands of acres had already passed into the hands of non-Indians.

Many of the landowners were early homesteaders who attempted, but failed, at farming the lands. The J. Neil's Lumber Company began purchasing tracts around the mid-1930s until 1957, when St. Regis acquired the company. Champion International acquired St. Regis in 1983 and, at that time, owned about 90 percent of the approximately 36,000 acres of fee lands.

In the early 1990s, the Yakama Nation began aggressively exercising their jurisdictional authority to regulate the harvesting of non-Indian timber within the Closed Area. On December 20, 1990, the YN Tribal Council passed Resolution T-25-91, which stated, "Any person or corporation engaged in harvesting timber within … the Closed Area of the Yakama Indian Nation Reservation … shall possess a Yakama Nation Timber Harvesting Permit … the harvesting of timber without such a timber harvesting permit is prohibited and, if necessary, shall be enjoined by a tribal or federal court."

In 1992, there were a series of court injunctions between the YN and Champion related to the Timber Harvest Permit process and Washington State's issuance of a State Forest Practices Application to Champion. In 1993, Tribal Council passed Resolution T-51-93, which supported the YN Timber Committee to negotiate options of acquiring Champion lands and the subsequent Resolution T-46-97 authorized the Timber Committee and Land Committee to negotiate purchase prices and acquire Champion lands within the Closed Area. Subsequent land purchases included:

- 1997–Kaiser Butte Parcel (793 Ac)
- 1998–Castile Falls Parcel (331 Ac)
- 1999–Signal Peak Parcel (798 Ac)
- 2000–Surveyors Creek Parcel (1,100 Ac)

Figure III–3. Castile Falls

International Paper (IP) eventually purchased Champion International, Inc., which included Champion's remaining 28,000 acres of lands within the Closed Area. In February 2001, IP announced that they were interested in selling all of their lands within Washington State—some 293,000 acres, including the 28,000 acres of lands within the Closed Area.

The Yakama Nation Tribal Council authorized YN Land Enterprise to secure the financing and purchase the IP lands within the Closed Area in accordance with Resolution T-090-01. The lands currently average about 10,000 board feet per acre with approximately 60% ponderosa pine, 30% Douglas-fir, and the remainder a mix of western larch, grand fir, and other minor species. Most of the area has been selectively harvested.

The Yakama Nation plans to continue to manage the lands for timber production. Bank of America financed the purchase with the understanding that proceeds from the sale of the timber from these lands will be used to repay the loan, consistent with the Resolution.

About 4,000 acres of non-Indian owned lands remain within the Closed Area (Table II–2). Small individual landowners hold title to most of the parcels, which are generally about 80 to 320 acres in size. Boise Cascade owns 1,932 acres. The Yakama Nation will continue its efforts to acquire these lands.

Table III–2. Non-trust Land Ownership within the Yakama Forest

Ownership	Acres	Percent
Tribal Fee	33,253	86.6
Non-industrial private	2,948	7.7
Boise Cascade	1,932	5.0
International Paper	248	0.7
Total	38,381	100.0

Transportation and Roads

Road management plans are developed for individual timber sales. In addition, a Master Transportation Plan for the Yakama Forest will be developed. The length of roads and trails that could be used by vehicles and their density in the 21 subbasins within the Yakama Forest are shown in Table III–3.

Table III–3. Miles and Density of Roads and Trails that Provide Vehicle Use in the 21 Subbasins Within the Yakama Forest

Subbasin	Acres	Length–Miles		Density Mi/Mi^2	
		Roads	Trails	Roads	Total
Ahtanum Creek	8,199	36.6	7.9	2.9	3.5
Big Muddy	20,109	36.0	8.9	1.1	1.4
Central Klickitat	42,744	185.6	71.3	2.8	3.9
Cunningham Creek	12,369	35.6	2.9	1.8	2.0
Diamond Fork	28,407	77.5	18.9	1.7	2.2
Dry Creek	37,823	181.6	79.2	3.1	4.4
Huckleberry	51,260	121.2	53.8	1.5	2.2
Logy Creek	35,076	174.5	60.1	3.2	4.3
Medicine Creek	3,801	16.0	7.4	2.7	3.9
Mill Creek	5,119	29.4	13.0	3.7	5.3
Mule Dry Creek	4,358	9.4	22.6	1.4	4.7
Outlet Creek	9,467	44.1	23.8	3.0	4.6
Piscoe	7,414	48.9	5.5	4.2	4.7
Satus Creek	48,614	204.6	120.3	2.7	4.3
Simcoe	44,362	201.3	57.6	2.9	3.7
Summit Creek	29,485	145.8	52.3	3.2	4.3
Tract D	90,337	486.7	168.3	3.4	4.6
Trout Creek	35,178	242.5	49.6	4.4	5.3
Upper Toppenish	72,206	408.8	142.5	3.6	4.9
West Fork	66,863	182.0	28.8	1.7	2.0
White Creek	88,927	531.1	85.9	3.8	4.4
Total/Average	742,118	3,399.3	1,080.6	2.9	3.9

Climate

The Yakama Reservation is within the northern temperate climatic zone. Climatic variation on the reservation is closely related to landform variation ranging from the higher elevation slopes at the crest of the Cascade Range to the valley lands near the Yakima River. The precipitation pattern is typical of the east slopes of the Cascade Range where annual precipitation ranges from near 100 inches at the crest to seven inches along the Yakima River (See Figure III–4). The forest cover on the reservation is primarily limited to areas where annual precipitation is 18 inches or greater and begins at approximately 1,800 feet elevation.

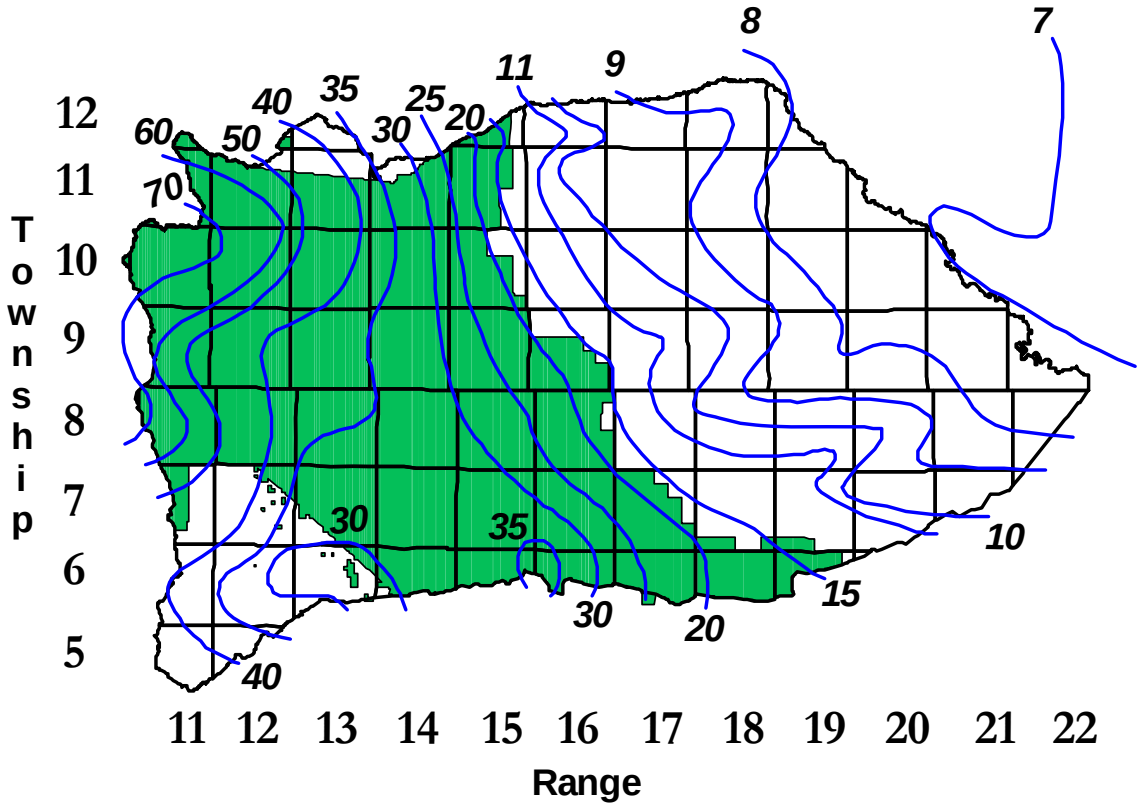

Figure III–4. Mean Annual Precipitation Patterns on the Yakama Reservation
Legend: blue lines—precipitation (inches); green shading—Yakama Forest; black lines—Township (North), Range (East, Willamette Meridian), and Yakama Reservation boundary (National Cooperative Soil Survey 1989).

Winter storms produce high winds and most of the annual precipitation. About 75 percent of the annual precipitation falls from October through March. The low valleys receive 10 to 20 inches

of snow per year from December to February, while higher elevations receive snow from October to April. Total snowfall ranges range from near 75 inches at the 2,500-foot elevation to near 400 inches at the Cascade Crest. Snow accumulations at the upper elevation sites generally remain on the ground until June or July.

Maximum and minimum lowland summertime temperatures range from 85° to 95° F and 55° to 65° F, respectively. Maximum highland summertime temperatures range from 65° to 75° F, and minimum temperatures range from 40° to 50° F. Maximum lowland winter temperatures range from 25° to 35° F, and minimum temperatures range from 15° to 25° F. Cold air masses from interior Canada occasionally move across the reservation and temperatures may drop to as low as –20° to –30° F.

Streams and Lakes

The Yakama Reservation is drained by four major subbasins. The eastern portion of the reservation drains towards the Yakima River and is divided into three major subbasins: Ahtanum Creek, Toppenish Creek, and Satus Creek. The western third of the reservation lies within the Klickitat River Basin where both the ground and surface water flows towards the Columbia River. The major rivers and streams of the Yakama Forest are shown in Figure III–5.

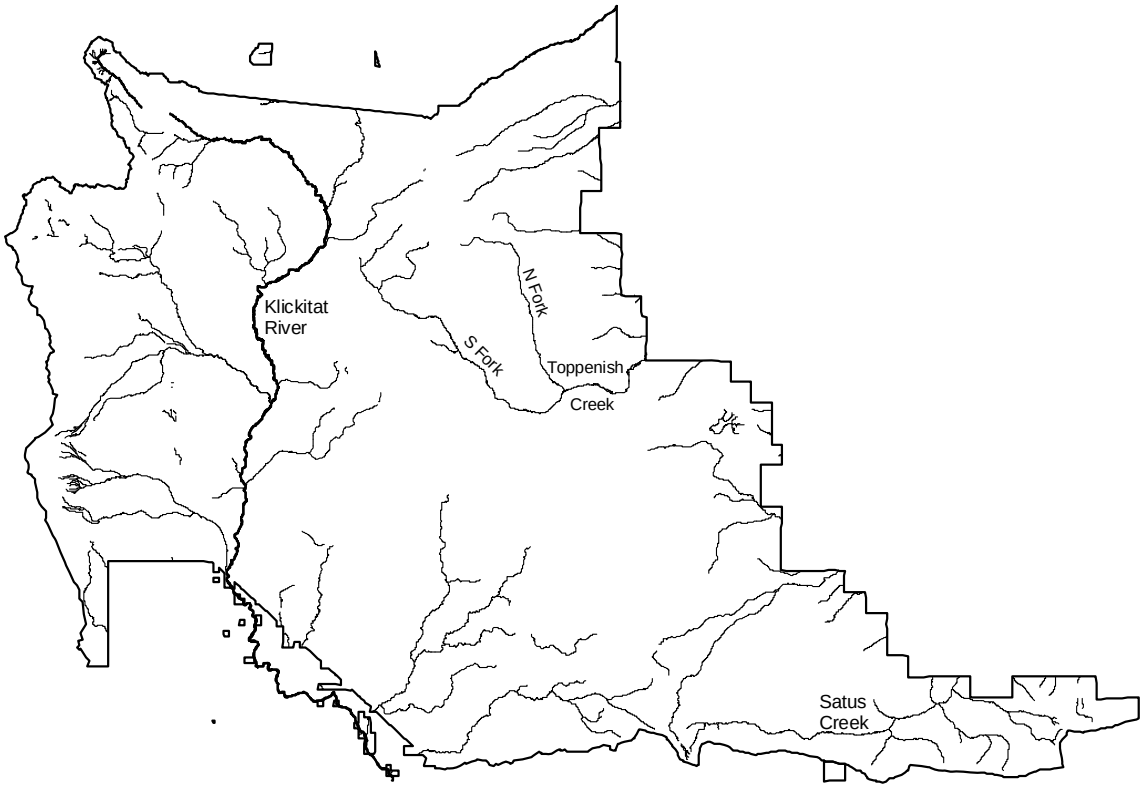

Figure III–5. Major Rivers and Streams of the Yakama Forest

Physiography

The Yakama Reservation has tremendous landform and geologic diversity. The relatively low-lying gentle landscape of the eastern portion of the reservation contrasts sharply with the high-elevation rugged western lands near the Cascade Crest. Elevation and precipitation accordingly increase with increasing distance west of the Yakima River. The Yakama Forest begins in the east at an elevation of approximately 1,800 feet and extends west to the crest of the Cascade Mountains.

The Cascade Mountain Range forms the western boundary of the reservation. The northwestern boundary follows the rugged outline of an ancient volcano, named the Goat Rocks, with elevations ranging from 5,000 feet to 8,184 feet on Gilbert Peak. Further south, 12,278-foot Mt. Adams (Pahto) dominates the landscape. South of Mt. Adams, the terrain is gentle and rolling with elevations ranging from 3,000 to 5,000 feet. The Klickitat River begins in the Goat Rocks and flows south, dividing the main Cascade Range from the eastern reservation lands. The east-west oriented Ahtanum uplift system is the northern most structural feature on the reservation. The Ahtanum uplift joins the Cascade Range at an elevation of 7,000 feet near the Goat Rocks and descends eastward to 2,500 feet elevation near Union Gap.

The southeast flowing Yakima River partially bounds the reservation on the east side and a portion of the Horse Heaven-Simcoe uplift system forms the remainder of the eastern boundary. Crests of three anticlines composing the Horse Heaven-Simcoe uplift system, define the southern boundary. From a gentle rolling section of the main Cascade Range, the Horse Heaven-Simcoe uplift system extends northeast along the southern edge of Camas Prairie, a six-mile long, northeast-draining valley. East of Camas Prairie, the uplift is dissected by a gorge cut by the Klickitat River to a depth of 2,500 feet. From the Klickitat River the uplift trends easterly, forming the major portion of the reservation's southern boundary. Elevations along the crest of the uplift range from 2,000 to 5,500 feet above sea level.

The dominant structural feature in the reservation's interior is the east-west oriented Toppenish uplift. The uplift ranges in elevation from 5,000 feet near the Klickitat River to 1,500 feet near the Yakima River, 50 miles to the east. The Toppenish uplift divides the reservation into north and south halves. The Toppenish structural basin lies between the Toppenish and Ahtanum uplifts. This 10- to 14-mile wide basin begins near the Klickitat River at an elevation of 4,500 feet, in the area called Lincoln Plateau, and stretches 40 miles east to the Yakima River where the elevation is 900 feet. The Toppenish structural basin is drained mainly by Toppenish and Simcoe Creeks.

The Cedar Valley-Satus structural basin lies between the Toppenish and Horse Heaven-Simcoe uplifts. This 10- to 16-mile wide basin begins at the Klickitat River. The first ten miles to the east covers an area known as Cedar Valley. Elevations within the basin range from 2,500 to 3,500 feet above sea level. Summit, White, and Trout Creeks drain Cedar Valley westward to the Klickitat River. East of Cedar Valley, the Satus structural basin is drained by Satus, Logy, Mule Dry, and Dry Creeks, which flow into the Yakima River.

Most of the Yakama Reservation is underlain by rocks of the Columbia Plateau, principally flows of Miocene Columbia River Basalt with sedimentary interbeds of the Ellensburg formation locally prominent between flows. The Ellensburg formation consists mainly of volcaniclastic sandstone, siltstone, claystone, and conglomerate. Tuffs, volcanic mudflows, and pumiceous volcanic breccias are also locally present.

The western part of the reservation is covered extensively by Pliocene olivine basalt and other volcanic rocks that erupted from numerous cones in and adjacent to the Simcoe Mountains. The northwest corner of the reservation is underlain by older, altered volcanic rocks. Quaternary volcanic rocks and glacial deposits cover much of the area west of the Klickitat River.

Existing Forest Vegetation Condition

Resource Setting

The Yakama Reservation is located in south-central Washington on the eastern slopes of the Cascade Range and over a portion of the lower Yakima Valley. The dry, eastern half of the reservation is irrigated for agriculture or is in sagebrush-steppe cover. Forest vegetation becomes the dominant cover on the western half where annual precipitation ranges from 18 to 100 inches.

Historic Conditions

Prior to the 1800s, the forested landscape on the Yakama Reservation was characterized by predominantly open, park-like ponderosa pine stands (Uebelacker 1984), particularly in the forest zone east of and along the Klickitat River. Since the late 1800s, however, land-use management practices in this zone have altered the natural condition and reduced the forest ecosystem's resistance to disturbances. These changes in forest conditions are characterized by a shift in species composition and an increase in stand density. Livestock grazing, fire exclusion, and timber harvesting appear to be the most dominant land management practices that have contributed to these major changes in the forest ecosystem.

The first major change in forest ecosystem characteristics occurred in the 1800s with the disruption of traditional land use patterns of Native Americans. This change coincided with the introduction of grazing animals by Europeans. Intensive grazing by domestic animals removed much of the understory vegetation and scarified the soil. These actions created ideal conditions for the establishment of large numbers of tree seedlings.

Prior to the 1900s, widespread wildland fire had been an effective agent that naturally controlled species composition and stand densities. Society of the early 1900s desired to control fires because it felt forests and man-made improvements therein, needed to be protected from the harmful effects of fire. Fire-fighting forces were trained to aggressively and quickly control fires, thereby eliminating fire as an effective natural component of the forest ecosystem.

This suppression of frequent, low-intensity wildland fires led to the transformation of the open, park-like forest dominated by large ponderosa pine into overcrowded stands of a different

species composition where often Douglas-fir and grand fir became the dominant species. Research (Hessburg and Agee 2003) indicates that many forest stands are experiencing major forest health problems, e.g., insect damage and stand-replacement wildland fires. Many of these stands were established when fires were suppressed in the early part of the last century.

In addition to the modification of the forest environment by the introduction of domestic animal grazing and the control of wildland fire, forest harvest began on the Yakama Reservation in 1944 with the Dry Creek Sanitation Salvage Sale. This initial harvest focused on ponderosa pine trees that were attacked or at risk of being attacked by bark beetles. Typically, only the largest risk trees were harvested and the smaller, shade-tolerant species (Douglas-fir and grand fir) were left to capture the available growing space. Figure III–6 illustrates the transformations in timber types that occurred on the Yakama Reservation from 1934 to 1997.

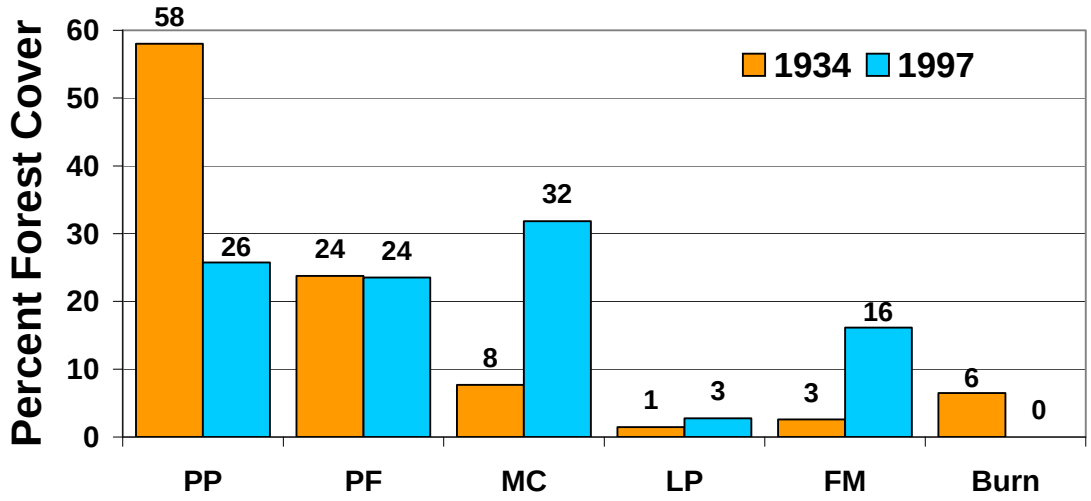

Figure III–6. Timber Type Transformations from 1934 to 1997 on the Yakama Forest.
PP= ponderosa pine; PF= pine-fir; MC= mixed conifer; LP= lodgepole pine; FM= true fir-mountain hemlock; and Burn= the 1934 survey recorded 36,380 acres of burned-over land that has since regenerated.

The changes in the forest stand structure and species composition that occurred over the last century on the Yakama Reservation are not unique. Similar patterns, resulting mainly from fire exclusion and selective timber harvesting, have been documented throughout the interior West (Hessburg and Agee 2003). The most dramatic changes have occurred in the Douglas-fir and grand fir habitat types where there has been a steady conversion of park-like ponderosa pine and western larch forest stands to denser stands dominated by insect-, pathogen-, and fire-susceptible, late-successional species such as Douglas-fir and grand fir.

Douglas-fir and grand fir habitat types were probably the most diverse of all east slope Cascade Range landscapes under the historical influence of low and moderately severe fire regimes. Exclusion of fire in this region has greatly reduced landscape diversity. These changes and the existing conditions of forest stand structures and species composition have been documented in the Eastside Forest Ecosystem Health Assessment (Hessburg *et al*. 1994). Similar findings and

recommendations for correction of this forest health issue appear in research reports from throughout the interior West (Hessburg and Agee 2003).

In general, livestock grazing, effective fire suppression and control, and selective harvesting of high-quality seral species have resulted in the following conditions in the lodgepole pine, ponderosa pine, Douglas-fir, and grand fir habitat types:

- Stand densities have significantly increased and tree vigor in many areas has decreased
- Extensive areas of the Douglas-fir and grand fir habitat types are dominated by late-successional, shade-tolerant species, namely Douglas-fir and grand fir
- Entire landscapes, rather than patches, are now susceptible to defoliator and bark beetle outbreaks as well as high-intensity stand-replacement fires
- The duration, extent, and severity of defoliator and bark beetle outbreaks have increased with the increased quality, uniformity, and continuity of susceptible tree species
- Conditions for nearly optimal spread of root diseases and dwarf mistletoe including those conditions created by past and present harvest activities exist in many stands
- Insect and pathogen effects are increasing fuel loads at extremely hazardous rates
- Some wildlife habitat conditions have developed that are unprecedented, according to historic fire disturbance patterns, and are non-sustainable in the long-term across large areas where moisture is a limiting factor
- The current patterns of landscape diversity are outside of the historic ranges of variability in terms of stand structure and diversity.

Across the reservation, extensive stand treatments are currently being implemented to correct these forest health issues through silvicultural prescriptions that remove the already heavily damaged fir species and encourage seral tree species establishment. By 2005, nearly all of budworm-affected areas in the General Forest, Wildlife Winter Habitat, and Visual Resource LUMAs have received these treatments.

The control of defoliating insects by suppression programs, including the use of the biological control agent *Bacillus thuringiensis*, provides only a temporary defoliator population setback and does not lead to a long-term solution to this forest health issue.

Existing Conditions

Forest Area and Timber Volume

The Yakama Reservation consists of 1,371,429 acres; 1,132,508 acres are categorized as Trust lands and 238,921 acres are categorized as Non-trust lands. The Yakama Forest includes 625,715 acres, of which 591,000 acres are Trust lands and 34,715 acres are Non-trust lands. The Trust lands within the Yakama Forest include 488,916 acres of timberland (forest land with at least 5% crown cover of commercial tree species), 5,896 acres of woodland (forest land with less than 5% crown cover of commercial tree species), and 96,188 acres of nonforest. There are an additional 23,024 acres in the Woodland Management Emphasis Area, which is outside the Administrative Forest boundary.

Table III–4. Trust Forest and Non-forest Areas by Management Emphasis Area

Management Emphasis Area	Forest (Acres)	Non-forest (Acres)	Total (Acres)
General Forest	228,623	11,697	240,320
Wildlife Winter Habitat	99,684	52,131	151,815
Safety Corridor	7,086	523	7,609
Old-Growth	14,485	0	14,485
Canyon	50,500	11,749	62,249
Alpine	41,035	7,062	48,097
Riparian	10,403	628	11,031
Primitive	30,990	5,197	36,187
Tract D Recreation	10,072	6,794	16,866
Traditional Use	1,934	407	2,341
Total Acres	494,812	96,188	591,000

Under the 1993-2002 FMP, the Yakama Forest was divided into 11 Land Use Management Areas (LUMAs). Each LUMA was managed for multiple uses with emphasis on dominant resource features and objectives. This FMP changes the designation of LUMAs to Management Emphasis Areas (MEA).

The General Forest MEA will be managed primarily for timber production; the Wildlife Winter Habitat MEA primarily for wildlife and timber values, and the Safety Corridor (formerly the Visual Resource LUMA) primarily for safety, aesthetics, and timber value. Old Growth, Canyon, Alpine, and Riparian MEAs have unique values that will be considered while planning harvests to restore forest health. Reserved land includes areas that have been administratively withdrawn from scheduled harvest for environmental, political, wildlife, archaeological, cultural or other reasons. The Traditional Use (formerly Special Use), Tract D Recreation, Primitive Area, and Woodlands include 78,418 acres that are managed for primary values other than timber production. Wildland fire suppression is the only approved management activity within the Primitive Area. Under emergency conditions, such as an insect or disease epidemic, the Yakama Tribal Council could approve other actions.

Forest volume and growth information was obtained by analysis of the 1995-96 measurement of 1,286 Continuous Forest Inventory plots across the reservation. Detailed descriptions of the timber resource, including summaries of volume, growth, and mortality and allowable annual cut will be reported in the Yakama Reservation Forest Inventory Analysis. Summaries from the preliminary analysis of acreages, volumes, growth, and mortality are shown in Tables III–5, III–6, and III–7.

The total gross timber volume in 1996 was 10.8 billion board feet (Table III–5) while the total net conifer volume was 9.5 billion board feet (Table III–5). Gross volume and net conifer volume on the non-reserve commercial acres were 6.2 and 5.7 billion board feet, respectively.

Table III–5. Gross Volume and Net Conifer Volume by Forest Cover Type on Trust Land

Forest Cover Type	Area Acres	Average Gross Volume BF/Acre	Total* Gross Volume MMBF	Average Net Conifer BF/Acre	Total* Net Conifer MMBF
Oak-Conifer	2,921	4,663	13.6	1,763	5.1
Ponderosa Pine	118,635	13,509	1,596.8	12,697	1,500.4
Pine Fir	110,163	18,172	2,067.0	16,855	1,916.3
Mixed Conifer	158,946	24,543	3,929.5	21,914	3,499.3
Lodgepole Pine	14,097	17,731	250.9	15,125	214.4
True Fir/Mt. Hemlock	79,541	36,460	2,912.3	28,967	2,339.1
Subalpine	4,669	9,464	22.8	5,906	15.4
Hardwoods	5,896	4,663	27.1	1,763	9.9
Total/Average	494,869	20,618	10,820.0	18,176	9,500.1

* Total volume is weighted by Management Area acres.

Table III–6. Average Annual Growth and Mortality per Acre and Total Annual Growth by Forest Cover Type on Trust Land

Forest Cover Type	Area Acres	Gross Growth BF/AC/YR	Mortality BF/AC/YR	Net Growth BF/AC/YR	Total* Gross Growth MMBF/YR	Total* Net Conifer Growth MMBF/YR
Oak-Conifer	2,921	147	85	62	0.3	0.1
Ponderosa Pine	118,635	354	61	293	40.2	35.2
Pine Fir	110,163	428	91	337	45.5	38.9
Mixed Conifer	158,946	468	185	283	71.2	44.9
Lodgepole Pine	14,097	328	240	88	4.5	1.5
True Fir/Mt. Hemlock	79,541	383	350	33	31.1	1.1
Subalpine	4,669	98	34	64	0.2	0.1
Hardwoods	5,896	147	85	62	0.8	0.2
Total/Average	494,869	397	154	243	194.1	122.0

* Total growth is weighted by management area acres.

Table III–7. Summary of Land Status and Distribution of Timber Volume on the Yakama Forest

Status	Acres	Total Volume (MMBF)	Net Conifer Volume (MMBF)
Reserved Inaccessible Productive Timberland	41,620	1,524.6	1,207.70
Reserved Inaccessible Productive Woodland	35	0.2	0.06
Reserved Inaccessible Unproductive Woodland	943	6.0	4.04
Unreserved Accessible Commercial Timberland	445,942	9,199.9	8,223.30
Unreserved Inaccessible Productive Woodland	3,862	17.6	6.35
Unreserved Inaccessible Unproductive Woodland	981	6.3	4.20
Total	493,383	10,754.5	9,445.64

Forest Vegetation

Cover Types

The 1993–2002 Forest Management Plan used forest cover types, which included overstory species, size, and density, to develop forest management strategies. Management directions were defined for five primary cover types including pine, pine-fir, mixed conifer, lodgepole pine, and true fir-mountain hemlock. Areas and volumes for the respective cover types on trust lands are shown in Table III–5. Total areas of combined trust and non-trust land by cover type are shown in Table III–8.

Table III–8. Total Area by Cover Type on the Yakama Forest

Total area includes 591,000 trust acres and 34,715 non-trust acres.

Cover Type	Acres		Cover Type	Acres
Oregon Oak	288		True Fir/Mt. Hemlock	73,192
Oak/Conifer Light	3,027		Subalpine Fir	4,714
Oak/Conifer	2,923		Whitebark Pine	1,934
Ponderosa Pine	128,904		Deciduous	699
Pine-Fir	111,032		Brush	61,648
Douglas-fir	12,263		Grass	3,691
Mixed Conifer	166,847		Meadow	2,580
Lodgepole Pine	14,402		Open, Rock, Water	30,935
Hemlock	6,635		Total	625,715

The ponderosa pine cover type dominates the dry, eastern fringes of the forest. Ponderosa pine forests provide a wide range of resources including winter habitat and forage for a variety of wildlife, abundant food and medicinal plants, and extensive livestock grazing opportunities.

The pine-fir cover type is generally located on gentle or moderate topography. Wildlife habitat, grazing, and recreation are the primary uses of this zone; timber production becomes more viable with increased soil moisture and more favorable site characteristics. Approximately 100,000 acres of ponderosa pine in Cedar Valley suffered heavy mortality from a pine butterfly (*Neophasia menapia)* epidemic from 1893 to 1895. Bark beetles attacked weakened trees and

wildland fires then burned through the area. The area is now overstocked with even-aged, pole- and sawtimber-sized ponderosa pines that became established around 1900 (Weaver 1961).

The most frequently encountered species in the mixed conifer type are grand fir, Douglas-fir, western larch, ponderosa pine, and Engelmann spruce. Mountain hemlock, western redcedar, western white pine, and lodgepole pine occur in some areas. Moderate terrain, favorable moisture and temperature regimes, and the superior growth rates of valuable tree species result in a high level of sustainable production of timber and wildlife habitat.

Dominant species of upper-slope types include Pacific silver fir, mountain hemlock, lodgepole pine, subalpine fir, Alaska-cedar, and whitebark pine. Much of the true fir-mountain hemlock cover type occurs on moderately steep drainage slopes and provides cover and protection for the headwater areas of primary watersheds. Some species of the true fir-mountain hemlock forest type also occur in drainages within pine-fir and mixed conifer types. Minimal human disturbance and infrequent fires have resulted in large tracts of older forests with complex structures. Portions of the older forests have been, or are managed for timber production; however, the most important values for most of the upper slope cover types are water protection, summer range, and huckleberry production.

Forest Habitat Types

With the theme of the Yakama Nation Strategic Plan of "Honoring Our Past…Taking Responsibility for Our Future" it is imperative that forest management be considered on an ecosystem basis.

Ecosystem management integrates ecological capabilities with social values and economic relationships to produce, restore, and sustain ecological integrity and desired conditions, uses, products, values, and services over the long term (Quigley *et al*. 1999). Ecological integrity refers to the presence and functioning of ecological components and processes (USDA Forest Service 1996). There are no absolute measures of ecological integrity, so proxies are used to describe ecological conditions. Ecological condition, or better known to the practicing forester as ecosystem or forest health, is one describer of ecological integrity.

Forest Habitat Types Defined

A **plant community** is an assemblage of interacting populations of plants occurring in a common environment. **Plant community types** are aggregations of similar plant communities. **Indicator plants** are species that signify certain environmental characteristics (*e.g.*, excessive or deficient soil moisture, cold or warm soils, short growing season) and are used to identify and describe plant associations. **Forest plant associations** are plant community types that are based on late-successional forest stands and emphasize the potential vegetation components. **Plant series** are groupings of plant associations with the same dominant, late-successional tree species.

A **forest habitat type** is a grouping of all of the land area capable of supporting similar forest plant associations over time. Habitat types characterize particular kinds of environments and can be used as a basis for distinguishing land areas of differing productive potential. They are based

on the characteristic vegetation that would dominate a given portion of a forest landscape over a long period of time (100+ years) in the absence of disturbance. Forest habitat types consider certain plants as indicators of future species composition, productive potential, and probable responses to management actions.

Forest succession refers to changes in species composition and vegetation structure that occur over a range of decades to centuries. A **sere** is a sequence of plant communities that succeed one another during succession. A **seral species** is a component of a sere. A seral species, or early-successional species, is one that is present during the early stages of succession but disappears over time in the absence of major disturbances. Early-successional species tend to be shade intolerant while late-successional species tend to be shade tolerant.

There are many definitions of ecosystem or **forest health** ranging from purely utilitarian to broad ecological perspectives (Edmonds *et al*. 2000). Ecosystem health can be thought of as encompassing both ecological integrity and what people want to do with the land. Ecosystem health includes not only how "intact" the ecological processes need to be compared to their capabilities, but it also includes measures of social and economic resiliency, management philosophies and goals, and other human factors (Quigley 1999). Restoring ecosystem or forest health is a key goal established in this Forest Management Plan.

Forest Habitat Types on the Yakama Reservation

To effectively address the forest health issue with an ecosystem management approach, different land unit descriptors are needed in addition to the current cover types and vegetation condition descriptors. Thus, plant associations and forest habitat types have been used for developing management strategies in this Forest Management Plan (Appendix C).

Fifty-two forest plant associations within ten series, two quaking aspen communities, and one lodgepole pine community have been described on the Yakama Forest (See Appendix C, Table C–1). For management purposes, land areas within the Yakama Forest have been grouped into nine broad forest habitat types (See Table III–9 and Figure III–7). The woodlands outside of the Administrative Forest are mostly within the Oregon white oak habitat type.

Forest habitat types within the Yakama Forest include ponderosa pine, Douglas-fir, grand fir, western hemlock, mountain hemlock, Pacific silver fir, subalpine fir, and whitebark pine.

The grand fir habitat type occurs across a large area and is subdivided into 4 groups: (1) Cedar Valley; (2) low elevation, dry; (3) high elevation, wet; and (4) low elevation, wet. Some of the western hemlock, mountain hemlock, and whitebark pine plant associations were grouped within the subalpine fir habitat type. The Pacific silver fir habitat type also includes areas of mountain hemlock habitat type.

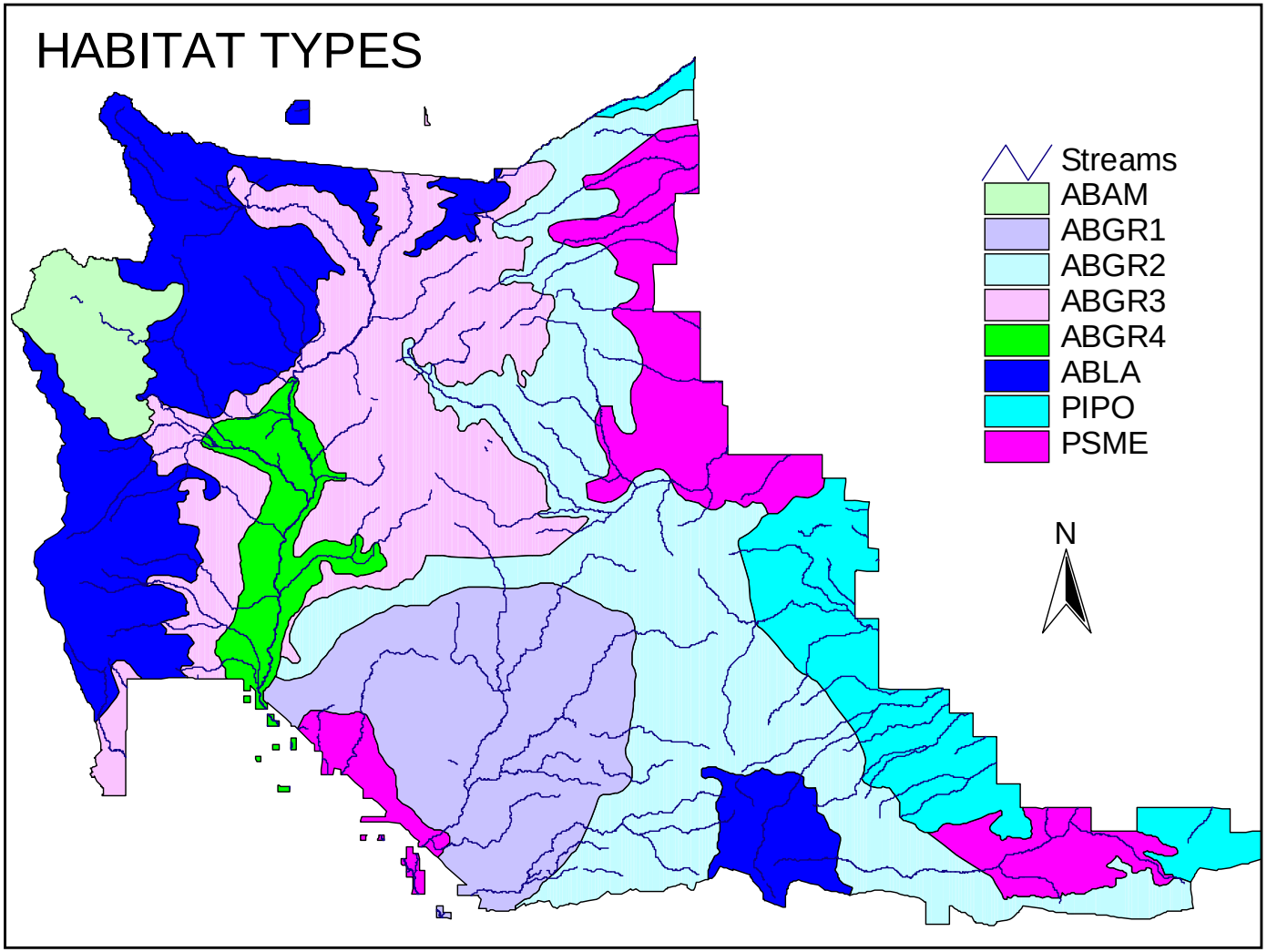

Figure III–7. Forest Habitat Types on the Yakama Forest
See Table III–9 for forest habitat type abbreviations.

Table III–9. Forest Habitat Types Used for Management Planning

Number	Abbreviation	Forest Habitat Type Grouping
1	PIPO	Ponderosa pine
2	PSME	Douglas-fir
3	ABGR_1	Grand fir, Cedar Valley
4	ABGR_2	Grand fir, low elevation, dry
5	ABGR_3	Grand fir, high elevation, wet
6	ABGR_4	Grand fir, low elevation, wet
7	ABLA	Subalpine fir and hemlock
8	ABAM	Pacific silver fir
9	QUGA	Oregon white oak

Existing Conditions of Forest Habitat Types

For this analysis of existing conditions, the 1995 Continuous Forest Inventory (CFI) plots were segregated by forest habitat type. The results of this analysis are summarized in terms of condition, size class, and structure class in Tables III–10, III–11, and III–12, respectively.

The ponderosa pine habitat type is generally a younger forest overstocked with pine seedlings and pole-sized trees and lacking the desired number of large sawtimber trees (>21"dbh). This stressed condition is reducing growth below the area's potential. The areas are also at risk from catastrophic fire and insect and disease outbreaks. Proposed silvicultural treatments are to manage the density by precommercial and commercial thinning and reduce the fuel loading by prescribed burning. Areas previously thinned could be maintained with prescribed fire.

The CFI data indicates that the Douglas-fir habitat type is overstocked with seedlings—about 2/3 are ponderosa pine. The existing density of 12–13 large sawtimber trees per acre is somewhat less than the desired 14–17 trees per acre in this category. The western spruce budworm was active in this habitat type. Silvicultural treatments will include salvage of budworm-caused mortality and density and species management through precommercial and commercial thinning. Fuels will be treated to maintain desired levels.

The Cedar Valley grand fir habitat type is overstocked with seedlings, pole-size, and small sawtimber trees—primarily ponderosa pine. The average basal area of 125 square feet per acre is higher than what is desired in a managed forest with limited moisture. The area is quite productive and current growth is good, but the area is at risk from stand-replacement fires and insect and disease attacks. Priorities for silvicultural treatments are precommercial thinning, commercial thinning, and treatment of the activity fuels. Once stocking is adjusted, prescribed fire could be utilized to maintain the desired condition.

The low elevation, dry grand fir habitat type was heavily affected by the western spruce budworm outbreak. The CFI data indicates an overstocked seedling and pole-size condition, with an average basal area of 121 square feet per acre. Extensive budworm salvage harvest has altered the average condition at a landscape level. Additional salvage harvest plus precommercial thinning, commercial thinning, and planting of openings to increase the

ponderosa pine composition are priority silvicultural treatments. Activity and excess natural fuels need to be treated to keep fuels at the desired levels.

The high elevation, wet grand fir habitat type is overstocked with seedlings. The average basal area is 150 square feet per acre where 100–120 square feet per acre is desired. Only ¼ of the trees are seral species and, prior to the budworm outbreak, the average mortality was 45 percent of the gross growth. This indicates a general forest health concern.

Several kinds of silvicultural treatments, including thinning and regeneration methods (group selection, shelterwood, or seed-tree) with planting will be needed to achieve desired managed conditions.

The average condition of the low elevation, wet grand fir habitat type is similar to the high, wet grand fir habitat type. The average basal area is somewhat lower (138 sq. ft./ac.), the mortality lower (26%), and the numbers of seral species higher (46%) than the high elevation, wet grand fir habitat type. This indicates a lessened immediate concern for forest health but the full array of silvicultural treatments will be utilized to achieve desired managed conditions

Much of the subalpine fir habitat type will be retained in a natural condition. Those portions that are to be managed are overstocked in all size classes. The average basal area is 180 square feet per acre (100–120 sq. ft./ac. is desired) and seral species comprise only 23% of the trees. Current mortality is 70% of the gross growth. Silvicultural treatments will emphasize regeneration, starting over with group selection, shelterwood, or seed-tree cuts. Some planting may be needed to achieve the desired composition of seral trees. Both precommercial and commercial thinning will be needed to manage the stocking levels.

The portions of the Pacific silver fir habitat type that are to be managed are extremely overstocked with an average basal area of 268 square feet per acre and an average volume of 50 thousand board feet per acre. There are excess trees in all size classes and the seral species have essentially been excluded (only 3% remain). The current mortality rate exceeds the gross growth rate. These stands will have a priority for regeneration cutting using the techniques described for the subalpine fir habitat type.

Table III–10. Forest Habitat Type Conditions on the Yakama Forest

Forest Habitat Type	# CFI Plots	Acres	Trees #/Acre	Gross Growth BF/AC/YR	Mortality BF/AC/YR	Net Growth BF/AC/YR	Basal Area FT^2/AC	Volume MBF/AC	% Seral Species
Ponderosa Pine	79	52,398	536	170	41	129	87	8.5	98
Douglas-fir	101	62,456	275	279	80	199	84	11.9	58
Grand fir (Cedar Valley)	184	63,294	445	438	49	389	125	16.45	77
Grand fir (Low Elev./Dry)	320	146,705	450	386	82	304	121	16.95	57
Grand fir (High Elev./Wet)	266	111,288	440	392	175	217	150	25.80	23
Grand fir (Low Elev./Wet)	58	24,446	525	434	112	322	138	22.20	46
Subalpine fir	210	107,428	657	298	207	91	180	24.39	23
Pacific Silver fir	46	20,528	836	195	263	-68	268	50.68	3

Table III–11. Tree Distribution by Forest Habitat Type and Diameter Class

Habitat Type	1–4” DBH Trees/Acre	6–10” DBH Trees/Acre	12–16” DBH Trees/Acre	18–24” DBH Trees/Acre	+24” DBH Trees/Acre	Total Trees/Acre
Ponderosa Pine	423	86	18	7	2	536
Douglas-fir	179	57	26	11	2	275
Grand fir (Cedar Valley)	308	80	38	16	3	445
Grand fir (Low Elev./Dry)	323	72	36	16	3	450
Grand fir (High Elev./Wet)	305	79	34	16	6	440
Grand fir (Low Elev./Wet)	416	60	26	16	7	525
Subalpine fir	445	131	60	17	4	657
Pacific Silver fir	585	152	53	34	12	836

Table III–12. Stand Structure Distribution by Forest Habitat Type on the Yakama Forest

Forest Habitat Type	Structure Type–Acres							TOTAL
	Open[1]	SI[2]	SE[3]	UR[4]	YFTS[5]	OFTS[6]	OFSS[7]	
Ponderosa Pine	23,131	2,222	599	2,934	20,395	3,983	62	53,326
Douglas-fir	21,814	6,043	2,713	2,540	23,471	7,046	69	63,696
Grand fir (Cedar Valley)	1,031	847	5,309	15,529	49,101	10,256	168	82,241
Grand fir (Low Elev./Dry)	8,600	5,141	6,365	18,231	78,906	27,146	1,185	155,574
Grand fir (High Elev./Wet)	9,786	1,905	6,415	8,646	60,449	27,659	523	115,383
Grand fir (Low Elev./Wet)	1,687	565	1,342	1,913	9,357	10,201	163	25,228
Subalpine fir	1,538	1,041	1,754	796	14,375	1,325	0	20,829
Pacific Silver fir	20,700	6,896	13,922	5,054	56,115	5,431	52	108,170
Total	98,287	24,660	38,419	55,643	312,169	93,047	2,222	624,447

[1] Open: Areas covered by brush, grass, meadows, water, rock, and ice.
[2] SI: Stand Initiation Stage—Young trees that have become established after a disturbance; includes seedlings and saplings less than 5 inches dbh and pole timber (5"–11" dbh) at less than 40 percent crown closure.
[3] SE: Stem Exclusion—High density, young stands (tree dbh < 30 inches) in which new trees are excluded because of crown (>40% CC) and root competition.
[4] UR: Understory Reinitiation—A new cohort of trees is established beneath an older overstory.
[5] YFTS: Young Forest, Two or More Strata—Two or more canopy layers (2 or more cohorts established); most trees less than 30 inches dbh and large trees are generally absent.
[6] OFTS: Old Forest, Two or More Strata—Large trees (>30 inches dbh) are present in the overstory with two or more canopy layers (with two or more cohorts established).
[7] OFSS: Old Forest, Single Story—Large trees (>30 inches dbh) are present in the overstory and understory trees are generally absent.

Existing Forest Health Conditions

Western Spruce Budworm

The western spruce budworm has been defoliating host tree species on the Yakama Forest since 1985 and outbreak conditions have existed since 1987. Resulting defoliation increased from 5,624 acres in 1985 to 205,584 acres in 2000 as shown in Figure III–8. Figure III–9 shows the extent of budworm activity in 2000—from the reservation's southern boundary to the northern boundary. Defoliation intensity also increased as the budworm activity progressed north. Most of the affected areas were in the Douglas-fir, pine-fir, and mixed conifer cover types.

In the mid 1980s budworm activity was observed only along the southern part of the reservation. The worst areas were located around Kaiser Butte, Hagerty Butte, McKays Butte, and Signal Peak. The mortality rate of commercial-sized trees was low, although it was noted that if more defoliation continued, more mortality would occur. By 1994 the outbreak had spread to an estimated 64,000 acres.

By the mid 1990s, the budworm activity had increased to the landscape level. Defoliation was uniform throughout the entire geographical area, with hardly any area being spared. At the time, about 50 to 70 percent of the current year's foliage was consumed. The amount of mortality and growth loss was difficult to assess but as the attack continued, high rates of mortality occurred.

In theory, the budworm outbreak should have subsided if either some weather pattern or the predator relation became unfavorable; however, this did not occur on the Yakama Forest. Destruction was rampant because the western spruce budworm expanded its range and continued feeding on new foliage. With the tremendous acreage of suitable habitat and stressed stands the budworm was able to persist from year to year in less than optimal conditions. By 1995 the budworm had expanded into virtually all the Douglas-fir and grand fir areas.

Because of heavy tree stresses from the budworm epidemic, Douglas-fir bark beetles were observed in some areas in 1997. It is believed the beetle populations started about 1.5 years earlier, attacking weaker trees previously defoliated by spruce budworm. Bark beetles continue to affect more acreage and mortality rates are anticipated to rise dramatically over the next few years. An integrated pest management strategy was implemented to avoid additional catastrophic losses. Activities included spraying, commercial timber harvest, and forest development follow-up.

Spraying. Although not a standard practice on the Yakama Reservation, several suppression projects using *Bacillus thuringiensis var. kurstaki (B.t.k),* a biological control agent, have been conducted. The first spray project on 70,827 acres in 1990 was effective but the results proved to be short-term. Defoliation was significantly reduced in 1991, only to rebound in 1992. Additional spray projects were conducted in 1999, 2000, and 2001 on a total of 97,000 acres to reduce losses until silvicultural treatments could be accomplished in the affected areas.

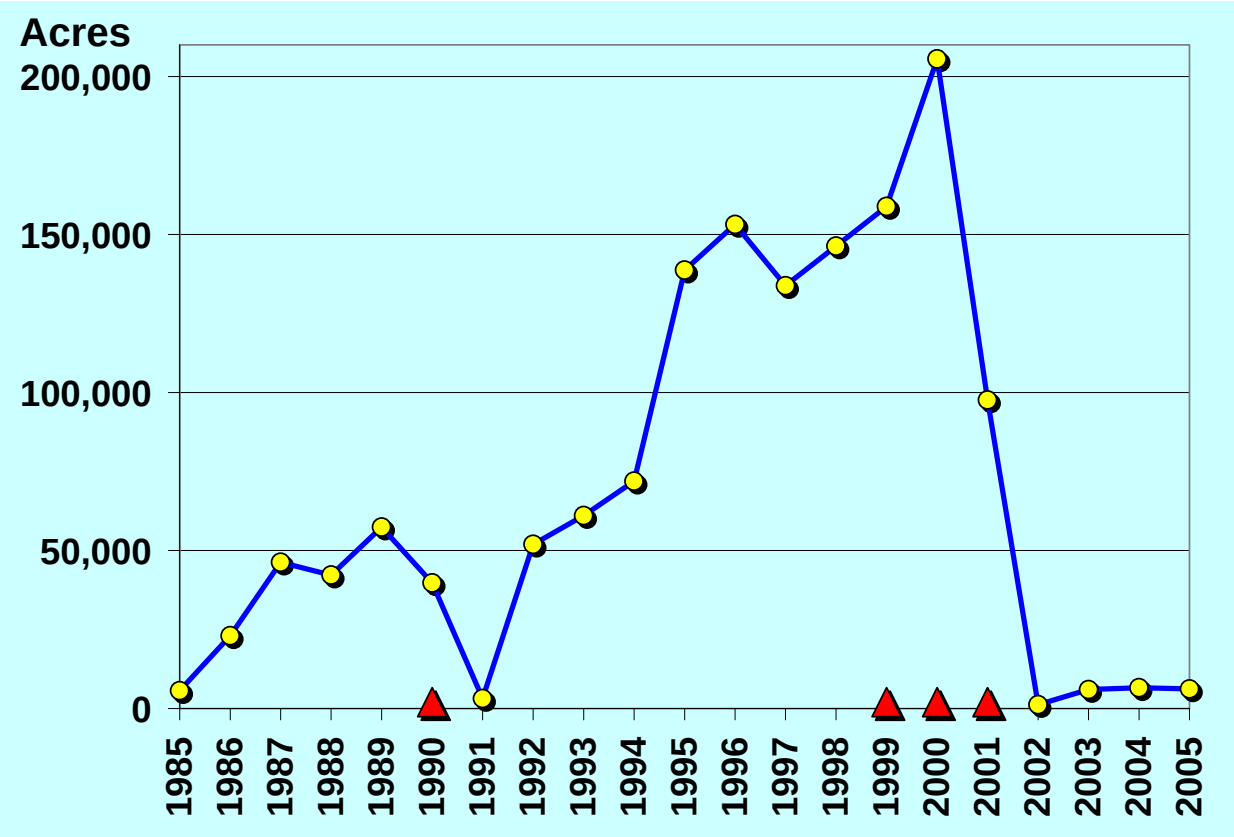

Figure III–8. Acres Defoliated by Western Spruce Budworm on the Yakama Forest from 1985 to 2005

Triangles indicate years in which there were suppression projects using the biological control agent *Bacillus thuringiensis* (B.t.).

Silvicultural Treatments. Silvicultural treatments that alter stand conditions are proposed for long-term management of western spruce budworm. These prescriptions call for invigorating stands of budworm host species with thinning, altering species mix from fir species to pines and larch, reduction of vertical diversity in fir-dominated areas, and replacement of pockets of damaged trees. As much of the impacted areas as possible are to be salvaged. Figure III–10 illustrates the significant increase in Douglas-fir and grand fir volume harvested in relation to pine species, especially since the onset of the budworm epidemic.

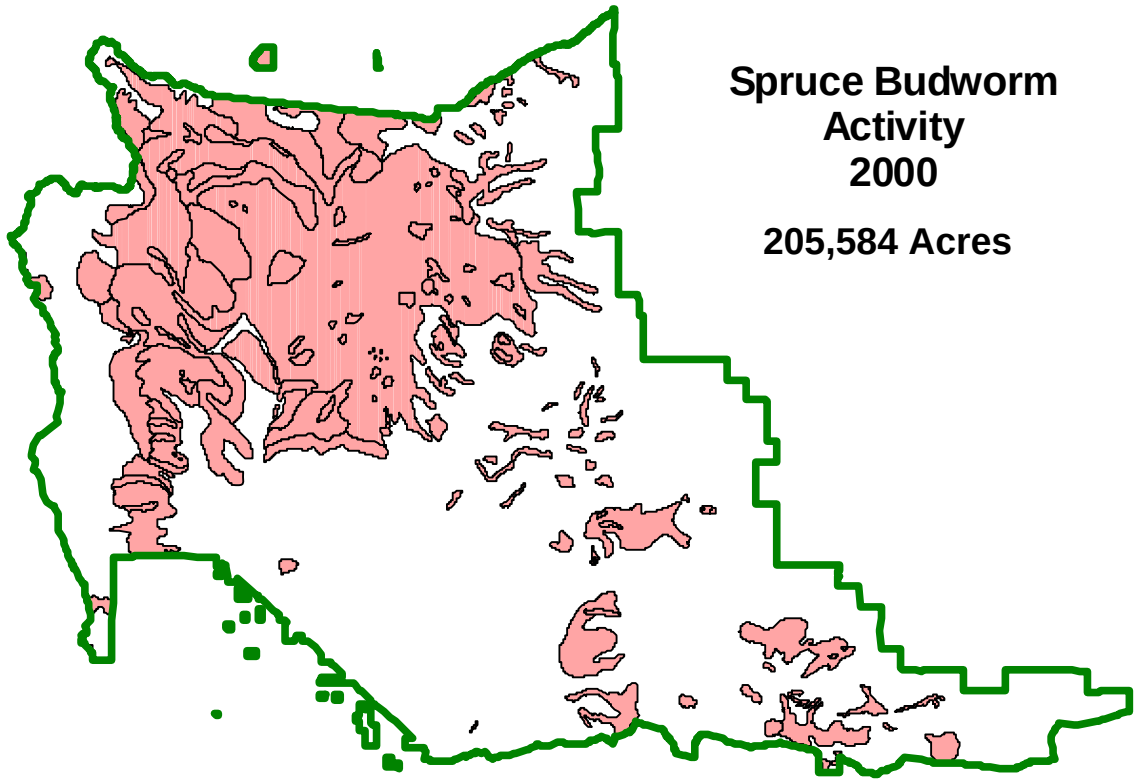

Figure III–9. Spruce Budworm Defoliation on the Yakama Forest in 2000

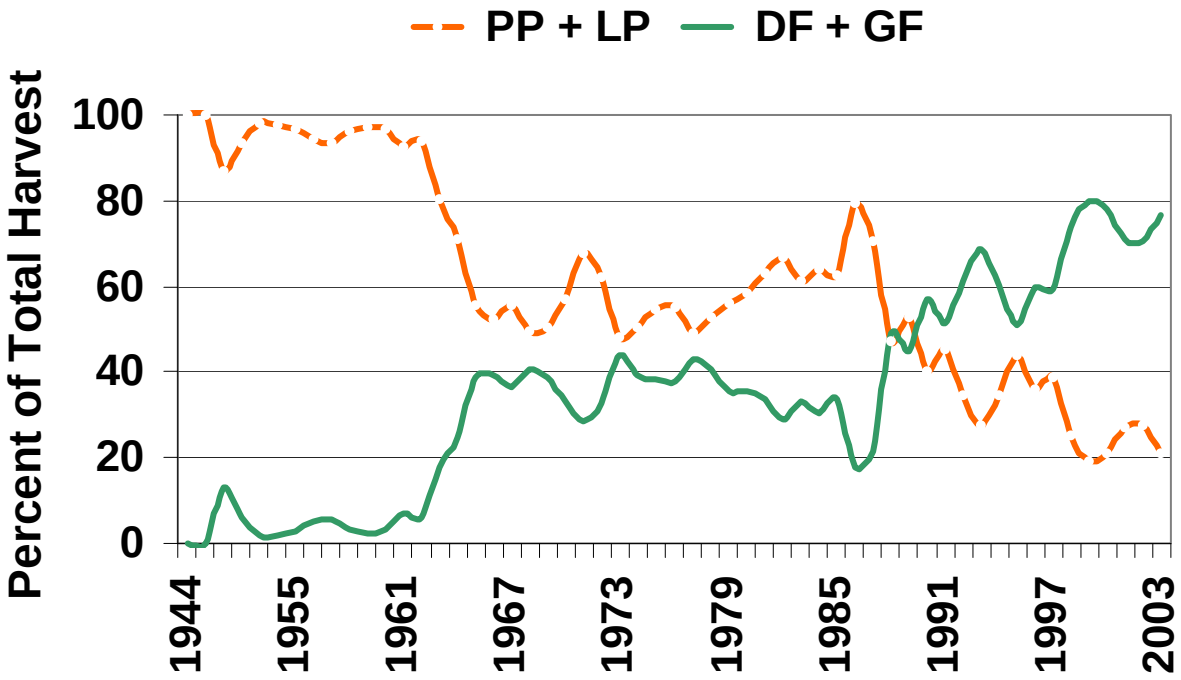

Figure III–10. Ponderosa Pine (PP) and Lodgepole Pine (LP) Compared to Douglas-fir (DF) and Grand Fir (GF) as Percentages of the Total Volume Harvested by Year on the Yakama Forest

Postharvest Treatments

After completion of the timber harvesting, the Forest Development program uses the following activities to address the budworm problem:

- **Mechanical site preparation.** Modification of soil, litter, or vegetation to promote natural regeneration and prepare areas for artificial regeneration.
- **Prescribed burning.** Reduction of fuel loads to reduce susceptibility to catastrophic fire and promote natural regeneration.
- **Artificial regeneration.** Planting appropriate species for the site to promote development of desired future stand structures.
- **Precommercial thinning.** Density management by timely thinnings to improve tree vigor and selective removal of budworm host species of non-commercial size.

Figure III–11 illustrates the areas associated with each of the Forest Development activities from 1991 to 2003.

The long-term approach to the western spruce budworm outbreak on the Yakama Reservation is a continuation of strategies already being implemented. The main emphasis is to aggressively salvage imminent mortality, take proactive measures to reduce the threat of insect outbreaks, and pursue the application of sound silvicultural treatments that modify stands and landscapes to promote resistance to future outbreaks. While forest health is important, implementation will be done at an intensity or a scale such that other resources are not damaged.

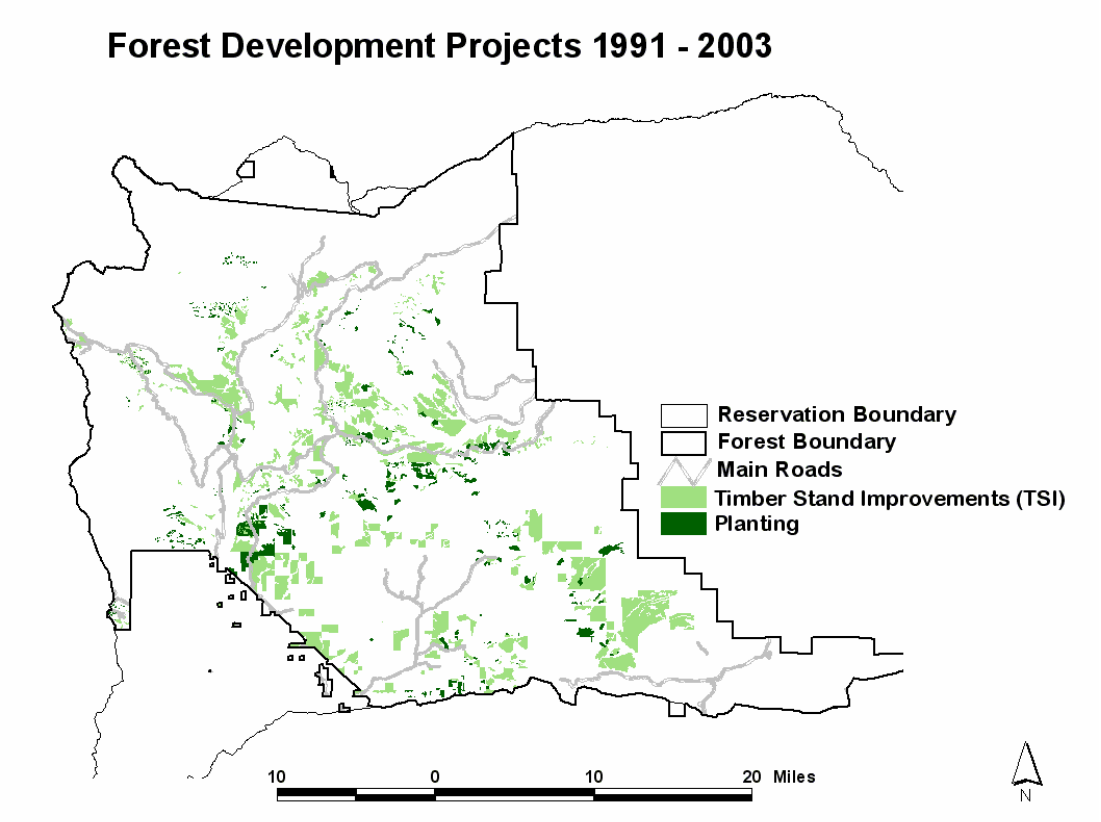

Figure III–11. Forest Development Projects on the Yakama Forest from 1991 to 2003

Insect and Disease Hazard Ratings

Insect and disease hazard indicators have been developed by the U.S.D.A. Forest Service (Lehmkuhl *et al*. 1994). Appendix A of this publication summarizes the hazard analysis used in the terrestrial landscape assessments for the Interior Columbia Basin Ecosystem Management Project (Quigley *et al*. 1999). This analysis evaluated the historical and current susceptibility of vegetation to insects and diseases.

This hazard rating system can be used to evaluate the insect and disease hazards on the Yakama Forest. An evaluation was made for eight forest habitat types using the 1995 CFI summaries and GIS mapping. The evaluation worksheets are in the analysis file and are summarized in Table III–13. The hazard associated with each insect or pathogen was rated for 4–6 hazard variables, including:

- Site Quality—forest habitat type
- Host Abundance—percent host species
- Canopy Structure—number of canopy layers and composition
- Stand Density—percent total canopy cover
- Crown Differentiation—difference in crown diameters—used in some beetle species as an additional variable for stand density
- Host Age—host size class
- Continuity of Host Species—host-host transition at cell edges

This analysis substantiates the fact that the majority of the Yakama Forest has a high hazard for defoliators, primarily because of host abundance, density, canopy structure, and continuity. Bark beetles become a high hazard as the host age, abundance, and stand density increases. Dwarf mistletoe hazard is somewhat less but becomes high with increased host age, abundance, and multiple canopy levels. The Douglas-fir and grand fir habitat types are prone to root diseases and the hazard increases throughout the forest with increased host abundance and age. Disturbances such as fire, logging damage, or drought increase the risk of losses. Often several of these pathogens work in concert, for example, Douglas-fir beetles will attack trees that have been weakened by western spruce budworm.

Forest Restoration

To address the forest health issue on the Yakama Forest, the following restoration approach has been initiated:

- Stand densities are being reduced where the long-term carrying capacity of the land is now exceeded. Densities are being reduced through silvicultural treatments including precommercial thinning, commercial thinning, and prescribed burning.
- The shift toward stands of late-successional, shade-tolerant species is being reversed with the goal of restoring a seral-dominated forest matrix. In the past, fire-adapted species and fire-adapted landscapes were favored by frequent, low-intensity fires. These seral-dominated forest stands appear to have been more sustainable than the current conditions existing on the reservation.

Table III–13. Summary of Insect and Disease Ratings by Forest Habitat Type

Agent	Habitat Types							
	Ponderosa Pine	Douglas-fir	Grand Fir Cedar Valley	Grand Fir Low Elev. & Dry	Grand Fir High Elev. & Wet	Grand Fir Low Elev. & Wet	Subalpine Fir	Pacific Silver Fir
Defoliators								
Western Spruce Budworm	NA	High	High	High	High	High	High	Mod
Pine Butterfly	Low	Low	Low	Low	N/A	N/A	N/A	N/A
Bark Beetles								
Western Pine Beetle								
Over mature trees	High	Moderate	Moderate	Low	Moderate	Moderate	NA	NA
Immature trees	High	High	High	Moderate	Low	High	N/A	N/A
Mountain Pine Beetle	N/A	Moderate	High	Moderate	High	Moderate	High	N/A
Douglas-fir Beetle	N/A	Moderate	Moderate	Moderate	High	High	Moderate	Moderate
Fir Engraver	N/A	N/A	Moderate	High	High	High	High	High
Dwarf Mistletoe								
Douglas-fir Dwarf Mistletoe	N/A	High	Moderate	Moderate	Moderate	High	Moderate	Moderate
Western Mistletoe (PP)	High	High	Moderate	Low	Moderate	Moderate	Low	Low
Lodgepole D. Mistletoe	N/A	Low	Moderate	Low	Moderate	Low	Moderate	Low
Western Larch D. Mistletoe	N/A	Moderate	Low	Low	Low	Low	Low	Low
Root Diseases								
All Combined	High	High	High	Moderate	High	High	Moderate	High

Primitive Area

The Primitive Area was established by Tribal Council Resolution T-22-78, in which the Yakama Nation directed the Bureau of Indian Affairs (BIA) to take no action within an area defined by "the headwaters of the Klickitat River and Fish Lake Stream drainages." It was the Tribal Council's belief that the "highest and best use of this northwest corner of the reservation is a Primitive Area." The BIA was also directed to include the Primitive Area in its next Forest Management Plan (FMP).

In addition, the Land and Natural Resources Policies Plan (LNRPP) of 1987 defined goals and policies and established permissible uses for the Primitive Area. The LNRPP also added Alpine Areas to be included in the Forest Management Plan. New Alpine areas on the slopes of Mount Adams and the Lakebeds area of the Simcoe Mountains were thus added in the FMP of 1988 (actually designed to cover the period 1983–1992). The 1993–2002 FMP stated that the Primitive Area was to be maintained in its natural state and that natural ecological events should be allowed to occur as freely as possible, provided adjacent lands are not unreasonably affected.

The Primitive Area consists of the upper reaches of the Klickitat River, roughly half of which drains into the West Fork of the Klickitat, with the other half draining directly into the Klickitat. The Primitive Area runs from just north of Potato Hill through the Two Lakes, Howard Lake, and Fish Lake areas, then north of Jennie's Butte, through McCormick Meadows, and ending just east of Diamond Butte. The Cascade crest forms the western edge of the Primitive Area, including Cispus Pass. Much of the Forest Service land north and west of the Primitive Area is also managed as reserve, notably the Goat Rocks Wilderness. Subalpine fir and Pacific silver fir are the primary forest habitat types in the Primitive Area.

Existing Timber Resource

The previous section described the historic and current forest vegetation conditions on the Yakama Reservation. This section will more specifically highlight one component of the forest ecosystem—the timber resource as it relates to the customs and practices of the Yakama Nation.

The current volume and condition of the timber resource is based on an analysis of the 1995-96 Continuous Forest Inventory (CFI) data. Data were collected on 1,286 permanent sample plots throughout the Yakama Forest. The data collected provides information on physical stand features, management activities, current stand conditions, stand density, volume, growth, mortality, tree problems, live crown ratios, and numbers of snags. The gross and net volumes are summarized by cover type in Table III–5. The average annual growth and mortality by cover type are summarized in Table III–6.

The CFI data were also stratified by the eight forest habitat types within the Yakama Forest. These summaries are included in Tables III–10, III–11, and III–12.

Historic Activities and Practices

The Yakama Forest has always been vital to the spirit, character, and survival of the tribes and bands that make up the Yakama Nation. It is a valued source of fresh drinking water; and many plants are utilized for food, medicine, building materials, and technological items. A diversity of resource zones and landforms are important including forest, woodlands, riparian areas, dry meadows, wet meadows, and berry fields.

Early Forest Management and Practices

In a more modern sense, the Yakama Forest produces many useful, commercially valuable products that may be utilized for personal and tribal benefits. These products include timber, wildlife, livestock, firewood, non-traditional forest products, posts/poles, house logs, fish, huckleberries, and mushrooms.

Commercial timber harvesting began on the Yakama Forest in 1944 with the Dry Creek Sanitation/Salvage Sale. Early harvesting activities concentrated on trees that were attacked or were at risk of being attacked by bark beetles—mostly large ponderosa pines. The species mix of the harvested trees has changed over time as shown in Figure III–11 and Table III–14.

Table III–14. Percentage of Timber Harvest by Species Groups and Period

Period	Species Groups		
	Ponderosa Pine and Lodgepole Pine	Douglas-fir and Grand Fir	Other Species
1944-1950	100	0	0
1951-1960	96	4	0
1961-1970	62	31	7
1971-1980	56	37	7
1981-1990	61	35	4
1991-2000	30	67	3
2001-2003	26	73	2

Initial harvests were principally ponderosa pine. The percentage of pine has decreased over time while the volumes of Douglas-fir and grand fir have increased significantly. The early harvest practices were one cause, along with fire exclusion and grazing patterns, for the changes in forest cover.

The first Forest Management Plan was developed in 1942. Since then, a new Forest Management Plan has been prepared in every decade. Directions and policies have changed as the plans were revised.

The 1942 Plan—Endorsed by the Yakama Nation in 1942

The impetus for this plan was the General Council's decision of June 20, 1941 to request that timber be sold from the Yakama Reservation. The plan proposed a rotation of 120 years, cutting cycles of 40 years, and an allowable annual cut of 42 million board feet. Nearly all cutting was directed towards ponderosa pine stands that were undergoing heavy attacks from western pine beetles. The total volume harvested under this plan was 127 million board feet with a gross stumpage value of 2.2 million dollars.

The 1953 Plan—Developed by Forest Manager Richard Delaney, Approved by the Yakama Nation in April 1953

There was a major increase in the allowable annual harvest to 70 million board feet. Additional changes included more rapid coverage of the forest, principally by sanitation sales, to combat a new beetle epidemic. The most significant result of this plan was the decision of the Yakama Nation to finance a portion of the increase in management costs. The total volume harvested under this plan was 603 million board feet with a gross stumpage value of 16 million dollars.

The 1962 Plan—Compiled by Richard Delaney with a 1965 Modification, Approved by the Assistant Commissioner of Indian Affairs in February 1966

This plan was based on information from the first complete forest-wide forest inventory that was finished in 1958. The 1965 modification raised the allowable annual cut to 157 million board feet. The total volume harvested from 1966 through 1974 was one billion board feet with a gross stumpage value of 26 million dollars.

The 1970 Plan—Approved in 1974

This plan was developed following completion of mapping projects and the 1970 forest-wide forest inventory. Ponderosa pine, pine-fir, and mixed conifer timber types were to be managed on an uneven-aged basis; lodgepole pine and true-fir timber types were to be managed on an even-aged basis. The allowable annual cut was established at 186 million board feet. This cut was to be expedited as soon as possible in order to achieve stand adjustment in 68 years for pine and pine-fir timber types and 88 years for mixed conifer types. The total volume harvested under this plan was 1.5 billion board feet with a gross stumpage value of $201 million.

The 1983 Plan—Approved in January 1988

This plan was developed subsequent to the remeasurement of the CFI plots and completion of a new timber type mapping project. The allowable annual cut was reduced to 162.7 million feet as a result of the decision of the Yakama Nation to place approximately 25 percent of the forested area into reserve status. Prior plans had established administrative units along geographic lines with all units similarly managed according to a single broad multiple-use philosophy. The 1983 plan established eight land use areas with separate dominant use management that was based on similar ecological capability of best serving certain desirable functions. The total harvest under this plan was 636 million board feet with a gross stumpage value of 132 million dollars.

The 1993 Plan—Practices and Accomplishments

The 1993 Forest Management Plan, approved by Tribal Resolution T-144-93 and the BIA in October 1993, provided forest management direction and guidance for the 1993-2002 planning period. This plan retained many of the concepts of the former plan, with further refinement of the location of the Management Areas and revision of the protection policies to reflect current knowledge and techniques. Three additional Management Areas (Old Growth, Riparian, and Woodland) were defined. An additional 44,000 acres were placed in reserved status with a total allocation of approximately 221,000 acres in Management Areas with no scheduled timber harvests. These revisions resulted in the reduction of the allowable annual cut to 143 million board feet.

Despite the reduced allowable annual cut, the volumes harvested increased in response to the western spruce budworm forest health emergency. In February 1998 the Yakama Tribal Council adopted a strategy, Resolution T-58-98, to address the budworm outbreak. The resolution provided for accelerated silvicultural treatments, including species preference harvesting and density management to reduce insect problems, protect other resource values, and recover some of the value of the dead and damaged trees. Table III–15 provides a summary of the annual volumes harvested, the tribal timber revenue, and average stumpage price.

Table III–15. Yakama Nation Harvest Volume and Revenue 1993–2002

Fiscal Year	Volume MMBF[1]	Market Value $	Average Stumpage $
1993	87.7	33,946,471.00	387.15
1994	88.5	36,473,761.00	412.21
1995	129.3	41,710,338.00	322.48
1996	141.7	45,123,618.00	318.36
1997	134.3	45,450,971.00	338.33
1998	152.0	34,101,975.75	224.31
1999	226.2	45,979,298.18	203.27
2000	202.0	39,195,709.62	194.00
2001	216.0	31,327,320.56	145.03
2002	147.3	22,489,879.40	151.75
Total	1,525.2	375,799,342.51	
Average	152.5	37,579,934.25	269.69

[1] Includes total green volume, woodlogs, residue, and salvage.

The total volume harvested, for the 1993–2002 period was 1,525,174,000 board feet for an annual average of 152.5 million board feet. The general pattern has been an increase in harvest volume (mainly Douglas-fir and grand fir), offset by a decrease in value.

The 2003 Revised Forest Management Plan

The Yakama Tribal Council declared a forest health emergency on the Yakama Forest in 2000 by Tribal Resolution (T-095-00A). In 2002, the Timber, Grazing, Overall Economic Development Committee declared a continuance of the emergency conditions by Committee Action (CA-006-2003-1). Defoliators, bark beetles, and pathogens were affecting entire landscapes dominated by grand fir and Douglas-fir; in addition, dense stands of lodgepole pine and ponderosa pine were being attacked by bark beetles resulting in increased tree mortality, wildfire hazard, and economic losses to the Yakama Nation.

A revised Forest Management Plan was developed for continued management of the Administrative Forest during the forest health emergency and while a new FMP was being developed. Under this plan, 131.3 million board feet was harvested in 2003; and 150 million board feet was harvested in 2004.

Silvicultural Prescriptions

Management Plan silvicultural prescriptions are for forest habitat types with modifications for management emphasis areas. The prescriptions represent the regulated stand condition at the beginning of the cutting cycle. Prescription stand densities represent the average target for each habitat type that maintains full stocking after harvest, avoids stressful overstocking prior to the next planned harvest, and meets the objective of the management area.

Table III–16 summarizes the silvicultural prescriptions for the land allocations that are managed in part for timber production.

Silvicultural Parameters

The following silvicultural parameters were used in the development of the silvicultural prescriptions:

q-Factor: The "q", or diminution quotient, is the ratio by which the number of trees in decreasing diameter classes increases. The "q" represents a diameter distribution that is biologically feasible and meets the objective of the management area. Low "qs" give a flat diameter distribution and represent a very open, park-like stand. High "qs" give a very steep diameter distribution and can be visualized as stands with thickets of small trees in the understory.

Basal Area: Basal area is a measure of stand density and is usually expressed as square feet per acre. Basal area per acre is the sum of the cross-sectional areas of tree stems measured at breast-height. The basal area targets in a managed forest will vary based on objectives, site, species composition, and the silvicultural practices being applied.

Maximum DBH: The average maximum diameter for a management stratum after regulation is reached. Regulation will not be achieved during this planning period.

Cutting Cycle: The cutting cycle is presently estimated at 18 years. However, the cycle should remain flexible. Scheduling should address forest pest management and stand health, which may require shorter or longer cutting cycles.

Veteran Trees/Acres: The number of live trees larger than 24 inches dbh to be retained to meet management area objectives.

Forest Fuels and Fire

Historical Perspective

Prior to the 1900s, much of the forested landscape on the Yakama Reservation was dominated by open, park-like ponderosa pine stands. Land-use management practices since the early 1900s have altered the natural disturbance regimes and have reduced ecosystem resilience to disturbances. Fire exclusion, timber harvesting, and livestock grazing are among the management practices that have contributed to changes in ecosystem character that are conducive to insect outbreaks such as the western spruce budworm. These past management practices have in many places, converted the Yakama Forest into areas of dense, mostly contiguous forest often dominated by Douglas-fir and grand fir—preferred species of the western spruce budworm. In addition, this vegetation type provides ladder fuels that allow cool, beneficial surface fires to explode into large stand-replacement fires in the dry, east Cascade climate. These ladder fuels create even greater risk of wildland fire when stands are severely affected by the spruce budworm.

While many factors are attributed to structural changes on the Yakama Forest, the most apparent single impact on the natural process existing prior to 1900 has been the exclusion of fire from the forest ecosystem. An important natural process in maintaining ecological diversity and complexity in the forest environment was lost or severely modified with the exclusion of fire.

Fahnestock and Rauw (1983) evaluated the fire history for the lower elevation ponderosa pine and ponderosa pine/Douglas-fir forest by evaluating fire scars from these tree species. They found a mean fire return interval of 13.2 years, evidenced by fire scars. This is likely a conservative estimate since many low-intensity fires, or fires burning in localized light fuel, would leave no fire scar. The number of fire scars increased per decade gradually to a peak between 1851 and 1880, declined slightly to 1920, dropped by 1/3 during 1921–1940, and fell sharply thereafter with no scars at all for the period 1975–1980.

The high incidence of scarring from 1851 to 1920 may reflect to some extent the influence of settlement and exploitation of the forest resource. Fire suppression is the likely cause of the decline in fire scars since 1921, and more efficient fire suppression methodology had likely caused the even greater decline in fires following 1940. Fire suppression was instituted on the reservation in 1910 although at first it involved only one lookout, Signal Peak, and only seven "fire chasers". A forestry staff, trucks, and a fire-fighting tractor was added in the 1920s but access was primarily restricted to walking or horseback.

Table III–16. Silvicultural Prescription Parameters by Forest Habitat Type.

These parameters are for stand conditions following harvest for 10- to 20-year harvest entry cycles.

Forest Habitat Type	Management Emphasis Area	q Factor[1]	Maximum DBH[2] (Inches)	Basal Area (Ft^2/Ac)	Total Trees/Ac[3]	Large Trees/Ac[4]	Veteran Trees/Ac[5]	% Seral Species	% Canopy Cover
Ponderosa Pine (PIPO)	General Forest	1.3	24	70-80	140-160	8-10	0.5-1.0	80-90	30-50
	Wildlife Winter Habitat	1.3	24	60-80	120-155	7-10	0.5-1.5	80-90	20-60
	Canyon	1.3	24	60-80	120-155	7-10	0.5-1.5	80-90	20-60
	Old Growth	1.3	26	40-100	15-185	5-13	0.5-1.5	90-95	20-60
Douglas-fir (PSME)	General Forest	1.3	24	70-90	140-180	8-11	0.5-1.5	60-80	20-60
	Wildlife Winter Habitat	1.3	24	60-80	115-150	8-10	1.5-2.0	70-80	20-60
	Safety Corridor	1.2	24	60-90	90-135	9-13	0.5	70-80	20-40
	Canyon	1.3	24	60-80	115-150	8-10	1.5-2.0	70-80	20-60
	Old Growth	1.3	26	40-100	20-190	5-13	0.5	90-95	20-60
Grand Fir, Cedar Valley (ABGR_1)	General Forest	1.3	24	70-80	140-160	8-10	0.5-1.0	80-90	30-50
	Safety Corridor	1.2	24	70-80	105-120	10-12	0.5	90-95	20-40
	Canyon	1.3	24	60-80	120-155	7-10	0.5-1.5	80-90	20-60
	Old Growth	1.3	26	50-120	90-230	6-15	0.5	90-95	20-60
Grand Fir, Low Elevation, Dry (ABGR_2)	General Forest	1.3	24	70-90	140-180	8-11	0.5-1.5	60-80	20-60
	Wildlife Winter Habitat	1.3	24	60-80	115-150	8-10	1.5-2.0	70-80	20-60
	Safety Corridor	1.2	24	60-90	90-135	9-13	0.5	70-80	20-40
	Canyon	1.3	24	60-80	115-150	8-10	1.5-2.0	70-80	20-60
	Old Growth	1.3	26	50-120	20-230	6-15	0.5	90-95	20-60
Grand Fir, High Elevation, Wet (ABGR_3)	General Forest	1.3	24	100-120	200-235	12-15	1.0-2.0	40-60	40-70
	Wildlife Winter Habitat	1.3	24	60-80	120-160	7-10	0.5-1.5	40-60	20-60
	Safety Corridor	1.2	24	60-100	90-150	9-14	0.5	40-60	30-60
	Canyon	1.4	30	80-110	190-260	9-11	0.5	30-50	20-60
	Old Growth	1.3	30	70-140	115-240	9-19	0.5	50-70	40-60

Table III–16 (continued)

Forest Habitat Type	Management Emphasis Area	q Factor[1]	Maximum DBH[2] (Inches)	Basal Area (Ft^2/Ac)	Total Trees/Ac[3]	Large Trees/Ac[4]	Veteran Trees/Ac[5]	% Seral Species	% Canopy Cover
Grand Fir, Low Elevation, Wet (ABGR_4)	General Forest	1.3	24	100-120	200-235	12-15	1.0-2.0	40-60	40-70
	Safety Corridor	1.2	24	70-100	105-150	10-14	0.5	40-60	30-60
	Canyon	1.4	30	80-110	190-260	9-11	0.5	30-50	20-60
	Old Growth	1.3	30	70-140	120-240	9-19	0.5	30-50	40-60
Subalpine Fir and Hemlock (ABLA)	General Forest	Even-aged seral species management, 40-year conversion period.							50-70
	Safety Corridor	1.2	26	90-100	125-140	14-16	0.5	40-50	50-70
	Canyon	1.4	30	120-140	280-330	13-16	1.0	30-50	60-80
	Old Growth	1.4	30	120-140	280-325	13-15	1.0	30-50	70-80
Pacific Silver Fir (ABAM)	General Forest	Even-aged seral species management, 40-year conversion period.							50-70
	Safety Corridor	1.2	26	90-100	125-140	14-16	0.5	40-50	50-70
	Canyon	1.4	30	120-140	280-330	13-15	1.0	30-50	60-80
	Old Growth	1.4	32	120-140	275-325	13-15	0.5	30-50	70-80
Lodgepole Pine (PIPO) Communities	80–100 year rotation, 20-year conversion period within commercial forest areas.								

[1] q Factor is the ratio by which the number of trees in decreasing diameter classes increases.
[2] DBH is diameter at breast height.
[3] Total Trees/Ac includes all live trees in all diameter classes.
[4] Large Trees/Ac includes all live trees greater than or equal to 20 inches dbh.
[5] Veteran Trees/Ac includes all live trees greater than 24 inches dbh.

Refer to the management directions in Chapter V for management within the Riparian MEA, Alpine MEA, and Primitive Area.

Weaver (1961) investigated fire history in the Cedar Valley. His observations indicated that fires occurred frequently until the early 1900s. He illustrated one example in which between 1807 and 1935 (130 years) a particular ponderosa pine was fire scarred on the average every ten years.

No fire history studies have been completed within the other "higher elevation" forest types on the Yakama Reservation. Fire history studies conducted in western Montana in similar forest types (Arno and Gruell 1983) indicated a mean fire return interval of 42 years for pre-European settlement stands. Within seral lodgepole pine stands, primarily on the east side of mountain ranges, fire cycles probably ranged from less than 100 years to about 500 years (Hendrickson 1972). Lodgepole pine forests greater than 60 to 80 years old accumulate fuel to hazardous levels rapidly from natural thinning, mountain pine beetle induced mortality, dwarf mistletoe infestations, and deadfall from previous fire killed timber. Once lodgepole pine stands reach this age with high levels of surface fuel they are highly susceptible to ignition and stand replacement.

Lower elevation subalpine forests likely had a fire return interval between a minimum age for lodgepole pine forests (50–60 years) and the moister, higher elevation subalpine forest of 90 to 130 years. Upper elevation subalpine forests have a wide variety of fire return intervals depending on fire severity. At these elevations the type of fire that had the greatest impact was wind-driven crown fires running from lower elevations during periods of extreme drought. These stand-replacement fires may be expected to occur at intervals of 200 years or more.

Existing Conditions

The historic fire regimes have influenced the structure of natural forests on the reservation. There are, however, few places on the reservation where forestlands have been managed for natural conditions such as those created by fires of the past. Success in fire suppression has allowed more uniform and increasing fuel loads across the reservation, shifting forest fire effects that were typically of low and moderate severity in historic times to severe fires today. Ironically, the increased risk of valuable timber loss has forced the use of more intensive and often mechanized forms of suppression actions. This in turn has added to fire costs with greater impacts on other resource values.

Fire exclusion and past selective cutting have changed the structure of today's forest—mainly species composition and density. Fire suppression removed the primary source of natural thinning in forest stands. It also removed a powerful force that selected in favor of thick-barked, fire-resistant trees and shade-intolerant, pioneer species. Additionally, suppression of naturally recurring fires has allowed the accumulation of fuels.

Selective harvest methods have advanced the successional character by disproportionately removing seral species while opening up the forest canopies enough to favor the establishment of either brush or shade-tolerant, late-successional species. In some areas, this resulted in the development of dense stands with multiple canopy layers. The upper canopy levels are often made up of remnants of the pre-management forest, largely ponderosa pine, Douglas-fir, and western larch. The lower levels are frequently made up of over-dense stands of shade-tolerant, late-successional species. Accumulated fuels are high. Historically, stands having the current structure were rare and temporary in nature.

Figure III–12 shows the results of a wildland fire hazard analysis in which historic fire regimes were compared to current regimes. Hazardous conditions develop in areas where fires are excluded for periods longer than their historic fire return intervals. The hazardous conditions result when fuels accumulate faster than they decompose or burn.

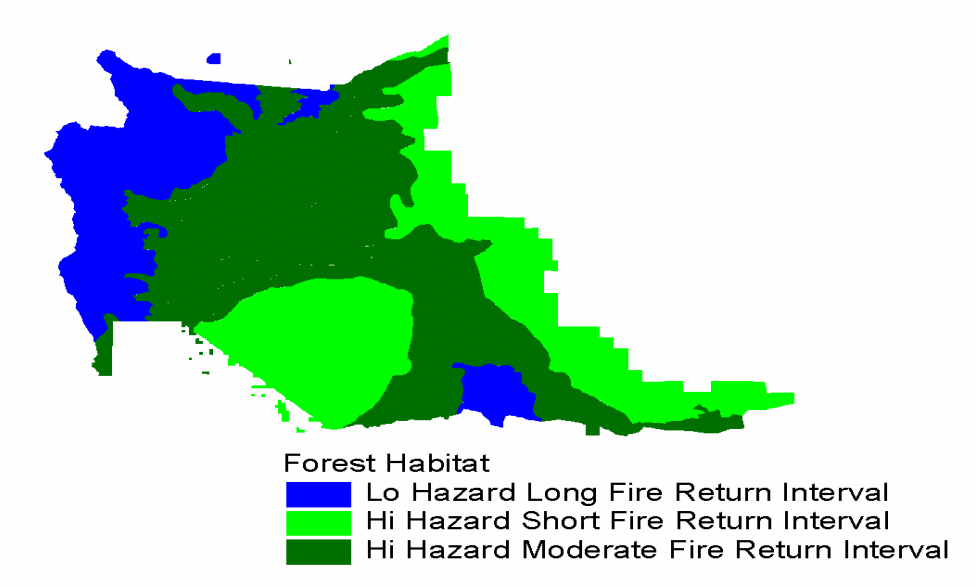

Figure III–12. Fire Return Intervals on the Yakama Forest
(Everett 1999)

Chapter IV. Management Alternative

Following public scoping and analysis, five management alternatives were developed and analyzed for the Yakama Forest (Yakama Nation 2005). These alternatives present a reasonable range of management options from the "no change in management direction" alternative (Alternative 1), where management would continue as directed in the 1993–2002 Forest Management Plan, to the ecosystem management alternative (Alternative 3). As a result of issues identified in the environmental analysis including social, economic, and resource concerns, Alternatives 2, 4, and 5 were developed.

The Yakama Tribal Council selected Alternative 4 for implementation in this FMP by Resolution T-021-04. Alternative 4 is identified within this document as the "management alternative" and its main components are shown in Table IV–1.

Alternative 4 is very similar to Alternative 3, but was further developed to address three issues of concern, namely (1) the length of time for reentry into harvest or timber sale units; (2) the social and economic impacts of continuing a 158 MMBF harvest level for ten years possibly followed by a rather sharp reduction in timber volume, revenue, and jobs; and (3) the need for additional mitigation to reduce resource impacts.

It is the intent of the management alternative to recover as much value as possible from the insect-damaged forest stands for the first five years of the planning period while decreasing the annual cut incrementally through 2014. Under this action, the reentry period on most timber sale areas will be near the desired 12–20 years.

The initial harvest level in 2005 will be about 158 MMBF. The harvest level will then decrease over the planning period to 143 MMBF so that the total volume harvested during the planning period will not exceed 1,509 MMBF. It is anticipated that by following this reduction in harvest during the planning period, there will be no sharp reduction of revenue or jobs during or immediately following the planning period. The work demand reduction could be managed with natural attrition.

The management alternative promotes the ecosystem management approach for the Yakama Forest. Resource programs required to support the ecosystem management approach are summarized in Table IV–1.

To effectively address the forest health issue under the ecosystem management approach, different land unit descriptors are needed in addition to the current use of vegetation cover types. Plant associations and forest habitat types described in Appendix A will be used for implementing management strategies during the planning period.

Table IV–1. Yakama Forest Management Components

Management Components	Alternative 4
Land Classification	Forest habitat types and management emphasis areas
Management Direction	Updated management goals, objectives, and directions by resource. Implement moderate mitigation to reduce current and possible future resource impacts.
Environmental Review	Programmatic Environmental Assessment and Timber Sale EA
Vegetation Management Units	Broad forest habitat types and vegetation cover types
Planned and Scheduled Harvest Charged to Allowable Annual Cut	Entire Yakama Forest except Primitive Area and Tract D Recreation Area.
Harvest That Protects Primary Resource Values	Harvest only in planned and scheduled sale areas. Areas needing special protection will be defined by management emphasis areas.
Silvicultural Treatment Objectives	**Short Term**: Treat budworm-affected and hazard areas on the Yakama Forest except Primitive Area and Tract D Recreation Areas. **Mid-Term**: Return social and economic stability to all resources through moderate mitigation over first 5 years of planning period. **Long Term**: Begin moving towards DFC by 2014.
Forest Development Objectives	Increase seral composition of stands by planting. Manage density with precommercial thinning to favor seral species.
Fuels Management and Prescribed Fire	Fuels management needed on 20,000 acres/year (includes timber sales and road corridors).
Sustained Yield	158.4 MMBF
Scheduled Annual Harvest Level	158.4 MMBF gradually reduced to 143.3 MMBF by 2014 (Total 1,508 MMBF). All Yakama Forest lands except Primitive Area and Tract D Recreation Area.
Jobs	Number of jobs will gradually decline from present level as annual harvest is incrementally decreased.
Revenue	With no change in log prices, revenue will gradually decline from present level as annual harvest is incrementally decreased.
Organization	Manage sale areas with Programmatic EA and timber sale proposals.
Road Management	Develop Master Road Management Plan. Implement moderate mitigation to reduce current and possible future road impacts on resource values
Range Management	Develop Integrated Grazing Management Plan for Livestock and Wildlife on Yakama Forest by Year 2008. Implement moderate mitigation to enhance condition of understory and forage habitat on Yakama Forest.

Table IV–1 (continued).

Management Components	Alternative 4
Areas with Roadless or Undeveloped Character	New road development will occur in some roadless areas; the undeveloped character of the Primitive and Tract D Recreation Areas will be maintained.
Watershed Management	The Watershed LUMA is designated as Canyon Management Emphasis Area. Riparian Areas are modified to new criteria.
Visual Resource	Visual Resource LUMA is designated as Safety Corridor Management Emphasis Area. Manage to edge of roads with additional cleanup, visual, and safety considerations.
Air Resource	Develop Integrated Smoke Management Plan by 2008.
Vegetation Management	Develop Integrated Pest Management Plan for invasive plant species by 2008. Develop moderate mitigation effort to reduce current and possible future impacts on cultural values, including traditional foods and plants.
Special Use Resource	Special Use LUMA is designated as Traditional Use Management Emphasis Area. Moderate enhancement of personal-use opportunities through mitigation for traditional foods and plants.
Old-Growth Resource	Through moderate mitigation efforts, complete an inventory and map by category all existing old-growth, near old-growth, and candidate sites for old-growth and develop a long-term old-growth management plan in coordination with DFCs by 2008.
Cultural Resource	Develop moderate mitigation effort to reduce possible impacts on cultural values including traditional foods and plants.
Water Resources	Develop new stream classification system.
Wildlife Resource	Through moderate mitigation, inventory and map amounts and locations of interior forest stands and suitable corridor habitat for interconnecting these interior forest stands.

The management alternative gives high priority to managing the water resource, fisheries, and wildlife conditions on the Yakama Forest. Under this alternative, action will be initiated to close roads that affect riparian management areas and to reduce the open road density to 3.0 miles per square mile. This may be difficult to achieve in areas near fee lands and Indian allotments, however, reasonable efforts will be made to meet the above standards. Physically blocking roads or decommissioning the roadbeds to prevent future vehicle use might be used to enforce road closures.

To effectively address the high priority road management issue, a Master Road Management and Maintenance Plan for the Yakama Forest will be developed during the planning period. In

addition, moderate accelerated mitigation will be implemented to reduce current and possible future road impacts on resource values including water, fish, wildlife, and cultural resources.

The short-term silvicultural treatment objectives under Alternative 4 will remain focused on treating the western spruce budworm-affected and hazard areas. Additional moderate mitigation measures will be implemented to address current and possible accelerated harvest impacts. As part of this mitigation, the mid-term silvicultural treatment objective will reflect the issue-driven need to return social, economic, and resource stability through a decrease in harvest volumes from 158 MMBF to 143 MMBF during the planning period. To meet the requirements of the ecosystem management approach for the Yakama Forest, a long–term silvicultural treatment strategy has been developed and will be implemented to move the Yakama Forest towards the Desired Future Condition (DFC) as described in Chapter V.

An ecosystem management approach will be implemented under the management alternative. NEPA requirements will be met by the Programmatic Environmental Assessment and individual Timber Sale Environmental Assessments. A more detailed description of the NEPA process for timber sale review is shown in Chapter VII.

Forest development objectives will continue to focus on reforestation and density management on timber sale areas as well as limited management in other priority areas. A desired increase in shade-intolerant species composition will be attained by planting in harvest units. In addition, increased density management with precommercial thinning will be used to favor shade-intolerant species.

The fuels management, including prescribed fire, objectives will be in coordination with the Yakama Reservation Fire Management Plan and focus on treating fuels in current timber sale areas and road corridors. A program will be developed to treat 20,000 acres/year to reduce fuel hazards and provide stocking control.

As the current harvest level is near 150 MMBF, the increased harvest to a 158 MMBF starting level in 2005 will increase revenue to the Yakama Nation to a level slightly higher than that of 2002. The number of forest related jobs will remain similar to or reach a level slightly higher than that in 2002. These higher levels will likely decline over the next 10 years because the harvest level will drop to about 143 MMBF in 2014.

To address the issue of overgrazing by livestock and big-game and its effects on vegetation communities on the Yakama Forest, it is recommended that an Integrated Grazing Management Plan be developed and implemented by the year 2008.

The watershed and riparian management LUMAs are discontinued and replaced with Canyon and Riparian Management Emphasis Areas. Protection and enhancement programs will continue to protect the primary resource values including water quantity and quality along with fish habitat. To facilitate these programs it is recommended that a new Stream Classification System be developed and implemented for the Yakama Reservation by the Department of Natural Resources.

Rather than prescribing fixed distance Riparian Management Emphasis Areas, an adaptive modified approach to protection will be used. This approach provides complete protection in the area below the ordinary high water mark and managed protection in the remaining riparian zone (i.e., the zone of influence, flood plains, and adjacent slopes).

The active channel as shown in Figure IV–1 includes the wetted channel and the stream banks. Floodplain widths will vary depending on terrain—the floodplain will be narrow where the land rises steeply from the stream banks and wider where the land rises more gradually. The riparian management zone (RMZ) extends outward from the ordinary high water mark to a distance of one to two site-tree lengths, depending on the stream classification. The RMZ includes a 20-foot buffer adjacent to the stream bank where machinery will be prohibited. Trees may be harvested within the RMZ when active management can be justified to improve forest health, reduce fire hazard, or enhance riparian habitat.

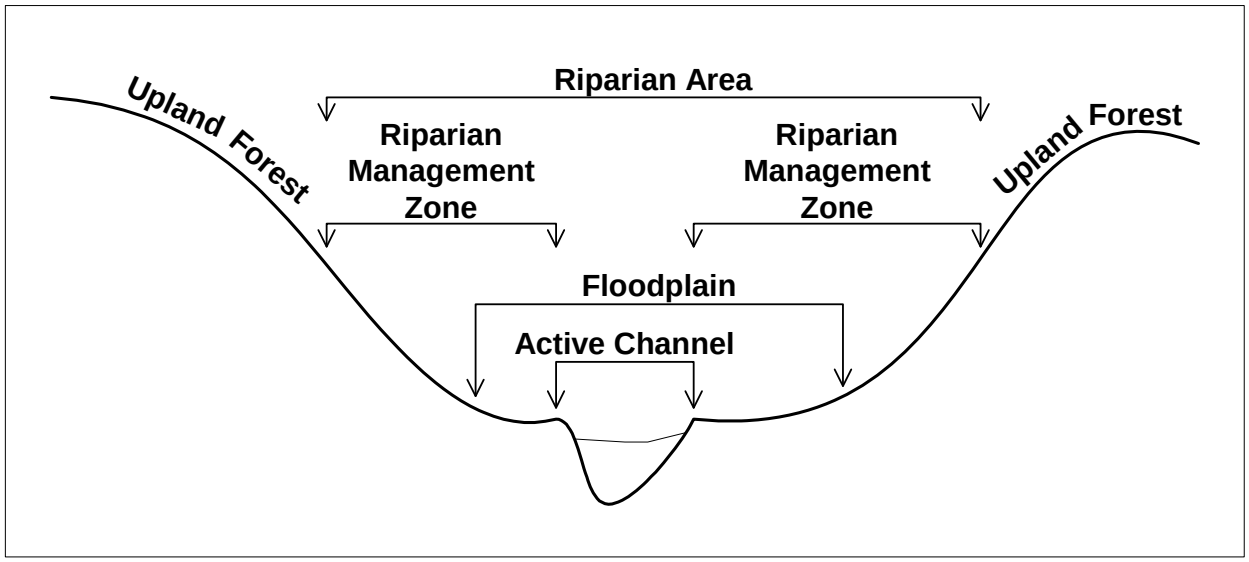

Figure IV–1. Cross-section of a Riparian Area

The Visual LUMA is discontinued and replaced with the Safety Corridor Management Emphasis Area. The areas along major travel corridors will be managed to the road edge with additional cleanup, visual, and safety considerations.

The Forestry Program, in coordination with the Environmental Program, will develop an Integrated Smoke Management Plan for the Yakama Forest by 2008.

Figure IV–2 shows the proposed timber sales by year of initiation on the Yakama Forest. Table IV–2 shows the distribution of harvest volumes by year for the management alternative.

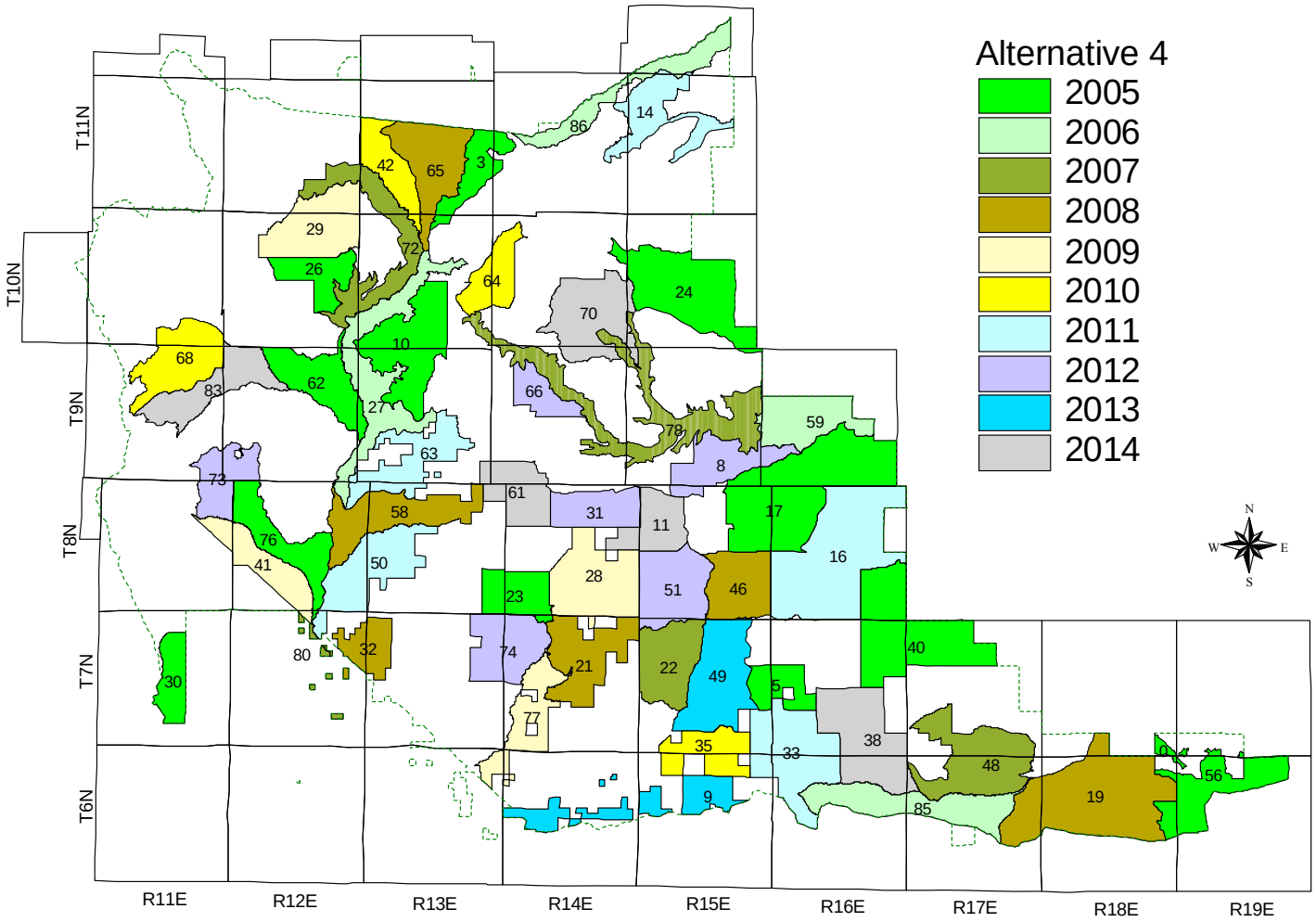

Figure IV–1. Proposed Timber Sales by Year of Initiation on the Yakama Forest

Key to Timber Sale Map Numbers for Figure IV–1

Map #	Timber Sale Name
1	Mt. Adams Lake II
2	Soda Spring West
3	Diamond Fork II
4	Hagerty Butte III
5	Smith Butte II
6	Pole Creek
7	Buck Camp III
8	Vessey "Y" III
9	South Boundary
10	Bullgrouse Budworm
11	Simon Butte III
12	Old Maid Canyon
13	Old Reservation Boundary II
14	Soda Spring East
15	Elk Creek II
16	Dry Creek South
17	Dry Creek North
18	Cougar Creek II
19	East Satus
20	Lyon Spring II
21	Brush Creek II
22	Sheep Creek II
23	West White
24	Woodchoppers Canyon II
25	High Ridge III
26	South McCreedy II
27	Yedlick
28	Poland Butte II
29	Upper McCreedy
30	Bird Creek II
31	Tepee Creek II
32	Bear Creek
33	Castle
34	Signal Peak II
35	Kinney Creek II
36	Trout Creek IV
37	Snow Creek
38	Yatama Creek III
39	Spring Creek III
40	Section Corner Creek II
41	Hellroaring III
42	Diamond Butte
43	Crawford Creek II
44	Jerusalem Camp II
45	South Fork IV
46	East Hoppers
47	Cunningham Creek IV
48	Telephone Canyon II
49	Sheep Butte II
50	Jungle Butte II
51	Hoppers Flat West
52	Holdaway Budworm
53	Lost Horse Plateau IV
54	Piscoe Budworm
55	Kusshi Creek III
56	Indian Spring II
57	Pileup Creek II
58	Surveyors Creek III
59	Whiskey Jim Flat
60	Borde Flat III
61	Shamrock Spring III
62	Icksix III
63	Pinegrass Ridge III
64	Panther Creek II
65	Fairview Ridge
66	Twenty Day Camp III
67	Wahtum Creek IV
68	Clearwater Creek
70	Branch Creek III
72	Line Skid
73	Mulligan Butte
74	Oak Hill
75	Deer Butte II
76	Big Muddy III
77	Twin Buttes III
78	Toppenish Creek
80	Tract D III
81	White Wood
82	Cold Creek
83	Trappers Creek II
85	Lakebeds III
86	Ahtanum Creek

Table IV–2. Distribution of Harvest Volumes by Year for the Management Alternative

ALTERNATIVE 4	HARVEST VOLUME (MMBF) BY CALENDAR YEAR										
TIMBER SALES	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**TOTAL**
Old Maid Canyon	10.0										10.0
Holdaway Budworm	3.0										3.0
Piscoe Budworm	6.0										6.0
Signal Peak II	6.0										6.0
Soda Spring West	12.0	8.4									20.4
Mt. Adams Lake II	12.0	8.0									20.0
Trout Creek #4	12.0	12.0	4.0								28.0
Jerusalem Camp	13.9										13.9
Diamond Fork II	10.0	2.8									12.8
Bullgrouse Budworm	12.0	12.0	12.0	3.6							39.6
Woodchoppers Canyon II	10.0	10.0	8.6								28.6
Dry Creek North	7.0	8.0									15.0
Indian Spring II	6.0	4.0									10.0
South McCreedy II	10.0	3.9									13.9
West White	9.0	12.0	4.0								25.0
Icksix III	8.0	12.0	5.0								25.0
Big Muddy III	7.0	10.0	12.0	8.0							37.0
Smith Butte II	4.0	12.0	7.0								23.0
Section Corner Creek II		10.0	10.0	10.0	1.0						31.0
Bird Creek II		12.0	8.0								20.0
Yedlick		10.0	12.0	12.0	1.0						35.0
Ahtanum Creek		5.0	12.0	10.0							27.0
Lakebeds III		3.0	12.0	12.0	3.0						30.0
Whiskey Jim Flat		2.0	10.0	3.0							15.0
Sheep Creek II			12.0	12.0	12.0	10.0					46.0
Toppenish Creek			10.0	12.0	12.0	12.0	4.0				50.0
Line Skid			10.0	12.0	12.0	4.0					38.0
Tract "D" III			2.0								2.0
Telephone Canyon II			5.0	10.0	10.0	5.0					30.0
Brush Creek II				10.0	12.0	8.0					30.0

Table IV–3 (continued). Distribution of Harvest Volumes by Year for the Management Alternative

ALTERNATIVE 4	HARVEST VOLUME (MMBF) BY CALENDAR YEAR										
TIMBER SALES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
Fairview Ridge				10.0	12.0	12.0	8.0				42.0
Surveyors Creek III				10.0	12.0	8.0					30.0
Bear Creek				10.0	5.0						15.0
East Hoppers				6.0	12.0	7.0					25.0
East Satus				3.0	12.0	12.0	3.0				30.0
Upper McCreedy					12.0	14.0	14.0	14.0	11.0		65.0
Poland Butte II					12.0	12.0	12.0	2.0			38.0
Twin Buttes III					9.0	12.0	6.0				27.0
Hellroaring III					2.0	12.0	12.0	2.0			28.0
Kinney Creek II						8.0	12.0	5.0			25.0
Panther Creek III						8.0	12.0				20.0
Diamond Butte						6.0	12.0	9.0			27.0
Clearwater Creek							12.0	12.0	12.0	12.0	48.0
Soda Spring East							10.0				10.0
Jungle Butte II							10.0	12.0	12.0	6.0	40.0
Pinegrass Ridge III							9.0	12.0	9.0		30.0
Dry Creek South							8.0	12.0	7.0		27.0
Castle							4.0	12.0	12.0	10.0	38.0
Tepee Creek II								12.0	12.0	1.0	25.0
Oak Hill								12.0	12.0	3.0	27.0
Twenty Day Camp III								10.0	8.0		18.0
West Hoppers								10.0	12.0	8.0	30.0
Mulligan Butte								7.0	12.0	12.0	31.0
Vessey "Y" III								5.0	12.0	12.0	29.0
Sheep Butte II									8.0	12.0	20.0
South Boundary									6.0	12.0	18.0
Trappers Creek II										12.0	12.0
Yatama Creek III										12.0	12.0
Branch Creek III										12.0	12.0
Shamrock Spring III										10.0	10.0
Simon Butte III										9.0	9.0
TOTAL GREEN VOLUME	157.9	157.1	155.6	153.6	151.0	150.0	148.0	148.0	145.0	143.0	1,509.2

To develop a long-term strategy for the management of old-growth or late-successional forest stands, an Old-Growth Management Plan in coordination with the Desired Future Conditions (Chapter V) will be developed and implemented by 2008. This Old-Growth Management Plan will be based on an inventory by category of all existing old-growth, near old-growth, and candidates sites for old-growth.

To meet traditional uses concerns on the Forest, an extensive review of the cultural needs for Huckleberry Field Management will be undertaken. Elders and other tribal members who use this resource will be consulted to determine the optimum management prescriptions for key areas of interest. As part of moderate cultural resource mitigation, forest practices will be initiated to reduce current and possible future impacts on cultural values including traditional foods and plants.

Through a moderate habitat mitigation effort, the Wildlife Resource Management Program will inventory and map amounts and locations of interior forest stands and suitable corridor habitat for interconnecting interior forest stands.

Chapter V. Management Directions

Forest-wide management directions are used to establish broad requirements and considerations for the planning and implementation of forest practices on the Yakama Forest. These management directions are intended to supplement the Land and Natural Resources Policies Plan (Yakima Indian Nation 1987) and are listed by resources.

Aesthetics

Management Goal

Maintain the high-quality visual characteristics of the landscape, particularly in the Alpine, Primitive, Traditional Use, and Tract D Recreation Areas.

Management Objectives

1. Protect and enhance the visual qualities of landscapes considered to be unique, rare, or fragile based on tribal values.
2. Maintain or enhance desired scenic quality through management of native vegetation and road densities.
3. Meet aesthetic resource goals based on management principles and techniques established by tribal or federal codes, regulations, contracts, MOUs, or plans.
4. Eliminate or suppress noxious, invasive plant species.

Management Directions

A1. It is recommended that a civil administrative code for dealing with illegal dumping and littering within the Administrative Forest boundaries be established.
A2. Vegetation management activities will be designed to mimic natural diversity and structure. Some of the vegetation management activities will include seeding disturbed areas to stabilize the soil with aesthetically pleasing native plant species and reduce noxious weed encroachment by filling the vacant niche.
A3. A strategy will be developed to reduce road densities while providing reasonable access for tribal members to root, berry, medicinal plants, and other cultural sites.
A4. Seasonal road closures and designation of foot or non-motorized vehicle trails will be used for vehicle access control.
A5. Landscapes of special tribal values will be defined and mapped.
A6. A visual sensitivity rating based on biophysical characteristics, viewing factors, and tribal member's values for landscapes within the Yakama Forest will be developed.
A7. Criteria will be established to evaluate impacts of human activities in relation to desired visual qualities.
A8. Best management practices (BMPs) will be developed for aesthetic resource mitigation.
A9. A Visual Resource Management (VRM) map of the Yakama Forest will be developed to assist resource managers in the design of future activities.

Air Resources

Management Goal

Maintain the high-quality air resource on the Yakama Reservation—low in particulates and pollutants.

Management Objectives

1. Maintain or improve the quality of ambient (outdoor) air within the boundaries of the Yakama Reservation.
2. Continue efforts to meet National Ambient Air Quality Standards and Prevention of Significant Deterioration Program.
3. Maintain and enhance air quality and visibility on the reservation in a manner consistent with the Clean Air Act.
4. Prescribed fire and other fuel management techniques will be used to reduce the potential for wildland fire emissions.
5. Consider alternative emission reduction techniques whenever they are compatible with land allocation objectives and other management actions or direction (see CH2MHill 1995).

Management Directions

B1. Resource management activities on the Yakama Forest will be in compliance with the requirements of the 1963 Clean Air Act as amended in 1966, 1970, 1977, and 1990. These requirements include meeting the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Program.

B2. The Yakama Nation Department of Natural Resources air quality managers will be responsible for adopting plans and rules sufficient to attain and maintain national air quality standards, prevent significant deterioration of air quality, remedy existing visibility impairment, and prevent future impairment in mandatory Class I Federal areas caused by manmade sources of pollution, including prescribed burning on the reservation, in accordance with direction by the Environmental Protection Agency.

B3. An air quality baseline will be established and efforts will be made to reduce particulate matter emissions and impacts from prescribed burning. This will be accomplished by planning, conducting monitoring, and if necessary, adjusting prescribed fire activities.

B4. Minimize broadcast burning in favor of lower intensity underburning. Use emission reduction mitigation measures and smoke dispersal techniques to the greatest extent practical.

B5. Management activities on the reservation that may affect air quality will be assessed and mitigation measures developed if impacts are likely to occur.

B6. Wildland fire hazard reduction, site preparation, and the use of prescribed fire for wildlife habitat mitigation as well as forest and range health mitigation will be implemented in a manner consistent with ecosystem management objectives.

B7. Where appropriate, use dust abatement measures during construction activities and on roads during wood product removal.

B8. Perform conformity determinations required by the Clean Air Act as part of implementing planning.

Cultural and Historic Resources

Management Goal

Where it is recognized that all resources on the Yakama Reservation including soil, water, air, plants, and animals are of cultural and historic value, it shall be the goal of the Yakama Nation to protect these values through a prescribed set of cultural and historic resource management objectives and directions.

Management Objectives

1. Strengthen existing programs to meet or exceed regulations and guidelines for preserving and protecting the cultural resources of the Yakama Nation.
2. Identify cultural resources of significance within the Yakama Reservation and usual and accustomed areas.
3. Preserve, protect, and enhance cultural resources that are significant to political integrity, cultural identity and practices, and tribal member's health and welfare.
4. Train and educate tribal members to identify and protect cultural resources.
5. Provide a sustainable level of culturally significant plants that meet the spiritual, cultural, subsistence, and recreational needs of tribal members.
6. Educate staff and tribal members about the existence, use, and ecology of cultural plants.
7. Enhance awareness and understanding of the history and culture of the Yakama Nation and the importance of its role in the development of Washington State and the United States of America.
8. Strengthen or improve the influence of traditional practices and values within the Yakama Nation organization.
9. Provide more opportunities to practice Yakama traditions.

Management Directions

C1. A controlled access electronic database of archaeological and historical sites, traditional use areas, and burial sites will be maintained, continually updated, and available to trained Yakama Nation cultural specialists and archaeologists to ensure site protection. The existing database will be expanded to include place names, their characteristics, value, and location. This data will be secured within the Cultural Resources Program.

C2. Cultural Resource surveys will be conducted per federal and Yakama Nation regulations and management directions.

C3. Federal and Yakama Nation codes, regulations, and management directions will be used as minimums for managing cultural resources.

C4. Cultural resources management will meet or exceed the NHPA, 36 CFR part 800, AIRFA, and ARPA on all timber sales provided they do not directly conflict with Yakama traditional practices.

C5. Habitats that have the potential to support or that historically supported culturally significant plants and animals will be enhanced or restored.

C6. Sustainable harvest levels will be determined for culturally significant species.

C7. The locations and acres that produce culturally significant foods and medicines will be increased.

C8. The purity of foods and medicines for spiritual integrity will be ensured.

C9. The integrity of spiritual sites, including views and geographical locations with place names, will be ensured.

C10. The Cultural Resources Program will assist in developing a guide to the locations, abundance, and ecology of culturally significant plants.

C11. Forest management practices that maintain or promote the abundance of culturally significant plants will be developed and implemented.

C12. Forest harvest activities will be excluded or restricted in areas designated by the Yakama Tribal Council Cultural Committee, or by an archaeologist with approval from the Committee, in coordination with the Branch of Forestry. Historic and archaeological resources will be protected in-place.

C13. When cultural or archaeological sites are discovered during forest management activities on the reservation, work will be stopped in the immediate vicinity of the discovery and the Yakama Tribal Council Cultural Committee, BIA Superintendent, and Forest Manager will be notified.

C14. The archaeological, cultural, and historic value of meadows, hardwood stands, and natural openings within the forest environment will be protected and maintained by restricting mechanical equipment or vehicular entry into these habitats. Movement of vehicles and equipment will be restricted to existing roadways when adjacent to or passing through these areas. This restriction will include parking of vehicles and equipment, placement of landings or slash piles, and grading or other modifications outside the existing road surface area. Where needed road modification conflicts with these cultural restrictions, consultation will be arranged between representatives of the Yakama Cultural Committee, Department of Natural Resources, and the Branch of Forestry to resolve the modification issue.

These restrictions are intended to protect the large, wet meadows and other open areas greater than 8 acres within the Yakama Forest, including Camas Patch, Polo Field, Buck Camp, Beauty Camp, and Piscoe Meadows. These measures, however, are not intended to restrict forest operations in areas where there may be smaller openings interspersed with patches of trees such as on the Piscoe Creek Timber Sale. In this example, the openings are characterized by rocky ground with sagebrush that would not be adversely affected by the passage of vehicles or machinery such as a skidder.

Fish Resources

Management Goal

To maintain an abundance of anadromous salmonids, non-anadromous salmonids, and other fish species that shall provide substantial subsistence, cultural, and personal value for tribal members.

Management Objectives:

1. Maintain or increase the quantity and quality of habitat on the Yakama Forest necessary to sustain and restore fish populations.
2. Maintain, enhance, or restore stream and lake habitats on the Yakama Forest that are conducive to salmonid passage, rearing, adult residency, and spawning.
3. Enhance all anadromous fisheries where the potential currently exists on the Yakama Forest.
4. Genetic diversity and local adaptation within and among all stocks will be maintained or increased to sustain long-term productivity and fitness.
5. Diverse indigenous species of salmonid stocks will be maintained at levels that sustain ecosystem processes. Populations of other fish species will be maintained at levels that sustain or promote abundant wild salmonid population in their habitats.
6. Promote tribal cultural and sustenance fisheries through natural reproduction and hatchery supplementation.
7. Conserve native aquatic species by maintaining high-quality habitat including water.

Management Direction

D1. The management of fishing activities and use of fish both on and off the reservation, including the Yakama Forest, will be in accordance with the requirements of all applicable Yakama Nation resolutions, committee actions, and codes.
D2. Habitat improvement or other enhancement programs will avoid significant negative impacts to wild salmonids and other native species while promoting or enhancing consumptive fisheries.
D3. The quantity and distribution of non-indigenous fish species or stocks that compete with, prey on, or parasitize salmonids and other indigenous species will be managed on the Yakama Forest.
D4. Introduction of fish populations on the Yakama Forest will be managed to avoid significant negative effects on diversity and productivity of native fish and wildlife populations, and in a way compatible with meeting other objectives for locally adapted populations. Desired and managed species of fish will be defined for the various water bodies on the Yakama Forest.
D5. Provide and maintain passage to all usable salmonid habitat for all life stages. Ensure natural, partial, or complete fish passage barriers are maintained where necessary, to maintain biodiversity among and within wild salmonid populations and other fish and wildlife species.
D6. Reduce or prevent salmonid entry into non-culvert artificial channels or conduits.
D7. Plan and implement watershed restoration activities to conserve fish strongholds and habitats occupied by species of concern, or federally listed threatened, endangered, and candidate species.
D8. Maintain or restore large woody debris within streams to proper functioning standards.

Forest Vegetation

Management Goal

Provide suitable conditions for desirable native and non-native flora and fauna to maintain biodiversity that includes the diversity of genes, species, communities, and ecosystems, as well as the evolutionary processes that link them. Manage landscapes that will in the future more closely resemble those created by historic disturbance agents such as fire (natural and human ignitions), wind, insects, diseases, and wildlife.

Management Objectives

1. Restore ecosystem processes by managing vegetation structure (stand density, species composition, patch size, patterns, and fuel loading and distribution) so ecosystems are resilient to endemic levels of insects, diseases, and wildland fire.
2. Manage production activities and their levels on available and suitable lands to produce commodities that create or maintain the desired range of future conditions while sustaining ecosystem processes including disturbance intensities and frequencies.
3. Restore fire as a natural process by developing and implementing prescribed fire plans on a landscape scale.
4. Rehabilitate areas disturbed by insects, diseases, and wildland fire to restore early-successional tree species, maintain productivity, and prevent accelerated soil loss.

Management Direction

E1. Timber harvest operations will produce between 120 MMBF and 160 MMBF annually.
E2. Forest habitat types and vegetation cover types will be used to formulate management strategies.
E3. Land uses (e.g., timber production, wildlife, water, fisheries, range, and traditional use) may vary by management emphasis areas within the forest habitat types.

E4. The Tract D Recreation and Primitive Areas will be managed without timber harvesting. These lands will not be included in the commercial timber base.
E5. The commercial timber base will include productive lands that can be successfully regenerated within ten years after harvest.
E6. The commercial timber base will be used to calculate the allowable annual cut.
E7. If any area is reserved from harvest for any reason and the basis for the reason is not temporary in nature, the area will be removed from the commercial timber base.
E8. Removal of forestlands from the commercial timber base does not exclude forest vegetation management for other resource benefits in the reserved areas (e.g., huckleberry enhancement and meadow restoration projects).
E9. Silvicultural prescription parameters by forest habitat type and management emphasis area are listed in Table III–16. Desired future conditions for old-growth areas are shown by habitat type in Table V–1 and Table V–9.
E10. Ecosystem analysis will be conducted at the landscape level to resolve potential conflicts between the preservation of terrestrial and aquatic species and habitats, and the restoration of stand structures.
E11. Vegetation management will be used to restore areas where the plant community characteristics are outside the desired range of future conditions.
E12. A variety of stand conditions and a distribution of large trees will be provided across the landscape.
E13. A characteristic representation of all size classes of down woody material will be maintained through time on all actively managed forest sites. Standing dead trees will be left as a future large woody debris source.
E14. Stand treatment entries over time will be minimized to reduce stand disturbance effects.
E15. Forest management will focus on the following guidelines to achieve the desired future condition:
- Uneven-aged management strategy on a subbasin basis within the ponderosa pine, Douglas-fir, and grand fir habitat types. Similar conditions in patches and groups across the landscape.
- Even-aged management strategy within lodgepole pine communities, subalpine fir habitat types, and Pacific silver fir habitat types. Similar conditions in patches and groups across the landscape.

E16. The short-term management strategy shall be to:
- Retrieve timber value from disturbance (insect, disease, fire, wind) areas.
- Treat forest conditions with moderate to high insect and disease hazard ratings.

E17. The mid-term management strategy shall be to:
- Develop treatment prescriptions to move existing conditions toward the DFC.
- Treatment intervals: 10–20 years.

<u>Prescribed Fire</u>

E18. Prescribed fire shall be used to reduce fuel loading, regulate species composition, adjust stand density, and maintain traditional use areas.
E19. Reduce activity fuels to levels consistent with wildland fire protection abilities and resource management objectives.
E20. Fire behavior, fuel loading, duff composition, and tree mortality models will be used to determine where desired stand conditions could be promoted with prescribed fire.
E21. More than one natural or prescribed fire event may be used to achieve desired stand conditions.
E22. An annual Fire Management Plan will be developed and specific direction from fire management and natural resources will be requested and included in this Plan.

<u>Insects and Diseases</u>

E23. Manage for low to moderate insect and disease hazard ratings.

E24. Stand densities will be regulated by precommercial and commercial thinning methods and prescribed fire to prevent insect epidemics.
E25. Soil compaction and disturbance will be minimized during stand treatments to maintain stand vigor.
E26. Prescribed fire, density management, and group selection cuts will be used in stands that have been severely infected by dwarf mistletoe.
E27. Changing species composition and minimizing treatment entries will be used to reduce stand susceptibility to annosus root disease.
E28. Using harvest treatments that do not favor the regeneration of shade-tolerant species will reduce the susceptibility of stands to laminated root rot.
E29. Using harvest and thinning treatments that favor the regeneration of resistant species in infected areas will reduce the susceptibility of stands to Armillaria root disease.

Forest Development

E30. All forestlands harvested by regeneration methods will be reforested naturally or by planting.

Safety Corridor Management Emphasis Area

E31. Forest management will focus on the following guidelines to achieve the desired future condition:
- Increase line of sight along primary travel routes through the forest (the Signal Peak road, Mt Adams Highway, Klickitat River, Potato Hill, Peavine Ridge, Cedar Valley, Vessey Y, Summit Creek, Piscoe Creek, Old Maid, and Panther Creek Roads).
- Provide safety zone for fire fighters.
- Promote the development of large, open-grown ponderosa pine.
  - Retain until mortality level exceeds growth, and then remove only most decadent patches or groups.

Canyon Management Emphasis Area

E32. Conditions may range from steep headwalls and rock outcrops with scattered trees to upper reaches with dense forest cover. Forest management will focus on the following guidelines to achieve the desired future conditions:
- Proactive management of soils and vegetation.
  - Goal is to maintain the vegetative filter to protect water quality.
- Density management.
- Limited use of prescribed fire to reduce natural fuel loading that threatens stream conditions or adjoining areas.

E33. The short-term management strategy shall be to:
- Retrieve timber value from high disturbance (insect, disease, fire, wind) areas when retention will increase future risk to primary value of area.

E34. The mid-term management strategy shall be:
- Implement density management when conditions threaten adjoining areas.
- Limited use of prescribed fire to reduce natural fuel loading that threatens stream conditions or adjoining areas.

Riparian Management Emphasis Area

E35. Forest management will focus on the following guidelines to achieve the desired future condition:
- Manage for conditions that will sustain stream and riparian function.
- Develop and protect late-successional, old-growth conditions where sustainable (damp valley bottoms and gentle north slopes):
  - Mix of late-successional species and complex structural stages.
  - Accumulations of snags and down woody material.

  - Retain until mortality level exceeds growth.
- Maintain a mosaic of structural stages on the remainder of the area.
  - Give special consideration to retention of shade, large woody material, and reducing fire hazard.
- Limited use of prescribed fire where necessary to accomplish priority objectives on adjacent areas.
- Insect and disease hazard rating: moderate.

E36. The short-term management strategy shall be to:
- Treat high insect or disease hazard conditions where stream or riparian function or adjacent areas are threatened.
- Retrieve timber value from high disturbance (insect, disease, fire, wind) areas when the amount of woody material will be a fire hazard and detrimental to stream and riparian function.

E37. The mid-term management strategy shall be:
- Where stream or riparian function or adjacent areas are threatened, develop site-specific treatment prescriptions to move existing conditions toward the DFC.
- Treat no more than 30% of the riparian area within a timber sale at any one entry.

Alpine Management Emphasis Area

E38. Forest management will focus on the following guidelines to achieve the desired future condition:
- Management that maintains the open, scattered trees, patches, and groups of dense cover.
- Give emphasis to maintenance of traditional use areas, especially huckleberry fields.

E39. The short-term management strategy shall be:
- Implement density management and prescribed fire to restore traditional food gathering fields.

E40. The mid-term management strategy shall be to:
- Implement density management when necessary to maintain traditional use areas.
- Prescribed fire used to reduce natural fuel loading and to maintain traditional use areas.

Reserved Areas—Primitive Area and Tract D Recreation Lands

E41. Forest Management will focus on the following guidelines to achieve the desired future condition:
- Passive management to allow natural forces to operate.
- Active management is proposed when:
  - Insect and disease conditions threaten adjacent areas.
  - Wildland fire is predicted to threaten adjacent areas.

E42. The short-term and mid-term management strategies shall be:
- Limited management actions to accomplish and maintain the DFC objectives.

Old-growth Management Emphasis Area

E43. Forest Management will focus on the following guidelines to achieve the Desired Future Condition as outlined in Table V–1 and Table V–9:
- Old-growth areas will be at least 80 acres in size.
- Condition desired on 10% of habitat type within subbasin, with an additional 5% of the area identified as potential replacement.
- Site-specific prescriptions will be used to achieve the goal of enhancing old-growth characteristics.
- Prescribed fire or mechanical methods will be used to reduce natural fuel loading, regulate species composition, adjust stand density, and maintain traditional use areas.
- Retain until mortality level exceeds growth, and then remove only most decadent patches or groups.

- When an area loses its old-growth character because of disturbances, a replacement old-growth area within the subbasin will be selected through an interdisciplinary process.

Table V–1. Interim Desired Future Conditions of Old Growth by Forest Habitat Type

This table is derived from Region 6 Interim Old Growth Definitions (USDA Forest Service 1993a) and is subject to change based on analysis of site-specific information.

Ponderosa Pine, Low Productivity Sites					
Main canopy			Tree Decadence[4]	Tree Species	Canopy Cover
DBH[1]	TPA[2]	BA[3]	10-15% w/ spike tops, dead limbs, or other decadence	90-95% ponderosa pine	20-50 % w/ 40-60 % in patches of smaller trees
≥21”	10-30	25-70			
≥31”	2-6	11-32			
Ponderosa Pine, High Productivity Sites					
Main canopy			Tree Decadence	Tree Species	Canopy Cover
DBH	TPA	BA	10-15% w/ spike tops, dead limbs, or other decadence	90-95% ponderosa pine	20-50 % w/ 40-60 % in patches of smaller trees
≥21”	13-45	30-100			
≥31”	3-8	13-40			
Douglas-fir					
Main canopy			Tree Decadence	Tree Species	Canopy Cover
DBH	TPA	BA	10-15% w/ spike tops, dead limbs or other decadence	Douglas-fir, lodgepole pine, western larch, and ponderosa pine	30 % or more
≥21”	10-50	25-120			
Grand Fir, Low (<40 ft^3/ac./yr) and Medium (40-100 ft^3/ac./yr) Productivity Sites					
Main canopy			Tree Decadence	Tree Species	Canopy Cover
DBH	TPA	BA	10-15% w/ spike tops, dead limbs, or other decadence	grand fir, Douglas-fir, ponderosa pine, western larch, and lodgepole pine	20-50 % w/ 40-60 % in patches of smaller trees
≥21”	10-50	25-120			
Grand Fir, High Productivity Sites (>100 ft^3/ac./yr)					
Main canopy			Tree Decadence	Tree Species	Canopy Cover
DBH	TPA	BA	10-15% w/ spike tops, dead limbs, or other decadence	grand fir, Douglas-fir, ponderosa pine, western larch, and lodgepole pine	40-60 %
≥21”	20-60	50-140			
Pacific Silver Fir					
Main canopy			Tree Decadence	Tree Species	Canopy Cover
DBH	TPA	BA	10-15% w/ spike tops, dead limbs, or other decadence	Pacific silver fir, mountain hemlock, western white pine, and western hemlock	70-90 %
≥22”	30-100	70-200			
Subalpine Fir					
Main canopy			Tree Decadence	Tree Species	Canopy Cover
DBH	TPA	BA	10-15% w/ spike tops, dead limbs, or other decadence	subalpine fir, Engelmann spruce, and lodgepole pine	30 % or more
≥13”	10-100	70-200			

[1] DBH=diameter at breast height
[2] TPA=trees per acre
[3] BA=basal area per acre
[4] Decadence=live trees with heart rot, standing dead trees, and fallen trees.

Traditional Use Resource

Management Goal

Provide diverse year-round traditional use opportunities for all age groups and ability levels with an emphasis on utilization and resource protection.

Management Objectives

1. Provide natural settings in non-roaded areas for Yakama Nation members to enjoy.
2. Provide a broad range of outdoor recreation opportunities and activities for Yakama Nation members and for nonmembers in designated areas.
3. Develop or maintain recreation opportunities that are socially, environmentally, and economically sustainable.
4. Develop a multi-resource management plan for the huckleberry field areas.

Management Directions

F1. The management of traditional use facilities and activities on the reservation will be in accordance with the requirements of the Yakama Nation.
F2. The existing primitive or semi-primitive settings that provide opportunities for solitude and other benefits on the Yakama Forest will be maintained.
F3. Traditional use at traditional camping, hunting, fishing, gathering, spiritual, and ceremonial areas will be reserved for Yakama Nation members with the exception of Tract D Recreation Area.
F4. A variety of traditional use opportunities will be made available focusing mainly on dispersed recreation with some developed sites within the Yakama Forest.
F5. Family oriented traditional use opportunities will be provided and maintained.
F6. Where appropriate, traditional use facilities will be developed in response to user demands.
F7. Natural appearing scenery will be maintained along major travel ways and at developed recreation sites.
F8. Personal-use development will have minimum impacts on the natural environment.
F9. A multi-resource Huckleberry Field Management Plan will be developed to provide long-term guidance and enhancement of this cultural resource.
F10. Develop a Personal-use Opportunity Spectrum map of the Yakama Forest to guide future development and management.

Range Resource

Management Goal

Provide a diverse native perennial shrub, forb, and grass community within the Yakama Forest that is capable of sustaining a variety of uses and values including livestock grazing, wildlife, fisheries, cultural values, traditional foods, medicinal plants, traditional use, and stable watersheds.

Management Objectives

1. Assure a viable Indian livestock industry by maintaining and enhancing forage production and protecting range improvements.
2. Maintain community structure and species composition in areas where forest rangeland is currently meeting resource goals and objectives.

3. Improve forest rangeland vegetation where goals for ecosystem function and values are not being met.
4. Control the introduction and spread of noxious weeds.

Management Directions

G1. Livestock grazing will be recognized as an objective in the management of forest resources.
G2. Coordinate forest management activities and practices to compliment range management objectives.
G3. Forest management activities will consider forest-wide management objectives for the distribution and containment of livestock.
G4. Range improvements on logging units such as fences, cattle guards, corrals, and water developments will be maintained in working order during logging activities.
G5. Impacts to livestock management and security will be considered when assessing road construction and closures.
G6. Manage slash and woody debris to promote proper livestock distribution and meet livestock movement and containment objectives.
G7. Prescribed fire will be used to manage vegetation and slash in order to meet natural resource goals including livestock and wildlife distribution.
G8. Forest management activities will include guidelines for limiting the potential introduction and spread of noxious weeds.
G9. Logging roads, roadsides, landings, skid trails, firelines (prescribed and wildland fire), and intensively burned areas will be seeded with the appropriate mix of grass species following disturbance activity.
G10. Seeding of disturbed areas should follow reservation-defined criteria.
G11. Habitat patch size and fragmentation will be considered when developing vegetation management strategies.
G12. The cover requirements for wildlife and livestock will be considered when designing vegetation manipulation projects.
G13. Forest rangeland treatments will be followed up with management that extends the life of the treatment and, when appropriate, addresses the causes for the original treatment.
G14. Sound range management principles will be followed on all forest management operational units.
G15. Meadows and openings will be protected from forest management activities that adversely impact the site's physical and hydrologic characteristics.
G16. The habitat elements of native plants and animals, including threatened, endangered, special status, and culturally important species, will be maintained.
G17. The Department of Natural Resources will develop and implement an Integrated Pest Management Plan for Invasive Plant Species.
G18. Range management Best Management Practices (BMPs) will be followed on all forest management operational areas.

Soil Resource

Management Goal

Implement forest management practices that protect the soil resources and maintain high long-term productivity and stability. Forest and range management practices will keep soil porosity and nutrient content high and soil compaction, displacement, and erosion minimal.

Management Objectives

1. Restore and maintain adequate nutrient content, soil moisture, erosion control, and decomposition processes through vegetation management to provide for natural site productivity levels over the long term including the suppression or eradication of noxious weed species.
2. Conduct forest management activities and land uses that minimize and mitigate disturbance such as detrimental compaction, displacement, erosion, puddling, and severe heating of the mineral surface soil.
3. Restore and maintain soil and soil processes in riparian areas to ensure high water quality on the Yakama Forest.
4. Develop soil productivity protection and restoration activities as part of forest and range ecosystem management planning.
5. Develop information exchange programs to facilitate and promote soil resource management.

Soil Quality Standards and Guidelines

These standards and guidelines (S&Gs) established for the soil resource on the Yakama Forest meet the specific resource management goal while ensuring long-term ecosystem and economic sustainability of the reservation's forest resource base. These S&Gs coupled with specific Soil and Water Best Management Practices (BMPs) will minimize forest management practice impacts on soil physical, chemical, and biological properties. These S&Gs must be considered when evaluating project management plans or proposals for the Yakama Forest (Procedures and Methodology adopted from CCT 1999). The general S&Gs presented below shall be managed for as an absolute minimum requirement.

S-QS1 Soil Organic Matter Standard.

S-QS1.1 Soil Organic Matter is present in forest soils in several different transitional states including current year litter, decomposing duff layer, decomposition products at the mineral surface interface, soil-incorporated products of decomposition, and subsoil transitional states from root biomass and pedoturbation sources. Soil organic matter serves several important functions which include but are not limited to promoting mycorrhizal development, increasing soil water holding capacity, acting as a surface mulch, protecting the mineral soil surface from dislodging forces, nutrient cycling, and promoting the development of soil structure. Soil organic mater will be managed to sustain the productivity of the forest.

S-QS1.2 Litter and duff must be present over at least 90 percent of the soil surface in precipitation zones with greater than 50 inches of precipitation, 80–90 percent in precipitation zones between 30–50 inches, 70–80 percent in precipitation zones between 25–30 inches, and no less than 70 percent in precipitation zones between 18–25 inches. The target values are based on the potential for soil erosion and surface sealing due to the destruction of soil structure as influenced by exposure to the kinetic energy of raindrops and surface flows. Values may be increased to 80 percent in areas of lower precipitation that are affected by rain-on-snow events. Patch scarification to promote regeneration normally will not exceed the standard established above. It is however, exempted from this standard and may exceed the required cover values as long as scarified areas conform with standard patch scarification methods, do not leave large contiguous exposed areas, patches are uniformly applied in the regeneration block, and slopes greater than 35 percent are avoided. Litter and duff must be uniform to the extent possible and reasonable, and the minimum organic layer thickness should be in an amount sufficient to persist through winter storms and summer oxidation.

The minimum cover amount guideline may be further adjusted to reflect the observed steady state surface organic matter accumulation potential of a given site. Factors influencing the development of an organic

surface layer include but are not limited to aspect, slope, effective precipitation, landscape position, elevation, soil depth, and soil texture.

S-QG1 Organic Matter Guideline. At least 25 percent of the removed litter and duff cover will be reestablished within one year and 50 percent of the removed cover will be reestablished within two to three years following soil surface disturbance or completion of the forest management activity. In no case, given a soil erodibility factor greater than 0.28 and slope lengths greater than 300 feet, will the contiguous surface cover removal be allowed to exceed 35 percent on slopes less than 15 percent, 25 percent on slopes between 15–35 percent, and 5 percent on slopes exceeding 35 percent. Initially it is expected that vegetation litter will provide most of the cover but that recovery will also be dependent on biomass production for the specific area in question based on climatic factors.

S-QG1.1 Coarse Woody Debris Guideline. Large tree (live and dead) and coarse woody debris (large down wood) management recommendation for maintaining soil productivity as well as desirable wildlife species are shown in Table V–9. These guidelines are provided by Forest Habitat Type and are ecologically appropriate for Yakama Reservation geoclimatic setting and vegetation types.

S-QS2 Soil Cover Standard

S-QS2.1 Ground Cover Manage over the long term for a total effective ground cover of at least 60 percent, with at minimum, 90 percent in areas most sensitive to soil loss by erosion.

Areas that are exposed during harvest operations, 40 to 10 percent respectively as indicated by the inverse of the ground cover standard above in S-QS2.1 above, will be managed for recovery based on Table V–2. Percentages in Table V–2 reflect the target value for the percent recovery of the exposed areas not the total harvest area. In high-use areas or areas of chronic activity or disturbance (e.g., from heavy grazing use), a specific management and monitoring program may be designed and implemented to ensure compliance with long-term ground cover requirements.

S-QS2.2 Canopy Cover. Manage for a desired minimum range of 30 to 50 percent. In the xeric ponderosa pine forested habitat, the minimum acceptable closure range may be adjusted to a lower percentage to reflect the potential capability of the soil and natural plant community.

S-QG2 Soil Cover Guideline for Reducing Soil Erosion. Soil Erosion defined: The susceptibility of a soil to erosion is a product of three primary factors: the soil erodibility factor, slope length of the exposed area, and percent slope. The soil erodibility factor (k_w) is further modified by the coarse fragment content on the soil surface. In general, as the coarse fragment content increases the erosion hazard decreases. The adjusted (k_w), is indicated by the (k_f) notation as used within the National Cooperative Soil Survey system.

If the soil and potential natural plant community are not capable of producing the desired effective ground cover indicated in Table V–2 because of geoclimatic conditions, minimum cover will be adjusted to reflect the site production potential.

Table V–2. Ground Cover Standards by Erosion Hazard (Soil Sensitivity) Ratings for the Yakama Reservation

Erosion hazard (Soil sensitivity)	Minimum percent effective ground cover[1]			
Classes Assigned to Soils[2]	End of Year 1	End of Year 2	End of Year 3	4th Year +
Slight (Low)	20–30	30–45	45	60
Moderate (Medium)	30–45	45–60	60	60
Severe (High)[3]	45–60	60–75	75	75
Very Severe (Extreme)[4]	60–75	75–90	75–90	75–90

[1] Effective ground cover includes any combination of rock fragments (>3/4 inch or 2 cm in diameter), dead herbaceous litter, duff, woody material, and the basal area of perennial vegetation. It also includes tree crowns and shrubs that are in direct contact with the ground. An ocular inspection determines the extent or percentage of mineral soil that is covered and protected.

[2] Erosion hazard classes were developed by the USDA Natural Resources Conservation Service procedures and assigned to soil types or soil map units identified during the reservation-wide soil resource inventory. Soil sensitivity rating classes for soil disturbance and surface erosion were assigned to the soil types and are based on results of a soil sensitivity analysis.

[3] Includes soils that are in a detrimental condition.

[4] Includes "severe" soils that are in a detrimental condition.

S-QG2.1 Water Erosion Hazard Prediction Guideline Utilizing the Water Erosion Prediction Project Model (WEPP). A zero tolerance for soil erosion and subsequent harvest block sediment deposition to streams will be the best management practice target goal. A threshold value no higher than 1/10th the USDA-NRCS allowable soil loss value (T) may be tolerated for sediment transport and deposition within the harvest block. The Water Erosion Prediction Project (WEPP) model developed by the USDA is a process-based, distributed-parameter, continuous-simulation, erosion-prediction model for use on personal computers. The current version, available through the Internet, is applicable to hill-slope erosion processes (sheet and rill erosion) as well as simulation of hydrologic and erosion processes on small watersheds (http://topsoil.nsert.edu/weppmsin.html). The WEPP model may be used by the Soil Scientist to calculate the erosion hazard on problematic sites during the planning process. This model incorporates soil surface texture, slope gradient, slope length, and percent surface cover in order to predict a mean annual soil loss in tons/acre. The soil loss tolerance range for soils in the Closed Area is 2 to 5 tons per acre per year. Shallow and/or skeletal soils (gravel content over 35 percent) have the lowest tolerance for soil loss (2 tons/acre/year) while deep soils have the highest loss tolerance (5 tons/acre/year) without a loss of production. An erosion rate of 5 tons/acre constitutes a surface soil thickness approximately equal to the thickness of a dime. Reduction of the calculated value to less than 10 percent of the allowable soil loss (T) will be accomplished by affecting three model parameters by the application of best management practices—percent cover removed, percent slope, and exposed slope length. This guideline applies specifically to the redistribution of soil material within the harvest area, the treatment of permanent roads will be considered in separate guidelines within the FMP.

S-QG2.2 General Guideline for Determining Erosion Severity. The erosion hazard severity rating is the probability that damage may occur as a result of harvest activity where the soil is exposed along roads, skid trails, fire lanes, and landings. Exposed slope length is an important compounding factor. Cross-slope operations or yarding can greatly reduce the erosion hazard within the harvest area. Location #1 generally applies to areas with a mean annual precipitation of greater than 45 inches, location #2 less than 45 inches. Soil erodibility factors within the forested area average between 0.24 to 0.32, with few isolated higher and lower values. Higher K factors indicate more highly erodible soils. K factors can be reduced by approximately one (1) value for soils with gravelly surfaces due to the ability of the gravel to resist dislodging.

S-QS3 Maximum Disturbance Standards. Soil disturbance refers to the effect of the harvest operation on soil compaction, soil puddling, and soil displacement.

Soil Compaction defined: The threshold level of detrimental compaction is defined as a 15 percent, or more, increase in bulk density which generally equates to a 50 percent reduction in macropore space for a well-structured mineral soil; and 20 percent or more increase in bulk density for soils derived from volcanic ash parent materials (Andisol taxonomic soil order). Approximately 90 percent of the forested area of the Yakama Nation contains soils with ash caps that qualify for the Andisol soil order. The ash cap thickness varies from 36 to 14 inches. The bulk density of the ash cap ranges from 0.65 to 0.90 grams per cubic centimeter (g/cm^3). While not conclusive, research suggests that significant detrimental effects from compaction can occur as the soil bulk density increases to 1.08 g/cm^3 or greater. Preliminary investigations also indicate that tree seedling and sapling growth rates are affected by compaction. In addition, diameter growth is affected more than height, but both produce significant colinear reductions in volume when compared to undisturbed areas (Froehlich and Robbins 1983, Wert and Thomas 1981).

Compaction has two primary components:

1. Surface soil compaction (upper 2–6 inches) is primarily related to ground pressure.
2. Subsoil compaction (below 6 inches) is primarily related to total axle load.

Dynamic forces, produced by equipment turning, vibrating, or other loaded movement also tends to increase compaction. Much of the compaction damage takes place within 2 to 4 equipment passes. Well-sorted mineral soils which contain a wide range of soil particle sizes and clays get their ability to resist compaction through cohesion of the soil particles, which is highest when the soil is dry. At moist soil conditions, water lubricates the particles, creating load bearing failure and compaction. Sands, very sandy soils, and angular gravelly sands, on the other hand, resist compaction through the interlocking of particles and the resultant creation of internal friction. These soils are more resistant to compaction over a wide range of moisture contents, including total saturation.

Soils may be expected to recover from compaction of the upper 6 inches within a few years as a result of frost action, natural pedoturbation, and re-aggregation processes. Subsoil compaction below 8 inches will generally not recover in the short term, defined as 30 years or more.

Soil Puddling defined: Puddling occurs under near saturated to saturated soil conditions when an exerted mechanical force destroys the soil structure by compression and shearing. The natural restoration period is not specifically known but it is thought to be somewhat less than that for compacted soils because the damaged is not as deep. The depth of the damage is limited by the support provided by incompressible confined water that fills subsoil pores at saturation.

Soil Displacement Defined: Soil displacement is the horizontal movement of soil caused by scraping or machine gouging. Removal of the organic-rich surface layer results in altered hydrologic characteristics, exposure of the mineral soil surface to erosion by the elements, and increased evaporation.

S-QS3.1a Maximum Disturbance Standard (All Sources). Limit disturbance on soils such that a minimum of 80 percent of an area remains in a non-compacted, non-displaced, non-puddled, or otherwise non-detrimental soil condition.

S-QS3.1b Maximum Disturbance Standard (Soil Compaction Component). Of the total area disturbed, limit disturbance on soils such that a minimum of 85 percent of an area remains in a non-compacted condition.

Table V–3. Erosion Severity Guide by K Factor and Percent Slope

Indicator Species	K Factor	Class-Determining Phases by Slope and Precipitation[1]					
		Location 1 (≥ 50-inch Precipitation Zone)			Location 2 (< 50-inch Precipitation Zone)		
		Slight	Moderate	Severe and Very Severe	Slight	Moderate	Severe and Very Severe
Ponderosa Pine-grasslands	0.00 0.02 0.05	All	-	-	All	-	-
	0.10	0–85	85 +	-	0–40	40–80	80 +
	0.15	0–45	45 +	-	0–35	30–45	45 +
	0.17	0–40	40 +	-	0–25	25–45	45 +
	0.20	0–35	35–85	85 +	0–25	25–40	45 +
	0.24	0–30	30–60	60 +	0–20	20–35	35 +
	0.28	0–25	25–50	50 +	0–20	20–30	35 +
	0.32	0–25	25–45	45 +	0–20	20–30	35 +
	0.37	0–20	20–40	40 +	0–15	15–25	25 +
	0.43	0–20	20–35	35 +	0–15	15–25	25 +
	0.49	0–15	15–30	30 +	0–15	15–20	20 +
	0.55	0–15	15–25	25 +	0–15	15–20	20 +
	0.64	0–15	15–25	25 +	0–10	10–20	20 +
Ponderosa Pine-Douglas-Fir (east side) and Grand Fir	0.0 0.02	All	-	-	All	-	-
	0.05	All	-	-	0–65	65 +	-
	0.10	0–70	70 +	-	0–35	35–65	65 +
	0.15	0–40	40 +	-	0–25	25–45	45 +
	0.17	0–40	40–95	95 +	0–25	25–40	40 +
	0.20	0–30	30–65	65 +	0–20	20–35	35 +
	0.24	0–30	30–55	55 +	0–20	20–35	35 +
	0.28	0–25	25–45	45 +	0–20	20–35	30 +
	0.32	0–20	20–40	40 +	0–15	20–30	25 +
	0.37	0–20	20–35	35 +	0–15	15–25	25 +
	0.43	0–15	15–30	30 +	0–15	15–25	20 +
	0.49	0–15	15–25	25 +	0–15	15–20	20 +
	0.55	0–15	15–25	25 +	0–10	10–20	20 +
	0.64	0–10	10–20	20 +	0–10	10–15	15 +

Table V–3 (continued).

Indicator Species	K Factor	Class-Determining Phases by Slope and Precipitation[1]					
		Location 1 (≥ 50-inch Precipitation Zone)			Location 2 (< 50-inch Precipitation Zone)		
		Slight	Moderate	Severe and Very Severe	Slight	Moderate	Severe and Very Severe
All Others	0.00 0.02 0.05	All	-	-	All	-	-
	0.10	All	-	-	0–50	50 +	-
	0.15	0–75	75 +	-	0–35	35–70	70 +
	0.17	0–60	60 +	-	0–35	35–60	60 +
	0.20	0–50	50 +	-	0–30	30–50	50 +
	0.24	0–40	40 +	-	0–25	25–45	45 +
	0.28	0–35	35–80	80 +	0–25	25–40	40 +
	0.32	0–30	30–65	65 +	0–20	20–35	35 +
	0.37	0–30	30–55	55 +	0–20	20–30	30 +
	0.43	0–25	25–45	45 +	0–20	20–30	30 +
	0.49	0–20	20–40	40 +	0–15	15–25	25 +
	0.55	0–20	20–35	35 +	0–15	15–25	25 +
	0.64	0–20	20–30	30 +	0–15	15–20	20 +

[1] The potential for soil erosion will also increase as the exposed slope length increases. Reducing the exposed slope length reduces the erosion potential. Generally the WEPP model will produce a better estimate of the erosion hazard on a site specific basis. The values in this table are conservative and have been and are still in the process of review and improvement. A precipitation break of 50 inches is currently used but may, at a later date, be substituted by the xeric-udic moisture regime boundary.

S-QG3 Maximum Soil Disturbance Guidelines

S-QG3.1 Leave the following minimum percentage of an activity area in a non-disturbed condition.

1. 80 percent for soils with slight limitations in Table V–3.
2. 85 percent for soils with one (or more) of the following limitations and defined as having moderate limitations in Table V–3:
   a. a moderate sensitivity to surface erosion (slopes greater than 15% but less than 35%, soil erodibility factor greater than 0.28, and slope lengths greater than 300 feet);
   b. a shallow depth (<20 inches) to bedrock or impermeable layer;
   c. a wet surface and profile, at least seasonally due to restricted drainage as a result of a high water table, low permeability, or impermeable subsurface medium;
   d. a distinct surface layer of volcanic ash greater than 7 inches thick.
3. 95 percent in soils with a severe sensitivity to surface erosion (slopes greater than 35%), a distinct surface layer of volcanic ash (>7 inches thick), and defined as having severe limitations in Table V–3.

S-QG3.2 Soil Compaction Potential Guideline. The hazard rating for soil compaction is based on the percent and shape of the coarse fragments in the soil profile, duff layer thickness, soil texture, and soil structure grade. Table V–4 provides general guidelines for soil susceptibility to compaction.

S-QG3.3 Designated Skid Trail Guideline for Reducing Soil Compaction

1. Allow mechanized harvest equipment to operate only on designated skid trails unless the Officer-in-Charge (Timber Sale Officer) identifies conditions and approves departure from the designated trials based on provisions in guideline S-QG3.4.

2. Establish designated skid trails at a minimum spacing of 132 feet from edge to edge. Skid trails established during prior entries at a spacing less than 132 feet but greater than 100 feet should continue to be utilized for the following reason. The creation of a new skid trail system would compact the soil over a greater portion of the harvest area if the new trail layout does not sufficiently coincide with the old trail system. This is due to the fact that subsoil compaction does not recover over the normal harvest entry interval. Developing new skid trail systems different from past trail layouts would produce compaction over too great an area of the harvest block. The minimum area affected by compaction under standard S-QS3.1b must be adhered to regardless of the designated skid trail spacing. Sub-soiling with a self-drafting winged sub-soiler will be required to meet the compaction standard if it is exceeded. Rock rippers may not be substituted as sub-soiling equipment.
3. Renovation of skid trails will be required if, as indicated in Table V–5, the level of disturbance reaches the Class 5 or 6 levels. Renovation will include sub-soiling, water bars, reshaping of the surface to close severely rutted areas, and cover seeding with an approved native seed mixture.
4. Sub-soiling will be accomplished with a self-drafting winged sub-soiler, or comparable type of equipment, to a depth of at least 24 inches. Soil moisture content during sub-soiling should be approximately 15 to 20 percent. Rock rippers can not be substituted for the required equipment stated above. The extent of sub-soiling required after a harvest operation will be based on meeting disturbance standards S-QS3.1a and S-QS3.1b.

   Sub-soiling is not recommended in selective cut harvest blocks, where root damage may occur. In addition, sub-soiling is not recommended on soils with the following conditions.

   a. Soils are less than 2 feet deep.
   b. Soils are “skeletal”, containing 35 percent or more gravel, on a volume basis, in the upper 30 inches of soil profile.
   c. Soils have extremely rocky surfaces (rocks larger than 6 inch diameter)
   d. Soils are on slopes greater than 35 percent.

5. When necessary, adjust skid trail layouts to improve harvest management or address other resource use concerns. Permanently abandoned skid trails, for the purpose stated above, will be subsoiled or ripped to reduce the amount of area within the harvest block that has been impacted by all sources of disturbance including soil compaction to no more than 20 percent and no more than 15 percent for compaction only. This includes compaction from all sources including temporary roads and landings.
6. Skid trails will be placed on the contour as much as is possible to achieve a minimum network of skid trails and connections to landings.
7. Tractor ground will be limited to slopes less than 35 percent.
8. The use of excavated skid trails will be limited by the level of disturbance allowed in the overall Maximum Disturbance Standard (S-QS3.1a). Excavation of skid trails will be limited to 1- to 2-foot cuts below the normal soil surface for short lengths on slopes between 20 percent but less than 35 percent to achieve a reasonably flat running surface.

S-QG3.4 Departure from Designated Skid Trails Guideline. Departure from established designated skid trails by harvest equipment with ground pressures less than 9 psi will be allowed under the following conditions when approved by the Officer-in-Charge.

1. For soils with a slight soil compaction hazard, departure from designated skid trails will be allowed under one or more of the following conditions:

a. Soil moisture of the upper 10 inches of soil is 30 percent or less;

b. Eighteen inches of snow cover;

c. Frozen ground with a frost depth of at least 4 inches in mineral soil;

d. Overnight temperatures must be below 25 degrees F. Afternoon temperatures should not exceed 35 degrees F with the following exception. If night temperatures are at least 20 degrees F or below, afternoon temperatures above 35 degrees F may be tolerated for short periods of time.

2. For soils with a moderate soil compaction hazard, departure from designated skid trails will be allowed under one or more of the following conditions:

   a. Soil Moisture of the upper 10 inches of soil is 20 percent or less.

   b. Eighteen inches of snow cover.

   c. Frozen ground with a frost depth of at least 4 inches in mineral soil.

   d. Overnight temperatures must be below 25 degrees F. Afternoon temperatures should not exceed 35 degrees F with the following exception. If night temperatures are at least 20 degrees F or below, afternoon temperatures above 35 degrees F may be tolerated for short periods of time.

3. For soils with a severe soil compaction hazard, departure from designated skid trails will be allowed under one or more of the following conditions:

   a. Soil Moisture of the upper 10 inches of soil is 15 percent or less.

   b. Eighteen inches of snow cover.

   c. Frozen ground with a frost depth of at least 4 inches in mineral soil.

   d. Overnight temperatures must be below 25 degrees F. Afternoon temperatures should not exceed 35 degrees F with the following exception. If night temperatures are at least 20 degrees F or below, afternoon temperatures above 35 degrees F may be tolerated for short periods of time.

4. Skidders must remain on the designated skid trails, except as directed by the Officer-in-Charge in accordance with conditions specified in the Timber Sale Contract and given that the following criteria are met.
   - Off-trail skidder operation will be designed to minimize the amount of turning in order to reduce the compounding effect of dynamic forces which lead to increased compaction.
   - Slash must be present on the travel path in order to reduce tire ground pressure.
   - Skidder must produce less than 15 psi ground pressure.
   - The majority of skidding (90%) must be accomplished by downhill yarding.
   - Use of off-trail skid paths trips is limited to three or less.
   - Winching logs to the designated skid trail is not practical.
   - Soils moisture content of the upper 8 inches of soil must not exceed that shown in 1 through 3 above.

Table V–4. Guideline for Evaluating the Soil Compaction Hazard Potential

Moist soil condition assumed, read table from left to right.

Soil Texture	Coarse Fragments (% by Volume)	Organic Layer Thickness (Inches)	Structure Grade	Character of Coarse Fragments	Rating
Loam Silt loam Silty clay loam Clay loam Heavy sandy loam Very fine sandy loam Medial sandy loam	< 35%	< 2 inches.	Strong	All	Moderate
			Moderate& Weak	All	Severe
		> 2 inches.	Moderate& Weak	All	
			Strong	All	Moderate
	35–60%	< 2 inches.	Moderate & Weak	Rounded	
				Angular	Slight
			Strong	All	
		> 2 inches.	Moderate & Weak	Angular	
				Rounded	Moderate
			Strong	All	Moderate
	> 60%	Any	All	All	Slight
Loam Sand Sand	Any	Any	All	All	
Silty clay Sandy clay Sandy clay loam Light sandy loam Ashy sandy loam	> 35%	Any	All	All	
	< 35%	< 2 inches	Strong	All	
			Moderate & Weak	All	Moderate
		> 2 inches	Moderate & Weak	All	
			Strong	All	Slight

Table V–5. Disturbance Level Guide

Developed in part by the USDA Forest Service, Wenatchee, WA.

Visual Class	Level of Soil Disturbance	Visual Effects
Class 1	Undisturbed	Snow trail or skid trail is frozen extremely hard and equipment is supported entirely on the snow base for the entire day. No indications that the snow base is deteriorating or evidence that mechanical use has broken down the snow base. No evidence of surface litter or soil in the skid trail or equipment path.
Class 2	Slight Disturbance	Snow trail or skid trail has hard packed snow slightly frozen for part of the day. Some indication that the snow base is deteriorating or evidence that mechanical use is beginning to breakdown the snow base. Equipment is beginning to break through the snow base or the snow is not able to entirely support the equipment traffic. Some surface soil litter is incorporated in the loose snow trail made by tire tracks. A few areas of smeared mineral soil are beginning to show in parts of the skid trail. Tire or track ruts are not apparent.
Class 3	Moderate Disturbance	Snow or skid trail has loose dry or wet snow for most of the day, indicating that the snow base is deteriorating or evidence of mechanical use is apparent. Snow base is not able to support equipment traffic for the entire operating day. Soil surface is not frozen. Surface soil litter is incorporated in loose snow in the skid trail or equipment path. Mineral soil is beginning to be smeared in the snow base of the skid trail. Shallow tire or track ruts are beginning to be apparent over some of the skid trail or equipment path.
Class 4	High Disturbance	Snow base in the skid trail has loose wet snow for the entire day. Snow base is not able to support mechanical use. Smeared soil and surface litter is incorporated over a substantial portion of the skid trail or path. Shallow tire or track ruts (< 3 inches deep) are apparent over a substantial part of the skid trail or path.
Class 5	Severe Disturbance	Snow base in the skid trail or path has substantially broken down. Snow is wet and has lost its supportive strength. Soil and snow are incorporated in the skid trail. Smeared soil occurs over most of the skid trail width and length. Tire or track ruts 3 to 6 inches deep are apparent over a substantial part of the skid trail.
Class 6	Altered Drainage	Snow base in the skid trail is essentially non-existent. Soil surface is smeared over most of the skid trail width and length. Deep tire or track ruts are apparent over most of the skid trail. Surface runoff and near surface drainage is adversely affected.

S-QG3.5a Guideline for Evaluating the Soil Displacement Potential (See Table V–6).

Table V–6. Guideline for Evaluating the Soil Displacement Hazard Potential

The hazard rating for soil displacement is based on the percent coarse fragments in the soil profile, duff layer thickness, soil texture.

<table>
<tr><th>Soil Texture</th><th>Coarse Fragments (% by Volume)</th><th>Organic Layer & A Horizon Thickness (Inches)</th><th>Rating</th></tr>
<tr><td rowspan="6">Sandy loam
Loamy sand
Sand
Ashy loam
Ashy silt loam</td><td rowspan="2">< 35%</td><td>> 6 inches</td><td>Moderate</td></tr>
<tr><td>≤ 6 inches</td><td rowspan="2">Severe</td></tr>
<tr><td rowspan="2">35–60%</td><td>≤ 6 inches</td></tr>
<tr><td>> 6 inches</td><td rowspan="2">Moderate</td></tr>
<tr><td rowspan="2">> 60%</td><td>≤ 6 inches</td></tr>
<tr><td>> 6 inches.</td><td rowspan="4">Slight</td></tr>
<tr><td>Clay loam
Clay
Silty clay
Sandy clay
Silty clay loam</td><td>Any</td><td>Any</td></tr>
<tr><td rowspan="3">Silt
Silt loam
Loam
Sandy clay loam
Very fine sandy loam</td><td>> 35%</td><td>Any</td></tr>
<tr><td rowspan="2">< 35%</td><td>> 6 inches</td></tr>
<tr><td>≤ 6 inches</td><td>Moderate</td></tr>
</table>

S-QG3.5b Equipment Turning Guideline Related to Soil Disturbance. Reduce number of turning points on skid trail layouts to an absolute minimum.

S-QG3.5c Gouge Paths. Rehabilitate gouge paths by spreading slash, water barring, or mechanically covering path with assorted debris.

S-QG3.6 Guideline for Evaluating the Soil Puddling Potential (See Table V–7).

Practices outlined in S-QG3.3 (Item 4) will be implemented to reduce the area impacted by soil disturbance and meet standards S-QS3.1a and S-QS3.1b.

Table V–7. Guideline for Evaluating the Soil Puddling Hazard Potential

The hazard rating for soil puddling is based on the percent coarse fragments in the soil profile, duff layer thickness, Soil texture, and soil structure grade. The following table provides a general guideline of the puddling hazard. A wet soil condition is assumed.

Soil Texture	Coarse Fragments (% by Volume)	Organic Layer Thickness (Inches)	Structure Grade	Rating
Clay Silty clay Silt Silt loam Silty clay loam Sandy loam Clay loam Very fine sandy loam	< 35%	< 2 inches	Strong	Moderate
			Moderate & Weak	Severe
		≥ 2 inches	Moderate & Weak	
			Strong	Moderate
	35–60%	< 2 inches	Moderate & Weak	
			Strong	Slight
		≥ 2 inches	Strong	
			Moderate & Weak	Moderate
	> 60%	Any	All	Slight
Loamy sand Sand Light sandy loam	Any	Any	All	
Loam Sandy clay loam Heavy sandy loam	> 35%	Any	All	
	< 35%	< 2 inches	Strong	
			Moderate & Weak	Moderate
		≥ 2 inches	Moderate & Weak	
			Strong	Slight

S-QS4 Fire Damage Standards Related to Soils. Departmental policy (620 DM 3.1) for the restoration of fire-damaged ecosystems attempts to emulate historical ecosystem structure, function, diversity, and dynamics; restore ecosystems degraded by non-native invasive species; and regenerate agency lands and Indian trust commercial lands.

S-QS4.1 Emergency Stabilization. Emergency stabilization actions will be taken if fire damage occurs that threatens the productivity of the soil resource or other related resources affected by the destruction of favorable soil properties by fire. Emergency stabilization will consist of a series of coordinated planned actions taken during and soon after a wildland fire to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of the fire, or to repair, replace, or construct physical improvements necessary to prevent degradation of land or resources.

S-QS4.2 Soil Resource Rehabilitation. Rehabilitation will consist of long-term post-fire efforts to repair or improve lands unlikely to recover naturally from wildland fire damage consistent with approved land management plans. The purpose of rehabilitation is either to emulate historical or pre-fire ecosystem

structure, function, diversity, and dynamics, or if that is infeasible, establish a healthy, stable ecosystem in which native species are well represented and soil conditions are such that favorable characteristics can regenerate.

S-QS4.3 Evaluation of the Magnitude of Adverse Affects.

Under the guidelines of DOI Burn Area Emergency Response, a postfire evaluation and burn area plan that includes a soil burn severity map will be completed. Mapping criteria will include the identification of soil hydrophobicity or water repellency, ground cover density, degree of organic matter destruction, macrobiotic crust damage, and a categorization of the intensity and depth of the destruction of mineral soil properties.

S-QG4 Soil Fire Effects Guidelines

S-QG4.1 Fire Intensity Rating Guideline (Soil). Ulery and Graham (1993) classify fire intensity into three major classes:

1. A low intensity fire is characterized by temperatures of 100–250° C producing a black burned soil color (from charred organic material).
2. A medium intensity fire has temperatures ranging from 300–400° C, most of the organic material is consumed, mineral soil is exposed.
3. A high intensity fire has temperatures in excess of 500° C, produces a white ash over a reddened mineral soil. Soil and fuel moisture also have an affect on fire intensity. Fire temperatures in moist soils generally do not exceed 95° C (212° F), until all the stored water has been evaporated. Given enough time, however, a low intensity fire can evaporate all of the stored soil water. At this point in time the 95° C cap on the soil temperature is removed and the heat from the fire can raise the soil temperature to a higher intensity level.
   In order to minimize soil damage on controlled burn areas, fire duration should be kept to the minimum required to manage fuels. Managing burn periods such that soils have some residual soil moisture can further reduce the potential for mineral soil damage before the burn takes place. The requirement for some residual soil moisture is not necessary for low intensity, rapid duration controlled burns containing moderate fuel loading.

S-QG4.2 Guideline for Soil Reserve Plant Nutrients Affected by Fire. Generally, the application of plant nutrients will not be required except in moderate to severe burn areas in which rapid soil surface stabilization is required.

Rapid plant regrowth is essential to the rehabilitation of burned areas because plants greatly influence soil hydrology. Plants require soil nutrients to grow back on burned areas and concentrations of several of these nutrients can be modified by fire. The degree of nutrient modification is determined by a fire's temperature, but there are a few general trends. Levels of phosphorus (Kutiel and Shaviv 1993; Marion *et al*. 1991) and pH (Kutiel and Shaviv 1993) both increase during a fire. Conversely, nitrogen decreases during a fire but ammonium levels during low-intensity fires increases (Kutiel and Shaviv 1993; Marion *et al*. 1991). Several published studies show how soil minerals essential for plant growth are affected by fire intensity. Low-intensity fires tend to increase levels of ammonium (Kutiel and Shaviv 1989, 1993), calcium, magnesium, and potassium (Marion *et al*. 1991; Kutiel and Shaviv 1989), while high-intensity fires tend to decrease these nutrients (Kutiel and Shaviv 1989). Kutiel and Shaviv also noted in their study that pH increased with fire intensity and that the highest concentrations of sodium, potassium, and magnesium occurred at a fire temperature of 250° C.

S-QG4.3 Hydrophobicity and Reduced Soil Infiltration Treatment Guideline. Hydrophobic soils are produced when organic compounds which are released or produced by burning organic material coats the soil particles. One by-product of fire, aliphatic hydrocarbons, is polar and attaches readily to the soil grains. The effect is not generally uniform throughout the soil because of vaporization and migration of the compounds below the surface, leaving upper layers somewhat more permeable than lower soil horizons (Scott and Van Wyk 1990). Several factors affect the degree of water repellency in a soil. Scott and Van Wyk (1990) indicated that in pine plantations the age of the vegetation was positively correlated with water repellency, in other words the greater the age, the greater the degree of water repellency. Hydrophobicity also increases with fire severity until the fire effects on the soil become so intense that even the organic by-products of fire causing the water repellency are consumed (Scott and Van Wyk 1990).

Soils will be evaluated for hydrophobicity after a fire event. Tillage or the use of soil amendments when necessary will be employed to help restore the infiltration capacity of the soil and protect the resources of the affected watershed.

Direct raindrop impact can also create a temporary seal on the soil surface due to disaggregation. (Dobrowolski *et al*. 1992; Wangemann *et al*. 2000). Soil will be evaluated for the construction of rehabilitation measures such as wattle dams, contour felling, and understory reseeding during post-fire reclamation activities. Measures required for treatment will be based on reducing the potential for soil loss to below a limit deemed feasible by Yakama Nation and BIA resource specialists. The WEPP model or comparable assessment procedure will be used to estimate the potential sediment production hazard.

Management Directions

H1. Soil quality standards and guidelines defined above will be applied in planning and implementation of forest management projects.
H2. Adequate ground cover (plants, litter, coarse debris) will be provided on disturbed surface soils to reduce evaporative losses and conserve moisture for plant growth.
H3. Adequate canopy cover and ground cover will be provided to protect the mineral soil from the weather and slow surface runoff.
H4. Biomass recruitment will be provided over time to maintain favorable soil chemical, biological, and physical characteristics.
H5. Levels of vegetation composition, density, size class, and distribution will be provided in both standing and downed biomass comparable to that with which soils evolved over recent geologic time.
    - Biomass distribution recommendations for varying vegetation types and geoclimatic environments will be developed to provide nutrient supplies that are sustainable spatially and temporally.
    - Future studies will measure soil fertility by management intensities and establish nutrient requirements for each of the resources.
H6. Standards and guidelines shown above will be used in timber harvesting, grazing, and other activities to maintain long-term soil productivity, hydrologic function, and stability over a high percentage of the landscape. Detrimental impacts to soil properties shall be limited in extent and concentrated in designated areas.
    - The frequency of timber harvest treatment entries in any one stand will be minimized.
    - The season, treatment type, harvest method, activity level, and site preparation technique will be considered in maintaining forest site conditions that promote soil hydrologic function and stability. Land use decisions will be based on site characteristics.

- The season, timing, frequency, duration, and intensity of grazing use in maintaining soil and plant conditions that promote or restore soil infiltration rates and permeability will be considered in decisions related to range vegetation management.
- Impacted soils from forestry, grazing, personal use, and other practices will be identified and mitigated to a predetermined level and extent to enhance watershed functions as quickly as possible after the disturbance activity.
- Ground disturbance effects will be mitigated as needed to minimize adverse impacts from activities where BMPs do not perform as expected due to improper prescription design or implementation.
- Severely compacted areas will be restored where feasible through ripping or other means during the next project entry to improve landscape productivity and soil hydrologic function.

H7. The presence of potential impacts to floodplain and riparian soils will be identified in project level environmental analyses and documents.

H8. The type of activity in stream corridors and riparian areas will be restricted and the allowable activities will be limited to designated areas, seasons, duration, and/or intensity levels to minimize adverse soil impacts.

H9. Floodplain and riparian wetland areas will be managed to protect or restore natural infiltration rates.

H10. Priority protection will be given to riparian areas along streams and reaches characterized by unstable, sensitive soils, or a sensitive, or culturally significant vegetation community.

H11. Soil quality standards may be modified or additional standards developed as necessary on a reservation-wide or site-specific basis to protect or restore riparian soils and to achieve riparian management objectives.

H12. Watershed analysis tools will be used to determine potential areas requiring special attention and management and to assist in determining appropriate protection and restoration measure.

H13. BMPs and site-specific recommendations will be identified, selected, scheduled, and executed on all forest management projects so as to meet soil quality standards. Monitoring and site evaluations will determine the adequacy of the practices used.

- BMPs will be adopted or designed for soil types, sensitivity classes, and groups that were determined in the Reservation Soil Resource Inventory.
- Management practices that may be used on sensitive soils will be developed for the reservation.
- GIS maps and databases will be developed and verified to identify soil problem sensitive areas including those areas susceptible to mass wasting that require special soil and vegetation management practices.

H15. Soil rehabilitation measures will be developed to implement in the event of soil disturbing activities such as fire suppression or wildland fire.

- Fire rehabilitation plans will be based on fire intensity and size of burned area, focusing on soil erosion issues.

H16. Management activities in each forest management activity area that might be adversely affecting the soil resource will be evaluated so as to develop and recommend alternative mitigation practices. The reservation's soil inventory manuscript and database will be continually updated and reviewed on an annual basis by the National Cooperative Soil Survey (NCSS) cooperators, which include the NRCS, BIA, and Yakama Nation.

On all harvest units on sustained slopes greater than 35 percent aerial methods of harvest yarding will be utilized. On ground to be harvested by ground-based skidders, designated skid trails meeting watershed management directions will be flagged and their use will be required during yarding.

Water Resource

Management Goals

1. Water—Continue forest management practices that protect the high quality of water on the reservation and that water quantity, distribution, and timing of runoff are sufficient to meet existing and future needs.
2. Watersheds—Landscape hydrologic performance and processes sustain the water, soil, and other resources. Wetland, riparian, and other aquatic ecosystems exist as functioning systems. Soil and vegetation conditions favorably influence runoff processes and the disposition of water within a watershed (on a landscape).

Management Objectives

1. Manage for water of high quality that meets resource and human needs on the reservation.
2. Manage for streamflow conditions and runoff timing that support the needs of dependent sources.
3. Manage flows and water quality for instream and related stream corridor values by balancing instream needs with out-of-stream demands.
4. Manage `lakes for balanced nutrient cycles and adequate water quality to support cultural values, recreational use, and desired fish species.
5. Manage for safe, high-quality groundwater supplies and water table elevations to meet needs of dependent resources.
6. Develop and conduct water management activities as part of ecosystem planning.
7. Develop and conduct restoration activities for waters with degraded condition and function as part of ecosystem management planning.
8. Enhance water quality and quantity to support aquatic resources, human health, and cultural values of the waters for existing and future uses.
9. Protect tribal water rights.
10. Manage water conveyance and removal activities, leases, permits, rights-of-way, and easements in a manner consistent with aquatic resource objectives.
11. Manage forest chemicals in a manner that minimizes harmful effects on aquatic resources and human health.
12. Manage solid waste and wastewater in a manner that prevents ground and surface water contamination.

Management Directions

Best Management Practices

J1. Soil and water best management practices (BMPs provided in Appendix A) will be used to mitigate the effects of resource management activities on the water resource.

J2. BMPs will be identified, selected, scheduled, and executed along with site-specific recommendations for projects to protect and maintain desired water quality.

J3. Special management practices will be designed and used on a site-specific basis where it is determined that standard BMPs will not protect and maintain the water resource.

Floodplains

J4. All shoreline stabilization and flood protection will be in compliance with the Water Code.

J5. A reservation-wide stream mapping and conditions survey will be performed that includes delineation of 100-year floodplains on Class I and II streams.

J6. Projects causing short-term impacts on floodplain values will only be allowed if specific mitigation measures designed to minimize the impacts are documented in the project environmental analysis.
J7. The timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands will be maintained or restored.

Forest Chemicals
J8. Procedures will be developed for the handling, storage, and application of fertilizers, pesticides, and forest chemicals. Federal Insecticide, Fungicide, and Rodenticide Act and other federal rules also apply.
J9. Untested herbicides that are not registered will not be used.
J10. The application of chemicals will be restricted and closely monitored in wellhead protection and groundwater recharge areas.
J11. Specific BMPs will be designed to eliminate the direct entry of pesticides to waters, while minimizing off-target drift.
J12. The storage of fuels and other toxicants will be prohibited within wellhead protection management emphasis areas.

Groundwater
J13. Groundwater withdrawal activities will be managed and regulated with threshold levels and with respect to instream values and flow requirements.
J14. A groundwater quality monitoring program will be designed focusing on areas with land activities that may adversely impact groundwater suitability for use.
J15. Strategies to address and prevent contamination within wellhead protection management emphasis areas and groundwater recharge areas will be designed.
J16. The extent of water that can be withdrawn from groundwater systems without adversely affecting down-gradient and downstream rights, including instream resource values, will be determined by the Water Resources Program.
J17. A system for regulating consumptive use will be designed such that ground water sources are not depleted in excess of threshold impact levels.

Regulation and Enforcement
J18. Enforcement of the water management directions will be in accordance with the Water Code.
J19. A hydraulic permit must be obtained from the Water Code Administration prior to constructing any form of hydraulic project or other work that will use, divert, obstruct, or change the natural flow or bed of any river or stream or that will utilize any of the waters or materials from the stream beds. The Yakama Nation has jurisdiction to enforce the hydraulic permit system in accordance with the Water Code.

Riparian
J20. Riparian management emphasis areas will be provided along all perennial and intermittent streams, lakes, wetlands, and other water bodies.
J21. The minimum large woody debris distributions desired in streams by habitat type group are shown in Table V–8.
J22. Trees may be felled in riparian areas where they pose a safety risk; some cut trees may be left on site to meet large woody debris (LWD) objectives.
J23. The presence of potential impacts to riparian areas and floodplains will be identified in project-level environmental analyses and documents.
J24. Logs will be end-lined out of streamside areas when harvest is allowed within riparian emphasis areas.

Table V–8. Recommended Minimum Large Woody Debris Levels for Forest Streams

Forest Habitat Type	Total Pieces[1] Per Mile	Pieces/Mile > 8" Diameter	Pieces/Mile > 20" Diameter and > 35' Long
PIPO, ABGR_1, and Woodlands Outside Yakama Forest	200	100	25
PSME and ABGR_2	270	150	30
ABGR_3 and ABGR_4	400	240	40
ABLA and ABAM	450	270	45

[1] Only pieces >4 in. diameter for 6.5 ft. of length included in total counts. Other diameters given are piece midpoint diameters.

J25. No piling or burning of slash will be permitted within 100 feet of active intermittent or perennial stream channel margins.

J26. Debris from silvicultural activities will be removed from streams in an agreed upon manner that will cause the least disturbance. Under some conditions the material will be left in stream.

J27. Silviculture and range management prescriptions will allow for adequate levels of large organic debris and future recruitment.

J28. No ground skidding equipment will be permitted within 20 feet of active intermittent and perennial stream channel margins.

J29. A minimum 50 percent shade potential (crown closure or topography) will be maintained when possible adjacent to stream channels.

J30. Riparian management emphasis areas for stream channels will meet the minimum width requirements and will be further delineated on the following criteria:
   a. Flood prone areas including the 100-year floodplain.
   b. Areas of active channel migration.
   c. Extent of riparian and potential riparian vegetation.
   d. Soil type.
   e. Adjacent sideslope sensitivity.
   f. Extent of vegetation that has the potential to provide shade and LWD to channels.

J31. Riparian management emphasis areas for lakes and wetlands will be delineated on the following criteria:
   a. Area inundated to ordinary high water.
   b. Areas usually influenced by a high water table and saturated soils consistent with mean annual precipitation regimes.
   c. Extent of riparian vegetation.
   d. Soil type.
   e. Adjacent sideslope sensitivity.

J32. Rather than prescribing fixed distance riparian management emphasis areas, an adaptive modified approach to protection will be used. This approach provides complete protection in the area below the ordinary high water mark and managed protection in the remaining riparian zone (i.e., the zone of influence, flood plains, and adjacent slopes). No ground-based machinery will be permitted in the 20-foot buffer zone adjacent to stream banks.

Roads and Structures

J33. The construction and maintenance of all transportation facilities are subject to Yakama Nation regulations.

J34. The reduction of road related effects on watershed and aquatic resources will be given a high priority for watershed restoration actions. Desired open-road density will be reduced to 3.0 miles/square mile or less wherever feasible within the Yakama Forest.
J35. New road construction will be designed to prevent or minimize adverse effects on aquatic/riparian and terrestrial species and their habitats.
J36. New roads and landings will be located outside of riparian management emphasis areas (at least 150 feet) except if all other practicable alternatives have been eliminated in project level analysis.
J37. Road planning criteria will be developed for the following:
   a. Road design criteria, elements, and standards that govern construction and reconstruction.
   b. Road management objectives for each road.
   c. Criteria that govern road operation, maintenance, and management.
   d. Requirements for pre-, during, and post-storm inspections and maintenance.
   e. Mitigation plan for road failures.
J38. New and improved existing culverts, bridges, and other stream crossings will be designed to accommodate a 100-year flood, including associated bedload and debris where those structures pose a substantial risk to riparian conditions and downstream values.
J39. Roads not needed for future management activities will be closed, stabilized, or obliterated.
J40. The location, operation, and maintenance of rock quarries, gravel pits, borrow pits, and spoil disposal areas not covered by the Surface Mine Reclamation Act of 1971 will be in accordance with direction provided by the Yakama Nation.

Surface Waters

J41. All surface waters including streams, lakes, and ponds will be classified as Class I, II, III, or IV (see 1993 FMP). Management of surface waters will meet the requirements of the Water Code.
J42. Instream minimum flow requirements will be established for streams.
J43. Surface water withdrawal activities will be managed and regulated within threshold levels and with respect to instream values and flow requirements.
J44. Stressed lake systems will be identified, assessed, and prioritized for corrective action and restoration on a five-year reccurring basis.
J45. Issuance of additional water conveyance permits will be prohibited in watersheds that support fish spawning/rearing habitat until instream flows are documented and shown to be adequate to accommodate both the needs of aquatic and riparian dependent species and the amount of water being conveyed.
J46. All water conveyance intakes will meet established standards or conveyance permits will be revoked.
J47. Leases, permits, rights-of-way, and easements will be issued and adjusted such that adverse effects on aquatic resources are prevented or minimized.
J48. A hydraulic permit in accordance with the Water Code must be obtained prior to conducting forest practices or any other developments within 200 feet of a stream, river, lake, pond, or any other body of water, floodplain, or wetland within the boundaries of the Yakama Reservation.

Surface Water Quality

J49. Water quality will be managed to standards established by the Water Resources Program for the surface and ground waters.
J50. Water quality standards for water classes on the Yakama Forest will be reviewed every three years and revised as necessary based on results of ambient (baseline) monitoring.
J51. Management parameters will be set and planned activities conducted in an integrated manner within threshold impact levels identified for various activities with regard to water quality.
J52. Water quality will be protected from the adverse effects of mining activities and forest practices by requirements provided in the Water Code.

Water Rights

J53. Surface and ground water development activities will be assessed on the Yakama Forest that are or have potential for infringing upon tribal water rights and degrading aquatic resources or values through direct, adverse impacts on water quantity and quality.

J54. The Yakama Nation will work to protect water rights and to regulate those activities that potentially have direct or indirect adverse effects on tribal water rights.

Watershed Vegetation

J55. Watersheds will be reforested following harvest activities according to approved silvicultural prescriptions.

J56. All shoreline vegetation management uses and activities are subject to regulations defined in the Water Code.

J57. Silvicultural treatments and instream mitigation efforts will be conducted in targeted watersheds to elevate (restore) seasonal low flows and improve water quality and aquatic habitats.

J58. Levels of canopy cover will be managed in each subbasin to meet desired future conditions.

J59. Periods of low or no timber harvest will be planned in forested watersheds that are hydrologically immature or sensitive due to previous silvicultural treatments or wildland fire.

Wetlands

J60. All wetlands including streams, lakes, and ponds will be classified and managed as (1) non-forested wetlands (Type A or Type B) or (2) forested wetlands.

J61. All shoreline uses and activities that take place in or near a wetland are subject to regulations defined in the Water Code.

J62. A classification system will be adopted or developed for assessing wetlands on the Yakama Forest.

J63. A wetland buffer management emphasis area of 200 feet will be required adjacent to wetland areas identified as having exceptional resource functions and values, unless a greater distance is required by other provisions of the Water Code.

Wildlife

Management Goal

Maintain viable populations (numbers and distribution of reproductive individuals which ensures their continued existence within the Yakama Forest) of native and desired non-native species of wildlife, and their supporting habitats, while providing wildlife in sufficient numbers to meet the cultural and subsistence needs of Yakama Nation members.

Management Objectives

1. Restore and maintain habitat conditions at or above a level capable of supporting diverse, healthy, sustainable, viable, and productive populations and communities of plant and animal species to meet spiritual, cultural, and subsistence needs of the Yakama membership.
2. Contribute to the recovery and management of federally-listed species (endangered, threatened, candidate, or sensitive) populations and habitats by restoring or protecting habitat quality, quantity, and effectiveness for listed species.
3. Manage rangelands and range units to maintain or enhance habitat requirements (including breeding, feeding, protection, dispersal, and travel) of species closely associated with or dependent on native rangeland, forested uplands, meadows, and riparian areas.
4. Institute wildlife population management practices that maintain sufficient wildlife numbers to meet the cultural, subsistence, and economic needs of Yakama Nation members.

5. Wild, free-roaming horses and their habitat shall be managed and controlled in a manner that maintains a wild horse herd on the reservation.

Species of Concern

Species of interest to forest management planning include:

1. Big-game species hunted by tribal members;
2. Carnivores and furbearers of cultural and economic interest to tribal members;
3. Federally-listed threatened and endangered species that have special legal status;
4. Species that are especially sensitive or rare on the Yakama Forest; and
5. Species that serve as management indicators or perform ecologically important functions.

Ungulates

Ungulate species inhabiting the Yakama Forest include black-tailed deer, Rocky Mountain elk, mountain goats, and horses. Of these, the black-tailed deer and Rocky Mountain elk are the primary species used by tribal subsistence hunters. Historically, these two species have played a central role in the cultural and ceremonial life of the Yakama Nation.

Deer and elk depend on forest vegetation, primarily grasses, forbs, and shrubs for their nutrient and energy needs. The distribution, abundance, and quality of these forage species are strongly influenced by landscape changes induced by natural disturbances such as fire and by human activities such as timber harvesting. Forest stands with a closed canopy that lack forage are used by deer and elk primarily for security and thermoregulation.

Although similar, preferred habitat characteristics for deer and elk are not the same (Collins and Urness 1983). Deer generally need more easily-digested food than elk. Therefore, deer typically only use the newest, most digestible leaves of grass plants and have preferred diets dominated by forbs and digestible leaves of shrubs. Elk, however, are supported by high-grass diets. This is the rationale for the classic characterization of deer as browsers and elk as grazers. Consequently, habitats of low-quality forage that will support elk may not always provide the nutritional requirements of deer. Likewise, cover capable of meeting the needs of deer may fail to meet the needs of much larger elk. In addition, elk are generally more intolerant of disturbance than are deer, which more quickly adapt to human activities. Therefore, current management direction is to manage cover to meet the needs of elk and manage forage to support deer.

Furbearers and Carnivores

Beaver, muskrat, coyote, bobcat, river otter, mink, marten, short-tailed weasel, long-tailed weasel, and raccoon are trapped by tribal members for their fur. These species also have cultural importance. Other carnivores present include cougar, black bear, skunk, and badger. Wolverine, Cascade red fox, lynx, and fisher are rare. Occasional reported, non-verified sightings indicate that gray wolf and grizzly bear may also occur on the Yakama Reservation.

Marten, fisher, and wolverine prefer mature and old-growth stands and occupy mixed conifer and high-elevation forest habitats. Marten and fisher use riparian areas extensively.

Threatened and Endangered Species

Federally-listed threatened and endangered species that may exist in or around the Yakama Forest include bald eagle, northern spotted owl, grizzly bear, lynx, and gray wolf (endangered). These species are afforded special management considerations as a result of their legal status. All federal agencies, including the USDI BIA, are required to consult with the USDI Fish and Wildlife Service prior to any action that may affect any threatened or endangered species (Section 7 consultation).

Bald-eagles winter on the Yakama Forest. Currently, no breeding pairs are known. Isolated multi-storied old-growth stands are preferred winter roosting habitat. Feeding and roosting sites for bald eagles are typically located near primary foraging areas such as lakes and streams.

Northern spotted owls are permanent residents on the Yakama Forest and are generally associated with mature and old-growth stands. Forest management activities potentially affecting northern spotted owls will continue to be based on the Yakama Nation Spotted Owl Management Plan and USDI Fish and Wildlife Service guidelines.

Grizzly bears, lynx, and gray wolves may occur on the Yakama Forest, but definitive documentation is currently not available. These species will receive special management consideration should their presence be documented in the future.

Sensitive Species

Sensitive species on the Yakama Reservation include:

- species that require habitat that is limited or declining;
- species that indicate environmental quality; and
- species that are rare on the Yakama Forest.

Many of these species are also listed as threatened, endangered, sensitive, or monitored species by the State of Washington or are candidate for federal or state listing. A preliminary listing of species meeting these criteria includes 53 sensitive species native to the Yakama Forest (see Appendix B, Table B-1 in the FMP Environmental Assessment).

Wildlife Habitat

Wildlife requires a wide range and combination of food, cover, and water for survival. Current wildlife management direction is to provide areas of each habitat type in each stage of succession across the Yakama Forest to provide a range of vegetative conditions to ensure the viability of each species.

Following are lists of wildlife species associated with the various habitat types.

Oregon Oak Woodlands

Oregon oak woodlands are highly variable communities, ranging from open savannas to dense forest stands. Mixed species stands may be dominated by Oregon oak or by associated conifer species, usually ponderosa pine and Douglas-fir. Understory vegetation may be composed of grasses, shrubs, or mixtures of both. Oak woodlands provide food, cover, and nest sites for a wide variety of species including most woodpeckers, bluebirds, nuthatches, chickadees, raccoon, Douglas squirrel, and black-tailed deer.

Ponderosa Pine

The ponderosa pine habitat is generally associated with the lower-elevation xeric climatic conditions of the reservation. At the lower elevation it grades into shrub-steppe or Oregon oak communities and at higher elevation it grades into Douglas-fir and grand fir habitat types. Consequently, the ponderosa pine habitat type is often associated with a wide range of other tree species including aspen, lodgepole pine, Oregon oak, Douglas-fir, grand fir, western white pine, and western larch—creating mosaics that provide high wildlife habitat diversity. Sensitive species found primarily in ponderosa pine habitat type are the white-headed woodpecker and the gray flycatcher.

Douglas-fir and Grand Fir.

The Douglas-fir and grand fir habitat types occur at middle elevations. Again, a diverse range of habitat conditions and vegetation types are found in these habitat types which support a wide array of wildlife species. Big-game species use these habitat types extensively. Several sensitive species that inhabit these habitat types, but require dense canopy include the sharp-shinned hawk, Cooper's hawk, marten, and fisher. The flammulated owl occurs here and in the ponderosa pine habitat type. Northern spotted owls are most often found within these habitat types as are Vaux's swift and the northern goshawk.

Pacific Silver Fir

The Pacific silver fir habitat type occurs on the upper elevation moist forestlands mostly west of the Klickitat River. Wildlife species found in this habitat type include those that often use the grand fir habitat type plus Townsend's chipmunk, Cascade red fox, wolverine, great gray owl, and occasionally lynx.

Subalpine Fir

The cold and moist subalpine forest habitat type dominates the highest elevation of the Yakama Forest. This habitat type is often interspersed with subalpine meadows that provide habitat diversity for a number of wildlife species such as bear, elk, and deer during summer and species that use edges or openings. Sensitive species that inhabit this zone include the boreal owl, Cascade red fox, mountain goat, marten, fisher, and wolverine.

Special Habitats

Lodgepole Pine

Lodgepole pine can be a dominant seral or an edaphic or topoedaphic species in most of the habitat types found on the Yakama Forest. It often becomes a dominant species in areas of frost pockets or permanent or fluctuating high water tables. Older lodgepole pine stands are used by two sensitive species—the black-backed and three-toed woodpeckers. Other special interest species that use lodgepole pine stands are lynx (younger stands that support hare), other woodpeckers (except the pileated), deer, and elk.
Wildlife Winter Habitat

The wildlife winter habitat is identified most often with the ponderosa pine forest habitat type that is transitional to open rangeland. Natural openings are more common and are often larger than in other management areas. The lower precipitation levels and higher ambient air temperatures during winter make wildlife winter habitat particularly valuable for wintering big game.

Riparian and Wetland Habitat

Riparian habitats are defined as those habitats between aquatic and upland areas including wetlands and meadows. Riparian and meadow habitats are characterized, in part, by plant assemblages that are exposed to saturated or near-saturated soil conditions over a considerable portion of the growing season. Their extent is highly dependent upon topographic features and the extent of the floodplain.

Many animal species directly depend on streams for all or part of their life cycle (e.g., amphibians, aquatic insects, and fish). Aquatic secondary production (e.g., insects, tadpoles, and fish) provides food for riparian species such as birds, bats, reptiles, and adult amphibians. Riparian lands and their vegetation also provide important habitat for land-based plants and animals. Not only is there an increased availability of water, there is often taller, denser vegetation, a more favorable microclimate, more or higher quality shelter and nesting sites, and greater concentration of food resources. Riparian lands often have the highest level of plant and animal biodiversity on the Forest. Riparian land also provides critical corridors for movement of plants and animals across the landscape. Healthy streams are important to fish, but since all wildlife are connected within a food web, water quality is a fisheries, wildlife, and cultural concern.

Healthy riparian zones are vital to forest health and sustainable land management. Predation upon aquatic organisms (insects, fish, or amphibians) could be a major pathway for movement of aquatic nutrients and energy through riparian food webs and back into terrestrial ecosystems. This movement of nutrients makes healthy riparian habitats an important forest health issue.

Coastal Tailed Frog (*Ascaphus truei*)

Tailed frogs have strict habitat needs during their tadpole and adult stages. These narrow habitat tolerances limit their distribution and recolonization abilities.

Tailed frog eggs are laid underwater and can be found attached to larger rocks. Tadpoles of this species are unique in requiring multiple years (3-4) in water before metamorphosing into adults. This makes perennial streams the most basic necessity for survival. Tadpoles have a suction mouth, also unique to this species, which is used to attach themselves to rocks in fast flowing streams. Streams supporting healthy populations of tailed frog tadpoles have the following features:

- Adequate, yearly perennial flow (stream must not dry more than once every 4-5 years);
- Majority of substrate composed of medium to large sized rocks (boulders and cobbles) with minimal amounts of sedimentation found between them;
- Minimal daily and seasonal water temperature fluctuations (tailed frogs will die in water temperatures that exceed 18°C);
- Clean water and rocks (minimal moss and algae);
- Adequately oxygenated water; and
- Minimal spring debris flows.

Tadpoles are also typically found in streams with >3% gradients and few or no fish, and which are characterized by step-pool and cascade bedforms. Riparian buffers and older forests are also important to tadpoles. Older forests and connected overstories help provide many of the conditions listed above. Soils are cold, wet, and with high coarse fragment content, which contributes to the stream morphology needed by tailed frogs.

Adult tailed frogs are also closely associated with streams. They spend much of the day underwater, and only venture from the stream bank at night to forage. Adults need older, intact, and sufficiently wide riparian buffers for foraging, without which they are susceptible to increased predation and desiccation. They do not migrate away from breeding areas, and rates of dispersal are low, making recolonization of extirpated populations difficult.

Tadpoles and adults are also found in marginal habitat, but likely in smaller and unstable populations, such as in the tributaries of Surveyor's Creek, for example. These streams are even more sensitive to disturbance and the populations more likely to respond negatively to alterations.

The largest threats to tailed frog are logging and development in riparian habitat. Problems resulting from riparian logging are:

- Loss of riparian vegetation—can result in increased sedimentation (which increases embeddedness of rocks and, consequently, reduces hiding and foraging spaces for tadpoles and adults), increased temperature, increased spring debris flows, (which causes mortality of tadpoles and adults), and possible early drying of some otherwise permanent streams;
- Road building and increased road use—can result in redirection of stream flow (removes water from original stream, causing mortality of tadpoles, some 2-3 years old) as well as increased sedimentation. Number of road crossings should be minimized and adequate ditch runs created on nearby roads;
- Loss of adequate riparian buffers—the presence of buffers and older forests are positively correlated with larval and adult tailed frog abundance; and
- Logging activity—operation of equipment and movement of logs across streams and through riparian buffers (causes sedimentation and possibly mortality of adults, which will bury themselves in soil near stream edges).

American Beaver (*Castor canadensis*)

Beavers have long coexisted with salmon (*Oncorhynchus* spp.) in the Pacific Northwest, and have an important ecological relationship with salmon populations (Cederholm *et al*. 2000). Beavers create and maintain a series of beneficial aquatic conditions in many headwater streams, wetlands, and riparian systems, which provide juvenile salmon rearing habitat. Beavers have multiple effects on water bodies and riparian ecosystems that include altering hydrology, channel morphology, biochemical pathways, and stream productivity. This function, however, has been severely altered by people.

Beavers are extremely important in contributing to large woody debris, which is a critical structural component in streams. Large woody debris provides important structural complexity as well as vital nutrients to streams. Large woody debris and beaver dams decrease stream velocity and temperature. They also provide refugia for migrating fish.

Beaver dams can obstruct channels, redirect channel flow, and cause the flooding of stream banks and side channels (Cederholm *et al*. 2000). By ponding water, beaver dams create enhanced rearing and over-wintering habitat that protect juvenile salmon during high flow conditions. Beaver dams are often found associated with riverine ponds called "wall-base channels" along main river flood plains, and these habitats are used heavily by juvenile coho salmon (*Oncorhynchus kisutch*) and cutthroat trout (*Oncorhynchus clarki*) during the winter. Aquatic conditions created for beaver also provide breeding habitat for other wildlife species such as western toads and sandhill cranes.

Many developmental activities have implications to both beavers and their habitat (Cederholm *et al*. 2000). Juvenile beaver move along riparian systems to search for mates and suitable habitat in which to

build dams. Timber harvest activities can fragment available beaver habitat, severing these movement routes. These activities can also decrease woody debris available to streams and increase sedimentation. Riparian logging may disturb breeding and winter preparation activities. Proper timing of logging can decrease disturbance. Roads also fragment habitat and increase mortality of beavers. Roads can also increase conflict between beaver and people, as beaver will often attempt to create dams in front of culverts.

Greater Sandhill Crane (*Grus canadensis tabida*)

Greater sandhill cranes were extirpated as a breeder from Washington after 1941 when the last nest was documented at Signal Peak. After this, greater sandhill cranes were not found again until 1972, when two adults were seen within the Conboy Lake National Wildlife Refuge. Nesting was also documented in the Camas Patch area in 1996. Today, there are three known breeding locations: Conboy Lake National Wildlife Refuge in the Glenwood and Panakanic Valleys, Deer Creek in Yakima County, and Polo Field. There are a few more suspected breeding areas. Surveys are conducted yearly by the YN Wildlife Program, which will hopefully confirm additional breeding sites.

Recommended habitat objectives include:

- Security from disturbance, isolation;
- Traditional nesting areas available for reuse;
- Surrounding trees and shrubs present, but not heavily encroaching; and
- Access to feeding areas during nesting—a study of 515 nest sites showed the average distance to the nearest feeding meadow was 40 m (131 ft).

Breeding sandhill cranes are extremely sensitive to disturbance. Disturbed adults may abandon their nest temporarily or permanently. Even the presence of people will cause them to abandon a nest temporarily. During temporary abandonment, the eggs are very susceptible to predation, which is the leading cause of egg and chick mortality. Potential predators include coyotes, bobcats, raptors, or crows.

Snags and Downed Woody Debris

Snags (standing dead trees) and downed woody debris (logs on the ground) provide nesting, roosting, and feeding habitat for many wildlife species. Over 60 species of birds and mammals on the Yakama Forest use snags for nesting or shelter. Some species require snags for nesting and their populations are affected when snag habitat is limited. Sensitive species on the Yakama Forest that are snag-dependent include the flammulated owl, Vaux's swift, pileated woodpecker, Lewis woodpecker, acorn woodpecker, Williamson's sapsucker, black-backed woodpecker, three-toed woodpecker, white-headed woodpecker, and western bluebird.

Wildlife Habitat Definitions

Big-Game Cover

Adequate cover is an important element of good deer and elk habitat. Cover is necessary for both hiding (security cover) and protection from the elements (thermal cover). The quality as well as the quantity of cover can be significantly influenced by forest management activities. Examples of the relationship between stand structure and big-game habitat are shown in Figures V–1, V–2, and V–3.

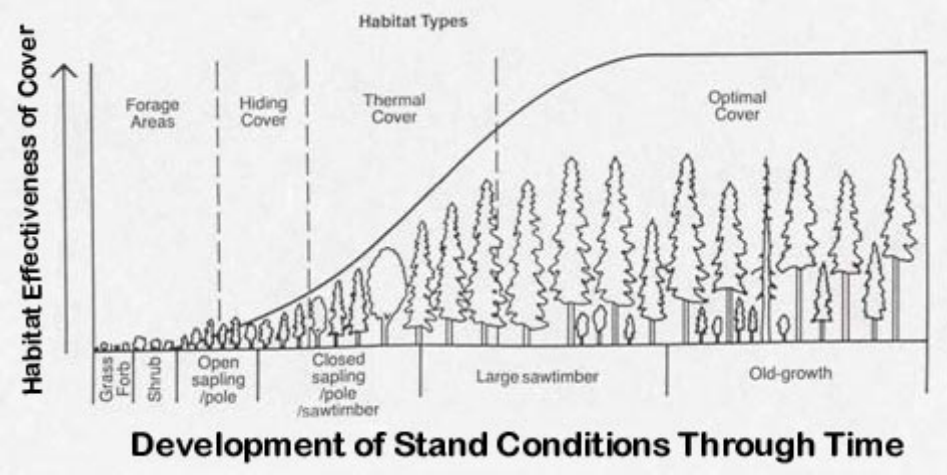

Figure V–1. Conceptual Relationship between Habitat Effectiveness of Cover and Development of Stand Conditions through Time
(From Wisdom *et al*. 1986)

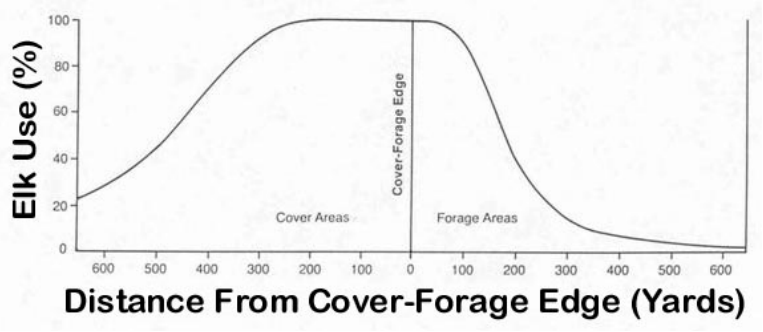

Figure V–2. Relationship of Elk Use to Distance from Cover-Forage Edge
(From Wisdom *et al*. 1986)

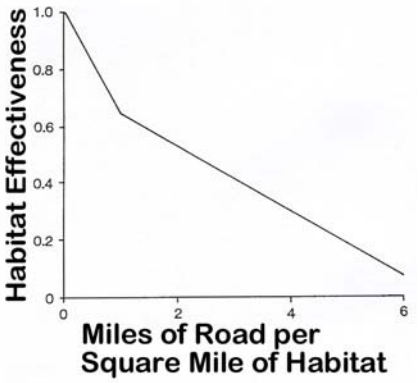

Figure V–3. Effectiveness of Habitat for Elk in Relation to Miles of Open Road
(From Thomas *et al*. 1988)

Security cover is more essential to elk than thermal cover. The standard definition for security cover is any cover capable of hiding 90% of an elk located 200 feet from an observer (Thomas 1979). Security cover for deer is much easier to provide since deer are much smaller than elk. Tall shrubs are usually adequate security cover for deer.

Thermal cover is a stand of conifers averaging at least 40 feet high with a canopy closure of at least 70%. Thermal cover may be more essential for the survival of deer rather than elk, but elk seek out and use thermal cover when it is available.

Optimal cover stands provide thermal cover, security cover, and small foraging areas. Forest stands capable of providing optimal cover should have four layers: (1) overstory; (2) sub-canopy; (3) shrub; and (4) herbaceous layer. Old growth and many mature forest stands have the structural elements that provide optimal cover. In general, stands providing optimal cover have dominant trees with average diameter at breast height (dbh) greater than 21" and at least 70% canopy closure.

Cervid cover[2] is provided in conifer stands with mean dbh ≥ 12" and canopy closure ≥ 60%. This classification was developed because very few managed stands on the Yakama Forest provide optimal cover. In areas where optimal cover is deficient, the next best big-game cover is cervid cover.

Old growth

Further work is needed for characterization of old growth by habitat type on the Yakama Forest, including descriptions of where these stands most readily develop and persist. The Yakama Reservation Wildlife Management Plan is expected to further address these issues. The following criteria are adapted from the R6 Interim Old Growth Definitions (USDA Forest Service 1993a). These criteria, plus wide variation in tree diameters, represent the minimum desirable conditions for old growth by vegetation series. Diameter, number of large trees per acre, and age are the most critical stand attributes, as snags and down logs may be lacking due to stand history. These minimums are not to be confused with desired future conditions, which exceed these in terms of tree size, age, density, and decadence, but these may serve as useful indicators for measurement of progress in managing stands for old-growth conditions.

Table V–9. Interim Minimum Attributes of Old Growth by Series

(From: USDA Forest Service 1993a)

Ponderosa Pine Series, low productivity sites								
Live Trees					Dead Trees			
Main canopy			Tree Decadence[3]	Tree Canopy Layers	Standing		Down	
DBH[1]	TPA[2]	AGE		Number	DBH	TPA	Dia.	Pieces
21"	10	150	Not required	1	14"	3	--	0
31"	2	200	Yes	1				
Ponderosa Pine Series, high productivity sites								
Live Trees					Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers	Standing		Down	
DBH	TPA	AGE		Number	DBH	TPA	Dia.	Pieces
21"	13	150	Not required	1	14"	3	--	0
31"	3	200	Yes	1				
Douglas-fir Series								
Live Trees					Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers	Standing		Down	
DBH	TPA	AGE		Number	DBH	TPA	Dia.	Pieces
21"	8	150	Yes	1	12"	1	12"	2
Grand fir Series, low and medium productivity sites								
Live Trees					Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers	Standing		Down	
DBH	TPA	AGE		Number	DBH	TPA	Dia.	Pieces
21"	10	150	Yes	2	14"	1	12"	5

[2] The definition of cervid cover was developed by Dr. William Bradley, former Yakama Nation Wildlife Resources Program Manager.

Table V–9 (continued)

Grand fir Series, high productivity sites (>100 ft^3/ac./yr)									
Live Trees						Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers		Standing		Down	
DBH	TPA	AGE		Number		DBH	TPA	Dia.	Pieces
21”	20	150	Yes	2		14”	1	12”	5
Pacific Silver Fir, (based on site class 4, USDA Forest Service 1993a)									
Live Trees						Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers		Standing		Down	
DBH	TPA	AGE		Number		DBH	TPA	Dia.	Pieces
25”	7	200	Yes	2		22”	4	24”	4
Subalpine Fir, low productivity sites									
Live Trees						Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers		Standing		Down	
DBH	TPA	AGE		Number	%cc	DBH	TPA	Dia.	Pieces
13”	10	150	2 tpa	1	30	10”	2	10”	4
Subalpine Fir, high productivity sites									
Live Trees						Dead Trees			
Main canopy			Tree Decadence	Tree Canopy Layers		Standing		Down	
DBH	TPA	AGE		Number	%cc	DBH	TPA	Dia.	Pieces
21”	10	150	4 tpa	2	30	12”	2	12”	4

[1] DBH=diameter at breast height

[2] TPA=number of trees per acre meeting or exceeding size specified under DBH.

[3] Decadence=live trees with heart rot, root rot, deformed tops, or dead tops.

Management Direction

General

K1. The management, hunting, and use of wildlife both on and off the Yakama Reservation will be in accordance with the requirements of Yakama Nation Tribal Code Chapter 32.03.

K2. Management activities will reduce fragmentation of wildlife habitat necessary to provide for the life requisites of viable populations of terrestrial species by:
   a. Fostering the restoration of vegetation structure and composition.
   b. Fostering the restoration of linkage management emphasis areas between similar habitats.
   c. Providing habitat patch sizes consistent with the needs of various wildlife species.

K3. Terrestrial species habitat will be restored or maintained so that terrestrial species can move freely within and between blocks of habitat for the purpose of genetic interchange, emigration, and immigration.

K4. Integrated management strategies addressing the long-term ecological integrity of sites and ecosystems will be developed to provide for associated species viability or conservation.

K5. Postharvest open-road densities within the Yakama Forest will be reduced to 3.0 miles per square mile or less.

K6. Habitat features such as wetlands, bogs, wet meadows, seeps, and springs will be protected.

K7. Foraging, nesting, and hiding requirements of terrestrial riparian-dependent species will be addressed as a high priority in management decisions related to vegetative treatments.

K8. When alternative sources are available, avoid quarrying or blasting talus slopes, cliff faces, and within 0.25 miles of caves. When alternative routes are available, avoid road building within 1 chain of talus slopes, cliffs, and within 0.25 miles of cave entrances.

K9. Wildlife travel corridors will be designated with widths of at least 400 feet that provide connectivity between larger blocks of habitat.

K10. Raptor nest sites and important roost sites for key species will be protected from habitat disturbance within a radius of 500 feet. To protect fledgling activities, disturbance activities will be avoided within 0.5 miles during the period March 1 through August 31.

K11. Management of active goshawk home ranges will be determined using three distinct activity zones: the nest area, post-fledging family area (PFA), and foraging area. Because individual sites may require different management guidelines, recommendations are ideally determined on a case-by-case basis. In some cases, harvest activities, such as precommercial thinning that open up the understory, can improve habitat conditions for goshawks. Forestry and Wildlife staff shall work cooperatively to determine the most appropriate locations and sizes of goshawk management areas and determine what treatments, if any, could be used to improve habitat conditions within them. The following are guidelines for the three activity zones:

Nest Area

- Three 30-acre nest patches, one containing the nest site and two alternate nest sites, totaling 90 acres;
- The three nest sites should be located approximately 0.5 miles away from each other;
- No harvesting or harvest-related activities in the nest site or alternate nest sites.

Post-fledging Family Area

- Approximately 420 acres (not including the 90 acres of nesting area) centered around the nest site and alternate nest sites;
- No harvesting or harvest-related activities during nesting season: March 1-September 30;
- Manage road density at the lowest possible level;
- Attempt to maintain at least 60% of the PFA in either mid- or late-successional stages with a minimum canopy cover of 50%. Of the remaining 40%, 20% should be in young forest, 10% in seedling/sapling, and 10% in grass/forb/shrub.

Foraging Area

- 5,400 acres (not including nest area and PFA) in size;
- The foraging area should surround the PFA;
- Attempt to maintain 60% of the area in either mid- or late-successional stages with a minimum canopy cover of 40%. Of the remaining 40%, 20% should be in young forest, 10% in seedling/sapling, and 10% in grass/forb/shrub.

K12. Report any peregrine falcon sightings to WRMP biologists. With guidance from WRMP biologists, impose activity timing restrictions around active eyries.

K13. The integrity of bald eagle nesting or winter roost sites will be maintained and/or enhanced. Timber harvest will not occur within 0.25 miles of an active bald eagle winter roost or feeding site from November 1 until April 1. In the event nesting occurs, guidelines for nest site protections will be developed by the WRMP.

K14. All Yakama Forest management operations will comply with the approved Yakama Nation Northern Spotted Owl Management Plan.

K15. Firewood programs will be managed to be consistent with snag and downed wood guidelines.

K16. Firewood cutting will be restricted to dead standing and dead down trees.

K17. In full recognition of the ecological importance of individuals or groups of species with known viability concerns, tribal management actions will not result in the extirpation of a species from the reservation.

K18. Within potential lynx habitat in Lynx Analysis Units, minimize wintertime use of roads to prevent disturbance; maintain older stands, especially lodgepole pine and subalpine fir stands, that exhibit characteristics of suitable lynx denning cover (jack-strawed logs in closed-canopy stands); in lodgepole pine harvest areas, use patch cuts to create future foraging habitat; maintain down logs wherever possible; attempt to maintain a tree density of >180 stems/acre with heights of at least 6 feet in areas linking primary habitat; after harvesting in lodgepole pine stands, site preparation should encourage the regrowth of lodgepole pine; any proposed thinning of lodgepole regeneration should be discussed with Wildlife staff prior to implementation; and report any suspected lynx sightings to the Wildlife Resources Management Program immediately.

K19. A wild horse management plan will be developed that addresses territories, population objectives, and habitat requirements.

K20. Leave-tree requirements by habitat type are as follows. These may be averaged for areas up to 20 acres. Naturally unproductive areas that are unforested or very lightly stocked may be excluded from these density calculations. Trees should be retained in a combination of intact patches (at least 2 acre in size), scattered smaller patches, and single trees.

Ponderosa pine and Douglas-fir Habitat Types
At minimum, leave the 6 largest live trees/acre and a total of at least 10 trees/acre ≥ 10" dbh standing.

Cedar Valley and Low Elevation Dry Site Grand Fir Habitat Types
At minimum, leave the 8 largest live trees/acre and a total of at least 18 trees/acre ≥ 10" dbh standing.

Low Elevation Wet Grand Fir, High Elevation Wet Grand Fir, Subalpine Fir and Pacific Silver Fir Habitat Types
At minimum, leave the 10 largest live trees/acre and a total of at least 24 trees/acre ≥ 10" dbh standing.

K21. A representation of all size classes of down woody debris and standing dead trees (snags) will be maintained on all actively managed forest sites, as per Table V–10. Exceptions to the snag guidelines are allowable in safety corridors within a site tree height of a road, traditional use areas, campsites, and other such sites where snags may pose a hazard to people or structures. Live trees with dead portions (such as spike tops) may be counted toward snag densities if the dead portions are at least 10 inches in diameter. On sites not capable of supporting larger trees or where a stand is too young to contain trees of sufficient size, snags and logs representative of the largest size class present should be left.

K22. In areas where additional snags or downed logs are desired, those existing will be protected during prescribed fire activities and (to the degree possible) during harvest activities. Consideration should be given to establishing 1½ snag height no-harvest buffers around large potentially hazardous snags so as to avoid conflicts with worker safety.

K23. Within a single drainage, conclude management activities in the shortest time possible. Large portions of a drainage should not be impacted concurrently or in consecutive years.

K24. To protect microclimates associated with talus, cliffs, and caves, maintain a minimum 1 chain (66 feet) no-entry buffer around the top, sides, and base. Buffer widths around cave entrances will be of significant width to maintain cave microclimate. Avoid new road construction, quarrying, and blasting within ¼ mile of cave entrances and cliff faces. Avoid applying pesticides within 3 chains of caves inhabited by bats. Report newly discovered caves to Yakama Nation wildlife biologists.

K25. Degraded or declining aspen habitat will be restored. Management of aspen stands will include removal of encroaching conifers; using moderate intensity prescribed burns, and small clearcuts to stimulate sucker growth; and control of livestock grazing by fencing, creating slash, other barriers, or herding. Deep slash will be removed to facilitate aspen regeneration.

Table V–10. Guidelines for Minimum Snag Densities by Forest Habitat Type

Forest Habitat Type	**Small Snags** 10"-19.9" dbh[1], and ≥10' tall	**Medium Snags** 20"- 35" dbh, and ≥ 30' tall	**Large Snags**[2] >35" dbh and ≥30' tall	**Down Wood** Pieces per Acre	
				Large-end Diameter	
				12-19.9"	**≥20"**
Ponderosa Pine Douglas-fir	≥5 snags/acre	≥2 snags/acre	≥0.05 snags/acre	8 ≥12' long	2 ≥12' long
Grand fir (Cedar Valley and Low Elev. Dry)	≥7 snags/acre	≥3 snags/acre	≥0.1 snags/acre	10 ≥20' long	6 ≥20' long
Grand fir (Low Elev. Wet and High Elev. Wet)	≥10 snags/acre	≥4 snags/acre	≥0.2 snags/acre (= 1 per 5 acres)	10 ≥20' long	6 ≥20' long
Subalpine fir	≥15 snags/acre	≥4 snags/acre	≥0.2 snags/acre	15 ≥20' long	10 ≥20' long
Pacific Silver fir	≥15 snags/acre	≥6 snags/acre	≥0.5 snags/acre	20 ≥20' long	20 ≥20' long

[1] dbh=diameter at breast height
[2] If insufficient snags exist in this largest size class, leave live recruits rather than converting large trees to snags.

K26. Oregon white oak woodlands will be managed for wildlife habitat. Thinning and burning will only be prescribed to enhance habitat. Large, dominant oaks and standing dead and dying trees will be retained when possible. Fallen trees, limbs, and leaf litter will be left for foraging, nesting, and denning sites.

K27. Habitat diversity on a small scale will be emphasized.

Cervids

K28. Big-game cover (the sum of security, thermal, and optimal and/or cervid cover) will be managed for on 40% of each sale area within dry habitat types (PIPO, PSME, ABGR_1, and ABGR_2) and on 60% of each sale area within moist habitat types (ABGR_3, ABGR_4, ABLA, and ABAM). At least 15% of each area will be managed to provide optimal cover. If the area currently has less than 15% optimal cover, the deficit will be made up with cervid cover. In wildlife winter habitat this will be increased to 25% optimal cover (or cervid cover if optimal is not present).

K29. Stands of optimal cover will be evenly distributed, at least 45 acres in size, and at least 1,300 feet wide.

K30. Security cover buffers 300 feet wide will be maintained around openings of 8 acres or larger. In some areas, alternatives may have to be developed when meadow restoration is desired, e.g., when tree encroachment has reduced meadow areas or where insects or diseases are affecting trees around the openings, such as the mountain pine beetle attacks on lodgepole pine around Piscoe Meadow.

K31. Security cover buffers 40 feet wide will be maintained along secondary roads and around small meadows from 1 to 7 acres that are used by big game. Along primary roads (Signal Peak Road, Mt Adams Highway, Klickitat River, Potato Hill, Peavine Ridge, Cedar Valley, Vessey Y, Summit Creek, Piscoe Creek, Old Maid, and Panther Creek Roads) and in areas that are scheduled for roadside firebreaks, the security buffers will be maintained at the outer edge of the clearing or firebreak, or at least 1 chain from primary roads. This is intended to maintain Safety Corridors and reduce vehicle animal collisions.

K32. Management will avoid creating extensive tracts of marginal cover. In addition, marginal cover will not exceed 50% of all available cover.
K33. Optimal cover buffers (or cervid cover if optimal cover doesn't exist) 200 feet wide will be maintained along each side of perennial streams, wet meadows, seeps, and other wetlands. Security cover buffers 50 feet wide will be maintained along each side of ephemeral streams. Development of optimal cover will be promoted if it does not exist along perennial streams.
K34. New forest openings will be managed so that animals are never more than 300 feet from security cover. In addition, heavy treatment of disease- or insect-infected areas and regeneration harvests (group selection, shelterwood, and seed-tree cuts) will be treated the same as openings.
K35. To protect big-game forage, minimum soil disturbance will be emphasized in forest operations.
K36. Deer and elk forage areas will not be wider than 600 feet between areas of thermal or security cover with an exception to this requirement in the ponderosa pine habitat type.
K37. Locate permanent and high-volume roads in those areas least used by elk.
K38. Design secondary roads, in both construction and layout, to facilitate eventual closure. This is particularly important where roads enter drainage heads.
K39. Maintain security cover near secondary roads (cover to hide 90% of an elk within 200 feet of the road).
K40. Avoid road construction in saddles or low divides frequented by elk in crossing ridges between drainages.
K41. Construct roads with the least impact to the environment while still meeting the management objectives (low speed, single track construction without large cut slopes, fills, or straight stretches).
K42. Dispose of right-of-way slash so it does not inhibit elk movement (slash no deeper than 1 ½ feet).
K43. Locate roads, even temporary roads, to avoid disturbance to meadows and water holes used by elk.
K44. Build as few roads as possible in elk winter range. If roads must be built in these areas, access them from areas of higher elevation. This makes access more difficult because of deeper snow depth during winter at higher elevations.
K45. All abandoned roads and major skid trails shall be reseeded with native and desirable non-native grass and forb seed mixes.
K46. Where maintenance of elk and deer habitat quality and security are important considerations, target open road densities will be ≤ 2 miles per section. The target may not be achieved in some areas if existing roads are desired for traditional uses, forest management, or fire management. Every open road will be evaluated for closure—high priorities for closure include:
    - Roads in the heads of drainages, saddles, and divides
    - Roads through moist areas, around springs, and through meadows
    - Loop roads that encourage through traffic
    - Roads in known fawning and calving areas
    - Roads in winter range; and
    - Roads in areas with poor cover.
K47. Both deer and elk seek areas of abundant green forage during the period of fawning and calving—from May 15 through July 1. If deer or elk are abundant in a timber sale area during this time, the likelihood of significant fawn and calf loss may be fairly high if timber sale activity is occurring. Timing restrictions will be in effect during this period to prevent loss of productivity in both deer and elk.

Wildlife Winter Habitat

K48. Leave at least 25% optimal cover in wildlife winter habitat.
K49. In fringe area stands, maintain optimal cover in strips at least 200 feet wide at the top of north facing slopes. Where optimal cover is not present, maintain cervid cover.

K50. Construct as few roads as possible and close as many roads as possible at the end of the sale. If new roads are constructed, connect roads from up slope areas instead of down slope. Deeper snow at higher elevations inhibits easy access.
K51. Avoid creating extensive tracts of marginal cover.
K52. Avoid working in these areas as much as possible when game animals are using them for winter range (December 1 to March 15).
K53. Prescribe burn where possible to enhance winter forage species such as *Ceonothus*. Scatter and burn slash to increase intensity of burns to stimulate *Ceonothus* germination.
K54. Avoid harvest of adjacent areas for at least a 10-year interval to maintain adequate cover in wintering areas.

Other Big Game

K55. Important mountain goat winter ranges, mineral licks, and kidding areas will be identified and protected in planning timber harvest operations.
K56. Areas within ½ mile of precipitous terrain or cliffs will be designated as goat habitat and these areas will be carefully evaluated before any logging takes place.
K57. Pathways of forest with snow-intercept capabilities may be important as migration corridors between seasonal ranges and wintering sites. Necessary width will be determined by field studies.
K58. Helicopter logging operations will be avoided within ½ mile of occupied mountain goat habitats. Overflights will be a minimum of 1000 feet above ground or away from canyon walls.
K59. Human related disturbances within ½ mile of mountain goat winter range will be discouraged when goats are present, usually November to June 1.
K60. New roads shall not be built in goat habitat areas.
K61. Stumps and down logs are an important resource for a variety of wildlife, including bears. Large-diameter logs are preferable over smaller logs because larger logs retain moisture better and provide better habitat. Leave as many large logs undisturbed as possible.
K62. Very large, old trees are very important denning habitat for black bear, both as standing trees and down logs. This is an important reason to grow large trees for replacement trees.
K63. Riparian areas, meadows, oak stands, old-growth stands, and berry fields are all very important to black bear and should be managed for the values they provide black bear as well as other wildlife. Entry into or management of these areas will consider these wildlife values.

Old Growth

K64. Old-growth management emphasis areas will be designated across the landscape through an interdisciplinary process. This may require development of old growth from young stands.
K65. At least 15% of each subbasin is to be designated as old growth or potential future old growth. The DFC is to have old-growth stands occupy at least 10% of each subbasin at any given time.
K66. Areas designated for old-growth management must be at least 80 acres in size. Those surrounded by young or open, managed stands may need to be larger to maintain internal integrity of old-growth conditions.
K67. Analyses will be conducted and strategies devised to provide for adequate distribution, occurrence, and connectivity of mature/old stands. The following conditions will be managed for:
    a. Mature/old stands will be connected within and among subbasins. Connectivity will be in a contiguous network pattern in two or more directions in forested portions of subbasins.
    b. Mature/old stands will be connected by stands in which >20” diameter trees are common and canopy closures is at least 50 percent of the historical closure for the habitat type. Preferred connectivity stand widths will be at least 1,300 feet at their narrowest points.

Riparian Areas and Meadows

K68. Along streams that may provide tailed frog habitat (generally perennial streams with rocky substrates, with site-specific determination of suitability to be made by a WRMP biologist):
- Maintain riparian buffers at least 165 ft wide, on each side, or to the floodplain edge, whichever is greater.
- Minimize new road building within this riparian buffer.
- No logging should occur within this riparian buffer, unless treatment can enhance the conditions within the buffer. Such treatments must follow site-specific prescriptions developed through an interdisciplinary process.

K69. Because sandhill cranes are sensitive to disturbances during breeding, a buffer and seasonal restriction will be placed around all meadows used for breeding. The seasonal restriction is needed to provide isolation during adult and fledgling nesting, roosting, and feeding. Any lifting of the seasonal restriction or adjustment of the buffer will need a review and approval by the YN Wildlife Program.
- No harvest activities, road building, or other noise-generating activities will take place within a 0.25-mile buffer around known nesting meadows between April 1 and August 10.

K70. If an active beaver dam or pond is found during logging or road building activities, the following guidelines should be adhered to:
- A minimal 80-foot no-entry buffer should be established around the active site.
- A YN Wildlife Program employee will survey the site to determine the extent of activity.

If old beaver signs are found but there are no signs of recent activity, the YN Wildlife Program should be consulted to assess whether silvicultural practices might be used to enhance beaver habitat.

K71. No new roads will be constructed through mardon skipper habitat. This includes meadows in which mardon skipper host plants (e.g., Idaho fescue) persist without desiccation through the summer. Pesticides harmful to lepidoptera are not to be applied, either directly or through aerial drift, to meadows known to harbor mardon skippers.

K72. No harvest activities, road building, or other noise-generating activities will take place between May 1 and August 30 within 0.25 mile of known maternity colonies of Townsend's big-eared bats. Notify WRMP biologists of any natural or human-made structures known to be harboring colonies of bats.

Chapter VI. Program Implementation Plans

The following Implementation Plans provide detailed explanations of how management activities will be performed to protect and enhance the forestlands of the Yakama Reservation. These Implementation Plans are conducted according to Yakama Nation mandates. This Chapter summarizes the following Implementation Plans:

- Resource Protection Plan: Provides direction for protecting the Yakama Reservation forestland from fire, insects, diseases, and trespass.
- Timber Management Program: Provides direction for conducting timber management activities while protecting all resources.
- Forest Development Program: Provides direction for timber sale follow-up activities such as planting, precommercial thinning, fuel management, and prescribed burning.
- Woodland Management Program: Provides direction for managing woodland resources outside of the Yakama Administrative Forest.
- Human Resources Program: Recruits Yakama Nation members into the forestry program and promotes their development as technicians and professionals.

Resource Protection Implementaton Plan

Overview

Forest protection is a primary objective in the management of the forestlands of the Yakama Reservation by the BIA as stipulated in 25 CFR 163.3 dated April 1, 2005. Implementation activities occur in three major categories including fire management, insect and disease management, and trespass.

Tribal ordinances or standards relevant to resource protection are incorporated into the Resource Protection Implementation Plan and include the Water Code (Yakima Indian Nation 1992), Hydraulic Code (Yakima Indian Nation 1991), and the Land and Natural Resource Policies Plan (Yakima Indian Nation 1987).

Fire management is responsible for suppression of wildland fires on forest and rangelands within the reservation boundaries. During the fire season, fire management staff may be stationed at the Yakama Agency headquarters, Signal Peak Ranger Station, Fort Simcoe Job Corps Center, and three lookout stations (Signal Peak, Satus, and Sopelia). Aerial reconnaissance may also be activated during periods of poor visibility or after lightning storms. The increased use of aircraft for transport of initial attack crews, delivery of retardants and supplies, and as observation points has substantially reduced response time and overall loss of resources.

Insects and diseases are natural components of forest ecosystems and perform important functions such as stand density regulation and nutrient recycling; some insects and diseases are considered forest pests. These pests cannot be completely eliminated and some forest product losses are unavoidable. Forest management practices are designed to afford the most practical method of keeping forest product losses at an acceptable level.

Integrated pest management is utilized to maintain long-term forest productivity and to meet Yakama Nation goals (Chapter II). Active and potential insect and disease problem areas are mapped and entered into the Reservation's Geographic Information System (GIS). Forested areas are rated for hazards and, if required, schedules of treatments are prescribed to alter stand conditions or moderate the impact of pest damages.

Detection of insects and diseases on the reservation includes trapping of insects, annual aerial reconnaissance, and stand exams. Day to day field observations, however, will continue as the foundation of detection and management efforts.

Trespass is the unlawful extraction, severance, injury, or removal of forest products from reservation lands, and may occur from timber trespass or the act of setting fires that burn out of control and cause damage to Yakama Nation property.

Aggressive patrol by forestry and law enforcement personnel, timely action in processing trespass actions, and publicizing the efforts to prevent or prosecute all trespasses will continue to be the general strategies used in the implementation of this protection program.

Fire and Fuels Management

Goal: To provide well-planned and well-executed fire protection, using programs that are effective in meeting resource management goals.

Policies: Levels of fire suppression activities will be consistent with resource management objectives. Suppression action and costs will be appropriate for the values threatened by wildland fire. Wildland fires that threaten public safety, improvements, or investments will receive highest priority for suppression.

Consider prescribed burning where the controlled use of fire will help to achieve management objectives. Levels and methods of fuel treatment will be guided by costs and resource objectives in the area. Fuel-loading abatement prescriptions will be incorporated with project plans. Burning plans are prepared and submitted to the Yakama Agency Superintendent for approval prior to management activities. The plans include air quality requirements and necessary coordination with local smoke management plans.

Fire Management

The Branch of Forestry is responsible for suppression of wildland fires on forest and rangelands within the boundaries of the reservation. The authority, responsibility, and policies concerning fire protection on Indian lands are set forth in IAM 90, Wildland Fire Management.

a. Prevention Program

Fire Prevention has been emphasized in protecting the Yakama Forest. A Prevention Plan was prepared by Fire Management. Educating the general public, adults, and children, through fire prevention programs is the key to reducing the number of person-caused fires and damage

caused by fires. Prevention programs are presented to tribal groups, civic, and church organizations, special events, tribal school, and day care centers.

Prescribed fire and mechanical fuels treatment will be used to reduce slash accumulations and hazardous fuels.

b. Detection Program

Two BIA lookouts on the reservation, Signal Peak and Satus, are usually manned during the fire season for early detection of fires. A third lookout, Sopelia, exists but has not been manned because of insufficient funds. During periods of poor visibility and after lightning storms, spotters in fixed-wing or rotorcraft are also used for aerial detection of fires. The period between detection and initial attack (response time) has been satisfactory for all detection methods.

Lightning causes the majority of wildland fires on the reservation. Person-caused fires are not common in the forest because it is closed to the general public; however, some arson-caused fires occur every year in the grasslands near the agricultural areas.

c. Presuppression and Suppression Program

During the fire season, initial attack crews and equipment are available for dispatch seven days a week. Fire suppression vehicles and equipment consist of three 250-gallon pumper units, one 750-gallon engine, one 4,000-gallon water tender, and three D-6/D-7 dozer units with transport. Additional firefighting equipment is available from the following programs: Glenwood Ranger Station: one 250-gallon pumper unit; White Swan Ranger Station: one 150-gallon pumper unit; Yakama Nation Forest Development: one 250-gallon pumper unit; and the Fort Simcoe Job Corps Center: two 250-gallon pumper units.

The BIA, through the Office of Aircraft Services at the National Interagency Fire Center in Boise, Idaho, contracts call-when-need aircraft/helicopters for fire management. Aerial retardant tankers are obtained from the U.S. Forest Service through the Shared Resources Agreement.

d. Other Sources of Assistance

Cooperative agreements between the BIA, the U.S.D.A. Forest Service, Washington State Department of Natural Resources, and local rural fire districts enable Fire Management to obtain services and mutual support. Additional manpower and equipment are available through the National or Geographic fire coordination centers through the resource ordering process.

Insects and Diseases

A. Introduction

Common insects and diseases of the Yakama Forest are listed in Appendix D. Images and information about insects and diseases can be found at the USDA Forest Service Western Forest Insects and Diseases website (http://www.fs.fed.us/r6/nr/fid/wid.shtml).

Most insects and diseases are natural components of forest ecosystems and perform important functions such as recycling nutrients and regulating stand density. In addition, insects and diseases provide valuable wildlife prey and create habitat for forest-dwelling species. Total eradication of insects and diseases is impossible; therefore, some insect- and disease-caused losses of timber are inevitable. Maintaining stand vigor is the best prevention against forest pests. Silvicultural manipulations, such as thinnings, can be prescribed to increase stand vigor and keep losses below an economic threshold.

Bark beetles account for most of the annual loss of merchantable timber on the Yakama Reservation. Most of the damage is caused by mountain pine beetle (*Dendroctonus ponderosae*) in western white pine and lodgepole pine, and western pine beetle (*D. brevicomis*) in ponderosa pine. Growth and volume losses from stem decays, dwarf mistletoes, and root rots probably exceed losses from direct mortality.

B. Pest Management

The growth loss resulting from insects and diseases remains a serious problem in some stands. Integrated pest management practices, involving sound silvicultural practices, will continue to be used to manage pests, maintain long-term productivity, and meet the Yakama Nation's management goals. The Branch of Forestry pest management strategy classifies the forest by administration, landform, and habitat types. Within each habitat type, the main insect and disease problems are identified and management strategies are devised through an interdisciplinary process. Whenever possible, appropriate silvicultural treatments are prescribed to alter stand conditions before forest pest problems become serious.

C. Detection and Evaluation

The Branch of Forestry uses the following resources and methods to monitor and evaluate insect and disease levels:

- ◊ The Branch of Forestry obtains data from insect survey flights conducted annually by the USDA Forest Service and Washington State Department of Natural Resources. The data is analyzed and maps of insect activity are produced. When trends indicate increasing insect populations, the Branch of Forestry proposes appropriate actions.
- ◊ The Branch of Forestry monitors western spruce budworm (*Choristoneura occidentalis*) and Douglas-fir tussock moth (*Orgyia pseudotsugata*) by sampling larvae and trapping adults.
- ◊ Day-to-day field observations are the foundation of detection and management efforts. Prompt reporting of new problem areas, especially initial insect outbreaks, allows for evaluation of risks and necessary treatments before critical stages are reached. Training sessions in identification and management of insects and diseases are conducted to increase the effectiveness of the field staff.
- ◊ Stand examinations and presale timber cruises are conducted to identify problem areas and possible treatments.
- ◊ The Branch of Forestry assesses and corrects problems as they are encountered on timber sales. Timber Sale Officers map any areas needing follow-up treatments after commercial timber harvesting and report their observations to the Forest Development Program.

D. Forest Insects

1. Bark Beetles

Bark beetles can cause considerable mortality in all species of conifers. In most cases, bark beetle activity is related to overstocked stands or older-aged stands. Beetle attacks should decrease with increased thinning and removal of low-vigor, overmature trees.

a. Western Pine Beetle (*Dendroctonus brevicomis*)

Western pine beetles primarily attack stressed, low-vigor, mature, and overmature ponderosa pine. Trees less than 6 inches (15 cm) in diameter are not usually attacked (Furniss and Carolin 1977). To assess hazard ratings, trees are classified by vigor and age (see Keen's tree classification). High-risk trees are removed during harvest entries. Prompt harvest of excessive blowdown will reduce potential beetle breeding areas.

Bark beetle outbreaks may be secondary to root rot problems. Stands undergoing insect attacks are inspected for evidence of root disease (primarily *Armillaria ostoyae*) and treated in accordance with guidelines given in the section on root diseases.

b. Mountain Pine Beetle (*Dendroctonus ponderosae*)

Mountain pine beetles can cause extensive losses of ponderosa pine, lodgepole pine, and western white pine stands. Stands with highest risk for beetle attack have the following characteristics: (1) ponderosa pine forest types; (2) even-aged; (3) single species; (4) age 50 years or older; (5) average diameter of 8 inches or greater; and (6) basal area per acre of 150 square feet or greater. Many stands in Cedar Valley fall within the high-risk category.

Conditions that favor outbreaks in lodgepole pine stands are similar to those for ponderosa pine: (1) even-aged stands; (2) greater than 80 years old; and (3) larger than 8 inches average diameter. Commercial thinning in previously unthinned lodgepole pine stands is usually not a practical option because live crowns tend to be small and there is an increased risk of windthrow.

Western white pine stands over 100 years old and greater than 16 inches average diameter are considered high risk, especially when stressed by such factors as overstocking or white pine blister rust infection. High-risk lodgepole pine stands, white pine stands, and stands under beetle attack are scheduled for stand replacement or stocking control treatments. Commercial thinning can be done in some stands to increase the vigor of remaining trees and reduce the basal area to less than 80 square feet per acre. Precommercial thinning prevents younger stands from reaching a high-risk condition.

c. Pine Engraver (*Ips emarginatus*, *Ips pini*, and other *Ips* species)

Pine engravers breed in fresh slash and primarily attack sapling- and pole-sized ponderosa pines. Thinning along with slash reduction should increase stand vigor and reduce pine engraver populations (Goyer *et al*. 1998).

d. Douglas-fir Beetle (*Dendroctonus pseudotsugae*)

Douglas-fir beetle outbreaks are associated with stand disturbances, such as windthrows, snow and ice damage, and fires (Schmitz and Gibson 1996). Prompt harvest of fire- or storm-damaged trees, especially in stands with high-risk characteristics, will prevent or reduce serious outbreaks.

e. Fir Engraver (*Scolytus ventralis*)

Stress factors associated with fir engraver attacks of true firs (*Abies* spp.) include drought, growth stagnation, root rot, insect defoliation, and logging damage. The beetles attack pole-sized and larger true firs. Silvicultural treatments that enhance stand vigor should reduce outbreaks. Operations that increase tree stress, including partial cutting of decadent stands, excessive logging damage, and soil compaction should be avoided.

f. Spruce Beetle (*Dendroctonus rufipennis*)

Spruce beetles breed in weakened, damaged, or windthrown Engelmann spruces and logging slash. High-risk stands have average diameters of 16 inches or greater, more than 65 percent spruce in the canopy, and occur in well-drained creek bottoms. The Yakama Forest contains only scattered stands of high-risk spruce and expected losses are small. Specific control measures are limited to prompt salvage of storm-damaged and windthrown timber, and harvest of mature stands of spruce during scheduled entries.

2. Defoliators

Defoliators such as the western spruce budworm have the potential of causing widespread growth losses if favorable conditions for the insects develop over extensive areas. Pine butterfly defoliation had an impact on stand development in Cedar Valley (Weaver 1961).

Aerial application of an approved pesticide can be an effective method to quickly control an insect epidemic; however, this may only provide a short-term solution. Spraying programs are coordinated with the USDA Forest Service. Such programs are only undertaken with approval of the Tribal Council. Long-term strategies use silvicultural treatments to alter stand conditions.

a. Western Spruce Budworm (*Choristoneura occidentalis*)

The western spruce budworm (WSBW) is native to the forests of western North America. During outbreaks, WSBW can defoliate vast areas of mixed conifer and pine-fir forest types.

In 1985, WSBW populations began increasing on portions of the Yakama Forest. By 1989 the infestation covered approximately 71,000 acres, primarily in mixed conifer and pine-fir types. In 1990, *Bacillus thuringiensis* (B.t.) was applied to the majority of impacted areas and WSBW populations were immediately reduced to endemic levels (USDA Forest Service 1993b). Unfortunately, the stand conditions that favored development of the outbreak remained unchanged and WSBW populations soon rebounded. The lesson learned from the suppression project was

that spraying B.t. provided only a short-term relief from defoliation. Long-term management of WSBW populations can be accomplished through silvicultural manipulations in susceptible stands.

Proactive management requires the development and implementation of long-term silvicultural strategies to decrease the probability of future WSBW outbreaks. The severity of the 1990 budworm outbreak and the resurgence in the years following the spray project highlight the need for integrated pest management in forest planning.

Following are the primary stand characteristics that favor WSBW populations:

Tree Species Composition WSBW is a defoliator that feeds on vegetative buds, reproductive buds, and foliage of shade-tolerant trees, primarily grand fir and Douglas-fir. WSBW also feeds, but to a much lesser extent, on subalpine fir, Pacific silver fir, Engelmann spruce, and western larch. WSBW outbreaks are likely to occur in grand fir and Douglas-fir habitat types (Schmidt *et al.* 1983). Individual trees of each species, however, may express some genetic resistance to WSBW. Trees that express resistance should be retained if more resistant, shade-intolerant species are not present.

Stand density Increasing density of host species is highly correlated with outbreak risk (Carlson *et al.* 1983). Dense stands consisting of host species provide abundant food for WSBW and appear to create conditions more favorable for successful mating flights.

Stand vigor Low-vigor stands are more susceptible to outbreaks (Cates *et al*. 1983). Low stand vigor frequently results from overstocking. Trees become more susceptible as a result of competition, impacts on the nutrient cycle, and weakened defense mechanisms, *e.g*., changes in the chemical composition of foliage.

Stand structure Uneven-aged, multistoried stands are more susceptible to WSBW attack (Stoszek and Mika 1983). These types of stands are favorable for WSBW because: (1) shade-tolerant host species in the understory provide an abundant food source; and (2) multilayered canopies facilitate larval dispersal—larvae can easily drop down through the canopy to feed on the understory.

Previous harvest practices Most of the affected areas of the Yakama Forest were previously selectively harvested—large-diameter, non-host species (*i.e*., ponderosa pine and western larch) were removed. Harvest of non-host species favored regeneration of Douglas-fir and grand fir—both shade-tolerant host species. In addition, the lack of commercial thinnings in true fir or Douglas-fir forest types resulted in many stands becoming overstocked and stagnating in growth.

Fire exclusion Since the early 1900s, wildland fires have been mostly excluded from the Yakama Forest. Fire exclusion has provided favorable conditions for the encroachment of Douglas-fir and grand fir into areas previously occupied predominantly by ponderosa pine and western larch. As a result, stands with high densities of host species have developed over extensive areas.

Weather patterns In addition to management-related factors, outbreaks appear to be cyclical and are often triggered by drought. WSBW larval development is favored by warm and dry conditions in the beginning of the growing season rather than cool and wet conditions.

Potential growth impacts resulting from WSBW defoliation include top kill, diameter and height growth loss, reduced seed production and tree mortality. Defoliation in several consecutive years can result in top kill. Growth loss may occur as a result of decreased photosynthesis in partially defoliated crowns. Susceptible species, including western larch, may not produce viable seed for 4 to 10 years as a result of decreased tree vigor and loss of reproductive buds.

Severe defoliation may cause mortality, primarily in the regeneration and polewood components of forest stands. In areas of heaviest defoliation, mortality can also occur in the dominant and codominant crown classes. The best measure of potential mortality appears to be the percent of total foliage loss; imminent mortality occurs when two-thirds or more of the live crown has been defoliated. Trees that have been defoliated in several consecutive years also become more susceptible to bark beetle attacks.

Chemical and biological insecticide applications are feasible short-term control measures; however, application of insecticides is not a standard practice in the Forest. Biological agents such as B.t. are an option for control of outbreaks. Such applications must be considered short-term components of a long-term strategy for dealing with the problem. Application of B.t. may suppress budworm populations for only one or two years. During this period, certain weather patterns (*e.g.*, wetter or colder) may prevent build up of the budworm population.

Long-term budworm control is achieved through silvicultural practices. The primary objective is to reduce susceptibility of stands to future attacks. The basic strategy is to reduce the host species in the stand, particularly in the understory, and to increase overall stand vigor. Strategic harvest practices include:

Species preference harvesting Non-host species, such as ponderosa pine and western larch, are retained. Regeneration harvests should encourage establishment of non-host serals. In areas of heavy budworm mortality, openings of approximately five acres are planned. If numbers of seed-trees are insufficient, the areas are planted with nonsusceptible species.

Decrease vertical diversity In stands with susceptible species, understory Douglas-fir and grand fir should be removed by thinning from below and regeneration cuts.

b. Douglas-fir Tussock Moth (*Orgyia pseudotsugae*)

Treatments for tussock moths are similar to those for western spruce budworm because both species attack stands of true firs and Douglas-fir (Brookes *et al*. 1978; Wickman *et al*. 1981).

c. Larch Casebearer (*Coleophora laricella*)

Larch casebearers infest western larch and have spread over much of the Yakama Forest. Larch defoliation becomes visible in early summer; some growth losses occur but little mortality results from the defoliation. Larch casebearers are not considered a serious problem, so no specific control measures are planned. In addition, *Agathis pumila*, a larval parasite, has become established from adjacent ownerships where it was introduced as a biological control of larch casebearer.

E. Forest Diseases

1. Root Diseases

Root diseases occur in isolated pockets throughout the Yakama Forest. Root disease symptoms include thin tree crowns, chlorotic needles, reduced leader growth, and distress cone crops, all of which result in a low-vigor appearance. Other indications of root disease include concentric areas of dying trees around stumps, excessive blowdown, and bark beetle attacks. Most root diseases are difficult to manage because the pathogen remains active in infected stumps and roots for many years.

a. Armillaria Root Disease (*Armillaria ostoyae*)

Armillaria ostoyae is an aggressive pathogen on Douglas-fir, true firs, and pines. Most conifer species are moderately to highly susceptible to *Armillaria* spp., so species conversion is not practical; however, short rotations of western larch or ponderosa pine could be an option in infected areas (Shaw and Kile 1991). Intensity of treatment will vary according to the degree of infection and stand conditions. Treatment of heavy infections includes salvage of all infected merchantable trees, with harvest extending 30 feet beyond obviously infected trees.

b. Laminated Root Disease (*Phellinus weirii*)

Douglas-fir, grand fir, and mountain hemlock are highly susceptible to *Phellinus weirii*; western hemlock and subalpine fir are less susceptible. Treatment of laminated root disease includes promoting growth of tolerant or resistant species such as ponderosa pine, western redcedar, and western white pine. Within disease pockets, all susceptible tree species should be removed up to 30 feet beyond those evidently infected.

c. Annosus Root Disease (*Heterobasidion annosum*)

Two strains of *Heterobasidion annosum* occur in western forests—the S strain occurs on spruces, firs, and hemlocks and the P strain typically occurs on pines, but also on S-type hosts. Infection by spores occurs through wounds or fresh cut surfaces of stumps; the fungus spreads through root contact. Damage to residual trees should be minimized during harvest operations to reduce the spread of annosus root disease.

2. Foliage Diseases and Rusts

a. Elytroderma Disease (*Elytroderma deformans*)

Elytroderma disease infects ponderosa pine but has not caused major losses on the Yakama Forest. Infection is favored in areas with high humidity, such as along the edges of meadows or in the bottoms of draws. Mortality is highest in sapling and pole-sized stands. Damage can be reduced by removing infected trees and thinning to increase stand vigor.

b. White Pine Blister Rust (*Cronartium ribicola*)

White pine blister rust infects and kills western white pine and whitebark pine. Total eradication of the alternate host (*Ribes* spp.) is not feasible. Development of resistant strains of western white pine may be the only practical long-term management strategy. Uninfected or lightly infected trees should be retained during harvest operations. These trees may have some degree of natural resistance and should be used as seed-trees for the immediate area. Pruning lower branches can decrease infection rates on western white pine.

c. Commandra Rust (*Cronartium comandrae*)

Commandra rust infects ponderosa pine. The most obvious symptom of this disease is a dead tree top. Mortality is infrequent in mature trees, but infected saplings may be killed. Infected trees should be removed, especially when located near patches of younger trees.

d. Western Gall Rust (*Endocronartium harknessii*)

Western gall rust occasionally causes high amounts of defect in lodgepole pine stands—primarily from the formation of large galls and cankers. Stem infections can kill young trees. Stands should be replaced when the number of uninfected stems falls below the minimum stocking level for the site. Regeneration from uninfected trees should be encouraged because there is considerable variation between trees in natural resistance to infection. Infected young trees should be removed during thinnings.

3. Stem and Branch Diseases

During initial stand entries, stem decays in the old, decadent stands resulted in substantial losses of merchantable volume. Heart rots are rare in young, managed forests because full development of the decay and subsequent breakdown of wood fibers requires extended periods of time.

a. Dwarf Mistletoes (*Arceuthobium* spp.)

Dwarf mistletoes occur in many ponderosa pine, western larch, and Douglas-fir stands on the Yakama Forest. Mistletoes can infect most conifers, reduce growth by 20 to 40%, and kill trees during severe infestations (Scharpf and Parmeter 1978).

Continuous Forest Inventory data indicates that mistletoes are increasing in severity and distribution. Harvest practices that decrease infection sources and maintain or enhance species diversity can reduce mistletoe spread. Group selection methods are used to eliminate infection centers. If conditions warrant, small block harvesting (2 to 5 acres) can be used to manage dwarf mistletoes.

b. Indian Paint (*Echinodontium tinctorium*)

Indian paint infects stressed and injured true firs and hemlocks. Heavily infected overmature stands should be replaced. Partial cutting in these stands is not appropriate because of the

increased potential for injury to the remaining trees. Stands of sapling- to small sawtimber-sized fir and hemlock can be thinned to increase vigor and remove damaged individuals.

A stand is considered a high risk for infection and should be replaced if (1) the trees have been growing at declining rates for more than 50 years, or (2) if trees exist beneath a severely infected overstory. Prompt harvesting of true firs and hemlocks as they reach rotation age (110 years) can minimize volume losses even if infections are present. Trees severely wounded during logging or thinning should be removed.

4. Other Decays

Other decay organisms include Schweinitzii butt rot (*Phaeolus schweinitzii*), red ring rot (*Phellinus pini*), brown trunk rot (*Fomitopsis officinalis*), red rot (*Dichomitus squalens*), and tomentosus root rot (*Inonotus tomentosus*). In general, these decays are most common in decadent old-growth stands and young vigorous stands are much less susceptible. Management practices that increase stand vigor and decrease logging injuries will minimize losses from these fungi.

Trespass

Trespass, as defined in 25 CFR §§163.1 and 163.29, is the removal of forest products from, or damaging forest products on, Indian forest land, except when authorized by law and applicable federal or tribal regulations. Trespass can include any damage to forest resources on Indian forest land resulting from activities under contracts or permits or from fire. The Indian Affairs Manual, Part 53, Chapter 7, released October 15, 2003, documents the policies, standards, and responsibilities for protecting all forest resources on Indian lands from trespass. Further guidance is available from handbooks, directives, and other guides as may be issued and revised to provide procedural guidance. The Indian Forest Management Handbook, Volume 7, titled "Forest Products Trespass," (currently in draft stage and under review) is intended to provide detailed process and procedural guidance for investigation, reporting, demand of payment, and referral for prosecution.

Thorough and aggressive forest and range management measures will continue to be used to prevent trespass incidents. Patrol of the forested areas by forestry and law enforcement personnel, timely action processing trespass cases and, if necessary, news articles in the local newspapers educating people provide a strong deterrent to would-be trespassers. Consequently, most trespass action is inadvertent, or unintentional, and is not likely to be repeated.

Timber trespass is usually the result of an erroneous boundary, usually involving a large local corporation or Washington State, and usually results in excellent cooperation when it comes time to settle. With most private lands on the reservation being purchased by the Yakama Nation, the probability of this type of trespass is becoming less. Occasionally, a small operator will trespass by not hiring a competent surveyor to locate property boundaries. This has mainly happened in the Public Domain area. Collections are made as soon as possible after the trespass discovery. Overall, expedient action and public education are the strongest deterrents to trespass.

Emergency Rehabilitation

In the event of a large disturbance of soil or ground cover, and a subsequent determination that natural recovery processes will be inadequate for a timely rehabilitation, an emergency plan will be developed in cooperation with an Interdisciplinary Team in the following manner:

Fire Rehabilitation: A site-specific plan will be developed for a burned area in accordance with the DOI Burned Area Emergency Rehabilitation (BAER) Handbook and IAM 90. BAER funding will be requested through the BIA Northwest Regional Office.

Other Natural Event Rehabilitation: A plan will be developed utilizing multiple resource specialists. The plan may include phased recovery planning over an extended period, with initial emphasis on mitigation or damage to the most sensitive resource at risk. Funding will be established through multiple sources, including a request for extraordinary appropriations.

Land Acquisition: The Yakama Land Enterprise

The Yakama Land Enterprise was created in 1950 by Tribal Resolution to buy, sell, manage, and improve reservation lands in the interest of the Yakama Nation. The Yakama Land Enterprise program is self-supporting, and is dependent upon income derived primarily from leasing and sales of timber from land purchased by the Enterprise.

The Yakama Branch of Forestry will continue to assist Yakama Land Enterprise by providing personnel and services for cruises to determine volume and values of timber on potential purchases, and accounting for receipts of timber sold from Land Enterprise tracts by maintaining a separate ownership record.

Timber Management Program Implementation Plan

I. Tribal Ordinances and Standards

Timber management is conducted in accordance with the objectives of the Yakama Nation and the directions provided by the Yakama Tribal Council. Ordinances and standards include the Water Code, Hydraulic Code, Zoning Regulations, and the Land and Natural Resources Policies Plan.

II. Silvicultural Objectives

A. General

Silviculture is the science, art, and practice of managing establishment, composition, structure, growth, health, and quality of forests and woodlands on a sustainable basis to meet landowner objectives.

Silvicultural prescriptions are prepared for the management plan and each individual project. Management-plan prescriptions are prepared for broad portions of the forest. These prescriptions set management guidelines for the project-level prescriptions. Project-level

prescriptions, along with an implementation and quality control guide, are prepared after the analysis of site-specific stand exams.

Silvicultural prescriptions must incorporate the multiple demands on the forest, as expressed in the FMP's goals and objectives. Since commercial timber sales began in the 1940s, the Yakama tribal leadership has established a style of multiple-use management that incorporates specific Yakama values.

Uneven-aged management is the preferred silvicultural system. Some of the specific tribal desires that are incorporated into current silvicultural practices include the following:

- Maintain the long-term ecosystem productivity and function.
- Although the Yakama Nation depends on the forest for annual income, management decisions will not to be based on monetary values alone. All values of the forest are to be considered during all levels of the decision-making process.
- Maintain a natural appearance in the forest.
- Maintain large-diameter trees.
- Maintain stands that contain diversity in species, size class, and structure.
- Limit the size of created openings.

In addition to policy considerations, prescriptions take into account the biological potential and environmental limitations of the site. Information utilized includes forest habitat types, fire ecology, previous management practices, successional theory, insect and disease relations, and present stand conditions. The Yakama Forest is an extremely complex ecosystem influenced by many environmental gradients including elevation, aspect, moisture, historical and present management practices, natural disturbances, and other factors described in Chapter III.

Timber harvests include a mix of single-tree, group selection, and small patch cutting practices that produce uneven-aged structures. Adaptive management practices are used to decrease tree density, increase seral species composition, address insect and disease problems, optimize current growing stock, and move the stands toward regulation. For these reasons, the Branch of Forestry requires highly qualified technical and professional staff at the ranger stations to implement prescriptions.

B. Issues and Concerns

1. Reducing Timber Stand Risk and Improving Health

The primary objective of all project prescriptions is to maintain or improve stand health. Through decades of uneven-age management, the Branch of Forestry has developed a tremendous working knowledge regarding effective forest practices. The Branch of Forestry will maintain or improve stand health by managing stand density, species composition, insects and diseases, and replacing unhealthy stands.

2. Maintaining or Improving Stand Diversity

Stand diversity is another objective of all project prescriptions. Forest diversity will be promoted by using the selection method of harvesting. Practices will include single-tree, group selection, and patch cuts distributed throughout the commercial forest. Current areas of large homogeneous stand conditions will be restructured with the creation of small openings to promote the establishment of new size classes.

3. Future Stand Appearance and Products

The desired future forest will be uneven-aged with large-diameter trees distributed across the landscape. Structures will include mosaics of single-, two-, and multi-storied stands. All species, age classes, and size classes will be represented; however, seral species will dominate all size classes. Management will be multiple resource oriented, using an interdisciplinary process. Timber products will focus on sawlogs and other fiber products for both domestic and export markets.

4. Soil Productivity

Soil productivity will be maintained through preventive and mitigation measures discussed in the Management Directions and Best Management Practices. In addition, the Branch of Forestry, as well as other resource departments, will conduct field monitoring and facilitate compliance.

The Branch of Forestry recognizes that management activities will have some level of negative impact to soil; however, proper planning and implementation should minimize negative impacts. For example, properly engineered roads and skidding patterns should minimize soil erosion. Standard water barring, closeout, and seeding of erosion prone areas should stabilize sites. Designation of skid trails and seasonal constraints on certain activities should minimize soil compaction.

Nutrient cycling should be promoted by allowing shrub and forb communities to dominate sites for periods after stand replacement and by retaining logging slash and cull material. Currently, fire exclusion has allowed woody material to accumulate to uncharacteristically high levels.

5. Snag Guidelines

Snag retention will be coordinated with the Wildlife Resources Management program. Recommendations for snags are in the Wildlife Management Directions in Chapter V. Intentional snag creation in areas deficient of snags may be considered.

6. Prescribed Burning Plans

Much has been learned over the past several decades about the need to reintroduce fire in frequent-fire forest ecosystems. Many of the current stand health problems can be attributed to the exclusion of fire. Prescribed burning can be used to reduce vegetation competition and fuel loading.

7. Planting

Uneven-aged prescriptions can promote natural regeneration in many areas; however, planting is being done more often to ensure establishment of desired species in adequate numbers and at desired spacings.

8. Precommercial Thinning

Successful uneven-aged management must include management of all size classes, including seedlings, saplings, and poles. These smaller size classes represent the future larger size classes and must include the proper number and species of healthy, fast-growing, insect- and disease-free, crop-tree quality seedling, saplings, and poles. Precommercial thinning is aimed at managing the density and spacing of the saplings and poles.

9. Clearcut Size Limits

Use of clearcutting to replace stands will be minimal. Clearcutting should be viewed as creating an environment favorable for shade-intolerant species, and as a treatment of some insect and disease problems. Clearcuts are areas where all trees, both commercial and precommercial size, are removed in blocks five acres and larger. In contrast, patch cuts are openings of two to five acres and group cuts are openings one half to two acres in size.

The Branch of Forestry will use even-aged practices, such as seed-tree and shelterwood methods, to convert decadent, mature stands to thrifty, young stands. Clearcutting will be primarily applicable in lodgepole pine and true fir-mountain hemlock forest types. Intermediate treatments for large blocks of even-aged stands will include commercial thinning.

Generally, clearcut units will not exceed five acres; however, units up to twenty acres in size may be prescribed by the Silviculture Unit where clearcutting would result in beneficial ground-warming and stimulation of shrub growth. The preferred regeneration method will be seed-tree cutting, using long-lived serals such as western larch. Seed trees may be retained on the site indefinitely or removed on the next entry cycle (in 15 to 20 years) if regeneration is adequate.

10. Future Plans for True Fir-Mountain Hemlock and Lodgepole Pine Types

If timber production is the primary resource goal on these sites, then stands dominated by hemlock and subalpine fir should be converted to early successional species. Therefore, most of the unreserved true fir timber types will be converted to a mosaic of small, even-aged stands of serals dominated by lodgepole pine.

Lodgepole pine stands will be managed on an even-aged basis with 80- to 100-year rotations. Longer-lived serals, such as Douglas-fir and western larch, will be retained throughout entire rotations, increasing their presence on these sites through seed production.

11. Stratification of Prescriptions

Timber sales are stratified into areas based on landforms, timber types, forest habitat types, insect and disease problems, management considerations, and other variables. Prescriptions consist of four main components:

- diagnoses that include stand exam data analyses, site visits by the silviculture staff, air photo interpretation, research of historical records, and the development of alternatives;
- prescriptions that describe in detail the harvest practices to be applied to each strata of the sale;
- descriptions of associated follow-up treatments, scheduling of these treatments, and special interdisciplinary concerns; and
- implementation guidelines for the field staff.

The entire silvicultural process functions within the established framework of the forest management plan. Prescriptions are not stand specific, so the acre-by-acre implementation of the prescription is the responsibility of the ranger station staff.

Responsibilities of the ranger station staff require increased silvicultural training. Currently, in-house formal and informal sessions, off-reservation training, and graduate programs meet these needs. More detailed prescriptions will require additional personnel in the Silviculture Unit.

12. Protection of Wildlife and Habitat

Wildlife concerns will be met by a combination of silvicultural practices and contract considerations, as directed by the management plan and identified in the IDT process. Buffer strips, seasonal considerations, road closure, and modified prescriptions will all be implemented on a case-by-case basis. Many of the requirements will be met by using uneven-aged practices. Wildlife Management Directions are in Chapter V.

13. Protection and Enhancement of Traditional Foods and Medicines

Traditional foods and medicines have been protected or enhanced by buffering environments where these plants exist. The Branch of Forestry has limited knowledge on the size or locations of plant populations, the ecology of these populations, or the impact of present land management practices on these resources. The Cultural Resource Program provides guidelines for protecting this valuable resource on individual timber sales.

14. Protection of Fish Habitat

Fish habitat will largely be protected through vegetative buffers along streams and development of acceptable roads and skid trails. In some cases, existing roads, bridges, and culverts are detrimental to fish habitat or water quality and will be removed or replaced.

Special projects will be identified in the IDT process. Long-term protection of watershed values may require limited management in vegetative buffers to reduce the risk of extensive stand dieback and large, damaging fires.

15. Protection of Meadows

Drying of meadows is a complex issue with many possible causes and management implications. Meadows may dry out because of erosion, overgrazing, prolonged drought, or fire exclusion. Ponderosa pine and lodgepole pine are early-successional species that become established in areas that receive full sunlight. Historically, frequent, low-intensity fires removed tree seedlings from meadows. Fire exclusion, however, has allowed seedlings to become established in meadows. Additionally, gullies can lower water tables and dry out meadows allowing pine seedlings to become established.

Changes in forest structure, and species mix can also influence water tables. Living trees function as water pumps, transferring water from the soil into the air through transpiration. Stands dominated by young, dense, late-successional species transpire more water than stands thinned and maintained by fire. Water tables will continue to be lowered as dense stands of climax species mature. Continued thinning and the reintroduction of fire should maintain meadows and increase water yield.

C. Silvicultural Prescriptions

1. Forest Management Plan Prescriptions

The Branch of Forestry developed management-plan prescriptions for the major forest habitat types in the Yakama Forest. In addition, prescriptions are tailored to timber types and management emphasis areas.

Prescriptions represent the regulated target stand condition at the beginning of the cutting cycle (immediately after stand treatments). They are developed as uneven-aged prescriptions using a q-factor, which results in an inverse-J diameter distribution. Average target conditions for management emphasis areas within forest habitat types, not of individual acres, are reflected in the prescriptions. Individual acres will include mosaics of small, even-aged groups with different stand conditions. Prescription density levels represent the average target for each management emphasis area, which will maintain full stocking after harvest, avoid stressful overstocking prior to the next harvest, and meet the management objectives of the area.

2. Project-Level Prescriptions

Management-plan prescriptions were developed for habitat types. Within the habitat types, however, there is a wide range of productivity. Site-specific stocking levels will be developed during the prescription process for individual logging units. Project-level prescriptions are not anticipated to vary greatly from these average targets. The management-plan prescriptions may be altered to better meet the primary objective of a management area on a specific project site. A

long-term goal for the Silviculture Unit includes the development of a silviculture handbook that will document the full range of prescriptions for the Yakama Forest.

Succession has been accelerated in some stands by fire exclusion and selective harvesting. Thus, true fir - mountain hemlock and mixed conifer timber types have increased, and ponderosa pine and pine-fir timber types have decreased. The possible negative consequences of allowing forest succession to occur include higher levels of insect and disease problems and increased fire danger. For these reasons, project-level prescriptions will strive to establish and maintain early successional species.

3. Prescription Parameters

The silvicultural prescription parameters used in the Forest Management Plan are described in Chapter III.

Harvest practices will be guided by both preventative and sanitation stand treatments to promote and maintain forest health. No diameter-limit harvest will be applied (no trees will be harvested strictly because they are above the targeted diameter). The general objective is to retain large-diameter, healthy seral species. As density is reduced, competition-related stress will decrease, allowing for the retention of large serals. These trees tend to be windfirm, seed producing, fire safe, and aesthetically pleasing. Consequently, the bulk of the harvest during the planning cycle will consist of commercial thinning, sanitation, salvage, and grand fir reduction.

III. Harvest Schedule

A. Scheduling

Scheduling of timber sales is based upon a number of factors including the approved level of harvesting, stand conditions, cumulative effects, and the number of years since the last entry. Timber sales are initially scheduled for the entire planning period and then reassessed annually to provide flexibility in addressing market and forest conditions.

B. Approved Harvest Level

Total planning period volumes may not be scheduled in excess of the approved total allowable cut for the planning period. Events during the planning period, however, may require harvesting at a level outside of the cutting budget. Guidelines for these departures include (1) overcutting in excess of 15 percent above the approved allowable annual cut (AAC) may be allowed for no more than two successive years, and (2) undercut volume may be harvested in succeeding years, except corrections for undercutting by 50% or more of the yearly AAC must be spread over three years.

C. Financial Returns

Inherent in the timber sale program is the obligation to provide reasonable economic returns to the Yakama Nation, Yakama Nation Land Enterprise, and allottees.

The harvest schedule should provide a reliable, steady flow of annual income to each ownership. Sound economic planning, such as marketing a mixture of species, with associated varying stumpage rates, is utilized in the development of harvests. There should also be sales within the planning period that may be used to take advantage of unexpected markets.

D. Stand Conditions

Unscheduled timber sales may be designed to specifically target extraordinary events, such as salvage of fire-damaged timber, or severe outbreaks of insects or diseases. A related complication is the value of the resource at risk. Biologically, an overmature lodgepole pine stand, for example, with multiple active pests may rank ahead of a young, otherwise relatively healthy stand of overstocked ponderosa pine. The value of the predicted results following stand treatment, however, may favor a reversal of that ranking.

Stand condition factors utilized in schedule ranking are in general weighted by the predicted severity of the adverse effects of the conditions, and the potential for improvement as a result of treatment.

E. Cumulative Effects

Timber sales should not be considered as stand-alone actions. Results of the activity are generally cumulative, and may be positive, such as a series of timber sales to address a particularly widespread problem, or negative, such as the combined disturbances to wildlife or watersheds created by multiple, adjacent timber sales.

In general, scheduled harvest locations will consider, and seek to mitigate through consultation with other resource managers, the cumulative impacts of all active sales, including disturbance factors, watersheds, and road use. More information on cumulative effects can be found in the Environmental Assessment for this Forest Management Plan.

F. Number of Years Since Previous Entry

It has been estimated that at least 12 years are required between entries for stabilization of an area; consequently, time since last entry will be used in timber sale scheduling.

G. Harvest Schedule

The timber harvest schedule is shown in Table IV-2.

IV. Harvest Policy

The harvest policy details timber sale objectives and practices for the unreserved areas of the Yakama Forest.

A. Administrative Objectives

A typical timber sale will contain a target net harvest volume of 20 to 40 MMBF, with a logging duration of two to four years. Variations may occur to accommodate special stand or market conditions, or to encompass a more reasonable geographic area.

Proposed timber sales will be located within the commercial timber types in all areas of the Yakama Forest except the Primitive Area and Tract D Recreation Area. Forest stand conditions will be monitored in all areas. If a problem is identified that is of sufficient severity that multiple resources will be negatively impacted, a stand-specific prescription may be implemented to mitigate the condition.

B. Procedures

Harvest schedules will be prepared in accordance with the Indian Affairs Manual, with yearly updating. The Geographic Information System will be used to locate and quantify the scheduled units.

The Sale Proposal, Appraisal, Forest Officer's Report, and other pertinent documents are developed during the sale planning phase. Sale Planning will incorporate integrated resource input. Resource information will be summarized in the draft sale plan. Boundaries, special logging requirements, transportation needs, and other sale specific provisions will be identified during this process.

Harvest unit guidelines relative to size and location will be formulated during the planning phase. The silvicultural prescription will provide technical direction for implementation of those guidelines. Sale Layout will include on-the-ground location of restricted logging areas, cable yarding, or special harvest units, and roads and associated structures.

In accordance with B8.1 of the Timber Sale Contract Standard Provisions, the Purchaser will be required to present an annual logging plan before logging operations begin. The logging plan will include at least the following information:

- A schedule showing the order in which logging will occur.
- A commitment to flag landings and skid trails at least five working days in advance of the falling crew.
- A pledge of road maintenance responsibilities.
- Log control procedures, including haul routes, scale sites, and instructions for receipt and use of truck tickets.

C. Product Size and Merchantability Standards

1. Sawlogs

Trees designated for cutting must have at least two minimum-size products per tree according to the following minimum specifications:

- Length: 8 feet
- Scaling Diameter: 5.5 inches
- Net Scale: 33 1/3 percent of gross scale[1]
- Net Scale: 10 board feet

[1] Minimum specifications are computed on actual log length for all logs 20 feet or less in length, and on the length of the scaling segment for all logs longer than 20 feet. Logs from marked western larch snags which are 50 percent or more defective, will be considered cull and, therefore, will not be waste scaled when left on the sale area; however, if removed from the logging unit such logs will be scaled for sound content using merchantability standards as specified above.

2. Woodlogs

Woodlogs are defined as all logs meeting product specifications as set forth above, but more defective, i.e., the net scale is less than 33.3 percent of gross scale. Removal of woodlogs is subject to approval by the Officer-in-Charge.

3. Other Wood Products

Other wood products are defined as all species wood products not meeting sawlog or woodlog product specifications. Removal of these products is subject to approval by the Officer-in-Charge. Woodlogs and other wood products specifications will include gross scale to the nearest foot. In order to maintain enough large woody debris, woodlog removal will not be allowed in some areas. See the Wildlife Resource section for snag guidelines.

D. Timber Market

The Yakama Tribal Council approved by Resolution the sale of all timber sales to Yakama Forest Products in White Swan.

E. Roads

1. Access Roads

From 1950 to 1980 the Branch of Forestry emphasized construction of access roads in the Yakama Forest. Consequently, most of the permanent access roads necessary for forest management are in place. Some additional permanent roads will still be needed in new timber sales. Future road construction will be mostly limited to improving existing facilities that will provide a few primary collector routes and a minimum number of low-speed, low-standard, low-impact connecting routes. Location and construction of roads, whether by contractor or forestry personnel, is subject to IDT and Branch of Forestry review to minimize potential environmental damages.

Principle access routes were maintained by the Branch of Roads until 1992. Roads are now maintained by YN DNR Forest Roads Maintenance Crew. During an active timber sale, however, the purchaser is required to perform routine maintenance and improvement.

Several roads provide access into the Closed Area without passing a guard gate. Accordingly, the Yakama Nation is concerned about trespass into the Closed Area, and associated illegal activities such as firewood gathering, cattle rustling, game and fish poaching, and timber theft. Prevention and prosecution of these activities will primarily be the jurisdiction of YN Law and Order. Timber theft will also be dealt with by the Branch of Forestry and is discussed in the Trespass section of the Harvest Policy.

Gate guards and patrols limit access. Additionally, the Branch of Forestry can discourage trespass by closing roads or including the following in road design: grass seeding, allowing vegetation to overgrow roadbed and edges, or surfacing with large-sized gravel.

2. Logging Roads

a. Need

Roads are essential for all aspects of natural resource management, development of facilities and improvements, livestock management in forested areas, and traditional activities. An effective and well-established transportation system requires a continuing program of inventory, analysis, and planning to provide for current and future needs.

The YN has established the following goals for the Branch of Forestry for logging systems and associated roads:

- Minimize adverse environmental impacts
- Minimize costs of road construction and maintenance
- Provide access for management, protection, and use
- Minimize total miles of forest roads
- Integrate tribal concerns into transportation system planning
- Provide adequate safety designs.

b. Planned Activities

Inventory and maintenance will be the core of road-related projects proposed over the planning period. Implementation of these projects will be subject to funding and tribal desires. Road standards will continue to be developed over the planning period, subject to approval by the Tribal Council.

Much of the Yakama Forest is now roaded. Accordingly, activities will focus on road maintenance, including repair and improvement. However, road maintenance will be reduced on unneeded roads. In general, new permanent type roads (collectors) will not be built, except to relocate or improve existing roads. Most new roads will be spurs.

(1) Inventory

The Branch of Forestry is inventorying all forest roads and the following data will be entered into GIS:

- Road numbering relative to location (Township, Range, and Section) or old federal system numbers
- Total length of road within a section
- Width
- Logging unit
- Current condition (open, closed, drainage structures)
- Location and names of streams crossed
- Surface.

(2) Maintenance

The amount of use and associated wear on the roads has increased substantially from historical levels. Proper maintenance would require three times the current levels of staffing and funding. Proposed projects, subject to funding, will include the following:

- Increase bridge maintenance for public safety and log hauling needs
- Resurface surfaced roads and repair unsurfaced roads
- Repair the two paved roads within the Yakama Forest—Signal Peak Road and Potato Hill Road
- Blade roads for a smooth running surface
- Maintain or improve road surfaces lost to erosion
- Remove shrubs and seedlings that become established on needed roads
- Clear ditches of vegetation and slide material
- Maintain road-drainage structures including culvert, ditch, lead into the ditch, catch basin, and culvert outfall to undisturbed ground
- Dust abatement on some roads with multiple users
- Remove snow when feasible on primary winter routes (e.g., Signal Peak, Klickitat River, Vessey Springs, and Brush Creek Roads) and roads that access root grounds in the spring (e.g., Dry Logy, Oak Springs, and Wilson Charley Canyon Roads).

c. Location

Location of forest roads is an important element considered prior to construction. Road location is constrained by the geologic and topographic features of the landscape. The Branch of Forestry considers multiple-resource impacts, technical site information, and experience in road design and layout.

(1) Classification

Roads include the following classes:

- Class I-III: High standard, designed roads meeting standards set by the Bureau of Indian Affairs, Northwest Regional Office.
- Class IV-A: Low-standard, designed roads meeting standards developed by the Yakama Agency Branch of Forestry.

- Class IV: Low-standard, undesigned, forestry roads.

Roads are also classified by type: arterials, collectors, and spurs. Arterials allow sedans to travel at high speed (45 to 50 mph). Collectors connect arterials and are used by sedans. Spurs are roads to individual landings that a sedan would not generally be able to use.

(2) Corrective Action

In the past, roads were designed, located, and constructed to provide the cheapest access for existing logging systems. As a result some roads were located in streamside zones. Some roads may be considered for relocation. Relocations will occur where road maintenance costs are higher than relocation costs. Roads will be relocated away from forest meadows.

(3) Future

As logging patterns and technology change, some landing areas and roads may need to be relocated. Future road locations will continue to incorporate needs of all natural resources. In addition, logging technology continues to increase the levels of mitigation that are now feasible. The Branch of Forestry will develop a new road numbering system and will use Yakama names.

d. Construction

The Branch of Forestry will issue written instructions for constructing Class III and IV-A roads. Operators will include plans for lower class roads in annual logging plans. To ensure environmental protection, plans will include information on equipment and season of work. Additionally, the Branch of Forestry will inspect and supervise road building for compliance with design and location specifications.

(1) General Guidelines

- Clear drainages of debris
- Stabilize sensitive areas by seeding, placing ballast rock, compacting, or other suitable means
- Stream crossings should have minimum disturbance to banks and existing channels
- Install drainage features during pioneer stages
- Restrict clearing widths to minimum required
- Describe road right-of-way slash cleanup in plans, including extent, location, and method.

(2) Design

Class III and IV-A standard roads provide access to management units. These roads will be designed by the Forest Engineer in accordance with Northwest Regional Area and Yakama Agency guidelines. The detail of information required for planning will be adjusted to suit project needs and sensitivity of terrain. All plans, however, will consider the following:

- Tribal concerns
- Management Emphasis Area goals

- Intent and duration of present and future use
- Topography, soils, timber, and stream courses
- Land ownership, permits, easements, etc.
- Proposed logging systems
- Current area road locations and condition
- Location of cultural resources, such as foods and medicines.

(3) Specifications

Following design approval, Class III and IV-A roads will be staked to provide control. Lower class roads will be field located by forestry staff or contractor. Approval to construct will be the responsibility of the Officer-in-Charge. Construction of lower class roads may be concurrent with location, provided Agency and project guidelines are followed. In addition to specific project guidelines, all designs will consider the following:

- Fit the road to the terrain to provide minimum alteration or impact to soil, vegetation, and water features. Avoid sensitive or unstable areas.
- Avoid duplication of other road systems. Old, poorly-designed, or poorly-located roads may be closed and rehabilitated and new access provided with approval by the Forest Engineer.
- Spurs will have a 16' running width (from inside ditch edge to inside ditch edge) and curves designed for less than 15 mph maximum speed
- Collectors will have a 22' running width and curves designed for 25 mph maximum speed
- Arterials will have a 28' running width and curves designed for 45-50 mph maximum speed.
- Additional standards of width, curvature, grade, and drainage features are provided in various Bureau manuals and local guidelines, on file at the Branch of Forestry.
- Grades will not accelerate runoff or erosion—maximum grades include 12% for a spur and 8% for a collector
- Collector standards will include surfacing
- Adequate drainage structures will be installed that carry both water and debris flows on a 100-year flow basis
- Drainage structures are not to impede fish passage

During construction:

- Construction will be no wider than necessary
- Side-cast will be end-hauled where practical
- Excavators will be used to cut the road prism out of side hills when necessary.

(4) Clearing

The clearing of rights-of-way for roads will be limited to only that vegetation necessary to allow unencumbered construction of the road itself.

(5) Culverts

Culverts of adequate size are required on all live stream crossings. Lack of adequate debris passage is the primary cause of culvert failure. This problem is being addressed with the replacement of undersized culverts. General guidelines for culvert installation include the following:

- Road building and culvert installation will be done in a manner that avoids constricting the flow of a stream
- Natural bottoms (rocks, sand, etc.) will be used inside the culvert
- The bottom of the culvert (invert grade) will be lower than the channel
- Culverts will be laid level to the extent possible.

Downstream scouring by culverts will be avoided with the following guidelines:

- Size culverts for conditions on the site
- Provide for adequate channel width through the culvert during high water flow
- Use bridges for wider channels.

(6) Drainage

All drainage feature components should be maintained by YN Roads and the Branch of Forestry. Culverts will be installed every 50' elevation change (not to exceed 0.2 tenths of a mile) or at every sag point in the ditch line.

Past construction has located some roads in narrow flood plains. This caused increased velocity during high water flows, resulting in road washouts. Solutions will include relocating a road or elevating a road above the stream.

(7) Surfacing

Primarily arterials, collectors, and roads close to stream areas will be rocked. Most sediment that is delivered to streams comes from unsurfaced roads (no gravel). To mitigate for sediments' negative impact to water quality, gravel will be used on the roads. Armoring ditches will also decrease sediment deliveries to streams.

The correct mix of mitigation measures will be determined on a sale-by-sale basis, taking into account economic and environmental factors. Other measures to be taken beyond surfacing that will maintain water quality include the following:

- Avoid construction in areas with potential drainage problems or where there are serious impacts to other resources
- Provide for water flow that does not increase sediment loading down stream with appropriate culverts.

e. Maintenance Specifications

Funding is the primary limit on the level of road maintenance that can be accomplished. The United States Forest Service manual, "Road Maintenance of Roads in Timber Sales" (Pacific Northwest Region Em 7730-20 7/91) will be used for maintenance specifications on the Yakama Forest. It is planned to eventually have a road specification sheet for each timber sale.

The maintenance program should be guided by an annual condition survey. Priorities for maintenance will be safety, prevention of environmental damage, and preservation of use. Travel speed and comfort will be considerations only in heavy use areas.

Maintenance associated with active timber sales will be performed by the purchaser. YN DNR Roads will be involved in maintaining other road systems. Guidelines used will follow instructions supplied by the Forest Engineer, Branch of Forestry, and YN DNR Roads.

Stabilization methods will normally be limited to vegetation and mulch. Lignin or other surface stabilizers will not be used without adequate environmental protection measures. The use of water for road maintenance is discussed in the Special Resources Protection section of the Harvest Policy.

f. Road Closure

Many factors must be considered before temporary or permanent closure decisions are made. Reasons for closing roads are to:

- minimize erosion of road surfaces and sideslopes
- protect archaeological sites
- reduce the risk of human-caused fires
- minimize wildlife disturbance
- discourage trespass
- reduce maintenance costs.

Unsurfaced open roads are a primary source of stream sediment. Since surfacing costs may be prohibitive on some roads, closure of the road may be a viable alternative. Access controls will be utilized when necessary to provide safety and to protect transportation facilities and the environment from damage. These controls may limit the timing, length, or type of use. Limits on vehicle size or weight will be set by the Branch of Roads with input from the YN DNR Roads. Temporary or permanent road closures will be administered by the Branch of Forestry.

Methods used for road closures will include one or several of the following:

- Earth or rock barriers
- Ripping
- Revegetation
- Drainage structure removal
- Cross-ditching, water barring.

Rehabilitation for permanently closed roads will include the above methods plus restoring the natural slope across the roadway.

(1) No Closure

Current arterials will not be closed. These roads receive sufficient use or satisfy an overriding need for continued use, such as resource management or protection to justify continued maintenance.

(2) Temporary Closure

Temporary closures can be enforced on an "as needed" basis, and normally require no extended roadwork and only limited additional construction of structures such as entrance barriers. These roads will be reopened when sales reoccur in the area.

(3) Permanent Closure

Roads that have been determined to have a continuing negative impact on the natural resources will be permanently closed to all motor vehicles. Examples include closures of unused roads that have been relocated and spurs that are no longer appropriate with current logging technology.

(4) Selection Criteria

The timber contract purchaser, BIA Fire Management, YN DNR Roads, and Forest Development will implement road closures. Closures will be accomplished on a sale-by-sale basis. Road density guidelines will vary depending on terrain and habitat. Administrative access will be considered for sale follow-up and fire control. Yakama tribal member access for firewood, hunting, and salting will also be considered in the decision-making process for road closure.

g. Processing Rights-of-Way

In the process of obtaining permission to cut allotted timber, an agreement is secured for the construction of roads required for harvest of the timber. While construction of any substantial mileage of permanent access roads is not expected, should such roads develop, care will be taken to formalize the right-of-way prior to the expiration of the sale. Roads that are desired for permanent access and maintenance by the YN DNR will be constructed to appropriate standards. Right-of-way agreements will be made before such roads will be accepted onto the YN maintenance system.

F. Falling and Bucking Standards

Trees will not be felled outside of unit boundaries or into regeneration unless this restriction would cause undue breakage or a hazardous situation. Trees in Safety Corridors that create a safety hazard to humans will be felled. Trees will be felled in a manner to have the least impact on all resources.

Bucking will be done to maximize utilization and stay within merchantability standards. Trees will be felled away from thickets of young trees. Trees will be "felled-to-lead" to facilitate skidding.

Notwithstanding the provisions of Section B5.1 of the Standard Provisions, the mean height of any stump will not exceed 12 inches, except that where this height is considered to be impractical, higher stumps may be authorized by the Officer-in-Charge. All other provisions of Section B5.1 remain unchanged.

Trees outside cutting unit boundaries that cause a hazard to personnel in the unit may be felled when approved by the Officer-in-Charge. Hazardous trees along primary public transportation routes may be felled with the approval of the Officer-in-Charge. When felling trees within a buffer strip, care will be taken to minimize damage to the residual trees. Trees will be felled away from the resource being protected.

Felling will be done to minimize breakage (e.g., avoid rocks and stumps). Under certain circumstances, stage falling may be required to protect residual stands, reduce breakage, and reduce overall skidding damage. Hangup trees will be reported for immediate skidding.

When removal of a bearing tree or reference tree is required (such as a safety hazard), cuts will be above the scribing or tags to preserve the information. The Forest Engineering unit will be notified ahead of time whenever possible.

Falling will be far enough ahead of skidding (1-2 days) to prevent dangerous situations, yet not too far to create a situation where a notable degradation in log quality or value could result.

G. Yarding Methods and Restrictions

Skidding equipment will be required to stay on designated skid trails. The use of skidding arcs, grapples, dozer blades, yarding equipment, tree-length or log-length skidding methods shall be regulated by the Officer-in-Charge. Restrictions in regard to size or kind of yarding equipment and methods will be specified by timber type or stand condition in the annual logging plan to minimize soil compaction and damage to residual timber.

The use of feller-bunchers on Yakama Reservation timber sales will be restricted according to the “Interim Policy Statement, Mechanized Feller-Buncher Operation Guidelines—July 1, 1990” governing their use. This policy will be periodically reviewed by forestry staff, soils staff, policy makers, purchasers, and changes implemented when necessary.

Skid trails will be laid out with a minimum width between trails, usually two chains. The minimum width will vary with stand timber size and terrain. Skid trails will be planned to efficiently and permanently access harvest areas. Existing skid trails will be utilized to the extent that they are capable of fitting into a permanent transportation system. All primary skid trails are to be designated and approved prior to use.

Line-pulling will be required year-round on all areas with sensitive soils, and on other areas where moist soil conditions warrant. Special soil restrictions will be listed in the timber sale description.

A reusable skid trail system will be developed and maintained. Skidding distances will generally not exceed 1500 feet. Skid trails and landings will be stabilized whenever they are subject to erosion. This is to be accomplished by water barring, seeding, or other means immediately following completion of operations. Stabilization may also be required on seasonal shut downs.

For restored skid trails located on slopes over 10 percent, drainage features will be constructed to distribute runoff over undisturbed areas. All landings are to be designed and approved prior to any harvest activity. Permanent landings will be planned to serve multiple units. Existing landings will be reused whenever possible.

All terrain over 30 percent slope will be considered for cable yarding methods. All extended terrain over 35 percent slope will be cable or helicopter logged. Cable yarding will be considered on all ground, independent of slope, where soils are either fragile, highly compactable, shallow, or poorly developed. Alternative methods include low ground pressure torsion sprung forwarders or helicopters.

Cable yarding methods will be considered in riparian zones and other areas of high ground water. Yarding will not cross perennial or flowing intermittent streams, except on a case-by-case basis through consultation with the YN Fisheries program. Most crossings will be located in stable areas at a right angle to the stream channel. Winter yarding will continue to be utilized on snow or frozen ground whenever possible to provide for resource protection.

The following guidelines will be implemented when skyline yarding:

- Except in lateral yarding, the yarding system must keep one end of the log suspended above the ground during inhaul. All yarding across perennial and intermittent streams will be done with the logs suspended free of the ground.
- Usually, no more than 3 corridors will be allowed to terminate at any one landing site.
- Initially, make skyline corridors as narrow as practical with the width of the corridor being only wide enough to allow free passage of the carriage and the turn of logs. The corridors will not exceed 12 feet in width after cable yarding has been completed. All severely damaged rub-trees will be cut and removed.
- Location of corridors will be agreed upon prior to felling.
- No felling until adjacent corridors have been approved by the Officer-in-Charge.
- Corridors may not be constructed closer than 125 feet and no more than 200 feet from each other except where more than one corridor terminates at a landing site.
- Guy lines should generally be attached to stumps, but when tail blocks, corner blocks, or guy lines are attached to live standing leave trees, either nylon straps, or similar protective devices shall be used to protect the trees.
- Except where required by stand conditions or terrain, tail blocks or tail holds should not be located more than 250 feet from an adjacent corridor.

- The carriage must provide a means of pulling slack and be able to maintain a fixed position on the skyline during lateral yarding.
- Individual timber sales will have a minimum external yarding capability distance specified in the contract.
- Skyline corridors for fan-shaped settings may be permitted where parallel corridors cannot be used.
- The purchaser will be responsible for ensuring that all running lines are free of debris that might result in fire from friction. All operating lines and running blocks will be suspended above the ground and clear of logging debris and snags during periods of high fire hazard when designated by the Officer-in-Charge. Excluded from the above requirements will be chokers, carriage tag lines, tower guy erection lines, and blocks. Specific fire equipment requirements are contained in the current Yakama Reservation Fire Plan.

H. Hauling Policies, Safety, and Routing

The Yakama Nation Law and Order Code provides current regulations for traffic control. Enforcement of the Code is primarily the responsibility of Tribal Law and Order.
Timber Sale Logging Plans require that hauling will not be permitted on roads if:

- Assistance of log truck is required for more than 100' or on more than an intermittent basis.
- The blading of surface mud to the side of the road to get to the "dry" soil is being done.
- Other specified conditions for individual Timber Sale Logging Plans occur.

Water and lignin sulfate will continue to be used for dust abatement. The logging plan will contain information on haul routes and haul hours.

I. Slash Disposal Standards

The preferred treatment will be lop and scatter. Logging slash will be lopped and scattered until it is 18 inches or lower to the ground surface. Machine piling will be routinely performed at landings.

Slash piles will be located a minimum of 15 feet from reserve trees, 20 feet in shelterwood areas. Blade width will not exceed 126 inches. All slash piling equipment will have brush rakes. Brush rakes will be equipped with teeth 12-18 inches apart, and extend at least six inches below the tractor blades. Rubber-tired skidder, front end loader, etc. are not acceptable slash piling equipment.

Machine piling away from landings may be required for areas containing unusually heavy loads of slash, along primary roads, and as a treatment for severe shrub problems causing severe competition to trees. Machine piling away from landings will not be allowed on sensitive soil types. Sensitive soil types will be delineated on the soils map within the timber sale documentation.

All nonmerchantable pushovers with lean of 45^{o} or more will be lopped.

Most slash created in connection with Class IV road construction will be piled during the construction phase in cleared openings within or adjacent to the road right-of-way. No slash piling will be permitted in meadows and root grounds. Stumps resulting from road clearing operations will be treated in one of the following ways, as directed by the Officer-in-Charge: (1) piled and burned within the cleared portion of the right-of-way, (2) moved out of sight from the road to be piled and burned with logging slash, (3) split and buried within or adjacent to the right-of-way but not within the road prism, or (4) moved out of sight and piled in small 10 to 30 cubic yard piles, not interfering with logging operations.

In areas of high fuel loading, such as landings, broadcast and slash pile burning will be used. Landing slash piles will be burned by the Officer-in-Charge. At completion of burning, piles will be leveled out with a dozer. Some slash piles away from landings will be left unburned for wildlife habitat.

Generally, only snags that are determined to be safety hazards will be cut. Slashing, the falling of submerchantable trees, may be required in individual timber sale contracts. The purpose would be to eliminate or reduce diseased or unwanted submerchantable vegetation.

J. Scaling Policies

The scaling provisions of the Timber Contract and Standard Provisions will be supplemented with the USDA Forest Service National Log Scaling Handbook (FSH 2409.11, 5/85 Amend.6) to provide standard instructions for volume determination.

Scaling will be done 100 percent by BIA or tribal personnel (Tribal Resolution T-64-91). The YN has committed to 100% scaling by raising the forest management deductions from 6 to 10% thereby funding scaling staff increases.

All scaling conducted by the Bureau of Indian Affairs will be at scale sites designated by the Officer-in-Charge. Notwithstanding Section B13.3 of the Standard Provisions, scaling services provided by the Bureau will be restricted to a normal work day period, including travel time from duty station to scale site and return, five days a week.

Safe scaling and check scaling facilities will be provided by all purchasers, as determined necessary by the Officer-in-Charge. The three most recently scaled loads will be reserved for surprise check scaling.

Waste scaling will be performed on a 100 percent basis until an acceptable sampling method is designed. Waste scaling will serve the purpose of measuring utilization compliance following skidding operations. Section B7.1 of the Standard Provisions is modified to state, in part, that the trim allowance for each log segment shall be 6-inches, regardless of the overall length of the log.

Woodlogs and all-species-other wood products as defined in the product size section will be gross scaled for payment purposes, or, as authorized in B7.0 of the Standard Provisions, measured and paid for based upon equivalent volume and value conversion as determined by the

Officer-in-Charge, and approved by the Approving Officer. No trim allowance will be allowed and scale will be based on total length to the nearest foot.

Both truck and roll out scaling will be utilized per purchaser request and subject to BIA approval. Scaling locations will be designated per purchaser request and subject to BIA approval.

K. Regeneration and Stand Improvement Policies

Tree regeneration trends will be monitored with CFI and stand exam plots. Regeneration prescriptions will be specified by habitat type, timber type, soil type, and stand condition. The Forest Development section describes additional policies for regeneration and stand improvement.

L. GIS Mapping Standards

The basic control requirements will be defined by the accuracy standards for digital spatial data, as revised by the American Society for Photogrammetry and Remote Sensing, March 1990. The limiting root mean square (rms) error for horizontal planimetric coordinates for well-defined points will not exceed 10 feet. The limiting rms error for vertical accuracy will be one-third (1/3) the indicated contour interval for well defined points. All ground control will be tied to the NAD83 (1991) coordinate grid of the Washington State Plane Coordinates, Washington South.

M. Special Resource Protection

1. Archaeological/Historical

During logging operations, if objects or sites of cultural value (such as historical or prehistorical ruins, graves or grave markers, fossils, or artifacts) are discovered or encountered on the contract area, all operations within the vicinity of the discovery will be immediately suspended and the Officer-in-Charge, Forest Manager, Yakama Tribal Council Cultural Committee Chairman, and the BIA Superintendent will be notified of the findings. Operations may resume at the discovery site upon receipt of written notice from the Superintendent.

2. Cultural

Native plants are an important cultural resource of the Yakama Nation. Protection of these plants may involve several methods including logging on snow or frozen ground, excluding tribally identified sensitive areas from harvest, or other procedures. In addition, specific enhancement projects, such as controlling tree encroachment into huckleberry fields and meadows, may also be undertaken.

Skidding activities and brush piling will be confined to timbered areas and away from natural openings and meadows to prevent disturbance of the root grounds and wildlife habitat. Protection zones will be established around traditional campsites, important areas of concentrated use, special interest, and other designated sites. Prescription and scheduling of

harvest, intermediate stand treatments, and cleanup will be designed to retain the environmental character and value of these sites.

Notwithstanding the provisions of Section B12.3 of the Standard Provisions, the Purchaser, their employees or subcontractors will not be permitted to camp within the closed area of the Yakama Reservation without the expressed approval of the Yakama Tribal Council. The Officer-in-Charge, however, may authorize as deemed necessary, camping by night watchmen and designate the camp locations. This provision will not apply to Yakama tribal members.

Funding and improvement policies for campground maintenance will be the responsibility of YN Facilities Management.

Tribal members cutting under free use permits will be permitted to gather dead firewood in designated areas as directed by the Officer-in-Charge while a sale is still active.

Data stored in the GIS may be accessed only by individuals authorized to enter the resident ARC/INFO program. The working environment is compartmentalized to prevent universal access to data except for the master user (GIS Forester). Confidential information is further restricted by use of various security techniques.

Training of new employees will include local sessions, which emphasize the cultural aspects and related responsibilities of the employee.

3. Fish

Fish protection measures are described in the Water and Road sections of the Harvest Policy.

4. Range

Range improvement is primarily the responsibility of BIA Range Management. Existing range improvements will be protected or repaired during the timber sale so that no loss in usefulness will occur as a result of the timber sale. Aggressive grass seeding of the most heavily disturbed areas (landings and new road construction) will limit the invasion of noxious weeds. The Branches of Forestry and Land Services, and the YN Noxious Weed Coordinator will cooperate on other projects to control noxious weeds. The Okanogan National Forest's Integrated Weed Management (Hoglund *et al*. 1991) document will be used as a guide for noxious weed management. In specified areas, winter logging may be utilized to protect forage species. Meadows, natural openings, and parklands will be protected from harvest activity to preserve animal forage, traditional foods, and medicines.

Grass seeding will be a cooperative effort between the Branches of Forestry, Range, and YN Forest Development. Forestry will provide the funding and will purchase the grass seeding materials. Range will provide expertise and recommendations. Forest Development will do the actual grass seeding. Skid trails, landings, and potentially erosive roads will be grass seeded. Other disturbed areas may be seeded with species that do not restrict the establishment and growth of tree seedlings.

Provisions to ensure reasonable success in integrating grazing and timber production will be considered in the project planning stage. Attempts to alleviate potentially serious loss of regeneration during critical seedling establishment periods may require changes in animal use patterns or other methods to decrease grazing pressure. Suggested alternatives include increased forage production outside of the project area, salt placement, fencing, and slash treatment that retains adequate ground cover.

Meadow complexes are generally sensitive to impacts of management activities, particularly those that modify adjacent vegetation patterns, or affect site physical hydrology characteristics. In order to limit these impacts, the following guidelines will be initiated for planned activities affecting forest openings identified as meadow complexes:

- All vehicle traffic, wheeled and tracked, will be prohibited from unroaded openings. This includes the purchaser, subcontractors, as well as Forestry vehicles. Rehabilitation of these areas will be required if damaged.
- Landings and skid trails will not be permitted in meadows.
- To the greatest possible extent, new road construction will not be permitted through meadows.
- Harvesting within buffers around meadows may be prescribed to decrease encroachment of trees.
- All intermittent as well as perennial feeder stream courses will be adequately buffered.

5. Soil

Soil protection measures are described in the Roads, Yarding, and Slash sections of the Harvest Policy.

6. Water

Springs identified during the presale planning phase of a timber sale will be buffered to prevent direct impacts from machine activity or harvesting. Previously unknown springs located during a timber sale will be mapped by the Timber Sale Officer and a protective buffer established. Springs in use as potable water sources, or with that potential use, will have buffers that exceed the standard area restrictions for similar sized non-spring water features.

The Hydraulic Code requires permits for water withdrawals, culvert installations, and other associated activities. In addition, the Branch of Forestry utilizes the following standard operating procedures:

- Water withdrawal sites and projects affecting streams or other water features that have been approved will be allowed to continue to operate as planned with no further action required.
- Additional projects or activities that are needed but were not planned for will require consultation and approval from the Yakima Nation Department of Natural Resources and the BIA Environmental Coordinator.
- Timber sales currently in the planning stages will have potential water withdrawal sites addressed in the process.

- A long-range plan will be developed that identifies potential water withdrawal sites throughout the reservation and assesses the impact as a whole in a separate environmental assessment.

Some logging may occur within riparian buffers. No machine activity will be allowed within 20 feet of the active channel. Traffic is permitted on existing roads within buffers for log hauling and other travel as per Section B8.3 of the Standard Provisions. Equipment may enter buffers for culvert installation.

7. Wildlife

If a federally-listed threatened or endangered species is found in a sale unit, all operations within the vicinity of the discovery will be immediately suspended and the Officer-in-Charge notified of the findings. The Officer-in-Charge will consult with the District Officer, Forest Manager, and YN Wildlife Resources Management Program to establish a protective no-logging buffer around the discovery site. Operations may resume at the discovery site upon the purchaser's receipt of written notice from the Superintendent. In addition, the occurrence of threatened or endangered species may have an effect on the timing of harvest operations.

Stands of cottonwood, alder, aspen, and other hardwood species may be restricted from logging activity to preserve diversity of wildlife habitat.

8. Other

The Purchaser will be responsible for hiring Indian labor in accordance with B13.6 of the Timber Sale Contract Standard Provisions, Part B. Indian labor is to be hired in preference to other labor not already in the employment of the purchaser.
The purchaser will be required to enter into and provide a signed copy of a Tribal Employment Rights Ordinance Compliance Plan approved by the Executive Board of the Yakama Tribal Council, prior to execution of the Timber Contract by the Approving Officer.

The Branch of Forestry has a considerable volume of confidential information on file, ranging from timber sale contract transactions and distribution of receipts, to private statistics on Branch personnel. This information is restricted from release except as authorized under the Freedom of Information Act, or by the proper local officials.

Any survey corner or other land office corner destroyed, damaged, or removed during logging or road construction will be re-established by the Officer-in-Charge at the expense of the purchaser.

N. Required Documentation

Besides the documents already mentioned in this Harvest Policy section, additional documents are needed to meet harvest policy requirements. Documentation will be provided for all activities in accordance with 53 IAM. Ten-year, five-year, and one-year harvest schedules will be prepared. Each timber sale shall have an appraisal done for each primary species. A contract and Forest Officer's Report will be prepared for each Logging Unit. Map exhibits, including

specified road work, will also be prepared for each logging unit. Following contract signing, a Logging Plan will be developed by District timber sales staff and the purchaser for each logging season.

Numerous Timber Sale Inspection Reports will be written by the District Timber Sale staff during the timber sale. Inspection Reports record the timber harvest conditions, positive or negative, outside of normal operations. The District Officer is delegated authority as the Officer-in-Charge by the Superintendent. Close-Out Reports are also completed by the District Timber Sale staff and discussed in the Postharvest Analysis section.

O. Permit Program

The Code of Federal Regulations, Title 25, Sections 163.3, 163.19 and 163.20 authorize the development and use of a timber permit cutting system. Title 25, Part 163.19, states "permits will be issued with the consent of the Indian owner." This consent is provided by the Annual Policy Statement which is approved by the Yakama Tribal Council, the Superintendent, and the Northwest Regional Director.

A Policy Statement provides an opportunity for the tribal governing body to lay the groundwork for permit issuance, what may be cut or utilized, and conditions of harvest. Generally, the policy is only applicable to tribal land.

There are two types of permits issued—free use and paid permits. Both are useful management tools which afford the opportunity to utilize small quantities of forest products without formal advertisement and contracting procedures. Paid permits are used by tribal members to supplement income by cutting and selling firewood, posts, and poles.

The Other Wood Products permit system relative to cordwood, posts, poles, and Christmas trees will be determined by the Yakama Tribal Council, generally in the form of a resolution.

P. Postharvest Analysis

Silvicutural inspections will be used for monitoring activities during timber sale implementation. Silvicultural inspections will be conducted by the supervisory forester in Timber Sales, District Officer, and Silviculture staff. Monitoring will be on-going during a sale.

A Close-Out Report is written by the Timber Sale Officer at the conclusion of the timber sale. The Report summarizes treatments made to the land, describes any problems encountered with the sale, and makes recommendations for future management. The sale report contains recommendations on follow-up treatments. The Silviculture Unit and the Forest Development program will take an active role in pursuing recommendations.

Forest Development Program Implementaton Plan

Overview

The Forest Development Program operates under the Yakama Nation Department of Natural Resources. Implementation of the program will be in accordance with the Plan developed by the tribal forestry staff. Emphasis during this planning period will be on addressing forest health issues through planting, precommercial thinning, and prescribed burning to manage species composition, stand density, and spacing.

Program Scope

This section of the Forest Management Plan will guide the planning and implementation of Forest Development projects consistent with tribal goals and objectives, and in accordance with 25 CFR and 53 IAM. It describes the program's strategies for meeting those goals during the planning period.

Definition

Forest development is defined as any activity performed on a forest site to promote the establishment and growth of trees. The activities are usually focused on trees that are below merchantable size. Forest Development projects include reforestation, stand improvement, and prescribed burning. The Forest Development program conducts silvicultural treatments to establish stands and to promote, enhance, and maintain stand growth and health so as to ensure a sustained yield of desired forest products.

Background

When the Yakama Reservation was established, much of the forest was open and park-like, dominated by scattered old-growth ponderosa pine. Frequent, low-intensity fires maintained the structure, favoring pine and larch while preventing shade-tolerant species such as Douglas-fir and grand fir from becoming established. Groups of regeneration occurred abundantly after disturbances and were thinned by wildland fires, insects, and diseases.

Since the beginning of the 20th century, man's activities have drastically altered the structure of the Yakama Forest (see Weaver 1961). A pine butterfly outbreak followed by bark beetles in the late 1890s killed vast expanses of old-growth ponderosa pine. At the same time, European settlers grazed animals, which removed ground vegetation and scarified soil. Dense thickets of pine subsequently regenerated around the remaining old-growth trees, growing to pole size without being thinned by wildland fire, and competing with old growth for moisture. Meanwhile, suppression of fires allowed shade-tolerant Douglas-fir and grand fir to persist in the pine zone. Ponderosa pine continued to dominate along the dry fringes of the forest.

Timber harvesting practices from the 1940s to the mid-1980s accelerated this trend of late-successional species establishment. Timber harvest prescriptions targeted high-risk trees, removing the large, older trees through single-tree selection, group selection, and patch cuts.

Current Situation

Current inventory data shows that the forest is generally overstocked with sapling and pole-sized trees and becoming less vigorous due to the increased competition for water, sunlight, and nutrients. This is evident by the large-scale insect and disease levels throughout the forested area.

The present forest also features a heavier mix of shade-tolerant species (primarily the fir species) than was present under the natural fire regime. The shade-tolerant species persist in great numbers in conditions of limited light but are generally susceptible to drought on sites where they would have been eliminated by fire.

Forest health becomes threatened when tree vigor is lessened over large tracts of land. The spruce budworm outbreak, beginning in the mid-1980s to present, is an indicator of the health problems resulting from overstocking and species conversion.

There are also areas in need of reforestation or rehabilitation. Prior to the mid-1990s, most reforestation resulted from group selection cuts of one to five acres in size. Some of these areas have adequate stocking but not the desired species or quality and will require rehabilitation.

Program History

Forest development activities have been implemented since 1963. The projects have long been a source of employment for tribal members. Records show that activities were initially funded under Public Works, Youth Corps, and Job Corps programs. Figure VI–1 shows the areas of precommercial thinning conducted from 1963 to 1990.

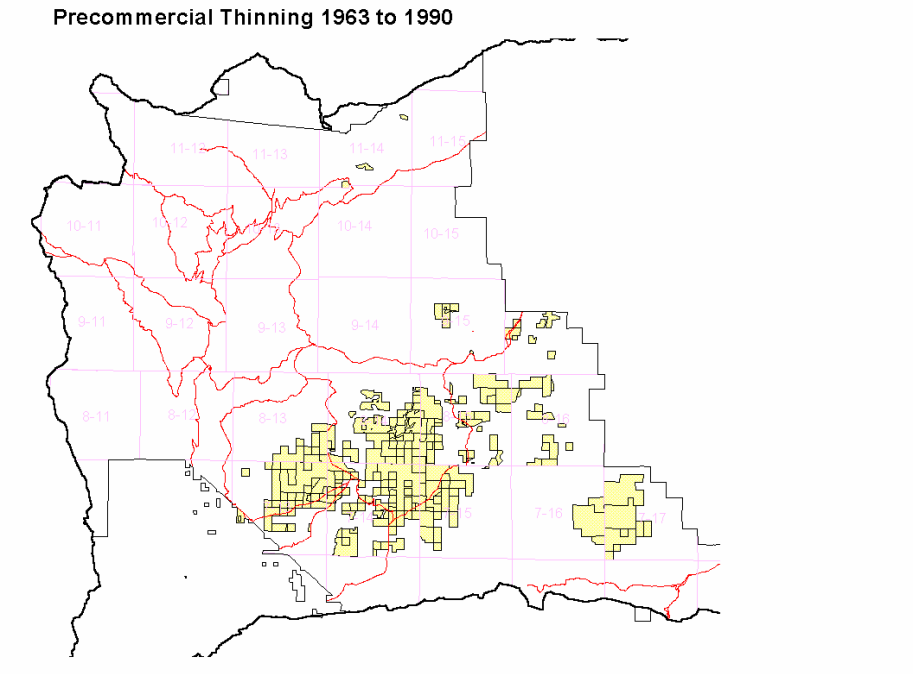

Figure VI–1. Precommercial Thinning by the Forest Development Program from 1963 to 1990

In 1977 Congress approved a new add-on program for forest development activities on Indian reservations. This helped move forest development from a small employment activity to a more prominent role in forest management, as illustrated in Table VI–1.

Table VI–1. Forest Development Funding, Employment, and Project Acres

Years	Funding $ /Year	Employment Man-years/Year	Acres Average/Year
1963–1976	88,800	10.8	1,783
1977–1989	391,600	19.3	2,554
1990–2003	720,000	31.2	4,856

The BIA subsequently identified backlogs (areas needing treatment) of 29,400 acres of precommercial thinning and 1,800 acres of reforestation. Between 1977 and 1991 tribal crews annually thinned an average of 2,453 acres and planted an average of 101 acres, employing an average of 19.5 man-years of labor. Costs and manpower rates averaged over that time period are shown in Table VI–2.

Table VI–2. Forest Development Project Costs and Manpower Rates

Operation	Cost/Acre	Man-days/Acre
Thin	$137	1.7
Plant	$321	3.0

The crews completed the declared backlog acreage in 1988, and the add-on funds were cut off. Some field activities continued after 1988 using forest management deductions and a small amount of recurring funds (banded funds). There remained many acres on the ground in need of thinning, yet, according to the records, the backlog from the 1977 calculation had been treated, and no additional forest development add-on funding would be forthcoming.

In 1990, the YN tribal forester analyzed stand exam information by timber type on 17 timber sales, designating areas with more than 302 precommercial-sized trees per acre as "thinning backlog". The program also calculated reforestation needs by analyzing timber sale maps and verifying field conditions. The Yakama Nation subsequently submitted a backlog of 202,113 acres of precommercial thinning and 653 acres of reforestation to the BIA. The report detailing the calculations of these acreages is on file in the YN Department of Natural Resources office.

In 1991, the Yakama Nation elected to contract the Forest Development portion of the BIA Forestry Program under provisions of the Indian Self-Determination and Education Assistance Act of 1975 (PL-93-638), assuming control of the program on July 1, 1991. Since then, the Forest Development Program has been under the supervision of the Yakama Nation Department of Natural Resources.

Contract Accomplishments

Since the inception of the 638 Contract, the Forest Development Program has accomplished projects on nearly 60,000 acres. Initially, the program focused on precommercial thinning of backlog areas using the force account crews. Crews consisted of about 20 people who were hired seasonally for about 9 months. Projects were scheduled to follow-up timber sales. Crews targeted trees from sapling size up to the minimum merchantable size (minimum merchantability specifications are usually 5.5 inches diameter inside bark at the small end of the log, which equates to approximately 8 to 9 inches diameter at breast height). Approximately 3,000 acres were thinned annually through the 1990s and annual thinning was just over 5,000 acres in 2003.

As thinning accomplishments approached 4,000 acres annually, the Forest Development Program looked at diversifying projects in response to the need to address the growing concern over forest health problems associated with the western spruce budworm. It became apparent that more reforestation and mechanical site preparation was needed. Toward the end of the last planning period, site preparation increased proportionately to the amount of tree planting. Forest Development accomplishments are shown by year in Figures VI–2, VI–3, VI–4, and VI–5.

Program Strategy

Goal

The goal of the Forest Development Program is to plan, implement, and monitor silvicultural treatments on the Yakama Forest. Forest development activities will include reforestation, precommercial thinning, prescribed burning, rehabilitation, and others. These treatments will be aimed at establishing regeneration and enhancing forest health. The status of forest development needs will be updated annually based on accomplishments, accruals, and administrative deductions.

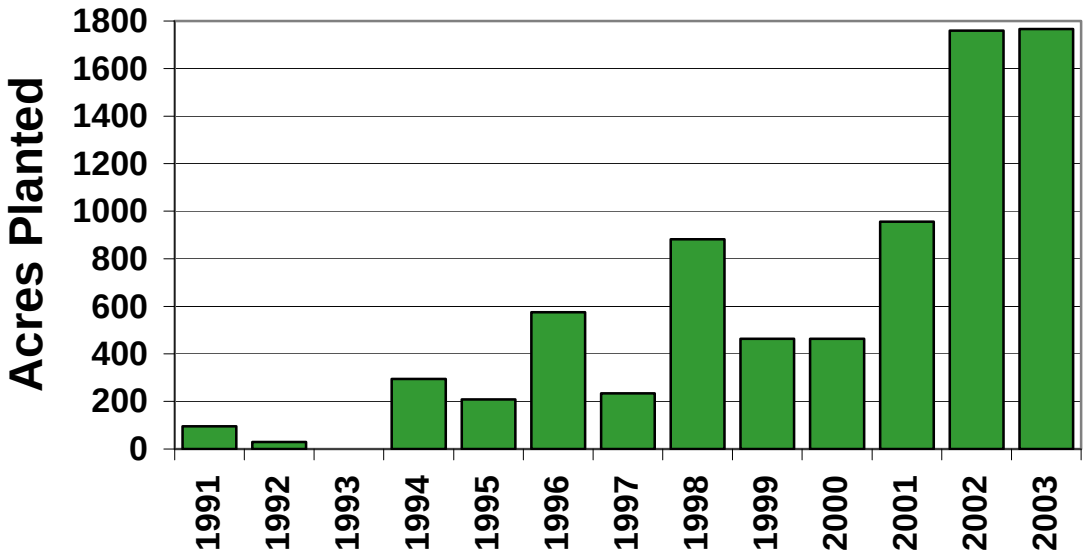

Figure VI–2. Forest Development Accomplishments—Acres Planted from 1991 to 2003

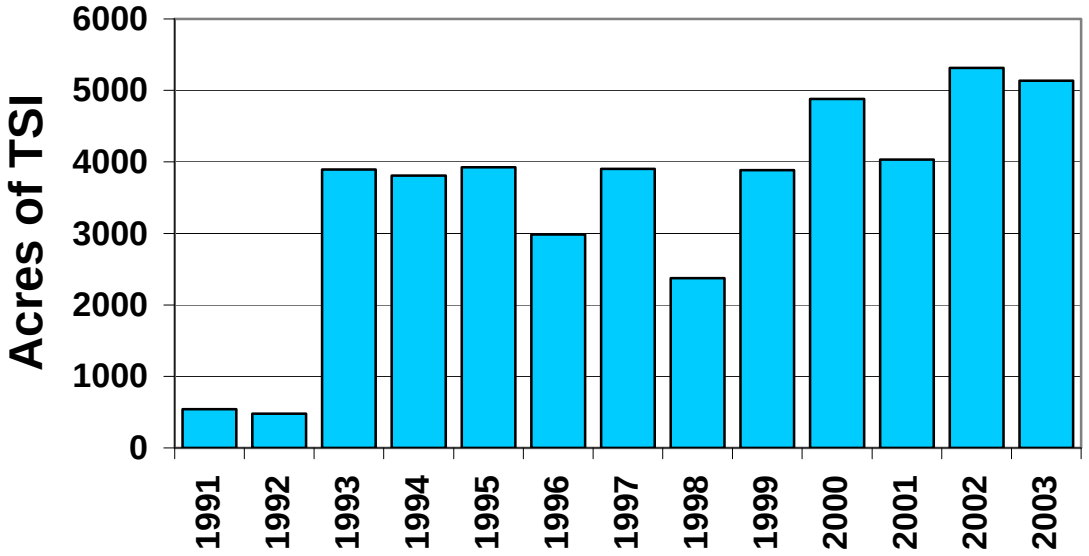

Figure VI–3. Forest Development Accomplishments—Acres of Stand Improvement (TSI) from 1991 to 2003

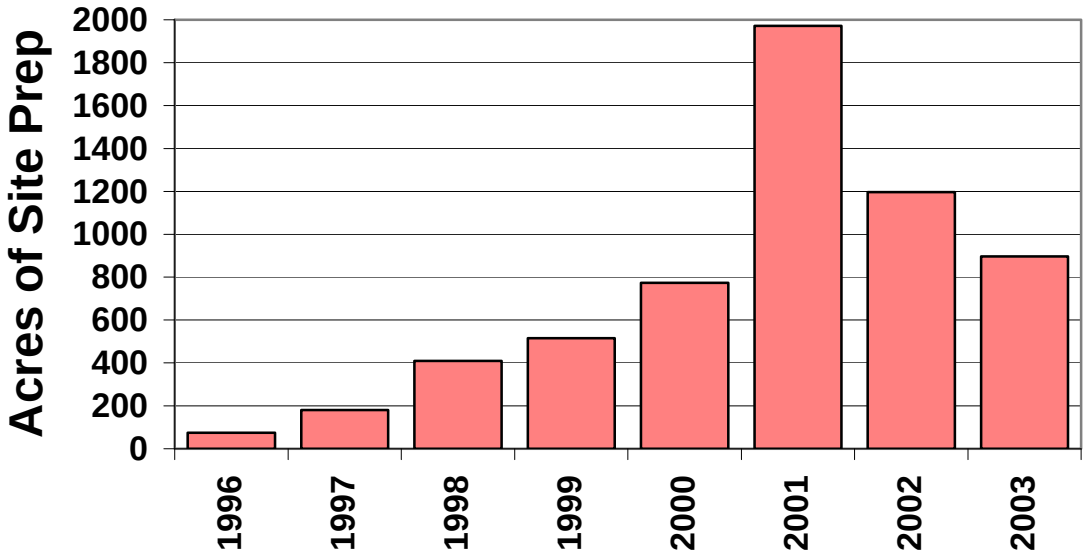

Figure VI–4. Forest Development Accomplishments—Acres of Site Preparation from 1991 to 2003

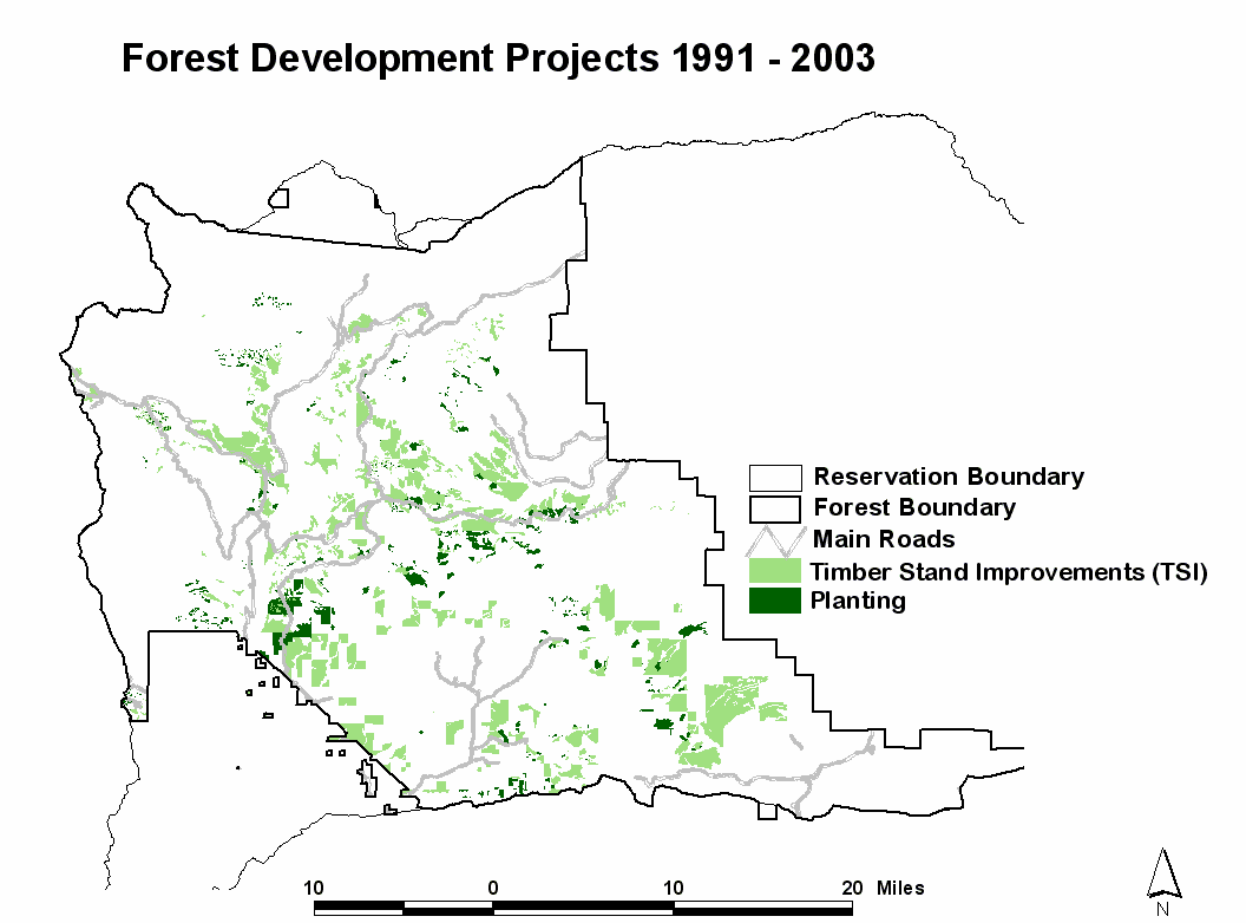

Figure VI–5. Forest Development Projects on the Yakama Forest from 1991 to 2003

Overall Strategy

(1) Project Identification and Prioritization

Forest development activities generally follow timber sales; there are several advantages of this approach. First, the silvicultural prescription can integrate both commercial and precommercial treatments and thus be able to adequately address the desired forest conditions—generally a healthy, vigorous, well-stocked stand of the desired species mix. Second, Forest Development Program staff can more effectively review the various stands within a timber sale by coordinating with the Timber Sale Officer. Third, scheduling planting and precommercial thinning after harvesting will avoid logging equipment damage to the planted seedlings and thinned trees.

The Forest Development Program has followed up on every timber sale completed since 1992, or about 65 different sales. The type of follow-up treatments vary considerably between timber sales and the amount of area treated has ranged from one to nearly 30 percent of the sale area. With the overall objective of maintaining multiple age classes as much as possible across the

landscape, each age class in a stand may have different needs. Frequently, neither overstory nor understory treatment will be complete as a stand-alone treatment. Staff will conduct informal walk-throughs of areas to determine the necessary follow-up treatments. The processes the staff will use to determine the treatments are illustrated in Figure VI–6 and Figure VI–7.

Prioritizing projects will be based, to some degree, on the amount of return on the investment. Generally, higher costs of projects can be justified on more productive sites; however, projects may be planned across the range of sites in order to address forest health concerns. To a large degree, the number of projects is based on the amount of funding. It is expected that the current trends in annual forest development projects will remain constant through this planning period.

There is not a definitive method of prioritizing projects. Instead, most timber sales will receive some follow-up treatments. Generally, the larger and more contiguous areas of forest development needs will take priority over the smaller units. This is because the cost per acre tends to decrease as project size increases. Forest development follow-up on any given timber sale will take between one and three years to complete.

During this planning period, the Forest Development Program will work at attempting to quantify the results of various treatments. Staff will continue to revisit forest development projects to assess whether the prescribed treatments are achieving the desired results. Informal walk-through inspections, pier review, and feedback from this step will allow the program to continually refine its approach to produce the desired forest stand conditions.

(2) Labor Force

The Yakama Nation has long relied on the use of the force account crew not only to complete the forest development projects, but to participate in initial attack on wildland fires, use in search and rescue, and other emergencies such as participation in flood control. The Forest Development Program anticipates the continued employment of this labor force and expects about one-half of all forest development projects will be completed by these seasonal and furlough crew members. The Program will continue to hire a 15- to 25-person in-house forest development crew, pending the availability of funds.

In addition to the force account crews, the Program has been utilizing Yakama contractors to complete a variety of forest development projects. The Contracting Program was initially set up to supplement the forest development in-house crew by offering enrolled Yakama members an opportunity to competitively bid on thinning contracts. A Programmatic Document was developed through a concentrated effort by staff, tribal administration, tribal support services, legal counsel, and elected officials. The Programmatic Document outlines how the contracts will be carried out. The Tribal Council approved a Resolution in 1993 supporting the contracting of forest development projects. Between 1993 and 1999, Yakama contractors were annually thinning between 500 and 1,500 acres annually, which ranged from 20 to 40 percent of annual thinning projects.

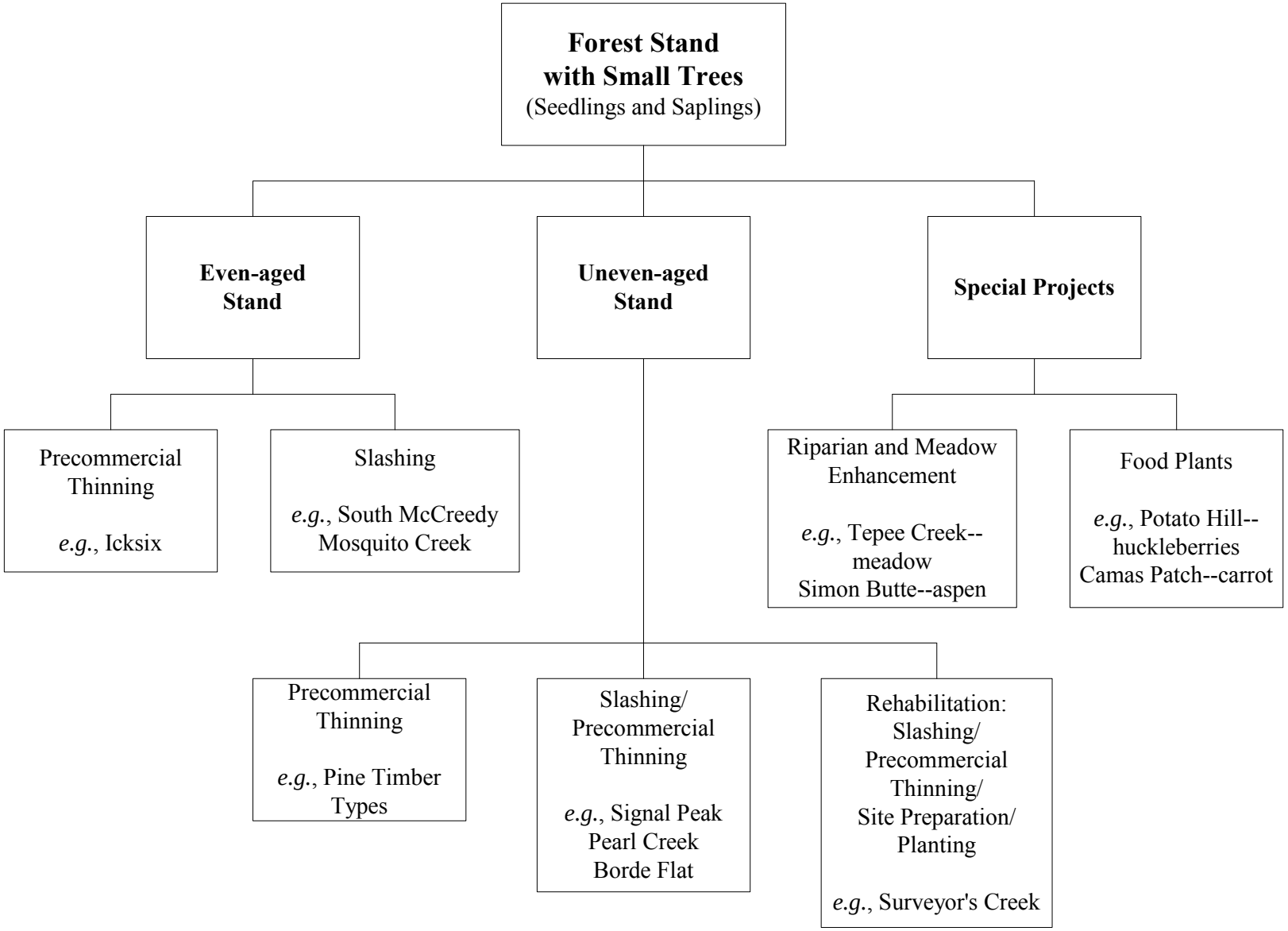

Figure VI–6. Yakama Stand Improvement Operations

Yakama Approach to Regeneration

Regeneration can be prescribed anywhere along a gradient from a broad, extensive, natural approach to a specific, planned, intensive, artificial approach. The natural approach is preferred and the least expensive. This method, however, is risky, slow, and one in which we have the least control over the assurance of an adequately stocked timber stand. By contrast, the artificial approach is the surest but most expensive and, at least in the short term, the most intrusive on the natural appearance.

	Extensive Natural	<---------->				**Intensive** Artificial
Activities	No Action	Prescribed Burn	Rake/Pile	Species Enhancement	Stocking Enhancement	Pile
Regeneration	Natural Regeneration	Natural Regeneration	Natural Regeneration	Planting w/ spot herbicide	Multi-aged Management w/ spot herbicide	Fixed-spacing Planting w/ spot herbicide
Habitat Type	Ponderosa Pine	Ponderosa Pine	Ponderosa Pine	Ponderosa Pine		
			Douglas-fir & Grand Fir	Douglas-fir & Grand Fir	Douglas-fir & Grand Fir	Douglas-fir & Grand Fir
		Lodgepole Pine	Lodgepole Pine	Lodgepole Pine		
	True Fir-Mt Hemlock	True Fir-Mt Hemlock				
Budworm Zone	No	Yes	Yes	No	Yes	Yes
Cost/Acre	$ 0	$ 50	$ 110		$ 320	$ 500 +

Figure VI–7. Regeneration Strategies

The Program will continue to offer Yakama contracts, which have many advantages. Contracting allows for projects to be completed at a competitive cost, keeps the funding locally within the tribal community, and supports the entrepreneurial efforts of tribal members who may prefer to work independently. Through the next decade, the Program anticipates that the Yakama contractors will continue to be a vital part of the Program. Project contracting will likely increase during this planning period because of the increase in hazardous fuel reduction funds. It is expected that the Program will offer annually $500,000 in Yakama contracts, which equates to about one-half of the annual acres of accomplishments.

Figure VI–8. Number of Contracts Awarded from 1995 to 2003

(3) Roles of Yakama Nation and BIA

The Yakama Nation will continue to provide both short-term and long-term direction for the Forest Development Program. It will extend its PL 93-638 Contract authority for the next ten-year management planning period. The tribe will staff professional, technical, and labor positions under Indian preference policy. The Forest Development Program will continue to operate under the YN Department of Natural Resources.

The Bureau of Indian Affairs, Yakama Agency Superintendent will continue to serve as contracting officer on the Yakama Nation's 638 contract and delegate alternate and subordinate officers. The Branch of Forestry will also provide technical recommendations upon request. The BIA will make the Geographical Information System available for Forest Development program use. A tribal or BIA silviculturist will approve silvicultural prescriptions. Government-sponsored training will be made available to Forest Development staff.

The BIA Northwest Regional Office is expected to continue allocating forest development add-on funds to the Yakama Agency. Other federal funds including special supplemental appropriations, specific project funds, Forest Pest Management (FPM) funds, and year-end banded federal funds have been utilized in the Program. In addition, the Program will be supported with funding from Forest Management Deductions. Other possible funding sources include stumpage fees, which have been applied to recent budworm sales at a rate of $6.00 per thousand board feet.

Forest Development crews will continue to participate in wildland fire suppression as requested.

Activities

Stand Improvement

(1) Precommercial Thinning

Precommercial thinning (PCT) is the regulation of stand density and spacing in submerchantable portions of forest stands to concentrate growth on desirable trees. The force account crews and contractors will conduct thinning. Thinning units will be evaluated, laid out, and monitored by technical or professional crews.

If current funding levels are constant, it is anticipated that the Forest Development Program will precommercially thin approximately 5,000 acres per year. Based on the estimate in the previous plan, the precommercial thinning needs were calculated at 10,000 acres. The Program may approach this annual target of forest development projects if it includes the accomplishments of the hazardous fuel reduction projects.

The funding levels for fuel-management related projects have increased substantially in recent years. Fuel reduction projects tend to focus on decreasing stand density, and therefore are closely aligned with the same goals of forest development projects. Accomplishments of these types of projects, combined with forest development projects, will result in an overall increase of annual projects compared with the past planning period. The program will evaluate alternatives to the current practice of leaving PCT slash in the woods, such as chipping, firewood programs, and small wood utilization.

(2) Sanitation

The Forest Development crew will implement sanitation projects when those projects do not involve commercial timber. Examples of this include slashing mistletoe-infected pine or other diseased trees. The program does not have an inventory of these needs. Projects will be funded on an as-needed basis. In addition to forest development funds, the U.S. Forest Service, Forest Pest Management Program has funds available on a project basis for this type of activity.

(3) Other

The Forest Development crew may occasionally implement other projects on special request or need. For example, the crew has in the past removed trees that competed with huckleberry fields used extensively by tribal members. During the last planning period, the Program completed more than 600 acres of huckleberry field enhancement projects, mostly in the Potato Hill area with some projects around Howard Lake. It is anticipated that about 100 acres of huckleberry enhancement projects will be scheduled annually. The program has also treated hardwood stands, focusing on aspen enhancement in meadow systems such as the Indian Springs project and the Starvation Flats projects. These projects were coordinated with other YN programs and

will continue during this planning period. These projects are mapped and recorded as forest development accomplishments.

Reforestation

(1) Tree Improvement

Tree improvement addresses the collection of seed from superior quality trees on the reservation for use in reforestation projects. Individual trees representing a variety of tree species, distributed at various elevations, will be located and identified as "Superior Trees." The program will collect all of the seed for reforestation projects from those superior trees in a non-destructive manner, unless trees are already marked for cutting on a timber sale.

(2) Tree Planting

Reforestation needs have greatly increased beginning around the mid-1990s as a result of the increased amounts of regeneration cutting. Figure VI–9 shows the number of seedlings planted from 1996 to 2003. Natural regeneration was adequate for long periods of time over much of the Yakama forest but changed recently during the accelerated levels of regeneration cutting. Reforestation is necessary when portions of existing advanced regeneration are of unacceptable quality due to diseases and tree species present. Reforestation is also needed in areas where unacceptable delays occur in natural regeneration. Those areas tend to be the difficult mid-elevation fir sites. Regeneration can be difficult to establish for a variety of reasons, which may include competing vegetation, gopher competition, lack of adequate seed sources, excessive duff layers, unfavorable soil textures, landform influences, and temperature extremes.

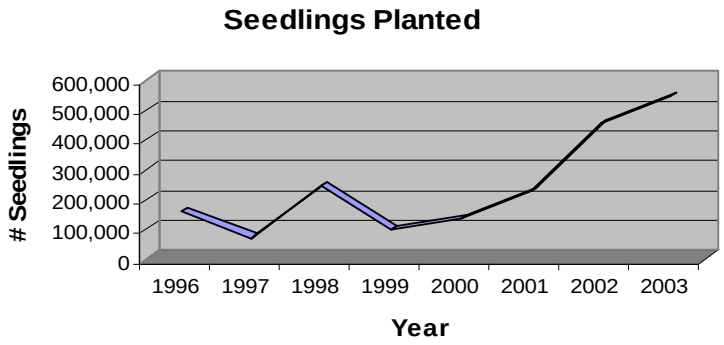

Figure VI–9. Numbers of Tree Seedlings Planted from 1996 to 2003

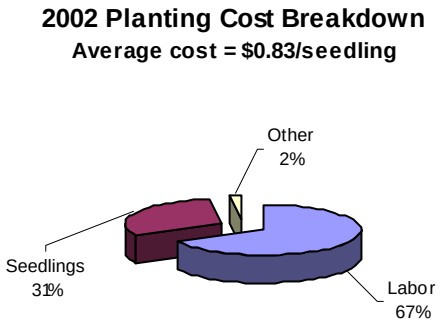

Figure VI–10. Forest Development Planting Costs

As the Forest Development Program began to increase planting, it was soon apparent that there was a lack of plantable sites (i.e., areas of exposed mineral soil) due in large part by the enforcement of designated skid trails, the movement away from mechanically treating slash, the use of whole-tree mechanized harvest systems, and winter logging. Site preparation is essential for both artificial and natural regeneration in the areas where regeneration cutting is prescribed.

In the late 1990s, an effort was made to again require piling as part of the timber sale contract. Although piling has always been part of a stand sale contract, the need to specifically state the amount of piling requirements was only recently added. As a result, the Forest Development Program relies heavily on the coordination with the sale officers to prepare the sites for planting. Generally, contract piling will be prescribed and completed as part of the timber sale contract where heavy regeneration cutting occurs.

The Program staff has evaluated a number of planting projects over the past several years, and has incorporated many changes that will improve seedling survivability. These changes include better seedling handling, movement to planting larger stock types (i.e., styro 15 to 20), change in planting tools, and staff participation in reforestation workshops and seminars.

In addition to these changes, the Program participates with the Oregon State University Nursery Technology Cooperative. This Cooperative serves in an advisory capacity to assist in the improvement of reforestation methods. The Program will continue to work with the Cooperative, including the establishment of various regeneration studies.

Another factor which has greatly aided in the improvement of reforestation projects is the use of vegetation control, which was approved by the Tribal Council. It is anticipated that most tree planting will be followed by spot herbicide application. Tree seedling survival rates have increased substantially by using this tool.

Beginning in 1999, the Yakama Tribal Council began authorizing the payment by the purchaser of Yakama timber a reforestation fee of $6.00 per 1,000 net board feet of scaled timber. The rate is based on the average estimated amount of funds needed for reforestation projects on various timber sales and is considered a “Revenue Account” budgeted by the Program. Reforestation

needs were increasing beginning in the mid-1990s; however, funding was not approved until late in 1999. Reforestation fees generated on sales needing fewer than the $6.00/mbm rate will be used to address the planting needs on past budworm sales. Figure VI–11 summarizes the amount of reforestation fees that have been generated thus far.

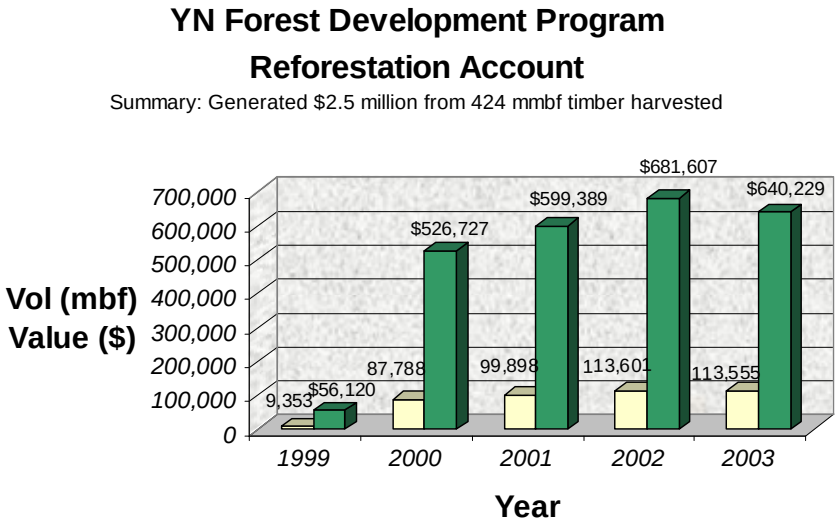

Figure VI–11. Forest Development Reforestation Account

The Program will continue to store seed for use in reforestation projects. The Program will annually determine the amount and variety of seed needed. Cones are collected on the Yakama Forest, the seed is extracted, and cold storage is provided by area nurseries. The nurseries provide germination and viability testing at the request of the Program. A sufficient amount of seed will be kept in storage so that in the event of a large forest fire, the nursery could grow a sufficient number of tree seedlings. The current inventory of tree seed is shown in Table VI–3.

Table VI–3. Inventory of Tree Seed

Species	Pounds of Seed
Ponderosa pine	384.4
Douglas-fir	10.9
Western larch	24.6
Lodgepole pine	27.0
Western white pine	8.5
Engelmann spruce	10.2
Western hemlock	1.1

Tribal foresters will evaluate alternatives in reforestation techniques with the goal of making it more efficient and effective. Some site preparation options to be considered include prescribed fire, mechanical, and herbicides. Site preparation for natural regeneration or direct seeding may be considered in lieu of tree planting.

Tree planting will be followed up by three activities. A sample of planted seedlings will be staked and visited three times a year (after snowmelt, mid-summer, and before snowfall) to determine survival and provide information on tree condition. Regeneration surveys will be conducted at two and five years after planting to determine survival over the planting area. The results of the five-year survey will be evaluated against the target established by the silvicultural prescription. Projects meeting prescription goals will be certified as successfully restocked, while those falling short of goals will be scheduled for corrective measures.

A second planting, if needed, will incorporate the knowledge gained through evaluation of the first planting. Special treatments may be required to prevent a reoccurrence of similar failures. Additional treatments may include tighter quality standards and planting specifications, refinement of planting weather limits, or refinement of acceptable site condition requirements.

(3) Rehabilitation

The objective of the rehabilitation program will be to fully stock the areas with tree species best suited for the sites. This will involve planting seedlings and removing unsuitable individuals. There is no inventory of rehabilitation needs available. Rehabilitation projects will be identified during the timber sale process and evaluated on a cost-benefit basis against reforestation projects.

(4) Regeneration Cut Monitoring

The program will monitor regeneration cuts to make sure that regeneration is successfully established. If natural regeneration is not established within five years, then the program may plant the area using forest development money. Stand responses to regeneration cuts will be studied and used to improve silvicultural prescriptions.

Monitoring and Evaluation

Activity Monitoring

Activity monitoring will be conducted to measure the results of field projects and compare them with prescriptions. All thinning and planting projects will be inspected for compliance with technical specifications and for post-project stocking. Acreages and costs will be recorded at the end of each project.

Project files will be established for each project. These files will contain information pertinent to the activities implemented on the project sites, which may include timber sale proposals, pre- and post-activity stocking surveys, silvicultural prescriptions, environmental assessments, inspection notes, and maps. Deviations from projected results will be explained in writing and filed with the project file. Project files will be summarized in a computerized database.

Project maps will be permanently stored on the Geographic Information System (GIS). Some data may be kept on the GIS such as the number of precommercial trees per acre, or the number and species of trees planted per acre. This information within the GIS will be general and is to

be used only as a quick reference for the manager. It is not intended to be the only source of information for a project.

An annual program summary will be prepared, documenting by project, the number of acres planned for treatment, the number of acres where planned treatments were accomplished, the average number of trees planted per acre or average number of stems cut per acre, total cost, date initiated, date completed, etc., and a reservation map indicating all acres treated during the year.

Programmatic Evaluations

Evaluation teams will be made up of technical, managerial, and administrative experts selected from governmental, tribal, and independent sources and will evaluate the progress of the program in meeting the established goals and activity targets defined in the management plan.

A National Level Programmatic Review of the Yakama Forest Development Program was conducted in 1992. The review was prompted in large part by the dramatic increase in forest development non-recurring funds following the recalculation of the backlog acres. The review team was headed by the BIA Central Office Chief Timber Sale Forester and assisted by other Area Office Foresters and one Silviculture Professor from the University of California Berkeley. The report is on file in Toppenish and confirms the backlog of 210,000 acres reported in the 1990 backlog report. The report offered favorable reviews and discussed the need to expand the program in order to address the forest development needs.

The BIA Branch of Forestry underwent Area Office review in June of 1988, which included the Forest Development Program. This report is also on file in Toppenish. The report is generally complementary of the direction of the Program, the accomplishments, and competency of the staff.

Organization and Funding

Personnel

A Program Manager, who reports directly to the Deputy Director of the Department of Natural Resources, oversees the program. The Program Manager provides program direction, continually evaluates the progress of the program towards achieving goals, and makes adjustments in the management systems in place when they are found to be deficient. The Forest Development Program Manager serves as the Yakama Nation's representative in all forestry matters not handled by the BIA. He or she may be requested to handle special assignments.

The Program Manager will be an individual with at least 5 years experience in the management of natural resources programs. The individual will need to complement technical skills in forestry with abilities in resource administration, information management, and impact evaluation.

A Supervisory Forester will serve as technical expert within the program. This individual will develop and constantly refine technical procedures utilized in the implementation of project

activities. He or she will be responsible for activity planning and coordination with other disciplines. The Supervisory Forester will also supervise the activities of the staff foresters.
The Supervisory Forester will have at least five years professional experience working in forest development projects. Special consideration will be given to foresters who have demonstrated an understanding of Inland Northwest forests, silviculture, and the ability to develop solutions to forest problems.

The program will need three Staff Foresters to give individual projects the professional attention necessary to assure quality results. Staff foresters will evaluate potential project areas, propose technical recommendations, and provide technical supervision during activity implementation. They will serve as contract inspectors for thinning contracts and will document project activities in written reports.

Staff foresters will be graduates of accredited university programs in forestry or natural resources management. Their individual responsibilities will depend on the amount of experience they have in the field.

Forest Technicians will assist the staff foresters in gathering field data. They will be high school graduates with math abilities, familiarity with forest plants, and good work habits. The program will require five full-time technicians.

Organization of Forest Development Program

An organizational chart for the Forest Development Program is in Appendix G. A Project Supervisor will supervise the in-house crew. This person will make sure that the crew is operative, that they follow the technical guidelines of individual projects, and that resource and personnel reports are prepared as required. The project supervisor will be a high school graduate with experience in supervision.

Resource workers will perform work on the projects such as planting trees and thinning saplings. Resource workers must be capable of heavy physical labor. They will be required to demonstrate good work habits such as reporting for work on time, following safety recommendations, and working at an appropriate speed. The program will employ between 15 and 25 resource workers during the field season.

Position descriptions for each of these positions are on file in the Forest Development office. The program will give selection preference to individuals that have demonstrated good performance on the forest development crews.

Training

The goals of training are to develop each individual's abilities to complete their job. An outline of training themes is presented in Table VI–4.

Table VI–4. Training Needs in the Forest Development Program

Position	Training Themes
Program Manager	Program Management, Resource Management Issues
Supervisory Forester	Supervision, Silviculture, Database Management
Forester	Silviculture, Sampling
Technicians	Silviculture, Sampling
Project Supervisor	Supervision
Resource Workers	Safety
Bookkeeper	Relevant Software
Secretary	Relevant Software

Financial Plan

The Forest Development Program will continue to be supported by a combination of federal and tribal funds. Annual forest development non-recurring funds are expected to remain at $600,000 and will be used primarily for stand improvement projects and related support costs. The amount of recurring funds (banded) is expected to remain at about $36,000 annually. Forest Management Deductions (fees) for the program amount to about 12% of the total fees and has decreased dramatically over the last several years.

Overall funding of the Program has increased in part because of the contracting of tribal shares funding and the one-time Congressional Appropriation in 1999 of $1.136 million used for budworm related projects. Revenue generated funds such as the reforestation fees have also aided in the increase of the overall program budget.

Figure VI–12 shows the Program's annual budget from Forest Management Deductions, and Figures VI–13 shows the allocation of funds by project categories.

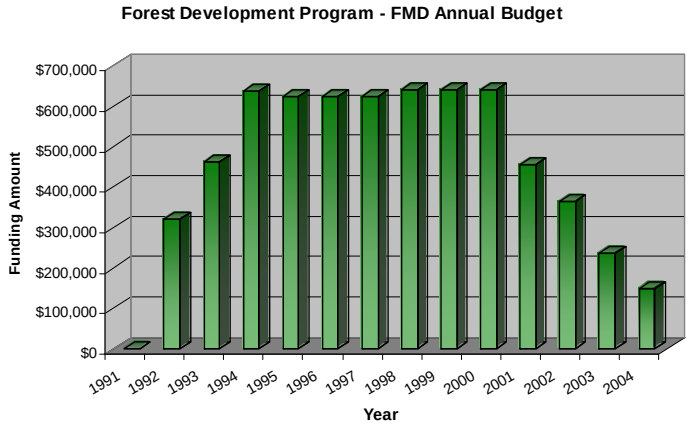

Figure VI–12. Forest Development Annual Budget from Forest Management Deductions

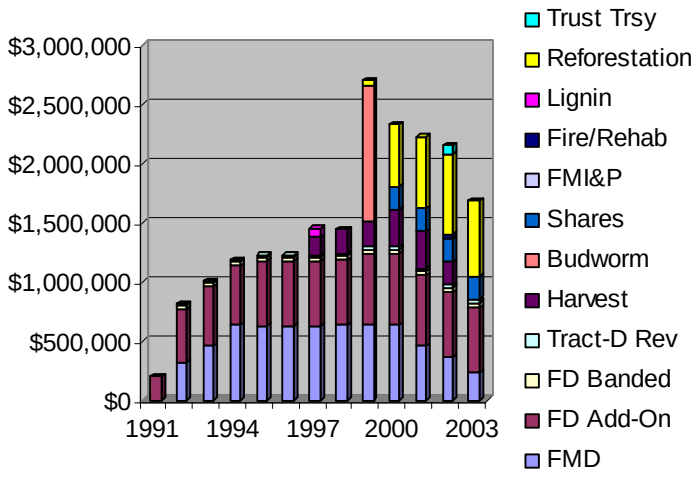

Figure VI–13. Overall Forest Development Budget

Woodland Management Program Implementation Plan

There are approximately 23,000 acres of woodlands outside of the Yakama Forest. Guidance for woodland management is provided in Part 53, Chapter 10 of the Indian Affairs Manual. Woodlands are reserved from scheduled timber harvests, although woodland products may be collected in accordance with the Yakama Tribal Council's Permit Policy. Proposed woodland management activities should enhance, protect, or sustain the cultural uses of the land and woodland species.

Oak woodlands occur along the eastern forest fringe. A description of the Oregon oak habitat type is in Appendix C, Yakama Reservation Forest Habitat Types. Oak woodlands provide food, cover, and nest sites for a wide variety of wildlife species including woodpeckers, bluebirds, nuthatches, chickadees, raccoons, Douglas squirrels, and black-tailed deer.

Riparian woodlands occur along the Yakima River and many creeks in the valley. These woodlands are generally composed of black cottonwood (*Populus trichocarpa*), willows (*Salix* spp.), and associated species. Riparian woodlands are valuable for stream bank protection, maintenance of water quality, and habitat for wildlife and plant species of cultural significance.

Human Resources Program Implementation Plan

Overview

There is a substantial need for natural resources professionals and technicians to manage the Yakama Nation's forest and woodlands. The Bureau of Indian Affairs is obligated to search for and identify prospective tribal members that may acquire the necessary education to qualify for these positions. The BIA will provide sources of funding, technical assistance, and the opportunity for employment and advancement. The BIA has an important challenge to vitalize

its workforce with qualified Yakama professionals. This will require the cooperation of the BIA and the Yakama Nation, emphasizing Human Resource Management to ensure success.

Introduction

The BIA is committed to the protection and advocacy of the Yakama Nation's sovereign rights, perform its trust responsibilities, carry out policies of tribal self-determination, develop a government-to-government relationship, and develop and enhance the BIA and tribal human resources expertise. This commitment to the Yakama Nation obligates the BIA to search for and identify prospective tribal members that may acquire the necessary education to qualify as professionals according the United States Office of Personnel Management (OPM) Operating Manual for Qualification Standards for Natural Resources Management and Biological Sciences[3] & BIA Excepted Qualification Standards. The BIA will provide funding, technical assistance, and opportunities for employment and advancement without cultural or institutional barriers.

An objective of the Human Resources Program Implementation Plan is to provide the opportunity for tribal members to attain professional forester status through financial assistance. Tribal members must sign an agreement that after completion of an educational program they will return to the reservation and work for the BIA or the Yakama Nation based on a month-for-month stipulation.

Within the Yakama Nation Department of Natural Resources there is a need for foresters, range conservationists, wildlife biologists, archaeologists, soil scientists, hydrologists, fishery biologists, cultural, traditional researchers, and a variety of roles related to the management of the Yakama Nation forest and woodlands.

This section outlines the need for professional foresters and the provisions for educational funding as allowed by Public Law 101-630, Title III, Section 304 (4) (H):

"provision of financial assistance for the education of Indians enrolled in accredited programs of post-secondary and post-graduate forestry and forestry-related fields of study, including the provisions of scholarships, internships, relocation assistance, and other forms of assistance to cover educational expenses."

Background on Entry Level Positions

Foresters perform professional and scientific work according to the following experience and education requirements:

A. Degree: Forestry, or related subject-matter field that includes a total of at least 30 semester hours in any combination of biological, physical, or mathematical sciences or engineering, of which at least 24 semester hours of course work are in forestry; or

B. Combination of experience and education courses equivalent to a major in forestry, or at least 30 semester hours in any combination of biological, physical, or mathematical sciences or engineering,

[3] Available on the Internet: www.opm.gov/qualifications/index.asp

of which at least 24 hours are in forestry. The curriculum must be sufficiently diversified to include courses in each of the following areas (1) Management of Renewable Resources; (2) Forest Biology; and (3) Forest Resources Measurements and Inventory, plus appropriate experience or additional education.

Work accomplishments are in the management, development, and protection of Indian-owned trust lands, including the provision of technical assistance to Indian tribes and Indian landowners in management of their forest resources including:

- Appraisal, valuation, and inventories of Indian-owned trust land for timber sales, land sales, land purchases, and exchanges
- Utilization of the natural resources of forests and associated lands; the inventory, planning, evaluation, presale activities, and the management of each forest resource including timber sales administration, and relationship to soil, land uses, water quality, wildlife, fish habitat, minerals, forage, forest recreation, wilderness, and reserved areas
- Protection against wildland fires, insects, diseases, erosion, trespass, air pollution, and other forms of environmental degradation
- Coordination and communication between the Yakama Nation, other tribal organizations and agencies, update of policies affecting those resources, and interpretation of policy changes
- To seek and disseminate new and improved methods, practices, and techniques necessary to perform forestry tasks.

Forestry Technicians work with professional foresters and perform technical work that does not require a professional degree. Education may be substituted for experience at various grade levels as specified below:

GS-2: Graduation from a full 4-year senior high school, or possession of a General Education Development High School Equivalency Certificate, may be substituted for in full for the experience requirements at the GS-2 level.

GS-3: One academic year of post-high school education that included some course work in subjects such as forestry, agriculture, range management or conservation, wildlife management, engineering, biology, mathematics, or other natural or physical sciences may be substituted for one year of experience, and meets in full the requirements at the GS-3 level.

GS-4: Two years of post-high school academic study, which included at least 12 semester hours in any combination of subjects such as forestry, range management or conservation, wildlife management, watershed management, soil science, natural resources, outdoor recreation management, civil or forest engineering, or wildland fire science may be substituted for two years of experience. This meets in full the experience requirements at the GS-4 level.

GS-5: Successful completion of (a) a full 4-year course in a college or university leading to a bachelor's degree with major study in forestry, range management, or a closely related subject-matter field, or
(2) four years of post-high school academic study which included at least 24 semester hours in any combination of courses listed under GS-4 above that may be substituted for three years of experience. This meets in full the experience requirements at the GS-5 level. Appropriate education and training other than shown above, such as in manpower development programs or military training programs, will be granted credit on a month-for-month basis. The maximum amount of experience for which education of any kind may be substituted is three years.

Forestry technicians require a technical and practical knowledge of forestry methods, techniques, practices, and uses of tribal forestland. They may assist other forestry technicians and professionals in the performance of the following technical work:

- Appraisal, valuation, and inventories of Indian-owned trust land for timber sales, land sales, land purchases, and exchanges
- The management, conservation, development, utilization, and protection of forest resources
- Participate in forestry research projects
- Administration of timber sales and applications of sound silvicultural practices
- Cruising, marking, scaling, appraising, and measurement of logs or trees
- Administration of wilderness areas, forest operations, collection of data from experimental plots, watershed, or other forestry operations
- Take measurements utilizing a variety of forest instruments and equipment for the collection and compilation of data
- Participation in fire presuppression and suppression activities
- Demonstrate the ability to deal with the Yakama Nation Tribal Council, tribal members, and the general public.

Branch of Forestry Organization

Organizational charts for the sections and units of the Yakama Agency Branch of Forestry are in Appendix G. The following tables show the number of employees by position within the Branch of Forestry:

Table VI–5. Employees in the Forest Management Section

The Forest Management Section consists of the Inventory, GIS, Engineering, Silviculture, and Presale Units.

Positions	Federal	Tribal	Total	Tribal Employees of Indian Descent
Professional Foresters	8	4	12	2
Archaeologist	0	1	1	1
Environmental Specialist	0	1	1	1
Technicians	2	22	24	22
Office Support Staff	0	1	1	1
Total	10	29	39	27

Table VI–6. Employees in the Timber Sale Section

The Timber Sale Section consists of the Toppenish Headquarters, the White Swan Ranger Station, and the Glenwood Ranger Station.

Positions	Federal	Tribal	Total	Tribal Employees of Indian Descent
Professional Foresters	14	1	15	1
Technicians	20	20	40	20
Office Support Staff	3	2	5	1
Total	37	23	60	22

Table VI–7. Employees in the Forestry Administration Section

Positions	Federal	Tribal	Total	Tribal Employees of Indian Descent
Professional Foresters	1	2	3	2
Education Specialist	0	1	1	1
Technicians	0	0	0	0
Office Support Staff	1	5	6	5
Total	2	8	10	8

Table VI–8. Employees in the Fire Management Section

Positions	Federal	Tribal	Total	Tribal Employees of Indian Descent
Permanent	2	3	5	1
Seasonal	0	21	21	21
Total	2	24	26	22

Table VI–9. Total Number of Employees in the Branch of Forestry

Positions	Federal	Tribal	Total	Tribal Employees of Indian Descent
Professionals	25	10	35	9
Technicians	23	42	65	42
Office Support Staff	4	11	15	7
Temporary	0	21	21	21
Total	52	84	136	79

Natural Resources Education Program

The Natural Resources Education Program is funded from Forest Management Deductions. Since its inception in 1991, 18 tribal members have graduated from a number of universities with undergraduate and graduate degrees in natural resources. There are 11 tribal members currently enrolled in the Natural Resources Education Program.

Human Resource Action Plan

The following action items will be implemented during the planning period.

- Strengthen recruitment efforts to identify potential Yakama Nation members who might pursue a degree in forestry and a forestry career
- Inform Yakama Nation members in middle schools and high schools of their opportunities for careers in forestry
- Provide educational and advancement opportunities for high potential tribal member employees
- Assist at least 11 tribal members through PL 101-630 education opportunities during the planning period
- Provide work experience for forestry students during their breaks from school
- Provide Yakama Nation members opportunities to obtain the qualifications necessary to assume management positions in the Branch of Forestry

- Develop and support a highly skilled workforce analysis, program evaluation, and mechanism to ensure organizational and managerial accountability toward these goals.

Employment Opportunities

Employment with the BIA Branch of Forestry will be provided as positions are vacated through retirement and attrition. Employment through the Yakama Nation will be designated by the immediate needs of the YN Forestry Program and goals set by the Yakama Tribal Council.

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Chapter VII. The Timber Sale Planning and Administration Process

The National Environmental Policy Act (NEPA) of 1969 (P.L. 91-190) declared a national policy on environmental quality. NEPA requires all federal agencies to give appropriate consideration to all potential impacts of proposed major federal actions as a part of planning and administration. Forest management activities conducted by the BIA are federal actions that require interdisciplinary coordination and NEPA documentation. Possible levels of NEPA documentation include:

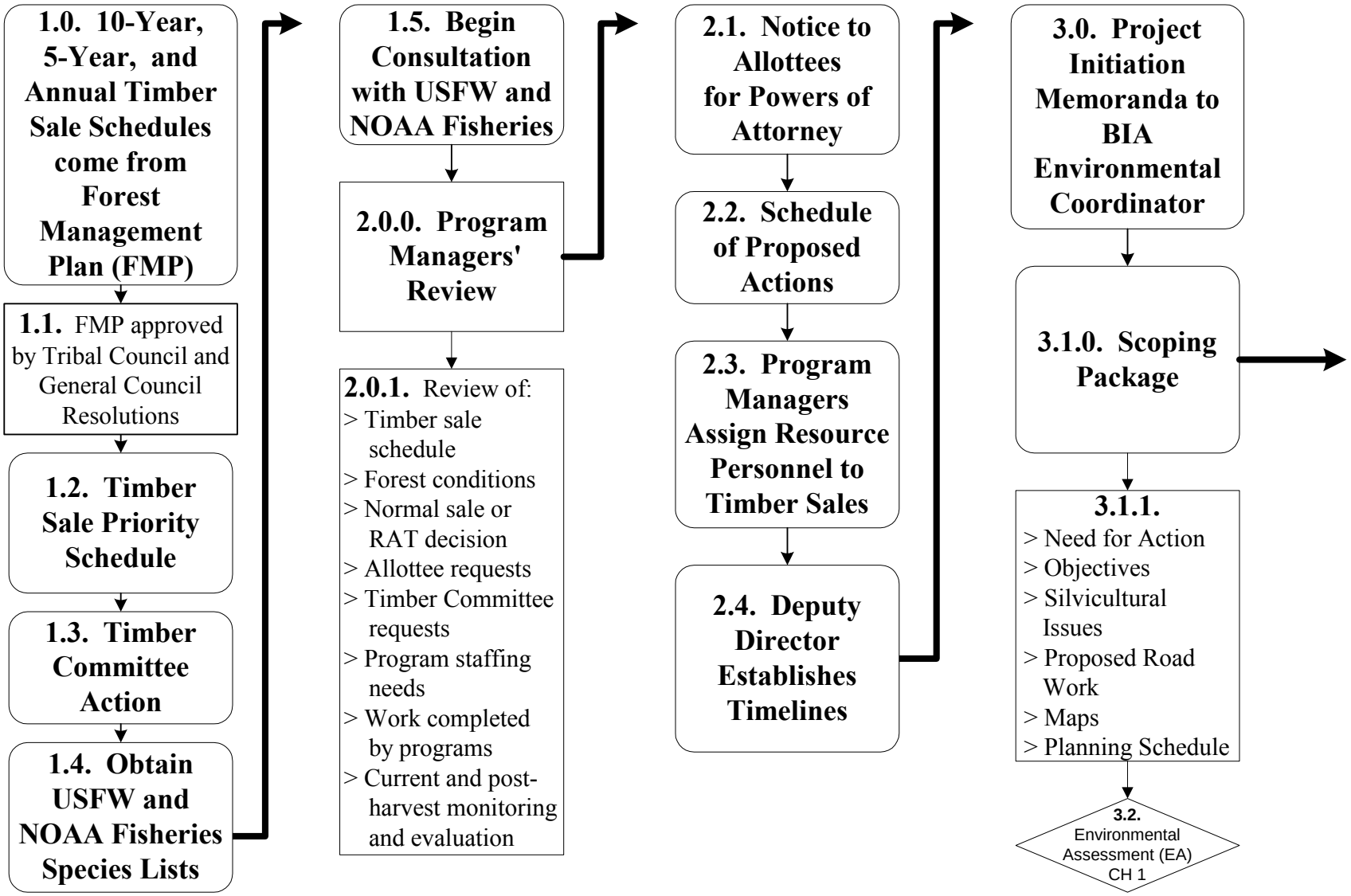
- Documentation of a Categorical Exclusion (CE);
- Preparation of an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI); and
- Preparation of an Environmental Impact Statement (EIS) and a Record of Decision (ROD).

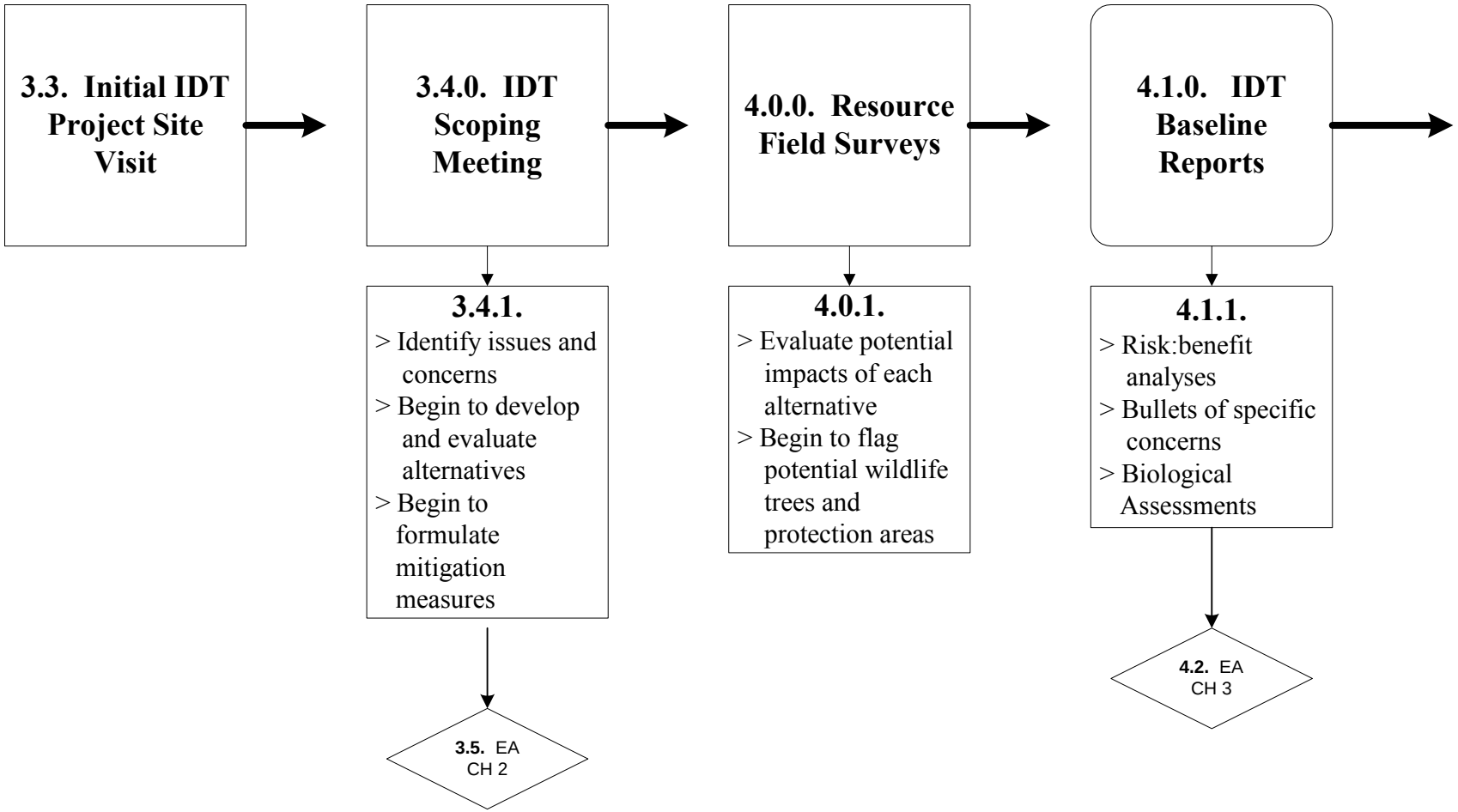
The FMP describes a strategy for achieving the goals and objectives of sustainable management on the Yakama Forest. The document was developed by the BIA Branch of Forestry in coordination with the YN Department of Natural Resources in accordance with the requirements of the National Indian Forest Resources Management Act (US Code Title 25, Chapter 33), the Code of Federal Regulations (CFR) Title 25, Indians, CFR Title 40 Protection of Environment, and the Indian Affairs Manual (IAM), Part 53, Forestry.

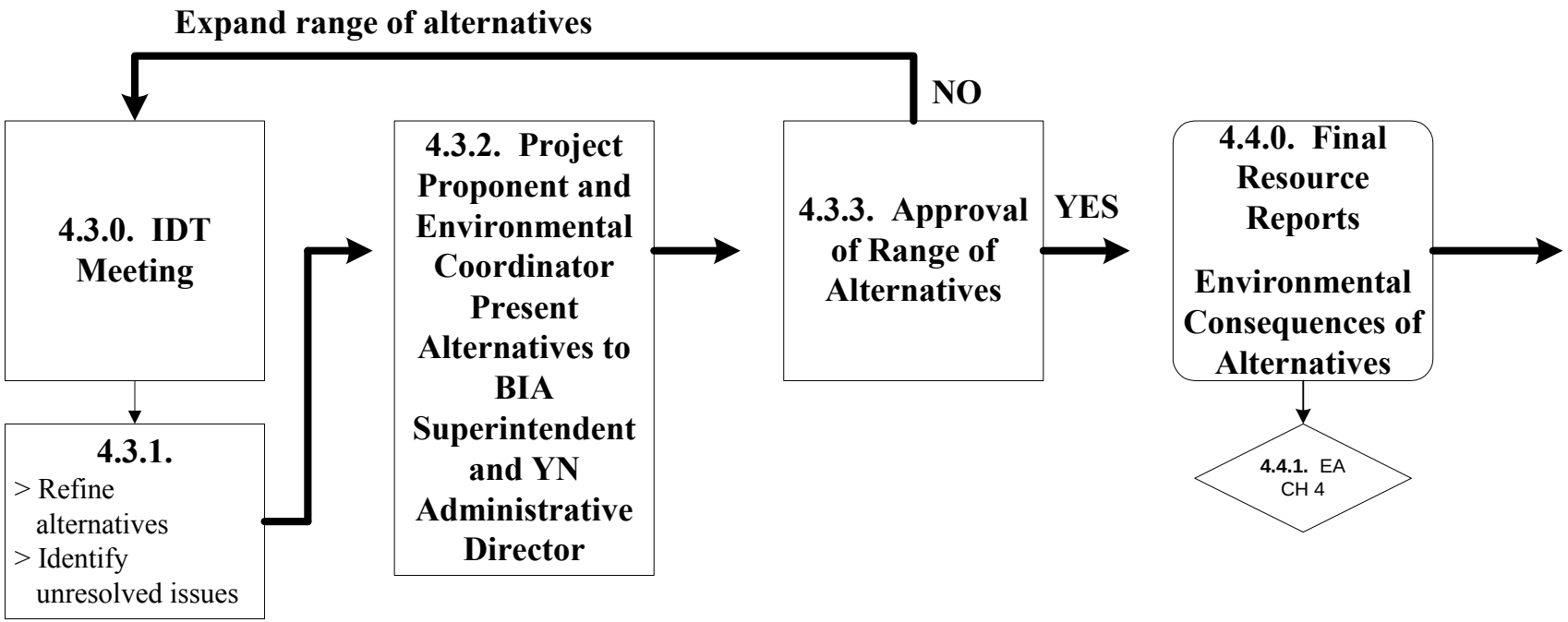
In this FMP the Yakama Forest is divided into 9 forest habitat types with management emphasis areas. Each habitat type is managed for multiple-uses with emphasis on dominant resources and objectives. Forest-wide policies are used in conjunction with habitat type silvicultural prescriptions for planning and implementing timber sales. These policies are described in Chapter V, Management Directions, and Appendix A, Best Management Practices.

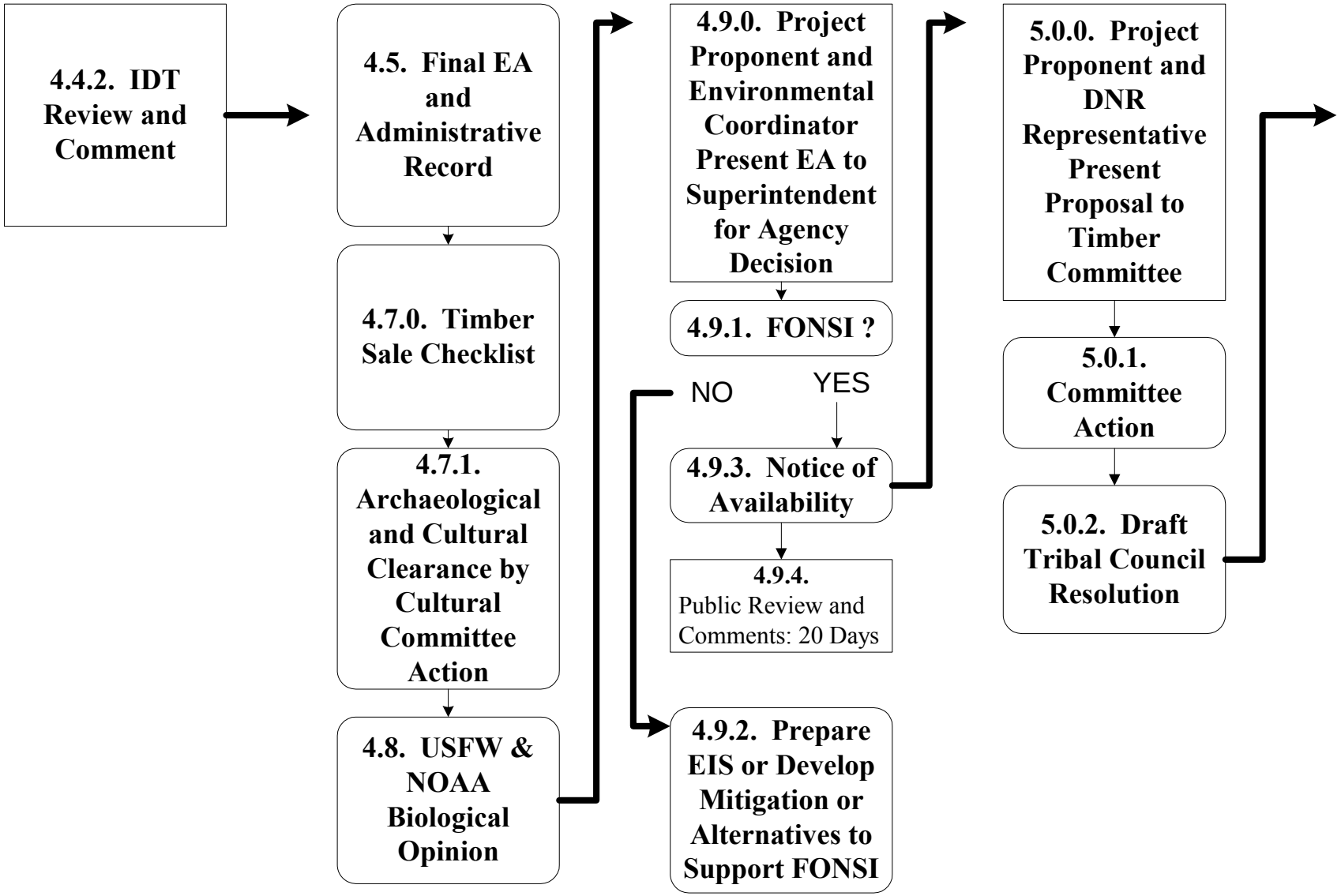
A programmatic EA was completed for this FMP. Timber sale EAs will be prepared for each harvest operation and will tier directly to the Programmatic EA. The following flowcharts illustrate the timber sale planning and administration process. A narrative follows with numbered paragraphs corresponding to the numbered boxes in the flowchart.

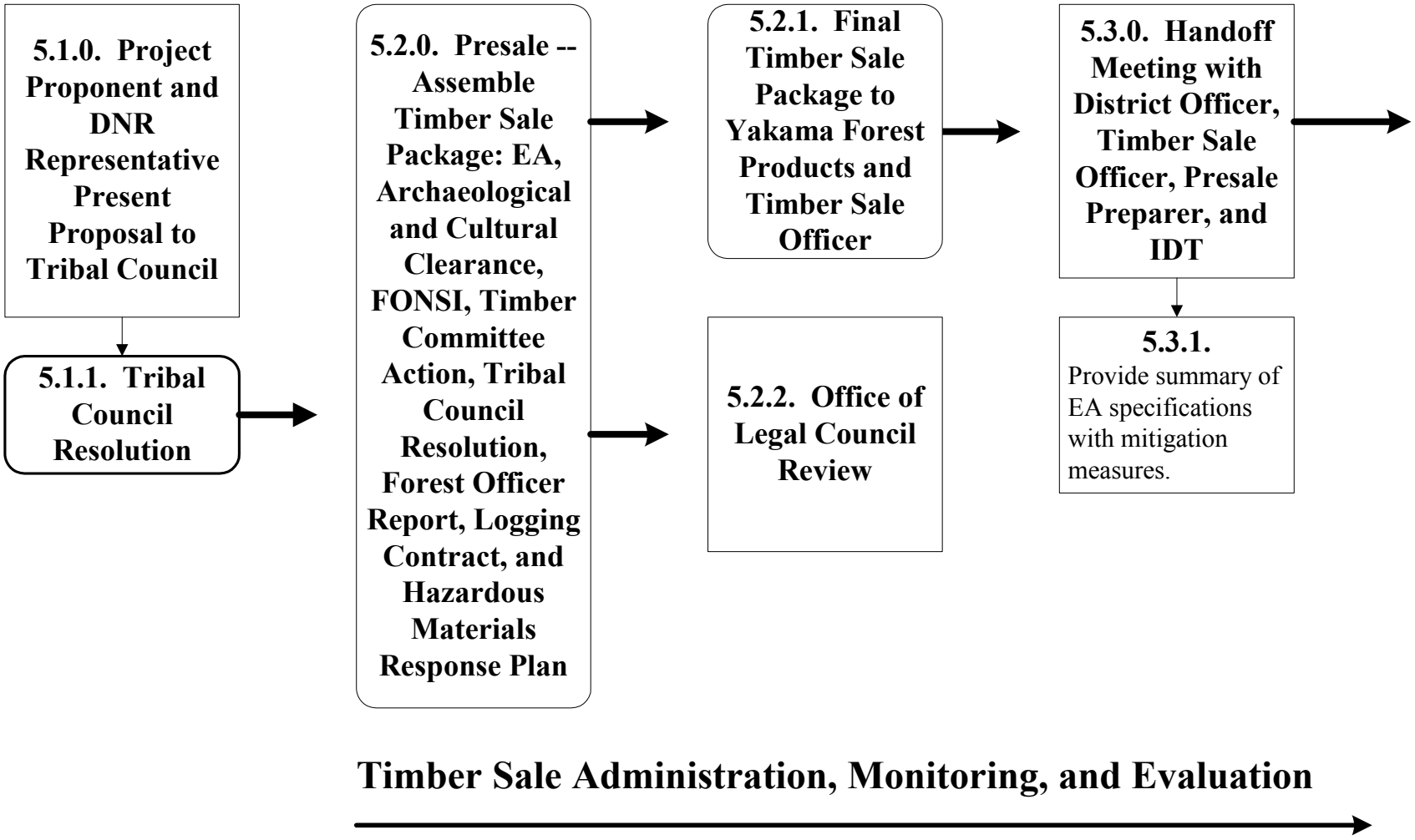
NEPA Process for Timber Sale Planning and Administration

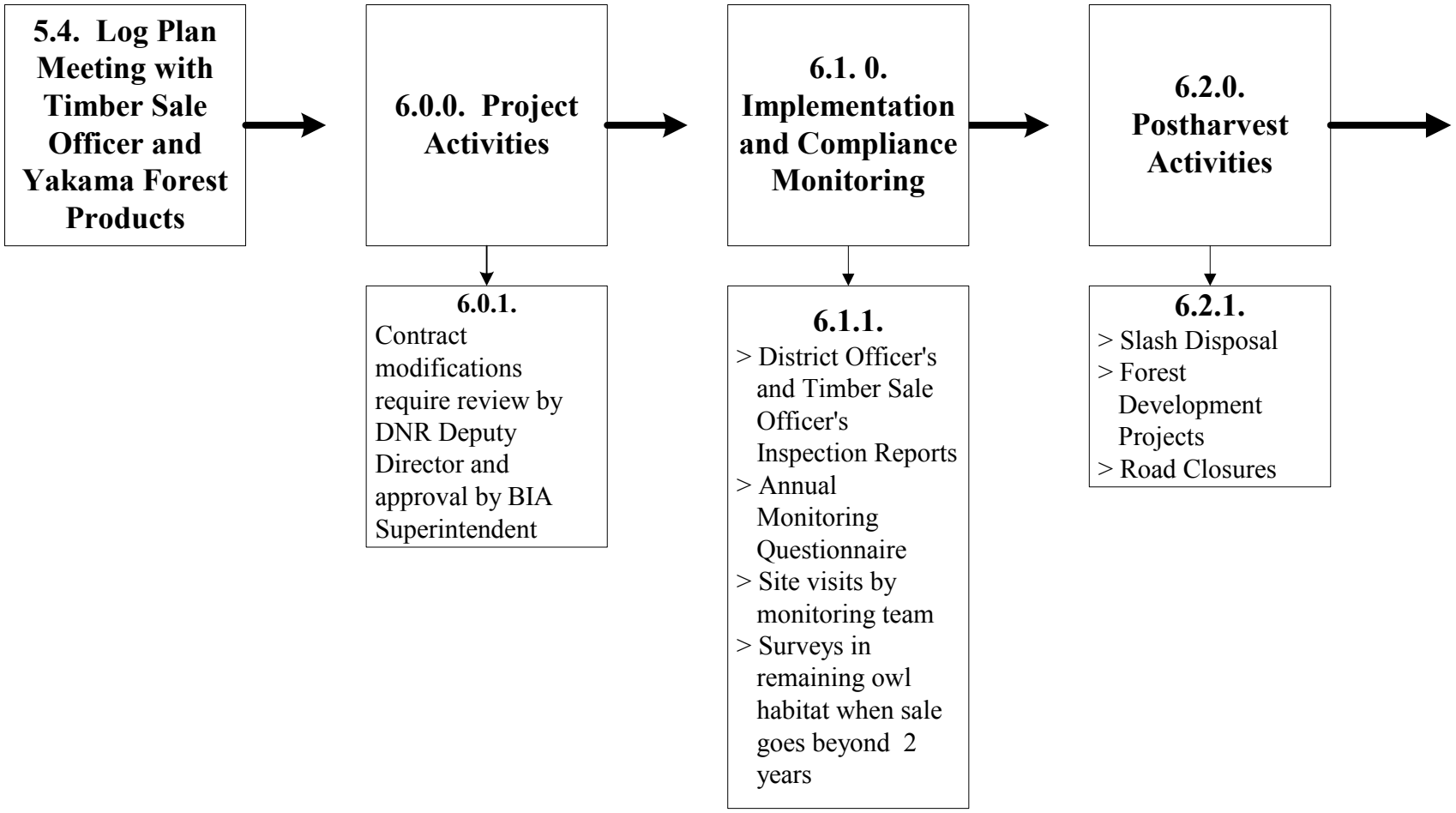



3.3. Initial IDT Project Site Visit
3.4.0. IDT Scoping Meeting
4.0.0. Resource Field Surveys
4.1.0. IDT Baseline Reports
3.4.1.
> Identify issues and concerns
> Begin to develop and evaluate alternatives
> Begin to formulate mitigation measures
4.0.1.
> Evaluate potential impacts of each alternative
> Begin to flag potential wildlife trees and protection areas
4.1.1.
> Risk:benefit analyses
> Bullets of specific concerns
> Biological Assessments
3.5. EA CH 2
4.2. EA CH 3


Expand range of alternatives
NO
4.3.0. IDT Meeting
4.3.1.
> Refine alternatives
> Identify unresolved issues
4.3.2. Project Proponent and Environmental Coordinator Present Alternatives to BIA Superintendent and YN Administrative Director
4.3.3. Approval of Range of Alternatives
YES
4.4.0. Final Resource Reports
Environmental Consequences of Alternatives
4.4.1. EA CH 4


4.4.2. IDT Review and Comment
4.5. Final EA and Administrative Record
4.7.0. Timber Sale Checklist
4.7.1. Archaeological and Cultural Clearance by Cultural Committee Action
4.8. USFW & NOAA Biological Opinion
4.9.0. Project Proponent and Environmental Coordinator Present EA to Superintendent for Agency Decision
4.9.1. FONSI ?
NO
YES
4.9.3. Notice of Availability
4.9.4. Public Review and Comments: 20 Days
4.9.2. Prepare EIS or Develop Mitigation or Alternatives to Support FONSI
5.0.0. Project Proponent and DNR Representative Present Proposal to Timber Committee
5.0.1. Committee Action
5.0.2. Draft Tribal Council Resolution


5.1.0. Project Proponent and DNR Representative Present Proposal to Tribal Council
5.1.1. Tribal Council Resolution
5.2.0. Presale -- Assemble Timber Sale Package: EA, Archaeological and Cultural Clearance, FONSI, Timber Committee Action, Tribal Council Resolution, Forest Officer Report, Logging Contract, and Hazardous Materials Response Plan
5.2.1. Final Timber Sale Package to Yakama Forest Products and Timber Sale Officer
5.2.2. Office of Legal Council Review
5.3.0. Handoff Meeting with District Officer, Timber Sale Officer, Presale Preparer, and IDT
5.3.1. Provide summary of EA specifications with mitigation measures.
Timber Sale Administration, Monitoring, and Evaluation


5.4. Log Plan Meeting with Timber Sale Officer and Yakama Forest Products
6.0.0. Project Activities
6.0.1.
Contract modifications require review by DNR Deputy Director and approval by BIA Superintendent
6.1. 0. Implementation and Compliance Monitoring
6.1.1.
> District Officer's and Timber Sale Officer's Inspection Reports
> Annual Monitoring Questionnaire
> Site visits by monitoring team
> Surveys in remaining owl habitat when sale goes beyond 2 years
6.2.0. Postharvest Activities
6.2.1.
> Slash Disposal
> Forest Development Projects
> Road Closures

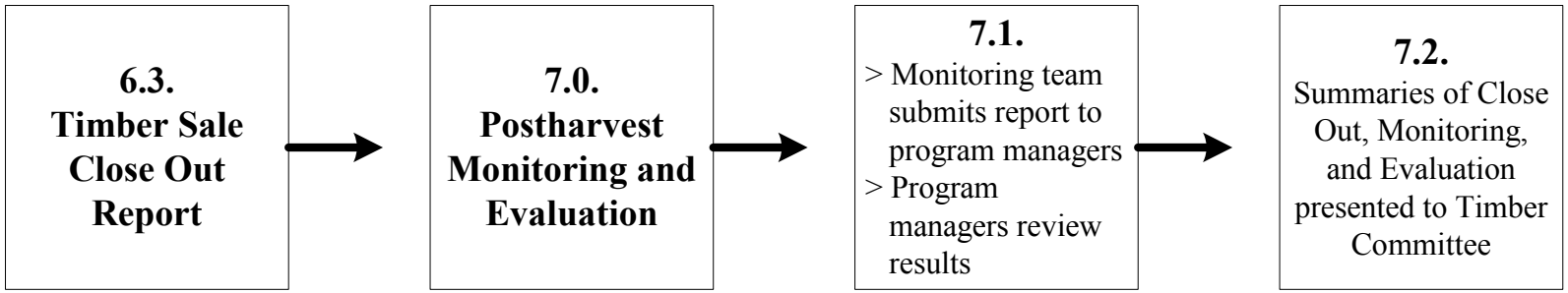


Figure VII–1. Implementation of the NEPA Process for Timber Sales

NEPA Process for Timber Sale Planning and Administration

Numbered items and actions correspond to the numbered boxes in Figure VII–1.

1.0. A 10-year timber sale schedule is developed by the Presale Unit for the FMP; revised 5-year and 1-year timber sale schedules are developed annually.

1.1. The Yakama Tribal Council identifies the preferred management alternative and approves the FMP by Resolution; the Yakama General Council also approves the FMP by Resolution.

1.2. The FMP is reviewed periodically during the planning period and, if necessary, a revised Timber Sale Priority Schedule is developed.

1.3. The timber sale priority schedule is approved by the Timber, Grazing, Overall Economic Development Committee (Timber Committee) by Committee Action. The Timber Committee sends the timber sale priority schedule to the forest manager for implementation.

1.4. Lists of species occurring on the proposed timber sales are obtained from the United States Fish and Wildlife Service (USFW) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries. (Species information is available on NOAA's internet websites.)

1.5. Consultation begins with USFW and NOAA Fisheries. Section 7 of the Endangered Species Act requires consultation with the USFW and NOAA for harvest activities. Biological assessments are prepared by the YN Wildlife Program, YN Fisheries Program, and BIA Branch of Forestry and submitted to USFW and NOAA Fisheries. The Agencies are expected to provide Biological Opinions within 135 days (see 4.8).

2.0.0. Program managers meet annually to discuss natural resources management issues. More frequent meetings (quarterly) may be scheduled when changes in resource conditions warrant.
2.0.1. Program managers will review the timber sale priority schedule and consider if any schedule modifications should be recommended to the Timber Committee. For example, timber sales were reprioritized because of the western spruce budworm epidemic—areas with heavy defoliation and increasing mortality were moved up in the sale schedule and less threatened areas were moved back in the schedule. The managers will take into consideration changes in forest conditions, allottee requests, Timber Committee requests, work completed by the programs, and program staffing needs.

2.1. Notices are sent to allottees for powers of attorney, allowing the BIA to administer the sale of timber from Indian-owned allotments. The notices are sent approximately two months before the anticipated harvest date.

2.2. A schedule of proposed actions (timber sale schedule) is posted in the Yakama Agency Headquarters in Toppenish.

2.3. Program managers assign resource personnel to the Interdisciplinary Team (IDT) to plan, implement, and monitor specific timber sales. The following disciplines are represented in the IDT:

- Archaeology
- Cultural Resources
- Environmental Quality
- Fisheries
- Forestry
- Range
- Roads
- Soil
- Vegetation Management
- Water Code
- Water Resources
- Wildlife

2.4. The YN Deputy Director, or designee, consults with DNR staff and establishes timelines for completion of the EAs.

3.0. The NEPA process for a timber sale begins when the BIA Yakama Agency Forest Manager submits a Project Initiation Memorandum to the BIA Environmental Coordinator. The primary preparer writes the timber sale Environmental Assessment (EA) if one is required. The primary preparer is responsible for reviewing input from resource specialists and the public regarding the proposed timber sale. All input for the project is placed in an Administrative File, which is kept in the Yakama Agency Headquarters in Toppenish, WA. The primary preparer decides what information is relevant to the project and should be included in the EA and what information is extraneous. The Yakama Agency Superintendent is consulted if there is uncertainty as to whether specific information should be included in the EA.

3.1.0. The primary preparer develops a timber sale scoping package and presents it to the IDT.
3.1.1. The scoping document identifies the project proponent, describes the proposed action, need for action, project objectives, silvicultural issues, proposed road work, maps, decisions to be made, mitigation measures, possible alternatives, anticipated issues, anticipated level of documentation, environmental laws, consultation, required permits, and a planning schedule. A project site visit is scheduled to occur within two weeks after the project initiation memorandum has been distributed. A target of three months is set for completion of the timber sale EA, from the date of distribution of the project initiation memorandum (3.0.) to completion of the final EA (4.7). Programs that fail to meet the deadlines for submitting resource reports lose their standing in the process.

3.2. The scoping information is used to develop the EA Chapter 1, Purpose of and Need for Action.

3.3. The initial IDT project site visit occurs within two weeks after the project initiation memorandum has been distributed.

3.4.0. An IDT scoping meeting occurs within two weeks after the project site visit.
3.4.1. Issues, concerns, and opportunities are identified; alternatives and mitigation measures are formulated.

3.5. The identified issues, concerns, opportunities, and proposed alternatives are used to develop EA Chapter 2, Alternatives.

4.0.0. Resource field surveys are conducted by personnel from the disciplines listed in 2.3.

4.0.1. Resource specialists evaluate potential impacts of each alternative. The target timeline is for the surveys to be completed during a two-month period of snow-free access to the project area. With adequate staffing, it is anticipated that 6 to 8 timber sales could be assessed per year.

4.1.0. IDT baseline reports are submitted to the project proponent.
4.1.1. Resource specialists submit reports that describe the affected environment. Reports include risk and benefit analyses, identification of specific concerns, and biological assessments.

4.2. The resources baseline reports are used to develop EA Chapter 3, Affected Environment.

4.3.0. The primary preparer receives comments during the project planning period. The draft EA is edited and distributed to the IDT. After the resource baseline reports are incorporated, an IDT meeting is held to review the draft EA.
4.3.1. Proposed alternatives are refined and unresolved issues are identified.
4.3.2. The project proponent and the BIA Environmental Coordinator present the alternatives and unresolved issues to the BIA Superintendent and the YN Administrative Director.
4.3.3. If the range of alternatives is approved, the IDT members write their final reports. If the range of alternatives is not approved then the IDT refines the existing alternatives or develops new alternatives.

4.4.0. Resource specialists submit their final reports that describe the environmental consequences of each proposed alternative.
4.4.1. The final resource reports are used to develop EA Chapter 4, Environmental Consequences. The IDT members review the Draft EA and submit their comments.

4.5. The final EA and Administrative Record are prepared.

4.7.0. Completion of reports and actions are recorded on the timber sale checklist by the BIA Environmental Coordinator. The checklist is forwarded to the Cultural Committee.
4.7.1. An archaeological and cultural clearance for the sale is approved by the Cultural Committee by Committee Action.

4.8. Biological Opinions are obtained from USFW and NOAA Fisheries.

4.9.0. The project proponent and the BIA Environmental Coordinator present the EA to the BIA Yakama Agency Superintendent.
4.9.1. The Superintendent determines if any or all of the alternatives support a FONSI.
4.9.2. If the alternatives do not support a FONSI then the IDT will develop mitigation or other alternatives that will support a FONSI or the IDT will develop an EIS.
4.9.3. If the alternatives support a FONSI then a Notice of Availability is posted in the Yakama Agency.
4.9.4. Individuals and entities that might be significantly affected or interested in the proposed action may provide comments about the FONSI and accompanying EA to the Yakama Agency Superintendent until 20 days after the signing of the FONSI. The Superintendent will consider all comments prior to implementing the proposed action. The opportunity to comment is not a

right to appeal the FONSI or EA. Any challenge to the adequacy of the FONSI or EA must be made, if at all, in an appeal of the decision which relies upon the FONSI and EA.

5.0.0. The project proponent and DNR representative present the proposal to the Timber Committee.

5.0.1. The Timber Committee selects an alternative and approves the sale by Committee Action.
5.0.2. The Timber Committee drafts a Tribal Resolution and recommends the proposed sale be considered by the full Yakama Tribal Council.

5.1.0. The project proponent and DNR representative present the proposed sale to the Yakama Tribal Council.
5.1.1. The Tribal Council approves the sale by Tribal Resolution.

5.2.0. A timber sale package is assembled, which includes the EA, Archaeological and Cultural Clearance, FONSI, Timber Committee Action, Tribal Council Resolution, Forest Officer Report, Timber Sale Contract and Hazardous Materials Response Plan.
5.2.1. A copy of the Timber Sale Package is given to the Timber Sale Purchaser.
5.2.2. The Timber Sale Package is also reviewed by the Office of Legal Council, which will notify the Timber Committee if any legal issues need to be addressed.

5.3.0. A handoff meeting is arranged with the District Officer, Timber Sale Officer (TSO), Primary Preparer, and the IDT.
5.3.1. IDT members provide summaries of EA specifications and mitigation requirements.

5.4. A log plan meeting is held with the TSO and a Timber Sale Purchaser representative.

6.0.0. Timber sale activities begin.
6.0.1. Contract modifications require review by the DNR Deputy Director and approval by the BIA Yakama Agency Superintendent. The DNR Deputy Director will determine if the contract modifications require interdisciplinary review.

6.1.0. Timber sale implementation and compliance monitoring is described in the FMP Appendix B. Yakama Forest Monitoring Guidelines.
6.1.1. The District Officer and TSO complete inspection reports during administration of the sale. Site visits are conducted by a monitoring team. Surveys are conducted in remaining owl habitat within the sale when the sale goes beyond two years.

6.2.0. Postharvest activities.
6.2.1. The Timber Sale Purchaser is responsible for slash disposal. Forest Development crews conduct precommercial thinning, site preparation, and tree planting. Some roads may be closed.

6.3. The TSO completes a timber sale close out report.

7.0. Postharvest Monitoring and Evaluation. A monitoring team conducts resource inspections and evaluates resource conditions.

7.1. The monitoring team submits their report to the program managers. Monitoring results are reviewed by the Program Managers (see 2.0.1.).

7.2. Summaries of the Close Out Report, Monitoring, and Evaluation are presented to the Timber Committee by the BIA Yakama Agency Forest Manager.

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Appendix A: Best Management Practices

Introduction

Purpose

Best Management Practices (BMPs) are required by the Clean Water Act (as amended by the Water Quality Act of 1987) on federally administered lands to reduce non-point source pollution to the maximum extent practicable. BMPs are considered the primary mechanisms to achieve Yakama Reservation water quality standards and will be adhered to under all resource management activities.

BMPs are defined as methods, measures, or practices selected on the basis of site-specific conditions to ensure that water quality will be maintained at its highest practicable level. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation).

Non-point sources of pollution result from natural causes, human actions, and the interactions between natural events and conditions associated with human use of the land and its resources. Non-point source pollution is caused by diffuse sources rather than a discharge at a specific single location. Such pollution results in alteration of the chemical, physical, and biological integrity of water. Erosion from a forest harvest unit or surface erosion from a road are examples of non-point sources.

The BMPs in this document are a compilation of existing policies, guidelines, and commonly employed practices designed to maintain or improve water quality. Objectives identified in this BMP Appendix also include maintenance or improvement of soil productivity and fish habitat since they are closely tied to water quality. Selection of appropriate BMPs will help meet Tribal Code and FMP objectives during management action implementation. Practices included in this Appendix supplement the management directions from this FMP Chapter V and they should be used together.

Organization and Use

Management activities plus separate sections that address activity planning and design, riparian reserves, wetlands, and fragile soils are included in this Appendix. Objectives are stated under each management activity followed by a list of practices designed to achieve the objectives.

BMPs are selected and implemented as necessary based on site-specific conditions to meet water quality, soil, or fish objectives for specific management actions. BMPs management directions may be modified to meet site-specific situations. This Appendix does not provide an exhaustive list of BMPs. Additional non-point source control measures may be identified during watershed analysis or during the interdisciplinary process when evaluating site-specific management actions. Implementation and effectiveness of BMPs need to be monitored to determine whether

the practices are correctly designed and applied to achieve the objectives. BMPs will be adjusted as necessary to ensure objectives are met.

Review and update of this Appendix will be an ongoing process. Updates will be made as needed to conform to changes in Yakama Nation policy, direction, or new information.

BMPs to Achieve Quality Soil and Water Management

Soils. See Soils Management Directions in Forest Management Plan Chapter V.

Water

Objective: To Meet Water Resource Management Direction for the Forest Management Plan

Practices in addition to those shown in the Soils Management Direction:

1. Construct new roads only where the existing road system is a) currently producing or has the potential (if utilized again) to cause high amounts of soil erosion and sedimentation into streams; b) inadequate to allow access to areas of sustained slope over 35 percent for cable yarding systems; or c) inadequate to access commercial timberland with skid distances less than 1,500 feet.
2. Use low impact forest harvest treatments and site preparation methods on soils that are highly susceptible to erosion. Avoid mechanical harvesting and site preparation in areas prone to accelerated erosion if potential for stream impact and sedimentation is moderate to high (soil scientist and hydrologist will provide input for project planning).
3. Relocate or decommission roads in riparian areas and place new roads outside of riparian areas.
4. Restrict grazing levels in stream corridors to reduce stream sedimentation and implement a grazing strategy based on rotation management.
5. Slash and fallen trees will be utilized in and near riparian areas wherever possible to restrict livestock access to stream channels.
6. Revegetate streambanks and riparian areas that have exposed soil as a result of management activities, construction, or natural impacts.

BMPs for Project Planning and Design

Planning

Objective: To include soil productivity, water quality, and hydrologic considerations in project planning.

Practices:

1. Use information from watershed analysis to prepare project level plans.
2. Use Soil Inventory mapping to identify areas classified as fragile due to slope gradient, mass movement potential, surface erosion potential, and high ground water levels.
3. Use the planning process to identify, evaluate, and map potential problems (e.g., slump prone areas, saturated areas, mass movement areas, and areas of accelerated erosion) that were not addressed in the watershed analysis.
4. Analyze watershed cumulative impacts and provide mitigation measures if necessary to meet water quality requirements.

5. Use watershed analysis information to determine potential for natural and activity-created high-intensity wildland fires at the project level. Reduce potential for high-intensity wildland fires through proposed management activities.

Design

Objective: To ensure that management activities maintain favorable conditions of soil productivity, water flow, water quality, and fish habitat.

Practices:

1. Design proposed management activities to mitigate potential adverse impacts to soil and water. Evaluate factors such as soil characteristics, watershed physiography, current watershed, and stream channel conditions, proposed roads, skid trails, logging system design, etc. to determine impacts of proposed management activities.
2. Design mitigation measure if adverse impacts to water quality, water quantity, or soil productivity may result from the proposed action.

Maps and Contract Requirements

Objective: To identify riparian areas to be protected and to ensure their protection on the ground.

Practices include the following on activity maps and contracts:

1. Locate all stream channels, lakes, ponds, reservoirs, and wetlands (springs, bogs, etc.) with appropriate riparian protection areas shown on project maps and contracts.
2. Include protection required for identified water bodies and riparian areas on project maps and contracts.

Cumulative Impacts

Objective: To minimize detrimental impacts on water and soil resources resulting from the cumulative impact of land management activities within a watershed.

Practices:

1. Coordinate scheduling of management activities such as timber sales, road construction, and watershed restoration activities among all participants on the reservation.
2. Use watershed analysis results to identify watersheds with a high level of cumulative impacts.
   A. The extent to which any or all of the following criteria exist will determine which watersheds have a high risk for water quality degradation due to cumulative impacts. The criteria are not listed in order of priority.
      a. Highly erodible soils (e.g., subject to surface erosion, landslides, or slumps).
      b. Large percent of forest vegetation harvested.
      c. Large area of compacted soil.
      d. Large percent of non-recovering openings in transient snow zone.
      e. High sedimentation potential.
      f. Poor to fair channel stability or condition.
      g. Poor to fair riparian condition (nonfunctional or functional-at-risk with downward trend).
      h. High impact from catastrophic event (e.g., wildland fire).
      i. High road density.
      j. Potential for adverse impact on a beneficial use.

   k. Monitoring data shows the water quality does not meet Tribal Code standards.
   l. Beneficial use impairment identified in non-point source assessments.
3. For watersheds identified as having a high risk for water quality degradation, an intensive evaluation will follow the initial analysis and include the nature of the problem, the cause of the problem, and a specific plan with objectives, and alternatives for recovery and mitigation. Water monitoring may also be initiated to validate the conclusion of the impact analysis and establish baseline data.
4. Based on site-specific conditions, select and apply special management practices, such as the following, to mitigate water quality impacts in high-risk watersheds.
   A. Develop and implement a watershed/riparian restoration plan and encourage coordination between Trust lands and fee land owners.
   B. Require plans of operation for mining, including rock quarries, and rights-of way.
   C. Require and review for BMP compliance, a management plan for all grazing allotments.
   D. Increase or decrease riparian protection area based on site-specific analysis.
   E. Utilize ecosystem-based concepts as defined in the FMP EA for timber harvest.
   F. Use helicopter logging where needed to protect soil and water resource values.
   G. Require full suspension cable yarding on sensitive soils and where vegetation is inadequate to protect the soil surface.
   H. Require seasonal restrictions with no waivers for timber falling and yarding.
   I. Minimize existing and prevent additional road caused impacts:
      a. Reduce road density (strive for 3 miles per square mile or less).
      b. Minimize road width and clearing limits.
      c. Require transport of excavated materials to appropriate disposal site (end hauling).
      d. Require seasonal restrictions with no waivers for construction, renovation, and hauling.
      e. Require special low impact maintenance and construction techniques.
      f. Limit roadside brushing/grubbing with excavator.
      g. No blading and ditch pulling during the spring runoff season unless to improve drainage.
      h. Remove culverts and reshape drainageway crossing on decommissioned roads.
      i. Provide for no net increase in roads (miles of road constructed cannot exceed miles of road decommissioned).
      j. Reduce soil compaction; and
      k. Reduce concentration of runoff.
   J. Restrict or officially close high and extremely sensitive watersheds to off-highway vehicle use and enforce the closure.
   K. Implement regular compliance reviews on all activities in the watershed.
   L. Assess trade-offs between wildland fire suppression impacts and wildland fire damage; plan suppression levels accordingly. Limit use of heavy equipment during wildland fire suppression.

Roads and Landings

Planning

Objective: To plan road systems that meets resource objectives and minimizes detrimental impacts on soil and water resources.

Practices:

1. Use an interdisciplinary team to develop an overall transportation system.
2. Establish road management objectives that minimize adverse environmental impacts.
3. Avoid fragile and unstable areas.
4. Encourage use of BMPs where not specifically required on non-Trust lands.

Location

Objective: To minimize soil erosion, water quality degradation, and disturbance of riparian vegetation.

Practices:

1. Locate roads on stable portions (e.g., ridges, natural benches, and flatter transitional slopes near ridges and valley bottoms). Implement extra mitigation measures, as necessary, when crossing unstable areas.
2. Avoid headwalls, midslope locations on steep unstable slopes, seeps, old landslides, slopes in excess of 70 percent, and areas where the geologic bedding planes, or weathering surfaces are inclined with the slope.
3. Locate roads to minimize heights of cutbanks. Avoid high, steeply sloping cutbanks in highly fractured bedrock.
4. Locate roads on well-drained soil types. Roll the grade to avoid wet areas and provide drainage.
5. Locate stream-crossing sites where channels are well defined, unobstructed, and straight.

General Design

Objective: To design the lowest standard of road consistent with use objectives and resource protection needs.

Practices:

1. Base road design standards and design criteria on road management objectives such as traffic requirements of the proposed activity and the overall transportation plan, an economic analysis, safety requirements, resource objectives, and the minimization of damage to the environment.
2. Consider future maintenance concerns and needs when designing roads.
3. Preferred road gradients are 2 to 10 percent with a maximum grade of 15 percent. Consider steeper grades in those situations where they will result in less environmental impact. Avoid grades less than 2 percent.
4. Road Surface Configurations:
   A. Outsloping—sloping the road prism to the outside edge for surface drainage is normally recommended for local spurs or minor collector roads where low volume traffic and lower traffic speeds are anticipated. It is also recommended in situations where long intervals between maintenance will occur and where minimum excavation is desired. Outsloping is not recommended on gradients greater than 8–10 percent.
   B. Insloping—sloping the road prism to the inside edge is an acceptable practice on roads with gradients more than 10 percent and where the underlying soil formation is very rocky and not subject to appreciable erosion or failure.
   C. Crown and Ditch—this configuration is recommended for arterial and collector roads where traffic volume, speed, intensity, and user comfort are a consideration. Gradients may range from 2 to 15 percent as long as adequate drainage away from the road surface and ditch lines is maintained.
5. Minimize excavation through the following actions: use of balanced earthwork, narrow road width, and end-hauling where slopes are greater than 60 percent.
6. Locate waste areas suitable for depositing excess excavated material.
7. Surface roads if they will be subject to traffic during wet weather. The depth and gradation of surfacing will be determined by traffic type, frequency of use, weight of traffic, maintenance objectives, along with the stability and strength of the road foundation and surface materials.

8. Provide vegetative or artificial stabilization of cut and fill slopes in the design process. Avoid establishment of vegetation where it inhibits drainage from the road surface or where it restricts safety or maintenance. However, promote certain types of vegetation, such as grasses and sedges, that stabilize soils and do not adversely affect drainage or safety considerations.
9. Prior to completion of design drawings, field check the design to assure that it fits the terrain, drainage needs have been satisfied, and all critical slope conditions have been identified and adequate design solutions applied.

Surface Cross Drain Design

Objective: To design road drainage systems that minimize concentrated water volume and velocity and therefore reduce soil movement and maintain water quality.

Practices:

1. Design cross drains in ephemeral or intermittent channels to lie on solid ground rather than on fill material to avoid road failures.
2. Design placement of all surface cross drains to avoid discharge onto erodible (unprotected) slopes or directly into stream channels. Provide a 200-foot buffer or sediment basin between the cross drain outlet and the stream channel.
3. Locate culverts or drainage dips in such a manner to avoid discharge onto unstable terrain such as headwalls, slumps, or block failure zones. Provide adequate spacing to avoid accumulation of water in ditches or surfaces through these areas.
4. Provide energy dissipaters (e.g., rock material) at cross drain outlets or drain dips where water is discharged onto loose material, erodible soil, or steep slopes.
5. Place protective rock at culvert entrance to streamline water flow and reduce erosion.
6. Use drainage dips in place of culverts on roads that have gradients less than 10 percent or where road management objectives result in blocking roads. Avoid drainage dips on road gradients greater than 10 percent.
7. Locate drainage dips where water might accumulate or where there is an outside berm that prevents drainage from the roadway.
8. When sediment is a problem, design cross drainage culverts or drainage dips immediately upgrade of stream crossings to prevent ditch sediment from entering the stream.
9. Rolling gradients are recommended in erodible and unstable soils to reduce surface water volume and velocities as well as culvert requirements.

Permanent Stream Crossing Design

Objective: To prevent stream crossings from being a direct source of sediment to streams, thus minimizing water quality degradation and to provide unobstructed access to spawning and rearing areas for anadromous and resident fish.

Practices:

1. Use pipe arch culverts on most fishery streams. Use bottomless arch culverts and bridges where gradients greater than 5 percent, stream discharge, and value of fishery resource dictate special engineering considerations necessary to ensure uninterrupted fish passage.
2. Use controlled blasting techniques that minimize the amount of material displaced from road location.
3. Construct embankments, including waste disposal sites, of appropriate materials (no slash or other organic materials) using one or more of the following methods:
   A. Layer placement (tractor compaction)

   B. Layer placement (roller compaction)
   C. Controlled compaction (85 to 95 percent maximum density)
4. Avoid sidecasting where it will adversely effect water quality or weaken stabilized slopes.
5. Slash and organic material may remain under waste embankment areas outside the road prism and outside units planned for broadcast burning.
6. Provide surface drainage prior to fall rains and snowfall.
7. Clear drainage ditches and natural watercourses of woody material deposited by construction or logging above culverts prior to fall rains and snowfall.

Temporary Stream Crossing Design

Objective: To design temporary stream crossings that minimize disturbance of the stream and riparian environment.

Practices:

1. Evaluate the advantages and disadvantages of a temporary versus permanent crossing structure for access to the area during all seasons over the long-term in terms of economics, maintenance, and resource requirements.
2. Design temporary structures such as prefabricated temporary timber bridges, multiple culverts with minimum fill height, cattleguard crossings, or log cribs to keep vehicles out of the stream.
3. Minimize the number of temporary crossings on a particular stream.
4. Avoid temporary stream crossings on fishery streams.
5. Avoid installation and use of temporary crossing structures during the rain/snow/snowmelt season. Plan for placement and use of structures during the dry season, generally from May 15 to October 15. When conditions permit operations outside the dry season, design and maintain structural integrity to the 100-year peak flow with consideration of the debris likely to be encountered.
6. Install temporary structures to provide adequate fish passage, as necessary.

Low-Water Ford Stream Crossing Design

Objective: To design low-water fords that minimize disturbance of the stream and riparian environment.

Practice:

1. Use only when site conditions make it impractical or uneconomical to utilize a permanent or temporary crossing structure.
2. Use when debris passage is an issue, such as after logging.
3. Use when maintenance is an issue.
4. Use on intermittent streams.
5. Use where approach grades are less than 15%.
6. Avoid placement in fish bearing streams.

Construction

Objective: To create a stable roadway while minimizing soil erosion and potential water quality degradation.

I. General

Roadway Construction

Practices:

1. Limit road construction to the dry season (generally between May 15 and October 15). Regardless of season, keep erosion control measures current with ground disturbance to the extent that the affected area can be rapidly closed/blocked and weatherized if weather conditions warrant. Employ erosion control measures to prevent fine sediments from leaving the worksite and entering streams.
2. Manage road construction so that any construction can be completed and bare soil can be protected and established prior to fall rains and/or snowfall.
3. Confine preliminary equipment access (pioneer road) to within the roadway construction limits.
4. Construct pioneer road so as to prevent undercutting of the designated final cutslope and prevent avoidable deposition of materials outside the designated roadway limits. Conduct slope rounding at the first opportunity during construction to avoid excess amounts of soil being moved after excavation and embankment operations are completed.
5. Use controlled blasting techniques that minimize the amount of material displaced from road location.
6. Construct embankments, including waste disposal sites, of appropriate materials (no slash or other organic materials) using one or more of the following methods:
   A. Layer placement (tractor compaction)
   B. Layer placement (roller compaction
   C. Controlled compaction (85 to 95 percent maximum density)
7. Avoid sidecasting where it will adversely effect water quality or weaken stabilized slopes.
8. Slash and organic material may remain under waste embankment areas outside the road prism and outside units planned for broadcast burning.
9. Provide surface drainage prior to fall rains and snowfall.
10. Clear drainage ditches and natural watercourses of woody material deposited by construction or logging above culverts prior to fall rains and snowfall.
11. Within 200 feet of streams, protect all disturbed areas from erosion using vegetation or other means, within seven days of project completion.

II. Permanent Stream Crossing Construction

Practices:

1. Confine culvert installation to the low flow period, or according to instream work windows regulated by the Water Code (generally July 15 to October 15 in Satus, Toppenish, Simcoe, and Agency Creek basins; July 15 to August 31 in Ahtanum basin; and July 1 to August 31 in the Klickitat River basin, except in Trout, White, and Summit Creek basins where July 1 to October 15 generally applies) to minimize sedimentation and the adverse effects of sediment on aquatic life.
2. Divert the stream around the work area to minimize downstream sedimentation.
3. Install culverts according to an approved design to maintain structural integrity with the 100-year peak flow with consideration of the debris loading likely to be encountered. Where excessive debris loading is likely to be encountered, route the flow past the culvert without jeopardizing the culvert or associated fill (e.g., install high flow sag or armored bypass dip in road fill).
4. Install culverts as close to zero percent slope as possible on fishery streams, but not in excess of 0.5 percent. Place culverts in the streambed at the existing slope gradient on larger non-fishery streams. Place energy dissipaters (e.g., large rock) at the outfall of culverts on small non-fishery streams to reduce water velocity and minimize scour at the outlet end.

5. Countersink culvert 6 to 8 inches below the streambed to minimize scouring at the outlet. Increase culvert diameters accordingly to offset the countersink.
6. Limit activities of mechanized equipment in the stream channel to the area necessary for installation.
7. Place permanent stream crossing structures in fishery streams before heavy equipment moves beyond the crossing area. Where this is not feasible, install temporary crossings to minimize stream disturbance.
8. Place riprap on fills around culvert inlets and outlets.
9. Limit alteration or disturbance of the bank and bank vegetation to that necessary for the project. Protect all disturbed areas from erosion using vegetation or other means within seven days following project completion.
10. Use erosion control methods to prevent siltation. Methods include, but are not limited to straw bales, silt fence, filter fabric, temporary sediment ponds, check dams, and mulching of exposed areas.
11. Deposit all waste materials, such as construction debris, silt, excess soil, or overburden material resulting from the project above the limits of flood water in an approved upland disposal site.

III. Temporary Stream Crossing Construction

Practices:

1. Where possible, limit the installation and removal of temporary crossing structures to only one time during the same year and within the prescribed work period. Installation and removal should occur during the low flow period (generally July 15 to October 15).
2. Use backfill material that is as soil-free as practicable over temporary culverts. Whenever possible use washed river rock covered by pit run of one inch minus as a compacted running surface.
3. Spread and reshape clean fill material to the original lines of the streambed channel after a crossing is removed to ensure the stream remains in its channel during high flow.
4. Use log cribbing in tractor logging units when it is impractical to use a culvert and rock backfill material. Remove upon completion of logging the unit.
5. Limit activities of mechanized equipment in the stream channel to the area that is necessary for installation and removal operations.
6. Remove stream crossing drainage structures and in-channel fill material during low flow and prior to fall rains. Re-establish the natural drainage configuration upon completion of project.

IV. Low-Water Ford Stream Crossing Construction

Practices:

1. Restrict construction and use to low flow period (generally July 15 to October 15).
2. Use washed rock/gravel or concrete slab in the crossing.
3. Apply rock on road approaches within 150 feet of each side of the ford to prevent washing and softening of the road surface.

Landings

Objective: To minimize soil disturbance, soil erosion, soil productivity losses, and water quality degradation.

Practices:

1. Locate landings at sites approved by the Officer-in-Charge.
2. Avoid placing landings adjacent to or in meadows or wetland areas.

3. Clear or excavate landing to minimum size needed for safe and efficient operations.
4. Select landing locations considering the least amount of excavation, erosion potential, and where sidecast will not enter drainages or damage other sensitive areas.
5. Deposit excess excavated material on stable sites where there is no erosion potential.
6. Where landings are compacted, rip with subsoiler equipment for site restoration.
7. Restore landings to the natural configuration or shape to direct the runoff to preselected spots where water can be dispersed to natural, well-vegetated, gentle ground.

Road Erosion Control

Objective: To limit and mitigate soil erosion and sedimentation.

Practices:

1. Apply protective measures to all areas of disturbed, erosion-prone, unprotected ground, including waste disposal sites prior to fall rains and/or snowfall. Protective measures may include water bars, water dips, grass seeding, planting deep-rooted vegetation, and/or mulching. Armor or buttress fills slopes and unstable areas with rock that meets construction specifications.
2. Use seasonal restrictions on natural surface roads.

Road Renovation/Improvement

Objective: To restore or improve a road to a desired standard in a manner that minimizes sediment protection and water quality degradation.

Practices:

1. Require roadside brushing be done in a manner that prevents disturbance to root systems (i.e., improve flat gradients to a minimum of 2 percent or provide raised subgrade sections (turnpike) to avoid saturation of the road prism).
2. Reconstruct culvert catch basins to specifications. Catch basins in solid rock need not be reconstructed provided soil, rock, or other debris does not restrict water flow.
3. Identify potential water problems caused by off-site disturbance and add necessary drainage facilities.
4. Identify ditch line and outlet erosion caused by excessive flows and add necessary drainage facilities and armoring.
5. Replace undersized culverts and repair damaged culverts and downspouts.
6. Add additional full-rounds, half-rounds, and energy dissipaters as needed.
7. Correct special drainage problems (e.g., high water table, seeps) that effect stability of subgrade through the use of perforated drains, geotextiles or drainage bays.
8. Eliminate undesirable berms that retard normal surface runoff.
9. Restore outslope or crown sections.
10. Avoid disturbing backslope while reconstructing ditches.
11. Surface inadequately surfaced roads that are to be left open to traffic during wet weather.
12. Avoid using excavators for brushing.

Road Maintenance

Objectives: To maintain roads in a manner that protects water quality and minimizes erosion and sedimentation.

Practices:

1. Provide basic custodial care to protect the road investment and to ensure minimal damage to adjacent land and resources.
2. Perform blading and shaping to conserve existing surface material, retain the original crowned or outsloped self-draining cross section, prevent or remove rutting berms (except those designed for slope protection), and other irregularities that retard normal surface runoff. Avoid wasting loose ditch or surface material over the shoulder where it can cause stream sedimentation or weaken slump prone areas. During maintenance, avoid undercutting backslopes.
3. Keep road inlet and outlet ditches, catch basins, and culverts free of obstructions, particularly before and during winter rainfall/snowfall. However, keep routine machine cleaning of ditches to a minimum during the wet season.
4. Promptly remove slide materials when it is obstructing road surfaces and ditch line drainage. Save all soil or material useable for quarry reclamation and stockpile for future reclamation projects. Utilize remaining slide material for needed road improvement or place in a stable waste area. Avoid sidecasting of slide material where it can damage, overload, saturate embankments, or flow into downslope drainage channels. Re-establish vegetation in areas where more than 50 percent of vegetation has been destroyed due to sidecasting.
5. Retain vegetation on cut slopes unless it poses a safety hazard or restricts maintenance activities. Cut roadside vegetation rather than pulling it out and disturbing the soil.
6. Remove snow on haul roads in a manner that will protect roads and adjacent resources. Remove or place snow berms to prevent water concentration on the roadway or on erodible sideslope soils.
7. Patrol areas subjected to road or watershed damage during periods of high runoff.

Dust Abatement

Objective: To minimize the movement of fine sediments from roads as well as to prevent introduction into waterways of chemicals applied for dust abatement.

Practices:

1. Use dust palliatives or surface stabilizers to reduce surfacing material loss and buildup of fine sediments that may wash off into watercourses.
2. Closely control application of dust palliatives and surface stabilizers, equipment cleanup, disposal of excess material to prevent contamination, or damage to water resource values.

Road Access Restrictions

Objective: To reduce road surface damage, thereby minimize erosion and sedimentation.

Practices:

1. Barricade or block roads using gates, guard rails, earth, logs, boulders, logging debris, or a combination of these methods. Avoid blocking roads that will need future maintenance (i.e., culvert cleaning, slide removal, etc.) with unremovable barricades. Use guardrails, gates, or other barricades capable of being opened for roads needing future maintenance.
2. Install waterbars, cross drains, cross sloping, or drainage dips if not already on road to assure drainage.
3. Scarify, mulch, and seed for erosion control.

Road and Landing Decommissioning

Objective: To reduce soil compaction, minimize or reduce sedimentation, and improve site productivity by decommissioning roads and landings and rehabilitating the land.

Practice:

1. Conduct interdisciplinary review before decommissioning roads to reduce road density and protect riparian habitat.
2. Rip temporary spur roads and landings by an approved method to remove ruts, berms, and ditches while leaving or replacing surface cross drain structures.
3. Return roads or landings not needed for future resource management to resource production by re-vegetating with native species. Apply mulch and fertilizer where appropriate.

Water Source Development

Objective: To supply water for various resource programs while protecting water quality and riparian vegetation.

Practices:

1. Design and construct durable, long-term water resources.
2. Avoid reduction of downstream flow that would detrimentally affect aquatic resources, fish passage, or other uses.
3. Direct overflow from water-holding developments back into the stream.
4. Locate road approaches to instream water source developments to minimize potential impacts in the riparian zone. Apply rock to surface of these approaches to reduce the effects of sediment washing into the stream.
5. Avoid use of road fills for water impoundment dams unless specifically designed for that purpose. Remove any blocking device prior to fall rains.
6. Construct water sources during the dry season (generally between July 15 and October 15).
7. Provide adequate fencing to prevent use of water source by livestock.

Rock Quarry Reclamation

Objective: To minimize sediment production from quarries and associated crusher pad developments susceptible to erosion due to steep sideslopes, lack of vegetation, or their proximity to watercourses.

Practices:

1. Prior to excavation, remove topsoil and place at a site with minimal erosion potential. Stockpile topsoil for surface dressing during the post-operation rehabilitation.
2. Use culverts and riprap for crusher pad drainage when necessary.
3. Stabilize quarry cutbanks and general quarry area.
4. Revegetate with native species, apply mulch, and provide adequate drainage to minimize erosion.
5. Rip, waterbar, block, fertilize, and revegetate access roads to quarries where no future entry is planned.

Timber Harvest, Yarding Methods

Cable

Objective: To minimize soil damage and erosion caused by displacement or compaction.

Practices:

1. Use full or partial suspension when yarding on erodible or ravel-prone areas where practical.
2. Use full or partial suspension with seasonal restrictions on areas with high water tables.
3. Use seasonal restrictions if required suspension cannot be achieved by yarding equipment.
4. Avoid downhill yarding.

Tractor

Objective: To minimize loss of soil productivity and reduce potential for surface runoff and subsequent water quality degradation.

Practices:

1. In previously unentered stands, use designated skid roads to limit soil compaction to less than 12 percent of the harvest area.
2. Minimize the width of skid roads.
3. For stands previously logged with tractors, utilize existing skid roads. Rip all skid roads used in the final harvest entry.
4. Rip skid roads discontinuously, preferably with winged ripper teeth when the soil is dry. Rips should be spaced no more than 36 inches apart and from 12 to 18 inches deep or to bedrock, whichever is shallower. Designated skid roads should be ripped if they will not be used again.
5. Avoid placement of skid roads through areas with high water tables.
6. Use appropriate seasonal restrictions that will not result in off-site damage for designated skid roads.
7. Allow logging on snow when snow depth is 18 inches or greater and negligible ground surface exposure occurs during the operation.
8. Restrict tractor operation to slopes less than 35 percent.
9. Construct waterbars on skid roads according to guidelines in Erosion Control for Timber Harvest section below.

Helicopter

Objective: To minimize surface disturbance on sensitive watersheds.

Practice: Employ helicopter yarding to avoid or minimize new road construction in sensitive watersheds.

Horse

Objective: To minimize soil disturbance, soil compaction, and soil erosion.

Practices:

1. Limit horse logging to slopes less than 20 percent.
2. Construct hand waterbars on horse skid trails according to guidelines in the following section.

3. Limit harvest activity to periods when soil moisture content at a six-inch dept is less than 25 percent by weight.

Erosion Control for Timber Harvest

Waterbars

Objective: To minimize soil erosion.

Practices:

1. Construct adequate waterbars on skid roads, yarding corridors, and fire lines prior to fall rains/snowfall.
2. Use the following techniques to construct waterbars:
   a. Open the downslope end of the waterbar to allow free passage of water.
   b. Construct the waterbar so that it will not deposit water where it will cause erosion.
   c. Compact the waterbar berm to prevent water from breaching the berm.
   d. Skew waterbars no more than 30 degrees from perpendicular to the centerline of the road or trail.
3. Use Table A–1 for waterbar spacing based on erosion class.

Table A–1. Waterbar Spacing by Gradient and Erosion Class

Gradient (%)	Erosion Class / Spacing in Feet		
	High	Moderate	Low
2–5	200	300	400
6–10	150	200	300
11–15	100	150	200
16–20	75	100	150
21–35	50	75	100
36+	50	50	50

Spacing is determined by slope distance and is the maximum allowed for the grade.
The following guide lists the rock types according to erosion class:
High: granite, sandstone, andesite porphyry, glacial or alluvial deposits, soft matrix conglomerate, Volcanic ash, and pyroclastics.
Moderate: basalt, andesite, quartzite, hard matrix conglomerate, and rhyolite.
Low: metasediments, metavolcanics, and hard shale.

Revegetation of Disturbed Areas

Objective: To establish an adequate vegetative cover on disturbed sites to prevent erosion.

Practice: Use native vegetation wherever possible that allows natural succession to occur. Avoid interference with reforestation operations. Include application of seed, mulch, and fertilizer as necessary. Complete prior to fall rains/snowfall.

Silviculture, Site Preparation

Gross Yarding

Objective: To achieve cool burn on sensitive soils and maintain protective duff layer.

Practice: Consider the following factors in preparing a prescription for gross yarding to reduce burn intensities: long-term site productivity, ecosystem dynamics, regeneration success, prescribed fire intensities, and smoke emissions.

Prescribed Fire—Underburn and Concentration Burning

I. General Guidelines

Objective: To maintain long-term site productivity of soil.

Practice: Evaluate need for burning based on soils, plant community, and site preparation criteria. Burn under conditions when a light burn can be achieved (See Table A–2) to protect soil productivity.

1. Category 1 Soils (highly sensitive) and Category 2 Soils (moderately sensitive): Burn only in spring-like conditions when soil and duff are moist. Maximize retention of duff layer. Assure retention of minimum levels of coarse woody debris and recruitment snags as specified in the FMP management directions.
2. Category 3 Soils (least sensitive): Burn to avoid high-intensity burns to protect a large percentage of the nutrient capital. Maximize retention of duff layer. Assure retention of minimum levels of coarse woody debris and recruitment snags as specified in the FMP management directions.

Table A–2. Guidelines for Levels of Prescribed Burn Intensity

Visual Characterization	Site-specific Results	Proportional Areas
Light Burn	The surface duff layer is often charred by fire, but not removed. Duff, crumbled wood or other woody debris is partly burned while logs are not deeply charred.	Less than 2 percent is severely burned while less than 15 percent is moderately burned.
Moderate Burn	Duff, rotten wood, or other woody debris partially consumed. Logs may be deeply charred, but mineral soil under the ash is not appreciably changed in color.	Less than 10 percent is severely burned and more than 15 percent is moderately burned.
Severe Burn	Top layer of mineral soil is significantly changed in color, usually to a reddish color. The next one-half inch of mineral soil is blackened from organic matter charring from heat conducted through the upper layer.	More than 10 percent is severely burned. More than 80 percent is moderately burned while the remainder of the surface area is lightly burned.

II. Firelines

Objective: To minimize soil disturbance, soil compaction, soil erosion, and disturbance to riparian management emphasis areas.

Practices:

1. Construct firelines by hand on all slopes greater than 35 percent.
2. Utilize one-pass construction with a brush blade for tractor firelines.
3. Construct waterbars on tractor and hand firelines according to guidelines provided in the Erosion Control for Timber Harvest section.
4. No machine-constructed firelines will be made in the riparian management emphasis area.

Prescribed Fire—Piling

I. Hand Piling

Objective: To prevent soil damage caused by high-intensity burn.
Practice: Burn piles when soil and duff moisture are high.

II. Tractor Piling

Objective: To protect soil productivity and to prevent soil damage caused by compaction, displacement, and high-intensity burn.

Practices:

1. Restrict tractor operations to dry conditions with less than 25 percent soil moisture content by weight in the upper six inches.
2. Restrict tractor operation to slopes less than 20 percent.
3. Construct small-diameter piles or pile in windrows using brush blades.
4. Avoid piling concentrations of large logs and stumps.
5. Pile small materials (1 to 3 inches diameter size).
6. Burn piles when soil and duff moisture are high.
7. Rip entire area to maintain soil productivity except those areas occupied by piles. Use winged ripper teeth and rip on the contour to a minimum depth of 12 inches.
8. Avoid displacement of duff and topsoil into piles or windrows.
9. Make only two machine passes (one round trip) over the same area wherever practical.
10. Use the lowest ground pressure machine capable of meeting objectives.

Fertilization

Objective: To protect water quality and to avoid impacts on the riparian zone.

Practices:

1. Avoid aerial application of material when wind speeds would cause drift.
2. Locate operations and storage areas away from riparian emphasis areas.
3. No applications of material will occur in the riparian emphasis areas.
4. Avoid direct application to ephemeral stream channels.

Mineral Development (Rock, Gravel, and Sand)

Objective: To protect surface and groundwater quality and to minimize disturbance to stream banks and riparian habitat.

Practices:

1. Require the operator to obtain all required federal and tribal operating permits.
2. Comply with seasonal restrictions.
3. Locate, design, operate, and maintain sediment-settling ponds in conformance with Tribal Code.
4. Use existing roads, skid trails, and stream crossings whenever possible.
5. Apply rock to roads constructed or reconstructed for vehicular access to the mining area. Provide roads with adequate drainage.
6. Prior to the winter season, rip, waterbar, seed, mulch, and barricade all roads and trails constructed for exploratory purposes that are unnecessary for the mining operation.
7. Construct waterbars and barricade all natural surface roads and trails when an operation shuts down for the winter season.
8. Rip, waterbar, seed, mulch, and barricade disturbed areas and watercourses.
9. Construct a berm or trench between disturbed areas and watercourses.
10. Stockpile topsoil for use during reclamation of the site. Construct a berm or trench immediately downslope of the stockpile to prevent sediment movement.
11. Stabilize and contour the area, replace topsoil and mulch, seed, and plant the area with tree seedlings where applicable when no further mining is contemplated.
12. During the winter season, contour and mulch disturbed areas that will not be mined for at least 30 days.
13. Confine mining operations to bench areas rather than allow encroachment on the stream whenever possible.
14. Locate and maintain adequate sanitation facilities.

Vehicle Fuels

Objective: To protect water quality by prevention of contamination with petroleum products.

Practices:

1. No transfer or storage of petroleum products will be made in riparian emphasis areas.
2. Berms will be constructed around petroleum storage areas to prevent off-site movement of leaks.
3. Contaminated soils from petroleum spills will be collected and transported to the proper facilities for treatment.

Livestock Grazing

Objective: To protect, maintain, or improve water quality, riparian-wetland areas, and upland plant communities to maintain properly functioning riparian ecosystems.

Practices:

1. Consider fencing springs, seeps, and water developments to protect water quality and riparian ecosystems.
2. Ensure rest for plant growth and vigor during the critical growing period.
3. Monitor, evaluate, and adjust livestock management practices to meet resource objectives.
4. Resolve management conflicts through the development of grazing management plans.
5. Promote ecological recovery through appropriate forage utilization levels.
6. Develop and implement recovery plans for riparian areas.

Wildland Fire, Prevention

Objective: To minimize occurrence of high-intensity wildland fires in riparian management emphasis areas on sensitive soils and sensitive watersheds.

Practice: Utilize prescribed burning to reduce both natural and management related slash (fuels) in and adjacent to silvicultural treatment units.

Suppression

Objective: To minimize water quality degradation while achieving rapid and safe suppression of wildland fires.

Practices:

1. Apply the appropriate level of wildland fire suppression that considers impacts of the wildland fire as well as the suppression activity.
2. Construct firelines by hand within riparian management emphasis areas where possible.
3. Apply aerial retardant adjacent to riparian management emphasis areas by making application parallel to the emphasis area.

Rehabilitation

Objective: To protect water quality and soil productivity with consideration for other resources.

Practices:

1. Utilize native vegetation information as the framework for prescribing rehabilitation activities.
2. Develop a fire rehabilitation plan through an interdisciplinary process.
3. Select treatments on the basis of on-site values, downstream values, probability of successful implementation, social, and environmental considerations (including protection of native and cultural plant communities), and cost as compared to benefits.
4. Erosion control seeding should attempt to meet the intent of ecosystem-based management and FMP management objectives. Use seed availability information to prioritize erosion control seeding. First priority should be native seed sources for grasses and forbs, followed by non-native annual grasses and forbs, and the lowest priority should be the use of exotic perennial grasses.
5. Examples of emergency fire rehabilitation treatments include:
   a. Seeding or planting native species or other vegetation that accomplishes necessary erosion control and meets site restoration objectives.
   b. Mulch with straw or other suitable materials.
   c. Fertilize.
   d. Place channel stabilization structures.
   e. Place trash racks above road drainage structures.
   f. Construct waterbars on firelines.

Watershed Restoration

Roads (See previous sections).

Riparian Vegetation (See previous sections).

In-Stream Habitat Structures

Objective: To minimize damage to streambank and riparian habitat during construction of in-stream habitat improvement projects.

Practices:

1. Carefully plan access needs for individual work sites within a project area to minimize exposure of bare soil, compaction, and possible damage to tree roots. Utilize existing trails and roads to the extent practical.
2. Base design of habitat improvement structures on state-of-the-art techniques and local stream hydraulics.
3. Conduct work in stream channels between July 1 and October 31 (in the Satus and Toppenish watersheds) or July 1 and August 31 (in the Klickitat watershed) to minimize the area of the stream that would be affected by sedimentation during the low-flow period. These in-stream work windows are subject to change based on flow conditions and downstream spawning activity.
4. Keep equipment out of streams to the extent possible.
5. Limit the amount of streambank excavation to the minimum necessary to ensure stability of enhancement structures. Place excavated material as far above the ordinary high water mark as possible to avoid entry into the stream.
6. Whenever possible, obtain logs for habitat improvement structures from outside the riparian management emphasis area or at least 200 feet from the stream channel to maintain integrity of riparian habitat and stream banks.
7. Inspect all mechanized equipment daily to help ensure toxic materials such as fuel and hydraulic fluid do not enter the stream.
8. Utilize waterbars, barricades, and seeding to stabilize bare soil areas.

Uplands

Objective: To increase soil stability, reduce soil erosion, and improve hydraulic functions.

Practice: Use corrective measures to repair degraded watershed conditions and rehabilitate with an ecologically appropriate vegetative cover that will maintain or improve soil stability, reduce surface runoff, increase infiltration, and reduce flood occurrence and flood damages.

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Appendix B. Yakama Forest Monitoring Guidelines

Monitoring is a critical element in the success of this Forest Management Plan. Baseline, implementation, and effectiveness monitoring will be conducted at both the forest-wide and project-level scales. To ensure consistency with the monitoring activities, the following implementation, monitoring, and effectiveness and validation monitoring guidelines are suggested by resource area for the Forest-wide Monitoring Program.

Aesthetics

Expected Future Conditions and Outputs

The Yakama Forest's managed landscapes more closely resemble those created by the activities of historic disturbance agents such as natural and aboriginal fire ignitions, wind, insects, disease, and animals.

The Yakama Forest is in a clean, green, and healthy condition pleasing to member's senses where man-made features and structures complement nature and meet the spiritual, cultural, social, and economic needs of the tribal membership.

Implementation Monitoring

Questions:

- Are visual resource design features and mitigation methods being followed during timber sales and other substantial resource management actions?
- Are management directions for Aesthetics documented in this FMP being implemented?

Monitoring Requirements

- Ten percent of the timber harvest project files will be reviewed annually to ascertain whether relevant aesthetic design features or mitigating measures were included.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the management impacts on the Forest's aesthetics?
- Has resource management for the Forest been in compliance with the management directions for Aesthetics documented in this FMP?

Air Quality

Expected Future Conditions and Outputs

1. High air quality continues to exist on the Yakama Reservation.

2. Attainment of National Ambient Air Quality Standards, prevention of significant deterioration goals, the National Visibility Protection Plan goals, and the FMP Smoke Management (air quality) standards.
3. Air quality and visibility will be maintained and enhanced in a manner consistent with the Clear Air Act.

Implementation Monitoring

Questions:

- Were efforts made to minimize the amount of particulate emissions from prescribed burns?
- Are dust abatement measures used during construction activities and on roads during timber harvest operations?
- Has the reservation meteorological and air quality monitoring effort been integrated with interagency monitoring within the Region?
- Are the air resource objectives and management directions as well as the goals, objectives, standards, and guidelines defined in the FMP being met?

Monitoring Requirements

- At least one meteorological and air quality monitoring station will be established on the Forest to determine the long-term ambient air quality conditions.
- Each year, at least 10 percent of the prescribed burn projects will be randomly selected for monitoring to assess what efforts were made to minimize particulate emissions, and whether the project level environmental analysis that preceeded the decision to burn addressed the air quality management directions in the FMP.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation reduce or remove the management impacts on air quality?
- What techniques were the most effective in minimizing the amount of particulate emissions from prescribed burns?
- Are Yakama Nation prescribed burns contributing to intrusions into Class I areas or non-attainment areas?
- Of the intrusions that the Yakama Nation might have been reported to be responsible for, what was the cause and what can be done to minimize future occurrences?
- Are prescribed forest underburns and range restoration projects causing adverse air quality impacts to rural and downwind communities?
- Are the prescribed fires decreasing the actual or potential impacts from wildland fire emissions?
- Is there Regional planning and collaboration for implementing and monitoring of PM_{10} impacts to non-attainment areas and Class I areas?
- Has resource management for the reservation been in compliance with the management directions for Air Resources documented in the FMP (Chapter V)?

Cultural Resources

Expected Future Conditions and Outputs

Culture, traditions, and practices remain in the personal, social, economic, spiritual, and political aspect of the lives of the reservation's membership.

Implementation Monitoring

Questions:

- Are cultural resources being addressed in deciding whether or not to go forward with forest management activities and other actions? During resource management activities and other actions that may disturb cultural resources, are steps taken to adequately mitigate disturbances.
- What mechanisms have been developed to describe past landscapes and the role of humans in shaping those landscapes?
- What mechanisms have been developed to adequately protect cultural plant populations?
- Are management directions for Cultural Resources documented in this Forest Management Plan being implemented?

Monitoring Requirements

- Each year, at least 10 percent of the resource management activities (forest, range, and watershed) and other relevant actions (e.g., rights-of-way, recreation) will be reviewed to evaluate documentation regarding cultural resource values and decisions in light of requirements, policy, management directions, and the Cultural Resources Management Plan.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the management impacts on cultural resources?
- Are sites of religious and cultural heritage adequately protected?
- Do tribal members have access to and use of forest species, resources, and places important for cultural, subsistence, or economic reasons?
- Has resource management for the reservation been in compliance with the management directions for Cultural Resources documented in this Forest Management Plan?

Fire/Fuels

Expected Future Conditions and Outputs

Appropriate suppression responses to wildland fires have been made in order to meet resource management objectives and minimize the risk of large-scale, high-intensity wildland fires.

Prescribed fire is utilized to meet resource management objectives. This will include, but not be limited to fuels management for wildland fire hazard reduction, restoration of desired vegetation conditions, management of habitat, and silvicultural treatments.

Smoke management/air quality standards of the Clean Air Act and management directions in this FMP will be followed to maintain high air quality on the reservation.

Implementation Monitoring

Questions:

- Are management directions for Fire/Fuels documented in this FMP being implemented?
- Does the preparation and implementation of the Wildland Fire Prevention Analysis and Plan meet the management directions of the FMP?
- Is fire restored as a natural process on the reservation?
- What is the status of the interdisciplinary team preparation and implementation of regional fire management plans that include fuel treatment reduction plans?

Monitoring Requirements

- The risk, hazard, and value mapping and databases in the Wildland Fire Prevention Analysis and Plan will be reviewed annually and updated as needed.
- An annual report will be compiled showing harvest fuel treatments, non-harvest prescribed fires, and wildland fire occurrences.
- An annual reservation-wide report will be prepared detailing the existing composite wildland fire hazard condition.
- Each year, at least 10 percent of the timber harvest and prescribed fire projects, stratified by treatment category, will be randomly selected for monitoring to determine whether or not the fuel treatment objectives were achieved as prescribed.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the management impacts on the Forest's wildland fire risk and fuels hazard condition?
- Has resource management for the reservation been in compliance with the management directions for Fire/Fuels documented in this FMP?
- Are fire suppression strategies, practices, and activities meeting forest management objectives and concerns?
- Is natural fire being utilized on a planned and prescribed basis in efforts to restore fire as a natural process on the Forest?
- Are prescribed fires applied in a manner that retains the desired amount of coarse woody debris, snags, recruitment green trees, and residual vegetative stocking levels?

Fisheries

Expected Future Conditions and Outputs

Viable populations (numbers and distribution of reproductive individuals) of native and desired non-native species of fish and their supporting habitat are maintained on the Forest.

An abundance of anadromous salmonids, non-anadromous salmonids, and other desired species continues in the waters of the Forest.

At-risk fish stocks and their habitat will be rehabilitated and protected.

Implementation Monitoring

Questions:

- Are at-risk fish species and stock being identified on the Forest?
- Are fish habitat restoration and enhancement activities being designed and implemented consistent with the FMP?
- Are potential adverse impacts to fish habitat and fish stock being identified?
- Are management directions for Fisheries Management documented in this FMP being implemented?

Monitoring Requirements

- The Annual Monitoring Report will identify at-risk fish species and stocks, their habitat within individual watersheds, and restoration project needs.
- The annual program summary will report on the status of the design and implementation of fish habitat restoration and habitat activities on the Forest.
- Each year, at least 10 percent of the project files on each year's harvest units and other relevant actions will be reviewed to evaluate documentation regarding fish species and habitat and related recommendations and decisions in light of policy and FMP management directions.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the management impacts on fisheries resources?
- Has resource management for the Forest been in compliance with the management directions for Fisheries Resource documented in this Forest Management Plan?
- Is the ecological health of the aquatic ecosystems recovering or sufficiently maintained to support stable and well-distributed populations of fish species and stocks?
- Is fish habitat in terms of quantity and quality of rearing pools, coarse woody debris, water temperatures, and width-to-depth ratios being maintained or improved or predicted?
- Are desired habitat conditions for listed and at-risk fish stocks maintained where adequate and restored when inadequate.

Forest Vegetation

Expected Future Conditions and Outputs

Suitable habitat conditions for desirable native and non-native plant and animal species exist to maintain reservation biodiversity that includes the diversity of genes, species, and ecosystems, as well as the evolutionary processes that link them.

Managed landscapes more closely resemble those created by the activities of historic disturbance agents such as natural and aboriginal fire ignitions, wind, insects, disease, and animals.

Implementation Monitoring

Questions:

- Are management directions for Forest Vegetation management documented in this FMP being implemented?
- Do harvest unit volumes, harvest acres, and the age and type of regeneration and intermediate harvest stands compare to the projections in the FMP EA and FMP?
- Does the forest condition following harvest meet conditions envisioned for practices recommended by Management Directions in this document?

Monitoring Requirements

- An annual report will be compiled showing both planned and non-planned timber volumes harvested as well as the summarized details of each harvest unit activities.
- An annual Forest-wide report will be prepared detailing the existing forest health condition.
- First-, third-, and fifth-year surveys will be used to determine if reforestation is meeting reforestation objectives.
- The vegetative mapping and databases will be reviewed annually and updated as new information becomes available to reflect existing conditions in terms of habitat types, size, and structural stage, as well as relationships to desired future conditions and trends.
- Maps and databases to be reviewed and updated annually will include, but not be limited to the following:
  - Water quality monitoring system.
  - Canopy closure and equivalent open area.
  - Habitat Type distribution.
  - Transportation network and road density.
  - Fuels management activities and fire hazard ratings.
- Global Positioning Systems (GPS) will be used to obtain the coordinates of the Continuous Forest Inventory (CFI) plots. The 2005 CFI data will be used along with GIS mapping to determine the Forest-wide condition and trends towards achieving the desired future conditions.
- In a minimum of at least one harvest unit activity (both intermediate and regeneration) in each timber sale area, new stand exam plots will be established following harvest in the activity area. The data from the plots will be used to determine existing conditions and analyze the results of treatments in meeting Management Directions in this FMP.

Effectiveness and Validation Monitoring

Questions:
- Did the planned mitigation for all resource activities reduce or remove the management impacts on the forest vegetation resource?
- Has resource management for the reservation been in compliance with the management directions for Forest Vegetation documented in this FMP?

Public Involvement

Expected Future Conditions and Outputs

Yakama Nation member's values are clearly stated and reflected in the management of their forest resource.

Implementation Monitoring

Questions:
- Are management directions for Public Involvement documented in this FMP and being implemented?

Monitoring Requirements

- A record of all public meetings with attendance, news releases, and notices will be kept and summarized in the annual monitoring report.
- The protocol for public involvement in Yakama forest management will be reviewed annually and modified as needed.

Effectiveness and Validation Monitoring

Questions:
- Has resource management for the Forest been in compliance with the management directions for Public Involvement documented in this FMP?

Range Vegetation

Expected Future Conditions and Outputs

Suitable habitat conditions for desirable native and non-native plant and animal species exist to maintain reservation biodiversity that includes the diversity of genes, species, and ecosystems, as well as the evolutionary processes that link them.

A mosaic of desirable rangeland plant communities with diverse forbs, grasses, and shrubs that optimize ecosystem processes exist across the Yakama Forest.

Implementation Monitoring

Questions:
- Are management directions for Range Vegetation management documented in this FMP being implemented?
- What is the status of the noxious weed infestation on the Forest?

Monitoring Requirements

Review the files of at least 10 percent of the annual noxious weed control applications to determine if noxious weed control methods were effective and completed successfully.

Effectiveness and Validation Monitoring

Questions:
- Did the planned mitigation for all resource activities reduce or remove the management impacts on the range vegetation resource?
- Has resource management for the reservation been in compliance with the management directions for range vegetation documented in this FMP?

Traditional Use

Expected Future Conditions and Outputs

Diverse year-round traditional use opportunities are provided for all age groups and ability levels with an emphasis on utilization and resource protection.

Implementation Monitoring

Questions:
- What is the status of the development and implementation of traditional use facility plans?

Monitoring Requirements

- The Forest will be monitored at least every three years to determine if the types of traditional use opportunities being provided are appropriate.
- All developed traditional use sites will be monitored annually to determine if facilities are being properly managed and all deficiencies documented.

Effectiveness and Validation Monitoring

Questions:
- Did the planned mitigation for all traditional use activities reduce or remove the management impacts?
- Are management directions for Traditional Use documented in this FMP being implemented?

- Are Yakama Nation developed recreation facilities meeting Yakama Nation member needs and expectations, including facility condition and visitor safety considerations?
- Is off-highway vehicle management adequate to protect resource values while providing appropriate motorized vehicle access opportunities?

Socioeconomics

Expected Future Conditions and Outputs

The Forest is in a clean, green, and healthy condition pleasing to member's senses where man-made features and structures complement nature and meet the spiritual, cultural, social, and economic needs of the Yakama Nation membership.

The forest landscape is producing a viable short-term and long-term economic stability for the Yakama Nation membership.

Non-reservation sources of revenue continue from other government entities and private enterprises to assist in managing the forest landscape for producing short-term and long-term economic stability on the Yakama Reservation.

Implementation Monitoring

Questions:
- Are management directions for timber sale revenue and employment being implemented?

Monitoring Requirements

- On an annual basis, the revenue returned to the Yakama Nation from forest resource management activities will be reviewed to evaluate the relationship of these values with the predicted revenue returns. This analysis will be used for adjusting future predictions and modifying future product outputs and pricing.

Effectiveness and Validation Monitoring

Questions:
- Has resource management been in compliance with the management directions for timber sale revenue and employment?

Soils

Expected Future Conditions and Outputs

The long-term productivity and stability of the reservation's forest soil resource is maintained.

Implementation Monitoring

Questions:

- Are management directions for Soils documented in Chapter V being implemented?
- Are site-specific Best Management Practices (BMPs—Appendix A) identified in the project planning stage and carried forward into project design and execution?
- What watershed analysis functions have been performed prior to management activities on subbasins scheduled for harvest?
- What subbasin soils restoration projects are being developed and implemented?
- What is the status of preparation of criteria and standards that govern the operation, maintenance, and design for the construction and reconstruction of roads?
- What is the status of the reconstruction of harvest roads and associated drainage features identified in the watershed analysis as posing a substantial risk?
- What is the status of closure or elimination of roads to further soil and water conservation strategy objectives, and to reduce the overall road mileage in subbasins? If funding is sufficient to implement road mileage reductions, are construction and authorization through discretionary actions denied to prevent a net increase in road mileage in all subbasins?

Monitoring Requirements

- Each year, at least 10 percent of the timber harvest and /or silviculture projects stratified by management category will be randomly selected for monitoring to determine whether or not soil-related Best Management Practices were implemented as prescribed. The selection of the management actions to be monitored will be based on beneficial uses likely to be impacted and for which BMPs are being prescribed.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the forest management impacts on soil resources?
- Has resource management for the reservation been in compliance with the management directions for Soils documented in this FMP?
- Are the soils-related ecosystem functions of the Forest's watershed improving?

Water

Expected Future Conditions and Outputs

High-quality surface and ground waters are in sufficient quantity and distribution in the Forest to meet existing and desired future needs.

Landscape hydrologic performance and processes sustain the water, soil, and other resources.

Wetlands, riparian, and aquatic ecosystems continue to function as natural systems.

Implementation Monitoring

Questions:

- Are management directions for Water Resources documented in this FMP being implemented?
- What watershed analysis functions have been performed prior to management activities on subbasins scheduled for harvest?
- What subbasin stream channel restoration projects are being developed and implemented?
- What fuel treatment and wildland fire suppression strategies have been developed to protect the quality of the reservation's forest waters.
- What is the status of development of road or transportation management plans to protect and enhance the quality of the reservation's forest waters.

Monitoring Requirements

- Each year, at least 10 percent of the timber harvest projects will be randomly selected for monitoring to determine whether or not water-related Best Management Practices were implemented as prescribed. The selection of the management actions to be monitored will be based on beneficial uses likely to be impacted and for which BMPs are being prescribed.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the management impacts on water resources?
- Has resource management for the reservation been in compliance with the management directions for Water Resources documented in this FMP?
- Are the water-related ecosystem functions of the Forest's watersheds improving?
- Is the reservation's Forest in compliance with Section 319 of the Clean Water Act?
- Are the riparian management emphasis areas on the reservation's Forest being restored and protected?

Wildlife

Expected Future Conditions and Outputs

Viable populations (numbers and distribution of reproductive individuals) of native and desired non-native species of wildlife, and their supporting habitats, are maintained, while wildlife is provided in sufficient numbers to meet the cultural, subsistence, and recreational needs of Yakama Nation members.

Implementation Monitoring

Questions:

- Are suitable diameters, lengths, and numbers of snags, coarse woody debris, and green trees being left in a manner that meets the needs of the species and provides for ecological functions in harvested areas as called for in the FMP (Table V–1)?
- Are special and big-game habitats being identified and protected?
- What is the status of designing and implementing wildlife habitat restoration projects?
- Are management directions for Wildlife Resource management documented in Chapter V being implemented?

Monitoring Requirements

- Each year, 10 percent of the harvest units on the Forest will be selected for pre- and post-harvest (after site preparation) inventories to determine snag and green-tree retention numbers by heights, diameters, and distribution within harvest units. Snags and green retention trees left following harvest and site preparation activities will be compared to those that were marked pre-harvest.
- The same harvest units will also be inventoried pre- and post-harvest to determine if the FMP down-log retention directions (Table V–9) have been made.

Effectiveness and Validation Monitoring

Questions:

- Did the planned mitigation for all resource activities reduce or remove the forest management impacts on wildlife resources?
- Are habitat conditions for late-successional forest associated species being maintained where adequate, and restored where inadequate?
- Are the snags, green retention trees, and coarse woody debris being left providing the habitat necessary to attain the desired population at a relevant landscape level?
- Are Yakama Nation actions intended to protect special habitat and big-game habitat actually protecting the habitat? Is the protection of special and big-game habitats helping to protect the species populations?
- What are the effects of the Yakama Nation's Wildlife Resource Management Plan on species richness (numbers and diversity)?
- Has forest management for the reservation been in compliance with the management directions for Wildlife Resources documented in Chapter V of this FMP?

Appendix C. Yakama Reservation Forest Habitat Types

Introduction

The classification of forest habitat types considers elevation, precipitation, vegetation, soils, and other physical site characteristics as indicators of future species composition, productive potential, and probable responses to management actions. Forest habitat types are used as a basis for developing silvicultural prescriptions for the Yakama Forest.

Definitions

A **plant community** is an assemblage of plant populations occurring and interacting in a common environment. **Plant community types** are aggregations of similar plant communities. **Indicator plants** are species that signify certain environmental characteristics (*e.g.*, excessive or deficient soil moisture, cold or warm soils, short growing season) and are used to identify and describe plant associations. **Forest plant associations** are plant community types that are based upon late-successional forest stands and emphasize the potential vegetation components. **Plant series** are groupings of plant associations with the same dominant, late-successional tree species.

A **forest habitat type** is a grouping of all of the land area capable of supporting similar forest plant associations over time. Habitat types characterize particular kinds of environments and are used as a basis for distinguishing land areas of differing productive potential. They are based on the characteristic vegetation that would dominate a portion of a forest landscape over a long period of time (100+ years) in the absence of disturbance.

Forest succession refers to changes in species composition and stand structure that occur over a range of decades to centuries. A **sere** is a sequence of plant communities that succeed one another during succession. A **seral species** is a component of a sere. A seral species, or early-successional species, is one that is present during the early stages of succession but disappears over time in the absence of major disturbances. Early-successional species tend to be shade intolerant while late-successional species tend to be shade tolerant.

Plant associations, forest habitat types, vegetation cover types, and land use were considered in developing management strategies in this Forest Management Plan. Fifty-two forest plant associations within ten series, two quaking aspen communities, and one lodgepole pine community have been described on the Yakama Forest (See Table C–1). For management purposes, land areas within the Yakama Forest have been grouped into nine broad habitat types (See Figure III–7 and Table III–16). The broad habitat types have inclusions of smaller areas with different habitat types, e.g., the Pacific silver fir habitat type includes some areas with mountain hemlock habitat type. The woodlands outside of the Yakama Administrative Forest are mostly within the Oregon white oak habitat type. Habitat types within the Yakama Administrative Forest include ponderosa pine, Douglas-fir, grand fir, Pacific silver fir, and subalpine fir. Western hemlock, mountain hemlock, and whitebark pine habitat types are also present but have been grouped within the broad habitat types.

Table C–1. Principle Plant Associations on the Yakama Forest

Code	Plant Association		Abbreviation	Habitat Type
	Scientific Name	Common Name		
01	*Abies amabilis/Rhododendron albiflorum*	Pacific silver fir/Cascade azalea	ABAM/RHAL2	ABAM
02	*Abies amabilis/Rhododendron albiflorum/Clintonia uniflora*	Pacific silver fir/ Cascade azalea /queencup beadlily	ABAM/RHAL2/CLUN2	ABAM
03	*Abies amabilis/Vaccinium membranaceum/Clintonia uniflora*	Pacific silver fir/big huckleberry/queencup beadlily	ABAM/VAME/CLUN2	ABAM
04	*Abies amabilis/Vaccinium membranaceum/Xerophyllum tenax*	Pacific silver fir/big huckleberry/beargrass	ABAM/VAME/XETE	ABAM
05	*Abies grandis-Picea engelmannii/Athyrium filix-femina*	grand fir-Engelmann spruce/lady fern	ABGR-PIEN/ATFI	ABGR
06	*Abies grandis-Picea engelmannii/Clintonia uniflora*	grand fir-Engelmann spruce/queencup beadlily	ABGR-PIEN/CLUN2	ABGR
07	*Abies grandis/Acer circinatum*	grand fir/vine maple	ABGR/ACCI	ABGR
08	*Abies grandis/Carex geyeri*	grand fir/elk sedge	ABGR/CAGE	ABGR
09	*Abies grandis/Calamagrostis rubescens*	grand fir/pinegrass	ABGR/CARU	ABGR
10	*Abies grandis/Corylus cornuta var. californica*	grand fir/hazelnut	ABGR/COCOC	ABGR
11	*Abies grandis/Linnaea borealis-Trientalis latifolia*	grand fir/northern twinflower-starflower	ABGR/LIBO3-TRLA6	ABGR
12	*Abies grandis/Pachistima myrsinites*	grand fir/Oregon boxwood	ABGR/PAMY	ABGR
13	*Abies grandis/Polemonium pulcherrimum*	grand fir/skunkleaf polemonium	ABGR/POPU3	ABGR
14	*Abies grandis/Spiraea betulifolia*	grand fir/white spiraea	ABGR/SPBE2	ABGR
15	*Abies grandis/Symphoricarpos albus*	grand fir/snowberry	ABGR/SYAL	ABGR
16	*Abies grandis/Symphoricarpos mollis var. hesperius*	grand fir/creeping snowberry	ABGR/SYMOH	ABGR
17	*Abies grandis/Vaccinium myrtillus*	grand fir/myrtle blueberry	ABGR/VAMY2	ABGR
18	*Abies grandis/Vaccinium myrtillus/Linnaea borealis*	grand fir/myrtle blueberry/northern twinflower	ABGR/VAMY2/LIBO3	ABGR
19	*Abies lasiocarpa/Carex geyeri*	subalpine fir/elk sedge	ABLA/CAGE	ABLA
20	*Abies lasiocarpa/Calamagrostis rubescens*	subalpine fir/pinegrass	ABLA/CARU	ABLA
21	*Abies lasiocarpa/Clintonia uniflora*	subalpine fir/queencup beadlily	ABLA/CLUN2	ABLA
22	*Abies lasiocarpa/Luzula hitchcockii*	subalpine fir/smooth woodrush	ABLA/LUHI4	ABLA
23	*Abies lasiocarpa/Vaccinium myrtillus*	subalpine fir/myrtle blueberry	ABLA/VAMY2	ABLA
24	*Abies lasiocarpa/Valeriana sitchensis*	subalpine fir/Sitka valerian	ABLA/VASI	ABLA
25	*Abies lasiocarpa/Xerophyllum tenax*	subalpine fir/beargrass	ABLA/XETE	ABLA
26	*Abies lasiocarpa/Xerophyllum tenax-Clintonia uniflora*	subalpine fir/beargrass-queencup beadlily	ABLA/XETE-CLUN2	ABLA
27	*Abies lasiocarpa/Xerophyllum tenax-Luzula hitchcockii*	subalpine fir/beargrass-smooth woodrush	ABLA/XETE-LUHI4	ABLA
28	*Chamaecyparis nootkatensis/Rhododendron albiflorum*	Alaska-cedar/Cascade azeala	CHNO/RHAL2	ABLA
29	*Pinus contorta/Spiraea douglasii var. menziesii*	lodgepole pine/Menzies spirea (community)	PICO/SPDOM	ABGR
30	*Pinus ponderosa-Quercus garryana/Carex geyeri*	ponderosa pine-Oregon white oak/elk sedge	PIPO-QUGA4/CAGE	PIPO
31	*Pinus ponderosa-Quercus garryana/Purshia tridentata*	ponderosa pine-Oregon white oak/bitterbrush	PIPO-QUGA4/PUTR2	PIPO
32	*Pinus ponderosa-Quercus garryana/Symphoricarpos albus*	ponderosa pine-Oregon white oak/snowberry	PIPO-QUGA4/SYAL	PIPO

Table C–1 (continued).

Code	Plant Association		Abbreviation	Habitat Type
	Scientific Name	Common Name		
33	*Pinus ponderosa/Camassia quamash*	ponderosa pine/camas	PIPO/CAQU2	PIPO
34	*Pinus ponderosa/Lomatium nudicaule*	ponderosa pine/barestem lomatium	PIPO/LONU2	PIPO
35	*Pinus ponderosa/Purshia tridentata*	ponderosa pine/bitterbrush	PIPO/PUTR2	PIPO
36	*Pinus ponderosa/Purshia tridentata/Festuca idahoensis*	ponderosa pine/bitterbrush/Idaho fescue	PIPO/PUTR2/FEID	PIPO
37	*Pinus ponderosa/Symphoricarpos albus*	ponderosa pine/snowberry	PIPO/SYAL	PIPO
38	*Populus tremuloides/Elymus glaucus*	quaking aspen/blue wildrye (community)	POTRT/ELGL	ABGR
39	*Populus tremuloides/Symphoricarpos albus*	quaking aspen/snowberry (community)	POTRT/SYAL	PSME
40	*Pseudotsuga menziesii/Arctostaphylos nevadensis*	Douglas-fir/pinemat manzanita	PSME/ARNE	PSME
41	*Pseudotsuga menziesii/Calamagrostis rubescens*	Douglas-fir/pinegrass	PSME/CARU	PSME
42	*Pseudotsuga menziesii/Corylus cornuta var. californica*	Douglas-fir/hazelnut	PSME/COCOC	PSME
43	*Pseudotsuga menziesii/Holodiscus discolor*	Douglas-fir/oceanspray	PSME/HODI	PSME
44	*Pseudotsuga menziesii/Spiraea betulifolia*	Douglas-fir/white spiraea	PSME/SPBE2	PSME
45	*Quercus garryana/Elymus glaucus*	Oregon white oak/blue wildrye	QUGA4/ELGL	QUGA
46	*Quercus garryana/Purshia tridentata*	Oregon white oak/bitterbrush	QUGA4/PUTR2	QUGA
47	*Quercus garryana/Symphoricarpos albus*	Oregon white oak/snowberry	QUGA4/SYAL	QUGA
48	*Thuja plicata/Lysichitum americanum*	western redcedar/skunk cabbage	THPL/LYAM	ABGR
49	*Thuja plicata/Asarum caudatum*	western redcedar/ginger	THPL/ASCA2	ABGR
50	*Thuja plicata/Cornus canadensis*	western redcedar/bunchberry dogwood	THPL/COCA	ABGR
51	*Tsuga heterophylla/Achlys triphylla*	western hemlock/vanilla leaf	TSHE/ACTR	ABLA
52	*Tsuga heterophylla/Cornus nuttallii*	western hemlock/Pacific dogwood	TSHE/CONU4	ABLA
53	*Tsuga heterophylla/Vaccinium membranaceum*	western hemlock/big huckleberry	TSHE/VAME	ABLA
54	*Tsuga mertensiana/Luzula hitchcockii*	mountain hemlock/smooth woodrush	TSME/LUHI4	ABAM
55	*Tsuga mertensiana/Vaccinium membranaceum*	mountain hemlock/big huckleberry	TSME/VAME	ABAM

Habitat Type Descriptions

The ponderosa pine habitat type occurs in the eastern portion of the Yakama Forest, generally between 1800 and 4000 feet elevation. The habitat type is characterized by successful reproduction of ponderosa pine and the absence of Douglas-fir and grand fir.

The Douglas-fir habitat type also occurs in the eastern portion of the Yakama Forest, generally between 1800 and 4000 feet elevation, and in the lowermost portion of Cedar Valley below 2400 feet. These areas are characterized by the presence of Douglas-fir that is successfully reproducing and the absence of grand fir.

The grand fir habitat type occurs across most of the middle-elevation areas of the Yakama Forest. For management purposes, the grand fir habitat type was subdivided into four areas: (1) Grand fir, Cedar Valley was delineated by topography and includes the major portion of Cedar Valley between 2400 and 3200 feet elevation; (2) Grand fir, low elevation, dry includes the eastern portion of the grand fir habitat type below 4500 feet; (3) Grand fir, high elevation, wet includes grand fir habitat type west of the Klickitat River generally between 3400 and 4700 feet and east of the Klickitat River generally between 3400 and 5000 feet; and (4) Grand fir, low elevation, wet includes areas along the Klickitat River below 3400 feet.

The Pacific silver fir habitat type occurs in the western portion of the Yakama Forest in the vicinity of Potato Hill and Two Lakes. The habitat type is characterized by Pacific silver fir that is reproducing more successfully than mountain hemlock and subalpine fir. Small areas of mountain hemlock habitat type were grouped with the Pacific silver fir habitat type.

The subalpine fir habitat type occurs in most of the western portion of the Yakama Forest and around the Lakebeds area, generally from 4500 up to 7000 feet. Some of the western hemlock, mountain hemlock, and whitebark pine plant associations were grouped within the subalpine fir habitat type.

Descriptions of the forested plant associations of the Wenatchee National Forest[4] were used to characterize the habitat types of the Yakama Forest.

Oregon White Oak Habitat Type

Oregon white oak is one of the most heat- and drought-tolerant tree species in the northwest (Franklin and Dyrness 1973; Minore 1979). Although widely distributed on the west side of the Cascades, Oregon white oak is limited on the east slope to a relatively small area north and south of the Columbia Gorge. On the Yakama Forest the Oregon White Oak habitat type is limited to the eastern forest fringe (woodlands) and small areas on Peavine Ridge and in lower Cedar Valley. It is the hottest and most droughty of the forest habitat types and, where it occurs, marks the lower boundary of woodland and forest. As such, the habitat type is transitional between conifer-dominated forests at higher elevations, and shrublands or grasslands at lower elevations

[4] Lillybridge, T.R., B.L. Kovalchik, C.K. Williams, and B.G. Smith. 1995. Field guide for forested plant associations of the Wenatchee National Forest. USDA Forest Service, Pacific Northwest Research Station, General Technical Report. PNW-GTR-359. 337 pp.

and to the east. Most stands occur below 3100 feet, on steep mid- and lower-slope positions, or along river and stream terraces. Annual precipitation in these areas is less than 20 inches. Oregon white oak typically occurs on soils that are very gravelly, stony, and (in uplands) subject to ravel. The Oregon white oak habitat type occurs largely on soils derived from basalt colluvium and alluvium.

Except in riparian areas, many of the oak stands are woodlands or open forest. Tree canopy cover is typically less than 40 percent in the upland stands but often exceeds 65 percent in riparian areas. Oregon white oak is both a late-successional dominant and pioneer in these habitats, as no other tree species can successfully and consistently regenerate. Many stands also have scattered Douglas-fir or ponderosa pine. In uplands, these conifers often are emergents above the oak canopy, but occur only in favorable microsites. The conifers do not form a consistent canopy, nor do they regenerate well.

The undergrowth reflects the transitional nature of these woodlands. Species typical of late-successional sagebrush and bitterbrush shrublands are present, as well as those species typical of conifer-dominated forests. Bitterbrush, serviceberry, shiny-leaf spirea, California hazel, and common snowberry are shrubs that can be found in one or more Oregon oak plant associations. Bitterbrush and serviceberry both seem to occur in drier Oregon oak plant associations. Snowberry and hazel are associated with river and stream terraces and can be very abundant. Shrubs are not abundant in the upland Oregon oak plant associations, except perhaps following wildland fire. Common herbs and grasses within the habitat type include elk sedge, pinegrass, bluebunch wheatgrass, sulfur lupine, Carey balsamroot, showy phlox, yarrow, Sandberg's bluegrass, and Lomatium spp.

The Oregon oak habitat type generally has low timber productivity because of low stocking and slow growth rates. Riparian areas are usually more dense and productive compared to upland sites. Oregon white oak is excellent firewood. Opportunity exists to use these woodlands for the production of firewood through a coppice silviculture system; however, stand growth may not be very good. Upland soils may not survive heavy vehicle traffic or vegetation removal without raveling. The composition and distribution of the flora in these stands has been considerably affected by past disturbance, including fire, grazing, and logging. Historical fire frequency in these areas is in the 5- to 30-year range, with most fires being of low intensity. Fire helped maintain the open woodland structure and the shrub species composition of these stands. Oregon white oak is very fire tolerant because its foliage is relatively non-flammable and it will resprout if the above-ground stem is killed.

Lack of fire or altered fire cycles in recent times have led to changes in floristic composition. Fire sensitive species are more common and fuel ladders have developed. Many stands are scrubby as a result of past logging and grazing and are more susceptible to stand-replacement fires. The ability of Oregon white oak to resprout after fire or cutting allows it to readily revegetate disturbed sites.

The primary root and trunk rot diseases of Oregon white oak include Armillaria root disease and oak anthracnose. Insects of note on oak include the western oak looper, western tent caterpillar, and Pacific tent caterpillar.

Oregon White Oak habitat types are important wildlife areas and are heavily used, especially as winter and early spring range. Thickets provide security cover and oak mast provides good fall and winter forage. Early spring green-up of the abundant grasses helps sustain wildlife until other forage becomes available at higher elevations. Snags and logs provide valuable habitat and perches and are especially critical because tree density is low and therefore snag and log recruitment will also be slow or episodic.

The Oregon white oak habitat type should provide moderate herbage for livestock. Invasion of noxious weeds is a serious problem, especially diffuse knapweed. Coarse soils are easily displaced on steep slopes. Heavy grazing reduces cover of elk sedge, bluebunch wheatgrass, beardless bluebunch wheatgrass, and Idaho fescue. The open nature of these stands leaves them very susceptible to noxious weed encroachment after heavy grazing or other ground disturbing activity. Introduced grasses (e.g., cheat grass) and forbs may persist for many years in these open environments.

Ponderosa Pine Habitat Type

Ponderosa pine is one of the most widely distributed conifer tree species in western North America. It is the lower timberline species in many areas and is also an early-successional species in many forest types throughout its range. It is very tolerant of hot, dry conditions and is one of the most drought-tolerant conifers in western North America. Ponderosa pine reaches its westernmost distribution as a major forest species along the east slopes of the Cascade Range in both Washington and Oregon. It is never very abundant in natural stands west of the Cascade Range.

Ponderosa pine is a major seral species in the Douglas-fir and grand fir habitat types. It is restricted to drier and warmer sites in the western hemlock and subalpine fir habitat types. It may also be found mixed with Oregon white oak. It is unusual to find ponderosa pine in the Pacific silver fir, mountain hemlock, and whitebark pine habitat types. Late-successional ponderosa pine stands are relatively limited and occur where soil drought and temperatures are too severe for any other conifer tree species.

The ponderosa pine habitat type grades into the Douglas-fir habitat type or directly into the grand fir habitat type as soil moisture increases and temperatures decrease. As soil temperatures increase and soil moisture decreases, the habitat type grades into non-forest vegetation.

Late-successional ponderosa pine stands typically grow as very open forests or woodlands. Ponderosa pine is often the only tree species present, although some Douglas-fir, or in rare instances grand fir, can be found. These last two species are interpreted as occurring only as “accidentals" and are not expected to assume dominance, or even necessarily to persist. They are often found growing in favorable microsites or on ecotones to Douglas-fir and grand fir sites. Many stands of ponderosa pine appear to be relatively uniform in size and spacing, which leads to the impression that they are even-aged. Some stands are even-aged but many stands contain several age classes. Stand age structure and patterns result from past disturbance events as well as from depth to bedrock. Ponderosa pine is well known for its episodic regeneration (Cooper 1961).

Grasses dominate the undergrowth in most of the ponderosa pine plant associations. Shrubs are important in some associations but they do not always form a continuous layer. Bluebunch wheatgrass is the most dominant and characteristic grass of the ponderosa pine habitat type. Pinegrass and elk sedge may occur on more mesic types. Many of the important forbs and grasses found in this habitat type are species also characteristic of nearby shrublands and grasslands that occur under conditions too harsh for trees. Some important taxa include Sandberg's bluegrass, Wheeler's bluegrass, western yarrow, lupines, balsamroots, and lomatiums.

Ponderosa pine sites have low timber productivity due to low stocking and slow growth rates; however, some trees may remain alive for several centuries and may grow very large. CFI plots within the ponderosa pine habitat type averaged 545 trees per acre, 89 square feet basal area per acre, 8,610 board feet per acre, and 191 board feet gross growth per acre. The site index for ponderosa pine averaged 37 feet (base age 50).

Fire has been an integral part of these forest and woodland ecosystems. Fire maintains the open, grass-dominated undergrowth, reduces litter accumulations, and recycles nutrients bound in the litter. Fire was frequent under natural conditions and helped to reduce the cover of shrubs such as bitterbrush and snowberry. Hot, dry conditions during summer months dried the grasses and litter enough to carry surface fires started by lightning. In addition to consuming litter, these fires also consumed woody material such as shrubs, tree seedlings, saplings, down logs, and snags. Successful ponderosa pine recruitment occurred only when seedlings and saplings escaped fire until large enough to develop resistance to damage. Fire also exposed bare mineral soil, which is helpful for some species' seed germination. Stand-replacement fires did occur, but were unusual. Tree re-establishment following a high-intensity fire can often require decades until conditions and a seed source are available.

Ponderosa pine habitat types are important wildlife areas. They supply forage and browse during spring and early summer, and at lower elevations provide important winter range. Snags and logs provide valuable habitat and perches and are especially critical because tree density is low and therefore snag and log recruitment will also be slow or episodic.

The ponderosa pine habitat type provides moderate herbage for livestock. Average herbage production on the three major plant associations on the Wenatchee National Forest ranged from 178 to 313 lbs./ac. Invasion of noxious weeds is a serious problem, especially diffuse knapweed. Coarse soils are easily displaced on steep slopes. Heavy grazing reduces cover of bluebunch wheatgrass, beardless bluebunch wheatgrass, and Idaho fescue. Introduced grasses and forbs may persist for many years in these open environments.

Primary root diseases include Annosum root disease and Armillaria root rot (Hessburg *et al*. 1994). Annosum root disease was scattered before the era of resource management, but increased dramatically by infecting stumps associated with selective logging. Other pathogens include comandra rust and elytroderma needle disease. They may be locally significant, but they rarely threaten entire forest stands. Western dwarf mistletoe currently infests about 26% of ponderosa pine east of the Cascades. This level is likely elevated from historical times because

lack of wildland fires has resulted in somewhat more dense stands, facilitating the spread of the parasite.

Insect species that can be pests include western pine beetle, mountain pine beetle, pine engraver, pandora moth, pine butterfly, sawflies, needle miners, tip miners, and the sugar pine tortrix (Hessburg *et al*. 1994). Of these, the western pine beetle, pine engraver, and mountain pine beetle have the potential for severe outbreaks in the ponderosa pine habitat type.

Douglas-Fir Habitat Type

Douglas-fir is one of the most important tree species in the Pacific Northwest. It is the dominant seral or late-successional species over a very broad range of habitats and economically has been the preferred species of the regional softwood industry. It is the late-successional tree species on sites too dry for more shade-tolerant species such as western hemlock, western redcedar, grand fir, or subalpine fir. Stands of the Douglas-fir habitat type may have greater moisture losses at 12- and 20-inch soil depths than stands in other habitat types, except for the ponderosa pine and Oregon white oak habitat types. Douglas-fir is often the dominant or codominant species in western hemlock, Pacific silver fir, and grand fir habitat types and is prominent on warmer sites in the subalpine fir habitat type. Within these habitat types, Douglas-fir is a long-lived pioneer. The grand fir habitat type is found on somewhat more mesic sites, while the subalpine fir habitat type is typical of cooler habitats on north slopes or bottoms, or at higher elevations. Late-successional Douglas-fir is very abundant in the drier portions of the forest but closer to the Cascade Crest it is more restricted to steep south slopes. On warmer, drier sites, the Douglas-fir habitat type grades into nonforest communities or into the ponderosa pine habitat type.

Several plant associations within the Douglas-fir habitat type have azonal distributions, that is, these types are not confined to a distinctive climatic belt where Douglas-fir is late-successional, but rather occur on especially dry habitats in areas where Douglas-fir is normally a seral species. For example, some Douglas-fir habitat types may occur on less harsh sites on dry slopes near 5000 feet surrounded by subalpine fir- or grand fir-dominated stands. Ponderosa pine, western larch, and lodgepole pine are major seral species within the Douglas-fir habitat type.

The Douglas-fir habitat type is generally easy to distinguish from more moist habitat types by the scarcity of mesic indicator species, even though microsite variation may permit occasional mesic indicators within a representative Douglas-fir plant association. The presence of more than trace or accidental amounts of some mesic species, however, should suggest a plant association more moist than the Douglas-fir habitat type. These species include: (trees) subalpine fir, Pacific silver fir, mountain hemlock, Alaska yellow-cedar, western hemlock, western redcedar, grand fir, and Engelmann spruce; (shrubs) western prince's pine, beargrass, dwarf bramble, Pacific yew, red-osier dogwood, devil's club, Cascade azalea, rusty menziesia, Cascade Oregon grape, bunchberry dogwood, prickly currant, and mountain ash; (herbs) queencup beadlily, false bugbane, baneberry, starry solomon’s seal, pathfinder, horsetail, skunk cabbage, sweet-scented bedstraw, lady fern, vanilla leaf, coolwort foamflower, oak fern, smooth woodrush, arrowleaf groundsel, Sitka valerian, wild ginger, Hooker fairybells, and rosy twistedstalk.

Plant growth on many plant associations in the Douglas-fir habitat type is limited by lack of growing season moisture. Summer soil drought is severe on many sites. Douglas-fir sites have low to moderate timber productivity due to low stocking and slow growth rates. CFI plots within the Douglas-fir habitat type averaged 397 trees per acre, 95 square feet basal area per acre, 12,450 board feet per acre, and 279 board feet gross growth per acre. The site index for Douglas-fir and ponderosa pine averaged 72 and 51 feet (base age 50), respectively.

Shade-tolerant trees such as western hemlock, western redcedar, subalpine fir, and grand fir are unable to successfully occupy habitats within the Douglas-fir habitat type, mainly because of drought stress.

Many herbs and shrubs in the Douglas-fir habitat type are rhizomatous and respond quickly to disturbances. Species such as pinegrass, elk sedge, northwestern sedge, common snowberry, and shiny-leaf spirea reproduce vegetatively and have a competitive advantage over species that rely entirely on seeds, especially early in succession.

Low-intensity surface fires (underburns) have significantly influenced the development of many stands, and many pre-European-settlement stands in the Douglas-fir habitat type were open and park-like in response to frequent surface fires. Individual Douglas-firs, ponderosa pine, and western larch are resistant to fires after they have matured enough to develop thick, corky, insulating bark. Stand-replacement fires were rare in these stands. Fire scars are common, especially on ponderosa pine, which is especially favored by underburns. Without underburning, ponderosa pine is eventually replaced by the more shade-tolerant but somewhat less fire-resistant Douglas-fir. The advent of vigorous fire protection has resulted in longer time periods between surface fires and dense Douglas-fir stands have developed in the absence of underburns. Surface fuel and "ladders" of Douglas-firs of various age classes have developed on more mesic sites, increasing the potential for catastrophic fires as well as for severe forest health problems.

If a site is capable of supporting lodgepole pine and a seed source is available, then repeated stand-replacing crown fires often lead to a near total dominance by lodgepole pine, through a combination of serotiny, early lodgepole pine seed maturity, and the elimination of seed sources for other species. Lodgepole pine increases in prominence if the interval between crown fires is less than its approximately 200-year average life span.

Timber harvesting and burning often result in extensive and persistent shrubfields or grasslands that resist reforestation efforts for years. Shrubfields may be an essential part of the sere, functioning to restore organic matter and nutrients before forest restoration can be successful.

Many Douglas-fir sites are important wildlife areas. The drier types supply forage and browse during spring and early summer, and at lower elevations provide important winter range. Snags and logs provide valuable habitat and perches and are especially critical in the drier types because tree density is low there and, therefore, snag and log recruitment is slow or episodic.

Many plant associations in the Douglas-fir habitat type provide moderate herbage for livestock (200 to 400 lbs/ac), especially those with grass dominated ground vegetation. Invasion of noxious weeds, especially diffuse knapweed, is a serious problem on these drier types.

Introduced grasses and forbs can also persist for many years. Coarse soils are easily displaced on steep slopes and on ravelly soils associated with dry bunchgrass types. Plant associations with dense cover of elk sedge and pinegrass are more resistant to trampling. Heavy grazing reduces cover of elk sedge, bluebunch wheatgrass, Idaho fescue, and other more palatable grasses.

Primary root diseases of Douglas-fir include P- and S-group Annosum root diseases, laminated root rot, and Armillaria root rot (Hessburg *et al*. 1994). These fungal diseases were scattered before the era of intensive resource management but have increased dramatically by infecting stumps associated with selective logging. Ponderosa pine is also infected by *Heterobasidion annosum* and *Armillaria ostoyae* it is resistant to *Phellinus weirii*. Other pathogens of ponderosa pine include comandra rust and elytroderma needle disease, which may be locally significant, though they rarely threaten entire stands. Various dwarf mistletoes currently infest at least 43% of Douglas-fir and 26% of ponderosa pine east of the Cascades. Dwarf mistletoe infections are also severe in lodgepole pine and are a major cause of mortality in western larch. These levels are likely elevated from historical times because lack of wildland fires has resulted in denser stands, facilitating the spread of mistletoe. In some cases dwarf mistletoe and root diseases threaten entire stands of trees. More often, however, they create fuel conditions and fire ladders that hasten and intensify wildland fire effects.

Insect species that can be pests of Douglas-fir include the Douglas-fir engraver, western spruce budworm, Douglas-fir tussock moth, and Douglas-fir beetle (Hessburg *et al*. 1994). The Douglas-fir beetle has the potential for severe outbreaks in Douglas-fir. Insects affecting ponderosa pine include the western pine beetle, mountain pine beetle, pine engraver, pandora moth, pine butterfly, sawflies, needle miners, tip miners, and the sugar pine tortrix. Of these, the western pine beetle, pine engraver, and mountain pine beetle have the potential for severe outbreaks in ponderosa pine, and the pine engraver and mountain pine beetle can severely impact lodgepole pine. In the past 20 years, the mountain pine beetle has killed lodgepole pine on hundreds of thousands of acres east of the Cascades and in the Rocky Mountains. Western spruce budworm outbreaks have been increasing in severity since the beginning of the 20th century (Hessburg *et al*. 1994).

Grand Fir Habitat Type

Grand fir is an important species on the Yakama Forest and late-succession grand fir stands are a major component of the Forest. In addition, it is a major seral species in the western hemlock habitat type, and a seral species in some of the warmer types in the Pacific silver fir and subalpine fir habitat types as well. It is virtually absent from the Douglas-fir, ponderosa pine, and Oregon white oak habitat types because they are too hot and dry. The extremely cold and harsh conditions of the whitebark pine habitat type also exclude grand fir.

The grand fir habitat type is characterized by warm, moderately dry to moist forest habitats. It supports plant species of both drier and more moist habitats to a greater extent than most other habitat types. On warmer and drier sites, it grades into the Douglas-fir habitat type and sometimes, on hot, dry sites, into the ponderosa pine habitat type. In areas with maritime

influence, more moist habitats are occupied by western hemlock associations, while more moist and cooler habitats closer to the Cascade Crest are occupied by Pacific silver fir associations.

The grand fir habitat type is widely distributed below 5000 feet in forests east of the Cascade crest and south of the Entiat River. It is found across all topographic positions and soil types. Geology, elevation, and topographic position are all important factors that influence the distribution of the grand fir plant associations across the landscape.

Douglas-fir or ponderosa pine, or both, dominate the overstory canopy of most stands in the grand fir habitat type. Grand fir often occurs as a codominant, especially in the more moist plant associations, but is less often found as a dominant. Western larch and lodgepole pine are seral species found in some associations. Western white pine is a significant component only in some associations. Western white pine was probably more important in the tree sere in the grand fir habitat type before white pine blister rust was introduced into the area in the 1920s.

Douglas-fir, subalpine fir, and western hemlock habitat types typically bound the grand fir habitat type. Undergrowth in mature forest stands varies from a dense shrub layer difficult to penetrate to grass and sedge-dominated swards. Few undergrowth species occur across all associations in the habitat type and none are confined to this habitat type. Some of the most ubiquitous species include baldhip rose, shiny-leaf spirea, pachistima, and pinegrass. Most other species are more restricted in their distribution within the habitat type. Important factors governing species patterns include water availability, temperature, parent material, and past disturbances, including grazing, logging, and fire.

A number of understory species are common to this habitat type and are rarely found in the drier Douglas-fir, ponderosa pine, or oak habitat types. Generally, the presence of star-flowered false Solomon's-seal, queencup beadlily, Hooker fairybells, vine maple, Cascade Oregon grape, or vanilla leaf indicates a habitat type that is more moist than Douglas-fir, ponderosa pine, or Oregon white oak habitat types. The presence of species such as dwarf bramble, oak fern, or skunkleaf polemonium indicates a more moist, maritime or cooler habitat type such as western hemlock, Pacific silver fir, subalpine fir, or mountain hemlock habitat type.

On many sites, dense shrubfields typify early-successional stages after logging, fires, and other disturbances. Perturbation types, timing, and intensity, combined with species composition prior to disturbance, are important modifiers of secondary succession. In spite of the complexity of possible successional paths, some general patterns exist. Fall broadcast burns tend to favor development of redstem and snowbrush ceanothus, with vine maple and Scouler willow more favored by spring burns. Fall burns meet the scarification and cold-wet stratification needs of ceanothus, while spring burns normally do not provide sufficient cold-wet seed stratification for maximum germination. If ceanothus was common on the site prior to burning, it will resprout vigorously; however, even if little ceanothus is evident, seeds stored in the duff may remain viable many years. Spring burning favors species that resprout from root crowns but do not have seeds that can be stored for long periods of time in the soil.

Tree productivity is generally good in the grand fir habitat type. Analysis of CFI plots within the grand fir habitat type showed the average density ranged from 446 to 588 trees per acre; average

basal area ranged from 123 to 151 square feet per acre; average volume ranged from 16,500 to 25,860 board feet per acre; and average volume growth ranged from 410 to 490 board feet per acre. The typical range in site index for Douglas-fir, grand fir, and ponderosa pine was 76 to 89, 71 to 89, and 50 to 60 feet (base age 50), respectively.

Prior to European settlement, fire often resulted in open stands of fire-resistant seral trees within most of the grand fir habitat type (all but the moist end). Fires were typically frequent and of low intensity. Grand fir was present in unburned areas, but generally was much less common and abundant than today. Douglas-fir, ponderosa pine, and western larch were the most common tree dominants; these species become resistant to fires after they have matured enough to develop thick, corky, insulating bark. Stand-replacement fires were rare in these stands. The advent of vigorous fire protection has resulted in longer time periods between surface fires, the development of fire ladders of grand firs of various age classes, and in the subsequent susceptibility of these stands to stand-replacement fires. Only in the moist end of the grand fir habitat type were frequent, low-intensity fires uncommon. On very moist grand fir sites, conditions were conducive to less frequent fires that were of higher intensity, usually resulting in stand replacement. After high-intensity fires, throughout the grand fir habitat type, seral trees are the first to regenerate and claim the open sites. Lodgepole pine can form dense stands in these instances if present in the previous stand.

Stands within this habitat type commonly serve as some of the most productive spotted owl habitats east of the Cascade Crest. Large amounts of dead and down material and multiple canopy layers (often the result of lack of natural fire) provide habitat suitable to meet the owl's requirements. The stands within the habitat type also tend to be relatively warm and therefore important fawning and forage areas in the spring for large ungulates.

Late-successional stands are not normally well suited to domestic livestock grazing because of the low amount of palatable forage produced in mature stands (except those with abundant pinegrass). Early seral stages may provide high quantities of forage and consequently serve as excellent transitional range. Areas with high shrub cover are useful for wildlife, providing both forage and cover.

Armillaria root rot is present in nearly 80% of stands examined in the grand fir habitat type in the northern Rocky Mountains (McDonald *et al*. 1987b). Laminated and annosum root diseases are also common within the grand fir habitat type (Hessburg *et al*. 1994). New centers of Annosum root disease are emerging in grand fir late-successional areas, especially where large grand fir trees were previously harvested.

Pathogenicity of Armillaria root rot is low in undisturbed stands, whereas the incidence of pathogenicity is increased threefold if the sites have been subject to man-caused disturbance e.g., logging or road building (McDonald *et al*. 1987b). Also, it has been found that the more productive the site, the less the incidence of pathogenicity in undisturbed sites. Thus, the more productive a site is, the less total effect a pathogen has. Apparently, this is because the total environmental and biological stress on productive sites does not exceed the adaptive tolerance of the trees. Late-succession stands within the Douglas-fir or subalpine fir habitat types with lower productivities have much higher rates of pathogenicity but lower overall incidence of the

pathogen (McDonald *et al*. 1987a). Dwarf mistletoe infections are more widely distributed and more severely damaging than ever before (Hessburg *et al*. 1994). Dwarf mistletoe infections are a major cause of mortality in western larch. With the increase in grand fir on sites that historically supported little, there has been a subsequent increase in Indian paint fungus.

Insect outbreaks have increased as a result of decreased fire frequency and as stands shifted towards an overstocked, late-successional condition. The most important insect pests are western pine beetle, mountain pine beetle, pine engraver beetle, Douglas-fir beetle, fir engraver, western spruce budworm, and the Douglas-fir tussock moth (Hessburg *et al*. 1994).

Pacific Silver Fir Habitat Type

Pacific silver fir is one of the most shade-tolerant and environmentally restricted conifers in east Cascade forest ecosystems. It is found only in areas of strong maritime climatic influence, usually within a few miles of the Cascade Crest. Pacific silver fir associations occur on sites that rarely if ever experience soil drought. Snowpacks are high and temperatures are cool to cold, but sites rarely experience intense, long-lasting cold temperatures below 0 degrees F. Pacific silver fir is more abundant and widespread on suitable sites west of the Cascade Crest than it is on the eastern slopes.

The Pacific silver fir habitat type includes all forest stands potentially dominated by silver fir. In the Washington Cascades, mountain hemlock and Pacific silver fir broadly overlap in their ecological distribution, so distinguishing between the two habitat types can be difficult. On the Yakama Forest, the habitat type is named for whichever species is reproducing most successfully. Late-successional Pacific silver fir sites are more moderate than those in the mountain hemlock habitat type. Most Pacific silver fir sites are over 3000 feet, but stands of Pacific silver fir may follow cold air down valley bottoms to as low as 2000 feet. The habitat type is normally bounded by the mountain hemlock habitat type on cooler sites with deeper snowpacks. Warmer, less snowy sites support the western hemlock habitat type.

Because of its superior shade tolerance, Pacific silver fir is often the most abundant species in the tree regeneration layer in mixed species stands. Some Pacific silver firs less than 10 feet tall are often 50 or more years old. Pacific silver fir can persist in the understory for years and then respond to canopy openings from windfall or the death of taller trees. Very old Pacific silver fir stands (>400 years) are rare on the east slope of the Cascades because of fire and other forms of disturbance, including wind, avalanches, and disease.

In spite of the cool, wet climate characteristic of the habitat type, fire has played a major role in the development of all of the Pacific silver fir stands that were sampled on the Wenatchee National Forest. Tree age samples indicate that fire return intervals are normally less than 400 years, even on the wettest sites. Fires are usually severe in these dense forests that characteristically have two or more tree canopy layers.

Species that may form part of the tree sere in the Pacific silver fir habitat type include western hemlock, western redcedar, subalpine fir, Douglas-fir, western larch, western white pine, noble fir, lodgepole pine, Engelmann spruce, and Alaska yellow-cedar. The seral role of each species

varies from one plant association to another. For example, western hemlock is more important on warmer sites and Alaska yellow-cedar is only a component of some plant associations near Howard Lake and the headwaters of the Klickitat River. On warm sites that have been harvested, Pacific silver fir may require establishment of a tree canopy by another species, such as western hemlock, western white pine, grand fir, or Douglas-fir, before it can enter the sere. As forest canopies develop, the interior of the stands become cooler and Pacific silver fir gains a competitive advantage over the equally shade-tolerant western hemlock.

Mature stands characteristically have two or more tree canopies, with species such as Douglas-fir, noble fir, and western larch forming a tall, emergent canopy above a layer made up of more shade-tolerant and slower-growing species such as Pacific silver fir, western hemlock, and grand fir.

The shrub and herb layers are floristically rich and varied, but heavily shaded stands are characterized by very low understory plant cover. Very dense canopies, deep litter layers, and low light levels at the forest floor reduce the number and amounts of shrubs and herbs. In very dense stands with very low cover of understory species, inspection of adjacent, more open stands or use of relative cover may be needed to identify the habitat type. Heavy grazing by elk reduces cover and species composition in some depauperate stands.

Pacific silver fir habitat types are very productive. Cool average annual temperatures and heavy snowpacks are the main limitations to tree growth. Some sites are swampy and as such, although tree growth is rapid, are difficult to manage for timber production.

CFI plots within the Pacific silver fir habitat type averaged 836 trees per acre, 268 square feet basal area per acre, 50,680 board feet per acre, and 409 board feet gross growth per acre. The site index for Douglas-fir, lodgepole pine, and Pacific silver fir averaged 77, 53, and 37 feet (base age 50), respectively. Douglas-fir is not well suited to the colder plant associations and ponderosa pine is not suited to the environmental conditions representative of the Pacific silver fir habitat type.

Primary root diseases include Annosum root disease and laminated root rot. Annosum root disease attacks subalpine fir, grand fir, Engelmann spruce, Pacific silver fir, western hemlock, and mountain hemlock, typically causing root and butt rot at maturity. Tomentosus root disease can be present in lodgepole pine stands. Indian paint fungus is a causal agent for heart rot of true firs, western hemlock, and mountain hemlock. Western white pine has been drastically affected by white pine blister rust and there have been dramatic increases in mountain pine beetle attacks on this tree (Hessburg *et al*. 1994). Western larch can be severely affected by dwarf mistletoe.

Insect species that can be pests include the silver fir beetle, mountain pine beetle, spruce beetle, western spruce budworm, and fir engraver. Of these, only the silver fir beetle and mountain pine beetle have the potential for severe outbreaks in the Pacific silver fir habitat type. The silver fir beetle can kill thousands of trees in an area. Presumably, this is most likely to occur in areas with extensive, pure, mature Pacific silver fir. The mountain pine beetle causes extensive mortality mainly in the limited areas within this habitat type dominated by lodgepole pine. Douglas-fir tussock moth and western spruce budworm can occur, but attack mainly Douglas-fir

and grand fir. This habitat type is too cold and has too much snowpack to develop a major component of grand fir, although many stands do have a significant Douglas-fir component.

Dense shrubfields often typify early-successional stages after logging, fire, or other disturbance within the habitat type. Although the development of shrubfields may initially appear deleterious to conifer establishment and early growth, the ecologic role of the shrub-dominated stage of succession is not well understood. Shrubs provide shade for conifers, add organic matter to the soil, and species such as ceanothus, alders, and russet buffaloberry fix nitrogen. Further, many shrubs provide important forage and cover for insectivorous wildlife, which also influence stand health and vigor. Common shrub species include vine maple, Douglas maple, Scouler willow, pachistima, big huckleberry, serviceberry, Sitka alder, and snowbrush ceanothus.

In the northern Rocky Mountains, shrub height growth and twig production are generally related to time since logging and to residual tree cover (Irwin and Peek 1979). Shrub size and twig production peaks between 10 and 14 years after logging. Seed-tree and shelterwood treatments have significantly less shrub development than clearcuts. Late summer and fall broadcast burning in clearcuts leads to the greatest shrub development, due to increased snowbrush ceanothus cover; presumably, the same holds true for the east slope of the Cascades. Ceanothus seeds have both seed coat scarification and cold-wet seed stratification requirements for optimum germination. These are met by most fall and late summer burns. Spring burns usually do not provide the necessary cold-wet stratification, so ceanothus germination is greatly reduced. Spring burning favors species that sprout from root crowns or buried roots.

Subalpine Fir Habitat Type

The subalpine fir habitat type includes all upland forest stands potentially dominated by subalpine fir or Engelmann spruce, or both. Single species late-succession may be difficult to project in some areas because many stands are young. Given the autecological characteristics of the two species and lacking ancient stands as benchmarks, it is difficult to assume that one species will completely replace the other over time. Subalpine fir is more shade tolerant than Engelmann spruce, but the latter is more disease resistant and longer-lived (Minore 1979). Subalpine fir is better able to establish in litter than is Engelmann spruce (Knapp and Smith 1982). Engelmann spruce bark and litter leachates may also limit reproduction and growth of associated conifers (Taylor and Shaw 1982). Daubenmire and Daubenmire (1968) and Pfister *et al*. (1977) consider Engelmann spruce a persistent seral species or a minor co-climax in their subalpine fir series. On the Wenatchee National Forest, subalpine fir is used as the inferred late-successional dominant, but Engelmann spruce is considered of equal value for indicating the subalpine fir series, at least in uplands. However, riparian studies in both Oregon (Kovalchik 1987) and eastern Washington (Kovalchik 1993) show that Engelmann spruce is late-successional in some riparian zones. Additionally, according to more recent observations, limited uplands areas on the Okanogan National Forest are clearly late-successional spruce. Consequently, spruce should be used with care as an upland subalpine fir zone indicator. Subalpine fir becomes the late-successional dominant when sites are too cold for more shade-tolerant species to reproduce. On the Yakama Forest, subalpine fir is considered a late-successional species on all upland forest sites where it or Engelmann spruce occur, if more

shade-tolerant species such as western redcedar, Pacific silver fir, or mountain hemlock are absent or unable to reproduce successfully.

The subalpine fir habitat type extends from mid-elevations to upper timberline. Consequently, temperatures are lower than in most other forest habitat types. When the subalpine fir habitat type is found at elevations below Pacific silver fir, western hemlock, grand fir, or Douglas-fir habitat types, it indicates cold air drainage and frost pockets. South of the Entiat River, subalpine fir and Douglas-fir late-successional forests are normally separated by other forest habitat types, such as grand fir, Pacific silver fir, or western hemlock.

Douglas-fir is an important seral species on warmer, drier environments at mid to lower elevations in the habitat type. Western larch is more common on sites south of the Entiat River. Lodgepole pine is found throughout most types in the habitat type and is an important component of many stands. It is especially representative of stands burned in the last 100 years. Intensive burns at less than 200-year intervals strongly favor the development of dense lodgepole pine stands. This is a common pattern in parts of the subalpine fir habitat type. Ponderosa pine is poorly represented and is not well adapted to subalpine fir sites (Cooper *et al*. 1961). Engelmann spruce is best developed on more moist habitats, is often the stand dominant in some more mature stands, and is especially prevalent in some riparian plant associations (Kovalchik 1993).

Lodgepole pine is one of the trees most susceptible to spruce litter leachates, while subalpine fir is less affected (Taylor and Shaw 1982). Engelmann spruce is less common on drier sites in the habitat type. Whitebark pine is found in some higher-elevation subalpine fir plant associations. These plant associations are more or less capable of forming closed canopies in mature stands. Therefore, shade intolerant whitebark pine is considered a seral tree and depends on occasional stand-replacement fires to maintain its stands in early- to mid-seral conditions. At or near timberline, stands become open and key to plant associations in the whitebark pine habitat type.

After subalpine fir is eliminated from extensive areas by intense wildland fire, and in the absence of seed sources, development of late-successional subalpine fir may take centuries. In the interim, such areas may be dominated by lodgepole pine, western larch, or Douglas-fir, with little evidence of either Engelmann spruce or subalpine fir.

A cold temperature regime is the major limiting factor to tree growth in the subalpine fir habitat type. Some of the highest elevation plant associations are poorly suited for intensive timber management but rather are more important for soil and water conservation. Slope position and topography are important considerations for frost pocket development. Species such as pachistima or pinegrass indicate warm sites, while grouse or low huckleberry indicates colder ones. Species such as whitebark pine, smooth woodrush, red mountain heath, and Cascade huckleberry indicate high-elevation sites with extreme snowpack. Seasonal, moderately high water tables are common in some plant associations.

Plant growth is not normally limited by lack of growing season moisture. Subalpine fir sites are relatively mesic and generally have moderate or better timber productivity. CFI plots within the subalpine fir habitat type averaged 658 trees per acre, 181 square feet basal area per acre, 24,480

board feet per acre, and 354 board feet gross growth per acre. The site index for Douglas-fir and lodgepole pine averaged 67 and 54 feet (base age 50), respectively. More mesic plant associations do not necessarily have faster growth rates, but have higher stocking levels.

Many herbs and shrubs in the habitat type are rhizomatous and respond quickly to disturbances. Such a vegetative reproduction strategy gives species such as pinegrass, elk sedge, northwestern sedge, common snowberry, and shiny-leaf spirea a competitive advantage over species that rely entirely on seeds. Invasion by introduced alien weeds is not normally as serious a problem in the colder and more harsh end of the subalpine fir habitat type, when compared to warmer habitats, such as the Douglas-fir habitat type. Observations on areas that were burned indicate that mixtures of exotic grass seed have germinated and established extremely well in the more moderate sites within the subalpine fir habitat type. Grass seeding may be successful to help maintain proper stocking in lodgepole pine-dominated stands, but may hinder establishment of native vegetation.

Both Engelmann spruce and subalpine fir are easily killed by fire. Thin, resinous bark, branches close to the ground, and high stand densities all contribute to the species' vulnerability. Lodgepole pine is also easily killed by fire, but its closed, often serotinous cones ensure quick re-establishment on severely burned sites. Therefore, many subalpine fir sites are dominated by lodgepole pine communities. Of the common seral species, only Douglas-fir and western larch are resistant to surface fires, because of their thick fire-resistant bark, and they may dominate sites with a past pattern of surface fires. In general, stand-replacement fires may be the rule rather the exception in this habitat type although some areas can underburn.

Usually, the plant associations in the subalpine fir habitat type provide little herbage for livestock. For example, herbage production on some of the less productive sites on the Wenatchee National Forest averaged between 27 and 79 lbs./ac. More productive sites averaged between 106 and 230 lbs./ac. Dense, lower-elevation lodgepole pine stands may be important components of Canadian lynx habitat because of the relative abundance of snowshoe hares.

Primary root diseases in the habitat type include S-group Annosum root disease, laminated root rot, Indian paint fungus, brown cubical rot, Tomentosus root disease, and Armillaria root rot (Hessburg *et al*. 1994). These root diseases were scattered before the era of intensive resource management, but have increased dramatically by attacking through stumps associated with logging, and because of the increase of subalpine fir associated with fire control. Dwarf mistletoe infestations are particularly severe in lodgepole pine, Douglas-fir, and western larch. Dwarf mistletoe infections are a major cause of mortality in western larch. These levels are likely elevated from historical times because lack of wildland fires has resulted in denser stands, facilitating the spread of mistletoe.

Bark beetles associated with the subalpine fir habitat type include the western balsam bark beetle, fir engraver, spruce beetle, Douglas-fir beetle, and mountain pine beetle (Hessburg *et al*. 1994). The mountain pine beetle infests lodgepole pine and has killed hundreds of thousands of acres in the Cascades and in the Rocky Mountains in the past 25 years. The spruce beetle and Douglas-fir beetle have the potential for outbreaks in Engelmann spruce and Douglas-fir, respectively. Western spruce budworm and Douglas-fir tussock moth infestations have

expanded due to the expanded food base associated with fire control. The introduced pest balsam woolly adelgid occasionally kills true firs.

White pine blister rust occurs at higher elevations in the subalpine fir habitat type. Flagging and dead whitebark pine is beginning to appear in the Washington Cascades. In twenty years it appears the Cascade stands will likely be as ravaged as Rocky Mountain whitebark pine stands unless trees genetically resistant to blister rust are developed and introduced to these sites.

Mountain Hemlock Habitat Type

Mountain hemlock is widely distributed in the Pacific Northwest in cold, maritime climates. It is the major upper timberline tree species along the Cascade Crest. Its presence indicates cold, snowy habitats where snow accumulations of several feet or more during winter are normal. These snowpacks, seldom occurring more than 15 miles from the divide, persist well into June, resulting in a relatively short growing season. Mountain hemlock appears to be the tree species most resistant to physical snow damage. In eastern Washington contiguous stands of mountain hemlock are restricted to areas near the Cascade Crest and are absent from other more continental sites.

Mountain hemlock is considered the late-successional species when it is reproducing more successfully than shade-tolerant western redcedar or Pacific silver fir. Mountain hemlock and Pacific silver fir broadly overlap in their ecological distribution in the Washington Cascades so that distinguishing between the two habitat types can be difficult. In many stands within the mountain hemlock habitat type, when Pacific silver fir is present, it will likely never be excluded, and is essentially a codominant even in late-successional and near-late-successional stands. Only on the harshest mountain hemlock sites is Pacific silver fir absent or nearly so.

At the highest elevations, the mountain hemlock habitat type usually grades quickly into subalpine parkland. On some sites, however, subalpine fir or whitebark pine plant associations can be found at the upper fringe of the habitat type. The controlling mechanisms of the ecotones between forest (tree islands) and non-forest are complex and still only poorly understood. Snowpack depth and duration, and excess or insufficient soil moisture during the growing season are some of the influential factors. Special communities often develop at the transition between forest and non-forest and may appear as “skirts” around the base of the tree island or along the forest border. At lower elevations, the mountain hemlock habitat type grades into the Pacific silver fir habitat type in a complex fashion, as noted above. At its driest fringe, the mountain hemlock habitat type grades into the subalpine fir or whitebark pine habitat type.

Though they may be intense, wildland fires are infrequent in these snowy habitats. Fires may start frequently, but conditions seldom favor extensive fires. Generally there will be many small fires and few large ones (Agee 1994). Consequently, some of the oldest stands are mountain hemlock stands.

On the Wenatchee National Forest, mountain hemlock averaged over 20% cover within most of the habitat type. Pacific silver fir is shade tolerant and is usually dominant where present. Subalpine fir, whitebark pine, and (rarely) lodgepole pine are the only seral species within the

higher elevation (often parkland) areas of the habitat type. The more moderate, closed areas within the habitat type support a plethora of other seral trees, including western hemlock, western redcedar, subalpine fir, Douglas-fir, western larch, and western white pine. Grand fir is notably absent in this zone and Douglas-fir is present in only about 25% of the stands. Only stands at the extreme elevation limits of the habitat type consist of nearly pure canopies of mountain hemlock, with crowns heavily festooned by lichens. These stands often have a uniform size-class structure, giving the false impression of an even-aged stand. Reproduction can be sparse.

Undergrowth varies from dense herbaceous or shrub layers to depauparate conditions characterized by a few scattered plants and deep litter. Dense shrub layers, including such species as Cascade azalea, are characteristic of more mesic habitats within the habitat type, while beargrass, smooth woodrush, and big huckleberry are found in the drier areas.

Many sites in the habitat type are poorly suited for intensive timber management. Short growing seasons and heavy snowpacks are the major limitations. Site index values (base age 100) for Pacific silver fir and mountain hemlock ranged from 56 to 87 and from 41 to 67 feet, respectively. Pacific silver fir becomes more successful on lower elevation sites and its presence indicates that timber productivity is increasing for all tree species.

The mountain hemlock habitat type is cold and wet with lingering snow. Tree ages are generally old, suggesting that fire frequency is generally low. Ridgetop and upper slope locations favor lightning strikes, but conditions seldom favor extensive fires. Usually fires started by lightning will burn briefly and extinguish. Sometimes fires can get established in the duff and burn small areas over extended periods. Typically, catastrophic fires occur only every 300 to 500+ years, when regional weather conditions are exceptionally favorable for fire.

Primary root diseases include Annosum root disease and laminated root rot. Annosum root disease attacks subalpine fir, grand fir, Engelmann spruce, Pacific silver fir, western hemlock, and mountain hemlock, typically causing root and butt rot at maturity. Laminated root rot can be especially prevalent where mountain hemlock is abundant. Tomentosus root disease can be present in lodgepole pine stands. Indian paint fungus is also an agent for heart rot of true firs, western hemlock, and mountain hemlock. Western white pine has been drastically affected by white pine blister rust, and there have been dramatic increases in mountain pine beetle attacks on this tree (Hessburg *et al*. 1994). Dwarf mistletoe infections are a major cause of mortality in western larch.

Insect pests of note include mountain pine beetle, spruce beetle, western spruce budworm, and fir engraver. Of these, only mountain pine beetle has the potential for severe outbreaks in this habitat type, mainly in the limited areas dominated by lodgepole pine. Douglas-fir tussock moth and western spruce budworm can occur and mainly attack Douglas-fir and grand fir, but grand fir is seldom present in sufficient quantities for extensive budworm mortality.

Whitebark Pine Habitat Type

Whitebark pine is distributed over a wide geographic area. It is restricted to upper slopes, ridges, and mountain tops on exposed sites, at or near upper timberline where stands do not form closed canopies. The habitat type indicates sites where the combination of cold, wind, late summer drought, and snow removal by wind creates conditions too severe to form a closed forest. Most aspects are south or west, but the habitat type can occur on northerly aspects in drier areas. Frost is possible any night of the year and diurnal temperature ranges are great. On the exposed slopes typical of the habitat type, insolation rates are very high on sunny days. On the Yakama Forest whitebark pine occurs at elevations from about 5,500 feet to over 7,000 feet on the slopes of Mount Adams.

Soils are coarse-textured and very rocky. Litter layers are abundant to thin or absent. Rock, gravel and exposed soil are common on many sites. Most soils are formed in granites and basalts. Nutrients and moisture-holding capacity are low.

Open-grown whitebark pine typifies the tree layer. Lodgepole pine, Douglas-fir, or rare ponderosa pines may be present in drier whitebark pine plant associations. Subalpine fir, Engelmann spruce, and mountain hemlock may be present, especially on moister sites, but are also clearly subordinate to whitebark pine. Conifers other than whitebark pine are near their upper elevation limits and are minor stand components. They are almost invariably deformed by the cold, windy environment. Whitebark pine is generally the only tree capable of establishing on the sites without shelter from other trees. It often forms the base of a tree island, with less hardy species growing in the shelter of established pines. Seed caches buried by Clark's nutcracker are important in establishing these trees and these seed-eating birds may be an essential part of the ecology of whitebark pine stands.

Tree growth rates and stocking are very low within the whitebark pine habitat type. Stand data from the Wenatchee National Forest indicated the average stand basal area for the various whitebark pine plant associations ranged from 41 to 69 sq. ft./ac. The site index for subalpine fir, lodgepole pine, and Douglas-fir averaged 29, 32, and 44 feet (base age 50), respectively. Sites are too harsh to manage for timber production, but the presence of vegetation is important for soil and water conservation.

Whitebark pine wood is highly flammable, even when green, and the upper slope locations are frequently struck by lightning. Only the discontinuous nature of the vegetation and the rocky sites limit the extent of wildland fire and allow stands to develop to maturity. Otherwise, frequent fires would preclude the development of mature forests in these lightning-prone environments. Fire frequency is higher in the whitebark pine habitat type than in any other subalpine community (Agee 1994).

Whitebark pine sites often adjoin or are intimately intermixed with subalpine and alpine shrublands and meadows. Mountain big sagebrush and green fescue stands are often ringed by open woodlands dominated by whitebark pine. The great diversity of plant communities and habitats associated with this mix of communities makes these sites very important for a variety of wildlife.

Whitebark pines have edible seeds (pine nuts) that are important forage for animals, including Clark's nutcrackers and grizzly bears. Whitebark pine stands may become snow-free early in the spring (June), thus providing early forage for ungulates, other mammals, or birds.

On the Wenatchee National Forest, herb cover and composition is quite variable among plant associations. Herbage production ranged from 22 to 204 pounds per acre. Species richness is especially high on the dry, grassy plant associations, in part because many stands were subject to intensive grazing in the past. These stands are often located on old stock driveways and may have fed sheep in the hundreds of thousands each year. Because of shallow, rocky soils, drought, and the short growing season, these sites are slow to recover after abusive grazing.

Sites are sufficiently harsh that management should concentrate on limiting site disturbance from recreation use. Resistance to trampling of the herb layer is also variable. Some sites are extremely sensitive to disturbance by both hikers and horses; soil can be easily displaced by trampling. Recovery may take centuries. Grouse and low huckleberry are very sensitive to trampling and soil compaction and are quickly obliterated in areas of concentrated trail or camping use.

White pine blister rust and mountain pine beetles are causing severe damage to stands of whitebark pine in the Rocky Mountains (Keane and Arno 1993). The numbers of dead and dying whitebark pines have been increasing annually in the Washington Cascades.

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Appendix D. Insects and Diseases of the Yakama Forest

Table D–1. Forest Insects Listed Alphabetically by Scientific Names

Scientific Name	Common Name
Adelges cooleyi	Cooley spruce gall adelgid
Adelges piceae	Balsam woolly adelgid
Aphididae	Aphids
Barbara spp.	Cone moths
Buprestidae	Flatheaded borers, metallic borers
Cecidomyia piniinopis	Gouty pitch midge
Cerambycidae	Roundheaded borers, longhorned beetles
Chionaspis pinifoliae	Pine needle scale
Choristoneura lambertiana	Sugar pine tortrix
Choristoneura occidentalis	Western spruce budworm
Coleophora laricella	Larch casebearer
Conophthorus ponderosae	Pine cone beetle
Dendroctonus brevicomis	Western pine beetle
Dendroctonus ponderosae	Mountain pine beetle
Dendroctonus pseudotsugae	Douglas-fir beetle
Dendroctonus rufipennis	Spruce beetle
Dendroctonus valens	Red turpentine beetle
Dioryctria spp.	Cone worms
Dryocoetes confusus	Western balsam bark beetle
Eucosma sonomana	Western pine shoot borer
Eucosma spp.	Cone borers
Ips spp.	Engraver beetles
Lambdina fiscellaria lugubrosa	Western hemlock looper
Leptoglossus occidentalis	Western conifer seed bug
Magdalis gentilis and *Scythropus elegans*	Defoliating weevils
Nacophora mexicanaria	Pine looper
Neodiprion nanulus contortae	Pine sawfly
Neophasia menapia	Pine butterfly
Nepytia freemani	Western false hemlock looper
Nuculaspis californica	Black pineleaf scale
Orgyia pseudotsugata	Douglas-fir tussock moth
Pissodes strobi	White pine weevil
Pissodes strobi and *P. terminalis*	Terminal weevils, white pine weevil, lodgepole terminal weevil
Pissodes terminalis	Lodgepole terminal weevil
Pristiphora erichsonii	Larch sawfly
Scolytus ventralis	Fir engraver
Synanthedon sequoiae	Sequoia pitch moth
Trypodendron spp., *Platypus* spp., *Gnathotrichus* spp., and *Xyleborus* spp.	Ambrosia beetles
Zeiraphera improbana	Larch bud moth
Zelleria haimbachi	Pine needle sheathminer

Table D–2. Forest Pathogens Listed Alphabetically by Scientific Names

Pathogen	Disease
Arceuthobium abietinum	True fir dwarf mistletoe
Arceuthobium americanum	Lodgepole pine dwarf mistletoe
Arceuthobium campylopodum	Western dwarf mistletoe
Arceuthobium douglasii	Douglas-fir dwarf mistletoe
Arceuthobium laricis	Larch dwarf mistletoe
Arceuthobium tsugense	Hemlock dwarf mistletoe
Arceuthobium tsugense subsp. *mertensianae*	Mountain hemlock dwarf mistletoe
Arceuthobium tsugense subsp. *tsugense*	Western hemlock dwarf mistletoe
Armillaria ostoyae	Armillaria root disease
Atropellis piniphila and *A. pinicola*	Atropellis canker
Botrytis cinerea	Gray mold
Chrysomyxa arctostaphyli	Spruce broom rust
Chrysomyxa pirolata and *C. monesis*	Spruce cone rust
Contarinia pseudotsugae, C. constricta, and *C. cuniculator*	Douglas-fir needle midges
Cronartium coleosporioides (Peridermium stalactiforme)	Stalactiform blister rust
Cronartium comandrae	Comandra blister rust
Cronartium ribicola	White pine blister rust
Cryptoporus volvatus	Pouch fungus, gray saprot
Cytospora abietis and C. kunzei	Cytospora canker
Davisomycella medusa	Medusa needle blight
Davisomycella montana	Lodgepole pine needle cast
Delphinella abietis	Delphinella shoot blight
Dermea pseudotsugae	Dermea canker
Diaporthe lokoyae	Phomopsis canker of Douglas-fir
Didymascella thujina	Cedar leaf blight
Dothistroma septospora (Mycospharella pini)	Red band needle blight, pine needle cast
Dothistroma sp., *Lophodermella* spp., and *Elytroderma* sp.	Pine needle casts
Echinodontium tinctorium	Indian paint fungus, rust red stringy rot, brown stringy rot
Elytroderma deformans	Elytroderma needle blight
Endocronartium harknessii	Western gall rust
Fomes ignarius var *populinus*	False-tinder fungus, white trunk rot of aspen
Fomitopsis cajanderi	Brown top rot, yellow brown top rot
Fomitopsis officinalis	Quinine conk, brown trunk rot
Fomitopsis pinicola	Red belt fungus, brown crumbly rot
Fusarium oxysporum f.sp. *pini*	Fusarium root rot, damping off
Ganoderma applanatum	Artist's conk, white mottled rot
Herpotrichia coulteri, and *H. juniperi*	Brown felt blight, snow molds
Heterobasidion annosum	Annosus root rot
Hypodermella laricis	Larch needle blight

Table D–2 (continued).

Pathogen	Disease
Inonotus tomentosus	Tomentosus root rot, false velvet top fungus, white pocket root and butt rot
Lachnellula flavovirens	Lachnellula canker
Laetiporus sulphureus	Sulfur fungus, dark brown cubical rot
Leptographium wageneri	Black stain root disease
Lirula abietis-concoloris and *Virgella robusta*	True fir needle casts
Lophodermella arcuata, L. concolor, and *L.morbida*	Lophodermella needle casts
Lophodermium crassum and *L. piceae*	Spruce needle diseases
Lophodermium seditiosum	Lophodermium needle cast
Melampsora medusae and *M. albertensis*	Douglas-fir rust
Melampsorella caryophyllacearum	Fir broom rust, yellow witches-broom of fir
Meria laricis	Larch needle cast
Phacidium abietis	Fir snow blight
Phaeocryptopus gaumanni	Swiss needle cast
Phaeolus schweinitzii	Schweinitzii root and butt rot, brown cubical rot, velvet top fungus
Phellinus pini	Red ring rot , pini rot
Phellinus weirii	Laminated root rot
Phellinus wierii	Cedar laminated butt rot
Pholiota limonella	Yellow cap fungus, mottled rot
Phytophthora spp.	Phytophthora root rots of seedlings
Phytophthora spp., Pythium spp., Fusarium spp., and *Rhizoctonia spp.*	Damping off
Poria sericeomollis	Cedar brown pocket rot
Pucciniastrum epilobii	Fir-fireweed rust
Pucciniastrum geoppertianum	Fir-blueberry rust
Rhabdocline pseudotsugae and *R. weirii*	Douglas-fir needle casts, Rhabdocline needle casts
Rhizina undulata	Rhizina root rot
Sphaeropsis sapinea	Diplodia blight
Stereum sanguinolentum	Red heart rot

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Appendix E. Tree Species of the Yakama Forest

Table E–1. Tree Species Listed Alphabetically by Scientific Name

Scientific Name	Common Name
Abies amabilis	Pacific silver fir
Abies grandis	grand fir
Abies lasiocarpa	subalpine fir
Abies procera	noble fir
Larix occidentalis	western larch
Picea engelmannii	Engelmann spruce
Pinus albicaulis	whitebark pine
Pinus contorta	lodgepole pine
Pinus monticola	western white pine
Pinus ponderosa	ponderosa pine
Populus tremuloides	quaking aspen
Populus trichocarpa	black cottonwood
Pseudotsuga menziesii	Douglas-fir
Quercus garryana	Oregon white oak
Salix spp.	willows
Thuja plicata	western redcedar
Tsuga heterophylla	western hemlock
Tsuga mertensiana	mountain hemlock

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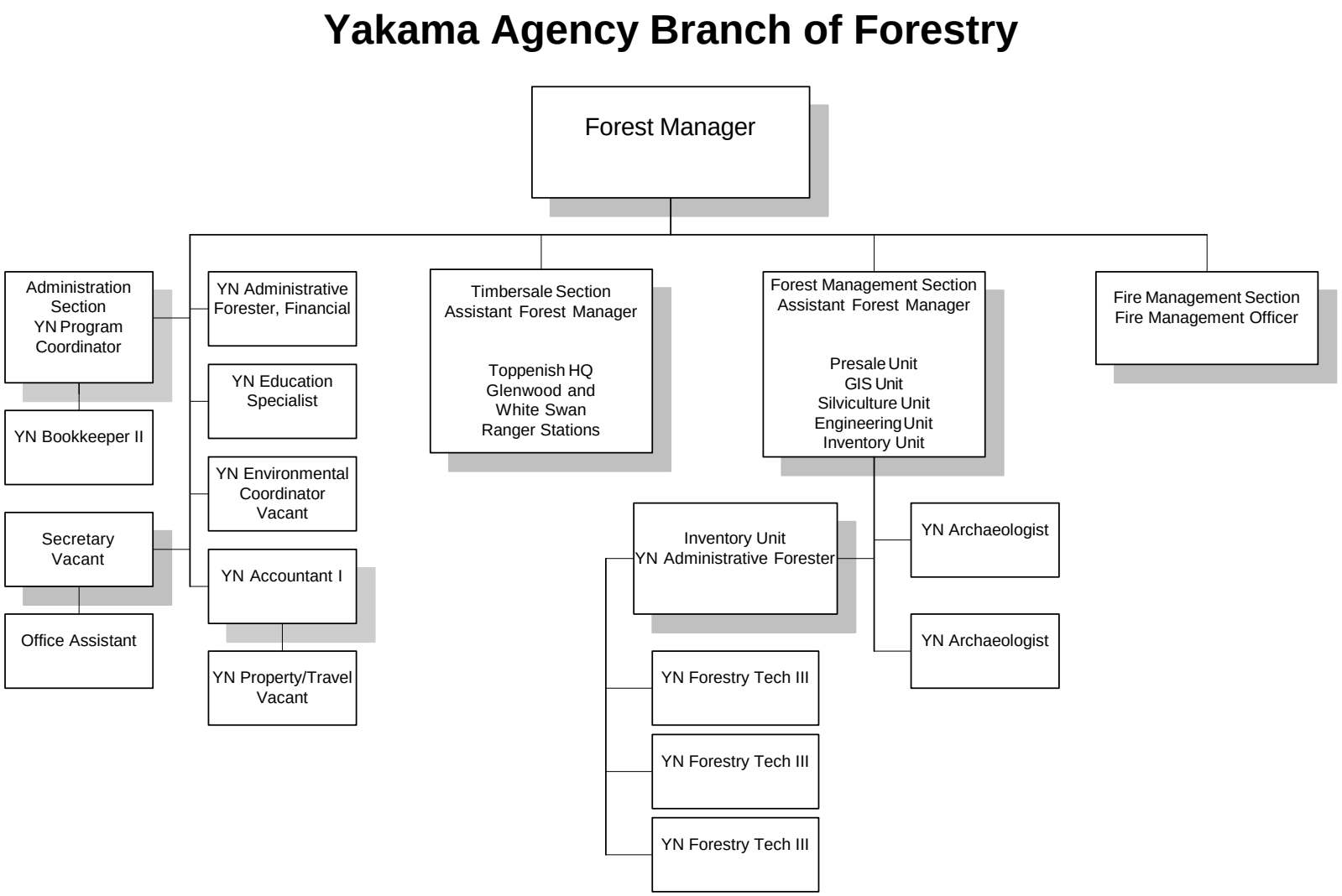
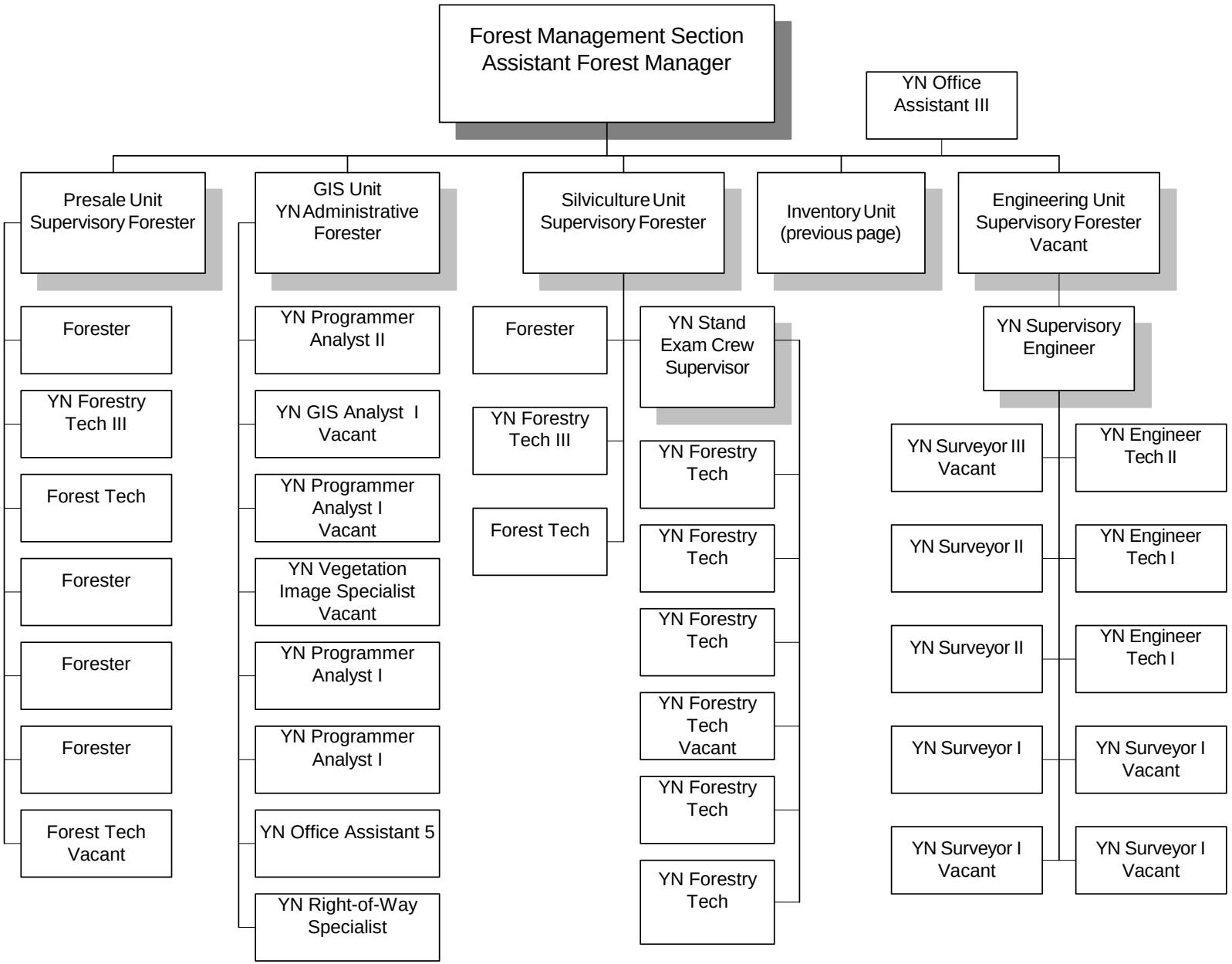
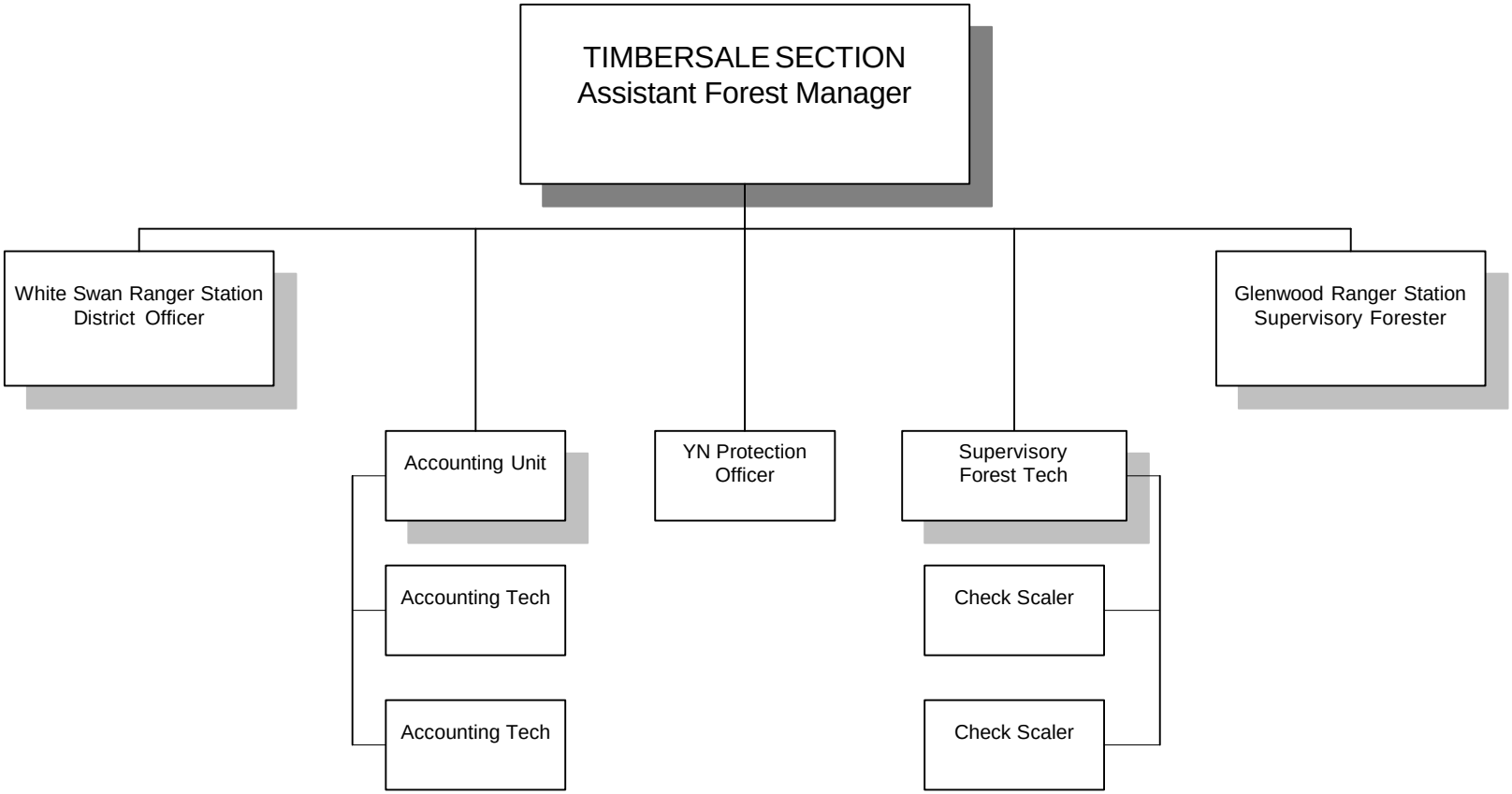
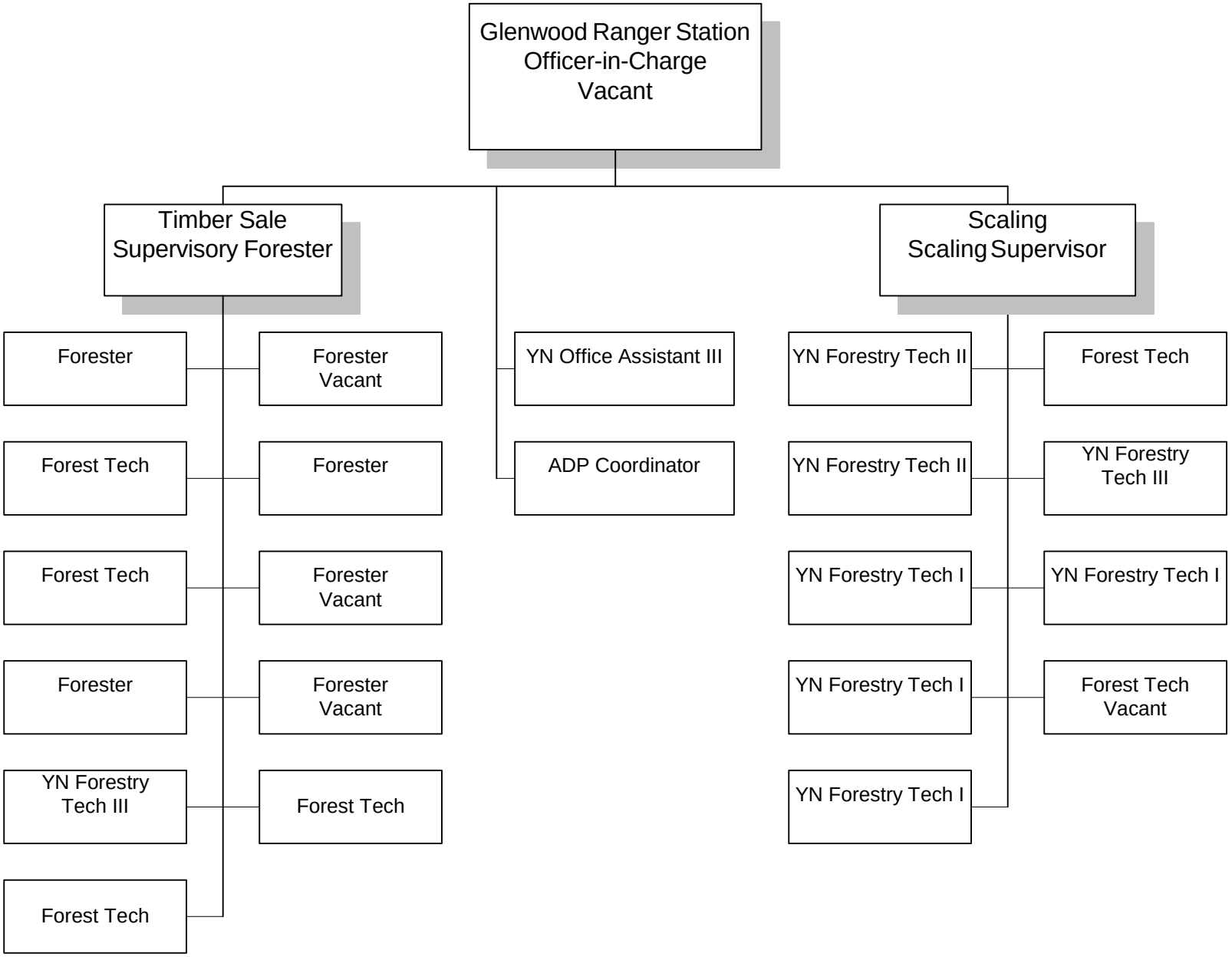
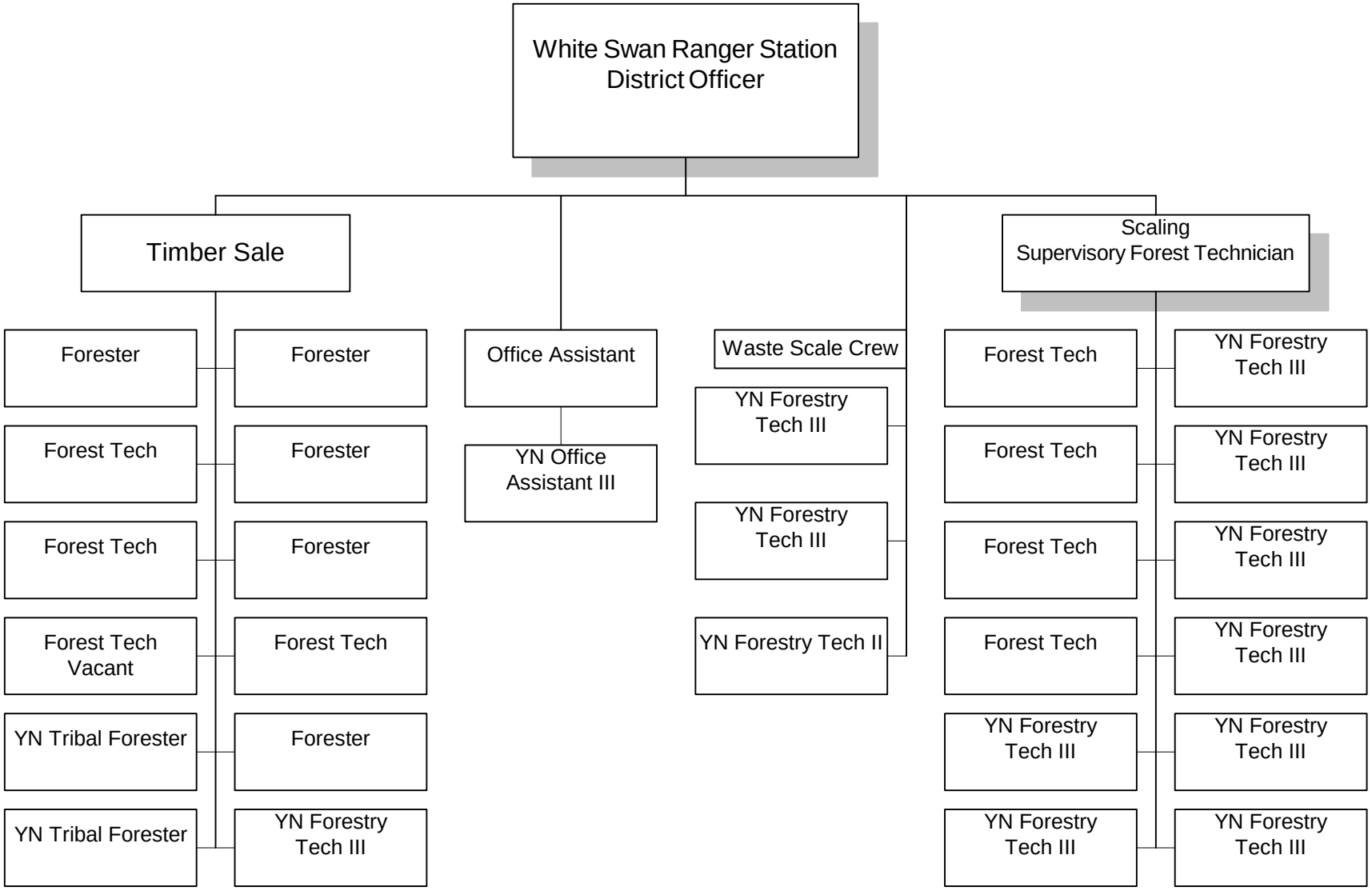
Appendix F. Yakama Agency Branch of Forestry Organizational Charts




Forest Management Section
Assistant Forest Manager
YN Office Assistant III
Presale Unit Supervisory Forester
GIS Unit YN Administrative Forester
Silviculture Unit Supervisory Forester
Inventory Unit (previous page)
Engineering Unit Supervisory Forester Vacant
Forester
YN Forestry Tech III
Forest Tech
Forester
Forester
Forester
Forest Tech Vacant
YN Programmer Analyst II
YN GIS Analyst I Vacant
YN Programmer Analyst I Vacant
YN Vegetation Image Specialist Vacant
YN Programmer Analyst I
YN Programmer Analyst I
YN Office Assistant 5
YN Right-of-Way Specialist
Forester
YN Forestry Tech III
Forest Tech
YN Stand Exam Crew Supervisor
YN Forestry Tech
YN Forestry Tech
YN Forestry Tech
YN Forestry Tech Vacant
YN Forestry Tech
YN Forestry Tech
YN Supervisory Engineer
YN Surveyor III Vacant
YN Surveyor II
YN Surveyor II
YN Surveyor I
YN Surveyor I Vacant
YN Engineer Tech II
YN Engineer Tech I
YN Engineer Tech I
YN Surveyor I Vacant
YN Surveyor I Vacant


TIMBERSALE SECTION
Assistant Forest Manager
White Swan Ranger Station
District Officer
Accounting Unit
Accounting Tech
Accounting Tech
YN Protection
Officer
Supervisory
Forest Tech
Check Scaler
Check Scaler
Glenwood Ranger Station
Supervisory Forester


Glenwood Ranger Station
Officer-in-Charge
Vacant
Timber Sale
Supervisory Forester
Scaling
Scaling Supervisor
Forester
Forester
Vacant
Forest Tech
Forester
Forest Tech
Forester
Vacant
Forester
Forester
Vacant
YN Forestry
Tech III
Forest Tech
Forest Tech
YN Office Assistant III
ADP Coordinator
YN Forestry Tech II
YN Forestry Tech II
YN Forestry Tech I
YN Forestry Tech I
YN Forestry Tech I
Forest Tech
YN Forestry
Tech III
YN Forestry Tech I
Forest Tech
Vacant


White Swan Ranger Station
District Officer
Timber Sale
Forester
Forester
Forest Tech
Forester
Forest Tech
Forester
Forest Tech
Vacant
Forest Tech
YN Tribal Forester
Forester
YN Tribal Forester
YN Forestry
Tech III
Office Assistant
YN Office
Assistant III
Waste Scale Crew
YN Forestry
Tech III
YN Forestry
Tech III
YN Forestry Tech II
Scaling
Supervisory Forest Technician
Forest Tech
YN Forestry
Tech III
Forest Tech
YN Forestry
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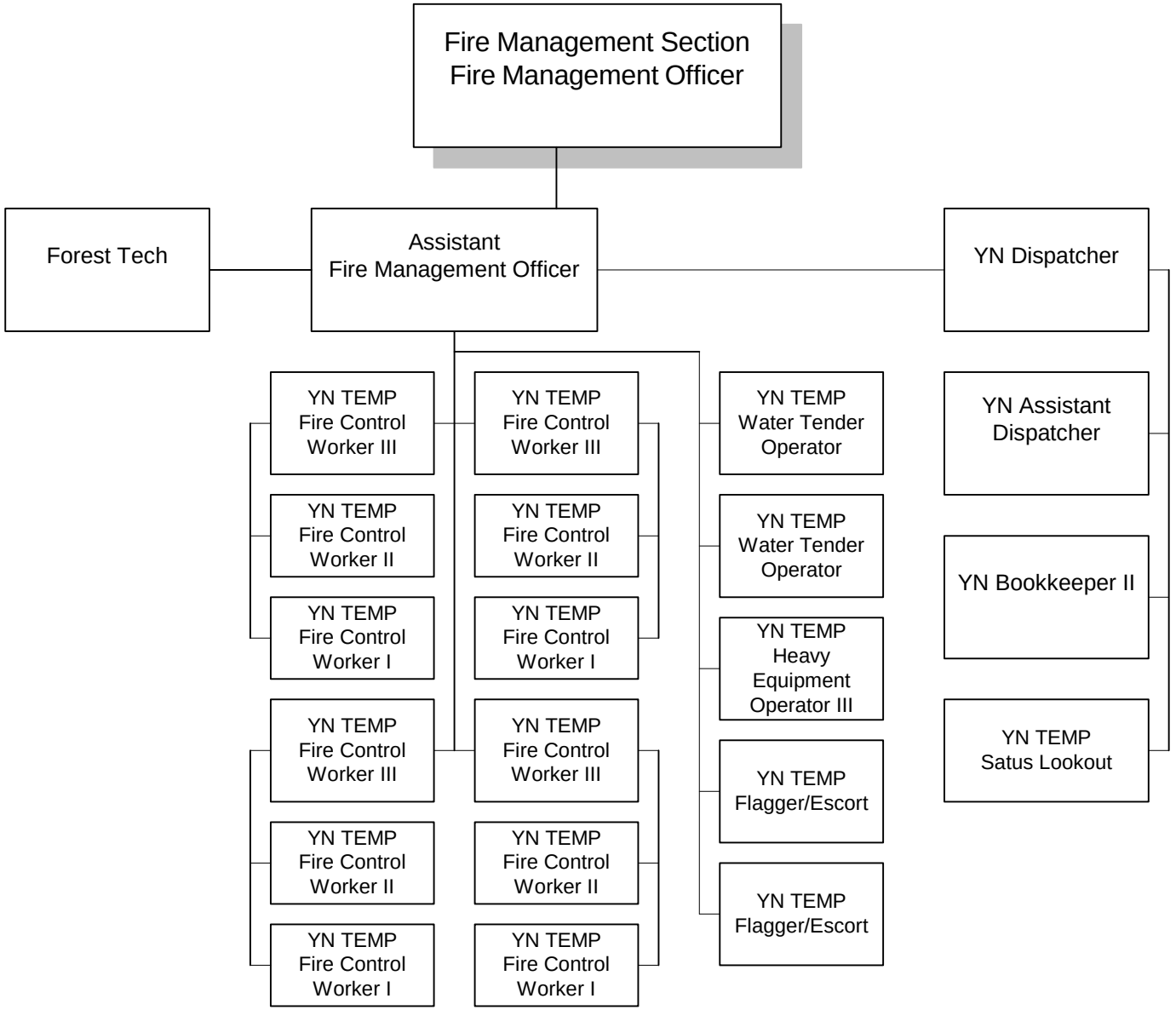
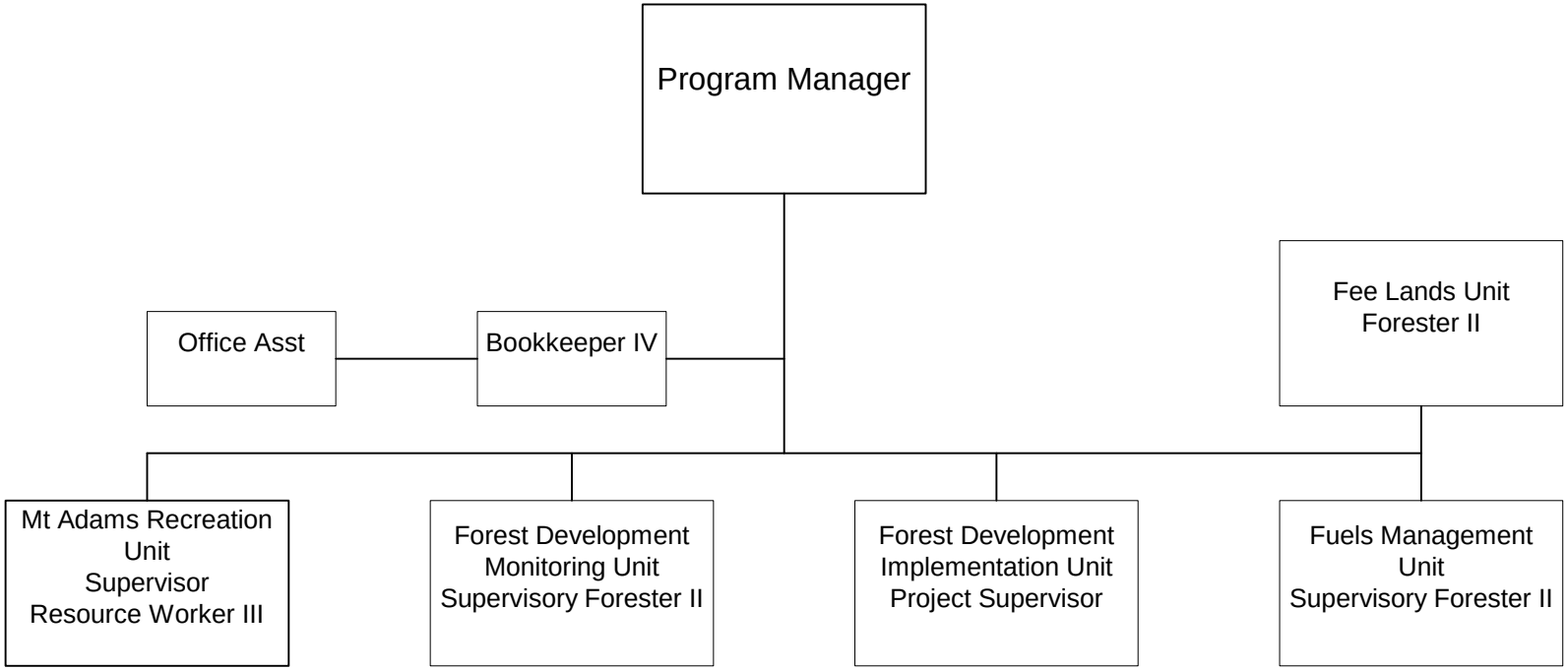
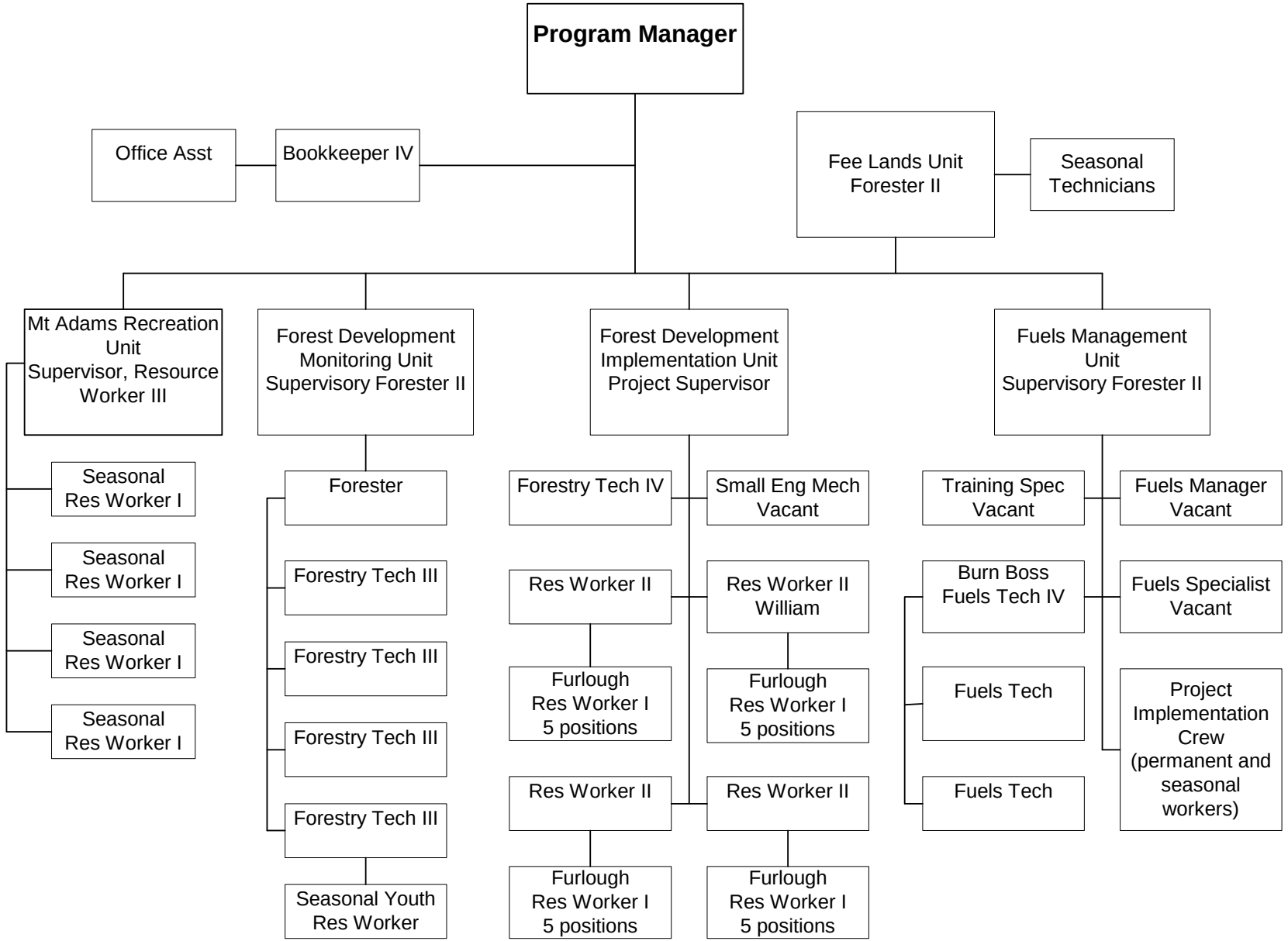

Fire Management Section
Fire Management Officer
Forest Tech
Assistant
Fire Management Officer
YN Dispatcher
YN TEMP
Fire Control
Worker III
YN TEMP
Fire Control
Worker III
YN TEMP
Water Tender
Operator
YN Assistant
Dispatcher
YN TEMP
Fire Control
Worker II
YN TEMP
Fire Control
Worker II
YN TEMP
Water Tender
Operator
YN Bookkeeper II
YN TEMP
Fire Control
Worker I
YN TEMP
Fire Control
Worker I
YN TEMP
Heavy
Equipment
Operator III
YN TEMP
Fire Control
Worker III
YN TEMP
Fire Control
Worker III
YN TEMP
Flagger/Escort
YN TEMP
Satus Lookout
YN TEMP
Fire Control
Worker II
YN TEMP
Fire Control
Worker II
YN TEMP
Flagger/Escort
YN TEMP
Fire Control
Worker I
YN TEMP
Fire Control
Worker I

Appendix G. Yakama Nation Forestry Program Organizational Charts

Yakama Nation Forest Development Program




Program Manager
Office Asst
Bookkeeper IV
Fee Lands Unit
Forester II
Seasonal
Technicians
Mt Adams Recreation
Unit
Supervisor, Resource
Worker III
Forest Development
Monitoring Unit
Supervisory Forester II
Forest Development
Implementation Unit
Project Supervisor
Fuels Management
Unit
Supervisory Forester II
Seasonal
Res Worker I
Seasonal
Res Worker I
Seasonal
Res Worker I
Seasonal
Res Worker I
Forester
Forestry Tech III
Forestry Tech III
Forestry Tech III
Forestry Tech III
Seasonal Youth
Res Worker
Forestry Tech IV
Small Eng Mech
Vacant
Res Worker II
Res Worker II
William
Furlough
Res Worker I
5 positions
Furlough
Res Worker I
5 positions
Res Worker II
Res Worker II
Furlough
Res Worker I
5 positions
Furlough
Res Worker I
5 positions
Training Spec
Vacant
Fuels Manager
Vacant
Burn Boss
Fuels Tech IV
Fuels Specialist
Vacant
Fuels Tech
Project
Implementation
Crew
(permanent and
seasonal
workers)
Fuels Tech

Fuels Management Project Implementation Crew

These positions will be filled by permanent and seasonal staff when fuels management projects are being implemented.