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present only as regeneration White fir and spruce generally dominate the regeneration and are the climax species. Large western white pine (*Pinus monticola*) up to 33 inches (84 centimeters (cm)) in diameter and 120 feet (37 m) in height are scattered within this community and are seral In all variations, Englemann spruce is present as mature trees and regeneration. Some of the largest spruce reach 41 inches (104 cm) d.b.h. and 120 feet (37 m) in height. This plant community has the richest herbaceous layer of the forested types One location of this community is south and west of the large lake in the southwest corner of the RNA. This is a very moist site in which mountain hemlock dominates the overstory. Englemann spruce and white fir are the next most common tree species.

Very little lodgepole pine is present. Regeneration is mostly white fir, then spruce. Few shrubs are present, primarily represented by prickly currant (*Ribes lacustre*) and big huckleberry (*Vaccinium membranaceim*). Near streams, water birch (*Betula occidentailis*) often is dominant. Common herbs are arrowleaf groundsel (*Senecio triangularis*), starry solomon-plume (*Smilacina stellata*), prince's-pine (*Chimaphila umbellata*), bigleaf lupine (*Lupinus polyphyllus*), queen's cup (*Clintonia uniflora*), western twinflower (*Linnaea borealis*), and coolwort foamflower (*Tiarella trifoliata*).

The mountain hemlock/grouse huckleberry and lodgepole pine/grouse huckleberry plant communities occupy the remainder of the RNA and similar dry sites. The mountain hemlock community is a climax situation which tends towards moister sites and those that have not been recently burned. Surface soils are relatively dry, coarse, and often shallow and rocky. Understories are dominated by regeneration of hemlock, white fir, and occasional lodgepole The herbaceous layer is depauperate. Grouseberry (*Vaccinium scoparium*) dominates the shrub layer and is often the only component of the ground layer. Pinemat manzanita (*Arctostaphylos nevadensis*) is common on rock outcroppings. Tree stands in this community are most often pole-sized with stems averaging 8 to 12 inches (20 to 30 cm) in diameter and 80 feet tall. On somewhat moist sites occasional Englemann spruce are seen. Western white pine of all ages are scattered throughout the community In a relatively productive area western hemlock is present with diameters up to 24 inches (61 cm) and basal area of 140 feet^2 per acre (32 6 meters (m)^2 per ha), western white pine up to 28 inches (71 cm) d b h and 40 feet^2 per acre (9 3 m^2 per ha), Englemann spruce with basal area of 40 feet^2 per acre (9.3 m^2 per ha), lodgepole pine and white fir each less than 20 feet^2 per acre (4.7 m^2 per ha). On one escarpment the incidence of western white pine increases substantially and lodgepole pine decreases Several ponderosa pine are present with average 34 inches (86 cm) in diameter and 130 feet (40 m) in height Golden chinquapin (*Castanopsis chrysophylla*) is found on the east side of some rock slopes. Other understory species found in this community include sticky currant (*Ribes viscossis-simum*), broadpetal strawberry (*Fragaria virginiana*) and long-stolon sedge (*Carex pensylvanica*)

The lodgepole pine/grouse huckleberry plant community occurs on some of the driest sites in the RNA and on areas recently burned This is a seral community maintained by fire or occasionally climax due to severe microclimate and poorly developed soils. Lodgepole dominates the overstory in pole-sized stands Regeneration is white fir and mountain hemlock with little lodgepole Understories are scanty Components of the shurb layer are sticky currant, grouse huckleberry, and pinemat manzanita Common herbs are western yarrow (*Achillea millefolium*), goldenrod (*Solidago* species), broadpetal strawberry and broadleaf lupine (*Lupinus latifolius*). Small patches occur within this community where lodgepole totally dominates the overstory and broadleaf lupine the ground layer. Regeneration is nearly pure hemlock These appear to be areas which have been burned and are slow to recover due to immature soils Another variation of this community is observed on moist east slopes Here white fir becomes the understory dominant and other common species are hemlock, spruce, and white pine regeneration, myrtle pachistima (*Pachistima myrsinites*), prince's-pine and western twinberry Stands are pole sized with lodgepole averaging 8 inches (20 cm) d b h and 100 feet (31 m) in height On rocky soils the size of the lodgepole drops to an average 6 inches (15 cm) in diameter and 70 feet (21 m) in height On some north slopes, prince's-pine becomes the dominant herb and the occurrence of western

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white pine increases substantially Some of the plant species seen on rock outcroppings in the lodgepole community include mountain lover, sticky currant, gland ocean-spray (*Holodiscus dumosus*), western serviceberry (*Amelanchier alnifolia*), squaw carpet (*Ceanothus prostratus*), bottlebrush squirreltail (*Sitanion hystrix*) and needlegrass (*stipa* species). Throughout the community the basal area of lodgepole averages 120 feet^2 per ha).

The fifth plant community of the Many Lakes RNA is one not described by Volland. The bog areas of the RNA are a mosaic of subalpine wet meadow communities. Campbell[7] described a *Carex-Sphagnum* community in a small valley near Mt Jefferson The description is similar to portions of the bogs in Many Lakes RNA The *Carex-Sphagnum* plant community is a bog type in which moving water is found at the level of the moss layer all year. It is found in the wettest parts of the bogs, primarily in the extreme northeast bog of the RNA. Beaked sedge and sphagnum moss are the major dominants and willow is an invader.

Other common species are great sundew, bog saxifrage (*Saxigraga oregana*), slender cotton-grass (*Eriophorum gracile*), Drummond's cinquefoil (*Potentilla drummondii*), Jeffrey's shooting star (*Dodecatheon jeffreyi*) and elephant's head (*Pedicularis groenlandica*). On less wet areas shrubs dominate the vegetation Dominant shrubs are bog birch and western bog blueberry Other common shrubs are swamp laurel and willow. Still other portions of the bogs are dominated by herbs and rushes Here common ground layer components are Baltic rush, sticky tofieldia (*Tofieldia glutinosa*), purple cinquefoil (*Potentilla palustris*) and white marsh marigold (*Caltha biflora*), in addition to many already named.

Many Lakes Research Natural Area falls within Kuchler's [8] It is also included in the SAF cover type [9]

[7]Alcetta Gilbert Campbell, *Vegetative Ecology of Hunt's Cove, Mt Jefferson, Oregon*, 1973, 89 pages, illustrated (Unpublished MS thesis on file at O S U , Corvallis, Oregon)

[8]A W Kuchler, *Potential Natural Vegetation of the Conterminous United States*, American Geographical Society, Special Publications Number 36, illustrated

[9]Society of American Foresters, *Forest Cover Types of North American, Exclusive of Mexico*, Society of American Foresters, Washington, D C , 1954, 67 pages, illustrated

Table 1, TENTATIVE LIST OF VASCULAR PLANTS OF MANY LAKES RESEARCH NATURAL AREA

	Scientific Name	Common Name
TREES	Abies concolor	white fir
	Picea engelmannii	Engleman spruce
	Pinus albicaulis	white bark pine
	Pinus contorta	lodgepole pine
	Pinus monticola	western white pine
	Pinus ponderosa	ponderosa pine
	Pseudotsuga menziesii	Douglas fir
	Tsuga mertensiana	mountain hemlock

Table 1, TENTATIVE LIST OF VASCULAR PLANTS OF MANY LAKES RESEARCH NATURAL AREA (continued)

	Scientific Name	Common Name
SHRUBS	Amelanchier alnifolia	western serviceberry
	Arctostaphylos nevadensis	pinemat manzanita
	Arctostaphylos patula	green-leaf manzanita
	Betula glandulosa	bog birch
	Betula occidentalis	water birch
	Castanopsis chrysophylla	golden chinquapin
	Ceanothus prostratus	squaw carpet
	Gaultheria humifusa	alpine wintergreen
	Holodiscus dumosus	gland ocean-spray
	Kalmia occidentalis	western swamp laurel
	Lonicera involucrata	bearberry honeysuckle
	Paschistima myrsinites	myrtle pachistima
	Ribes lacustre	prickly currant
	Ribes viscosissimum	sticky currant
	Salix species	willow species
	Spirea douglasii	Menzies' spirea
	Vaccinium membranaceum	big huckleberry
	Vaccinium occidentale	western bog blueberry
	Vaccinium scoparium	grouseberry
SEDGES AND RUSHES	Carex disperma	soft leaved sedge
	Carex muricata	muricate sedge
	Carex nigricans	black alpine sedge
	Carex pensylvanica	long-stolen sedge
	Carex rostrata	beaked sedge
	Juncus balticus	Baltic rush
	Juncus mertensianus	Mertens' rush
GRASSES	Calamagrostis inexpansa	narrow-spiked reedgrass
	Calamagrostis neglecta	slimstem reedgrass
	Calamagrostis rubescens	pinegrass
	Danthonia intermedia	timber oatgrass
	Deschampsia cespitosa	tufted hairgrass
	Eriophorum gracile	slender cotton-grass
	Festuca species	fescue species
	Glyceria borealis	northern mannagrass
	Glyceria striata	fowl mannagrass
	Sitanion hystrix	bottlebrush squireltail
	Stipa species	needlegrass species

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Table 1, TENTATIVE LIST OF VASCULAR PLANTS OF MANY LAKES RESEARCH NATURAL AREA (continued)

	Scientific Name	Common Name
FORBS	Achillea millefolium	western yarrow
	Actea rubra	western red baneberry
	Arnica mollis	hairy arnica
	Aster foliaceous	*leafy aster*
	Athyrium felix-femina	lady-fern
	Caltha biflora	white marsh marigold
	Castilleja miniata	scarlet paintbrush
	Chimaphila umbellata	prince's-pine
	Clintonia uniflora	queen's cup
	Cornus canadensis	bunchberry
	Dodecatheon jeffreyi	*Jeffrey's shooting star*
	Drosera anglica	great sundew
	Epilobium species	willow-herb species
	Equisetum palustre	marsh horsetail
	Fragaria vesca	woods strawberry
	Fragaria virginiana	broadpetal strawberry
	Galium aparine	cleavers
	Hypericum formosum	*western St. John's-wort*
	Linnaea borealis	western twinflower
	Lupinus latifolius	broadleaf lupine
	Lupinus polyphyllus	bigleaf lupine
	Mimulus primuloides	primrose monkey-flower
	Mitella breweri	Brewer's mitrewort
	Nuphar polysepalum	Indian pond lily
	Pedicularis groenlandica	elephant's head
	Pedicularis racemosa	leafy lousework
	Polemonium occidentale	western polemonium
	Polystichum munitum	common christnas-fern
	Potentilla drummondii	Drummond's clinquefoil
	Potentilla palustris	purple clinguefoil
	Pyrola asarifolia	alpine pyrola
	Rumex occidentalis	western dock
	Saxifraga oregana	box saxifrage
	Senecio triangularis	*arrowleaf groundsel*
	Smilacina stellata	starry solomon-plume
	Solidago species	goldenrod species

	Tiarella trifoliata	coolwort foamflower
	Tofieldia glutinosa	sticky tofieldia
	Trifolium longipes	long-stalked clover
	Trillium ovatum	white trillium
	Veratrum californicum	California fals hellebore
	Veronica species	speedwell species
	Viola species	violet species
	Xerophyllum tenax	beargrass

TIMBER RESOURCES. Many Lakes RNA.

The existing timber resources are best described as a composite of "stands." The 1978 stand mapping and classification project included all proposed Research Natural Areas and is used as the basic description of Timber Resources.

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Principal Distinguishing Features

Torrey-Charlton Research Natural Area contains excellent representatives of mountain hemlock (*Tsuga mertensiana* [Bong.] Carr.)[1] forests, and lakes and ponds of the High Cascades of Oregon. The Research Natural Area is divided into two units having different principal distinguishing features The Torrey Unit contains an abundance of lakes and ponds. The Charlton Unit contains a variety of mountain hemlock stands of different ages and densities. (See Figure 6.)

The variety of standing water (lentic) habitats in the Torrey Unit ranges from ephemeral ponds which dry up in late spring or summer, to permanent lakes with trout populations Many of the lakes and ponds are isolated with no interconnecting drainages. One chain of lakes in the RNA is connected, however, during spring runoff The variety of lentic habitats with differing degrees of isolation provides for aquatic communities with strikingly different phytoplankton, zooplankton, invertebrate, and vertebrate composition

Excellent examples of mountain hemlock-dominated forest, an important forest type in the High Cascades, are found on both units of the RNA. Old-growth (400-year-old) mountain hemlock stands occur on all aspects on the conical Charlton Butte for which one of the units is named This butte which rises 600 feet (183 m) above the High Cascade Plateau makes the Charlton Unit particularly valuable as a mountain hemlock-oriented RNA. Scattered *Phellinus* (*Poria*) *weirii* (laminated root rot) infestations over the rest of the RNA create islands of seral stands within a matrix of old-growth (350+ years) mountain hemlock forests that are typical of Oregon's High Cascades

Justification

Much of the High Cascades of Oregon is a wide, gently sloping plateau with scattered volcanic peaks Major features of this landscape are an abundance of small lakes and ponds and extensive mountain hemlock forests. A Research Natural Area which combines these features is a logical addition to a natural area system which seeks to preserve examples of all significant natural ecosystems for comparison with those influenced by man

[1]Nomenclature follows C L Hitchcock and A Cronquist, 1973, *Flora of the Pacific Northwest*, University of Washington Press, Seattle, Washington, 730 pages

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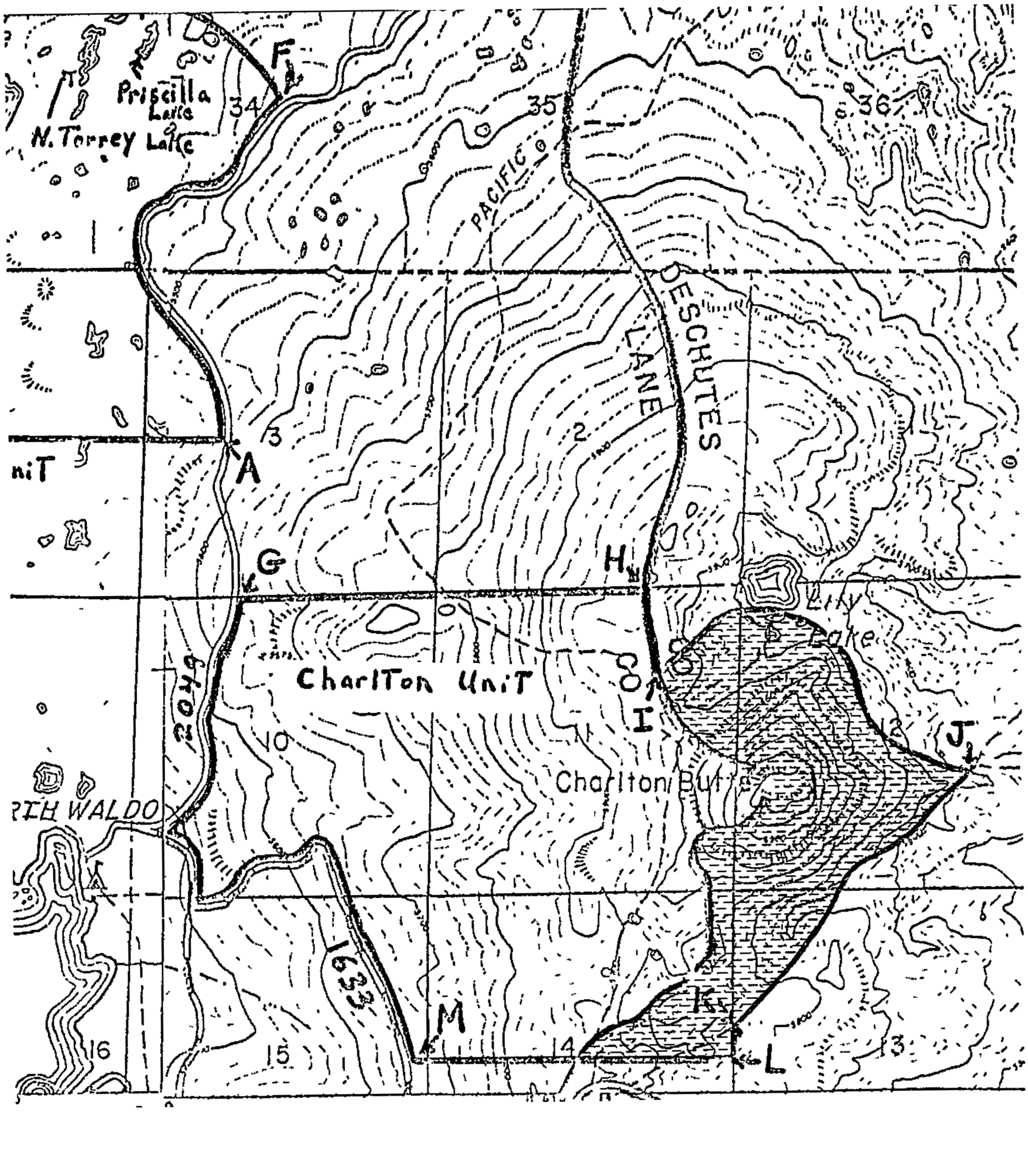

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The need for such an area was recognized by the Pacific Northwest Natural Area Needs Task Force. Table 64 of their report, "Research Natural Area needs in the Pacific Northwest, a contribution to land use planning"[2] lists this very need as a priority item

The reasons for this are quite clear. Burgeoning regional and national populations are placing unprecedented demands on both recreational and timber resources Until quite recently, the High Cascades were used solely for recreation, and that use was light and seasonal. Increasing year-round recreation use, and pressures to manage mountain hemlock forests for timber production make establishment of the Torrey-Charlton Research Natural Area timely.

The High Cascade ecosystems contained in the RNA are poorly understood, and their wise management will require substantially more knowledge than is currently available Torrey-Charlton RNA provides an excellent natural laboratory in which the natural ecology of lakes and ponds in mountain hemlock watersheds and the forests themselves can be studied. An understanding of how these systems function in their natural state is prerequisite to sound evaluations of effects of different management practices.

As an example, the Oregon Fish and Game Commission has been stocking High Cascade lakes and ponds for decades with several species of trout Very little research has been conducted on survival rates of the planted fish or the stocking effects on the aquatic community as a whole Preliminary research in Torrey Unit by Drs Kenneth Cummins and James Sedell indicate dramatic aquatic community differences between lakes which may, in part, be related to stocking differences Fundamental questions such as these can be addressed in the RNA

Difficulty of access is often offered as a reason for the paucity of past research on High Cascade lakes. Access is excellent in the Torrey Unit during the snow-free period. The Taylor Burn road (Forest Service Road No 2049) parallels the east boundary. The lakes and ponds within the Unit are a mile hike or less from this road.

The array of lakes and ponds in the Torrey Unit is representative of much of the variation to be found within the High Cascade portion of the Willamette National Forest Results from research in Torrey Unit would have wide ranging applicability

Although much of the old-growth mountain hemlock forests of Oregon's High Cascades are in Wilderness Areas or Recreation Areas, large tracts remain which could be managed for their timber resources Because mountain hemlock has not been an important timber species in the past, very little research has been conducted in mountain hemlock dominated ecosystems Questions remain as to growth rates and patterns, regeneration requirements, silvicultural systems, genetic variation, pest and pathological problems, successional patterns, etc

The Charlton Unit of the RNA supports excellent examples of old-growth mountain hemlock forests. Aspect and elevation effects on productivity and composition can be examined on the conical Charlton Butte within the Unit

Permanent vegetation plots have been located by PNW ecologists along a 1 6 mile (2 6 km) transect which ascends the Charlton Butte More permanent plots will be placed in Charlton Unit as part of ongoing research on the ecology of upper slope conifers in the Pacific Northwest Specific processes being examined include succession, productivity, and decomposition

Questions on the patholoy of laminated root rot (*Phellinus* (*Poria*) *weirii*) and its effect on stand dynamics can be examined in the Unit An understanding of these processes (and others) as they occur in undisturbed systems will permit a more accurate evaluation of the effects of timber management on this ecosystem Charlton Unit provides an excellent "benchmark" area for such comparative studies

[2] C T Dyrness, J F Franklin, Chris Maser, Stanton A Cook, James D Hall, and Glenda Faxon 1975 *Research Natural Area Needs in the Pacific Northwest, a Contribution to Land-Use Planning*, USDA Forest Service General Technical Report PNW-38, 231 pages

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Location and Access

The Torrey-Charlton RNA lies on the crest of the Oregon Cascades about 55 air miles (88 km) east-southeast of Eugene Torrey Unit (940 acres, 380 ha) is completely within the Willamette National Forest, and includes portions of Sections 33 and 34, T. 20 S., R. 6 E , and Sections 3 and 4, T. 21 S., R. 6 E., Willamette Meridian. The 1720-acre (695 ha) Charlton Unit centered on Charlton Butte, includes portions of the Deschutes National Forest (520 acres, 210 ha) as well as the Willamette National Forest (1200 acres, 485 ha). It occupies portions of Sections 10, 11, 12, 13, 14, and 15, of T. 21 S., R. 6 E

Access to both units of the RNA is excellent The Charlton Unit is easily reached by U S Forest Service Road No 204 and a side road off No. 204, No 1633 The Pacific Crest Trail (No. 2188) passes through the middle of the Unit. Torrey Unit is easily reached by Forest Service Road No. 2049 which joins No. 1633 near North Waldo Campground. Road No 2049 (Taylor Burn Road) forms a part of the west boundary of the Charlton Unit and a part of the east boundary of the Torrey Unit allowing easy road access with those portions of the RNA

Physical and Climatic Conditions

Torrey-Charlton RNA lies within the High Cascades physiographic province, a broad weakly dissected undulating plateau with scattered volcanic peaks. The elevation of the plateau in the Torrey Unit is about 5400 feet (1650 m) rising abruptly to 5800 feet (1792 m) on Taylor Butte In the Charlton Unit the plateau slopes gradually to the west rising from 5500 feet to 6000 feet (1675 m to 1830 m) at the base of Charlton Butte This conical butte rises abruptly to about 6600 feet (2010 m)

The High Cascades are developed on andesitic and basaltic flows of the Pliocene Epoch. The plateau formed from a series of composite volcanoes from which quietly flowed great quantities of lava, alternating with short periods of explosive eruptions

The geomorphology of the RNA has developed from four separate processes: (1) the formation of the Boring Lava and Volcanic Rocks including cinder cones, scoriaceous materials, and andesites and basalts; (2) mountain and alpine glaciation, (3) pumice and ash deposition from Mount Mazama (Crater Lake), and (4) recent development of organic and mineral soil deposits

Soils within the RNA are generally deep to moderately deep, light-colored pumice soils overlaying dark-colored, medium-textured soils. *Taylor Butte and Charlton Butte have deep* light-colored pumice soils over a reddish, cindery, buried soil

Some of the soil characteristics for the RNA are presented in Table 1 These are divided into soils of the plateau area and soils of the buttes within the RNA. The data are from an unpublished manuscript by Mr. Lew Manhart, on file at the Supervisor's Office, Willamette National Forest, Eugene, Oregon

The climate of the area is cool and wet with much of the precipitation falling as snow Annual precipitation ranges from 1600 mm to 2200 mm (63 to 87 inches), about three-fourths of which falls as snow Snowpacks of 16.5 feet (5 m) are not uncommon. A 6-month duration of snowpack is typical, but in certain years it can persist for 8 months

Average annual temperature is probably about 3.56° C (38° F.), with average January and July temperatures of about -3 5° C. and 13 5° C (25.5° F and 56° F.), respectively Average January minimums of -8.5° C (16 5° F) and average July maximums of 21.5° C. (70 5° F) are likely, based on records from similar locations in the Oregon High Cascades.

Terrestrial Ecosystems

Vegetation: Both Torrey and Charlton Units provide excellent examples of mountain hemlock-dominated ecosystems of Oregon's High Cascades Mountain hemlock stands tend to be monotonous forests with little understory vegetation and low species diversity (plant and animal) under closed canopy conditions. Torrey-Charlton RNA is

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no exception While mountain hemlock stands are poor in vascular plant diversity, they are extremely rich in fungal species diversity, however [3]

Considerable structural diversity exists in the RNA, also Age and height of dominants and stand basal area varied from 100 to 400 years, 20 to 40 meters (65 5 feet to 131.2 feet) and 30 m to 130 m² per ha (130 feet to 560 feet² per acre) respectively on plots placed in the RNA. This degree of variation compares favorably with that found in stands sampled from Windigo Pass (30 miles, or 48 km, south) to Broken Top (30 miles, or 48 km, northeast). It is also comparable to stands sampled in the Mount Hood National Forest [4]

Over most of the RNA, mountain hemlock is the dominant tree species in the overstory Lodgepole pine (*Pinus contorta* Dougl. var. *lati-folia* Engel) and Pacific silver fir (*Abies amabilis* [Dougl.] Forbes) are minor components of the overstory in general, but constitute a larger proportion of the stand in the drier and wetter areas, respectively

Other tree species occasionally found in the RNA include. western white pine (*Pinus monticola* Dougl.), subalpine fir (*Abies* lasiocarpa [Hook.] Nutt.) and Shasta red fir (*Abies magnifica* Murr. var. *shastensis* Lemm). A sparse shrub layer, generally less than 50 percent cover, of grouse huckleberry (*Vaccinium scoparium* Leiberg) is typical of closed stands The herb layer tends to have few species, with low cover values of generally less than 1 percent Typical herb species are· fringed pinesap (*Hypopitys monotropa* Crantz), one-sided wintergreen (*Pyrola secunda* L.) and two sedges *Carex rossii* Boott and *C. pensylvanica* Lam. Moss and lichen cover on the ground is generally less than 0 1 percent.

Scattered through this type of forest are islands of *Phellinus* (*Poria*) *weirii* (laminated root rot) infection. When viewed from the air, these *Phellinus* pockets have a bull's-eye appearance caused by an outer ring of dead and dying trees, an inner ring of seedling establishment and growth and frequently an inner circle of dead and dying trees In places, these enlarging islands have coalesced to form irregular patches Vascular plant species diversity increases greatly in these areas which are open to colonization The edge effect of the *Phellinus* infection centers seem to enhance bird species diversity as well.

The life cycle of *Phellinus* (*Poria*) *weirii* is not well known. The long-term patterns of expansion of the infected areas and subsequent plant colonization and fungal reinfection is presently under study. Successional patterns in uninfected areas are hypothetical at present. The effects of Phellinus infection are even less understood in terms of likely successional trends Torrey-Charlton RNA offers an excellent field site for studies of these processes.

In summary, while not all of the forest types within which mountain hemlock is found are contained in the RNA, the area is typical of closed mountain hemlock forests of the High Cascades. Productivity, succession, decomposition and pathology studies can be focused in Torrey-Charlton RNA, the results of which should have wide applicability

Terrestrial Vertebrates. As mentioned in the previous section, Torrey-Charlton RNA tends to be relatively poor in terms of vertebrate species The RNAs fauna is representative of much of the High Cascades

Table 2 lists the vertebrate species known to utilize Torrey-Charlton RNA for at least a portion of the year The list is compiled from direct observation of animals or obvious sign Due to the lack of sampling it is a brief list, and certainly under-represents what is actually there.

[3]Personal communication from Dr James Trappe, Forestry Sciences Laboratory, Pacific Northwest Forest and Range Experiment Station, Corvallis, Oregon

[4]Unpublished data on file at Forestry Sciences Laboratory, Pacific Northwest Forest and Range Experiment Station, Corvallis, Oregon

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Small mammal trapping was done in mid-September 1976 in four separate locales in the RNA. In over 1000 trap-days only 23 animals were captured: 2 Townsend chipmunks (*Eutamias townsendi*), 3 wandering shrews (*Sorex vagrans*), 10 California red-backed voles (*Clethrionomys californicus*) and 8 deer mice (*Peromyscus maniculatus*). Because the sampling was conducted just one time for only 10 days it is impossible to state that small mammal populations are always low in the RNA. Trap lines run in other closed canopy mountain hemlock stands have indicated higher populations.[5]

[5]Personal communication from Mr Chris Maser, Biologist, Bureau of Land Management, Vale, Oregon

Table 2, TERRESTRIAL VERTEBRATES KNOWN TO UTILIZE THE TORREY-CHARLTON RESEARCH NATURAL AREA FOR AT LEAST SOME OF THE YEAR (List Compiled from Field Observations of Individuals, or Positive Signs)

	Common Name	Scientific Name
REPTILES AND AMPHIBIANS:		
Salamanders		
Family Ambystomatidae	Pacific giant salamander	Dicamptodon ensatus
	Northwestern salamander	Ambystoma gracile
Family Salamandridae	Rough-skinned newt	Taricha granulosa
Frogs and Toads		
Family Ascaphidae	Tailed frog	Ascaphus truei
Family Bufonidae	Western toad	Bufo boreas
Family Ranidae	Cascade frog	Rana cascadae
MAMMALS:		
Order Insectivora	Trowbridge shrew	Sorex trowbridgii
	Wandering shrew	Sorex vagans
Order Lagomorpha	Snowshoe hare	Lepus americanus
	Pika	Ochotona princeps
Order Rodentia	California red-backed vole	Clethrionomys californicus
	Yellow-pine chipmunk	Eutamias amoenus
	Townsend chipmunk	Eutamias townsendi
	Bushy-tailed muskrat	Neotoma cinera
	Deer mouse	Peromyscus maniculatus
	Golden mantled ground squirrel	Spermophilus lateralis
	Chickaree	Tamiasciurus douglasi

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Table 2, TERRESTRIAL VERTEBRATES KNOWN TO UTILIZE THE TORREY-CHARLTON RESEARCH NATURAL AREA FOR AT LEAST SOME OF THE YEAR (List Compiled from Field Observations of Individuals, or Positive Signs) (continued)

	Common Name	Scientific Name
Order Carnivora	Coyote	Canis latrans
	Bobcat	Lynx rufus
	Black bear	Ursus americanus
Order Artiodactyla	Roosevelt elk	Cervus canadensis, sub-species roosevelti
	Black-tailed deer	Odocoileus hemionus, sub-species columbianus
	Mule deer	Odocoileus hemionus, sub-species hemionus
BIRDS:		
Family Aythyinae	Barrow's goldeneye	Bucephala islandica
Family Cathartidae	Turkey vulture	Carthartes aura
Family Accipitrinae	Cooper's hawk	Accipiter cooperi
Family Buteoninae	Red-tailed hawk	Buteo jamaicensis
Family Tetraonidae	Blue grouse	Dendragapus obscurus
Family Picidae	Red-shafted flicker	Colaptes cafer
	Pileated woodpecker	Dryocopus pileatus
	Hairy woodpecker	Dendrocopos villosus
Family Hirundinidae	Violet-green swallow	Tachycineta thalassina
Family Corvidae	Gray jay	Perisoreus canadensis
	Steller's jay	Cyanocitta stelleri
	Common raven	Corvus corax
	Clark's nutcracker	Nucifraga columbiana
Family Paridae	Black-capped chickadee	Parus atricapillus
Family Sittidae	Red-brested nuthatch	Sitta canadensis
Family Certhidae	Brown creeper	Certhis familiaris

Table 2, TERRESTRIAL VERTEBRATES KNOWN TO UTILIZE THE TORREY-CHARLTON RESEARCH NATURAL AREA FOR AT LEAST SOME OF THE YEAR (List Compiled from Field Observations of Individuals, or Positive Signs) (continued)

	Common Name	Scientific Name
Family Turdidae	Robin	Turdus migratorius
	Varied thrush	Ixorens naevius
	Townsend's solitaire	Myadestes townsendi
Family Sylviidae	Golden-crowned kinglet	Regulus satrapa
	Ruby-crowned kinglet	Regulus claendula
Family Parulidae	Townsend's warbler	Dendroica townsendi
Family Fringillidae	Evening grosbeak	Hesperiphona vespertina
	Pine siskin	Spinus pinus
	Oregon junco	Junco oreganus

Aquatic Ecosystem

A wide variety of lakes and ponds exist within the Torrey Unit of the RNA, from ephemeral snowmelt ponds which dry up in spring after runoff to permanent lakes with resident trout populations This variation covers much of the natural variation to be found in Oregon's High Cascades

Many of the lakes and ponds on Torrey Unit are isolated from one another with no interconnecting streams, even during spring runoff. In the northern portion of Torrey Unit several lakes are connected by a stream except in late summer of the driest years The lakes and ponds differ in area and depth. A wide range in the abundance of emergent aquatic plants exist. This variety of sizes and depths and degree of isolation provides the setting for strikingly different aquatic communities.

Drs James Sedell and Kenneth Cummins collected from a representative set of lakes and ponds in the Torrey Unit in mid-September 1976. The beds of emphemeral ponds were examined and collections made. Bottom samples and plankton net tows were made on several lakes Scuba gear was used to examine the bottoms of the deeper lakes.

Their collections revealed rich aquatic communities which differed widely in phytoplankton, zooplankton, and invertebrate composition

Drs. Sedell and Cummins think that the different stocking programs for lakes within the area may account for some of the variation observed The Oregon Fish and Game Commission's stocking program for the Torrey Unit is given in Table 3 This possibility is intriguing because of the management implications, which are an ability to change a lake's natural processes by altering the fish species stocked This is an area of research which could easily be addressed on the Torrey Unit.

In conclusion, the ecological diversity of the lakes and ponds, plus the relative ease of access, which allows the use of heavy analytical and experimental equipment, make Torrey Unit especially well suited for limnological research in Oregon's High Cascades

Impacts on Other Resource Values

Timber. Timber resource values are low on this tract. The entire area is equivalent, at best, to Western Hemlock Site Class VI and, in many places, even poorer. Much of the proposed area is within the Waldo Lake Recreational Area, in the Pacific Crest Trail System corridor, or has some other aesthetic or recreationally-oriented constraint on timber harvest activities. Consequently, although some harvestable timber volume will be eliminated by the RNA, its effect on timber production is considered to be minimal.

Water. Establishment of the RNA is expected to have a neutral effect on watershed values since disturbance will be minimized.

Recreation: Substantial recreational use of areas included within the RNA does occur and can be expected to continue in the future. It is confined to essentially two different types of users in the two units: (1) hikers on the Pacific Crest Trail and, to a lesser degree, associated trails circling Charlton Butte; and (2) fishermen visiting the larger lakes and ponds in the Torrey Unit

Recreational use associated with the Pacific Crest Trail is confined to the immediate vicinity of the trail due to a lack of off-trail attractions and camping spots within the Research Natural Area Consequently, hiker use of the trail, even in greatly expanded numbers, should have little significant impact. Restrictions on trail use are not planned although developments which would tend to increase the duration of a hiker's stay within the RNA will be avoided. Appropriate signing will be developed to advise the hikers of the reserved nature of the area they are passing through

Recreational use of lakes in the western section of the RNA currently occurs at modest levels Most of this is day use by fishermen visiting the lakes that are planted periodically The current stocking program is presented in Table 3

Table 3, FISH STOCKING RECORD FOR THE LAKES WITHIN TORREY UNIT, TORREY-CHARLTON RESEARCH NATURAL AREA, WILLAMETTE NATIONAL FOREST (Number of Fish Stocked Every Other Year)

Lake	Brook Trout	Cutthroat Trout	Rainbow Trout
Torrey Lake	5000	2000	2000
Cultus Lake	1500	X	X
Priscilla Lake	X	250	X
North Torrey Lake	1000		

Impact on the lake-side vegetation is insignificant based upon examination during evaluation of the RNA. Restrictions on recreational use including the fish planting programs are not, therefore, anticipated in the near future It is conceivable that restrictions on recreational use and/or alterations in fish planting programs will be considered in the future either because (a) recreational use is significantly altering the lake ecosystems, or (b) cessation of fish planting is necessary for development of basic research programs on High Cascade lake limnology. The lakes within the RNA are expected to serve as the controls for research effectiveness and ecological impacts of recreational programs, including fish planting, on high lakes

Any alterations in current fish management programs in the area would be developed cooperatively by the Oregon Fish and Game Commission, Willamette National Forest, and the Pacific Northwest Forest and Range Experiment Station Unilateral action to alter or restrict recreational uses, including fishing, could not and would not be considered All parties are, therefore, going to have to concur on altering management programs which affect the scientific potential of the RNA

Mineral: No mineral explorations are known to have occurred in the RNA. No mineralized bodies are known to exist there. The area will be withdrawn from mineral entry after establishment as an RNA.

Protection and Management

The management objective within Torrey-Charlton RNA will be to maintain natural conditions for scientific study.

Roads and roadside strips: The 200-foot (61 m) buffer alongside roads adjacent to the RNA will not be developed in a way which would tend to increase use of the RNA by recreationists. Exceptions would be development of parking facilities at existing trailheads, should safety reasons warrant such.

Salvage of dead, down, or dangerous trees will be allowed along the adjacent roads for 100 feet (30.5 m) on the RNA side of the road. Only these types of trees will be logged. Logging will be by cable methods using the road as a landing.

Trails: Developments along trails in the RNA which would tend to increase the duration of a hiker's stay within the RNA will be avoided. Appropriate signing will be developed to advise hikers of the reserved nature of the area through which they are passing.

Proposed additions to the existing system of trails would be planned cooperatively by Willamette National Forest and the Pacific Northwest Forest and Range Experiment Station. The existing trails into Torrey Lake will remain unsigned.

Stocking of lakes: Any alterations in current fish management programs will be developed cooperatively by the Oregon Fish and Game Commission, Willamette National Forest, and the Pacific Northwest Forest and Range Experiment Station

Public use: No effort will be made to unilaterally prohibit recreational use of the RNA. Conflicts with research objectives will be evaluated on a case by case basis. Any restrictions on recreational use will be developed jointly by the Willamette National Forest and the Pacific Northwest Forest and Range Experiment Station

Signs: In accordance with Region 6 standards, permanent boundary markers (7 inch by 10 inch metal Research Natural Area signs, GSA Catalog) will be posted along the boundary of the Research Natural Area at 200 feet (61 m) intervals The project will be the responsibility of the Oakridge District Ranger, and funds for this operation will be requested after formal establishment of the RNA.

Mapping The RNA boundary will be shown on the Planning Unit map for the Oakridge Ranger District.

Fire suppression. The use of chemical fire retardation is to be avoided, if possible, within the RNA Water should be first considered if aerial suppression techniques are to be used

APPENDIX E
DRAFT ESTABLISHMENT REPORT FOR TORREY-CHARLTON RESEARCH NATURAL AREA, WILLAMETTE AND DESCHUTES NATIONAL FORESTS

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976

By
Dr. Kenneth Cummins, Limnologist, Michigan State University, East Lansing, Michigan
and
Dr. James Sedell, Limnologist, Oregon State University, Corvallis, Oregon

The numbers in parentheses refer to the location of the lake or pond sampled.

I. Emphemeral Ponds (1)

A Ponds which dry in spring These early-drying ponds held little evidence of aquatic forms, although when water is present, interesting communities are probably present.

1. Phytoplankton. When water is present, at least motile flagellate algae.

2 Zooplankton. When water is present, probably Protozoa and Rotifera and possibly fairy shrimp(Branchipoda).

3. Benthos A few inactive whirligig beetles (Coleoptera-Grinidae) were found in the dampest spots under logs.

B Ponds which dry in summer These late-drying ponds held aquatic insects in several stages in damp places under logs and rocks

1. Phytoplankton. More diverse than A when water is present Dried mats of filamentous green algae were observed.

2 Zooplankton More diverse than A when water is present Undoubtedly Protozoa, Rotifera and certain microcrustacea

3. Benthos (in damp locations)
Insecta
Odonata
Anisoptera (dragonflies)
Libellulidae mymphs
Trichoptera
Lepidostomatidae (undet adults)
Phryganeidae (undet. adults)
Limnephilidae
Lenarchus (eggs, and early instar larvae?), prob passes the fall and winter primarily as eggs
Coleoptera (beetles)
Gyrinidae (whirligig beetles)

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

II. Shallow Ponds

A. Elk Print Lake (2)
Insecta
Odonata
Anisoptera
Libellulidae-nymphs
Aeschnidae-nymphs
Hemiptera
Notonectidae (back swimmers), probably *Buenoa*-nymphs
Trichoptera
Phryganeidae
Banksiola-early instars
Limnephilidae
Halesochila -probably taylori
Coleoptera
Dytiscidae
Bidessus-adults
Diptera
Chironomidae (midges)
Chaoboridae (phantom midges)
Chaoborus
Oligochaeta

1. Phytoplankton
Chlorophyceae
Undet. filamentous and colonial greens
Desmidaceae
Staurastrum
Cosmarium
Diatoms
Navicula-type
Cymbella
Gomphonema
Eunobia
**Melosira*

2 Zooplankton
Copepoda (Copepods)
*Cyclopoida
Cladocera (water fleas, etc)
Bosmina
Chydorus

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A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

II Shallow Ponds (continued)

*B. Pika Bog (3) - Dormant forms indicated by **

1. Phytoplankton
   Chlorophyceae
      Undet filamentous and colonial greens
         Desmidaceae
            Staurastrum
            Cosmarium
         Diatoms
            Navicula-type
            Cymbella
            Gomphonema
            Eunobia
            *Melosira

2 Zooplankton
   Copepoda (Copepods)
      *Cyclopoida
   Cladocera (water fleas, etc)
      Bosmina
      Chydorus

3 Benthos
   Insecta
      Odonata
         *Anisoptera
         Libellulidae
            Aeschnidae
            Trichoptera
            Limnephilidae
            H taylori? - larvae
            Undet. early instar larvae
      Coleoptera
         Dytiscidae, probably Agabus-adults
         Gyrinidae
         Gyrinus-adults
         Chrsomelidae
            **Galerucella* - All life stages (on floating leaves of rooted aquatic plants)
      Diptera
         Chironomidae
      Mollusca
         Pelecypoda (clams)
            Sphaeriidae (fingernail clams), probably Pisidium

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

II. Shallow Ponds (continued)

C. O'er the Ridge Lake (4)

1 Phytoplankton
*Desmidaceae

2 Zooplankton
Rotifera
Keratella cochlearis
Polyarthra
Conochilus unicornis
Copepoda
Diaptomus
Cladocera
Holopedium

3 Benthos
Insecta
Trichoptera
Limnephilidae
H taylonia?-larvae
Leptoceridae-undet larvae
Coleoptera
Chrysomelidae
**Galerucella*-all stages

D. Pond 2 (5)

1. Phytoplankton
Desmidaceae
Triplocerus
Diatoms

2. Zooplankton
Protozoa
Undet. ciliates
Rotifera
**K cochlearis*
Polyarthra

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

II. Shallow Ponds (continued)

D. Pond 2 (5) (continued)

3. Benthos
Insecta
Odonata
Anisoptera
Aeschnidae-nymphs
Libellulidae-nymphs
Emphemeroptera (mayflies)
Baetidae
Callibaetis
Hemiptera
Notonectidae
Notonecta-nymphs
Gerridae
Gerris-adults
Megaloptera (helgramites, etc.)
Sialidae (alder flies)
Sialis probably *rotunda*-larvae
Trichoptera
Phryganeidae
Banksiola crotchi-larvae
Agryonia improba-larvae
Diptera
Chironomidae
Chaoboridae
Chaoborus
Mollusca
Pelecypoda
Sphaeridae
Pisidium?

III. Lakes

A. North Torrey Lake (6)

1. Phytoplankton
Demidaceae

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

III. Lakes (continued)

A North Torrey Lake (6) (continued)

2. Zooplankton
   Rotifera
      C. unicornis?
   Copepoda
      **Diaptomus*
   Cladocera
      Bosmina
      Daphnia

3. Benthos
   Insecta
      Odonata
         Anisoptera
            Aeschnidae
         Zygoptera (damselflies)
         *Coenagrionidae
         Ephemeroptera
            Baetidae
            Callibaetis-nymphs
      Megaloptera
         Sialidae
            S rotunda?-larvae
      Trichoptera
         Phryganeidae
            B. crotchi-early instar larvae
         Leptoceridae
            Mystacides alafimbriata-early instar
         Limnephilidae, probably *Clistoronia*, *Halesochila* early instar larvae
   Amphipoda
      Gammaridae

B. Let's Wait Lake (7)

1. Phytoplankton
   Chlorophyceae
      Undet. colonial and filamentous forms
      Desmidaceae
         **Cosmarium*
   Diatoms
      Undet. pennate forms

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DRAFT ESTABLISHMENT REPORT FOR TORREY-CHARLTON RESEARCH NATURAL AREA, WILLAMETTE AND DESCHUTES NATIONAL FORESTS

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

III Lakes (continued)

B. Let's Wait Lake (7) (continued)

2. Zooplankton
   Rotifera
      **K cochlearis*
      Asplanchana
      Polyarthry
   Copepoda
      Diaptomus
   Cyclopoida
   Cladocera
      Chydorus

3. Benthos
   Insecta
      Odonata
         Anisoptera-undet adults
      Trichoptera
         Phryganeidae
            B crotchi-larvae
         Limnephilidae
            **H taylori*-larvae
            Undet larvae
      Coleoptera
         Chrysomelidae
            Galerucella
      Diptera
         Chironomidae
         Chaoboridae
            Chaoborus

C Priscilla Lake (8)

1 Phytoplankton
   Chlorophyceae
      *Undet. colonial and filamentous forms
   Desmidaceae
      Arthrodesmus
   Diatoms
   Navicula
   Melosira
   Synedra
   Cymbella
   Eunotia

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

III. Lakes (continued)

C. Priscilla Lake (8) (continued)

2 Zooplankton
Rotifera
K. cochlearis
C. unicornis
Polyar thra vulgaris
Collotheca pelagica
Copepoda
Diaptomus
Cladocera
Holopedium

3. Benthos
*Porifera-undet erect sponges
Insecta
Odonata
Anisoptera
Libellulidae
Cordulia?
Aeschnidae
Aeschna?
Zygoptera
Coenagrionidae
Enallagma
Ephemeroptera
Baetidae
Callibaetis
Megaloptera
Sialidae
S. rotunda
Trichoptera
Phryganeidae
A improba-larvae
Limnephilidae
Halesochila-early instar larvae
Undet. larvae
Leptoceridae
Oecetis-larvae
M alafimbriata-larvae

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A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

III. Lakes (continued)

C. Priscilla Lake (8) (continued)

3. Benthos (continued)

Coleoptera
Dytiscidae
prob *Hydaticus*-larvae
Diptera
Chironomidae-larvae
Chaoboridae
Chaoborus-larvae
Mollusca
Pelecypoda
Sphaeriidae
Pisidium?

D Cervus Lake (9)

1 Phytoplankton-not sampled

2 Zooplankton
Copepoda
**Diaptomus*

3. Benthos
Porifera-undet. erect sponges
Insecta
Odonata
Anisoptera-nymphs
Ephemeroptera
**Callibaetis*-nymphs
Megaloptera
Sialidae
S rotunda-larvae
Trichoptera
Phryganeidae
B crotchi
Limnephilidae
Undet early instar larvae
Diptera
Chironomidae-larvae
Chaoboridae
Chaoborus-larvae

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A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

III. Lakes (continued)

E. Torrey Lake (10)

1. Phytoplankton
   - Chlorophyceae
     - *Undet. colonial greens
   - Diatoms
     - Navicula
     - *Gomphonema*
     - *Cymbella*
     - *Pinnulcuria*

2. Zooplankton
   - Copepoda
     - **Diaptomus*
   - Cladocera
     - *Daphnia*
     - *Bosmina*

3. Benthos
   - Porifera-undet erect and prostrate sponges
   - Insecta
     - Odonata
       - Anisoptera
         - Aeschnidae-nymphs
         - Libellulidae-nymphs
           - prob. Cordulia
       - Hemiptera
         - Gerridae
           - Gerris (*remigis*)-adults
       - Ephemeroptera
         - Baetidae
           - **Callibaetis*-nymphs
       - Megaloptera
         - Sialidae
           - *S. rotunda*-larvae
       - Trichoptera
         - Limnephilidae
           - *Halesochila*-early instar larvae
           - *undet. early instar larvae
         - Leptoceridae
           - *M. alafimbriata*-larvae

A SUMMARY OF COLLECTIONS MADE IN THE TORREY-CHARLTON RESEARCH NATURAL AREA, TORREY UNIT, ON SEPTEMBER 14-16, 1976 (continued)

III Lakes (continued)

E. Torrey Lake (10) (continued)

3. Benthos (continued)

Coleoptera
  Chrysomelidae
    Bonacia-larvae and pupae in roots of sedges, adults on emergent plants
  Gyrinidae
    Gyrinus
Diptera
  Chironomidae
  Chaoboridae
    Chaoborus
Amphipoda
  Gammaridae
Hiruninea
  Glossophonidae

APPENDIX E
ESTABLISHMENT REPORT FOR THE PROPOSED WECHEE BUTTE RESEARCH NATURAL AREA

Principal Distinguishing Features

The Wechee Butte Research Natural Area is located in the Central Oregon pumice plateau, an area of numerous small cinder cones, extensive pumice deposits, and young lava flows. The RNA contains approximately 360 acres of lodgepole (*Pinus contorta*) and ponderosa pine (*Pinus ponderosa*) forests, of which nearly 300 acres is occupied by Wechee Butte (Figure 7). Wechee Butte is a totally undisturbed, entirely forested cinder cone. The northern rim of the cone rises 300 feet above the general terrain and is breached to the northwest. The crater is approximately 120 feet below the northeast rim of the cone and 10 feet below the southwest rim.

Antelope-bitterbrush (*Purshia tridentata*) associations predominate as pole stands throughout most of the area, and as lodgepole thickets on the northeast slope of the cinder cone. At midslope on east and west exposures the lodgepole forest grades into a ponderosa-manzanita (*Arctostaphylos patula*) community, with nearly pure ponderosa pine stands occurring on the south slopes and on the crater rim. The crater itself is occupied by pole size (6 to 8 inch) lodgepole pine in contrast to the open ponderosa pine community on the south rim 20 feet away. On the north side of the cone at midslope is an area in which lodgepole, ponderosa pine, whitebark pine (*Pinus albicaulis*), and white fir (*Abies concolor*) may be found together. The herbaceous layer throughout the RNA is sparse. Gradual changes in plant community types may be observed with variations in percent slope and soil type as the butte is ascended, and with changing slope aspects on the cone as it is circumnavigated

Surface soils range from sandy loam to red cinders, with a few outcroppings of volcanic bedrock Slopes vary from 5 to 10 percent surrounding the butte, to as much as 40 percent near the crater rims. The proposed area is heavily used summer mule deer range and is reproductive habitat for 72 species (Table 3, Hypothetical List) of terrestrial vertebrates

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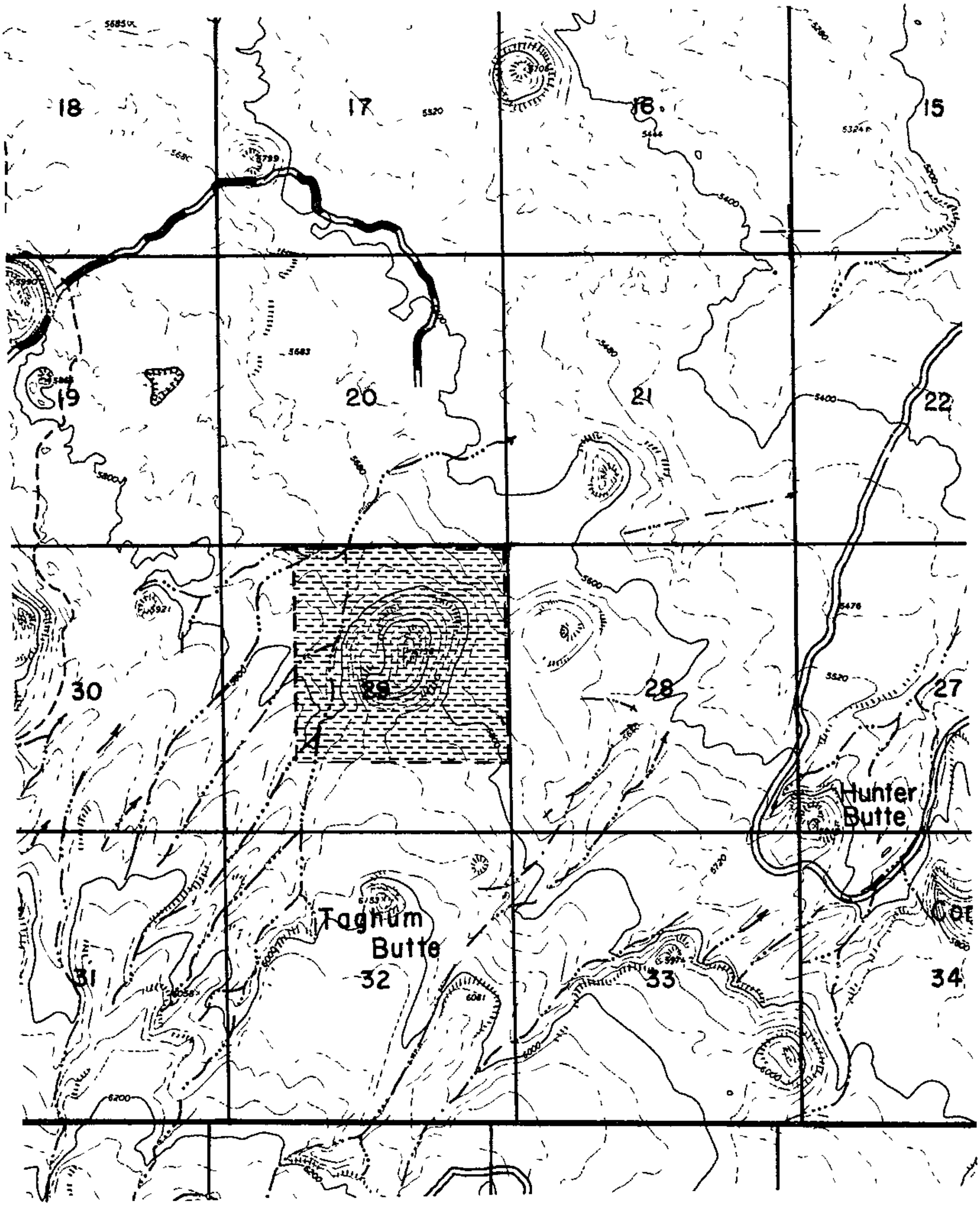
ESTABLISHMENT REPORT FOR THE PROPOSED WECHEE BUTTE RESEARCH NATURAL AREA



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ESTABLISHMENT REPORT FOR THE PROPOSED WECHEE BUTTE RESEARCH NATURAL AREA

Justification

The Wechee Butte RNA fills a high priority need identified by the Pacific Northwest Natural Area Committee in 1973. It fills the need for an undisturbed, entirely forested cinder cone, and would provide the first representation of this cell in Planning Area 4. The varying topography of the cinder cone and surrounding land creates several microclimates and environmental gradients, adding to the inherent diversity of the area. The RNA primarily presents a comparison of lodgepole and ponderosa pine communities on different soils, slopes, and aspects, within a small area The south side of the cone and the crater rims are the driest sites in the RNA, and it is here that nearly pure stands of ponderosa pine are found. The surface soil in this area is coarse red cinders with a scant herbaceous layer, and a shrub layer of manzanita and bitterbrush Numerous large ponderosa pines are found here, up to 100 feet in height and 36 inches d b.h. The crater supports a dense pole stand of lodgepole pine in sharp contrast to the widely spaced ponderosa pine on the rims bordering the crater This situation may be attributed to cold air drainage into the crater forming a frost pocket and subsequent top or climax of lodgepole. The north slope of the cone is the most moist area in the RNA and supports a unique mixture of species within the tract. In order of abundance, the important species found here are lodgepole pine, ponderosa pine, whitebark pine and white fir in the overstory, sticky current (*Ribes viscosissimum*) in the shrub layer, and broadpetal strawberry (*Fragaria virginiana*) plus three species of *Pyrola* as common herbs Adding to the diversity of the RNA is the gradual change from climax pole stands of lodgepole pine with very little shrub layer on the relatively flat land around the butte, to climax ponderosa pine with seral lodgepole and a manzanita and bitterbrush shrub layer at the summit of the cinder cone

Wechee Butte is in the midst of typical commercial forest land. At this time there is no stand disturbance in the proposed area, no evidence of past logging, road building, or recent fires. There are active timber sales within a mile of the butte, and several more are planned. Many public pole cutting areas are located with a few miles of the RNA on access Road 1915B The multiple use designation for the area is wood/forage

The Wechee Butte RNA provides an opportunity to study ponderosa and lodgepole pine together in a natural setting with a variety of volcanic soils, aspects, slopes, and resultant microclimates. Studies might include comparison of dominance of the two species on different sites, dry sites, immature soils or the effects of soil moisture on each species. The abundance of dwarf mistletoe (*Arceuthobium americanum*) in many of the climax lodgepole stands suggests research possibilities involving the pathogen Additional research might involve comparisons of the edaphic climax of ponderosa pine and the topoedaphic climax of lodgepole pine in the RNA.

Location

The proposed Wechee Butte Research Natural Area occupies approximately (unless its been surveyed) 360 acres in the Deschutes National Forest, at North Latitude 43° 49', West Longitude 121° 13' The tract is located in Deschutes County, 17 air miles south-southeast of Bend, Oregon. It is accessible only by foot and no trails exist at this time The nearest road is No 0304, a primitive Forest road 1/2 mile to the north of the RNA boundary. The RNA is located in NE1/4, E1/2NW1/4, N1/2SE1/4 and NE1/4SW1/4 of Section 29, T 20 S , R 13 E., W.M

Community Types

Forest composition within the RNA changes with slope, aspect, topography and soil type These factors affect the amount of moisture available for plant use, and the temperature range to which the plants are subjected Changes in the forest communities are apparently closely related to the moisture holding capacity of the soils and minimum night-time temperatures during the growing season.

The Central Oregon Pumice Zone is known for its forests composed solely of lodgepole and ponderosa pine These trees have developed on immature, coarse-textured and droughty pumice soils. Tree species, in order of abundance in the RNA, are lodgepole pine, ponderosa pine, white-

APPENDIX E
ESTABLISHMENT REPORT FOR THE PROPOSED WECHEE BUTTE RESEARCH NATURAL AREA

bark pine, and white fir Lodgepole constitutes approximately 80 percent of all trees, ponderosa pine about 20 percent, whitebark pine 1 percent, and white fir less than 1 percent Lodgepole appears to be the major climax species throughout the tract, based on reproductive success Ecologically, the communities encountered in the Wechee Butte RNA are typical of the *Pinus ponderosa* and *Pinus contorta* Zones of the pumice plateau of south-central Oregon[1] These zones are characterized by a short growing season, low summer precipitation and wide diurnal temperature fluctuations Lodgepole stands are generally situated on nearly level terrain or in depressions where cold air drainage from surrounding slopes produces substantially lower nighttime temperatures In these situations, where the soil is well drained, lodgepole is considered to be a topoedaphic climax due to its greater resistance to low temperatures Ponderosa pine occupies drier sites than lodgepole and often does better on coarse textured or sandy soils than on finer soils Studies indicate that the distribution of ponderosa pine is closely correlated with available soil moisture, soil texture, and temperature

Three plant community types are represented in the RNA and can be correlated to Volland's types[2] as follows

Unit	Plant Community	Location	Acreage
1	Lodgepole/bitterbrush needlegrass CL-S2-11	Flats surrounding butte, lower 2/3 of east slope, lower 1/3 of west slope	310
2	Lodgepole/currant-bitterbrush/needle-grass CP-S2-15	North slope of butte	10
3	Ponderosa/bitterbrush-manzanita/needlegrass CP-S2-13	Rim of crater, south side of butte, top 1/3 of east slope, top 2/3 of west slope	40

Unit 1 is occupied by the Lodgepole/bitterbrush/needlegrass community. This climax lodgepole forest is found in the relatively flat areas of the RNA surrounding the butte and in the crater, with slopes from 5 to 10 percent, and on the lower 2/3 on the east side and the lower 1/3 on the west side of the cinder cone, with slope up to 35 percent This unit includes approximately 200 acres of the RNA *In the flats surrounding the cone, lodgepole* has an average basal area of 100 feet² per acre. In this type of area the lodgepole forest occurs as an all-age stand, with an average stem size of 60 feet in height, 10 inches d.b.h., the largest reaching 100 feet in height, 14 inches d b h There are scattered large ponderosa pines throughout the unit, the largest measuring 100 feet tall, 40 inches d b h , and occupying up to 30 feet² per acre. A *small amount of ponderosa and whitebark pine is* present as regeneration up to 20 feet in height. No mature whitebark pine have been located in the RNA The shrub layer in this community is dominated by bitterbrush which has been hedged by deer, much of which has died out Squaw currant is scattered throughout the unit and there is very little herbaceous vegetation Broadpetal strawberry is the dominant herb with other common but sparse understory species being tailcup lupine (*Lupinus caudatus*), western yarrow (*Achillia millefolium*), fireweed (*Epilobium angustifolium*), princess-pine (*Chimaphila unbellata*), bottlebrush

[1]Jerry F Franklin and C T Dyrness, *Natural Vegetation of Oregon and Washington*, U S Government Printing Office, Washington, D C , 1973, 417 pages, illustrated

[2]Leonard A Volland, *Plant Associations of the Central Oregon Pumice Zone*, USDA Forest Service, Pacific Northwest Region, Portland, Oregon, September, 1982 R6-Ecol-104-1982, 122 pages

squirreltail (*Sitanion hystrix*), and long-stolon sedge (Carex pensyl-vanica). In the thickets in the north-eastern portion of the unit, the basal area of lodgepole increases to 140 feet² per acre, on slopes up to 25 percent. Stems average 40 feet in height, 5 inches d.b.h., with the largest measuring 60 feet, 8 inches d b h. Understory vegetation is identical to that just described, but less abundant. The lower 2/3 of the east slope of the butte has a near co-dominance of ponderosa pine with lodgepole about midslope, a large quantity of dead manzanita, and almost no herbs present The crater supports a dense pole stand of lodgepole averaging 60 feet tall and 8 inches d b h , up to 110 feet, 12 inches d b h A few large ponderosa pines occur in the crater, no shrub layer exists, and dominant understory species are broadpetal stawberry and Nevada bluegrass (*Poa neva-densis*) On the lower third of the west side of the butte, on a 35 percent slope, ponderosa and whitebark pine are found only as regeneration There is no shrub layer and common herbs are dominated by broadpetal strawberry, with prince's-pine, tailcup lupine, Holboell rockcress (*Arabis holboellii*), and broadseed rockcress (*Arabis platysperma*) also present

In Unit 2 a slightly different lodgepole community occurs on the moist north side of the butte, on a slope of 30 to 35 percent In this lodgepole/currant-bitterbrush/needlegrass community lodgepole has a basal area of 110 feet² per acre, average tree height of 60 feet, average d b.h. of 6 inches, with the largest 70 feet tall, 9 inches d.b.h. A few ponderosa pines of all ages are present with the largest reaching 100 feet in height and 30 inches d b.h. In addition, there are a few whitebark pine saplings, and one grand fir about 50 feet in height and 8 inches d b h. has been found. Bitterbrush is absent and the only shrub component is sticky currant, which is found nowhere else in the RNA. Broadpetal strawberry is dominant in the herbaceous layer over a few prince's-pine and fireweed Also unique to this unit are three woods wintergreen species, *Pyrola dentata*, *Pyrola picta*, and *Pyrola secunda*

The ponderosa/bitterbrush-manzanity/needlegrass community of Unit 3 is found on the rim and the south slope of the cinder cone, the top 1/3 of the east slope, and the top 2/3 of the west side of the butte with slopes up to 30 percent On the crater rim the basal area of ponderosa pine ranges from 80 feet² per acre on the south rim to 120 feet² per acre on the northeast rim All ages of ponderosa are represented with a few pole-sized lodgepole also present It is here on the summit of the butte that numerous ponderosa pines are prevalent in the range of 100 feet in height and 36 inches d.b.h. Many of these large trees have broken or dead tops and multiple stems The shrub layer in this area is composed entirely of greenleaf manzanita and antelope bitterbrush, with the bitterbrush varying from weak subordinate to strong co-dominate Common herbs are small-flowered blue-eyed mary (*Collinsia parviflora*), dwarf purple monkey-flower (*Mimulus nanus*), and Nevada bluegrass The east and west slopes of the cone have very little understory and a large amount of dead manzanita Lodgepole pine becomes more common as the cinder cone is descended, reaching co-dominance with ponderosa and then becoming dominant with bitterbrush again near the base of the butte

The Wechee Butte Research Natural Area falls within Kuchler's.[3]

It is also included in the SAF Cover Type [4]

Physical and Climatic Conditions

The Wechee Butte RNA is occupied by a 200-acre cinder cone in the midst of gently sloping lodgepole forest All aspects are represented on the cone, and the surrounding land has a slight northeasterly incline. Slopes range from 5 to 40 percent with the sides of the cone between 25 and 40 percent Elevation is approximately 5800 feet (1769 meters) surrounding the butte and 6138 feet (1872 meters) at the highest point on the cinder cone

[3] A W Kuchler, *Potential Natural Vegetation of the Conterminous United States*, American Geographical Society, Special Publication Number 36, illustrated

[4] Society of American Foresters, *Forest Cover Types of North America, Exclusive of Mexico*, Society of American Foresters, Washington, D C , 1954, 67 pages, illustrated

APPENDIX E
ESTABLISHMENT REPORT FOR THE PROPOSED WECHEE BUTTE RESEARCH NATURAL AREA

The climate of central Oregon is typified by cold winters, hot summers, a short growing season, and low annual precipitation. Wide diurnal temperature fluctuations of 10° C to 16° C are common The summers are very dry and a high proportion of annual precipitation falls as snow. The nearest weather record is at Pine Mountain Observatory, 13 miles to the east of the RNA The data in Table 2 is an average of the 10-year period from 1968 to 1978 from Pine Mountain

Protection and Management

See direction in Forest Plan for Research Natural Areas.

Table 1, TENTATIVE LIST OF VASCULAR PLANTS WECHEE BUTTE RESEARCH NATURAL AREA

	Scientific Name	Common Name
FORBS	Achillea millefolium	Western yarrow
	Arabis holboellii	Holboell rockcress
	Arabis platysperma	Broadseed rockcress
	Chryptantha ambigua	Obscure chryptantha
	Collinsia parviflora	Small-flowered blue-eyed mary
	Epilobium angustifolium	Fireweed
	Eriogonum umbellatum	Sulfur buckwheat
	Erysimum asperum	Rough wallflower
	Fragaria virginana	Broadpetal strawberry
	Lupinus caudatus	Tailcup lupine
	Mimulus nanus	Dwarf purple monkey-flower
	Montia perfoliata	Miner's lettuce
	Penstemon humilis	Low penstemon
	Phacelia hastata	Whiteleaf phacelia
	Pterospora andromedea	Woodland pinedrops
	Pyrola dentata	Toothleaf pyrola
	Pyrola picta	Whitevein pyrola
	Pyrola secunda	Sidebells pyrola
TREES	Abies concolor	White fir
	Pinus albicaulis	Whitebark pine
	Pinus contorta	Lodgepole pine
	Pinus ponderosa	Ponderosa pine
SHRUBS	Arctostaphylos patula	Greenleaf manzanita
	Chimaphila umbellata	Prince's-pine
	Purshia tridentata	Antelope bitterbrush
	Ribes cereum	Squaw currant
	Ribes viscosissimum	Sticky currant
GRASSES	Festuca idahoensis	Idaho fescue
	Poa nevadensis	Nevada bluegrass
	Sitanion hystrix	Bottlebrush squirreltail
	Stipa occidentalis	Western needlegrass

Table 1, TENTATIVE LIST OF VASCULAR PLANTS WECHEE BUTTE RESEARCH NATURAL AREA (continued)

	Scientific Name	Common Name
SEDGES	Carex pensylvanica Carex rossii	Long-stolon sedge Ross sedge

Table 2, AVERAGE TEMPERATURE AND PRECIPITATION AT PINE MOUNTAIN OBSERVATORY (Based on Average of Years 1968 to 1978)

	Temperature (°F)	Precipitation (Inches)
Average Annual	40 6	11 78
Average January	26 6	
Average July	61 0	
Average June-August		0 84

TIMBER RESOURCES Wechee Butte RNA

The existing timber resources are best described as a composite of "stands" The 1978 stand mapping and classification project included all Proposed Research Natural Areas and is used as the basic description of Timber Resources

APPENDIX F

APPENDIX F
SOCIAL EFFECTS OF ALTERNATIVES

Area Of Influence

This area has been defined as that area where almost all of the social effects of the Alternatives would occur, specifically

1. Deschutes County

2. Those communities in adjacent counties affected by management decisions

3 Those people in Willamette Valley communities affected by and concerned with Deschutes management decisions

The Social Effects Work Group divided the Area of Influence into four sub-areas for analyzing social effects These four sub-areas were seen as characterizing the four principal community types in the Area of Influence as defined by their social and economic relationships with the Deschutes National Forest The description of these community types and a discussion of recent social and economic trends and conditions was presented in Chapter III The sub-areas are shown below

Sub-Area	Typified By
Central Oregon Urban Center	Bend
Rural Recreation and Residential Based Communities	Sisters, LaPine, Metolius River area, Upper Deschutes River area
Rural Industrial Communities	Gilchrist, Redmond, Prineville, Crescent
West Side Communities	Eugene, Portland, Lebanon, Salem, Springfield, Roseburg, Corvallis

Categories of Social Effects ("Variables")

The Work Group selected three categories of social effects as encompassing the significant social effects of the Forest Plan Alternatives·

1. Job and Lifestyle Dependence

Effects are changes in the whole pattern of work-subsistence-leisure which ties people to the Forest. Negative effects are created by actions which (1) reduce employment opportunities (jobs, pay, stability), (2) reduce the diversity of recreational opportunity, (3) reduce freedom of use of the Forest for subsistence (firewood, food) and recreation because of increased regulation and/or resource conflicts, or (4) lower the environmental qualities of the area Actions which do the opposite are positive.

2. Community Cohesion

Effects are indicated by a change in the solidarity of a community, the degree of conflict, or division. Negative effects are seen in issues that divide the community. Significant negative effects occur when several divisive issues divide a community along the same lines, (polarizing issues) (However, controversy, if directed outward, can make a community more cohesive)

3 Expectations of Minimal Change

Actions which are counter to the beliefs, perceptions, and sense of control people have about the Forest are negative social effects; actions consistent with expectations are positive effects. People in the area have a preference for slow-to-moderate compatible growth (Obermiller, 1980). Negative effects occur from significant changes in (1) timber management practices, (2) the appearance of the Forest, (3) the public's freedom of use for recreation and firewood, (4) the supply of wood for industry,

APPENDIX F
SOCIAL EFFECTS OF ALTERNATIVES

and (5) the development of mineral and energy sources Actions which increase uncertainty have negative effects too

Social Effects With Few Variations Between Alternatives

1 Land Ownership and Use Changes

Land exchanges would be primarily with corporations which would use the land for Forest use (in accordance with the County land use zones) Land for development is generally off-Forest, and not significantly affected by decisions made in the Forest Plan. County land use zones will reduce the possibility of changing uses anyway

2 Population and Crowding

The Alternatives will probably not cause changes in the economic and social conditions of the Area of Influence great enough to affect the population in a predictable way. Migration in recent years has been responsive to both employment and a variety of amenity and lifestyle factors. No net population effect from the Alternatives could be discerned

3. Racial and Cultural Minorities

About 2 percent of the population of the Area of Influence east of the Cascades are members of racial or cultural minorities. Six percent of the West Side residents are members of racial minorities and 2 percent are hispanic Apart from American Indians, they have no unique ties to the Deschutes National Forest. The Alternatives will, therefore, have no special social effects on them

Most American Indians in and adjacent to the Area of Influence reside in Jefferson County (1,990, or 17 percent of the County's 1980 population) They reside on, or have strong ties to, the Confederated Tribes of the Warm Springs Indian Reservation. Most of their social, economic, and cultural ties to Forest land occur on the Reservation, though some unidentified private use of the Deschutes National Forest probably occurs An 1855 Treaty with the Middle Oregon Tribes outlines the rights and privileges of the Tribes on lands outside the Reservation Data on Indian ties to the Deschutes National Forest was not sufficient to discern any clear social effects of the Alternatives

4 Ranching Communities

The social effects on these groups, given the small grazing program on the Deschutes National Forest, and their greater dependence on Bureau of Land Management, Crooked River National Grasslands, and Ochoco National Forest, were not of sufficient magnitude to demonstrate a clear pattern of social effects

5. Hunting and Fishing

This is one factor with potentially significant social effects which would have very little variation between Alternatives Thus, it will not show as a social effect of the Alternatives The Alternatives provide varying levels of wildlife habitat and provide for the maintenance and improvement of fish habitat No significant social effects could be directly linked to habitat Changes in hunting and fishing regulations could result in social effects, but regulations governing hunting and fishing are under the authority of the Oregon Department of Fish and Wildlife, therefore, social effects relating to hunting and fishing were not evaluated

Social Effects Which Would Vary By Alternative

The following shows the social effects which vary by Alternative

CURRENT DIRECTION (ALTERNATIVE A)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
AREA WIDE	Increasing restrictions, regulations, and instructions for use of resources (firewood, recreation permits, and fees). Increasing pressure and conflicts on resources Wide diversity of recreational opportunities	Resource conflicts now handled on a case-by-case basis; compromises and substitutions found. Foresee a decreasing ability to find substitute areas/resources to resolve, thus intensifying conflicts.	Increasingly intensive timber management practices will change visual and recreational aspects of the Forest Minimum maintenance of roads and recreation sites Increased competition for resources (between resources, and for same ones).
CENTRAL OREGON URBAN CENTER	Adequate to good wood products industry. Trade and service center for Central Oregon plateaued, gradual growth later Wood products increasingly capital intensive Feelings of self-sufficiency increasingly difficult because of regulation and conflicts. Increasing scarcity of accessible firewood.	Room to compromise will diminish. Resource conflicts will be harder to resolve and tend to polarize the community more Community cohesion will suffer, particularly if conflicts are managed poorly.	Harvest and burns in visible areas (especially lodgepole) will be disconcerting. Competition for recreational space/experience will reduce quality of experience
RURAL RECREATION AND RESIDENTIAL COMMUNITIES	Lifestyle centered around environmental amenities and leisure (outdoor recreation) Timber management in adjacent and traveled areas will create concern	Concerns center around environmental quality and amenities and recreation. Coming conflicts will tend to increase the internal cohesion of these communities.	Visible changes in Forest, increased use of fire, increased harvest in travel, and recreation areas will be troubling. Minimal maintenance of facilities troubling
RURAL INDUSTRIAL COMMUNITIES	Adequate to good wood products industry increasingly capital intensive. Feelings of self-sufficiency diminished through regulation and conflicts	Have concerns about resource use and economy Coming conflicts will tend to increase the internal cohesion of these aspects of these communities	Minimal change, changes in harvesting and milling as lodgepole harvest is increased Increasing competition for logs

CURRENT DIRECTION (ALTERNATIVE A) (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
WEST SIDE COMMUNITIES	Deschutes National Forest touches only a segment of lives as a recreational area, may be an increasingly significant source of raw material for industry Regulation and conflicts will impinge on recreation and self-sufficiency activities	Some segments already somewhat polarized Deschutes National Forest conflicts seen as symbolic of the same issues elsewhere	Any of the above, as they touch on the person's/group's principal orientation to the Deschutes National Forest

ALTERNATIVE B

The social effects of Alternative B are similar to those of Alternative F, with one exception--geothermal development near areas heavily used for recreation will be disruptive to many for all types of communities

ALTERNATIVE C

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
AREA WIDE	An increase in wood products industry jobs (cyclical), and some increase in recreation jobs (low-paying) It gives the most stimulus to the local economy of all Alternatives. Has the most potential development of geothermal resource, but extent not predictable, could cause major changes A reduction in the diversity of recreation opportunities from Current Direction (Alternative A) More roads, ORV use, regulations, and controls Personal-use firewood unavailable to meet demand, causing higher heating costs and loss of enjoyed activity.	The most polarizing of the Alternatives. Industrial aspects versus environmental quality aspects. Developed and motor-based recreation versus nonmotorized recreation Termination of permits for summer homes controversial. Debates on geothermal development and on allocation of firewood	The intensity of management and the density of Forest use is far greater than under the Current Direction Alternative. Lower quality of recreation experience because of more encounters and conflicts with other uses and other recreationists I Significant change in recreation and appearance of Forest, even in visually and recreationally sensitive areas
CENTRAL OREGON URBAN CENTER	An increase in wood products industry jobs (cyclical), and some increase in recreation jobs (low-paying). It gives the most stimulus to the local economy of all Alternatives It has the most potential development of geothermal resource, but extent not predictable, could cause major changes A reduction in the diversity of recreation opportunities from Current Direction (Alternative A) More roads, ORV use, regulations, and controls. Personal use firewood unavailable to meet demand, causing higher heating costs and loss of enjoyed activity	Polarizing divisiveness between those with economic and environmental concerns (between motorized and nonmotorized recreationists, and between rich and poor firewood users	The intensity of management and the density of Forest use is far greater than under the Current Direction (Alternative A). Potential industrial (geothermal) development in sensitive areas. Lower quality of recreation experience, because of more encounters Significant change in recreation and appearance of Forest

ALTERNATIVE C (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
RURAL RECREATION AND RESIDENTIAL COMMUNITIES	Loss of recreational diversity, particularly at the more primitive categories on the ROS spectrum Some increase in recreation-based jobs, primarily servicing developed recreation sites and activities.	Increased internal cohesiveness to protest timber management actions, road improvements, geothermal development in recreation areas, firewood policy. Termination of permits for summer homes issue may intensify the cohesion Increased scrutiny of timber management plans and practices.	Everything changes much faster than under the Current Direction (Alternative A) (roads, timber sales, people, summer homes). Change touches many aspects which are the reasons for living and recreating here.
RURAL INDUSTRIAL COMMUNITIES	Increase in wood products jobs, but ease of access and use for recreation and subsistence (firewood) reduced. Amount of available firewood reduced	Conflicts over local/nonlocal use of firewood. Questions on geothermal development in sensitive areas. Otherwise, cohesion grows only in response to issues raised by environmental and recreation-based communities Otherwise, somewhat less cohesive than Current Direction (Alternative A).	Faster changes than expected, and maybe "too much of a good thing." Losses of quality and opportunity of recreation and subsistence perceived
WEST SIDE COMMUNITIES	Increased supply of raw materials beneficial to industrial users Changes in recreational opportunities and qualities tend to lower recreational satisfactions	The most polarizing of the Alternatives Industrial aspects versus environmental quality aspects Developed and motor-based recreation versus nonmotorized recreation Termination of permits for summer homes controversial Firewood and goethermal issues may be spilled over the Cascade Crest	Generally, same as for Area Wide The purely economic user would see few drawbacks, but most recreationists would see changes as detrimental

ALTERNATIVE D

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
AREA WIDE	Wood products and recreation jobs increase some (This Alternative second in economic stimulus to Alternative C.) Less nonmotorized recreational opportunity, but more motorized. Greater regulation and controls than Current Direction (Alternative A). Personal use firewood scarce Potential geothermal development hard to predict, but no leasing in sensitive recreation areas could be a major economic impetus and social impact.	Some polarization centered on economic outputs. Conflicts between motorized and nonmotorized recreation interests. Principal conflicts over improving roads, firewood, geothermal.	Significant changes, but not noticeable to the casual visitor unless major geothermal development occurs. Possible increase in conflicts between recreation users Improving and building roads will be seen as change. Firewood scarcity is disruptive
CENTRAL OREGON URBAN CENTER	Wood products and recreation jobs increase some. (This Alternative second in economic stimulus to Alternative C.) Less nonmotorized recreational opportunity, but more motorized. Greater regulation and controls than Current Direction (Alternative A). Personal use firewood scarce. Potential geothermal development hard to predicts, but no leasing in sensitive recreation areas could be a major economic impetus and social impact.	Same as for Area Wide, with some conflicts between recreationists, and other firewood and geothermal.	Significant changes, but not noticeable to the casual visitor unless major geothermal development occurs Possible increase in conflicts between recreation users. Improving and building roads will be seen as change. Firewood scarcity disruptive

ALTERNATIVE D (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
RURAL RECREATION AND RESIDENTIAL COMMUNITIES	Less recreational diversity, and less nonmotorized Some more recreation-based jobs Visual quality better Personal use firewood scarce Potential geothermal development hard to predict, but no leasing in sensitive recreation areas could be a major economic impetus and social impact	Same as for Area Wide, but opposition to road improvements and building and to termination of summer homes may create some conflict-based cohesion Geothermal development may be generally opposed Competition for firewood increases, as does scrutiny of timber management	Significant changes, but not noticeable to the casual visitor unless major geothermal development occurs Possible increase in conflict between recreation users Improving and building roads will be seen as change. Firewood scarcity is disruptive.
RURAL INDUSTRIAL	Wood products jobs up some, motorized recreation increases some, and fewer *restrictions and regulations make Forest* easier to use for recreation and subsistence Personal use firewood scarce Potential geothermal development hard to predict, but no leasing in sensitive recreation areas could be a major economic impetus and social impact.	Conflict over impacts of geothermal development Cohesion grows in response to issues *raised by others and over access to scarce* personal use firewood	Significant changes, but not noticeable to the casual visitor unless major geothermal development occurs. Possible increase in conflict between recreation users Improving and building roads will be seen as change Firewood scarcity is disruptive
WEST SIDE COMMUNITIES	About the same in its effects as the Current Direction (Alternative A) It does provide a little more of everything, except undeveloped recreation opportunities are reduced	Some polarization centered on economic outputs Conflict between motorized and nonmotorized recreation interests Principal conflicts over improving roads	Significant changes, but not noticeable to the casual visitor unless major geothermal development occurs Possible increase in conflict between recreation users Improving and building roads will be seen as change Firewood scarcity is disruptive

ALTERNATIVE E

The social effects of Alternative E are similar to those of Alternative F, with one exception--The reactions to geothermal development, which may occur in more areas than under Alternative F, may be stronger and less conducive to community cohesion and more contrary to expectations of minimal change.

ALTERNATIVE F

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
AREA WIDE	Effects are quite close to those in Current Direction (Alternative A). Some added wood products jobs, some increase in diversity of recreation opportunity. Somewhat fewer conflicts because of changes in land allocations compared to Current Direction (Alternative A) Self-sufficiency improved some, with personal use firewood available at current level	Very close to Current Direction (Alternative A) Management may become more intensive, thus intensifying conflicts Ease of resolution of on-the-ground conflicts and encounters is improved due to change in land allocations.	Very close to Current Direction (Alternative A) More outputs and more intensive management than Current Direction (Alternative A), but level of change would be acceptable. Geothermal development only in least sensitive areas, few major concerns. Firewood supply constant, so may be a problem if demand increases; more regulations and restrictions
CENTRAL OREGON URBAN CENTER	Effects are quite close to those in Current Direction (Alternative A) Some added wood products jobs, some increase in diversity of recreation opportunity Somewhat fewer conflicts because of changes in land allocations compared to Current Direction (Alternative A) Self-sufficiency improved some, with personal use firewood available at current level	Very close to Current Direction (Alternative A) Management may become more intensive, thus intensifying conflicts Ease of resolution of on-the-ground conflicts and encounters is improved due to change in land allocations.	Very close to Current Direction (Alternative A) More outputs and more intensive management than Current Direction (Alternative A), but level of change would be acceptable Geothermal development only in least sensitive areas, few major concerns Firewood supply constant, so may be a problem if demand increases, more regulations and restrictions

ALTERNATIVE F (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
RURAL RECREATION AND RESIDENTIAL COMMUNITIES	Effects very close to those in the Current Direction (Alternative A)	Some as for Area Wide. Some conflict-based cohesion may be centered on visible timber management activities and visible geothermal development	Very close to Current Direction (Alternative A) More outputs and more intensive management than Current Direction (Alternative A), but level of change would be acceptable. Geothermal development only in least sensitive areas, few major concerns. Firewood supply constant, so may be a problem if demand increases, more regulations and restrictions
RURAL INDUSTRIAL COMMUNITIES	Effects are quite close to those in Current Direction (Alternative A) Some added wood products jobs, some increase in diversity of recreation opportunity Somewhat fewer conflicts because of change in land allocations compared to Current Direction (Alternative A) Self-sufficiency improved some, with personal use firewood available at current level	Very close to Current Direction (Alternative A) Management may become more intensive, thus intensifying conflicts Ease of resolution of on-the-ground conflicts and encounters is improved due to change in land allocations.	Very close to Current Direction (Alternative A). More outputs and more intensive management than Current Direction (Alternative A), but level of change would be acceptable Geothermal development only in least sensitive areas; few major concerns. Firewood supply constant, so ma;y be a problem if demand increases; more regulations and restrictions

ALTERNATIVE F (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
WEST SIDE COMMUNITIES	Effects very close to those in the Current Direction (Alternative A).	Very close to Current Direction (Alternative A) Management may become more intensive, thus intensifying conflicts. Ease of resolution of on-the-ground conflicts and encounters is improved due to change in land allocations.	Very close to Current Direction (Alternative A) More outputs and more intensive management than Current Direction (Alternative A), but level of change would be acceptable. Geothermal development only in least sensitive areas, few major concerns. Firewood supply constant, so may be a problem if demand increases, more regulations and restrictions.

ALTERNATIVE G

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
AREA WIDE	Small increase in wood products jobs, geothermal development, and winter sports expansion and use The economy is impacted negatively Increase in primitive recreation Demand for firewood will be met	Conflicts will occur over timber, geothermal, ski area expansion, summer homes, and winter sports access Conflict would all tend to focus at Forest Service, so would in effect, increase community cohesion	The expectations of slow change are violated by a group of decisions which would block a number of changes people expect Would be seen as too little change, and harmful to the communities' stability.

ALTERNATIVE G (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
CENTRAL OREGON URBAN CENTER	Small increase in wood products jobs, geothermal development, and winter sports expansion and use The economy is impacted negatively Increase in primitive recreation Demand for firewood will be met	Conflict will occur over timber, geothermal, ski area expansion, summer homes, and winter sports access Conflict would all tend to focus at Forest Service, so would, in effect, increase community cohesion	The expectations of slow change are violated by a group of decisions which would block a number of changes people expect. Would be seen as too little change, and harmful to the communities' stability.
RURAL RECREATION AND RESIDENTIAL COMMUNITIES	Fewer timber management activities and fewer visual disturbances Impact on economy, winter sports, and summer homes counter to way of life and recreation	Conflict will occur over timber, geothermal, ski area expansion, summer homes, and winter sports access Conflict would all tend to focus at Forest Service, so would, in effect, increase community cohesion.	The expectations of slow change are violated by a group of decisions which would block a number of changes people expect Would be seen as too little change, and harmful to the communities' stability.
RURAL INDUSTRIAL COMMUNITIES	Small increase in wood products jobs, geothermal development, and winter sports expansion and use The economy is impacted negatively Increase in primitive recreation Demand for firewood will be met.	Conflict will occur over timber, geothermal, ski area expansion, summer homes, and winter sports access Conflict would all tend to focus at Forest Service, so would, in effect, increase communities' cohesion.	The expectations of slow change are violated by a group of decisions which would block a number of changes people expect Would be seen as too little change, and harmful to the communities' stability.
WEST SIDE COMMUNITIES	The Deschutes National Forest becomes more visible to groups on the West Side Loss of timber and lack of winter sports expansion become noticeable	Concern over specific decisions adds to local conflicts	Would be seen as violating expectations that things would go as they are going now

ALTERNATIVE H

The social effects of Alternative H will be similar to those of Alternative G, with this exception--if timber is harvested on an accelerated basis in a departure from NDEF, the economic impacts on wood products jobs will not be as extreme.

ALTERNATIVE I

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
AREA WIDE	Small increase in wood products jobs An increase in primitive recreational opportunities. Ease of use about the same as under Current Direction (Alternative A), except motorized use is restricted on some roads and areas.	Generally, there are the same conflicts with this Alternative as with Current Direction (Alternative A) However, concerns over departure, beetle program, road closures, and summer homes may tend to be more polarizing than Current Direction (Alternative A).	A little less change than under Current Direction (Alternative A), and thus a little less impact on this category
CENTRAL OREGON URBAN CENTER	Small increase in wood products jobs. An increase in the primitive category of recreational opportunities. Ease of use about the same as under the Current Direction (Alternative A), except motorized use is restricted on some roads and areas	Generally, there are the same conflicts with this Alternative as with Current Direction (Alternative A) However, concerns over departure, beetle program, road closures, and summer homes may tend to be more polarizing than Current Direction (Alternative A)	A little less change than under Current Direction (Alternative A), and thus a little less impact on this category
RURAL RECREATION AND RESIDENTIAL COMMUNITIES	About the same in its effects as the Current Direction (Alternative A) More evidence of timber management activities	Probably a fairly agreeable Alternative, but may be some conflict-based cohesion resulting from conflicts over summer home termination and visible timber management activities	Same as for Area Wide, plus changes associated with the termination of recreation residence permits

ALTERNATIVE I (continued)

	Types of Jobs and Lifestyles	Community Cohesion	Expectation of Minimal Change
RURAL INDUSTRIAL COMMUNITIES	Increased timber output is supportive Ease of use for subsistence and recreation is better than under the Current Direction (Alternative A), except for some roads	Generally, there are the same conflicts with this Alternative as with Current Direction (Alternative A). However, concerns over departure, beetle program, road closures, and summer homes may tend to be more polarizing than Current Direction (Alternative A).	A little less change than under Current Direction (Alternative A), thus a little less impact on this category.
WEST SIDE COMMUNITIES	The Deschutes National Forest is not a visible topic for groups on the West Side This Alternative has less impact on the West side than does Current Direction (Alternative A), but does provide more primitive category recreation opportunities.	Less conflict over the Deschutes National Forest than under Current Direction (Alternative A).	Less impact than the Current Direction (Alternative A) would have, except for changes on specific issues.

APPENDIX G

APPENDIX G
SELECTION OF HARVEST CUTTING METHOD

Harvest Cutting Methods

Harvest cutting methods include both even-aged and uneven-aged silvicultural systems Even-aged harvest cutting methods (silvicultural treatment methods) generally include clearcutting, shelterwood cutting, and seedtree cutting Uneven-aged harvest cutting methods (silvicultural treatment methods) generally include individual tree selection and group selection cutting The intent here is to document the rationale for selection of the broad harvest cutting methods (even-aged or uneven-aged) to be applied on the Forest The specific harvest treatment methods (such as clearcutting, seedtree cutting or group selection) will be selected on a site specific basis as identified in environmental assessments or in silvicultural prescriptions written or approved by certified silviculturists

A Discussion of Even-aged Versus Uneven-aged Selection Criteria

The criteria used for selection of harvest cutting methods were developed using selection criteria identified in the Regional Guide for the Pacific Northwest Region (1984) as well as direction provided in 36 CFR 219.27(b) for management prescriptions that involve manipulation of tree cover. A brief description of the criteria follows A more detailed discussion can be found in the respective documents

Selection Criteria from the Regional Guide

1. The selected method must permit the production of a volume of marketable trees sufficient to utilize all trees that meet utilization standards and which are designated for harvest.

2. The selected method must permit use of a logging method which can remove designated trees without excessive damage to the residual stand and while meeting other established land management objectives. Table 3-1 in the Regional Guide displays the compatibility of logging systems with common harvest cutting methods Generally, ground based logging methods, helicopters, and cable methods using slack pulling carriages are appropriate for all harvest methods, while cable methods without slack pulling carriages and balloons are appropriate only for clearcuts

3. The selected harvest method must be capable of providing special conditions that are required to meet resource management objectives. Table 3-2 in the Regional Guide displays commonly used harvest methods which achieve desired Forest character.

4. The selected method must permit control of vegetation to establish desired numbers and rates of growth of trees, as well as other vegetation needed to achieve special management objectives. Tables 3-3 and 3-4 in the Regional Guide outline these harvest cutting methods. Generally, both even-aged and uneven-aged methods can be used in vegetation zones occurring on the Forest, however uneven-aged methods are not applicable for wildlife forage production or optimum tree seedling and sapling growth

5 The selected method must promote a stand structure and species composition which minimizes serious risk from insects, disease, animal damage and wildfire and will allow treatment of existing insect, disease and fuel conditions Table 3-5 in the Regional Guide displays harvest cutting methods favorable to the reduction and treatment of these agents. Generally, uneven-aged methods are not applicable where dwarf mistletoe and root disease present serious risks

6 The selected method must meet management objectives identified in the Regional Guide and Forest Plan.

Selection Criteria From 36 CFR 219 27(b)

The seven criteria identified in 36 CFR 219.27(b) which direct management prescriptions for the manipulation of tree cover can be summarized as follows:

1 Be best suited to multiple use goals, considering biological, environmental, engineering, economics, and other impacts

2 Assure that lands can be adequately restocked.

3. Not be chosen primarily because of the greatest dollar return or timber output, although these factors should be considered

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SELECTION OF HARVEST CUTTING METHOD

4 Consider the potential impacts on residual trees and adjacent stands

5 Avoid permanent reduction of site productivity and ensure conservation of water and soil

6. Provide the desired effects to meet special management objectives.

7. Be practical in terms of transportation and harvesting requirements and total costs of timber sale preparation, logging, and administration

Combined Criteria for Selection of Harvest Cutting Method

The criteria identified in the Regional Guide and in 36 CFR 219.27(b) were subsequently combined to eliminate duplication of intent and simplify the rationale for selecting the harvest cutting methods used to implement the Forest Plan. These seven combined criteria are summarized as follows:

1 Selected method must produce a volume of marketable trees that meet utilization standards and are designated for harvest (Regional Guide: criteria 1)

2. Selected method must use available and acceptable logging methods. (Regional Guide: criteria 2; 36 CFR: criteria 4.)

3. Selected method must be capable of meeting special management objectives. (Regional Guide criteria 3 and 6; 36 CFR: criterias 1 and 6)

4 Selected method must permit control of vegetation to establish desired species composition, density, and rates of growth (Regional Guide criteria 4, 36 CFR: criteria 4 and 6)

5 Selected method must promote a stand structure and species composition which keeps risks from insects, disease and wildfire at an acceptable level. (Regional Guide: criteria 5)

6 Selected method must assure that lands can be adequately restocked. (36 CFR: criteria 2)

7. Selected method must be practical and economical in terms of transportation, harvesting, preparation and administration of timber sales (36 CFR. criteria 7)

In addition, no harvest cutting method was selected solely because it resulted in the greatest dollar return or provided the highest output of timber, or which permanently reduced site productivity, or could not assure conservation of the water and soil resources (36 CFR: criterias 3 and 5.)

Working Groups and Management Areas

Both even-aged and uneven-aged harvest cutting methods were available and evaluated for selection within the Forest's species working groups and management area combinations. The four working groups and their applicable management emphasis area combinations are summarized as follows:

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Working Group	Management Emphasis
Ponderosa Pine	General Forest Bald Eagle Osprey Deer Habitat Scenic Views Front Country Metolius Special Forest Metolius Scenic Views
Lodgepole Pine	General Forest Bald Eagle Osprey Deer Habitat Scenic Views Metolius Special Forest
Mixed Conifer	General Forest Bald Eagle Osprey Scenic Views Front Country Metolius Black Butte Scenic Metolius Special Forest Metolius Scenic Views
Mountain Hemlock	General Forest Scenic Views

Literature Cited or Reviewed

The evaluation of harvest cutting methods is based on operational experience and research findings published in the following documents:

1. J. W. Barrett, 1979, *Silviculture of Ponderosa Pine in the Pacific Northwest. The State of Our Knowledge* USDA Forest Service General Technical Report PNW-92, PNW Forest and Range Experiment Station, Portland, OR, 106 pages.

2 R M. Burns, technical composition, 1983, *Silvicultural Systems for the Major Forest Types of the United States*. Agricultural Handbook 445, USDA, Washington, D.C., 191 pages.

3. H. A. Fowells, technical composition, 1965, *Silvics of Forest Trees of the United States.* Agricultural Handbook 271, USDA, Washington, D C., 762 pages.

4 D Minore, 1979, *Comparative Autecological Characteristics of Northwestern Tree Species: A Literature Review* USDA Forest Service General Technical Report PNW-87, PNW Forest and Range Experiment Station, Portland, OR, 72 pages

5. W. C. Schmidt and R. R. Alexander, 1985, *Strategies for Managing Lodgepole Pine*, pp. 201-210 In D. M Baumgartner, *Educational Proceedings, Lodgepole Pine: The Species and Its Management.* Cooperative Extension, Washington State University, Pullman, WA

6 D Smith, 1962, *The Practice of Silviculture* . John Wiley & Sons, Inc., New York, 578 pages.

APPENDIX G
SELECTION OF HARVEST CUTTING METHOD

Rationale for Selection of Harvest Cutting Method

The following analysis documents the rationale for selection of harvest cutting method within each working group/management emphasis area based on those combined criteria which have a significant effect on the selection

Ponderosa Pine Working Group

1 Ponderosa Pine/General Forest

Lands within this management area will be managed for both timber and forage production Hiding areas for big game will be provided as outlined in the S&Gs Satisfactory tree growth rates should be maintained and stands should be protected from insects, disease and damage Both even-aged and uneven-aged methods are biologically acceptable (Barrett, 1979, Burns, 1983) Even-aged methods generally provide enhanced forage production and maximize wildlife species diversity (combined criteria 3) Even-aged methods generally provide for enhanced seedling and sapling growth rates because of the significant adverse effect of mature or larger trees on height and diameter growth of the understory (Barrett, 1979) (combined criteria 4) For this reason, uneven-aged methods generally produce reduced timber volumes. Clearcutting allows the introduction of genetically improved stock Where dwarf mistletoe and root disease infections exceed acceptable levels, uneven-aged methods are not applicable (combined criteria 5) Even-aged methods are more economical and practical in terms of transportation, harvesting, preparation and administration (Barrett, 1979, Burns, 1983) (combined criteria 7) Within this working group, periodic use of prescribed fire reduces unacceptable fuel accumulations and eliminates undesirable competitive vegetation (Burns, 1983). Even-aged methods are more compatible with this treatment Uneven-aged methods may produce less big game forage, may reduced timber yields, may increase risk of disease and wildfire, and generally increase management costs and complexity On the other hand, uneven-aged management maintains big trees over time, avoids clearcutting, and is visually more acceptable than even-aged management to most Forest visitors Therefore uneven-aged management is selected for Ponderosa pure/general forest when it is capable of meeting long and short-term management objectives in Ponderosa pure/general forest. Even-aged management is selected when this is not the case.

2 Ponderosa Pine/Bald Eagle and Osprey

Habitat management for bald eagles and osprey will emphasize large, overmature trees potentially useable as perch trees and nest sites. Suitable trees should be available throughout time and should be widely distributed The S&Gs describe the average number of trees per acre and their size. Both even-aged and uneven-aged methods are biologically acceptable and can produce large trees over time The selected harvest cutting method must be capable of providing the special conditions which are required to meet the resource management objectives (combined criteria 3), and they take precedence over economic considerations and timber volume production The selected method should be capable of developing large diameter Ponderosa pine or Douglas-fir perch and nest trees at the appropriate point in the rotation (combined criterias 3 and 4). Either even-aged or uneven-aged methods can be selected here The ultimate selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription.

3 Ponderosa Pine/Deer Habitat

Vegetation here will be managed to provide optimum habitat for deer. Special conditions required to meet the resource management objectives include providing hiding areas and/or thermal cover over 40 percent of the area as well as a vigorous forage base Prescribed burning is recommended for site preparation and forage enhancement Both even-aged and uneven-aged harvest cutting methods are biologically acceptable. Uneven-aged methods should utilize small group selection rather than individual-tree selection.

4 Ponderosa Pine/Scenic Views and Metolius Scenic Views

Ponderosa pine managed in this area will maintain visual diversity through variations of stand densities and size classes. Large, old growth trees will provide an important stand component Both even-aged and uneven-aged methods are biologically appropriate and can provide for the visual variety and maintenance of a large tree component Here, the special conditions required to meet management objectives take precedence over economic considerations or timber volume production (combined criteria 3). Tree growth rates should be sufficient to produce the characteristic large tree component within the rotation age and maintain trees in a healthy condition (combined criteria 4). In addition, trees should be managed to minimize risks from insects, disease and wildfire (combined criteria 5). Either even-aged or uneven-aged harvest cutting methods may be selected here. The ultimate selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription.

5. Ponderosa Pine/Front Country

Stands in this area are managed to maintain a natural appearing forested landscape on the slopes northeast of the Three Sisters and Tam MacArthur Rim, while providing high and sustainable levels of timber production. The desired visual condition is a landscape where color contrasts are minimal and the full crowns of younger trees create a visually uniform, primarily dark green, gently rolling landscape. Management activities should not result in shapes or lines that are visible from significant viewer locations (as identified in the S&Gs). Openings and textural changes are generally small and remain subordinate in the landscape, except during the winter months when snow, weather and lighting conditions exaggerate color contrasts. Both even-aged and uneven-aged harvest cutting methods are biologically acceptable to achieve the above conditions. The final selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription.

6. Ponderosa Pine/Metolius Black Butte Scenic

This area will be managed to perpetuate the scenic quality of Black Butte by maintaining or creating a continuous forest canopy of stands having large mature and overmature trees. Large diameter Ponderosa pines with yellow, deeply fissured bark are desirable. Target tree size is 36 inches in diameter, with no tree larger than 42 inches harvested unless it is an eminent safety hazard. Two or more replacement canopy layers that will eventually provide replacement overstory trees are desirable. Created openings are to be very limited, and only result from harvesting natural mortality. Biologically, the uneven-aged harvest cutting method is the most reasonable means of meeting these management objectives.

7. Ponderosa Pine/Metolius Special Forest

Lands in this area will be managed with an emphasis on timber production, while maintaining a near-natural appearance for public use and enjoyment. Promoting healthy and vigorous stand conditions will be the highest priority management goal. The objective is to have stands in a variety of age classes utilizing the site's growth potential while minimizing disruption of a continuous forest canopy. Created openings will normally be 10 acres or less in size and not exceed 10 percent of the management area in any decade. Target tree size in managed stands is 24 inches in diameter. Biologically, both even-aged and uneven-aged harvest cutting methods are acceptable. Generally, uneven-aged methods are better at meeting the objectives of maintaining a near natural appearance and minimizing disruption of a continuous forest canopy. For those reasons it is the preferred silvicultural system,except where it is inappropriate for stand health and vigor considerations. The final selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription.

Lodgepole Pine Working Group

1 Lodgepole Pine/General Forest

Lands within this management area should be managed for both timber and forage production. Hiding areas for big game will be provided as outlined in the standards/guidelines. Satisfactory growth rates should be maintained and stands protected from insects, disease and wildfire. While some variation does occur, the lodgepole pine type is generally considered to be a pure, even-aged, single-storied, overly dense forest (Burns, 1983). This stand structure and condition has provided the setting for a catastrophic mountain pine beetle epidemic The mature infested and susceptible stands will be converted to less susceptible, young stands within a 15 to 20 year period Although both even-aged and uneven-aged harvest cutting methods are biologically acceptable, the current stand structure and catastrophic conditions strongly favor even-aged methods. With an annual harvest program in lodgepole pine which approaches 15,000 acres, strong consideration must be given to methods which are practical and economical in terms of transportation, harvesting, and timber sale preparation and administration (combined criteria 7) This is particularly significant in view of current relatively low stumpage values for lodgepole pine. Opportunities for forage production are generally more favorable using even-aged methods (combined criteria 3). Desired tree growth rates and resistance to future mountain pine beetle epidemics can generally be maintained with greater success using even-aged methods (Schmidt and Alexander, 1985) (combined criteria 4) Serious dwarf mistletoe problems are common in lodgepole pine Uneven-aged methods will perpetuate this problem and are not applicable in this situation (Schmidt and Alexander, 1985) (combined criteria 5). For these reasons, even-aged methods are recommended for lodgepole pine in the general forest management area

2 Lodgepole Pine/Bald Eagle and Osprey

Lodgepole pine forest, although not capable of providing nest or perch trees, is still important in some areas to visually screen human activity from eagle and osprey nests. Satisfactory growth rates should be maintained to protect the stand and surrounding area from insects and disease While some variation does occur, the lodgepole pine type is generally considered to be a pure, even-aged, single-storied, overly dense forest (Burns, 1983). This stand structure and condition has provided the setting for a catastrophic mountain pine beetle epidemic The mature infested and susceptible stands will be converted to less susceptible, young stands within a 15 to 20 year period. Although both even-aged and uneven-aged harvest cutting methods are biologically acceptable, the current stand structure and catastrophic conditions strongly favor even-aged methods. Desired growth rates and resistance to future mountain pine beetle epidemics can generally be maintained with greater success using even-aged methods (Schmidt and Alexander, 1985) (combined criteria 4). Serious dwarf mistletoe problems are common in lodgepole pine. Uneven-aged methods will perpetuate this problem and are not applicable in this situation (Schmidt and Alexander, 1985) (combined criteria 5) For these reasons, even-aged methods are usually recommended for lodgepole pine

3 Lodgepole Pine/Deer Habitat

Land within this management area should be managed for deer thermal cover and forage. Satisfactory growth rates should be maintained to protect the stand from insects and disease While some variation does occur, the lodgepole pine type is generally considered to be a pure, even-aged, single-storied, overly dense setting for a catastrophic mountain pine beetle epidemic The mature infested and susceptible stands will be converted to less susceptible, young stands within a 15 to 20 year period. Although both even-aged and uneven-aged harvest cutting methods are biologically acceptable, the current stand structure and catastrophic conditions strongly favor even-aged methods Desired growth rates and resistance to future mountain pine beetle epidemics can generally be maintained with greater success using even-aged methods (Schmidt and Alexander, 1985) (combined criteria 4) Serious dwarf mistletoe problems are common in lodgepole pine Uneven-aged methods will perpetuate this problem and are not appliccable in this situation (Schmidt and Alexander, 1985) (combined criteria 5) For these reasons, even-aged methods are usually recommended for lodgepole pine

4 Lodgepole Pine/Scenic Views

Lodgepole pine will be managed in this area to increase species and size class diversity and maintain stands in a healthy condition. Here, the stand structure and condition, as well as operational constraints common to the general Forest management area, will apply. Although both even-aged and uneven-aged methods are biologically acceptable, the even-aged method is strongly favored. Management here will differ from the general Forest,primarily in scale. Emphasis will be placed on retention of islands of healthy, immature lodgepole pine and native ground vegetation. Even-aged methods are generally selected here to meet these special management objectives (combined criteria 4)

5. Lodgepole Pine/Front Country

Stands in this area are managed to maintain a natural appearing forested landscape on the slopes northeast of the Three Sisters and Tam MacArthur Rim, while providing high and sustainable levels of timber production The desired visual condition is a landscape where color contrasts are minimal and the full crowns of younger trees create a visually uniform, primarily dark green, gently rolling landscape. Management activities should not result in shapes or lines that are visible from significant viewer locations (as identified in the S&Gs). Due to the mountain pine beetle, created openings can exceed 40 acres in size However mitigation measures such as feathering, scalloping and other edge treatments should be employed. Although both even-aged and uneven-aged harvest cutting methods are biologically acceptable, the current stand structure and catastrophic conditions strongly favor even-age methods Desired growth rates and resistance to future mountain pine beetle epidemics can generally be maintained with greater success using even-aged methods (Schmidt and Alexander, 1985)(combined criteria 4). Serious dwarf mistletoe problems are common in lodgepole pine Uneven-aged methods will perpetuate this problem and are not applicable in this situation (Schmidt and Alexander, 1985)(combined criteria 5). For these reasons, even-aged methods are usually recommended for lodgepole pine.

6 Lodgepole Pine/Metolius Special Forest

Lands in this area will be managed with an emphasis on timber production, while maintaining a near-natural appearance for public use and enjoyment. Promoting healthy and vigorous stand conditions will be the highest priority management goal. The objective is to have stands in a variety of age classes utilizing the site's growth potential while minimizing disruption of a continuous forest canopy. Created openings will normally be 10 acres or less in size and not exceed 10 percent of the Management Area in any decade. Although both even-aged and uneven-aged harvest cutting methods are biologically acceptable, the current stand structure and catastrophic conditions strongly favor even-age methods. Desired growth rates and resistance to future mountain pine beetle epidemics can generally be maintained with greater success using even-aged methods (Schmidt and Alexander, 1985)(combined criteria 4). Serious dwarf mistletoe problems are common in lodgepole pine. Uneven-aged methods will perpetuate this problem and are not applicable in this situation (Schmidt and Alexander, 1988)(combined criteria 5). For these reasons, even-aged methods are usually recommended for lodgepole pine

Mixed Conifer Working Group

1 Mixed Conifer/General Forest

Lands within this management area will be managed for both timber and forage production Hiding areas for big game will be provided as outlined in the standards/guidelines Satisfactory growth rates should be maintained and stands should be protected from insects, disease and damage Species composition in this working group should be controlled to produce trees which can maintain these satisfactory growth rates and resistance to insects, disease and damage. Both even-aged and uneven-aged methods are biologically acceptable here. The selection decision is weighted heavily by successional trends and upon the relative shade tolerance of species present within the mixed conifer working group (Burns, 1983; Minore, 1979) Here, shade intolerant species, including ponderosa pine, Douglas-fir, western white pine, western larch, and noble fir, are considered more desirable and better meet management objectives for growth and resistance to insects, disease and damage Even-aged management and group selection uneven-aged management is most desirable to convert overmature, old-growth stands to vigorous stands of shade intolerant species (Burns, 1983) (combined criterias 4 and 5). On the Deschutes National

Forest, mixed conifer stands sometimes occur on slopes greater than 30 percent where acceptable logging systems and fuels treatment may favor even-aged methods (combined criteria 2) These methods are generally more practical and economical in terms of transportation, harvesting, preparation and administration of timber sales (combined criteria 7). Even-aged methods or group-selection uneven-aged management methods are generally selected for the mixed conifer/general Forest.

2. Mixed Conifer/Bald Eagle and Osprey

Lands within this management area will be managed to provide nesting and perch tree habitat from large, overmature trees Ponderosa pine is the preferred species, with Douglas fir also usable. Suitable trees should be available throughout time and be widely distributed. Except for stands where the overstory is dominated by true firs, both even-aged and uneven-aged methods are biologically acceptable and can produce the small groups of large trees over time. The selected harvest cutting method must be capable of providing the special conditions which are required to meet the resource management objectives (combined criteria 3), and they take precedence over economic considerations and timber volume production. Stands dominated by true fir overstory can be converted to Ponderosa pine or Douglas fir using even-aged methods or group selection uneven-aged method where Ponderosa or Douglas fir can be maintained as crop trees The selected method should be capable of developing large diameter Ponderosa pine or Douglas-fir perch and nest trees at the appropriate point in the rotation (combined criteria 3 and 4) Either even-aged or uneven-aged methods can be selected here. The ultimate selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription

3. Mixed Conifer/Scenic Views and Metolius Scenic Views

Mixed conifer stands managed in this area will provide a variety of species, snags and size classes Large, old-growth trees will provide an important stand component. Both even-aged and uneven-aged harvest cutting methods are biologically applicable and can provide for the visual variety and maintenance of the large tree component Here, the special conditions required to meet visual management objectives are the primary consideration (combined criteria 3) While economic returns and timber volume production are also important, they play a secondary role in this management area. Tree growth rates should be sufficient to produce the characteristic large tree component within the rotation age and maintain trees in a healthy condition (combined criteria 4). In addition, trees should be managed to minimize risks from insects, disease and wildfire (combined criteria 5) Either even-aged or uneven-aged methods may be selected here. Uneven-aged methods may require artificial regeneration to maintain the appropriate species composition and may be restricted to sites where acceptable logging methods can be applied (combined criteria 2) Uneven-aged methods are not applicable where insect or disease conditions cannot maintain stands with relatively low risk (combined criteria 5). The ultimate selection should be based on specific stand and site characteristics and documented in an environmental assessment or silvicultural prescription

4 Mixed Conifer/Front Country

Stands in this area are managed to maintain a natural appearing forested landscape on the slopes northeast of the Three Sisters and Tam MacArthur Rim, while providing high and sustainable levels of timber production. The desired visual condition is a landscape where color contrasts are minimal and the full crowns of younger trees create a visually uniform, primarily dark green, gently rolling landscape Management activities should not result in shapes or lines that are visible from significant viewer locations (as identified in the S&Gs) Openings and textural changes are generally small and subordinate in the landscape, except during the winter months when snow, weather and lighting conditions exaggerate color contrasts. Both even-aged and uneven-aged harvest cutting methods are biologically acceptable to achieve the above conditions The final selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription

5. Mixed Conifer/Metolius Black Butte Scenic

This area will be managed to perpetuate the scenic quality of Black Butte by maintaining or creating a continuous forest canopy of stands having large mature and overmature trees. Large diameter Ponderosa pines with yellow, deeply fissured bark are desirable. Target tree size is 36 inches in diameter, with no tree larger than 42 inches harvested unless it is an eminent safety hazard. Two or more replacement canopy layers that will eventually provide replacement overstory trees are desirable. In areas where white fir and other coniferous species are replacing Ponderosa pine due to the elimination of fire management will emphasize Ponderosa pine. Created openings are to be no greater than 5 acres in size and cover no more than 5 percent of the management area per decade Both even-aged and uneven-aged methods are biologically acceptable The final decision should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription.

6. Mixed Conifer/Metolius Special Forest

Lands in this area will be managed with an emphasis on timber production, while maintaining a near-natural appearance for public use and enjoyment. Promoting healthy and vigorous stand conditions will be the highest priority management goal. The objective is to have stands in a variety of age classes utilizing the site's growth potential while minimizing disruption of a continuous forest canopy Created openings will normally be 10 acres or less in size and not exceed 10 percent of the management area in any decade Target tree size in managed stands is 24 inches in diameter. Biologically, both even-aged and uneven-aged harvest cutting methods are acceptable. Generally, uneven-aged methods are better at meeting the objectives of maintaining a near natural appearance and minimizing disruption of a continuous forest canopy. For those reasons it is the preferred silvicultural system, except where it is inappropriate for stand health and vigor considerations. The final selection should be based on specific site and stand characteristics and documented in an environmental assessment or silvicultural prescription

Mountain Hemlock Working Group

1. Mountain Hemlock/General Forest and Scenic Views

The mountain hemlock working group will be managed extensively to provide both timber and forage production. Hiding areas will be provided as outlined in the standards/guidelines Satisfactory tree growth rates should be maintained and stands should be protected from insects, disease and damage. Both even-aged and uneven-aged methods are biologically acceptable (Burns, 1983). The selection decision is weighted heavily by successional trends and upon the relative shade tolerance of species present within the mountain hemlock working group (Burns, 1983, Minore, 1979). Here, shade intolerant species including lodgepole pine, shasta red fir, and western white pine are considered more desirable because they better meet the management objectives with regards to growth and resistance to insects, disease and damage. Even-aged methods are most desirable to convert overmature, old-growth stands to vigorous stands of shade intolerant species (combined criterias 3 and 4) In view of the current relatively low stumpage values for mature and overmature mountain hemlock and associated true fir species and the unroaded condition of the majority of sites in this working group, strong consideration must be given to methods which are practical and economical in terms of transportation, harvesting, and timber sale preparation and administration (combined criteria 7) Steep and severe sites associated with the mountain hemlock working group will require harvest cutting methods where acceptable logging systems can be applied (combined criteria 2) and will permit control of vegetation to assure desirable stocking (combined criteria 6), species composition, and growth rates (combined criteria 4). Consideration must also be given to minimizing risks from insects and disease (combined criteria 5). Management objectives in the scenic views management area will differ from the general Forest, primarily in scale Emphasis will be placed on retention of islands of healthy, immature trees of an acceptable species and native ground vegetation. Harvest cutting methods are largely untested in the working group. Even-aged methods are selected for the majority of sites. Uneven-aged systems may be applicable in a limited number of cases, particularly on very severe sites (Burns, 1983) The ultimate selection should be based on stand and site characteristics and documented in an environmental assessment or silvicultural prescription.

Appendix H

Appendix H
Best Management Practices

Definitions

Nonpoint Sources: Refers to diffuse or unconfined sources of pollution where wastes can either enter into, or be conveyed by the movement of water to public waters (Oregon Water Quality Standards, 340-41-007(17)). Silvicultural sources, such as erosion from a harvest unit or surface erosion from a road, are considered nonpoint sources.

Best Management Practices: Defined as "methods, measures, or practices selected by an agency to meet its nonpoint source control needs. Best Management Practices (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).

Usually BMPs are applied as a system of practices rather than as a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility. (EPA Interagency Nonpoint Task Force, 1985).

BMPs are basically a preventative rather than an enforcement system. BMPs are a whole management and planning system in relation to sound water quality goals, including both broad policy and site-specific prescriptions

Introduction

BMPs are the primary mechanism to enable the achievement of water quality standards (Environmental Protection Agency, 1987). BMPs will be selected and tailored for site-specific conditions to arrive at the project-level BMPs for the protection of water quality. The process for determining appropriate BMPs, and for ensuring their implementation at both the Forest Plan and Project level, is described. Following is a description of the methods and procedures that will be used to control or prevent nonpoint sources of pollution from resource management activities and to ensure compliance with the Clean Water Act of 1972, as amended in 1977 and 1987. Section 319 of the Clean Water Act Amendments of 1987 requires that the states determine those waters that will not meet the goals of the Act, to determine those nonpoint source activities that are contributing pollution, and to develop a process of determining BMPs to reduce such pollution to the "maximum extent practicable." This Appendix is designed to fulfill the intent of the requirements of Section 319.

Oregon's Administrative Rules
(Chapter 340-41-001-975)
Department of Environmental Quality

Oregon's Administrative Rules contain water requirements for the protection of identified beneficial uses of water.

Memorandum of Understanding: The Oregon Department of Environmental Quality and U S. Department of Agriculture, Forest Service (February 12, 1979 and December 7, 1982), and "Attachments A and B" referred to in this Memorandum of Understanding (MOU) ("Implementation Plan for Water Quality Planning on National Forest Lands in the Pacific Northwest", December, 1978, and "Best Management Practices for Range and Grazing Activities on Federal Lands," respectively).

Washington's Administrative Code
(Chapters 173-201 and 202)
Department of Ecology

Washington's Administrative Code contains water requirements for protection of various classes of surface waters.

Memorandum of Understanding: The Washington Department of Ecology and U.S. Department of Agriculture, Forest Service (July, 1979), and "Attachment A" referred to in this MOU ("Implementation Plan for Water Quality Planning on National Forest Lands in the Pacific Northwest" December, 1978).

California's Porter-Cologne Water Quality Control Act
(California Water Code, Division 7)

The Water Quality Control Plan for the North Coast Region was approved by the North Coast Regional Water Quality Control Board on April 28, 1988. It

Appendix H
Best Management Practices

is pending approval by the State Water Resources Control Board and the Environmental Protection Agency.

The Draft North Coast Regional Water Quality Control Plan contains water quality objectives that are considered necessary to protect those present and probable future beneficial uses of water.

Memorandum of Understanding: The State Water Resources Control Board, State of California and U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, 1981.

The EPA has certified the Oregon Forest Practices Act and Washington Forest Practices Rules and Regulations as BMPs. The States of Oregon and Washington compared Forest Service practices with these state practices and concluded that Forest Service practices meet or exceed state requirements. As state practices change, comparisons are made to ascertain that Forest Service practices meet or exceed these changes Monitoring and evaluation will determine the need for changes in BMPs and/or state standards.

Forest Service management practices will meet, as a minimum, the substantive state BMP requirements, and other considerations required by the National Forest Management Act (NFMA), and other authorities, for the protection of the soil and water resources.

The general BMPs described herein are action-initiating mechanisms which call for the development of detailed, site-specific BMP prescriptions to protect beneficial uses and meet water quality objectives. They are developed as part of the NEPA process, with interdisciplinary involvement by a team of individuals that represent several areas of professional knowledge, learning, and/or skill appropriate for the issues and concerns identified BMPs also include such requirements as Forest Service manual direction, contract provisions, environmental documents, and Forest Plan Standards and Guidelines. Inherent in prescribing project-level management requirements is recognition of specific water quality objectives which BMPs are designed to achieve.

Best Management Practices Implementation Process

In cooperation with the state, the primary strategy for the prevention and control of nonpoint sources is based on the implementation of BMPs determined necessary for the protection of the identified beneficial uses.

The objective is to identify the most practical means of attaining water quality objectives Water quality objectives include water quality measures that adequately reflect the needs of identified beneficial uses

The Forest Service Nonpoint Source Management System consists of:

1. Selection and design of BMPs based on site-specific conditions, technical, economic and institutional feasibility, and the water quality standards of those waters potentially impacted.

2. Implementation and enforcement of BMPs

3. Monitoring to ensure that practices are correctly applied as designed

4 Monitoring to determine the effectiveness of practices in meeting design expectations and in attaining water quality standards

5 Evaluation of monitoring results and mitigation where necessary to minimize impacts from activities where BMPs do not perform as expected

6. Adjustment of BMP design standards and application when it is found that beneficial uses are not being protected and water quality standards are not being achieved to the desired level; evaluation of the appropriateness of water quality criteria to reasonably assure protection of beneficial uses; consideration of recommending adjustment of water quality standards

Best Management Practices Selection and Design - Step 1

Scoping: Potential concerns are identified (for example, water quality) as part of the NEPA process for environmental analysis Public notices are dispersed inviting comment and participation in the process. Alternatives are developed to address potential problems and to accomplish project objectives

Environmental Analysis: Each alternative is evaluated for its potential effect on different resources, including water. From this analysis, a preferred alternative is identified, along with the measures (BMPs) needed to reduce risk and increase the potential for success.

Documentation: An Environmental Assessment (EA) or Environmental Impact Statement (EIS) is developed with a decision notice and includes required measures (BMPs).

Water quality standards are used as objectives towards which practices are designed to protect beneficial uses.

Appropriate BMPs are selected for each project by an interdisciplinary team. BMP selection and design are dictated by water quality objectives, soils, topography, geology, vegetation, climate, economics, institutional constraints, etc. Environmental effects and water quality protection options are evaluated and a range of practices is considered. A final set of practices are selected that not only protect beneficial uses, but meet other resource needs. These final selected practices constitute the BMPs.

The selected BMPs, an estimate of their effectiveness, and a plan for monitoring them is included in the project EA or EIS. The site-specific BMP prescriptions are normally included in project implementation plans, but may also be included in the body or appendix of a project environmental document.

Best Management Practices Implementation and Enforcement - Steps 2 and 3

The site-specific BMP prescriptions are taken from plan-to-ground by a combination of project layout and resource specialists (hydrology, fisheries, soil, geology, etc.). Final adjustments to fit the BMP prescriptions to the site are made before implementing the resource activity.

When the resource activity (for example, timber harvest or road construction) begins, timber sale administrators, engineering representatives, resource specialists, and others ensure that the BMPs are implemented according to plan A similar implementation process is used for other resource activities (range management, mining, etc) on National Forests

BMP implementation monitoring is done before, during, and after resource activity implementation. This monitoring answers the question: Did we do what we said we were going to do? Some examples of implementation monitoring for a streamside management unit BMP prescription may be:

1. **Before project:** Checking Stream Management Units (SMUs) along streams to see if layout meets the objectives of the BMP prescription, or if the road crossing of a stream is properly located and designed per estimates made during the environmental analysis

2. **During project:** During timber felling, the timber sale administrator checks to see if the timber fallers understand marking prescription for timber to be felled in the SMU. The timber sale administrator also observes on-going harvest operations to see if the activity meets the objectives defined in the project plan.

3. **After project:** Measuring canopy stream shading to see if the amount specified in the BMP prescription was retained, or monitoring a beneficial use of the water to determine a change or trend in use.

Enforcement is carried out primarily through internal project reviews and contractual enforcement (for example, timber sale contract, grazing or special use permit).

Contract enforcement is a more formal method used to achieve desired results Normally, each project is assigned a person as a contracting officer. For timber sales, that person is called a timber sale administrator The project is routinely monitored to ensure that practices are being carried out in the manner and method prescribed in the contract, permit, etc. When a contractor or permittee is not in compliance, they can be held in breech with penalties (i.e , bond forfeiture) until remedies are implemented.

Often during the course of an activity, adjustments are made if it is determined that unsatisfactory results are currently resulting or may occur. This can often mean that a contract modification may be necessary (as in the case of a timber sale).

Best Management Practices Monitoring - Step 4

Once BMPs have been implemented, further monitoring is done to evaluate their effectiveness BMP effectiveness monitoring answers the question: Are BMPs effectively meeting management objectives for protection of water quality?

Water quality standards are the yardstick against which the effectiveness is tested. If, through objective monitoring, BMPs do not meet prescribed objectives, then information is available to modify either the BMPs for future management, or the objectives, or both.

The natural variability of water quality under unmanaged conditions is an important factor that will be considered during the monitoring and evaluation Additionally, effectiveness monitoring will include measurement against land management objectives as well as water quality objectives.

Some examples of the types of BMP effectiveness monitoring to be conducted are·

1. Measuring stream temperatures to see if the riparian prescriptions in a watershed are maintaining water temperature.

2. Storm period surveillance monitoring of a road system to see if road rocking is effectively preventing road surface erosion.

The monitoring and evaluation section of the Forest Plan (Chapter 5) provides that monitoring of BMPs will be accomplished on an appropriate sample basis
Once a specific project is designed, a site-specific monitoring plan may be developed.

Results of monitoring should be shared with state and local agencies, as well as being available to the public. Monitoring design, sampling, and laboratory analyses will be coordinated.

Best Management Practices Evaluation and Adjustment - Steps 5 and 6

The technical evaluation/monitoring described above will determine how effectively BMPs protect and/or improve water quality. If the evaluation indicates that water quality objectives are not being met and/or beneficial uses do not appear to be receiving adequate protection, corrective action will consider the following three components·

1. **The Best Management Practices:** Is it technically sound? Is it really best, or is there a better practice which is technically sound and feasible to implement?

2. **The Implementation Program or Processes:** Was the BMP applied entirely,as designed? Was it only partially implemented? Were personnel, equipment, funds, or training lacking which resulted in inadequate or incomplete implementation?

3. **The Water Quality Standards:** The water quality standards are established to protect the beneficial uses of water. They include numeric and narrative criteria that, when exceeded, are assumed to indicate detrimental impacts on beneficial uses. They are intended to provide a benchmark for evaluating harm to beneficial uses.

Assessing the applicability of the standards is a responsibility of the state The Forest Service will provide information to the state to address the following types of questions·

1 Do the standards describe the conditions necessary for protecting beneficial uses?

2. Are standards higher or lower than that necessary for protecting beneficial uses?

3. Do the standards reflect the natural variability occurring within the natural and human-affected ecosystem?

4. Do the parameters and criteria that constitute water quality standards adequately reflect (are they sensitive enough) human-induced changes to water quality and beneficial uses?

Validation monitoring may be needed to make this assessment. The purpose of validation monitoring is to answer the question whether standards, coefficients, requirements, and guidelines are appropriate to meet objectives (i e., protect beneficial uses). For example (1) did the change in water temperature impact the fish population?, and/or (2) did the soil compaction effect tree growth?

Validation monitoring will need to be closely coordinated with, or in some cases, conducted by, research. It may require the establishment of permanent plots or administrative studies. This kind of monitoring will be very limited and will require coordination to select projects with broad application and to prevent duplication. Only those coefficients and standards that are not reasonably validated by existing research or documentation should be candidates for this monitoring.

Corrective action may be initiated once the reason for failing to achieve the management objectives is determined. The management practice may have to be changed, the water quality objectives modified, or both.

Training

National Forest personnel involved with project location, design, layout, administration, and maintenance activities will receive BMP training. The training will consist of BMP awareness, as well as the more technical aspects such as planning, implementation, monitoring, and evaluation.

General Best Management Practices and Examples

Individual general BMPs are described in *General Water Quality Best Management Practices*, Pacific Northwest Region, November, 1988. This provides guidance, but is not a direction document. Also included in this document is a description of the process, and limitations, and use of these BMPs. Each BMP listed includes the title, objectives, explanation, implementation and responsibility, and monitoring. Evaluations of ability to implement and estimated effectiveness are made at the project level.

Not all of the general BMPs listed will normally apply to a given project, and there may be specific BMPs which are not represented by a general BMP in this document

The sensitivity of the project determines whether the site-specific BMP prescriptions are included in the EA/EIS or in the sale/project plan, or in the analysis files

Following is an example of a general BMP, as described in this document, along with an example of a site-specific BMP which is developed at the project level.

General BMP Example:

T-5. Title: Limiting the Operating Period of Timber Sale Activities

Objective: To ensure that the Purchaser conducts operations in a timely manner, within the time period specified in the Timber Sale Contract (TSC).

Explanation: The TSC specifies a Normal Operating Season during which operations may generally proceed without resource damage Operations are permitted outside the Normal Operating Season only when they can be conducted without damage to soil, water, and other resources. Where determined to be necessary through the environmental analysis, the TSC will limit operations to specific periods or weather conditions. Operations are not permitted to continue if damage will occur.

Implementation and Responsibility: Limited operating periods are identified and recommended during the Timber Sale Planning Process by the Interdisciplinary Team and followed through the life of the timber sale primarily by the Sale Administrator.

Ability to Implement: Add at project level.

Effectiveness: Add at project level.

Monitoring: During implementation of timber sale activities by the Sale Administrator, Forest Service Representative (FSR), engineers, and watershed specialists. Also see Forest Plan monitoring plan, Appendix 8, monitoring plan item: Water Resource Monitoring.

Specific BMP Example:

PT-5. Title: Limiting the Operating Period of Timber Sale Activities

Objective: To ensure that the Purchaser conducts operations in a timely manner, within the time period specified in the Timber Sale Contract (TSC).

Explanation: The Ship Mountain Timber sale contains sensitive soils that are subject to soil compaction during tractor skidding, and a non-surfaced road that is not suitable for wet weather haul.

The normal operating season for the Forest will be enforced for the Ship Mountain Timber sale. All operations off Road FR 10 (non-surfaced) will be halted at the onset of wet weather to prevent erosion and damage to the road. Tractor skidding on Units 1-5 will be restricted if soil moisture is above the level established by the soil scientist. Other operations can continue outside the normal operating season if they can be conducted without damage to soil, water, and other resources.

Implementation and Responsibility: For the Ship Mountain Timber sale the normal operating season for the Forest will be enforced. All operations off Road FR 10 (non-surfaced) will be halted at the onset of wet weather to prevent erosion and damage to the road. Other operations can continue outside the normal operating season if they can be conducted without damage to soil, water, and other resources. The Forest watershed specialists will work with the timber sale administrators to evaluate the potential for resource damage if operating outside the normal operating season.

Ability to Implement: High

Effectiveness: High

Monitoring: During implementation of timber sale activities by the Sale Administrator, Forest Service Representative (FSR), engineers, and watershed specialists. Also see Forest Plan monitoring plan, Appendix 8, monitoring plan item: Water Resource Monitoring.

References

USDA Forest Service, Pacific Northwest Region, *General Water Quality Best Management Practices*, November, 1988.

U.S. Environmental Protection Agency, *Nonpoint Source Controls and Water Quality Standards*. Water Quality Standards Handbook, Chapter 2, General Program Guidance, pages 2-25, August 19, 1987.

U.S. Environmental Protection Agency, *Final Report on the Federal/State/Local Nonpoint Source Task Force and Recommended National Nonpoint Source Policy*. Office of Water, Washington, D.C., page 17.

APPENDIX I

APPENDIX I
ANALYSIS OF MANAGEMENT REQUIREMENTS

INTRODUCTION

This Appendix is included in the Final Environmental Impact Statement for the Forest Plan in response to decisions of the Chief of the Forest Service and the Deputy Assistant Secretary of Agriculture regarding appeal No 1770, brought by the Northwest Forest Resource Council on September 18, 1986 The appeal centered on direction from the Regional Forester to incorporate "minimum management requirements" (MMR's) in forest plan alternatives. The appellant requested that the appropriateness of the MMR's be examined through the environmental impact statement process. The information in this Appendix also responds to comments about Management Requirements that were raised during the review of the Draft Environmental Impact Statement.

A summary of Management Requirements is provided in Chapter 2, "Management Requirements" section. Additional information is in Appendix B The Standards and Guidelines (or specifications) for implementation of the management requirements are found in the Forest Plan

BACKGROUND OF THE MANAGEMENT REQUIREMENTS

WHAT ARE MANAGEMENT REQUIREMENTS

Many laws and regulations guide Forest Service activities. One law in particular, the National Forest Management Act of 1976 (NFMA), and its implementing regulations provide direction for the Forest planning process The direction for National Forest Systems Land and Resource Management Planning, in Section 36 of the Code of Federal Regulations, Part 219 [36 CFR] specify: (1) the minimum specific management requirements to be met in accomplishing the goals and objectives of the National Forest System [36 CFR 219 27] and (2) the minimum requirements for integrating individual forest resource planning into the Forest Plan [36 CFR 219.14 through 219 26] The term "management requirements (MR's) will be used in this Appendix to refer to these NFMA regulations instead of "minimum management requirements (MMR's) which were used in the Draft Environmental Impact Statement and Proposed Forest Plan.

Some management requirements are procedural in nature and need not be dealt with here Some requirements were analyzed and were available for review during the Regional Guide Environmental Impact Statement process and are not dealt with here. See Appendix B for a more complete discussion The management requirements which have not been fully dealt with elsewhere, and which require additional analysis due to significant opportunity costs associated with implementation are:

1. Maintenance of habitat to assure viable populations of fish and wildlife populations particularly mature and old growth habitat and,

2. Protection of water resources, particularly water temperatures.

These management requirements are described in greater detail in later sections of this Appendix MR's for dispersal of created openings, other wildlife habitats and other requirements noted in 36 CFR 219 27 which have not been addressed in other Environmental Impact Statements do not cause significant opportunity costs when implemented.

LEGAL REQUIREMENTS VERSUS IMPLEMENTATION METHODS

The management requirements from the National Forest Management Act (NFMA) and its implementing regulations are legal requirements. These represent "ends" which must be met during Forest Plan implementation. For example, the NFMA implementing regulations require that "Fish and wildlife shall be managed to maintain viable populations of existing and desired non-native vertebrate species in the planning area." It is mandatory that, whatever implementation methods are chosen, the management requirement be met

Specifications or standards for achievement for each management requirement are established at the national level or through analysis at the regional

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level for most of the management requirements. These are listed in the regulations or as Standards and Guidelines in the Regional Guide Additional specifications identified on the Forest are listed as Standards and Guidelines in Chapter 4 of the Forest Plan The specifications must be based on knowledge of the resources involved. For example, in meeting the management requirement for viable populations of vertebrate species it is necessary to define the type of habitat required by the species, the maximum distance between habitats which will still provide reasonable assurance of genetic interaction, and the size of habitat area needed to support a breeding pair

Often, the pool of scientific knowledge is insufficient to provide the entire basis for defining the specific conditions or standards that will satisfy or meet a management requirement When this happens it is necessary to rely on the field experience and the professional judgement of knowledgeable professionals and to establish monitoring and research that will provide better information for future planning efforts

Implementation methods are the "means" or "ways" in which the management requirements will be met Using the northern three-toed woodpecker as an example, the management requirement or "end" is to provide habitat sufficient to maintain a viable population into the foreseeable future The "means" or "ways" of providing this habitat involve designing and implementing a set of practices which will assure that nesting and feeding areas, of a size suitable for the needs of the three-toed woodpecker, are available in the future, and that these habitats are close enough together so that the woodpeckers occupying adjacent habitat areas will be able to interact, thus assuring continued genetic diversity

Unfortunately, the distinction between "ends" and "means" is not always clear NFMA and implementing regulations clearly describe the "end" regarding viable populations of vertebrate species However, in the case of the harvest dispersion management requirement, the "end" is not as well defined. NFMA requires that harvest openings be limited to a prescribed size and be dispersed, but does not specifically state the reason (or end) to be accomplished by doing so. The implementing regulations and the Regional Guide comply with NFMA by specifying maximum unit sizes, and describing how they are to be implemented to achieve a dispersed standard Limited size and dispersal of harvest openings have no clear precedent regarding "means" or "ends," though for the purpose of this analysis it is treated as though it were an "end" in itself

The "means" (implementation methods) for meeting management requirements must be based on knowledge of the resources involved For example, in meeting the management requirement for viable populations of vertebrate species it is necessary to define the type of habitat required by the species, the size of habitat area needed to support a breeding pair, and the maximum distance between habitats which will still provide reasonable assurance of genetic interaction Often, the pool of scientific knowledge is insufficient to provide the entire basis for defining the specific conditions or standards that will satisfy or meet a management requirement. When this happens it is necessary to consider the field experience and the professional judgement of knowledgeable individuals and to rely on monitoring and research in providing better information for future planning efforts

ALTERNATIVE WAYS OF MEETING THE MANAGEMENT REQUIREMENTS

Usually there is more than one way in which a management requirement can be met (for example, different means (or ways) can be analyzed for assuring the specifications that indicate ends are satisfied or met) The specifications involve choices as well as the means for achieving those specifications to meet the same end Considering and analyzing different means (or ways) of meeting a specific management requirement are particularly important if there are potentially large opportunity costs involved

HOW ALTERNATIVE WAYS OF MEETING THE MANAGEMENT REQUIREMENTS WERE DEVELOPED

The selection of means sufficient to meet management requirements is based on effectiveness in meeting resource protection and on minimizing reductions to economic efficiency and timber availability. The general process used in evaluating alternate ways of meeting the management requirements is as follows:

1. Identify the desired "end" for each management requirement.

2. Assemble existing information about the resources addressed by the management requirement

3. Analyze the existing information to determine what conditions or specifications need to exist on the ground to assure meeting the "ends" of the management requirement (see Table I-1).

4. Develop various ways or means to meet the management requirement (see Table I-2).

5 Evaluate the effectiveness of the alternative means in meeting the management requirements. Estimate the environmental effects of each set of means.

6. For each set of means, estimate the effects on economic efficiency (as measured by changes in present net value) and the effects on timber availability (as measured by allowable sale quantity).

7. Where opportunity costs of meeting a management requirement exceed two percent of present net value (PNV) or allowable sale quantity (ASQ) of the Maximum Present Net Value Benchmark, the analysis used to select the means are presented. Two percent was used because differences less than two percent would not be significant in terms of opportunity costs of alternative means. A higher threshold would preclude evaluation of many alternatives.

For discussion purposes, opportunity costs are reductions in PNV and reductions in ASQ that result from implementing resource protection measures (means or ways) to meet the management requirements set forth in NFMA regulations. In order to provide habitat for viable populations of wildlife on the Deschutes National Forest, some opportunities to maximize present net value or to maximize timber production must be foregone

Table I-1 presents each of the MRs subject to analysis of opportunity costs on the Deschutes National Forest and a summary of the specifications or standards that are indicators of achievement of those ends.

Table I-2 shows the alternative means considered for implementing each management requirement

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Table I-1

Ends	Summary of Specifications
Openings created by timber harvest activities are dispersed and limited in size	Maximum created opening size of 40 acres (with some exceptions) Limit to 1/3 the size and 1/3 the perimeter of adjacent natural openings Corners of two or more created openings may touch, but are considered a single opening and cannot exceed 40 acres (with some exceptions) if they are not stocked with trees 4 1/2 feet tall Protect vegetation along edge of natural openings at all times Site must be adequately stocked with trees 4 1/2 feet tall before a harvest area is considered a closed stand and not an opening
Habitat provided that maintains viable populations of existing native and non-native vertebrate species:	
Northern three-toed woodpecker, pine marten and goshawk	Maintain mature conifer stands (for nesting and feeding) of adequate size and distribution to permit interaction among breeding pairs of dependent species [See Tables I-5, I-6, and I-7]
Northern spotted owl	Maintain old growth conifer stands (for nesting and feeding) of adequate size and distribution to permit interaction among breeding pairs of dependent species
Primary cavity excavators	Maintain adequate dead and defective tree habitat of sufficient numbers, size and distribution to permit interaction among breeding pairs of dependent species

Table I-2

Management Requirement	Alternative Means
Harvest Dispersion	Assume 10 years to grow to 4 1/2 feet in height to consider an opening "closed" or no longer an opening, with 210 foot wide uncut areas in between openings
	Assume 10 years to grow to 4 1/2 feet in height to consider an opening "closed" or no longer an opening, with 420 foot wide uncut areas in between openings
	Assume 10 years to grow to 4 1/2 feet in height to consider an opening "closed" or no longer an opening, with 630 foot wide uncut areas in between openings
Provide for adequate habitat to maintain viable populations of existing native and desired non-native vertebrate species'	
Northern three-toed woodpecker, pine marten and goshawk	Manage habitat sites on 100 year rotations
	Dedicate habitat sites for no timber harvest
Northern spotted owl	Manage habitat sites on 350 year rotations
	Dedicate habitat sites for no timber harvest
Primary cavity excavators	Distribute snags evenly over an area
	Provide snags in small clumps
	Provide snags in larger clumps

In analyzing the effects of the alternative means of meeting the MRs on PNV and ASQ, FORPLAN runs were made with and without constraints designed to simulate meeting the management requirement The Maximum PNV Benchmark was used for this analysis. This benchmark is a FORPLAN run which identifies the mix of management activities which would result in the highest level of economic efficiency (for example, the highest PNV) in managing the resources of the Deschutes National Forest It also identifies the ASQ associated with the most economically-efficient mix of management activities See Appendix B of the DEIS for further discussion of the FORPLAN model

A benchmark was chosen to use in the with and without constraint comparison, rather than an issue-based Forest Plan alternative, because management practices necessary to meet other objectives of the issue-based alternatives may partially or fully meet the MR, thus clouding any analysis of opportunity costs induced by the management requirement The true effect when measured against a fully developed alternative is significantly less because the objectives of that alternative may satisfy the management requirements to a large extent

Table I-3 summarizes the findings of the analysis. It displays the PNV and the first-decade ASQ for the Maximum PNV Benchmark as shown in the DEIS and shows the reduction in PNV and ASQ resulting from application of the selected means of meeting the management requirements Also displayed is the percent change in ASQ and PNV

Where the opportunity costs exceeded 2 percent, the analysis of the alternative means for meeting management requirements is presented This is done only for the viable wildlife populations MR. As indicated in the analysis results shown on Table I-3, management requirements for harvest dispersion were determined not to have significant effects on ASQ and PNV.

The following sections present for the management requirements requiring a presentation of the alternatives: (1) the source of the management requirement, (2) a description of the management requirement, (3) alternative ways considered for meeting the management requirement, (4) an opportunity cost analysis, (5) consequences of the different ways of meeting each management requirement, (6) rationale for the selected method, (7) implications for Forest Plan alternatives, and (8) a discussion of the role of monitoring and research

Table I-3, APPROXIMATE CHANGE (OPPORTUNITY COST) ASSOCIATED WITH MEETING THE MANAGEMENT REQUIREMENTS WITH SELECTED IMPLEMENTATION METHOD

	First-Decade Allowable Sale Quantity MMCF/Year (MMBF/Year)	Percent Change in Allowable Sale Quantity[1]	Present Net Value (MM$)	Percent Change in Present Net Value
MAXIMUM PNV BENCHMARK AS DISPLAYED IN THE DEIS	51.2 (-268 2)	--	1133.3	--
OPPORTUNITY COST (MMCF/ YEAR, MMBF/YEAR, MILLIONS OF DOLLARS OF PNV, AND PERCENT):				
Total Opportunity Cost of Meeting All Selected Management Requirements	-0.5[2] (-3.0)	-0 9	-43.0	-3.8
Opportunity Cost of Meeting Harvest Dispersion MR	+1.1 (+14 6)	+2.1	-12.3	-1.1
Total Opportunity Cost of Meeting Viable Populations MR	-1.2 (-6.5)	-2 3	-33.9	-3 0
Opportunity Cost of Meeting Mature Habitat MR	+0.03 (+0 2)	+0.1	-1 0	-0.1

Table I-3, APPROXIMATE CHANGE (OPPORTUNITY COST) ASSOCIATED WITH MEETING THE MANAGEMENT REQUIREMENTS WITH SELECTED IMPLEMENTATION METHOD (continued)

	First-Decade Allowable Sale Quantity MMCF/Year (MMBF/Year)	Percent Change In Allowable Sale Quantity[1]	Present Net Value (MM$)	Percent Change In Present Net Value
Opportunity Cost of Meeting Old Growth Habitat MR	-0.5 (-2.8)	-0.9	-9.8	-0.9
Opportunity Cost of Meeting Dead and Defective Habitat MR	-0.8 (-3.9)	-1.5	-23.1	-2.0

MMCF/YEAR = Millions of cubic feet per year

MMBF/YEAR = Millions of board feet per year

MM$ = Millions of dollars

[1]Percent change calculated on cubic foot basis

[2]Although the potential effects of meeting all the MRs are displayed as if they they were additive, there is actually some overlap not reflected in the analysis.

TIMBER HARVEST DISPERSION

Table I-3 shows that the opportunity costs of providing for dispersion are insignificant in terms of PNV. Timber availability, in terms of ASQ, actually increases when the dispersion constraints are applied. This is due to the harvest of lower valued species where volumes are higher but costs are also higher. Consequently, there are no timber availability opportunity costs associated with the dispersion requirement. Alternative ways of meeting dispersion requirements, however, were examined and presented in Appendix B of the FEIS.

VIABLE POPULATIONS OF VERTEBRATE SPECIES

Source of the Management Requirement

The NFMA regulations require that.

"Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure continued existence in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area." (36 CFR 219.19)

Description of the Management Requirement

In assessing those wildlife species which could be put at risk as a result of future management activities, the Forest Service also examined the types of habitat existing today and how they would change in the future. Through this review, it was determined that nearly all types of habitat existing on the Forest today would continue to exist at current population levels in the future The significant exceptions to this were· (1) the mature and old growth Forest habitat type, and (2) dead and defective tree habitat. Unless management activities were specifically designed to retain a component of these habitat types, it was apparent that dependent wildlife species could be significantly reduced in population and distribution.

Identification of MR species was made on a regional (all the National Forests in Oregon and Washington) and a sub-regional basis. The results, by sub-region, are shown in Table I-4 The Deschutes National Forest is a part of the Eastside Cascade sub-region (Zone 3). Management requirements also exist for riparian habitat and Threatened and Endangered species but these requirements have been dealt with elsewhere or do not have significant opportunity costs on the Deschutes National Forest

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Table I-4, SPECIES MATRIX FOR ADDRESSING MANAGEMENT REQUIREMENTS FOR WILDLIFE[1] AND THREATENED AND ENDANGERED SPECIES

Habitat	Zone 1, North Coastal	Zone 2, Westside Cascades	Zone 3, Eastside Cascades	Zone 4, Blue Mountains
Mature and Old Growth	*Northern Spotted Owl Pine Marten	Northern Spotted Owl Pine Marten	*Northern Spotted Owl Pine Marten Pileated Woodpecker	Northern Spotted Owl Pine Marten Pileated Woodpecker
Seral States V & VI	Pileated Woodpecker	Pileated Woodpecker	Northern Three-Toed Wood-pecker	Northern Three-Toed Woodpecker
**Dead and Defective	Primary Cavity Excavators	Primary Cavity Excavators	Primary Cavity Excavators	Primary Cavity Excavators
Riparian (coordination of this process with adjacent Forests was necessary to determine consistency.)				
Big Game		Mountain Goat	Mountain Goat (Wenatchee	
TE Species	Bald Eagle Peregrine Falcon Brown Pelican Aleutian Canada Goose	Bald Eagle Peregrine Falcon	Bald Eagle Peregrine Falcon Grizzly Bear Woodland Caribou (Colville)	Bald Eagle Peregrine Falcon

*The current effort to develop a supplemental environmental impact statement will result in direction for managing the spotted owls in the Pacific Northwest Region

**The Forest determined, and documented as part of the planning records, whether it needed to address wildlife in addition to fish, and if so which wildlife species would represent the riparian habitat

[1]The species listed were selected as management indicators because they are representative of all species requiring the identified habitats

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Once the MR species were identified, the Regional Office defined habitat requirements and biological characteristics for the species. These are the basis for providing for species habitat, and also for deciding how best to represent the species' needs in the planning process and in the FORPLAN model.

Habitat needs were defined using information from "Wildlife Habitats in Managed Forests. The Blue Mountains of Oregon and Washington," J W. Thomas (1979), and other resources (see Bibliography). This information was used to define the habitat conditions, habitat dispersal, and habitat sizes necessary to meet the management requirement. When information was available, but did not exactly fit the MR context, professional judgment was used to apply the information in estimating habitat needs. When information was not available, habitat needs were developed using professional judgment of a number of the more knowledgeable biologists on the subject. Information from existing research was used whenever possible.

This information for each species is provided for three habitat factors described below and presented specifically thereafter for each indicator species

1. Principal Habitats Used

Information about the seral stages and Kuchler vegetation types which are used by the various species is documented in many research papers for individual species Information as to which Kuchler type and/or seral stage are primary or secondary habitat, and the amount of dependency upon each habitat, is based primarily on professional judgment. (Guenther and Kucera 1978, Phillips, et al., 1981)

2. Dispersal Distance Between Habitats

The guideline on distribution of habitat areas is intended to establish a network that allows individuals of a species to successfully disperse to adjacent habitat areas. This provides interactions among individuals and prevents isolation of sub-populations. This guideline is called the dispersal distance. Research information alone is generally not adequate to establish reasonable dispersal distances between habitats As a result, dispersal distance is often determined on the basis of observations, experience, and professional judgement. In establishing the network of habitat areas for each species, consideration is given to habitats in reserved areas and to habitat areas being established for other species

3. Size of Habitat Areas

The size of individual habitat areas provided for each wildlife species is based on the habitat acreage needed to support the basic social or reproductive unit of the species, for example, breeding pairs Both home range and species density information are used to estimate the needed size of habitat area This was supplemented with professional judgement where no data were available for the specific habitat types being managed

The specific regional direction for the identified indicator species and the scientific source of that direction are discussed in the following sections This direction is summarized from "A Report on Minimum Management Requirements for Forest Planning on the National Forests of the Pacific Northwest Region, USDA Forest Service" (USDA Forest Service, June 1986) In developing the report, various habitat sizes and dispersal distances were considered Based on that analysis, minimum habitat sizes and maximum dispersal distances were identified for each species Since those minimums are based on the best available data, and there are no data specific to the Eastside Cascades or the Deschutes area which would indicate different habitat needs, alternate minimums were not further considered in developing the Forest Plan for the Deschutes National Forest.

There are 40-50 wildlife species on the Deschutes National Forest which show a definite preference for mature and old growth Forest In this analysis four species are considered. They are the northern three-toed woodpecker, the pine marten, goshawk and the northern spotted owl These species were selected because, in combination, they represent (are indicators of) all species dependent on mature and old growth Forest habitats Habitats selected were based on broad seral stages of groups of plant communities which were based on Kuchler's classification system.

Over fifty species depend upon dead and defective trees. Such trees are usually abundant after fires and in old growth stands. This habitat is potentially limited on the Forest and is a regional MR. A group of primary cavity excavators has been identified as the indicator for the habitat

Once these species were chosen, habitat needs were determined These habitat characteristics and biological requirements were developed by regional Forest Service biologists by reviewing the available literature and discussing the habitat needs of the species with acknowledged experts outside the Forest Service.

Because the type of habitat needed for three of the four species is the same, habitat areas can overlap (The exception is the northern three-toed woodpecker, which is restricted to only lodgepole) In addition, where the locations established by distribution requirements coincide, goshawk and marten habitat areas can overlap habitat areas established for the spotted owl, or areas set aside for Wilderness or other undeveloped areas (provided the mature conifer condition is present).

The first step in identifying the necessary habitat for the above species was to map all the existing stands of mature and old growth ponderosa pine, lodgepole pine, mixed conifer, and mountain hemlock. This included the Wilderness areas and lands determined to be not suited for timber production The next step was to identify other lands that were not available for timber production such as Research Natural Areas This provided the basic framework around which the rest of the MR areas were selected in order to meet the required distribution patterns Selecting areas that could serve the needs of two species was emphasized The final selection of areas was coordinated with the Winema and Willamette National Forests to assure a proper distribution without unnecessary duplication.

On the Deschutes National Forest, mature conifer habitat requires stands of conifers in excess of 80 years old The trees in a contiguous reproductive core area must be at least 80 years old and could not be scheduled for harvesting until they reach at least 100 years of age assuming that replacement stands would be available In the alternatives that went above the MR levels, some of these same areas were enlarged and set aside as Old Growth Management Areas. Many of these areas in alternatives that went above the MR levels also were absorbed into other management prescriptions that resulted in old growth

Meeting the MRs for three-toed woodpecker, marten and goshawk resulted in a total of 12,200 acres managed on a 100-year timber rotation Meeting the MR for spotted owl resulted in approximately 7,200 acres being managed on a 350 year rotation

NORTHERN THREE-TOED WOODPECKER

Principal Habitats Used

The three-toed woodpecker represents species dependent upon mature and old growth seral stages Habitats listed are the result of a literature review of Guenther, et al (1978), Jackman and Scott (1975), and Thomas (1979)

Dispersal Distance Between Habitats

The 2 mile dispersal distance between habitats was the result of professional judgment documented in Phillips and Roberts (1985) In June, 1986 this dispersal distance was converted to allow one habitat for every 2,000 to 2,500 acres, to permit greater flexibility in application.

Size of Habitat Areas

The 75 acres per pair was taken from Thomas (1979) The specific numbers and size class for snags as well as seral stages was based on data from Jackman and Scott (1975) and Thomas (1979). The habitat specifications for the three-toed woodpecker are summarized in Table I-5

PINE MARTEN

Principal Habitats Used

The pine marten uses seral stages III-VI (Thomas, 1979, Guenther and Kucera, 1978, Phillips, et al., 1981). The Kuchler types used are from Geunther and Kucera (1978). The principal habitat for the pine marten is seral stages V and VI.

Dispersal Distance Between Habitats

Burke (1982) recommends that the maximum dispersal distance between habitat areas for pine marten should be two miles In 1984 the Regional Forester changed the dispersal distance from two miles to three miles. This change was made because it was felt that where more than one adjacent habitat is available for dispersal, the dispersal distance can be extended to three miles for martens. This change has been reviewed by a number of biologists within and outside the Forest Service and most agree that it would appear not to create a population viability problem for represented species. In June of 1986, the dispersal distance specification for the pine marten habitat was converted to one habitat for every 4,000 to 5,000 acres, to allow greater flexibility in application

Juvenile marten dispersal up to 25 miles has been observed (Hawley and Newby, 1957 and Jondel, 1959), and average juvenile dispersal distances greater than 6 miles were observed in these studies and in Burnett (1981). Based on this information, Irwin (1987) concluded that "the dispersal distance used in the MMR standards might be increased without reducing probabilities for interactions among adults or dispersing young". However, he did not provide a specific alternative, and concluded that there was little empirical insight into the probability of maintaining a viable marten population using the MR guidelines. As Burke (1982) noted, the distance covered by dispersing individuals is not an absolute guide to appropriate spacing between habitat areas. The probability of dispersing individuals locating habitat areas and other individuals decreases rapidly as habitat areas are spaced further apart. Burke suggested that the observed range of population densities might be a better guide to spacing of habitat areas. He noted that the three mile spacing would result in a marten density 1/9 to 1/27 of normal densities reported in the literature.

Size of Habitat Areas

In the professional judgment of the biologists listed in Phillips and Roberts (1985), a breeding female pine marten can be supported on 160 acres of quality habitat Research is not unanimous as to the size of area needed, but the home range of a female marten is estimated to be 160 acres (Campbell, 1979). The biologists listed in Phillips and Roberts (1985) judged that this area should be contiguous to ensure that there would be enough habitat within the home range of the female. They also judged that crown closure should equal or exceed fifty percent Research papers indicate that areas with a lower percent crown closure receive little or no use by pine marten Therefore, to ensure an adequate crown closure, a minimum requirement of 50 percent closure was selected.

Research shows that marten require dead and down material for foraging, cover, and denning Six down logs/acre (Burke, 1982) was selected as the minimum down material requirement The number and size of snags required was selected to ensure that the amount of down material was achieved. The specifications for pine marten habitat are summarized in Table I-7.

Irwin (1987) noted that the MR guidelines contained an implied hypothesis that 160-acre areas would meet reproductive and winter range needs, and that marten would use broader areas containing a mix of less suitable habitat types at other times He concluded that monitoring and research could provide appropriate tests of this hypothesis.

GOSHAWK

Principal Habitats Used

The goshawk uses trees in older seral stages throughout a number of Kuchler types (Guenther, 1978; Reynolds, 1983)

Dispersal Distance Between Habitats

A 5 mile dispersal distance was used and this was based on observed distances that ranged from 2.3 miles in Alaska (McGowan, 1975) to 8 miles between nests in Oregon (Reynolds, 1983)

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Size of Habitat Areas

The size of area selected was 60 acres. This was based partly on the work of Reynolds and partly on the experience and professional judgement of the biologists in eastern Oregon.

The percent distribution of nest sites through the five listed plant communities is based on data from the Modoc National Forest and the Fremont National Forest (Camilleri, 1981, Forsman, 1980) The specifications for goshawk habitat are summarized in Table I-7.

Table I-5, WILDLIFE SPECIES HABITAT REQUIREMENTS--SPECIES: NORTHERN THREE-TOED WOODPECKER

Principal Habitats Used	*Dispersal Distance Between Habitats*	*Size of Area to Which Wildlife Prescriptions Apply*	Habitat Requirements to Be Used in Analyses
REPRODUCING--Seral Stage V and VI of Kuchler Types K4, K15, and Lodgepole Pine	One habitat area for every 2,000 to 2,500 acres	75 acres per pair	Maintain 75 acres of conifers in seral stages VI and/or V, per pair, for reproducing Maintain a minimum average of 2 hard snags per acre greater than or equal to 10 inches d.b.h, within 75 acre reproductive areas. Forty-five of these 150 snags should be greater than or equal to 12 inches d.b.h.
FEEDING--All Seral Stages of Kuchler Types K4, K15, and Lodgepole Pine, Provided Snags Are Present			

Table I-6, WILDLIFE SPECIES HABITAT REQUIREMENTS--SPECIES: PINE MARTEN

Principal Habitats Used	Dispersal Distance Between Habitats	Size of Area to Which Wildlife Prescriptions Apply	Habitat Requirements to Be Used in Analyses
REPRODUCING--Seral Stages V and VI of Kuchler Types K4, K12, K13, K14, K15, and Lodgepole Climax	One habitat area for every 4,000 to 5,000 acres	160 acres per habitat area (this figure represents the territory of one female and part of the territory for a male)	Maintain 160 contiguous acres of conifers in seral stages V or VI, with a crown closure of 50% or greater. Within the 160 acre unit. Maintain an average of 2 hard snags per acre greater than or equal to 12 inches d.b.h. Twenty-four of these 320 snags should be greater than or equal to 20 inches d b.h. Maintain a minimum average of 6 down logs per acre, at least 12 inches d.b.h., and 20 feet long.
FEEDING--Seral Stages III-IV of Kuchler Types K4, K11, K12, K13, K14, K15, and Lodgepole Pine Climax			

Table I-7, WILDLIFE SPECIES HABITAT REQUIREMENTS--SPECIES: GOSHAWK

Principal Habitats Used	Dispersal Distance Between Habitats	Size of Area to Which Wildlife Prescriptions Apply	Habitat Requirements to Be Used in Analyses
REPRODUCING--Seral Stages V and VI of Kuchler Types K4, K5, K10, K11, and Lodgepole Climax	Habitat areas approximately 5 miles apart	60 acres per pair	Maintain 60 acres of conifers per pair in seral stages VI and/or V
FEEDING--Seral Stages III-VI of the Vegetation Types Listed for Reproducing Habitat			

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NORTHERN SPOTTED OWL

Specific regional direction for the northern spotted owl is found in the Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide released in August, 1988 The Supplement was prepared, in response to an appeal of the Regional Guide, to address planning direction for spotted owl habitat management. Standards and guidelines adopted as a result of the Supplement will be used by National Forests in the Pacific Northwest Region to meet the management requirement to maintain viable populations of spotted owls. Selection of the final alternative has not yet been made. Any changes will be incorporated into the Final Forest Plan.

The Final Supplement was prepared after a series of public meetings and study of the nearly 42,000 comments received on the Draft Supplement issued in the summer of 1986 A summary of the analysis of public comments, substantive comments, and copies of letters received from government agencies and elected officials can be found in Appendix K of the Final Supplement.

The Forest Service Preferred Alternative (F) designates Spotted Owl Habitat Areas (SOHAs) to contain a variable amount of suitable habitat by physiographic province based on location of owl pairs and location of habitat in lands unsuitable for timber production. Current distribution of habitat on lands unsuitable for timber production is evaluated for adequacy of distribution. Areas are then designated on lands suitable for timber production if they are needed to meet distribution standards

Standards and guidelines for the Forest Service Preferred Alternative (F) are briefly summarized in the following discussion Chapter 2 of the Final Supplement should be reviewed for a detailed description of the direction If Alternative F is selected, these regional standards and guidelines will provide specifications or standards for achievement of management requirements for northern spotted owls

1. Amount of Suitable Habitat in Designated Habitat Areas. Designated habitat areas shall contain 1,500 acres of suitable habitat within 1 5 miles of the nesting site in the Oregon Cascades physiographic province Habitat shall occur as one contiguous stand if possible or as a 300-acre stand containing the known or suspected nest site with the remaining habitat as contiguous as possible Each stand shall be larger than 60 acres

2. Spacing of Designated Habitat Areas Designate habitat areas where more than 6 miles separates areas which occur in reserved lands or in lands unsuited for timber production, and which are capable of supporting less than three breeding pairs of spotted owls, or where more than 12 miles separates such areas capable of supporting three or more pairs

3. Location of Designated Habitat Areas Designate habitat areas on lands suitable for timber production only as needed to meet spacing standards

4. Priority for Locating Designated Areas Priority for locating designated areas follows status of occupancy by spotted owls with the highest priority to locations with verified occupancy by spotted owl pairs, next highest to locations with confirmed sightings of owls, lowest priority to locations where only the suitability or potential suitability of habitat is known.

5. Management of Habitat Habitat can be managed with prescriptions for no scheduled timber harvest or those calling for uneven or even-aged harvest with an extended rotation to maintain suitable habitat within the area Prescriptions to be used and where they will apply shall be specified in the Forest Plans.

6. Identification of Suitable Habitat. Suitable habitat shall be identified in Forest Plans according to the general definition in the spotted owl Final Supplement and with concurrence by the Regional Forester.

The above information relates to the Final Supplement to the EIS for the Regional Guide and represents a change in direction when compared to the Draft Forest Plan for this Forest and will be incorporated into the Final Forest Plan and FEIS In the Draft Forest Plan and DEIS for the Deschutes, the following approach was taken

Principal Habitats Used

The northern spotted owl is listed as threatened by the State of Oregon and as sensitive by the Pacific Northwest Region of the Forest Service. The spotted owl requires well-spaced, old-growth and mature conifer habitat of a certain size and distribution pattern to maintain its viability. The spotted owl also serves as an indicator for other species that require older Forest environments.

Old-growth habitat is made up of multi-layered stands with large dead and defective trees--both standing and fallen. Normally, this condition occurs late in the natural succession of a stand.

Dispersal Distance Between Habitats

The MR was defined as 14 sites, distributed across the Forest Due to the limited amount and existing distribution of spotted owl habitat on the Deschutes National Forest, rigid distribution requirements could not be applied. Consequently, sites were selected where habitat and occupancy occurred

Size of Habitat Areas

Sites were selected that contained at least 1,000 acres of habitat including a nesting area and foraging habitat. The 1,000 acres are contiguous to the extent possible

The number of sites and their locations were determined through a series of field inventories that have been conducted since 1979. All potential habitat was mapped and then investigated in the field Most sites were visited two or more times. Through this process, approximately 37,900 acres of spotted owl habitat was established The established spotted owl management areas were modeled in FORPLAN by assigning the identified habitats to special management prescriptions

Three sites are wholly inside Wilderness or the Oregon Cascades Recreation Area (OCRA) Seven sites (about 6,600 acres) are wholly outside Wilderness or the OCRA, on lands tentatively suitable for timber production The remaining 4 sites contain 1,600 acres of Wilderness/OCRA and 4,800 acres of lands tentatively suitable for timber production.

PRIMARY CAVITY EXCAVATORS

Dead and defective tree habitat is provided in all management areas. The habitat would be at natural levels in Management Areas 1 (Special Interest Areas), 2 (Research Natural Areas), 4 (Spotted Owl), 6 (Wilderness), 9 (Scenic Views), 10 (Bend Watershed), 12 (Undeveloped Recreation), 13 (Winter Recreation), 14 (Oregon Cascade Recreation Area), and 15 (Old Growth). The amount of habitat in the other management areas varies, but must provide enough habitat for distribution across the Forest. Therefore, all prescriptions which allow timber harvest were designed to support at least 20% of the potential population capability of species dependent on dead and defective trees

This MR was modeled in FORPLAN by adjusting timber yields to reflect leaving snags and downed trees (See Yield Table Documentation in the process records for the amount and distribution of these trees)

In terms of on the ground management, a wide range of options exist for providing cavity excavator habitat. Options include leaving lesser or greater numbers of trees per acre as habitat The spatial arrangement of the habitat can also be varied. Individual trees can be distributed somewhat evenly over harvested areas, or can be clumped The size and distribution of habitat clumps can also be varied. Additionally, special areas could be dedicated to the habitat needs of cavity excavators and no residual trees provided elsewhere within harvested areas Regardless of the approach implemented on the ground, for a given standard such as 20% of the maximum potential population level, the same total numbers of trees would be provided for cavity excavator habitat over a defined geographical area

The timber yield tables were reduced by 1-5%, depending on species and management intensity, to reflect the future need for future dead and downed trees

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Principal Habitats Used

All habitats that are capable of producing trees.

Dispersal Distance Between Habitats

There are different primary cavity excavators in each habitat type Each species of excavator has its specific distribution requirements. Each Forest will provide the needed dispersal distance (Thomas, 1979, Brown, 1985).

Size of Habitat Areas

Because snags are provided on all acres of conifer and broadleaf plant types, there is no need to have an area requirement region-wide Each Forest will establish guidance to provide for the size of area Professional judgement is used where specific data is unavailable

"Hard snags" are required, realizing that hard snags decay into soft snags If enough hard snags are required, then the soft snags required will also be available (Thomas, 1979). Thomas (1979) suggested that primary cavity excavators be at or above 40 percent of potential population. This is if primary cavity excavators are going to affect the ecosystem Minimum viable populations may be below the level that affects the ecosystem.

Many biologists (Phillips and Roberts, 1985) felt comfortable with 40 percent levels and uncomfortable at 20 percent potential levels. Review of other MR indicator species showed reduction of those populations to below the 40 percent potential population. Therefore, 20 percent potential was selected as the management requirement standard. It was agreed that managing a Forest for 20 percent potential levels was not desirable but would maintain viability of the group

ALTERNATIVE WAYS CONSIDERED FOR MEETING THE MANAGEMENT REQUIREMENT

Application of the regional direction for size and dispersal of habitats to the Deschutes National Forest requires that approximately 19,400 acres of mature and old growth Forest, outside of Wilderness or other lands not suitable for timber production, be retained as wildlife habitat for the four indicator species and other species occupying the same habitat. In this analysis habitat requirements for the northern three-toed woodpecker, pine marten and goshawk are not considered separately since all three species require the same type of habitat, though in differing amounts In order to reduce the total amount of mature and old growth Forest necessary to provide for viable populations, every opportunity was taken to overlap areas managed for the indicator species Consequently, opportunity costs for one species cannot reasonably be considered separately from the other two

In the published DEIS the Deschutes elected to provide mature habitat by managing areas in the allocation of lands. One other way of meeting the management requirement was considered prior to selection of this strategy and that was to dedicate the necessary habitat areas with no timber harvest permitted

The Forest considered two ways or means for providing spotted owl habitat One is to dedicate the required number of acres of suitable habitat in each site These areas would not be managed for timber production and would be expected to remain in suitable habitat over time The second way is to manage timber stands through long rotations in order to produce replacement stands over time

All of the alternate ways examined for meeting the dead and defective tree habitat requirement would result in the same opportunity costs No additional reasonable alternatives were identified other than the three distribution schemes described in Table I-2. Consequently, no additional opportunity cost analysis is presented in this Appendix

Analysis of Opportunity Costs

Table I-8 displays the opportunity costs associated with the two ways of meeting the viable wildlife populations management requirement

The Final Supplemental Environmental Impact Statement to the Regional Guide (for spotted owl habitat management guidelines) does not include the number of designated habitat areas as part of any alternative because that will be a consequence of applying standards and guidelines in Forest Plans, rather than being a specification in the Regional Guide.

In preparation of the DEIS for the Deschutes Forest Plan, the two alternative ways of providing spotted owl habitat were evaluated on the basis of ten 1,000 to 1,200 acre sites. With adjustments for overlap on unsuitable lands, 7,200 acres of spotted owl habitat were needed to meet the management requirements discussed in the DEIS Similar results can be expected when evaluating management or dedication of four additional sites and enlarging all to 1,500 acres as proposed in the spotted owl Final Supplement. This analysis will be updated in the Final EIS for the Forest Plan and will incorporate the final decision on the standards and guidelines and resulting spotted owl habitat network on the Forest as determined by the SEIS Record of Decision.

Under a dedicated strategy, each acre of habitat is withdrawn from timber production entirely and all other acres are available for scheduled harvest. In the managed habitat strategy, small size regeneration harvests or uneven-aged harvest methods are applied to a limited number of acres each decade in order to maintain the old growth habitat character. For mature habitat, 100 year timber rotations are applied.

Consequences of the Different Ways of Meeting the Management Requirements

Populations of northern three-toed woodpeckers, pine marten, goshawk, spotted owl and other mature and old growth forest-dependent species would not be expected to differ significantly under any of the different ways considered to meet the management requirement. There are, however, differences in the opportunity costs. These are displayed in Table I-8

Table I-8, APPROXIMATE CHANGE (OPPORTUNITY COST) ASSOCIATED WITH MEETING THE VERTEBRATE SPECIES MANAGEMENT REQUIREMENT

	First-Decade Allowable Sale Quantity MMCF/Year (MMBF/Year)	Percent Change in Allowable Sale Quantity[1]	Present Net Value (MM$)	Percent Change in Present Net Value
MAXIMUM PNV BENCHMARK AS DISPLAYED IN THE DEIS	51.2 (268.2	--	1133.3	--
OPPORTUNITY COST (MMCF/ YEAR, MMBF/YEAR, MILLIONS OF DOLLARS OF PNV, AND PERCENT)				
Total Opportunity Cost of the Selected Way of Meeting the MR for Viable Populations (Managed Habitat)	-0.5 (-2 6)	-0.9	-10.8	-1.0
Opportunity Cost of Providing for Northern Three-Toed Woodpecker, Pine Marten and Goshawk (+0.2)	+0.03	+0 1	-1.0	-0.1
Opportunity Cost of Providing for Northern Spotted Owl	-0.5	-0 9	-9.8	-0.9
Total Opportunity Cost Using Dedicated Habitat	-1 1 (-5 8)	-2 1	-24.9	-2.2

Table I-8, APPROXIMATE CHANGE (OPPORTUNITY COST) ASSOCIATED WITH MEETING THE VERTEBRATE SPECIES MANAGEMENT REQUIREMENT (continued)

	First-Decade Allowable Sale Quantity MMCF/Year (MMBF/Year)	Percent Change in Allowable Sale Quantity[1]	Present Net Value (MM$)	Percent Change in Present Net Value
Opportunity Cost Using Dedicated Habitat for Northern Three-Toed Woodpecker, Pine Marten and Goshawk	-0 5 (-2 6)	-1.0	-11.3	-1 0
Opportunity Cost Using Dedicated Habitat for Northern Spotted Owl	-0.6 (-3.1)	-1.1	-13.6	-1.2

MMCF/YR = Millions of cubic feet per year

MMBF/YR = Millions of board feet per year

MM$ = Millions of dollars

[1]Percent change calculated on cubic foot basis

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Rationale for the Selected Method

Based on the preceding analysis, it was determined that for the Deschutes situation, the managed habitat approach would best achieve desired mature and old growth Forest habitat, while having the least effect on outputs of other resources.

In addition, the managed approach has less effect on timber ASQ and PNV than the dedicated approach.

Implications for Forest Plan Alternatives

Alternatives were designed to address public issues As a result most alternatives, including the preferred alternative, incorporate objectives for retention of old-growth and mature timber for wildlife, visual, and recreational purposes, at levels higher than needed to meet many of the basic management requirements. Consequently, there are no associated opportunity costs with satisfying the MR in the context of some Forest Plan alternatives or there are lower opportunity cost than those presented in the analysis of the Maximum PNV Benchmark

Role of Monitoring and Research

The monitoring plan (Forest Plan Chapter 5) calls for monitoring populations and habitats of northern three-toed woodpeckers, pine martens, goshawks, and spotted owls as well as primary cavity excavators. In future planning efforts this data will be considered in determining the suitability and effectiveness of the selected way for meeting the management requirement for viable populations. This is important in testing the appropriateness of the selected modeling assumptions If the results of monitoring indicate a significant change in assumptions or estimated outputs, the Forest Plan can be amended or revised in accordance with procedures detailed in Chapter 5 of the Forest Plan.

BIBLIOGRAPHY

Brown, Reade E (Editor), 1985 *Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington.* USDA Forest Service, Portland, OR.

Burde, T.E., 1982 *Marten* (unpublished). Colville National Forest, Washington.

Burnett, B W. 1981. *Movements and Habitat Use of American Marten in Glacier National Park, Montana.* M S. Thesis. Univ. of Montana. Missoula, MT.

Camillere Ernie, 1981 *Personal Communication.* Modoc National Forest.

Campbell, T.M., 1979 *Short-Term Effects of Timber Harvest on Pine Marten Ecology* M S Thesis Colorado State University. Ft. Collins, Colorado. 71 pages.

Forsman Eric D., 1980 *Accipiter Management on the Fremont National Forest* USDA Forest Service Lakeview, Oregon

Guenther, K and Kucera T , October 1978. *Wildlife of the Pacific Northwest.* USDA Forest Service, Pacific Northwest Region.

Hawley, V.D and Newby F.E. 1957 *Marten home ranges and population fluctuations in Montana* J Mammal. 38:174-184.

Irwin, L.L. 1987 *Review of minimum management requirements for indicator species pine marten and pileated woodpecker.* National Council of the Paper Industry for Air and Stream Improvement Tech Bull No. 522. New York 24p.

Jackman Siri M and Dr. J. Michael Scott, 1975. *Literature Review of Twenty-three Selected Forest Birds of the Pacific Northwest.* USDA Forest Service, Pacific Northwest Region. 382 pages.

Jonkel, C.J. 1959. *Ecological and Physiological Study of the Pine Marten* M S Thesis Montana State Univ. Missoula, MT.

McGowan, Jerry D 1975. *Distribution, Density and Productivity of Goshawks In Interior Alaska* Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration, Project Report W17-3, 4, 5, 6.

Phillips, C.A and Roberts R., June 4, 1985. *Documentation of Wildlife MMRs* USDA Forest Service Memo.

Phillips, et al., January 1981. *Wildlife Habitats and Species Management Relationship Program*

Reynolds, Richard T. 1983 *Management of Western Coniferous Forest Habitat for Nesting Sccipiter Hawks.* USDA Forest Service General Technical Report RM-102 7 pages Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado

Thomas, J. W. Edited 1979. *Wildlife Habitats in Managed Forests· The Blue Mountains of Oregon and Washington.* USDA Agriculture Handbook No 553. Washington, D.C.

USDA Forest Service, June 1986. *A Report on Minimum Management Requirements for Forest Planning on the National Forests of the Pacific Northwest Region, USDA Forest Service.*

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