APPENDIX A

LOOMIS STATE FOREST CHRONOLOGY

The following Loomis State Forest Chronology helps illustrate the complex relationships in the forest where economic, historical, biological and social issues have all come together.

1889

- Washington becomes a state; receives 3 million acres of "original grant lands" from federal government. Washington keeps most of its grant lands to generate income from the construction of state's schools, prisons, institutions and Capitol buildings.

1900-1920s

- Wildfire sweeps through large blocks of the Loomis, part of a natural wildfire, grow-back life cycle of this forest.

- Lodgepole pine naturally seeds and grows in the 4,000 to 6,000 foot elevations, creating large blocks of same-aged, same-species trees in remote areas inaccessible by road.

1925

- The Loomis State Forest, west of Tonasket, in eastern Washington's Okanogan County, resulted from federal land grant and lieu land selections.

1957

- State Legislature creates Department of Natural Resources to consolidate the state's land management and resource protection into one agency.

- Board of Natural Resources created to set policy direction for state trust lands on behalf of the trust beneficiaries and the public.

1960s-1970s

- Department of Natural Resources emphasis is placed on generating income for trust beneficiaries through timber harvest.

- The state Legislature creates the Resource Management Cost Account (RMCA) to actively reinvest some revenue from state lands into making the long-term investments needed to keep trust lands productive.

1970s

- Harvest of marketable timber begins in Loomis (lodgepole is not economically feasible to sell).

1980s

- Bark beetle infestations begin to appear in stands of lodgepole in nearby Ferry County and Canadian Okanogan.

1984-85

- Loomis lodgepole reaches harvest maturity, but little or no market exists for the trees. A harvest of the trees is not economically sound for trust.

1987

- Bark beetle infestation begins in Loomis State Forest.

1989

- Loomis beetle infestation reaches lodgepole in scattered pockets on 5,000 acres. A few small lodgepole sales are auctioned by Department of Natural Resources.

1990

- Emergency statewide closure of Canadian lynx trapping and hunting season by Washington Wildlife Commission.

Early 1990s

- Supply of timber on federal lands becomes restricted. Mill owners demand shifts from federal to state and private lands.

- Increased timber harvesting in Loomis brings increased review and legal challenges from groups concerned about dwindling lynx habitat and environmental issues.

- First Loomis State Forest public advisory process begins; disintegrates due to disagreement among interest groups.

1991

- The first Loomis Forest Advisory Committee (twelve-member) appointed by Department of Natural Resources to review each Loomis timber sale.

1992

- Lodgepole pine becomes valuable to timber purchasers and mills as other supplies dry up. Mill price at this time increases.

1993

- Commissioner of Public Lands Jennifer Belcher takes office.

- Commissioner appoints second Loomis State Forest citizen advisory committee (13-members). Committee participates in a public process to recommend goals and objectives for ecosystem-based trust management of the forest.

- Department of Natural Resources facilitates "focus group" meetings to gather information from groups interested in the Loomis.

- First successful lodgepole timber sale in Loomis since 1989.

- Lynx listed as threatened by the Washington Wildlife Commission.

- Annual survey shows beetle infestation in Loomis rose dramatically, affecting pockets of 90+ year old lodgepole on thousands of acres.

- Public meetings gather citizen comment on Loomis State Forest in Tonasket, Spokane, Seattle and Olympia.

1994

- Citizen advisory committee completes Loomis State Forest goals and objectives.

- Public meetings gather comment on *Loomis State Forest Planning Process: Recommended Goals and Objectives* formed by citizen advisory committee.

- Department of Natural Resources begins to develop strategy on how to meet the goals and objectives developed by the citizen advisory committee.

- Open house to share information and gather additional public comment for Loomis State Forest Landscape Plan.

- Department of Natural Resources uses citizen advisory committee goals and objectives and public comment to develop the Loomis State Forest Landscape Plan to be presented to the public in the fall of 1995.

- Since 1980, Department of Natural Resources has managed 98 timber sales in the Loomis, generating revenues of $21.4 million for public school construction projects.

1995

- Department of Natural Resources completes development of SNAP computer modeling for use in eastern Washington.

- Okanogan County and Quillayute Valley School District file lawsuit.

1996

- Department of Natural Resources completes draft Loomis State Forest Landscape Management Plan, which incorporates lynx management plan. A 30-day public review and comment period follows.

- Loomis State Forest Landscape Management Plan presented to the Board of Natural Resources for review.

- Board of Natural Resources is expected to act on Loomis State Forest Landscape Management Plan.

APPENDIX B

VEGETATION

The following provides an explanation of the vegetation zones used in this document.

Introduction

A classification of vegetation zones (potential vegetation) provides an information storage and retrieval system that is related to real landscape features. Potential vegetation can serve as a template for block planning and stand management because 1) the spatial limits of species distribution and abundance are defined, 2) a range of site productivity is defined, 3) species' reactions to disturbance and management action are related to a landscape unit, and 4) a map unit is created for data storage and retrieval for comparison of management actions.

Vegetation zones are large areas of the landscape that if, left to its natural process, would give rise climax vegetation with the same set of dominant species A zone is an elevation belt that has the same climax vegetation on zonal sites, e.g., Ponderosa pine would dominate in the Ponderosa pine zone. Zonal sites have gentle slope, deep, nonstony soils, moderate drainage, and average chemical characteristics (Daubenmire, 1970). Within a zone, drier or wetter sites may support different types of potential vegetation than the zonal site. These specific plant communities that reflect site variations within a vegetation zone are called plant associations. As with vegetation zones, plant associations, indicate a particular range of environments, species, and natural processes, but do not necessarily represent existing vegetation.

Community classifications do not directly address structural and temporal variability in vegetation. Structural diversity of individual stands (described by tree height and numbers, density and height of shrubs, etc.) and patterns of stands on the landscapes (described by shape, size and distribution of different stands) portray the architecture of ecosystems. Structural variability reflects species composition but more often reflects development and growth of species and the history of disturbance. Structural features are important indicators of ecosystems functions such as habitat for wildlife and many specialized lichens, mosses, and fungi.

AN ECOLOGICAL FRAMEWORK TO CREATE MANAGEMENT OPTIONS

Understanding how forest ecosystems are constructed and how they work (function) is a prerequisite to maintaining healthy forests and managing the multiple values they hold. The biological basis of forest management is an appreciation of the processes that create the forest, their origins, structure and complex interrelationships of all its components parts. The growth of trees and viability of all forest inhabitants is a product of many interactions within the ecosystem. Within an ecological framework, a healthy forest is defined as the maintenance of healthy relationships among all the resources. As we manage forests for specific products and outcomes, the condition of a specific resource may very overtime and space but the maintenance of the ecosystems ability to support that resource should not be impaired.

The ecological framework relates the natural range of conditions for each major vegetation zones on the Loomis State forest, to the ideal characteristics of forest composition, structure and landscape composition for each resource (water, soil, air, wildlife, fish, and cultural resources). In folding together all resources using the common denominator of vegetation zone condition we have integrated resource needs on a functional basis. In tracking the vegetation condition over time in relation to the desired condition for each resource we provide accountability for the status of each resource.

Defining the desired future condition

To reach the level of required specificity the analysis examines the 7 impacted resources (water, soil, air, wildlife, fish, cultural resources and ecosystem integrity) and the 4 impacting resources (timber harvesting, grazing, and mining), on parallel paths. All are examined in terms of their goals, objectives for the entire forest, and targets and standards stratified by vegetation community group.

The desired future condition combines the standards for each resource into a composite desired future condition for the entire ecosystem. This common vision expressed in the same terms for each resource, is used to integrate and reconcile standards for each resource by vegetation zone. This is essentially an ecosystem-level summary of the needs of all resources by the 7 vegetation zones.

Vegetation Zones

The purpose of a plant community classification is to define areas of similar function on the landscape. The Okanogan guide to forested plant associations is based on the climax community concept were by the zone is named for the most shade tolerant tree species that occupies the site. The most favored crop species is usually a fast growing early seral species. The forest zone represents a land area of similar climate, soils, and biotic influences that determine the functioning and growth of forests. Forest zones are divided in to plant associations and are usually considered as the smallest division of an ecosystem. Plant associations are based of floristic analysis of sites within forest zones and are named for the characteristic understory vegetation that is intended to represent different growing sites reflecting changes in soil moisture and nutrient status within a forest zone.

The vegetation found on any piece of ground is a result of available flora, climate, soils, competition, herbivory, disease, and history. Each of these elements shapes the character of the vegetation by affecting its composition, vertical structure, or horizontal pattern.

The Loomis Block has seven vegetation zones. Of these, the Douglas fir and Subalpine Fir Zones are the most widespread. The other four zones occur only in limited areas of the Block. Each zone is described below.

SHRUB STEPPE ZONE:

The threetip sagebrush zone occurs at the lowest elevations within the Block. Communities dominated by threetip sagebrush are found on typical sites. Antelope bitterbrush and big sagebrush are common shrubs in this zone. Ponderosa pine woodland may occur on relatively moist, well-drained sites. Soils in the valley centers are very moist to subirrigated and can support a lush grassland or riparian woodland.

STRUCTURE: This zone consists of non-forested areas dominated by bunchgrasses and shrubs, and is mainly devoid of trees. Grasses and forbs generally make up the majority of vegetative cover. Shrubs often form a taller, more discontinuous layers above the herbaceous layer. Shrub cover may be greater on heavily grazed sites. Occasional trees may be widely scattered. In undisturbed condition, the ground between grasses, shrubs, and forbs is generally covered with a layer of lichens and mosses (biotic crust). Riparian areas often have dense cover of trees and/or tall shrubs.

SPECIES COMPOSITION: Dominant grasses in undisturbed condition are bluebunch wheatgrass and/or Idaho fescue. Sandberg's bluegrass is of secondary importance. With grazing disturbance, cheatgrass may be the dominant grass. Important shrub species are bitterbrush, big sagebrush, and three-tip sagebrush. Many species of forbs may be present; arrowleaf balsamroot is often the most abundant. Ponderosa pine or Douglas fir may occasionally be present in small amounts.

DISTURBANCE

A. Fire -- appears that fires are relatively frequent; fire return intervals not well known because of lack of trees for ring count analysis. The importance of cheatgrass tends to increase probability and frequency of fire by increasing fuel continuity, therefore fires are probably more frequent now than they were in pre-settlement times. Bitterbrush is killed by most fires; low-intensity spring fires may promote its sprouting (bitterbrush is much used by cattle in winter). Big sagebrush is generally killed by fire; three-tip sagebrush, bunchgrasses, and most forbs resprout after fire. If present, cheatgrass, an annual non-native species, may increase after fire.

B. Grazing -- Over-grazing tends to eliminate bunchgrasses, compact soil, and increase density of big sagebrush where present. Biotic crust (lichens/mosses) is removed or reduced by grazing (biotic crust is important to ecosystems because it fixes nitrogen and increases infiltration). Prevalence of cheatgrass and other non-native and annual species increases with grazing pressure. Grazing is most damaging to native bunchgrasses from flowering to seed ripening (about mid April-July). Riparian zones are preferentially used by cattle and are negatively affected in multiple aspects by overgrazing. Bitterbrush is heavily browsed by cattle and deer in the winter. Noxious weeds may invade with grazing, especially diffuse knapweed.

PRODUCTIVITY: Low productivity, because of low precipitation and warm temperatures. Grasses provide most of usable productivity. The major growing season for grasses and forbs is April-June, later at higher elevations. This zone has marginal conditions for tree growth. Regeneration of what few trees are present is very uncertain because of hot, dry conditions.

LANDSCAPE SETTING: Elevation 2,460 to 4,640 feet; mainly southeast to west aspects, less commonly on other aspects; slope steepness varies; slope position variable.

SOILS: Variable; soils tend to be relatively coarse-textured.

CLIMATE/MOISTURE: Hot and dry; lowest precipitation of any of the zones; moderately cold winters and warm to hot summers; effective precipitation mainly autumn through winter; soil moisture deficits common; high evapotranspiration.

The specific plant associations contained within this zone on the Loomis State forest are as follows:

threetip sagebrush/Idaho fescue
bitterbrush/Idaho fescue
bitterbrush/bluebunch wheatgrass
mountain big sagebrush (Artemisia tridentata spp. vaseyana)
big sagebrush/bluebunch wheatgrass
big sagebrush/Idaho fescue
Idaho fescue-Wyeth's buckwheat

PONDEROSA PINE ZONE:

The ponderosa pine zone forms a narrow belt around the lowest valley bottoms in the Block. Also included in this zone is the driest of the Douglas fir vegetation zone plant associations, because their management is identical to that of ponderosa pine plant associations. Zonal vegetation is ponderosa pine woodland with bunchgrasses, such as Idaho fescue and bluebunch wheatgrass, and shrubs, such as antelope bitterbrush and snowberry. Cottonwood and aspen may occur near water. Dry sites within this zone have big sagebrush or threetip sagebrush communities. Because this is the lowest forest or woodland zone, tree regeneration can be difficult.

STRUCTURE: In pre-settlement conditions (frequent fires), these forests were very open and park-like in structure, with small groups of even-aged trees dominating the canopy in a patchy fashion. Stands were uneven-aged at the forest level, but even-aged at the small patch level (1 acre or less). The understory is dominated by grasses and, to a lesser degree, by a discontinuous shrub layer. Biotic crust (as in the steppe zone) may be a prominent feature where bunchgrasses dominate the understory. Density of trees has increased on some of these sites in the last 80 years due to fire suppression and other management activities, and the open, park-like structure has consequently given way to more closed structural conditions with an abundance of younger trees. Overstory canopy cover is generally less than 50% in old stands, and may be much lower.

SPECIES COMPOSITION: Trees are almost exclusively ponderosa pine and Douglas fir. On the warmest and driest sites within this zone, Douglas fir is absent. Ponderosa pine tends to predominate among older trees; Douglas fir tends to predominate (when present) in the younger age classes. On many sites, both species appear capable of regenerating indefinitely. Bluebunch wheatgrass and Idaho fescue are the dominant native grasses, with pinegrass important also on the more mesic sites within the zone. Cheatgrass is a major increaser with grazing that may dominate the understory. The most abundant shrub is bitterbrush; bearberry is important on the coolest, most mesic sites within the zone. Snowbrush and buffaloberry may be important after fire on the relatively cool, mesic sites. Arrowleaf balsamroot is the most abundant forb; many other species may be present, with strong floristic similarities to the steppe zone. In many ways, this zone is a steppe with an open-canopy tree layer added.

DISTURBANCE:

A. Fire -- Fire regime characterized by frequent, low-severity fires (low-severity fire regime - Agee 1993). Typical pre-settlement fire return intervals were 5-30 years. The low-severity fires tended to kill small trees, especially Douglas fir, and favor dominance by the fire-resistant ponderosa pine. Fires helped to maintain the open, park-like structure and the grassy understory by limiting the importance of small, young trees. Young trees were primarily limited to the small patches where old trees had recently died. Bitterbrush is killed by most fires, but may resprout after low-intensity spring fire. Most grasses, forbs, and other shrubs resprout after fire. Current conditions of more dense, younger stands in many areas tend to result in more intense, high-severity fire when fires do occur.

B. Disease -- Dwarf mistletoe is abundant in Douglas fir.

Dwarf mistletoe is a parasitic plant which seeds onto tree branches, distorting growth, weakening and eventually killing infested trees. Each major commercial conifer species is infested with a different dwarf mistletoe species. Treatment of dwarf mistletoe may involve isolation of infested trees, selective removal of infested trees, or growing only non-host trees beneath and among infested host trees.

C. Insects -- Western pine beetle attacks old-growth ponderosa pine. Mountain pine beetle also attacks ponderosa pine. Much of the mortality in small patches that set a template for the small even-aged patches in the pre-settlement landscape was probably due to western pine beetle attacks on old ponderosa pine.

Bark beetles are small insects which lay eggs in the inner bark of trees. Bark beetle attack and kill the host trees. Some species and sizes of trees are more susceptible to bark beetles. Treatment for bark beetles includes managing susceptible stands to reduce their likelihood of coming under attack by bark beetles. Altering unattacked stands is more effective for controlling beetle populations than treatment of attacked trees which are still occupied by beetles.

D. Grazing -- Over-grazing affects forage (both in terms of species and amounts). The native bunchgrasses decrease with grazing pressure and undesirable exotic species and annuals, especially cheatgrass, increase with grazing pressure. Bunchgrasses are most damaged by grazing from flowering to seed ripening (about mid April-July?). Grazing introduces noxious weeds. Grazing will result in degradation or elimination of biotic crust where present. Riparian zones are preferentially used by cattle and are negatively affected in multiple aspects by over-grazing. Bitterbrush is heavily browsed by cattle and deer in the winter.

E. Logging -- Low-value trees and low volumes make artificial regeneration economically impractical; natural regeneration is very slow and sparse due to stressful conditions (too warm, dry). Winter access can promote soil compaction and displacement unless ground is frozen. Thinning of smaller trees followed by prescribed underburns have potential to restore healthier conditions more in tune with a natural disturbance regime.

SILVICULTURAL REGIME:
1) Unevenaged management.
2) Harvest 30% of the volume on a 30 year re-entry cycle.
3) Favor Ponderosa Pine.

PRODUCTIVITY: Low productivity for trees. Site index is low (ponderosa pine mean 68-70 or lower, Douglas fir mean 65-66). Herbage production is excellent where the native bunch grass understory has been maintained and is naturally lower where bearberry is important in the understory. Herbage production is reduced by over-grazing. Natural regeneration of trees is slow. Mesic sites or micro sites within the zone will tend toward overstocking of trees in the absence of frequent fire.

LANDSCAPE SETTING: Elevation ranges from 2400 to 4800 feet. Aspects range from east to west; slopes from 12% to 68%. Slope position ranges from ridge top to lower slope.

GEOLOGY/SOILS: Soils are generally derived from granitic glacial till or outwash. Soil texture is sandy loam to sand.

CLIMATE/MOISTURE: The warmest and driest of the forested zones. Slightly cooler, with more precipitation, than the steppe zone. Warmer and often drier than the mesic Douglas fir zone. Evapotranspiration and soil water deficits are significant.

The specific plant associations contained within this zone on the Loomis State forest are as follows:

ponderosa pine/bitterbrush
ponderosa pine-Douglas fir/beardless bluebunch wheatgrass
Douglas fir/bitterbrush-bearberry

DOUGLAS FIR ZONE:

The Douglas fir zone is the most widespread vegetation zone found in the Loomis Block. Douglas fir is the climax tree species on these zonal sites. Ponderosa pine is the major seral species on most sites. It is likely that ponderosa pine woodland maintained by frequent fire was a significant cover type within the zone. Undergrowth varies from bunch grass on drier habitats to snowberry thickets on relatively moist habitats. Dry slopes are often dominated by mountain big sagebrush. These sagebrush communities are widespread on dry south and west-facing slopes. Aspen and cottonwood occur along streams and other wetland areas. Engelmann spruce may also occur along streams where cold air drains near the upper elevations of the zone. An isolated population of Rocky Mountain Juniper occurs in Toats Coulee (below Juniper Point). This zone encompasses the Mixed Conifer habitat in the Loomis Wildlife Resource Workshop Report.

STRUCTURE: Semi-open, but relatively continuous, tree canopy. Stand structure quite variable due to variability in fire regime and recent fire suppression. Three general structural types may be described that represent points on a continuum: (1) park-like stands resembling those in ponderosa pine zone, (2) more dense single-layer canopies with relatively few smaller or larger trees, and (3) broken upper canopy of tall trees with shorter, more dense main canopies, with or without prominent subcanopy (multi-layered structure). Park-like structure probably was a major type in the pre-settlement landscape, but it is now mostly gone because of fire suppression. Understory is dominated by shrubs and/or grasses, and may be limited by dense tree growth.

SPECIES COMPOSITION: Douglas fir is the dominant late-seral (understory) tree species throughout this zone. The canopy (overstory) may be dominated by one or more of the following species: ponderosa pine, Douglas fir, western larch, or lodgepole pine. Ponderosa pine tends to be more important at lower elevations (warmer), and western larch and lodgepole pine are more important at higher elevations (cooler). Wide variety of shrub species reflects variability of site conditions within the zone. Important shrubs include bearberry, Snowbrush, pachistima, shiny-leaf spirea, ninebark, common snowberry, and mountain snowberry. Abundant common snowberry indicates the warm, moist extreme of this zone, bordering on the ponderosa pine zone. Pinegrass is a major understory dominant throughout much of this zone. Many species of forbs may be present, but none with very high constancy or cover.

DISTURBANCE

A. Fire -- Fire regimes characterized by a mixture of frequent, low-severity fire and less frequent, moderate to high severity fire (primarily low-severity fire regime). Typical pre-settlement fire return intervals were probably 10-50 yr. Frequent fire tends to favor ponderosa pine over Douglas fir, which is less fire-resistant. Open park-like structure favored by frequent, low-severity fire. Fire suppression, combined with some management practices (e.g., high-grade logging), has resulted in dense young canopy layers and ladder fuels, which in turn have increased the probability of stand-replacement high-severity fires and insect/disease outbreaks. Snowbrush increases after fire from buried seed. Most

shrubs and grasses resprout after fire.

B. Disease -- Phellinus weirii in Douglas fir causes root rot pockets; dwarf mistletoe abundant in Douglas fir; Armilleria root rot can affect all species.

Root diseases or root rot are caused by pathogenic fungi which occupy dead, buried root material. Susceptible trees are slowly killed after their growing roots contact infested material. Treatment may involve removing susceptible trees from the site and replacing them with resistant tree species.

C. Insects -- Western pine beetle attacks older ponderosa pine; mountain pine beetle attacks lodgepole and ponderosa pines. Douglas fir tussock moth and western spruce budworm attack Douglas fir periodically; this has been a major reason to discriminate against Douglas fir in management. Insect problems have been increased by fire suppression which has favored Douglas fir and created more dense stands where individual trees have lower vigor.

The Douglas-fir tussock moth is a caterpillar/moth which feeds on the foliage of Douglas-fir, grand fir and subalpine fir. Outbreaks develop quickly and can cause extensive tree growth loss, damage, and mortality before the epidemic subsides in a four year period. Human health risks are associated with outbreaks because of toxic compounds in the caterpillar hairs. Overcrowded pure host stands on warm, dry sites are the most susceptible condition. Maintaining individual tree vigor and favoring pine on dry sites reduces risk.

The western spruce budworm is a caterpillar/moth which feeds on the new growth of Douglas-fir, subalpine fir and Engelmann spruce. Periodic epidemics of this native insect cause tree growth losses, defects, and mortality. The most susceptible stands have multiple layers of pure host species, providing windblown caterpillars plenty of food. Treatments to reduce budworm susceptibility favor non-host species such as pines and reduce canopy layering.

See subalpine fir/lodgepole pine section for discussion of pine beetles.

D. Grazing -- Understory composition is more resistant to alteration by grazing than in ponderosa pine zone; however, pinegrass will decrease under heavy grazing pressure and certain forbs may increase (e.g., luina). Dense tree cover will decrease pinegrass production which is the major grass forage.

E. Silviculture -- Natural regeneration may be successful in some circumstances, but is not always reliable due to heat/drought stress, competition, or frost. Competition from pinegrass can be a serious impediment to regeneration - prompt planting is recommended where pinegrass is abundant. On some sites, shrub competition may be a problem. Soil compaction occurs if logging is done on wet ground. Frost generally not a problem, except on some higher elevation sites. Thinning of smaller trees followed by prescribed underburns has potential to restore healthier conditions more in tune with natural disturbance regime where future losses from pests and fire will be less.

F. Rodents -- Post-harvest shrub fields are subject to rodent damage.

SILVICULTURAL REGIME

1) Shelterwood Harvest favor Ponderosa Pine
    a) For timber production, retain 10 trees per acre.
    b) For late successional characteristics, retain 18 trees per acre, greater than 18 inches dbh if possible.
2) Rotation age is 90 years.
3) Ten year regeneration lag.
4) No pre-commercial thinning.
5) No commercial thinning.
6) Final harvest shelterwood (retain either 10 or 18 trees per acre)

PRODUCTIVITY: Productivity is generally moderate, but can be relatively good (e.g., PSME/SYAL association) or relatively poor (e.g., PSME/ARUV). Site index: ponderosa pine = 59-100; Douglas fir = 57-98; western larch = 43-87; lodgepole pine = 27-72. Initial tree growth may be slow on higher elevation sites. Grazing forage production is good on PSME/CARU association and generally fair elsewhere.

LANDSCAPE SETTING: Elevation 2240-5290 feet; all aspects; flat to steep (74%) slopes. This zone tends to occur on north aspects at lower elevations and on south aspects at higher elevations.

GEOLOGY/SOILS: Parent materials are variable, including glacial till and outwash, colluvium, and alluvium. Soil texture is generally sandy loam to sand, with abundant coarse fragments. Soil moisture is higher than in ponderosa pine zone because of greater precipitation and/or less solar insolation. Soil organic matter may accumulate because of lower soil temperatures. Drought is less important than in ponderosa pine zone, but still may be significant on some sites.

CLIMATE/MOISTURE: Overall, the zone could be considered moderately dry and moderately warm. Precipitation is equivalent to or somewhat greater than in the ponderosa pine zone. Temperatures are intermediate between upper and lower zones, although there is considerable variation in temperatures within this zone. This zone is warmer and/or more moist than the ponderosa pine and steppe zones, more dry than the mesic and wet subalpine fir zones, and warmer than the dry subalpine fir/cold Douglas fir zone.

The specific plant associations contained within this zone on the Loomis State forest are as follows:

Douglas fir/pinegrass
Douglas fir/common snowberry
Douglas fir/mountain snowberry
Douglas fir/pachistima
Douglas fir/bearberry
Douglas fir/ninebark

SUBALPINE FIR and SUBALPINE FIR/LODGEPOLE PINE ZONES:

The high elevation forests of the Loomis Block form the subalpine fir zone. It is characterized by deep winter snow packs and relatively short, cool growing seasons. This is the second most widespread zone on the Block. Subalpine fir and or Engelmann spruce are the climax dominates. Major seral tree species include Douglas fir, western larch, lodgepole pine, and aspen. Ponderosa and western white pine may occur in limited numbers. Larch and Douglas fir will dominate on sites where catastrophic burns generally occur more than 200 years apart.

In the Subalpine fir/Lodgepole pine zone, lodgepole pine forms pure stands. At high elevations it may represent an edaphic or fire climax, where either soils are too poor to support more demanding species or the disturbance is to frequent to allow other species to establish. Lodgepole pine seems to dominate forests where catastrophic burns occur at intervals less than 200 years (Williams and Lillybridge 1983).

Many of these drier forests may have had frequent underburns which maintained park-like stands of large Douglas fir or larch with pinegrass and the dominant undergrowth. Common undergrowth species include pinegrass, dwarf-huckleberry, twinflower, low huckleberry, and cascades azalea. At higher elevations in this zone, Labrador tea and grouse huckleberry are major forest undergrowth species. Mountain big sagebrush communities occur on dry, south and west-facing slopes.

The subalpine zone also for RMZ park and woodland areas at upper timberline. It mainly occurs near Chopaka Mountain, although it is very extensive on adjacent US Forest Service land. Forests and woodlands are characterized by Engelmann spruce. Under riparian conditions, spruce for RMZ a stable old growth climax, occupying 80% or more of the basal Area. Subalpine fir is generally absent. Whitebark pine or subalpine larch may occur as persistent, seral trees at the highest forest elevations. Grouse huckleberry and skunk-leaf polemonium are common forest undergrowth species. The subalpine parkland is characterized by extensive grass, sedge, and forb dominated meadows. Shrubby willows dominated riparian and some wetland vegetation.

SUBALPINE FIR ZONE:

STRUCTURE: Relatively dense forest dominated by a single main canopy layer. Varying development of subcanopy/regeneration layers depending on time since last disturbance and initial stocking pattern. Some stands may have a scattered upper canopy layer of larger trees over the dense main layer. The stand age structure variable and may be even-aged, all-aged, or multi-cohort. Shrub understory can be dense in early stages of succession; may become relatively sparse in middle stages of succession because of canopy shading. Grasses and forbs generally less important than shrubs, but usually present. Heavy litter accumulations on the ground.

SPECIES COMPOSITION: Major late-successional tree species is subalpine fir, which may take some time to occupy the site after a major disturbance. Engelmann spruce may also be an important late successional species (ABLA2/LIBOL association). The main canopy is dominated by one or more of the following: Douglas fir, western larch, lodgepole pine, Engelmann spruce, and, least commonly, subalpine fir. Major understory species include huckleberries (4 species), twinflower, pachistima, shiny-leaf spirea, and pinegrass. Huckleberry in abundance indicates cooler temperatures within this zone.

DISTURBANCE

A. Fire -- Fire regime typified by relatively infrequent, high-severity fires, and on some sites somewhat more frequent, moderate-severity fires (primarily high-severity fire regime). Mean fire return intervals probably 70-300 yr. Fires are either stand-replacement events, or partial-mortality events that considerably thin the canopy. Douglas fir and western larch are the only trees that survive fire regularly. High-severity fires at less than 200 year intervals favor dominance by lodgepole pine. Less intense fires favor dominance by Douglas fir or western larch. Subalpine fir and Engelmann spruce increase in importance with less frequent fire. Most understory species resprout after fire.

B. Disease -- Fallowness weirii root rot in Douglas fir; dwarf mistletoe in Douglas fir, western larch, subalpine fir.

Root diseases or root rot are caused by pathogenic fungi which occupy dead, buried root material. Susceptible trees are slowly killed after their growing roots contact infested material. Treatment may involve removing susceptible trees from the site and replacing them with resistant tree species.

C. Insects -- Western spruce budworm attacks Douglas fir, subalpine fir, Engelmann spruce. Mountain pine beetle attacks lodgepole pine, and creates major economic damage. Larch casebearer attacks western larch.

The western spruce budworm is a caterpillar/moth which feeds on the new growth of Douglas-fir, subalpine fir and Engelmann spruce. Periodic epidemics of this native insect cause tree growth losses, defects, and mortality. The most susceptible stands have multiple layers of pure host species, providing windblown caterpillars plenty of food. Treatments to reduce budworm susceptibility favor non-host species such as pines and reduce canopy layering. See subalpine fir/lodgepole pine section for discussion of pine beetles.

The larch casebearer is a non-native caterpillar/moth which feeds on the foliage of larch. Healthy larch trees can withstand severe infestation for four or more years before mortality is threatened. The casebearer may weaken trees so they die from other causes. Introductions of natural parasites have reduced the impact of larch casebearer on forests.

D. Grazing -- Grazing is not too important in this zone, but could be very destructive in riparian areas.

E. Silviculture -- Logging can damage soils if done on moist soils (compaction and displacement). Heavy equipment can compact soils. Frost damage to regeneration can be a problem in frost pockets created by tree removal. Competition from pinegrass or shrubs can also limit regeneration, so prompt reforestation is recommended. If a high water table is present, tree removal may result in water at the surface, due to reduced evapotranspiration, and attendant regeneration difficulties.

SILVICULTURAL REGIME:

1) Shelterwood harvest favor Douglas-fir and western larch.
    a) For timber production, retain 10 trees per acre.
    b) For late successional characteristics, retain 18 trees per acre greater than 18 inches dbh if possible.
2) Rotation age is 80 years.
    a) 80 years for timber production.
    b) 100 years for late successional characteristics.
3) No regeneration lag.
4) Pre-commercial thinning at age 30.
5) Commercial thinning at age 50 if economically feasible.
6) Final harvest, shelterwood (retain 10 or 18 trees per acre).

PRODUCTIVITY: The most productive forest zone, on average. Stands are relatively easy to regenerate. Site index: western larch = 93-100, Douglas fir = 67-102, lodgepole pine = 57-85, subalpine fir = 67-92, Engelmann spruce = 54-129. Huckleberry understory indicates cooler, less productive end of zone. Dense stocking common.

LANDSCAPE SETTING: Elevation ranges from 2170 to 5940 feet. All aspects. Slopes flat to steep (maximum 61%). Slope position variable.

GEOLOGY/SOILS: Parent materials are variable, and often mixed, including glacial till and outwash, alluvium, and volcanic ash. Soil texture is silt loam to sand, on average finer than in Douglas fir or ponderosa pine zones. Ground water may be relatively near the surface on some sites.

CLIMATE/MOISTURE: Moderate to cool, moist climate. Snowpack is a significant winter feature here, which may last for some months on the cooler sites. Precipitation is relatively high. This zone is drier than the wet subalpine fir zone, more moist than the mesic Douglas fir zone, and warmer and/or more moist than the dry subalpine fir zone.

The specific plant associations contained within this zone on the Loomis State forest are as follows:

subalpine fir/twinflower
subalpine fir/huckleberry
subalpine fir/pachistima
subalpine fir/Cascade azalea

Engelmann spruce/horsetail
Douglas fir/huckleberry
subalpine fir/pinegrass
subalpine fir/pinegrass/grouse huckleberry

SUBALPINE FIR/ LODGEPOLE PINE ZONE:

STRUCTURE: Relatively dense single-layer tree canopy with varying development of subcanopy based mainly on age of the stand. Age structure consists of post-fire cohort and then potentially broad spread of understory regeneration. Trees are relatively small and often over stocked. Understories are dominated by short shrubs. Many relatively small snags and logs are typical of mature to old stands. This is lynx habitat.

SPECIES COMPOSITION: Subalpine fir and/or Engelmann spruce are the late-successional tree species. The main canopy is dominated primarily by lodgepole pine and secondarily by Engelmann spruce. Subalpine fir generally only becomes important in the canopy in old stands. Understory vegetation is dominated by grouse huckleberry, with low huckleberry co-dominant about half the time.

DISTURBANCE

A. Fire -- High-severity fire regime typified by somewhat infrequent, high severity fires. Mean fire return intervals in the pre-settlement landscape were probably 100-200 years. Almost all trees are killed by fires when they do occur. Lodgepole pine has a significant degree of serotiny here, allowing it to rapidly reseed burned areas by cones opened in the heat of the fire. Generally, lodgepole remains a significant component of the canopy for about 200 years after fire, at which time it become uncommon due to mountain pine beetle-induced mortality. Natural fire cycles favored the maintenance of extensive lodgepole pine stands because fire generally returned prior to the loss of lodgepole as a dominant from the stand. Fire-sensitive subalpine fir has been kept from dominating by fires.

B. Disease -- unknown

C. Insects -- Mountain pine beetle is a major mortality agent for lodgepole pine. If pine are not killed by fire, they are generally killed by beetles. Beetle mortality generally will become significant about 100 years after a fire.

Bark beetles are small insects which lay eggs in the inner bark of trees. Bark beetle attack and kill the host trees. Some species and sizes of trees are more susceptible to bark beetles. Treatment for bark beetles includes managing susceptible stands to reduce their likelihood of coming under attack by bark beetles. Altering unattacked stands is more effective for controlling beetle populations than treatment of attacked trees which are still occupied by beetles.

D. Silviculture -- Frost hazard is extreme from re-radiation cooling and cold air drainage. Removal of upper soil horizons by logging or other damage may severely reduce nutrient availability and productivity. Clearcutting and burning may leave site so exposed to

environmental stress that regeneration is difficult. Snags and logs may be important to maintaining 'safe sites' for tree regeneration. Soil compaction possible with heavy equipment. Many overstocked stands need to be thinned in order to maintain reasonable growth rates on individual trees.

SILVICULTURAL REGIME:
1) Evenage harvest (retain 10 trees per acre)
2) 10 year regeneration lag, natural regeneration.
3) No pre-commercial thinning.
4) Commercial thin if economically feasible at age 50
5) Rotation age is 80 years.

PRODUCTIVITY: This zone has low productivity due to short growing season and cold conditions year-round. Site index: lodgepole pine = 31; Engelmann spruce = 36. Overstocking can be a problem. Little forage here for grazing.

LANDSCAPE SETTING: Elevation range 5500-7000 feet. Aspect variable. Slopes mostly moderate (mean 21%, range 3-65%). Slope position mostly mid to upper slope.
SOILS: Parent material mostly granitic glacial till. Soil texture sandy loam to sand. Soils are cold, acid, shallow, doughty, and poorly developed.

CLIMATE/MOISTURE: Cold and moderately dry. Frost or snow is possible any day of the year. Significant winter snowpack. Colder than mesic or dry subalpine fir zones; colder and drier than wet subalpine fir zone; warmer, more moist, or more dry than subalpine parkland/alpine zone.

The specific plant associations contained within this zone on the Loomis State forest are as follows:

subalpine fir/grouse huckleberry-pinegrass
subalpine fir/grouse huckleberry
subalpine fir/pinegrass

ALPINE ZONE:

The alpine zone is the highest zone; it is a minor component in the Loomis Block. It occurs above tree-line on Chopaka Mountain within the Loomis Block. Extensive areas of alpine are widespread in the Pasayten Wilderness and Tiffany Mountains. Sedge, grass, and forb communities dominate (Douglas and Bliss 1977).

Associated with the alpine areas are non-riparian Quaking aspen forest types throughout the higher elevations of the Loomis State forest. These areas have little evidence of conifer regeneration and often adjoin wet meadows or other edaphic feature that limits conifer growth. Understories consist of common snowberry or pinegrass. These areas likely are successionally stable and represent a climax community of aspen.

STRUCTURE: Non forest or aspen grove. This zone includes 3 main structural types: (1) open-canopy subalpine forest or aspen grove, (2) parkland of subalpine meadows in a mosaic with scattered trees or tree clumps, (3) alpine vegetation with no upright trees. Trees are relatively small and poorly formed. Alpine vegetation and subalpine meadows are generally dominated by herbs, especially graminoids. Short shrubs are important in certain types of forest, parkland, or alpine. 'Krummholz' thickets of trees are a common feature of this zone. Krummholz cannot assume an upright form due to winter stresses above the snowpack. This is a variable high-elevation zone.

SPECIES COMPOSITION: Open forests and parklands may have one or more of the following important tree species: subalpine larch, Engelmann spruce, subalpine fir, whitebark pine, quaking aspen and lodgepole pine. Subalpine larch and whitebark pine are limited primarily to this zone and occur higher than any other trees. Open forest understories are generally dominated by one or more of the following species: pinegrass, red mountain-heather, moss-heather, common snowberry, grouse huckleberry, and smooth woodrush. Many subalpine meadow and alpine community types may be present: some of the more important dominants are probably green fescue, sedges, kobresia, timber danthonia, and common juniper. Mountain big sagebrush may codominate some parkland meadows.

DISTURBANCE

A. Fire -- Fire regimes not well known. Forest and parkland portions probably do burn infrequently and at high severity. Maybe considerable variability in fire regimes within this zone. Whitebark pine forests are the most likely to burn on a more frequent basis. Alpine areas may never burn. Fire regime altered where grazing has reduced herbaceous fuels. Fire not necessarily a 'disaster' here as some might expect. Trees can be naturally slow to establish after fires, taking up to 100 years to stock a formerly open forest. In some cases, fires can convert open stands to semi-permanent meadows. Conversely, some meadows slowly fill in with trees. A slow dynamism appears to be natural here.

B. Disease -- White pine blister rust attacks whitebark pine, and could extirpate the species.

C. Insects -- None of economic significance. Mountain pine beetle attacks whitebark and lodgepole pines.

D. Grazing -- Parklands and alpine have been used by sheep. Grazing alters species composition, introduces exotic species which are likely to increase with grazing pressure.

E. Silviculture -- Very poor economic return for degree of ecological disturbance inflicted by logging here. Regeneration is difficult because of frost damage, long-duration snowpacks. Natural regeneration very slow. Compaction and erosion is of concern. No logging entry is recommended in this zone.

PRODUCTIVITY: Timber productivity is very poor. Trees grow very slowly. Short growing season and low temperatures limit productivity.

LANDSCAPE SETTING: Elevations above 5810 feet. Aspects, slopes, slope positions various. At lower end of zone, tends to occur on steep, southerly aspects on upper slopes to ridgetops, or moderate northerly aspects with deep, long-duration snowpack.

SOILS: Parent materials are bedrock or glacial till. Soils are shallow, cold, poorly developed.

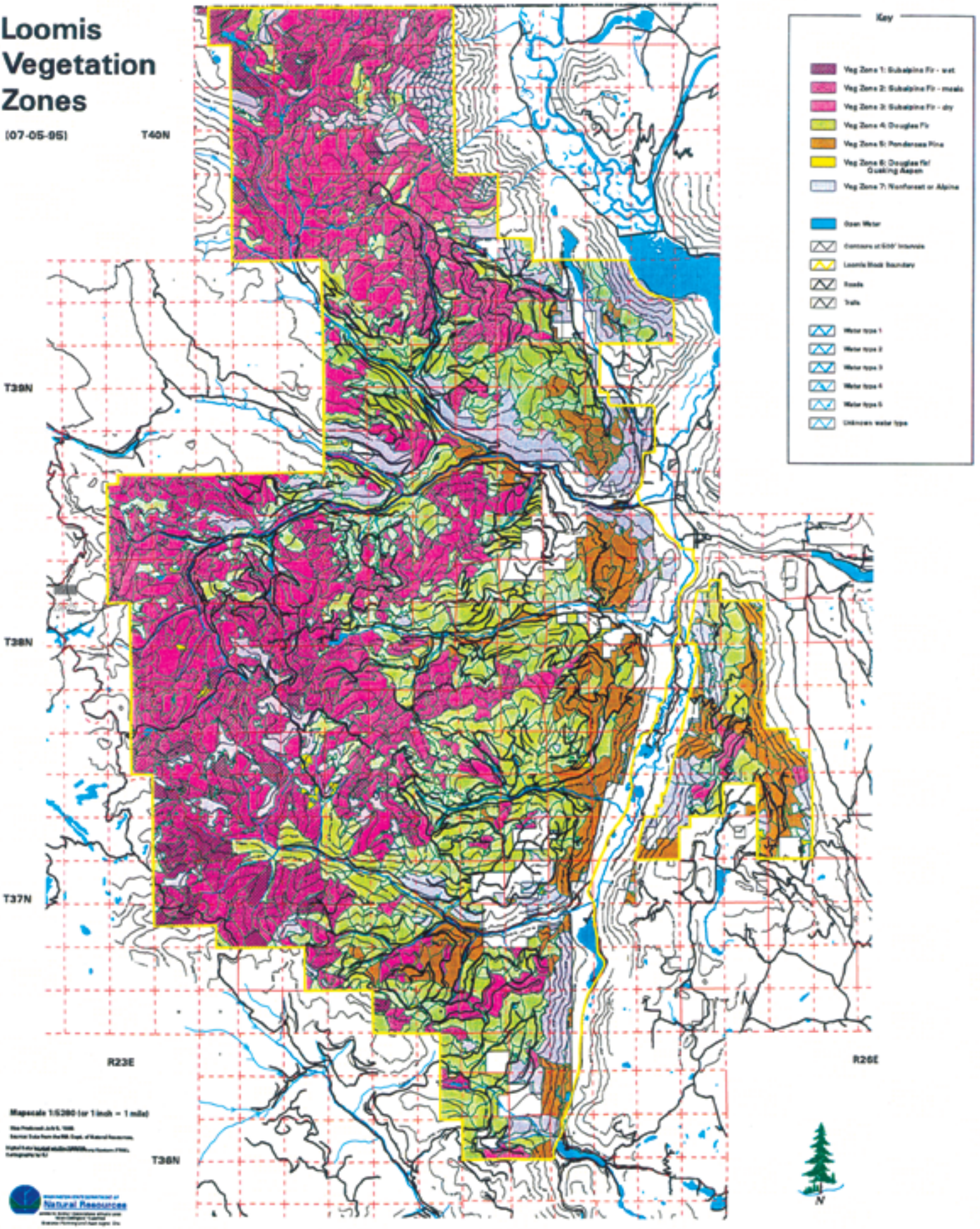
CLIMATE/MOISTURE: Coldest zone. Dry to wet moisture conditions. Wind is a significant factor, especially in winter when blowing snow and ice crystals contribute to winter desiccation. Very short growing season. Long-duration snowpack. Extreme frost heaving once snow is gone.

The specific plant associations contained within this zone on the Loomis State forest are as follows:

whitebark pine/pinegrass
subalpine larch
subalpine fir/red mountain heather
green fescue
mountain big sagebrush
sedge-kobresia
timber danthonia-sedge
quaking aspen/common snowberry
quaking aspen/pinegrass
other subalpine parkland and alpine associations

Loomis Vegetation Zones

(07-05-95)



Natural Resources

APPENDIX C

GLOSSARY

Adaptive management: Implementing management decisions as science-driven experiments that tests assumptions and predictions in the landscape plan.

Adjacency requirements: Management restrictions to regulate the creation of harvest openings. An opening created by harvest must "close" through a new timber stand and grow to a certain height before another harvest unit may be placed next to it.

Alpine: High elevation lands above the upper limited of tree growth. (See SUBALPINE.)

Anadromous fish: Species which migrate from the sea to spawn in fresh water; their offspring return to the sea and spend most of their adult lives there (e.g., salmon and steelhead).

Animal Unit Month (AUM): A unit of measurement consisting of a cow and calf used in expressing the carrying capacity for cattle on a permit range.

Associated species: A species found to be numerically more abundant in a particular forest type or successional stage compared to other areas.

Barrier (wildlife): A natural or artificial obstruction that stops fish or animals from passing through.

Biological diversity: A variety of life for RMZ and processes, including a complexity of species, communities, gene pools, and ecological functions.

Biotic: Applied to the living components of the biosphere or of an ecosystem, as distinct from the abiotic physical and chemical components.

Board Foot: A unit of quantity for timber, equal to the volume of a board 12 x 12 x 1 inches.

Board of Natural Resources: A state board that establishes policies for the Department of Natural Resources to ensure that the acquisition, management and disposition of lands and resources within the department's jurisdiction are based on sound principles. The board is composed of six members: the Commissioner of Public Lands, who chairs the

board; the Governor; the Superintendent of Public Instruction; the Dean of the College of Agriculture, Washington State University; the Dean of the College of Forest Resources, the University of Washington; and an elected representative from a county that contains Forest Board land.

Browse: Young twigs, leaves and tender shoots of plants or shrubs eaten by animals.

Buffer strips: A zone left untreated, usually located at the outer margin of the treated area or adjacent to streams. An area between a stream and a harvest area.

Canopy: The continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth. **Understory canopy** refers to the forest undergrowth (the lowest canopy layer of trees). **Overstory canopy** refers to the tallest canopy layer.

Carrying capacity: The maximum number of animals that can be sustained over the long term on a specified land area.

Clearcutting: An even-aged silvicultural system in which all timber is removed over a considerable area (generally more than a few acres) at one time. This method establishes a stand without protection from an overstory canopy. The new stand is composed of artificially or naturally established trees and may include advance reproduction that was established prior to the harvesting.

Climate: Generalized statement of the prevailing weather conditions at a given place, based on statistics of a long period of record. Includes seasonality of temperature and moisture.

Climax: The culminating stage in plant succession for a given site where the vegetation has reached a highly stable condition.

Climax vegetation: The culminating stage in plant succession for a given site. The species composition of the vegetation has reached a highly stable condition over time and perpetuates itself over time unless disturbed by outside forces.

Community: Any grouping of populations of different organisms that are found living together in a particular environment; essentially, the biotic component of an ecosystem. The organisms interact and give the community a structure.

Composition: The constituent elements of an entity; for example, the species that constitute a plant community.

Connectivity: Condition in which the spatial arrangement of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation.

Coordinated Resource Management Plans: A process through which people with diverse interests can communicate and coordinate land and resource management decisions in an area.

Corridor: A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction and other life sustaining needs.

Cover: Vegetation used by wildlife for protection from predators, or to ameliorate conditions of weather, or in which to reproduce.

Crop trees: Trees left following a thinning based on their dominance, vigor, form and spacing. These remaining trees develop long, deep crowns. They are larger and more economical and efficient to harvest.

Deferred lands: State forest lands that are deferred or postponed from harvest for a specified period of time. No harvesting occurs there during the period of deferral.

DEIS: Draft environmental impact statement. A public document prepared pursuant to the State Environmental Policy Act (SEPA).

Den Sites: A large amount of blown down, jack-strawed logs; particularly on north or northeast slopes with 60% canopy closure.

Diversity: The relative degree of abundance of wildlife species, plant species, communities, habitats or habitat features per unit area.

Down log: Portion of a tree that has fallen or been cut and left in the woods.

Duff: Partly decomposed organic matter on the forest floor.

Ecosystem: A natural unit that consists of living (biotic) and non-living (abiotic) parts, interacting to form a stable system. Fundamental concepts include the flow of energy via food chains and food webs, and the cycling of nutrients biogeochemically.

Ecotone: The zone where two or more vegetation communities meet and integrate.

Edge: Where plant communities meet, or where variations in successional stage or vegetation conditions within the plant community come together.

Enabling Act: The Congressional Enabling Act of 1889, which authorized statehood for Washington. This act provided the state with Federal Grant lands to be held in trust for the support of the state's public institutions and placed limits on the sale, lease and management of these lands.

Endangered, Threatened and Sensitive Species: Rare plant and animals are assigned one of three categories.

1. **Endangered.** A plant or wildlife species in danger of becoming extinct or extirpated in the near future if factors contributing to its decline continue. These are species whose populations are at significantly low levels, or whose habitat has been significantly degraded or depleted. Extinction means the species is gone throughout its range; extirpation means it is gone from part of its range.
2. **Threatened.** A plant or wildlife species likely to become endangered in the near future if factors continue that contribute to its population decline or to habitat degradation or loss.
3. **Sensitive.** A plant species with small populations, or localized distribution that is not now endangered or threatened, but whose populations and habitat will be jeopardized if current practices continue. b. A wildlife species of concern because of its uniqueness, rarity, scientific value or vulnerability to human disturbance of land management activity.

Endemic: Native; restricted to a single or particular locality or region.

Environmental impact statement: A document prepared under the State Environmental Policy Act (or the National Environmental Policy Act) to assess the effects that a particular action will have on environmental conditions.

Environmental checklist: A brief list set forth in the State Environmental Policy Act (SEPA) for analyzing or describing the environmental impacts of a proposed project.

Evapotranspiration: Loss of water from soil by evaporation and by transpiration from plants growing on it.

Even age: A system of forest management in which stands are produced or maintained with relatively minor differences in age.

Extirpated: A species that has been destroyed or removed from a portion of its natural territory.

Federal Grant lands: Endowments of land by the United States to the State of Washington to be sold, leased or managed to support designated beneficiaries in perpetuity. There are approximately 1.463 million acres of forested Federal Grant lands in the state.

FEIS: Final environmental impact statement. A public document prepared pursuant to the State Environmental Policy Act (SEPA).

Forage habitat: A sub-category of forested lynx habitat that includes dense regenerating stands having over 1,000 trees and 14,700 stems per acre, providing cover for lynx and snowshoe hare and browse for snowshoe hare at least 1m (3.3 feet) above average snow level, especially during the winter.

Forage: Vegetation used for food by wildlife, particularly hoofed wildlife and domestic livestock.

Forb: Fleshy-leaved plants.

Forest health: A condition where biotic and abiotic influences on the forest (i.e. insects, diseases, animals, adverse weather, atmospheric deposition, silvicultural treatments and harvesting practices) do not threaten management objectives for a given forest stand, now or in the future.

Forest Practices Board: A state board created as the body that writes forest practices rules which are administered and enforced by the Department of Natural Resources.

Forest Practices Act: A comprehensive state statute establishing minimum standards for forest practices and providing for necessary administrative procedures, rules and regulations applicable to activities conducted on or pertaining to forests on both state and private lands.

Forest health practices: The methods by which forest stands and trees may be treated to cure problems brought on by any cause which impedes or otherwise affects normal growth.

Forested lynx habitat: Forested land that meets or exceeds minimum requirements to be potentially suitable for lynx: at least 445 trees per hectare (180 trees per acre), trees more than 1m (3.3 feet) above average snow level.

Fragmentation: The process of reducing size and connectivity of stands that compose a forest.

Function: The flow of mineral nutrients, water, energy, or species.

Future forage areas: Regenerating stands that have the capability of becoming forested lynx habitat in the future, although they do not meet the definition currently and are therefore typically but temporarily avoided by lynx.

Geographic Information System (GIS): A computer database that allows one the department to perform the following tasks:

1) assign information and attributes to polygons and lines, which represent special relationships on the ground; and 2) update and retrieve inventory, mapping and statistical information. The GIS is the management tool that the department proposes to use for setting landscape-level planning objectives.

Green-tree retention: An approach during timber harvest of leaving a few live trees per acre for seeds and wildlife habitat, future snags and a source of diversity in canopy height.

Ground water: Water beneath the ground surface, consisting largely of water that has seeped down; the source of water in springs and wells.

Habitat diversity: A mix of the component parts found within a particular habitat. Also, the number of different types of habitat within a given area.

Habitat: The sum total of environmental conditions of a specific place occupied by plant or animal species or a population of such species.

Habitat capability: The number of pairs or individuals of a particular wildlife species that can be supported by the amount and distribution of suitable habitat in the area.

Home range: The area to which the activities of an animal are confined during a defined period of time (e.g., seasonal, annual).

Hydrologic Maturity: Forest stands are considered hydrologically mature when evapotranspiration, interception of precipitation, and influencing of snowment processes are the same as a fully stocked, mature stand.

Integrated Pest Management: The department's strategic process for dealing with forest pests. It is a decision-making tool that incorporates biological, economic, social and environmental considerations.

Integrated Resource Management: The simultaneous consideration of ecological, physical, economic, and social aspects of lands, waters, and resources in developing and implementing multiple-use, sustained-yield management.

Intensive forest management: Activities, in addition to those required for basic management and stand establishment, designed to increase timber growth and develop greater yield of forest products. Typically, it refers to precommercial thinning, fertilizing and pruning, separately or in combination.

Krumholtz: The zone of stunted, wind-shaped trees (at timberline) where the forest gives way to the alpine tundra.

Landscape: A broad geographic area that is defined by a natural boundary, identified for the purposes of making forest land management decisions. A landscape is made up of plants, terrain features, aquatic elements and animals, which provide the environment to support a significant part or all of life needs for the plants and animals located in the area.

Landscape diversity: The size, shape, and connectivity of different ecosystems across a large area.

Landscape-level planning: The department's process of planning for a specified landscape by setting specific objectives (for example, timber production and protection of wildlife) for the area in question.

Large organic debris (LOD): Trees larger than 4 inches in diameter and longer than 6 feet. It provides habitat diversity (fish cover, velocity and turbulence) and streambed stability.

Late successional stages: Old growth and mature stands of trees that exhibit a set of ecological characteristics, including structure, composition and function.

Management activity: A particular course of action designed to accomplish a specific management objective, such as planting, precommercial thinning or harvesting.

Marginal lands: Those state forest lands on which regeneration of a new stand will be difficult after initial harvest.

Mass wasting: The movement of large volumes of earth down a slope. A landslide.

Mature trees: Trees in vigorous condition but where growth rates are declining. In Douglas-fir trees, this condition is typically found in trees 100 to 160 years old.

Microclimate: The local climate of a small site or habitat.

Mixed stands: Forest stands containing a variety of tree species.

Multiple use: The process of coordinating a property's primary land and/or resource use with compatible, secondary uses. Multiple use may include recreation, educational or scientific use, greenbelts and watershed protection. These uses will be allowed to the extent they are compatible with the financial obligations of trust management.

Native: Indigenous to or originated naturally in Washington; remaining or growing in an unaltered condition.

Native wildlife: Any wildlife species naturally occurring in Washington for the purposes of breeding, resting, or foraging, excluding introduced species not found historically is this state.

Natural Area Preserves: Lands that are set aside to protect examples of undisturbed terrestrial or aquatic ecosystems, rare plants and animal species and unique geologic features.

Natural Heritage Program: A program established by the department to assist in selecting and nominating outstanding natural areas.

Noxious weeds: Any vascular plant species not native to the State of Washington which are highly destructive, competitive or difficult to control, and are listed in Chapter 16-750 WAC.

Off-base lands: Lands currently not capable of economically growing timber or which have been set aside for other uses.

Off-road vehicles (ORV): Any non-highway vehicle when used for cross-country travel on trails or on land, water, snow, ice, marsh, swamp or other natural terrain.

Old growth: A successional stage after maturity that may or may not include climax old growth species. Douglas-fir trees older 160 year which are past full maturity and showing signs of deterioration are generally classified as old growth.

On-base lands: Lands currently capable of economically growing timber.

Pests: Living biotic organisms that adversely affect trees are generically referred to as pests.

Plant association: A kind of plant community represented by stands occurring in places where environments are so closely similar that there is a high degree of floristic uniformity in all layers.

Population viability: Probability that a population will persist for a specified period across its range despite normal fluctuations in population and environmental conditions.

Population: A group of organisms, all of the same species, that occupies a particular area. The term is used for the number of individuals of a species within an ecosystem. A collection of individuals that share a common gene pool.

Population persistence: A general term for the capacity of a population to maintain sufficient numbers and distribution over time.

Precommercial thinning: Cutting trees at an immature age to allow for better growth of the remaining trees. May also include removal of excess and/or diseased trees in the 10-35 year class.

Priority Species: Wildlife species requiring protective measures for their perpetuation due to their population status, their sensitivity to habitat alteration, and/or their recreational importance.

Regeneration: The renewal of a tree crop at an adequate stocking level of desired tree species by natural or artificial means. Natural regeneration depends on seed-fall from mature trees. Artificial regeneration requires seeds to produce nursery stock for planting.

Representative: A criterion for assessing how adequately an area of interest represents the range of biological and biophysical variation on a site.

Riparian area: The area that influences and is strongly influenced by an adjacent aquatic environment. They occur between aquatic and terrestrial ecosystems but have distinct vegetation and soil characteristics. These areas are associated with rivers, lakes, reservoirs and intermittent or perennial streams. They may also be adjacent to springs, seeps, and wetlands.

Riparian Management Zone (RMZ): The area immediately adjacent to streams, rivers, swamps, ponds and lakes which directly affect conditions within the body of water as well as the associated wetlands. An RMZ includes all vegetation in the zone. Different size zones are established by the Forest Practices Act and are intended to protect water quality, fish and wildlife habitat and other natural resources in the area.

Rotation age: The planned length of time that trees will be left to grow until harvest. An average rotation (cutting) age is set for management activities and is used for calculating harvest levels.

Salvage cutting: Removing snags, downed logs or dead and dying material.

Seed tree (reserve tree) cutting: An even-aged silvicultural system which removes the mature timber in one harvest except for a small number of seed trees left singly or in small groups. These trees furnish seed to restock the harvested area naturally and/or to provide habitat for cavity-nesting wildlife. Only a small percentage of the original timber volume is left standing, usually less than 10 percent, or 4-20 trees per acre. The primary character is open, but the crown cover in not enough to make the microclimate of the harvested area different from a broad, open clear-cut area. Seed tree cutting can also refer to the removal of remaining seed trees after the new stand is established.

Selective cutting: A general term for partial cutting or salvage cutting in which individual trees are removed.

Seral stage: Successional stages in a forest stand prior to climax or final stage of that stand.

Shelterwood cutting: An even-aged silvicultural system which removes mature timber in a series of two or more harvests made near the end of stand rotation. A new even-aged stand is established under the shelter of a partial canopy of remaining trees. Site and seedling protection are the principle function of the residual trees in each stage of harvesting. Four types of harvesting are possible: preparatory cutting; seed cutting; intermediate removal cutting; and final cutting. Preparatory cutting and seed cutting prepare the stand for regeneration. Usually more than 20 well distributed trees are left per acre. Final cutting removes the remainder of the original stand after regeneration is established.

Silviculture: The art and science of growing and tending forest crops by controlling the establishment, composition, distribution and representation of tree species, age and/or size classes.

Site preparation: Activities that prepare the ground for growing new trees after harvest. These activities will differ depending on the method of regeneration to be used.

Slash: Forest debris such as tree tops, limbs, brush and other dead, flammable material remaining after logging.

Slash burning: Planned and controlled burning of forest debris, typically before replanting but also used to reduce and/or prevent fire and other hazards.

Snag: A standing dead tree.

Species richness: The relative number of species of plants or animals present in an area. The more species present, the high the degree of species richness.

Species: One or more groups (populations) of individuals that can interbreed within the group but that do not, under natural conditions, exchange genes with other groups (populations).

Species diversity: The species-richness of a community or area. The concept provides a more useful measure of community characteristics when it is combined with an assessment of the relative abundance of species present.

Stand: A homogeneous unit of trees that can be clearly differentiated from the surrounding forest by its age, composition, structure, site quality or geography.

State candidate species (SC): Wildlife species native to the state of Washington that the Department of Wildlife will review for possible listing as endangered, threatened, or sensitive. Candidate species are designated in Wildlife Policy 4802.

Stocking: In forestry, adequate stocking refers to a minimum number of healthy, young tree stems being present per acre. Non-stocked areas refer to those that are below the minimum requirement.

Structural diversity: Diversity in spatial arrangements or configuration of forest elements.

Stumpage: The value of timber as it stands uncut in the woods.

Subalpine: The area above the upper limit of contiguous closed forest and below the upper limit of growth. It is typically composed of a mosaic of tree patches and meadows.

Subpopulation: A well-defined set of interacting individuals that comprise a proportion of a larger, interbreeding population.

Subsurface water: Water between the ground surface and water table.

Succession: The changes in vegetation and animal life that take place as a plant community develops from bare ground and approaches or moves toward climax stage.

Successional stage: A stage or recognizable condition of a plant community that occurs during its development from bare ground to climax.

Sustainable, even-flow harvest: The volume of timber that can be harvested on state forest land without allowing for major annual variations. The department sets volumes for each decade and then divides by 10 to establish average, annual harvest levels. The actual annual harvest can vary plus/minus 25 percent from the average.

Sustained yield: The volume of timber that can be harvested on a continuing basis without major prolonged curtailment or cessation.

Territory: The area that an animal defends against intruders of its own species, usually during breeding season.

Thinning: Harvesting trees within stands to redistribute growth to fewer trees per acre (thus increasing value and reducing the cost of final harvest), and to achieve desired stand and landscape structure.

Threatened species: See *ENDANGERED SPECIES.*

Timber, Fish and Wildlife Agreement: A 1986 agreement reached between the department, tribes, environmental groups, timber companies and other state agencies that provides a statewide framework for dealing with timber and related natural resource issues.

Traditional Use: Those uses of the forest that have been conducted by Native Americans and European settlers for generations, such as hunting, fishing, gathering, hiking, etc.

Travel corridors: Used in regard to lynx habitat, a special management zone at least 300 feet wide where forested lynx habitat is continuously maintained along lynx travel routes

Travel routes: Used in regard to lynx habitat, a specified network of ridges, saddles, and streams potentially used by lynx for travel between habitats.

Trust beneficiary: The institution that is to benefit from trust property. In the case of state trust lands, the beneficiaries include public schools, universities, counties, the capitol building fund and others.

Trust lands: Those lands held in trust and managed by the state Department of Natural Resources for the benefit of the trust beneficiaries. State forest lands are a component of trust lands.

Trust: In law, a fiduciary relationship in which one person (the trustee) holds the title to property or manages it for the benefit of another (the beneficiary).

Understory vegetation: Forest undergrowth; the lowest canopy layer of trees.

Vagility: The ability of the animals in a species to move about; refers to mobility within home range; dispersal and migration capacity.

Viability: The ability of a population to maintain sufficient size so that it persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a specific population for a specified time period.

Wetlands: Those transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. Wetlands must have one or more of the following attributes:

1) at least periodically, the land supports predominantly hydrophytes;
2) the substrate is predominantly undrained hydric soil;
3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year. (U.S. Fish and Wildlife Service definition)

Wildlife communities: The distinct assemblage of species and the relationships among its members. A wildlife community includes the vertebrate component of an ecosystem (the animals and their ecological functions).

Wildlife damage: The point beyond which the viability of a local population is likely to be lost.

Wildlife: All species of the animal kingdom whose members exist in Washington in a wild state, this includes but is not limited to mammals, birds, reptiles, amphibians, fish and invertebrates.

Wind-throw: Trees blown down by the wind; also called blowdown.

APPENDIX D

LATE SUCCESSIONAL FOREST CHARACTERISTICS

The following guidelines provide a general description of stand scale and landscape scale characteristics of late successional forest management areas referred to in this document.

Stand scale description of late successional characteristics

Note: The following tree sizes are estimates, and portray RELATIVE proportions and sizes. Actual diameters and heights are determined by site capability in the subalpine fir (wet and mesic) and Douglas fir zones.

1) Structurally diverse stands with at least 4 vegetative layers (mature overstory canopy, pole/sapling canopy, shrub, herbaceous) and patchy canopies (variety of tree sizes and spacings within each 2,950 acre block): suitable ranges below:

   - overstory conifers = approximately 15-20 mature or older tpa >18" dbh (or largest available according to site capability); varied spacing

   - at least half of overstory trees are overmature, some leaning or crooked, with: broken tops, thick bark, large asymmetrical limbs, accumulations of lichens (can double for snag and log recruitment)

   - combination of overstory and understory conifers averages about 60-70% canopy cover within a 100-acre stand, but consists of patchy canopies ranging from 100% cover to 40% cover; includes scattered high density clumps and small openings (clumps and openings = about 1/8 acre size and 0 - 3 per acre); varied tree sizes and spacing throughout block

2) An average of 5 dead or damaged live tpa: 3 tpa > 24" dbh x 40' tall, 2 tpa > 17" dbh x 40' tall (or largest available according to site capability).

3) An average of 5 large down wood components/acre: down logs >18" x 20' long, or largest available according to site capability.

4) Within 200' of RMZs, meadows and wetlands, an average of 10 additional large down wood components/acre; RMZs have >60% canopy closure and 18 tpa >18" dbh (or largest available).

5) Native grass, herb and shrub species approximate site potential for composition and densities.

6) Humus and litter accumulations maintained.

Landscape scale guidelines

Blocks within Loomis Forest:
Guidelines for designation of blocks within the forest:

Designate approximately 25% of Douglas fir and subalpine fir (wet and mesic) well distributed as 5 blocks averaging approximately 2,950 acres each. Guidelines for block location, shape and composition illustrated in Figure __. Stand selection criteria:

1) Stands with high densities of lynx corridors, RMZs, off-base and subalpine fir fringe communities.

2) At least 60% of stands are Douglas fir zone.

3) Stands with least risk for insect damage.

4) Stands with lower economic value, if possible.

5) Largest aggregates possible.

6) Oldest stands possible.

Stands Within Blocks:
Guidelines for management of stands within designated blocks:

1) Age class proportions maintained through the life of plan within each block:
   60% in age class >70 years
   20% in age class 40 - 69 years
   20% in age class <40 years

2) Harvest unit size: 80 acres maximum

3) Stand sizes: >70 year age class = 120 acres minimum
   <40 year age class = 320 acres maximum

4) RMZ average widths increase by 50' each side.