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Old-growth forests provide an important resource in terms of both timber and non-timber values. Northwest Oregon represents an area where this resource is scarce and options for preserving old-growth habitat are limited. This study identifies the old-growth resource on public lands within the area, suggests a range of preservation alternatives for remaining old-growth stands, and assesses the effects of these alternatives on harvest levels, present net values, payments to counties, and the forest products industry.

Alternatives range from setting aside a distribution of old-growth tracts to preserving all remaining old growth. Acreages withdrawn vary from 3,027 to 21,627 acres.

Harvest scheduling and economic effects of these alternatives vary over time. In the short term, harvest levels drop by a greater percentage than the percentage of the land base withdrawn. Alternative harvest schedules represent present net value opportunity costs of 16 to 74 million dollars.

Harvest Scheduling and Economic Effects of Old-Growth Forest Preservation in Northwest Oregon

by

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

HARVEST SCHEDULING AND ECONOMIC EFFECTS OF OLD-GROWTH FOREST PRESERVATION IN NORTHWEST OREGON

INTRODUCTION

Old-growth timber has been harvested in western Oregon for over 50 years. Only recently has this become a major concern. Much of the concern is related to wildlife habitat requirements. It has been observed that "of the timber management objectives that most influence wildlife in the Northwest, the programmed liquidation of old-growth forests has become the focal forestry-wildlife issue" (Meslow et al. 1981).

Bureau of Land Management (BLM) and U.S. Forest Service (USFS) policy is to maintain habitat to support viable populations of native wildlife. Research suggests that as many as 18 bird and mammal species may find optimum habitat in old-growth Douglas-fir forests (Meslow et al. 1981, Franklin et al. 1981).

Although much attention has been focused on declining northern spotted owl (*Strix occidentalis caurina*) populations, biologists stress that this is only an indication of a more widespread problem. Elimination of old-growth forests may have negative effects on other species of plants and wildlife which rely on this type of habitat. Because little is known about the requirements of many of these species, it is hoped that by maintaining old-growth habitat for spotted owls, suitable habitat for other species will also be provided (Forsman et al. 1982).

The challenge of old-growth management is in how it will be implemented. Economic costs of setting aside large areas of old growth are potentially high. These areas often contain large volumes of high quality timber. Not only would the value of the standing timber be lost, but if permanent set-asides are proposed, all future timber yields from many productive sites would also be foregone.

The objective of this study is to identify the old-growth resource on public lands in northwest Oregon, to suggest a range of preservation alternatives for the remaining old-growth areas, and to address the economic effects of the alternatives considered. The focus is on public lands because very little old growth remains on privately owned lands and preservation of wildlife habitat is primarily a public land management issue. The study only looks at the economic costs of foregoing harvests on these areas and does not attempt to assign a value to the more intangible benefits of old-growth preservation. These assessments of economic opportunity costs associated with old-growth set-asides provide a means of evaluating tradeoffs between the value of the timber resource foregone and nontimber values which would be preserved.

STUDY AREA

An eight-county region of northwest Oregon was chosen for this study (Figure 1). This area has only a small percentage of commercial forest land in the 180-year old and older age classes (Beuter et al. 1976). Sixty-three percent of the commercial timberland is privately owned, and the BLM and USFS timberland in this area is among the most heavily cutover of that managed by these two agencies in the Northwest (Meslow et al. 1981). Along with a history of early logging, the region has been affected by large forest fires in recent times, most notably the Yaquina Fire (1850's) and the Tillamook Burn (1930's).

The old-growth resource in Northwest Oregon is scarce. This means that critical habitat for old-growth dependent wildlife has been severely depleted, and distributional options for preserving remaining old-growth islands are limited.

The forest products industry in this area is also unique for western Oregon. Because of the scarcity of larger old-growth timber the northwest Oregon forest industry processes the highest proportion of young-growth logs of any resource area of the State (Howard et al. 1978, Howard 1984). Few mills are dependent solely on old-growth timber as their main source of raw material.

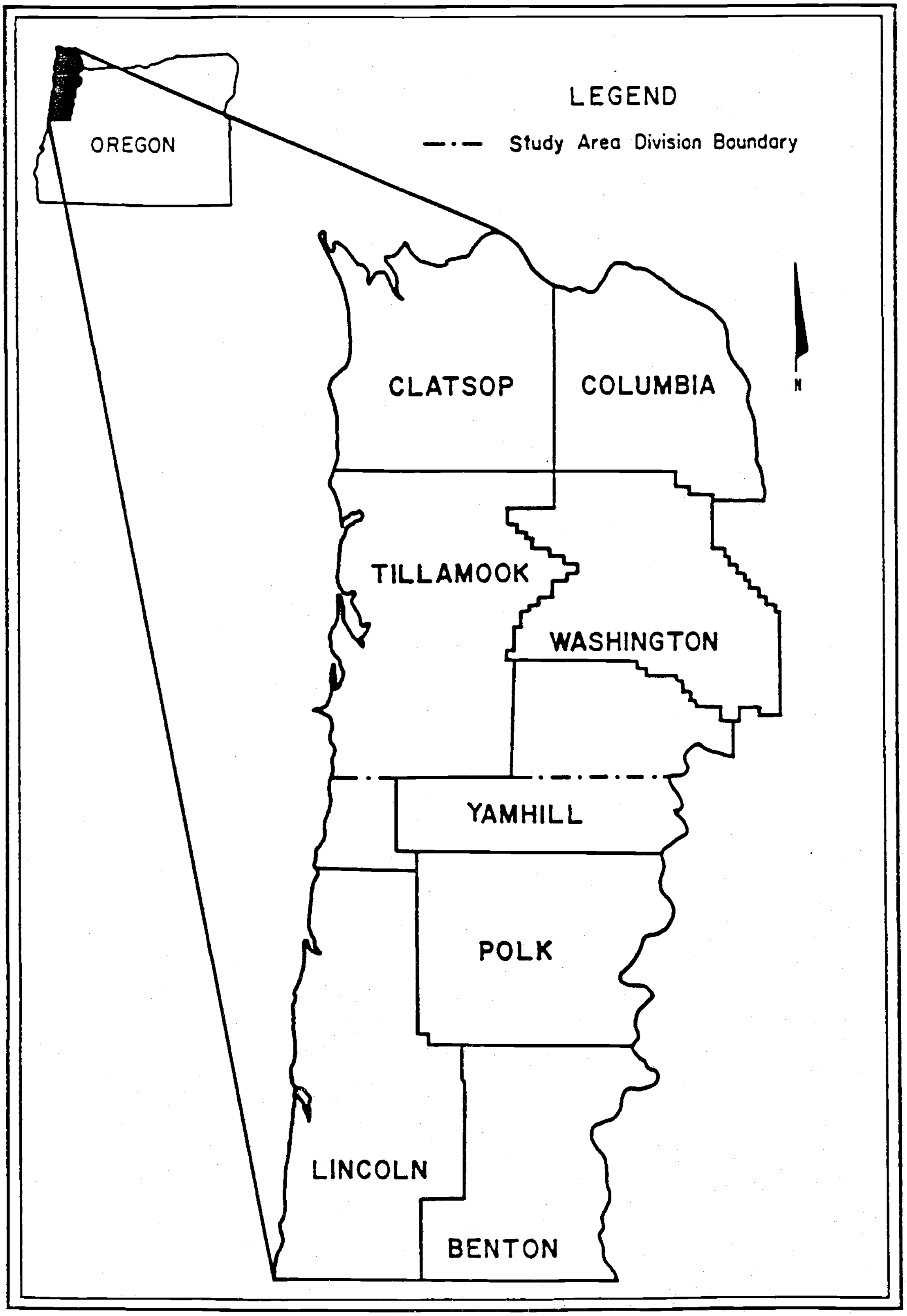

Figure 1. Old-Growth Study Area, Northwest Oregon

DEFINITION OF OLD GROWTH

The term "old-growth forest" often implies different things to different people. In order to suggest preservation options for old growth, criteria for identifying existing areas had to be determined.

Research dealing with ecological characteristics of old-growth forests in the Douglas-fir region emphasizes characteristics of structure, composition, and function. Old-growth stands display a wide variety in structural characteristics. However, typical distinctive features include: (1) two or more tree species, generally long-lived dominants with shade-tolerant species in the understory, (2) a multi-layered canopy, (3) large, live old-growth trees (greater than 200 years of age and greater than 40 inches d.b.h.), (4) coarse woody debris, and (5) large snags and downed logs (Franklin et al. 1984). Age alone does not determine whether a stand is old growth, because these characteristics develop at varying rates depending on site conditions and stand history. On medium to high site lands in the northwest Oregon coastal environment, old-growth characteristics probably emerge at about 175 to 200 years of age (Franklin et al. 1984, 1981, Society of American Foresters 1984).

The USDA Forest Service Pacific Northwest Regional Guide, which provides management direction for the national forests in Oregon and Washington, defines an old-growth stand as containing mature and overmature trees in the overstory, multi-layered canopies, standing dead and down trees, and evidence of human activities that, if present, do not significantly alter the other stand characteristics. Minimum acceptable characteristics for the spruce/cedar/hemlock and cedar/hemlock/Douglas-fir types within the study area are listed as:

> "...at least 60 percent of the overstory canopy level is dominated by large individual trees...The stand will contain some trees with stem diameters 32 inches or greater, an average of two snags per acre, and 30 tons of down logs per acre...Stands in these forest types will be considered old-growth until there are fewer than five overmature trees per acre..." (USDA Forest Service 1984).

These descriptions suggest how the determination of an old-growth stand could be made. However, much of this information is not readily available from forest inventories. For the purposes of this study, the initial criterion for defining old-growth areas was an average stand age of at least 180 years. The locations and acreages of such stands were recorded and mapped. The number of stands so defined probably exceeds those that would meet the qualitative definition of old growth in terms of ecological characteristics. However, no attempt was made to further screen the areas because that would require more site-specific information than was available for the individual stands.

There are various reasons why some of the areas assumed to be old growth in this study are not representative of the typical old-growth type. Average site productivities in this part of the Coast Range are moderate to high. Therefore, large diameter trees may develop in a shorter period of time than on lower sites and, if these stands are identified using aerial photographs or limited field sampling, they may be inaccurately typed as old growth without having the additional old-growth stand characteristics of large snags and downed logs.

Another important reason why the old-growth areas in this study may not be representative of the previously-defined old-growth type is the history of logging and fires in the northwest Oregon area. Many of these stands consist of residual old-growth trees with a much younger understory. Therefore, despite the presence of genuinely old trees, other components such as snags and downed material may be absent.

Although many of the areas may not meet an ecological definition of old growth, they probably represent areas closest to the desired condition and, if preserved, might, over time, develop the characteristics they lack.

MANAGING FOR THE OLD-GROWTH ECOSYSTEM

Old-growth retention serves two wildlife management objectives, maintenance of overall habitat diversity and support of viable populations of old-growth dependent species. Although much attention has focused on individual species' habitat requirements, such as those of the northern spotted owl, biologists stress that the intent is to manage for the old-growth community (Meslow et al 1981).

Recommendations for preservation of an old-growth system often have a basis in island biogeography theory. If remaining old-growth stands are looked upon as habitat islands within the younger, managed forest, key variables such as the number, size, and distribution of these areas must be considered to manage an effective system. Harris (1984) suggests for a given percentage of forest acreage committed to old-growth retention, an interconnected network of many old-growth stands and travel corridors of moderate size is better than a few large but isolated old-growth tracts. A log-normal frequency distribution of island size and numbers would allow for this type of system (Figure 2).

When fitting this approach to the landscape, biologists recommend that special emphasis be given to locating the smaller old-growth stands within riparian areas. These ideally would be connected to serve as travel corridors for dispersal to larger habitat islands, parks, and wilderness areas. Maintenance of large old-growth tracts at low elevations is also considered a priority since these areas afford the greatest species richness and productivity (Harris et al 1982, Harris 1984).

Support for this type of old-growth retention system has been echoed by many biologists and ecologists (Franklin et al 1981, Luman and Neitro 1980, Juday 1978). To ensure that habitat is available to support viable populations of old-growth dependent species, this

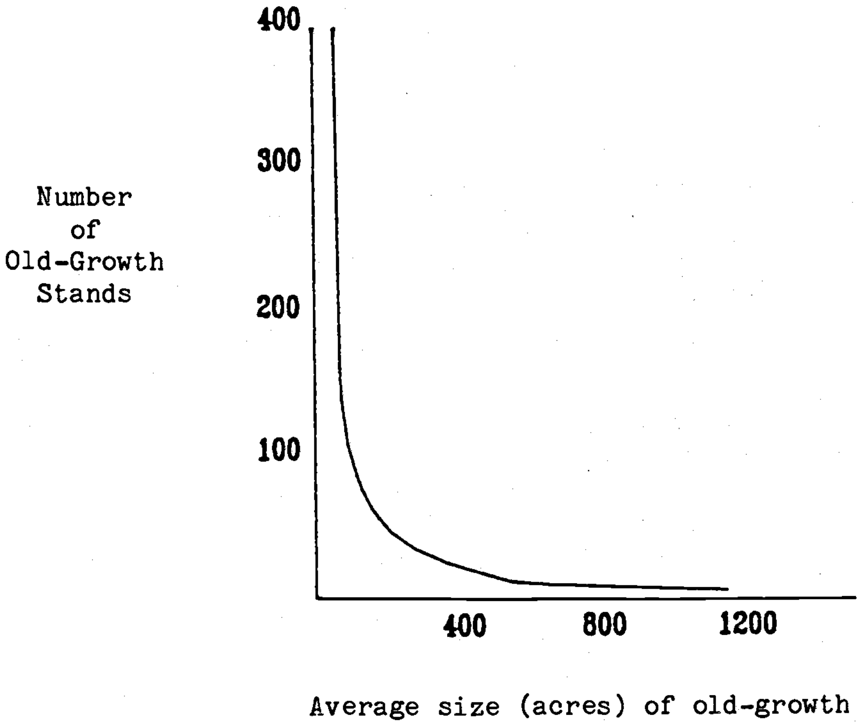

Figure 2. Hypothetical Log-normal Old-growth Island Size Frequency Distribution (Adapted from Harris 1984).

idealized system also needs to incorporate individual species' requirements in the determination of distribution and island sizes. Minimum island size for a viable old-growth stand is difficult to assess. Habitat usefulness is related to the old-growth island's effective size, that is, the stand area which remains relatively free of disturbance from outside forces. Areas which are contiguous with less exposed perimeter are probably better candidates for preservation than narrow strips of isolated old growth which are susceptible to windthrow.

Small parcels of 50 to 100 acres may meet the requirements of cavity-dwelling birds, bald eagles, and species with small home ranges, as well as serving as dispersal corridors for juvenile spotted owls (Forsman et al, personal communication, 1983). Areas of 300 to 500 acres are sufficient for many plants and animals (Franklin et al 1981), and 1,000 to 2,200 acres have been suggested as minimum acreages to manage as home ranges for a pair of spotted owls (Forsman et al 1984, Mahlein 1985).

Given the variability in habitat requirements, one possible scenario for incorporating species needs into the overall old-growth network would be to use estimates of the largest home range requirements, in this case the spotted owl, to set the range of sizes, numbers, and distribution of the largest individual old-growth islands in the system. Based on current research, these areas would generally be in the range of 1,000 to 3,000 acres in size and would be distributed from 1.2-6.2 miles apart (Forsman et al 1984, Mahlein 1985). Then, using the log-normal distribution for number of islands of a given size, additional islands in the intermediate size category (200-1,000 acres) and the greatest number of islands in the smallest viable size range (50-200 acres) would be added to the old-growth system. These smaller areas would be situated, if possible, to act as travel corridors connecting the old-growth islands within the network.

These concepts highlight an approach for maintaining an idealized system of old-growth preserves. In northwest Oregon, the extent to which this type of system could be achieved is limited by the small number of remaining old-growth stands and their irregular distribution.

OLD-GROWTH INVENTORIES

Four agencies manage significant acreages of public forest lands in northwest Oregon: the Oregon State Department of Forestry (OSDF), the Oregon State Department of Parks and Recreation (OSP), the Bureau of Land Management (BLM), and the U.S. Forest Service (USFS).

Each of these agencies was contacted to determine old-growth inventories and locations using the initial criterion of an overstory age of 180 years or older.

OREGON STATE DEPARTMENT OF FORESTRY

The Department of Forestry's inventory system shows just over 300 acres in age classes 170-years and older (OSDF 1980). Out of five parcels within the area, four are less than 50 acres in size. These areas were disregarded in the preservation alternatives because they are too small and isolated to provide a significant source of old-growth habitat. The largest OSDF old-growth area, 168 acres, is shown on the map of existing distribution. This tract, although relatively small, could serve as a viable unit to preserve some old-growth characteristics in an area comprised of primarily younger-aged timber. It is not included in the analysis of old-growth preservation because the economic effects of withdrawing this area from harvesting would be insignificant.

OREGON STATE DEPARTMENT OF PARKS AND RECREATION

The Department of Parks and Recreation manages seven State Parks within the study area each of which contains old-growth areas larger than 20 acres (Table 1). Although an age class breakdown was not readily available for these stands, they are believed to be over 180 years old. These areas are generally reserved from harvesting, although salvage logging has been done in the past in some of these Parks (A. Tocchini, personal communication, 1983). Therefore, these areas are included in the assessment of old-growth distribution but are not discussed as an opportunity cost related to the preservation alternatives because they are already withdrawn from harvesting.

TABLE 1 -- Oregon State Parks [1/]
Old-Growth Acreages
Northwest Oregon

Name of Park	County	Total Park Acres	Old-Growth Acres
Ecola State Park	Clatsop	1,909	500
Oswald West State Park	Clatsop, Tillamook	2,474	1,476
Saddle Mountain State Park	Clatsop	3,042	250
Sunset Highway Forest Wayside	Columbia, Tillamook, Clatsop, Washington	1,000	150
Cape Meares State Park	Tillamook	233	180
Cape Lookout	Tillamook	1,974	380
Van Duzer Forest Corridor	Lincoln, Polk, Tillamook	1,513	590
Totals		12,145	3,526

[1/] Only Parks with greater than 20 acres classified as old growth are included here.

(Taken from Oregon State Parks data compiled by A. Tocchini, 1983).

BUREAU OF LAND MANAGEMENT

The BLM's Westside Salem District, excluding Lane County, falls within the study area. The total suitable commercial forest land base, less areas withdrawn as problem sites (adverse locations, fragile soils, or reforestation problems), includes 197,917 acres of coniferous forest and 10,084 acres of hardwoods. The 1980 timber inventory data shows 7,596 acres in the 175-year-old and older age classes. Ninety-seven percent of these areas are in the 195-year and older age classes, and 57 percent are in the 255-year and older age class. The plot data for these stands shows an average diameter at breast height of 43 inches and an average stocking level of 47 trees per acre. Species composition is primarily Douglas-fir and hemlock in the overstory and Douglas-fir, hemlock, and red alder in the understory (Derived from USDI Bureau of Land Management Planning Records 1983).

Another BLM inventory component has an overstory age of close to 180 years or older. It is comprised of stands with a poorly stocked overstory of old-growth trees with a younger understory. BLM wildlife biologists have chosen to regard these areas as potential old-growth wildlife habitat because so little suitable habitat remains (R. Hershey, personal communication, 1983). There are 6,151 acres of this category in the commercial land base. Acreages are distributed throughout the younger age classes in the inventory according to the understory average age. Sixty-eight percent have an understory age of 75 years or older, and 30 percent have an understory age of 100 years or older. These areas were considered to be suitable as old growth for the purpose of this study.

Only 430 acres of BLM old-growth stands in both the poorly stocked and better components are withdrawn from the land base suitable for timber production. The reason for withdrawals are reforestation problem areas, poor soil conditions, or generally adverse sites.

U.S. FOREST SERVICE

Roughly 50 percent of the Siuslaw National Forest lies within the study area. Total commercial timberland in the area, less withdrawals for Drift Creek Wilderness, Cascade Head Experimental Forest, and problem sites left for soil and water protection, is 242,674 acres.

Data from the Forest's 1979 inventory, updated for sales sold after that time, was the basis for determining acreages. However, the initial inventory did not distinguish old growth as a separate component. Instead, all old-growth acreages were included in one of two mature stand components. The first of these was a component identified to be greater than 90-percent conifer stocking. The other component is a mixed type with between 50- and 90-percent conifer stocking and between 10- and 50-percent hardwoods (N. Graybeal, personal communication, 1984).

From these mature inventory components, an assessment was made for planning purposes by the Forest wildlife biologist as to which areas would qualify as old growth. These areas are believed to be greater than 175 years of age and generally meet the USDA Forest Service Pacific Northwest Regional Guide criteria for the old-growth

Douglas-fir types (C. Phillips, personal communication, 1983). Based on this assessment, a subset of 10,256 acres is considered old growth out of the mature conifer component, and 3,608 acres were typed as old growth from the original conifer with hardwood mature inventory component. Of this total of 13,864 acres, 2,287 acres are within the Drift Creek Wilderness Area, 1,719 acres are in the Cascade Head Experimental Forest, and 1,978 acres are withdrawn from the suitable land base for soil and water protection. Remaining are 7,880 acres of old-growth in the commercial forest base - 6,124 acres of the conifer old-growth component, and 1,756 acres of the mixed conifer with hardwood component (Derived from USDA Forest Service Planning Records 1984).

Table 2 summarizes the information for the three agencies.

TABLE 2 -- Old-Growth Acreages Within Northwest Oregon

Agency	Old-Growth Acreages Presently Withdrawn[1]	Old-Growth Acreages Available for Timber Production	Total Old-Growth Acreages
OSP	3,570	--	3,570
BLM	430	13,747	14,177
USFS	5,984	7,880	13,864
Totals	9,984	21,627	31,611

1/ Withdrawn acreages for the BLM and USFS only include areas within Drift Creek Wilderness, Cascade Head Experimental Forest, or acres withdrawn as problem sites (fragile soils, potential reforestation problems, soil and water protection, or adverse location).

EXISTING DISTRIBUTION

In order to achieve some spatial resolution to the preservation alternatives, existing old-growth areas from the OSDF, OSP, BLM, and USFS inventory data were delineated on a base map of the study area. Stand location data was taken from OSP location maps and OSDF, BLM, and USFS forest type maps. Isolated tracts less than 20 acres in size were not included.

The stands were coded for relative size. This map and the stand summary data corresponding to each area were the basis for deriving the acreage and distribution information for the alternatives.[1]

Figures 3 and 4 depict the distribution of old-growth areas for the four agencies in much less detail than the original map. Some of the smallest areas are left off these maps since they would not be discernible at this scale.

Very little old growth remains on public lands in the north half of the study area. Within the south half, the majority of the tracts are small and isolated. The largest approximately contiguous tract, 3,328 acres, falls within the City of Corvallis Watershed in Benton County. Cascade Head Experimental Forest in Tillamook County and Drift Creek Wilderness Area in Lincoln County contain the largest tracts of old growth presently withdrawn from harvesting.

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[1]The original map is available for examination at Oregon State University, Department of Forest Management, College of Forestry, Corvallis, Oregon.

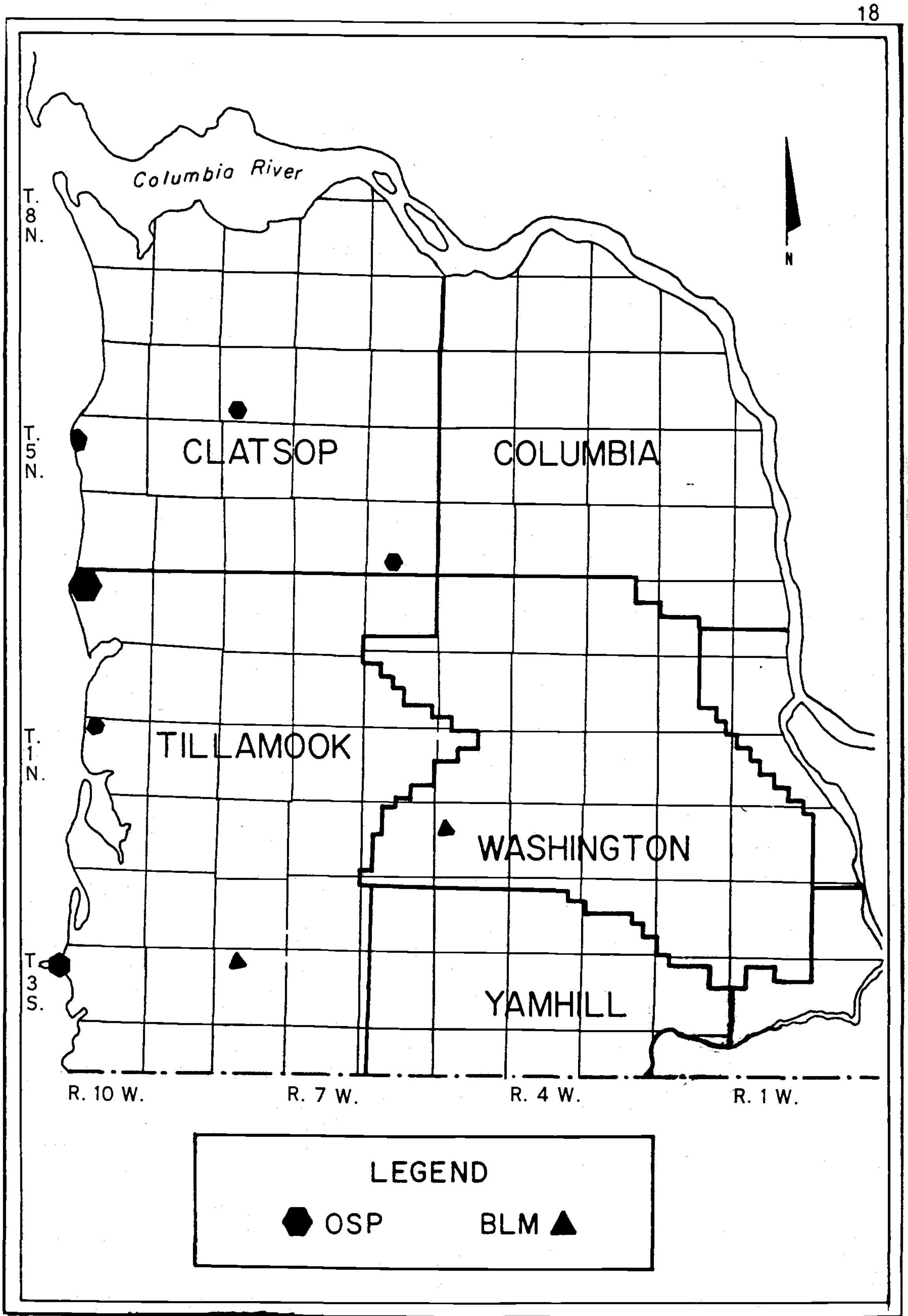

Figure 3. Ownership, Location, and Relative Size of Old-Growth Tracts North Half of Study Area. (Individual tract sizes displayed range from approximately 100 to 1,500 acres.)

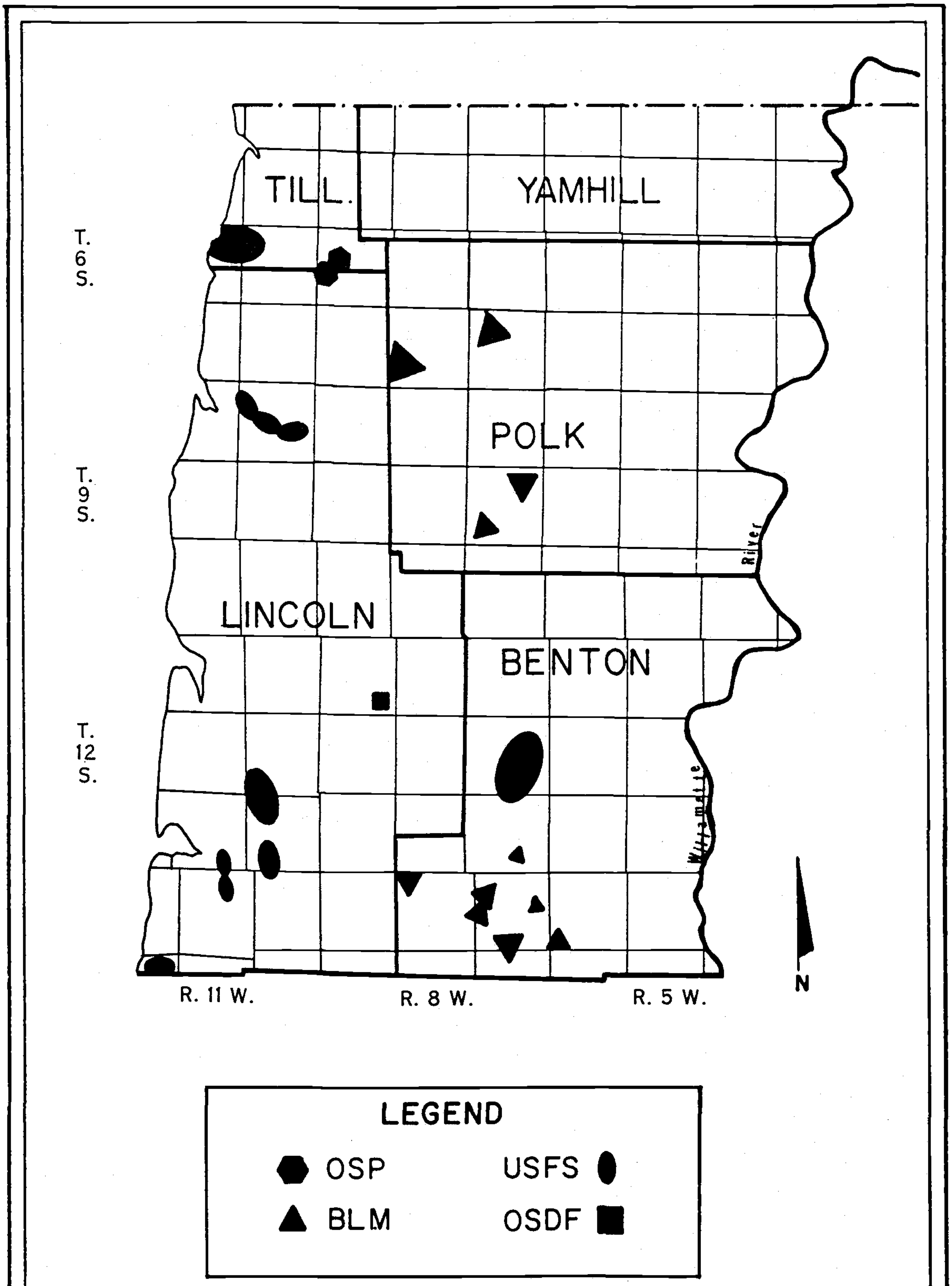

Figure 4. Ownership, Location, and Relative Size of Old-Growth Tracts South Half of Study Area. (Individual tract sizes displayed range from approximately 100 to 3,300 acres.)

ALTERNATIVES CONSIDERED

The retention of old-growth ecosystems has received considerable attention in the last few years. Although there is no national policy specifically requiring retention of old-growth stands on federal lands, this direction has been implied in some of the major forest policy statutes in the last 25 years (Teeguarden 1984).

On National Forest lands, old-growth retention is largely guided by the Multiple Use-Sustained Yield Act of 1960, the Endangered Species Act of 1973, and the National Forest Management Act of 1976. Requirements that the National Forests be managed to maintain viable populations of native and desired non-native species and to provide for species diversity have led to a policy of retaining some old-growth stands. (USDA Forest Service 1984).

Authority and direction for old-growth preservation on BLM lands in the northwest Oregon area is not as easily defined. The majority of the lands managed by the BLM in this area fall under the requirements of the O&C Act of 1937. Although the Act specifies that O&C lands be managed for permanent forest production, it also allows for the resource to be maintained for various other purposes.

Principles for managing the O&C land resources are set forth in a 1983 BLM policy statement. Although the primary management objective for these lands remains "a high-level and sustained-yield output of wood products," other resource objectives may also be considered. Timber harvesting may be restricted or excluded on suitable forest lands in order to protect habitat of native wildlife species and species which are federally or state-listed as threatened, rare, or endangered (Society of American Foresters 1984).[2]

The precedent exists for setting aside areas for special management on both BLM and National Forest lands. The concerns are: how much land should be set aside; in what distribution; for what management objectives; and what are the trade-offs and consequences of these set-asides?

This study is limited to examining the economic consequences of old-growth withdrawals in terms of changes in potential harvest levels, changes in revenues to affected counties, and a general assessment of effects on the area's economy.

Four alternatives were examined which include a range in tract sizes to be withdrawn and distribution of these old-growth islands over the area. Locational data for the alternatives was taken from the base map for the study area. None of these alternatives necessarily provides an ideal distribution of old-growth preserves for wildlife habitat. However, the options are limited by the existing distribution of old-growth tracts. Only existing stands meeting the criteria for old growth in this study were considered as potential candidates for set-asides. The "Report of the SAF Task Force on Scheduling the Harvest of Old-Growth Timber" concludes "the best way to manage for old-growth is to conserve an adequate supply of present stands and leave them alone" (Society of American Foresters 1984).

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[2]These references to policies and laws pertaining to old-growth retention are only provided to show intent by the USFS and BLM to maintain some old-growth ecosystems. They are not intended to imply that this is definitely a legal requirement for these two agencies.

Harris (1982), using island biogeography principles, suggests,

> "...remnant patches of old-growth salvaged from much larger, continuous stands are projected to support a greater number of species than would a...stand that developed in isolation...This provides incentive to conserve existing old-growth rather than depend on the development of replacement stands."

The alternatives are described here in summary form. Additional information on calculation of tract sizes, forest types, age classes, and acreages is contained in Appendix A. An old-growth area was considered to be a viable tract if the area was contiguous or if parcels were within no more than approximately one-quarter mile of each other. This assessment was made to allow flexibility to include areas which were not shown on the map scale as being connected but may actually be close enough to represent a viable unit.

The alternatives are presented in terms of changes in BLM and USFS lands available for timber harvest. All commercial forest land in these ownerships was considered available except areas in wilderness, the experimental forest, or withdrawn as problem sites. State Park old-growth information is not discussed for each alternative since these areas are already reserved from harvesting.

ALTERNATIVE #1

This alternative was designed to include those tracts within the area that are approximately 1,000 acres or larger. Only five tracts meet this criterion. They lie in Cascade Head Experimental Forest, Drift Creek Wilderness and surrounding old-growth stands outside the wilderness, a portion of the City of Corvallis Watershed, and include a Siuslaw National Forest tract in Lincoln County, and a BLM tract in Polk County.

A total of 6,310 acres of lands suitable for timber production would be withdrawn in this alternative. Of this, 5,320 acres is on lands administered by the Siuslaw National Forest, and 990 acres is on BLM lands. The resulting distribution of old-growth tracts is skewed to the western and southern portions of the study area. Because so few large tracts remain in the area, no attempt was made to define a desirable distance between the areas. However, the distance between old-growth islands would well exceed the maximum 6.2 mile interval recommended for spotted owl habitat to prevent populations from becoming reproductively isolated (Forsman et al 1984).

ALTERNATIVE #2

This alternative examines setting aside all old-growth tracts that are 200 acres or larger. Included are all those areas discussed in the first alternative plus additional old-growth parcels between 200 and 1,000 acres.

Total acreage removed from the harvestable land base is 9,776 acres. Siuslaw National Forest lands comprise 6,085 acres of the total and BLM lands make up the other 3,691 acres withdrawn.

Again in this alternative, no attempt was made to discriminate because of location of these areas. Because the smaller tracts were included, more tracts were considered to be suitable. Only three more areas (in addition to those in Alternative #1) were available on National Forest lands and ten additional areas were available on BLM lands. This highlights a difference between the Siuslaw and BLM's inventoried old growth in the area. Remaining stands on the Siuslaw National Forest tend to be larger tracts (1,000 acres or more), and many are concentrated in special areas such as wilderness, the experimental forest, or the Corvallis Watershed. On the other hand, remaining BLM old-growth areas are much smaller and occur in scattered parcels over the study area.

ALTERNATIVE #3

This alternative examines setting aside a distribution of 200- to 300-acre tracts with a desired distance of three to six miles between old-growth areas. However, given the existing location of stands, the spacing is often much greater than 6 miles between tracts. Where existing preserves, such as State Parks, wilderness, and the experimental forest fit the desired pattern, these areas were utilized instead of other lands not presently withdrawn from harvesting. Tract size for additional set asides was limited to approximately 300 acres. The least acreage, only 3,027 acres total, is withdrawn in this alternative; 966 acres occur on the Siuslaw National Forest and 2,061 acres on the BLM Salem District lands.

ALTERNATIVE #4

This alternative considers setting aside all old-growth areas greater than 20 acres in size on USFS and BLM lands. Total acreage removed from the lands available for harvest would be 21,627 acres, with 7,880 acres of this from National Forest lands and 13,747 acres on BLM lands. Included are old-growth areas which occur in isolated small parcels throughout the study area. Some of these areas may be too small to be free of disturbance from outside influences. However, this alternative comes the closest to meeting suggestions of biologists on how to manage old-growth stands for species diversity and maintenance of viable populations of wildlife. Recommendations have focused on "...development of an interdependent system of strategically located habitat islands interconnected by habitat corridors" (Harris et al 1982). This same theme has been echoed by Juday (1978) in his rationale for a network of old-growth enclaves and again by Harris (1982) who suggests that for a given acreage commitment to old-growth management,

> "...it is not clear that larger but fewer islands will maintain more species...A well integrated old-growth island system consisting of a large number of islands interspersed throughout the matrix of the managed forest is probably a better alternative..."

Although this analysis only considered existing inventoried old-growth areas as candidates in the alternataives, it may be desirable in some cases to include surrounding stands from younger age classes to form a realistic management unit or to provide additional areas which may in time develop old-growth characteristics to serve as replacement stands.

Table 3 summarizes the old-growth acreages that are available and suitable for timber production which would be reserved in the four alternatives and displays these as a percentage of the toal available and suitable forest land base.

TABLE 3 — Summary of Old-Growth Acreages Withdrawn from the Available and Suitable Forest Land Base[1/]
BLM and USFS

Ownership

Alternative	Siuslaw National Forest: Acres Withdrawn	Siuslaw National Forest: Percent of Available & Suitable Forest Base	BLM Westside Salem District: Acres Withdrawn	BLM Westside Salem District: Percent of Available & Suitable Forest Base	Siuslaw National Forest & BLM Westside Salem District: Acres Withdrawn	Siuslaw National Forest & BLM Westside Salem District: Percent of Available & Suitable Forest Base
No. 1	5,320	2.2	990	.5	6,310	1.4
No. 2	6,085	2.5	3,691	1.8	9,776	2.2
No. 3	966	.4	2,061	1.0	3,027	.7
No. 4	7,880	3.3	13,747	6.6	21,627	4.8

1/ Available and suitable lands refer to timberland not presently reserved from harvesting for wilderness, the experimental forest, or problem sites.

HARVEST SCHEDULING MODELS

To assess the potential effects of the four alternatives, base harvest schedules were simulated for the BLM Westside Salem District and Siuslaw National Forest lands within the study area. All lands not already removed from the commercial forest base due to wilderness designation, special areas such as Cascade Head Experimental Forest, or problem sites were considered available for harvest. Harvest schedules were determined for the BLM and USFS lands separately and then summed for the combined projections.

Base level harvest schedules presume timber management on all land currently available and suitable for timber production, without modification of current management practices and yields to meet non-timber resource objectives.

Two simulation models were used for the harvest schedules. Timber Resource Economic Estimation System (TREES) was the primary harvest scheduling model (Tedder et al. 1980). The BLM conifer component and Siuslaw National Forest conifer and hardwood conversion components were included in this model.

The HARVEST program (Barber 1983) simulated harvest schedules for areas that the two agencies are considering for hardwood management. These components include what the BLM Westside Salem District has termed "loggable hardwoods" and the Siuslaw National Forest's riparian hardwood areas. No old-growth acres were withdrawn from either of these types, so the hardwood harvest schedules do not vary between the base level runs and the alternatives.

Harvest schedules for the four alternatives were derived using the same set of assumptions as the base level runs. The only difference is that beginning inventories were adjusted for those old-growth acres removed from the harvest base in each alternative.

Total harvest levels are the sum of the TREES model projections for the base level runs and alternatives along with the hardwood harvests simulated with the program HARVEST.

BASE LEVEL HARVEST SCHEDULES

The TREES Model

Basic requirements for developing harvest schedules using TREES include initial inventories with an age class/acreage array, yield projections for both existing and future stands, and assumptions about management practices applied on these areas. These can be separated into two general categories - data needs and harvest scheduling goals and constraints.

Data needs

Initial inventories comprised of existing age class/acreage distributions and average volumes per acre were obtained from the BLM Westside Salem District and the Siuslaw National Forest. These inventories were separated into three major groups based upon assumptions of how they would be managed. These are the management intensities used in the model. Numbering for the management intensities follows the conventions listed in the TREES user's manual

(Tedder et al. 1980). A description of the practices implied in each management intensity is found in Table 4.

TABLE 4 -- Management Intensity Description

Management Intensity Number	Management Practices Assumed
3	Reforestation, Regeneration Harvest
6	Reforestation, Precommercial Thinning, Fertilization, Commercial Thinning, Regeneration Harvest
7	Reforestation with genetically improved stock, Precommercial Thinning Fertilization, Commercial Thinning, Regeneration Harvest

The BLM Westside Salem District inventory for the conifer land base contained one component that was subdivided into acres by age class with an average volume in each age class. All age classes were adjusted forward to the midpoint of the first decade in the TREES model. Age classes of 55 years and beyond were assigned to Management Intensity 3 with the assumption that no intermediate treatments would be applied before final harvest. A cubic regression volume equation was derived for this management intensity based upon the empirical volume data. This equation was used to estimate future yields from these older existing stands.

Existing younger stands, those between 5 and 45 years of age, were assigned to Management Intensity 6. DFSIM, a stand simulator for Douglas-fir, (Curtis et al 1981) was used to predict yields for this management intensity. Assumptions incorporated into these projections are a precommercial thinning at stand age of 10 years and two commercial thinnings scheduled before the stand is available for final harvest. These assumptions approximate an average level of management considered for these areas (D. Kahle, personal communication, 1984).

Presently nonstocked areas were assumed to be brought back into production over the next five decades. These areas and all regenerated stands were considered to be managed at Management Intensity 7. This intensity is the same as Management Intensity 6, except that an increase in future yields due to the use of genetically improved planting stock is assumed.

Table 5 summarizes the BLM inventory and breakdown by management intensity for the conifer land base modelled in TREES.

TABLE 5 -- BLM Westside Salem District - Initial Inventory - TREES Model Management Intensity Breakdown

Existing Component	Age Class	Acres	Management Intensity (MI) Existing Stands	Management Intensity (MI) Regenerated Stands
Conifer Base	Nonstocked	9,976	MI #7	
	5	13,380		
	15	21,559		
	25	11,113	MI #6	
	35	32,624		
	45	20,883		
	55	9,955		
	65	6,177		
	75	8,552		
	85	9,890		
	95	18,865		MI #7
	105	11,459		
	115	3,813		
	125	5,045	MI #3	
	135	4,564		
	145	1,170		
	155	1,296		
	175	519		
	195	1,392		
	215	456		
	225	912		
	255+	4,317		

The Siuslaw National Forest inventory was divided somewhat differently. Instead of one component separated into acres by each age class, the data was subdivided into five older inventory components each with an average initial age and future yield trajectory. In addition, there was a plantation component with an average age of 20 years, which was separated into four different age categories based on Siuslaw National Forest planning records (R. Hagestedt, personal communication,1984).

All existing components, except plantations, were assigned to Management Intensity 3. Projections of yields for these stands were taken from Siuslaw National Forest empirical yield tables. These tables were translated into cubic regression volume equations which were used to update empirical yield tables to the midpoint of the first period and to project future yields.

Existing plantations were depicted as Management Intensity 6. Yield tables were again derived using DFSIM as in the case of the BLM yields, except that only one commercial thinning was scheduled for these stands based upon assumptions from current forest planning (N. Graybeal, personal communication, 1984).

Nonstocked acres in this inventory represent an adjustment for sale areas presently under contract. As such, all of these acres were assumed to be brought into the land base to be planted in the first period. These stands and all future stands were assigned to Management Intensity 7 which again is identical to Management Intensity 6, except for the assumption of slightly higher yields for gains from genetic stock.

Table 6 displays the inventory breakdown for the Siuslaw National Forest areas modelled in TREES by component and management intensity.

TABLE 6 -- Siuslaw National Forest - Initial Inventory - TREES Model Management Intensity Breakdown

Existing Component	Age Class	Acres	Management Intensity (MI) Existing Stands	Management Intensity (MI) Regenerated Stands
Plantations	Nonstocked	16,726	MI #7	MI #7
	15	16,726	MI #6	
	25	21,409		
	35	12,043		
Douglas-fir/ Red Alder, Immature	35	2,101	MI #3	
Douglas-fir, Immature	65	20,039	MI #3	
Red Alder	75	28,139	MI #3	
Douglas-fir Red Alder, Mature	95	33,453	MI #3	
Douglas-fir, Mature	105	80,669	MI #3	

Harvest scheduling goals and constraints

Harvest schedules were projected for a 100-year period. Harvest controls specified that harvest volumes each decade be maximized subject to a condition that this level could be maintained for 8 decades. This specification uses a binary search algorithm to find the highest harvest level for each decade which can be sustained into the future for at least the 80-year look-ahead period. Combined with this is a requirement to harvest all volume above an age class of 75 years for BLM and 85 years for USFS lands by the last period in the planning horizon. These ending-condition tests ensure that the forest is approaching a regulated condition with rotations of 70 and 80 years for the BLM and USFS, respectively. The difference in the ending condition between the two agencies was intended to allow a slightly older age class condition on USFS lands for other resource objectives. Harvest priority was set as oldest age class first.

Although this harvest flow constraint does not correspond to the nondeclining harvest flow constraint employed by the BLM and USFS, it insures that the harvest level in each period can be sustained for at least 80 years into the future. However, slight fluctuations in harvests, both upward or downward, are allowed.

The HARVEST Model

The program HARVEST (Barber 1983) was used to simulate harvest schedules for the BLM hardwood and Siuslaw National Forest riparian hardwood components. Hardwood inventory data was obtained from both agencies. BLM data consisted of acres by age class and average volumes per acre. The Siuslaw National Forest inventory was aggregated into two hardwood age classes - one with an average age of 20 years, and the other with an average age of 80 years.

For each agency, only two yield tables were used for the harvest simulation. Existing stand yields were based upon empirical volumes and regenerated stand yields were modelled using Siuslaw National Forest red alder yield tables.

Harvest levels were based upon a sequential 100-year even-flow harvest schedule with a 40-year look-ahead period and a minimum harvest age of 40 years. This model also uses a binary search technique to find the highest harvest level each decade which can be sustained for the specified look-ahead period.

ALTERNATIVE HARVEST SCHEDULES

Harvest schedules were modelled using TREES with initial inventories adjusted to reflect acreages withdrawn for old-growth preservation in each alternative. The total harvest schedule for each alternative is the sum of the TREES model projections and the hardwood harvest levels from the program HARVEST.

The BLM base level inventory was adjusted for the various alternatives by removing acres from the 175-year-old or older age classes for medium to well-stocked old-growth stands to be set aside or removing acres from the understory age class in the case of stands in the poorly-stocked old-growth component. Since the BLM type map only identified oldest stands as originating in the year 1800 or previous to that, an actual age for each stand was not determined. Acreages of old-growth withdrawn from the 175+ year age classes were taken from the oldest (255+ year) age class first in adjusting alternative inventories.

Old-growth acreages set aside in the alternatives on Siuslaw National Forest lands were withdrawn from either the mature conifer or the mature mixed hardwood and conifer inventory types.

Appendix B contains further detail on yield tables used in the harvest projections. Resulting TREES inventories for each alternative are displayed in Appendix C.

HARVEST SCHEDULES

Resulting harvest schedules for the BLM and USFS lands within the study area are displayed in Figures 5 and 6. In these figures, harvest levels for each alternative are contrasted to the base level projections. Some general patterns can be discerned from these harvest schedules.

Potential harvests on BLM lands for both the base level schedules and the alternatives tend to be highest in the earlier decades and decrease over the 100-year planning period. This suggests that without the nondeclining flow constraint currently used by the BLM, higher harvest levels could be sustained in the near term in existing mature inventory components, but these harvest levels must drop because there are few acres in the intermediate age classes. Future managed stand volumes per acre are projected to be higher than existing volumes for a given age class, however these yields are not realized soon enough in the planning horizon to sustain the initially higher harvest levels.

Potential harvests on USFS lands show a different pattern. Although the first decade potential harvest is higher than that in the second decade, the overall trend in potential harvest levels is upward over the planning horizon. Without a nondeclining flow constraint, higher harvest levels could be sustained in the first decade. However, most of the potential for increased harvest levels comes from higher yields from the younger age classes and not from the existing mature inventory components.

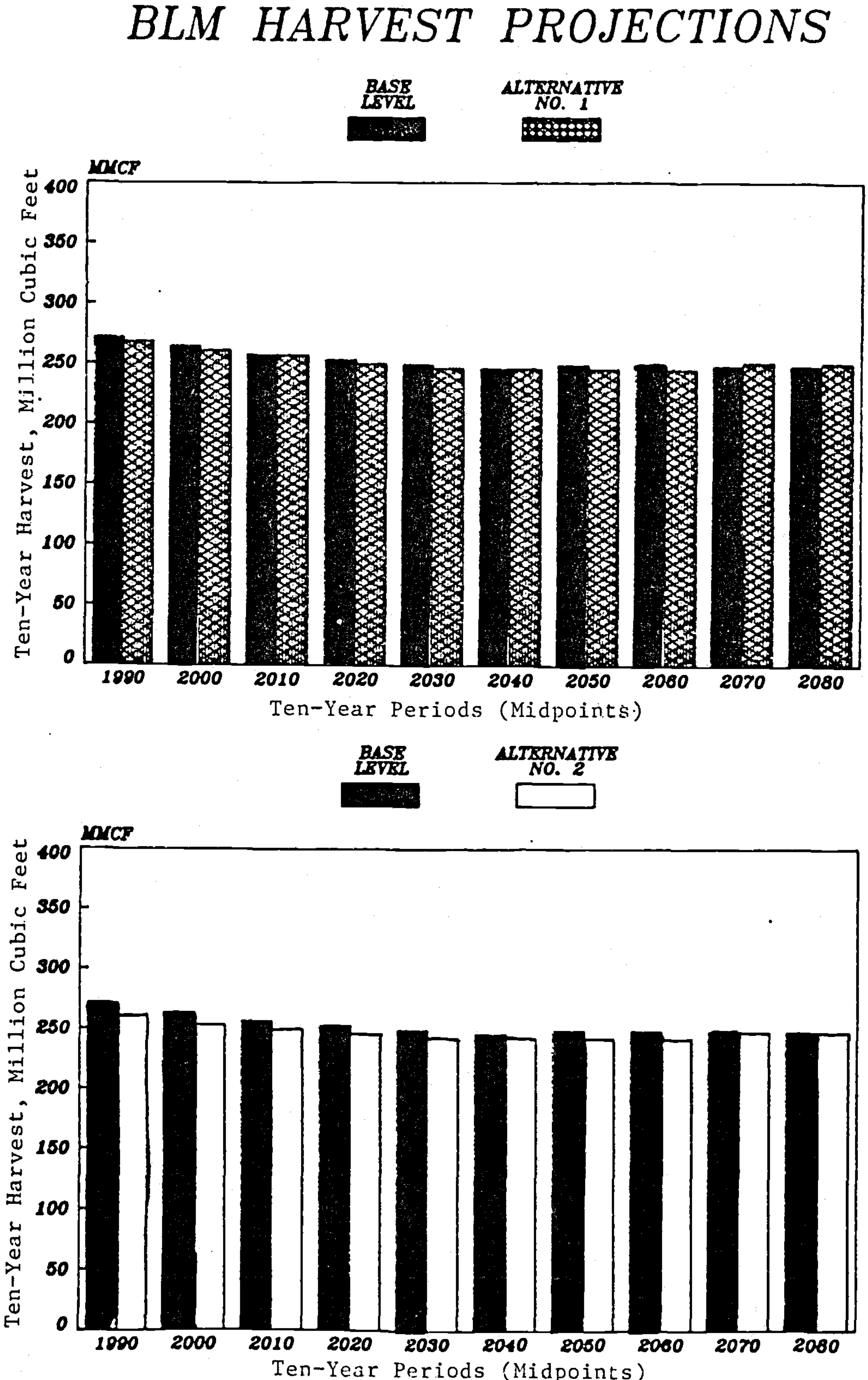
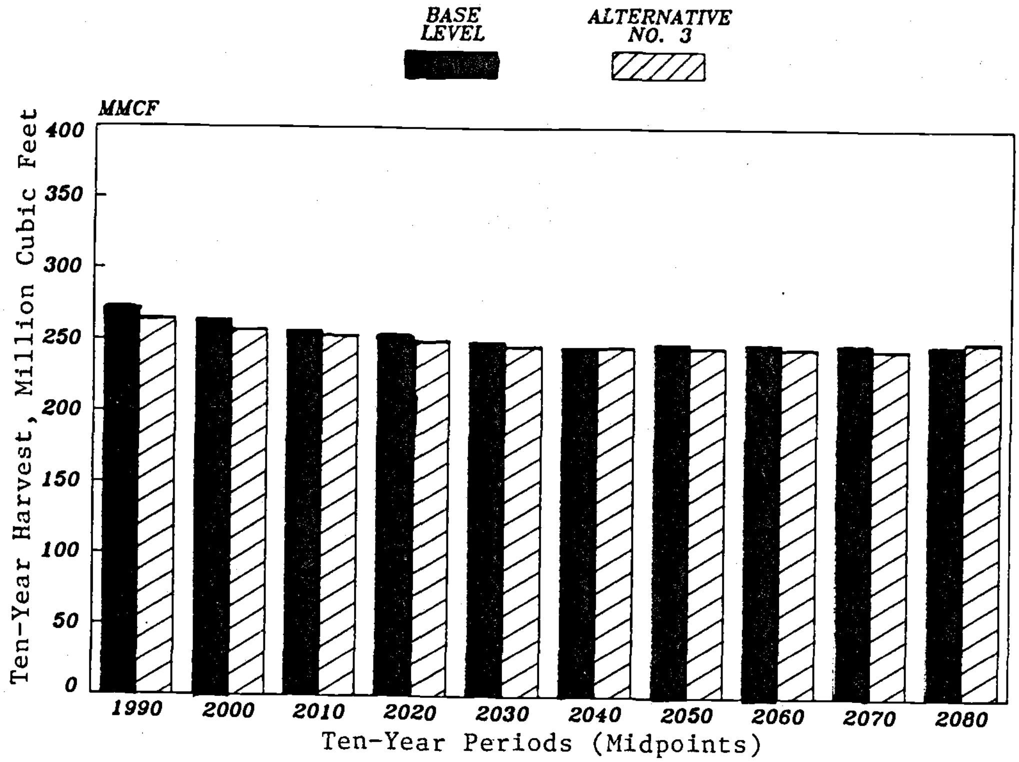


Figure 5. BLM Harvest Projections - Base Level and Alternatives.

BLM HARVEST PROJECTIONS



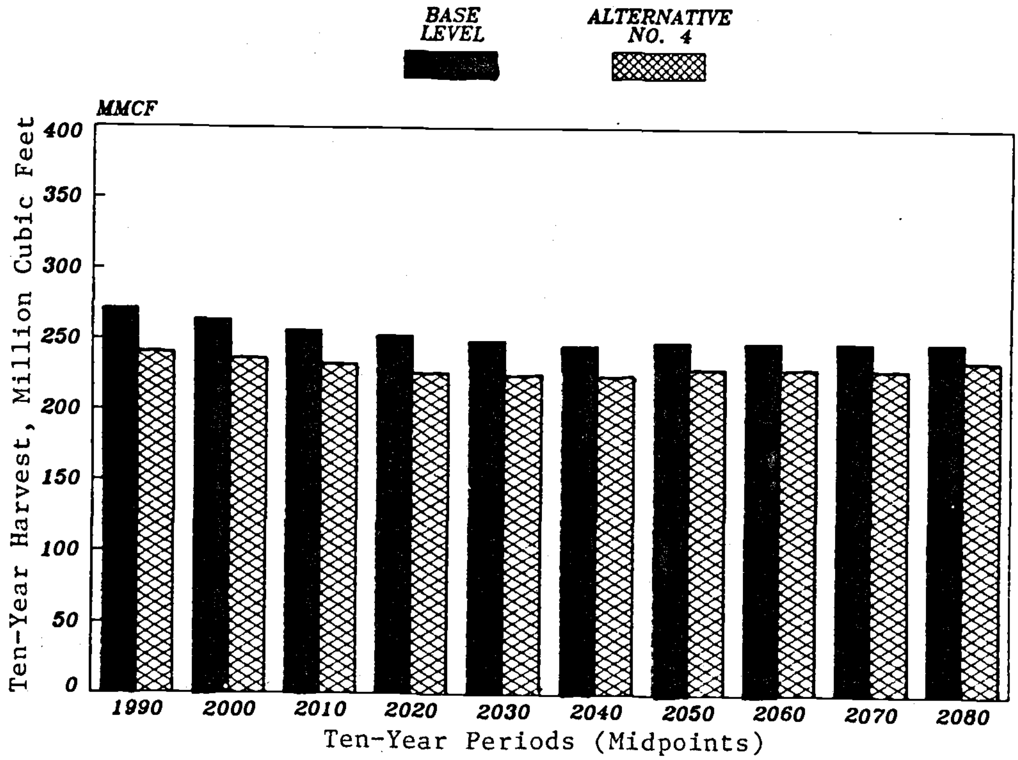


Figure 5. (continued).

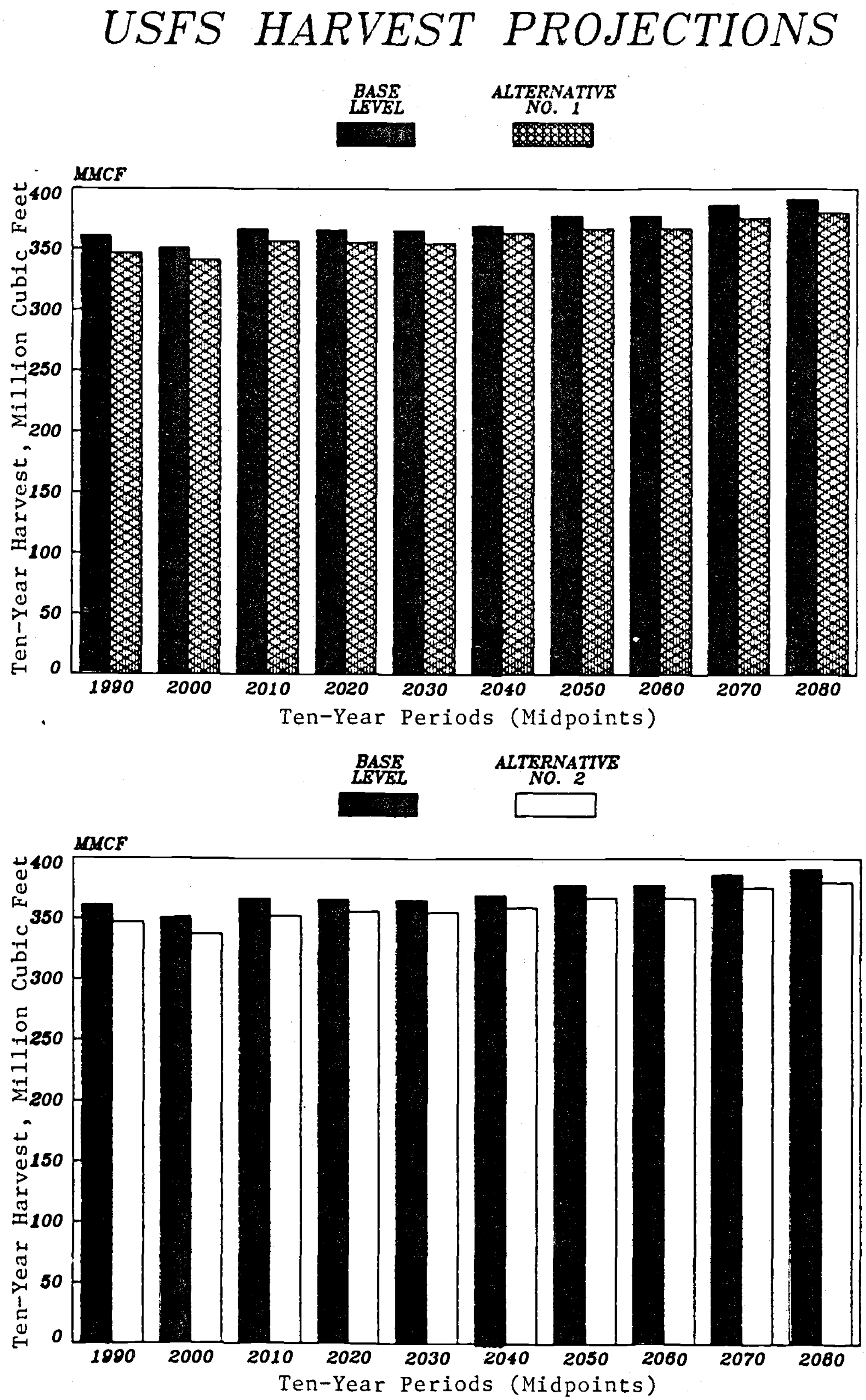
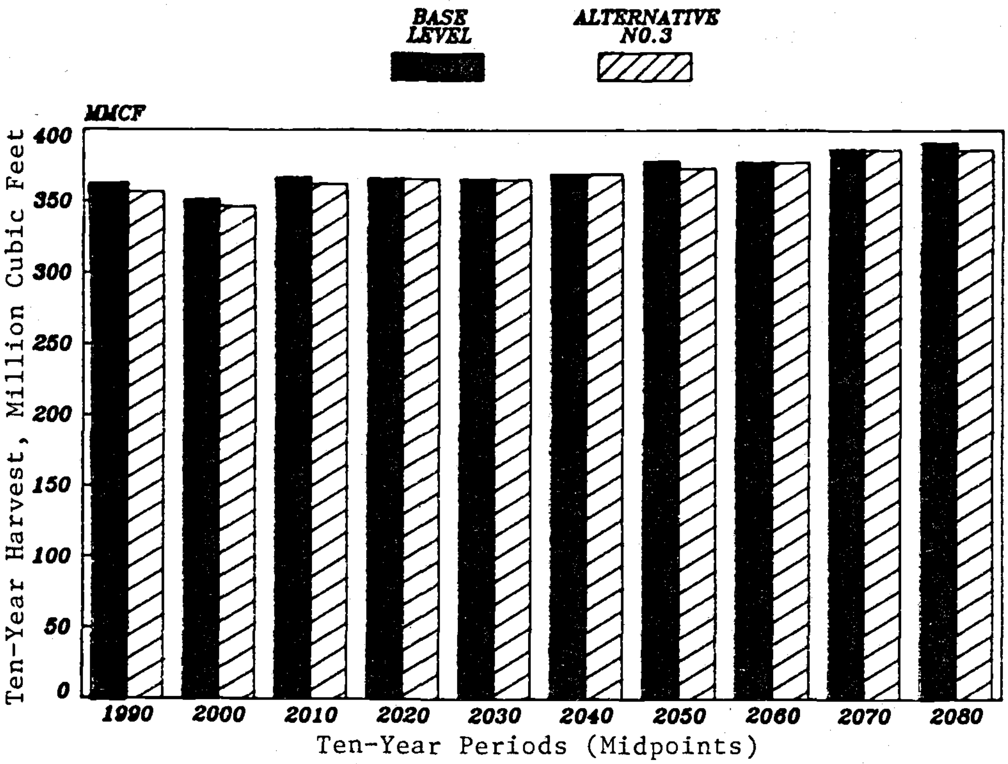


Figure 6. USFS Harvest Projections - Base Level and Alternatives.

USFS HARVEST PROJECTIONS



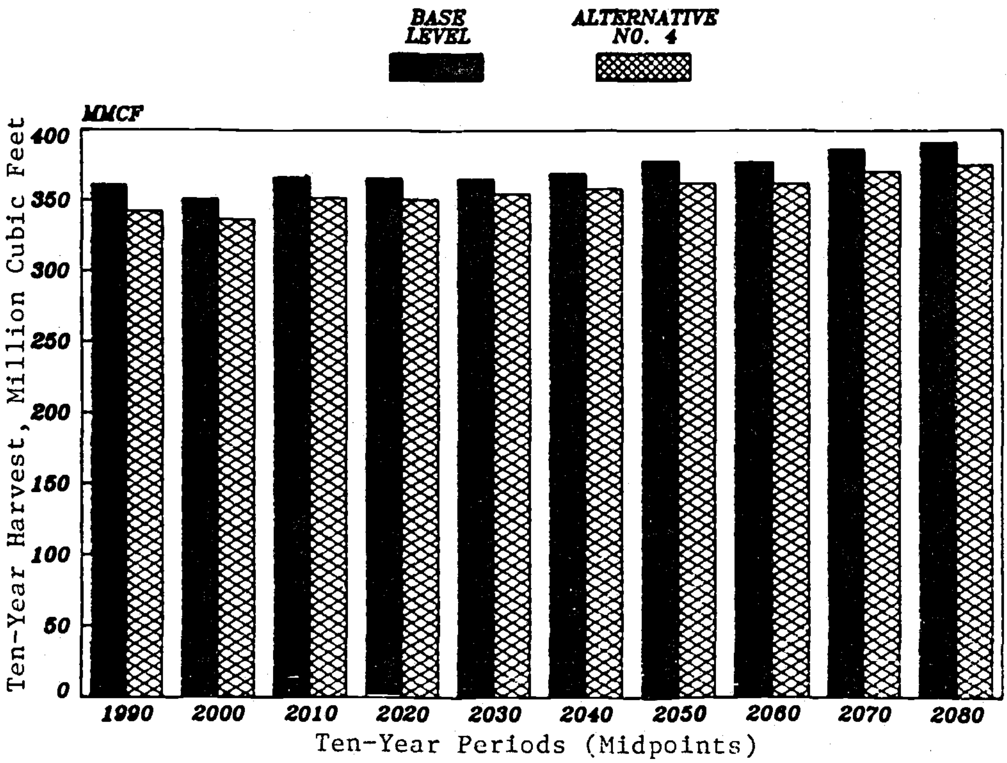


Figure 6. (continued).

Table 7 depicts the percentage changes in harvest levels for the alternatives for three decades within the planning period. These are contrasted to the percentages of the commercial forest land base withdrawn in each alternative. For both the USFS and BLM harvest schedules, the decrease in harvest levels is most extreme in the early decades. In all cases, the percentage decrease from the base level projections in the first decade is greater than, often double, the corresponding percentage decrease in the land base acreages. However, by the tenth decade, the changes in harvest levels are much closer in magnitude to the changes in the land base. This is what would be expected, a long term effect of a reduction in the sustained yield capacity roughly equivalent to the proportion of the land base withdrawn.

In the short term, because the old-growth acres withdrawn generally are in the oldest age classes available for harvest, as these acres are removed from the harvestable land base other mature age class acres are not always available to substitute for those withdrawn. In the BLM projections, the old-growth age classes also tend to have higher predicted volumes than the other mature components, so when these acreages are withdrawn from the harvest base, more acres have to be harvested to maintain the same harvest level. The effect of placing a nondeclining yield constraint on these harvest schedules would generally be to minimize the drop in harvest levels in the early decades primarily on BLM lands. Since harvest levels could not be higher in the early periods, available stands would be harvested more slowly and the alternatives would show less difference in harvests in the early decades.

TABLE 7 -- Percentage Changes in Harvest Levels, USFS, BLM, and Combined Projections

	Percentage Changes in Harvest Levels from Base Projections			
Harvest Units	Alt. #1	Alt. #2	Alt. #3	Alt. #4
USFS				
1st Decade	-3.9	-3.9	-1.3	-5.2
5th Decade	-2.7	-2.8	- .1	-2.9
10th Decade	-2.8	-2.8	-1.3	-4.1
Percentage Change in Acreage from Base Level	-2.2	-2.5	- .4	-3.3
BLM				
1st Decade	-1.3	-3.8	-2.5	-11.4
5th Decade	-1.3	-2.6	-1.3	-9.8
10th Decade	+1.1	- .3	+1.1	-5.4
Percentage Change in Acreage from Base Level	- .5	-1.8	-1.0	-6.6
Combined BLM & USFS				
1st Decade	-2.8	-3.9	-1.8	-7.9
5th Decade	-2.2	-2.7	- .6	-5.7
10th Decade	-1.2	-1.8	- .4	-4.6
Percentage Change in Acreage from Base Level	-1.4	-2.2	- .7	-4.8

The rate at which old-growth acres in the harvestable land base are actually harvested in these projections varies by alternative and by agency. Much of this depends upon the assumptions of a harvest priority of oldest age class first and the way in which old-growth acres are arrayed in the initial inventories.

For BLM lands, old-growth acres are arrayed in two ways. Those stands with a predominant old-growth overstory are depicted in the initial inventories in the oldest age classes. Poorly-stocked old-growth stand acreages are included in the acreages of the understory component by age class. Base level inventories and alternatives with old-growth acres remaining in the harvestable base show that all old-growth acres in the 175-year or older age classes are harvested in the first period. The rate at which the stands with a predominantly younger understory are harvested varies between the base level run and the alternatives. However, the majority of these areas, those with an understory age of 75 years or older, are scheduled for harvest in all the projections within the next five decades. This analysis suggests that, given the assumptions employed in these harvest schedules, old-growth areas on BLM lands not withdrawn from the harvest base would all be harvested in a relatively short period of time. The primary old-growth component, the medium to well stocked old-growth stands, would all be harvested within the next 10 years.

On Siuslaw National Forest lands included in these harvest schedules, old-growth acres are again arrayed in two components. With a harvest priority of oldest age class first, the older component, the mature conifer type, must be harvested completely before the next oldest component, the mixed hardwood and conifer type, can be harvested. Old-growth acres make up a small percentage of each of these inventory components. The assumption was made that for old-growth acres remaining in the commercial base for each projection, these acres would be harvested first as each mature component is scheduled for harvest. Given this assumption, on USFS lands, all old-growth acres remaining in the harvestable land base would be harvested in the next four decades. However, all old-growth acres available for harvest in the mature conifer type would be harvested in the next 10 years. For the next two decades, harvests concentrate in the rest of the mature conifer component. Not until the fourth period would the remaining old-growth acres in the mixed conifer with hardwood component be harvested.

Appendix D contains additional information including tabular displays of harvest schedules for both agencies and the combined projections.

ECONOMIC EFFECTS

Declines in harvest levels on BLM and USFS lands due to old-growth withdrawals have direct economic effects. This study addresses the effects on the agencies themselves, the counties which receive payments as a percentage of agency receipts, and the area's forest products industry.

THE AGENCIES

Lowered harvest levels projected in the alternatives generally indicate decreased timber revenues for the BLM and USFS units. Although this may directly affect the agencies in terms of employment levels and funding for various programs, more significantly, it reflects changes in the economic worth of investments on these federal lands. Present net values for the harvest schedules are used to compare the opportunity costs to the agencies and the public related to old-growth preservation.

THE COUNTIES

Payments made to counties as a percentage of receipts from BLM and USFS lands represent an important source of income to local governments, especially in those counties with a high percentage of land in federal ownership. If federal receipts are reduced, counties will either have to adjust to lower levels of income, or find substitute funding for their programs elsewhere. The extent to which each county may be affected depends not only on the amount of federal lands within the county, but upon whether the lands are managed by the BLM or USFS.

For USFS lands, 25 percent of gross revenues is returned to a county in proportion to the amount of the National Forest lying within that county. Distribution of revenues from BLM lands in the area was established by the McNary Act of 1937. This Act stipulates that 50 percent of revenues be returned to counties based upon their share of total assessed value of all O&C lands, set in 1915. (Nicholson et al 1982, USDI Bureau of Land Management 1981).

Based upon these revenue-sharing conditions, Lincoln and Tillamook Counties receive the largest payments from Siuslaw National Forest receipts, while Benton, Columbia, and Polk Counties share the highest percentages of BLM receipts. These counties stand to lose the most income due to reduced USFS and BLM revenues. Relative changes in payment levels to study area counties are used to compare the harvest schedules.

THE FOREST PRODUCTS INDUSTRY

Forest products industry employment and incomes are important to the economic well-being of Oregon's northcoastal area. Statewide projections for 1986 estimate approximately 32 percent of total manufacturing employment will be in the lumber and wood products sector; this is roughly 6 percent of all non-agricultural wage and salary employment (Oregon State Department of Human Resources 1980). However, estimates for the counties within the study area, omitting Clatsop and Washington Counties, indicate that timber industry employment made up 59 percent of manufacturing employment and 15 percent of wage and salary employment averaged over the years 1976-1979 (USDI Bureau of Land Management 1981). This indicates a level of economic dependence on the forest products sector which is greater than the statewide average. Clatsop County information was not included in this BLM data. However, employment and payroll trends would be expected to be similar to other counties in the area based upon industry characteristics. Washington County was excluded because it has a large urban population where the amount of other manufacturing is much more prominent. In this county, although timber industry salaries are similar to those in the rest of the area, there is not as significant a spread between these earnings and those in all industries.

Payroll earnings of workers in the forest products industry statewide averaged $12,427 in 1975 versus $11,239 per worker in other manufacturing employment (Derived from Brodie et al 1978). This represents roughly an 11 percent higher average salary for forest products workers. Within the study area counties, again excluding Clatsop and Washington Counties, average earnings for workers in timber industry in 1978 were 25 to 72 percent above the average for all industries in these same counties (USDI Bureau of Land Management 1981).

Although the forest products industry is expected to remain a major employer in the foreseeable future, important changes are taking place within this labor force. In western Oregon, a significant downward trend in the number of employees per million board feet of logs consumed in sawmills and plywood and veneer plants has been noted in the last 30 years (Wall et al 1975). These declines have generally been attributed to the "substitution of capital for labor" as less efficient mills have been forced to close and larger, more mechanized mills have emerged (Stevens 1978).

This phenomenon has taken place to some extent within the study area. In 1976, 58 sawmills were operating in the eight counties. In 1982, this number had dropped to 31 mills. Out of this decrease of 27 operating mills, 17 were in the smallest size category (less than 80,000 board foot capacity per 8-hour shift). However, the area still had the largest number of these smallest mills of any area in the State (Howard et al 1978, Howard 1984).

Along with declining employment, average wages in the forest products sector have also been decreasing as industry attempts to cut costs. In the near term, even with lower employment and income levels, the wood products sector will likely remain a dominant part of the area's economic base.

Potential effects of lowered BLM and USFS harvests on the area's forest products industry depend upon the level of reliance on federal stumpage, both old growth and younger aged timber, and industry's ability to acquire and use substitute sources of raw material.

Several aspects of the northwest area industry are unique in these respects:

1. The percentage of commercial timber land area in federal ownership (17.2%) is the lowest of the western Oregon

timbersheds (Beuter et al 1976). Consequently, dependence on federal stumpage supplies has historically been lower than in many areas of the state. In 1976, log consumption from USFS and BLM lands was 31 percent of the total sawmill consumption in the area and 32 percent of the total plywood and veneer mill totals. This contrasts with an average statewide consumption from USFS and BLM lands of 52 and 56 percent for sawmills and veneer and plywood mills, respectively. In 1982, sawmill log consumption from USFS and BLM lands was 45 percent of the total consumed, while the statewide average was 49 percent (Howard et al 1978, Howard 1984).[3]

2. The forest products industry processes the highest percentage of second growth logs (less than 100 years of age) of any western Oregon area. Sawmills, which account for the majority of log consumption in the area, had over 70 percent of material processed in 1976 and 1982 coming from trees less than 100 years of age (Howard et al 1978, Howard 1984).

3. In a 1976 study of timber availability, this area was highlighted as the only western Oregon timbershed which would be able to maintain or increase current harvest levels in the

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[3]Information is not provided here for 1982 plywood and veneer mill consumption since this was not shown at the county level but was aggregated into an area total which does not represent the study area.

next 30 years while still maintaining existing federal harvest policies. Although harvest from industry lands showed a slight decline in the near term, the capability exists for substituting harvests from state and other public lands and the nonindustrial private sector without increasing harvest levels on federal ownerships (Beuter et al 1976).

These statistics present the characteristics of the northwest Oregon forest products industry as a whole. However, percentages of federal stumpage and older aged timber consumed vary by types of mills and by county.

Sawmills, plywood and veneer plants, and shake and shingle mills rely on raw material from BLM and USFS lands more than other types of mills. Historically, a greater percentage of older aged material has been consumed by plywood and veneer mils than by sawmills. Shake and shingle mills, which use almost exclusively western redcedar (<u>Thuja plicata</u>), process primarily older aged logs. On the other hand, pulpmills and boardmills rely almost completely on private, younger-aged stumpage supplies (Howard et al 1978, Howard 1984).

Although many facilities process older aged timber, this does not necessarily indicate dependence upon the old-growth resource. In 1983, BLM timber sale data showed 18 primary purchasers of Westside Salem District timber sales with processing facilities. Of these manufacturers, 11 processed both old growth and second growth logs and seven processed only second growth. None processed exclusively old-growth logs (R. Hershey, personal communication, 1983).

Log consumption from federal ownerships also varies by county. In 1976 and 1982, sawmill log consumption from USFS and BLM lands was highest in percentage terms in Yamhill, Polk, Benton, and Lincoln Counties and was lowest in Clatsop and Columbia Counties. Use of older aged material showed large variation by county, but the general trend was low consumption in areas where this resource is very scarce. This includes Tillamook, Washington, and Yamhill Counties. Levels of consumption of older aged material (logs over 100 years) in Clatsop and Columbia Counties is close to the average for the study area. However, little is from USFS or BLM lands. Instead, it is primarily from State and private supplies and most is probably in the 100-to 120-year-old age category based upon inventory statistics for these ownerships (Howard et al 1978, Howard 1984, Beuter et al 1976, OSDF 1980).

Current conditions and trends provide an overview of the northwest Oregon forest products industry. This industry has been characterized by the ability to adapt to available forest resources. The transition from an old-growth economy to primarily second growth processing is an example of this. Potential effects on the industry from the old-growth preservation alternatives are discussed in qualitative terms based upon these characteristics.

VALUE OF THE PRODUCT

An assessment of the economic effects of these harvest schedules requires assumptions about the value of timber products harvested. Three key areas relating to timber values are addressed here:

existing value differences between old-growth and second-growth stumpage; the expected trend in old-growth values relative to younger aged timber; and changes in the prices paid for stumpage due to changes in federal harvest levels.

The first of these issues deals with the relative value of old-growth versus younger aged timber. Is there a value differential or "quality premium" for old-growth timber and is this differential, if any, carried through to stumpage prices paid for old growth?

Lumber and veneer recovery studies for Douglas-fir have consistently shown higher values from larger diameter logs as better lumber grades and higher quality veneers can be produced per unit of raw material (Fahey 1982a, 1982b). However, not all old-growth trees are capable of producing these high quality products. Large, old-growth Douglas-fir which remain after fires and past logging may represent a different timber resource in terms of product recovery. Studies have shown that these types of logs have significantly higher percentages of defect and lower lumber grade yields than typical old-growth Douglas-fir (Snellgrove et al 1975). Higher proportions of this lower quality old-growth timber may be expected within the study area because of many residual old-growth stands.

Even if the old-growth timber in these stands represents an inherently more valuable resource than smaller, younger aged timber, it is speculative whether this difference would be carried through to higher stumpage values. Many factors affect the actual price paid for federal stumpage. Characteristics such as species composition, mixes of log grades, distances from mills, volumes per acre, percentages of low grade material, and accessibility of timber sale areas have all been theorized as being physical factors which may affect stumpage prices (Brannman et al 1981). How these factors for old-growth stands in the area compare to other second growth stands is not known. While these stands may have higher volumes per acre, they may also have more defective material. Also, many of the remaining old-growth stands are on steep, inaccessible areas which would represent higher than average logging and road building costs (R. Hershey, personal communication, 1983).

For comparison purposes, the value per unit harvested was assumed to be the same for both the old-growth and younger aged timber in these harvest projections. If this were not the case, then these assessments of changes in present net value and payments to counties may understate the opportunity costs associated with the alternatives.

The second factor in timber value estimates for the harvest projections has to do with the trend in old-growth stumpage values relative to values of younger aged timber. Presently, the majority of raw material processed in the area is from young, second growth timber. As existing mills are modernized or replaced, the new facilities would most likely be designed to efficiently process predominantly second growth stumpage. Therefore, even as the old-growth resource becomes more scarce, no significant upward trend in the value of old-growth versus second-growth stumpage is anticipated.

The final determinant of timber values addressed here is the responsiveness of stumpage prices to quantities of federal timber supplied. The largest projected decrease in combined BLM and USFS harvests was 8 percent in the first decade and less for the later decades. Even assuming a continuation of past dependence levels on federal stumpage of 45 percent, this would only represent a 3.6 percent reduction in raw material supplies. However, this does not address substitution of raw material which may be available from other ownerships. Because of these factors, although there may be increased competition for federal stumpage, it is assumed to have little overall effect on average stumpage prices.

The calculation of future revenues for these harvest schedules requires predictions of future stumpage prices. Of concern here are changes in stumpage prices directly related to changes in these harvest schedules. Based upon this analysis, no distinction was made between values of old-growth and second-growth stumpage and no changes in average values due to decreased federal supplies were assumed. Further discussion and calculations of economic measures are included in Appendix D.

EFFECTS OF HARVEST PROJECTIONS

Opportunity costs associated with decreases in federal harvest levels include changes in present net values, reductions in payments to counties, and effects on local industry production and employment. In these factors, it is the short-term changes in harvest levels which are of most concern.

Present net value changes related to these harvest projections are influenced most by decreases in harvest levels in the early decades.

Table 8 shows these changes compared in percentage terms to the base level runs and the reductions in the land base for each alternative.

TABLE 8 -- Percentage Changes in Present Net Values, USFS, BLM, and Combined Projections

Harvest Units	Percentage Changes in Present Net Values from Base Projections			
	Alt. #1	Alt. #2	Alt. #3	Alt. #4
USFS	-3.3	-3.8	-1.2	-4.6
Percentage Change in Acreage from Base Level	-2.2	-2.5	- .4	-3.3
BLM	-1.1	-3.5	-2.2	-10.9
Percentage Change in Acreage from Base Level	- .5	-1.8	-1.0	-6.6
Combined BLM & USFS	-2.4	-3.7	-1.6	-7.3
Percentage Change in Acreage from Base Level	-1.4	-2.2	- .7	-4.8

Reductions in present net values display the opportunity costs of old-growth preservation. These can be compared to the old-growth resource provided to measure tradeoffs associated with these old-growth set-asides.

State Parks, Drift Creek Wilderness, Cascade Head Experimental Forest, and areas withdrawn as problem sites contain 9,984 acres of old growth which would be reserved from harvest across all alternatives. These include only five old-growth tracts over 500 acres and many smaller areas widely dispersed over the area.

Alternative #1 would add three more large tracts (greater than 1,000 acres each) and old-growth areas surrounding the wilderness to the distribution of old-growth preserves. Thirteen areas, in addition to those in Alternative #1, of 200-1,000 acres each (primarily in the 200-400 acre range) would be reserved from harvest in Alternative #2. Alternative #3, which considers adding only 200-300 acre old-growth tracts to those already set-aside, would contribute 11 old-growth areas in this size range. Some of these areas would be as close as three miles apart, but the average spacing of old-growth areas would be much greater. All old-growth areas on public lands would be reserved in Alternative #4. This alternative results in the most variation in sizes and distribution of old-growth areas to be preserved.

Table 9 summarizes the acreages of old growth reserved from harvesting in each alternative compared to the present net value opportunity costs in total dollars and dollars per acre withdrawn.

TABLE 9 -- Old-Growth Acreages Withdrawn from Harvesting and Present Net Value Opportunity Costs

	Old-Growth Acreages			Present Net Value Opportunity Costs	
Alternative	Acres Presently Withdrawn	Additional Acres Withdrawn in Alternatives	Total Old-Growth Acres Withdrawn	Total Present Net Value Reduction	Per Acre Present Net Value Reduction
No. 1	9,984	6,310	16,294	$24,370,000	$3861/acre
No. 2	9,984	9,776	19,760	$37,780,000	$3865/acre
No. 3	9,984	3,027	13,011	$16,370,000	$5408/acre
No. 4	9,984	21,627	31,611	$74,310,000	$3436/acre

Changes in harvest revenues for the next 30 years are depicted in Table 10. These values correspond closely to the percentage declines in harvest levels in these three decades. Changes in agency revenues are slightly larger percentages because as the total harvest levels decrease, hardwood harvests, which have a lesser value, make up a larger portion of the total.

TABLE 10 -- Percentage Changes in Harvest Revenues, USFS and BLM

Harvest Units	Percentage Changes in Harvest Revenues from Base Projections			
	Alt. #1	Alt. #2	Alt. #3	Alt. #4
USFS				
1st Decade	-4.0	-4.0	-1.3	-5.4
2nd Decade	-2.8	-4.0	-1.3	-4.2
3rd Decade	-2.8	-4.0	-1.3	-4.2
BLM				
1st Decade	-1.3	-3.9	-2.6	-11.8
2nd Decade	-1.3	-3.9	-2.6	-10.7
3rd Decade	-.1	-2.7	-1.4	-9.5

Decreased agency revenues directly affect payment levels to counties. These changes are highly dependent not only on changes in revenues from harvests within the study area but upon total revenues generated within the agency units.

For the USFS lands, revenues are distributed on an administrative unit basis. Twenty-five percent of the gross revenues generated on Siuslaw National Forest lands is returned to counties which contain these lands. However, half of the Siuslaw National Forest is outside the study area. Therefore, changes in returns to area counties depend on changes in revenues from the entire national forest. If old-growth withdrawals were extended over the entire forest in similar percentages and types of land area withdrawn the overall effects on reduced payments to counties would be expected to be similar to the percentage decreases in revenues. In this case, the most extreme change would be only a 5.4 percent decrease in county revenues in the next 10 years. Every county would experience the same percentage decrease in returns. In absolute terms, Lincoln and Tillamook Counties would realize the largest decreases in dollars returned.

Returns to counties from BLM O&C land revenues are distributed as 50 percent of total gross receipts from all western Oregon counties based upon their share of total assessed value of these lands (Nicholson et al 1982). Therefore, the actual effects of these decreased harvests within the study area are dependent upon the changes in harvest levels and revenues from all O&C lands in western Oregon. If similar changes in O&C revenues were experienced from all these lands, then the resulting changes in payments to counties would be similar to the decreased revenue percentages shown for BLM lands in Table 10. If this were the case, the most extreme effect of the old-growth withdrawals would be a 11.8 percent decrease in BLM payments to counties. Benton, Polk, and Columbia Counties would lose the most in total dollar returns from O&C lands.

Four factors may tend to minimize the adverse effects of old-growth withdrawals on the area's forest products industry. These include relatively small changes in federal harvest levels because of few acres of old-growth remaining, an industry which used primarily second growth as a source of raw material, lower levels of reliance on federal stumpage when contrasted to other areas of the state, and increased harvest potentials from other ownerships to substitute for the loss of federal supplies.

Although the decreased federal harvest levels in these projections may affect individual mills which rely heavily on harvests from BLM and USFS lands, no significant effects on forest products industry employment would be anticipated for the area as a whole.

SUMMARY AND CONCLUSIONS

The objective of this study was to identify the old-growth resource on public lands in northwest Oregon, to suggest a range of preservation alternatives for these areas, and to assess the harvest scheduling and economic effects of these old-growth set-asides.

A stand age of 180 years or older was the criterion used to determine old-growth acreages. Based upon this definition, there are just under 32,000 acres of old-growth forest on public lands within the study area. Roughly half of these old-growth acres occur in tracts of 200 acres or larger and the other half are in scattered tracts less than 200 acres each. Approximately 10,000 acres of old-growth forest are already reserved from harvesting. These occur in State Parks, wilderness, experimental forest, and acres withdrawn as problem sites. The remaining 22,000 acres of old growth are on BLM and USFS lands.

Preservation alternatives based upon existing old-growth tract sizes and distribution were developed. Alternatives ranged from setting aside 3,027 to 21,627 acres of old-growth forest not presently reserved from harvesting. These represent reductions in the combined BLM and USFS commercial forest land base from as little as .7 percent to 4.8 percent. All alternatives considered were limited by the existing distribution of old-growth tracts. Because stand information was derived from agency inventories without field sampling, no distinction was made in the alternatives for varying old-growth characteristics in these areas. Therefore, there is no way to know which, if any, of these alternatives would be best for preserving wildlife habitat or other resource values. The intent was simply to suggest a range of possibilities for old-growth preservation and to show the opportunity costs associated with each alternative.

To assess the effects of the alternatives, harvest schedules were simulated for BLM and USFS lands. Base level schedules with no additional old-growth acreages withdrawn were derived for each agency. These provided baseline projections and were contrasted to the alternative harvest schedules to depict changes in harvest levels due to old-growth set-asides.

Harvest scheduling effects vary over time. In the short term, harvest levels in the alternatives drop by a greater percentage than the percentage of the land base withdrawn. Reserving all existing old-growth areas from harvesting represents a 4.8 percent acreage reduction in the BLM and USFS land base. However, the corresponding first decade decrease in harvest levels is 7.9 percent. Long term effects show a reduction in harvest levels by the tenth decade comparable to the percentage of the land base withdrawn.

Reductions in present net values depict opportunity costs associated with old-growth preservation. Decreases in present net values for BLM and USFS harvest schedules ranged from 2.4 to 7.3 percent. These represent from 16 to 74 million dollar decreases in the value of the harvest schedules. On a per acre basis, these reductions are equivalent to from 3,436 to 5,408 dollars of present net value lost per acre permanently withdrawn from the land base.

Decreased agency revenues directly affect payment levels to counties. Effects of these old-growth set-asides on county revenues are uncertain because of the methods of revenue-sharing. Payments to study area counties from federal receipts are dependent not only on changes in revenues from harvests within the study area, but upon total revenues generated within the agency units. However, if similar decreases in revenue were experienced from the revenue-sharing areas as a whole, the most extreme decreases in projected revenues would be in the first decade. These amount to projected decreases of 5.4 percent from USFS harvest receipts and 11.8 percent from BLM harvest receipts.

Decreased federal harvest levels projected in the alternatives are not expected to have significant effects on the area's forest products industry as a whole.

This study focused on effects of old-growth forest preservation. However, given the limited acreages and distribution of old-growth habitat within the study area, it may be desirable to preserve other forest stands in the next oldest age classes available in order to provide additional older forest habitat within an area managed primarily on much shorter future forest rotations.

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APPENDICES

APPENDIX A - ALTERNATIVE SUMMARIES

Summary information is provided here for BLM and USFS old-growth areas reserved from harvesting in each of the alternatives. Oregon State Parks (OSP) old-growth areas are not included because they are reserved from harvest across all alternatives. Refer to Table 1 for OSP old-growth summaries.

The information is organized by alternative to show:

1. Total acres withdrawn from the commercial forest base by agency, inventory component, and age class.

2. Summary of old-growth tracts in each alternative - including location, total acres of old growth, acres presently reserved from harvest, and acres used to adjust initial inventories.

The data is presented in terms of changes from the base inventories used in the TREES model. For the BLM, the acreage reductions came from either the oldest age classes first (for medium to well stocked old-growth stands) or the understory age class (in the case of poorly stocked old-growth stands).

For USFS lands, the old-growth acres were removed from either the mature conifer component (typed DM), with an initial TREES age class of 13, or from the mature conifer and hardwood component (typed MM), with an initial TREES age of 12. The old-growth components, which are subsets of the mature types, are termed DO, for the conifer old-growth type, and MO, for the mixed old-growth type.

Acres presently withdrawn from the commercial forest base had to be determined for each alternative. For the BLM, this information was available from the base map. For the USFS, acres withdrawn for wilderness and the experimental forest were identified. However, stands withdrawn as problem sites for soil and water protection were not denoted on the map. From agency records, the average percentage of old-growth types withdrawn due to problem sites was 23.4% in Lincoln County and 13.5% in Benton County. These percentages were used to estimate stand acres which would be reserved from harvest for soil and water protection within the USFS old-growth tracts.

In the TREES model, up to 33 age classes are used. The first two (TREES Ages 1 and 2) are reserved for modelling a regeneration lag period. Age classes from 3 to 33 represent stocked stands in 10-year increments. For these simulations, TREES Age 5 represents an inventory component with an average age of 25 years, TREES Age 10 an inventory component of 75 years, and so forth.

ALTERNATIVE #1 - SUMMARY OF INVENTORY REDUCTIONS

Alternative #1 - All Old-Growth Tracts ≥ 1,000 Acres Withdrawn

<u>Siuslaw National Forest</u>

Mixed Old-Growth Acres (MO)	=	1,090
Conifer Old-Growth Acres (DO)	=	<u>4,230</u>
Acres Removed from Initial Inventory		5,320

New Initial Inventory Acreages, TREES Model

TREES Age 13 (DM + DO) = 80,669 - 4,230 = 76,439 acres
TREES Age 12 (MM + MO) = 33,453 - 1,090 = 32,363 acres

<u>BLM Westside Salem District</u>

Medium to Well Stocked Old-Growth Acres	=	898
Poorly Stocked Old-Growth Acres	=	<u>92</u>
Acres Removed from Initial Inventory		990

New Initial Inventory Acreages, TREES Model

TREES Age 28 = 4,317 - 898 = 3,419 acres

TREES Age 10 = 8,552 - 54 = 8,498 acres
TREES Age 12 = 18,865 - 38 = 18,817 acres

Alternative #1 - Old-Growth Area Locations and Acreages

Area I - Cascade Head Experimental Forest, Siuslaw National Forest

Approximately 1719 acres (DO + MO), already withdrawn

Area II - Siuslaw National Forest,
Lincoln County, T.12S.,R10W.
T.13S.,R.10W.

Tract size	2,927 acres
Less Drift Creek Wilderness (DO + MO acres)	-2,287 acres
Less percentage withdrawn for problem sites (23.4% Lincoln County)	- 150 acres
Alternative acreage reduction	490 acres

Inventory reduction:

Mixed Old-Growth Acres (MO) = 319
Conifer Old-Growth Acres (DO) = 171

Area III - Siuslaw National Forest, Benton County within City of Corvallis Watershed, T.12S.,R.7W.

Tract size	3,328 acres
Less percentage withdrawn for problem sites (13.5% Benton County)	- 450 acres
Alternative acreage reduction	2,878 acres

Inventory reduction:

Mixed Old-Growth Acres (MO) = 29
Conifer Old-Growth Acres (DO) = 2,849

Alternative #1 - Old-Growth Area Locations and Acreages (continued)

Area IV - Siuslaw National Forest, Lincoln County, T.8S.,R10W.

Tract size	2,548 acres
Less percentage withdrawn for problem sites (23.4% Lincoln County)	- 596 acres
Alternative acreage reduction	1,952 acres

Inventory reduction:

Mixed Old-Growth Acres (MO) = 742
Conifer Old-Growth Acres (DO) = 1,210

Area V - BLM Westside Salem District, Polk County, T.7S.,R.8W.

Tract size	1,031 acres
Less withdrawn acres	- 41 acres
Alternative acreage reduction	990 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 898
Poorly Stocked Old-Growth Acres
(TREES Age 10 - 54)
(TREES Age 12 - 38)
Subtotal 92 92

ALTERNATIVE #2 - SUMMARY OF INVENTORY REDUCTIONS*

Alternative #2 - All Old-Growth Tracts $\geq$ 200 Acres Withdrawn

Siuslaw National Forest

Mixed Old-Growth Acres (MO) =	319
Conifer Old-Growth Acres (DO) =	446
Additional Old-Growth Acres Removed	765
Acres Removed from Initial Inventory	
Alternative I	5,320
Alternative II	765
	6,085

New Initial Inventory Acreages, TREES Model

TREES Age 13 (DM + DO) = 76,439 - 446 = 75,993 acres
TREES Age 12 (MM + MO) = 32,363 - 319 = 32,044 acres

BLM Westside Salem District

Medium to Well Stocked Old-Growth Acres =	1,440
Poorly Stocked Old-Growth Acred =	1,261
Additional Old-Growth Acres Removed	2,701
Acres Removed from Initial Inventory	
Alternative I	990
Alternative II	2,701
	3,691

New Initial Inventory Acreages, TREES Model

TREES Age 28 = 3,419 - 1,440 = 1,979 acres

TREES Age 6 = 32,624 - 244 = 32,380 acres
TREES Age 7 = 20,883 - 68 = 20,815 acres
TREES Age 9 = 6,177 - 12 = 6,165 acres
TREES Age 10 = 8,498 - 85 = 8,413 acres
TREES Age 11 = 9,890 - 97 = 9,793 acres
TREES Age 12 = 18,827 - 225 = 18,602 acres
TREES Age 13 = 11,459 - 385 = 11,074 acres
TREES Age 14 = 3,813 - 145 = 3,668 acres

*These are reductions in addition to those from Alternative I.

Alternative #2 - Old-Growth Area Locations and Acreages

Area I - Siuslaw National Forest, Lincoln County, T.15S.,R.12W.

Tract size	306 acres
Less percentage withdrawn for problem sites (23.4% Lincoln County)	- 72 acres
Alternative acreage reduction in addition to Alternative #1	234

Inventory reduction:

Mixed Old-Growth Acres (MO) = 84
Conifer Old-Growth Acres (DO) = 150

Area II - Siuslaw National Forest, Lincoln County, T.13S.,R10W. T.14S.,R.10W.

Tract size	269 acres
Less percentage withdrawn for problem sites (23.4% - Lincoln County)	- 63 acres
Alternative acreage reduction in addition to Alternative #1	206 acres

Inventory reduction:

Mixed Old-Growth Acres (MO) = 89
Conifer Old-Growth Acres (DO) = 117

Area III - Siuslaw National Forest, Lincoln County, T.13S.,R.10W.

Tract size	424 acres
Less percentage withdrawn for problem sites	- 99 acres
Alternative acreage reduction in addition to Alternative #1	325

Inventory reduction:

Mixed Old-Growth Acres (MO) = 146
Conifer Old-Growth Acres (DO) = 179

Alternative #2 - Old-Growth Area Locations and Acreages (continued)

Area IV - BLM Westside Salem District,
Benton County, T.13S.,R.7W.

Tract size 248 acres

<u>Inventory reduction</u>:

Poorly Stocked Old-Growth Acres	
TREES Age 6	222
TREES Age 11	26

Area V - BLM Westside Salem District,
Benton County, T.14S.,R.6W.

Tract size 215 acres

<u>Inventory reduction</u>:

Medium Stocked Old-Growth Acres	- 206
Poorly Stocked Old-Growth Acres (TREES Age 6)	- 9

Area VI - BLM Westside Salem District,
Benton County, T.14S.,R.7W.

Tract size 222 acres

<u>Inventory reduction</u>:

Medium Stocked Old-Growth Acres	- 17
Poorly Stocked Old-Growth Acres	
(TREES Age 14 - 145)	
(TREES Age 13 - 38)	
(TREES Age 10 - 22)	
Subtotal 205	205

Alternative #2 - Old-Growth Area Locations and Acreages (continued)

Area VII - BLM Westside Salem District,
Benton County, T.14S.,R.7W.

Tract size	227 acres
Less withdrawn acres	- 1 acres
Alternative acreage reduction in addition to Alternative #1	226 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres =		149
Poorly Stocked Old-Growth Acres		
(TREES Age 11 -	50)	
(TREES Age 12 -	14)	
(TREES Age 6 -	13)	
Subtotal	77	77

Area VIII- BLM Westside Salem District,
Benton County, T.14S.,R.7W.
T.15S.,R.7W.

Tract size	244 acres
Less withdrawn acres	- 5 acres
Alternative acreage reduction	239 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres =		206
Poorly Stocked Old-Growth Acres		
(TREES Age 9 -	12)	
(TREES Age 11 -	21)	
Subtotal	33	33

Area IX - BLM Westside Salem District,
Benton County, T.14S.,R.8W.

Tract size	347 acres

Inventory reduction:

Poorly Stocked Old-Growth Acres	
(TREES Age 13 - 347)	347

Alternative #2 - Old-Growth Area Locations and Acreages (continued)

Area X - BLM Westside Salem District,
Polk County, T.7S.,R.7W.

Tract size		322 acres
Less withdrawn acres	-	2 acres
Alternative acreage reduction		320 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 320

Area XI - BLM Westside Salem District,
Polk County, T.9S.,R.7W.

Tract size 309 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 309

Area XII - BLM Westside Salem District,
Polk County, T.9S.,R.7W.

Tract size		246 acres
Less withdrawn acres	-	1 acres
Alternative acreage reduction		245 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres =	233
Poorly Stocked Old-Growth Acres TREES Age 10	12

Alternative #2 - Old-Growth Area Locations and Acreages (continued)

Area XIII- BLM Westside Salem District,
Polk County, T.9S.,R.7W.

Tract size 330 acres

<u>Inventory reduction</u>:

Poorly Stocked Old-Growth Acres	
(TREES Age 12)	211
(TREES Age 10)	51
(TREES Age 7)	68

ALTERNATIVE #3 - SUMMARY OF INVENTORY REDUCTIONS

Alternative #3 - Distribution of 200-300 Acre Old-Growth Tracts

Siuslaw National Forest

Mixed Old-Growth Acres (MO)	=	402
Conifer Old-Growth Acres (DO)	=	564
Acres Removed from Initial Inventory		966

New Initial Inventory Acreages, TREES Model

TREES Age 13 (DM + DO) = 80,669 - 564 = 80,105 acres
TREES Age 12 (MM + MO) = 33,453 - 402 = 33,051 acres

BLM Westside Salem District

Medium to Well Stocked Old-Growth Acres	=	1,120
Poorly Stocked Old-Growth Acred	=	841
Acres Removed from Initial Inventory		1,961

New Initial Inventory Acreages, TREES Model

TREES Age 28 = 4,317 - 1,220 = 3,097 acres

TREES Age 6 = 32,624 - 13 = 32,611 acres
TREES Age 7 = 20,883 - 68 = 20,815 acres
TREES Age 9 = 6,177 - 12 = 6,165 acres
TREES Age 10 = 8,552 - 105 = 8,447 acres
TREES Age 11 = 9,890 - 71 = 9,819 acres
TREES Age 12 = 18,876 - 225 = 18,640 acres
TREES Age 13 = 11,459 - 347 = 11,112 acres

Alternative #3 - Old-Growth Area Locations and Acreages

Area I - Siuslaw National Forest,
Lincoln County, T.13S.,R10W.
T.14S.,R10W.

Tract size	269
Less percentage withdrawn for problem sites (23.4% - Lincoln County)	- 63 acres
Alternative acreage reduction	206 acres

Inventory reduction:

Mixed Old-Growth Acres (MO) = 89
Conifer Old-Growth Acres (DO) = 117

Area II - Siuslaw National Forest,
Lincoln County, T.15S.,R12W.

Tract size	306 acres
Less percentage withdrawn for problem sites (23.4% Lincoln County)	- 72 acres
Alternative acreage reduction	234

Inventory reduction:

Mixed Old-Growth Acres (MO) = 84
Conifer Old-Growth Acres (DO) = 150

Area III - Siuslaw National Forest,
Lincoln County, T.8S.,R.10W.

Tract size	299 acres
Less percentage withdrawn for problem sites (23.4% County)	- 70 acres
Alternative acreage reduction	229 acres

Inventory reduction:

Mixed Old-Growth Acres (MO) = 229

Alternative #3 - Old-Growth Area Locations and Acreages (continued)

Area IV - Siuslaw National Forest, Benton County,
Within City of Corvallis Watershed, T.12S.,R7W.

Tract size	343 acres
Less percentage withdrawn for problem sites (13.5% Benton County)	- 46 acres
Alternative acreage reduction	297 acres

Inventory reduction:

Conifer Old-Growth Acres (DO) = 297

Area V - BLM Westside Salem District,
Benton County, T.14S.,R.8W.

Tract size 347 acres

Inventory reduction:

Poorly Stocked Old-Growth Acres
(TREES Age 13) 347

Area VI - BLM Westside Salem District,
Benton County, T.14S.,R.7W.
T.15S.,R7W.

Tract size 239 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 206
Poorly Stocked Old-Growth Acres
TREES Age 9 - 12
TREES Age 11 - 21
Subtotal 33 33

Alternative #3 - Old-Growth Area Locations and Acreages (continued)

Area VII - BLM Westside Salem District,
Benton County, T.14S.,R.7W.

Tract size	227 acres
Less withdrawn acres	- 1 acres
Alternative acreage reduction	226 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres =		149
Poorly Stocked Old-Growth Acres		
TREES Age 11 -	50	
TREES Age 12 -	14	
TREES Age 6 -	13	
Subtotal	77	77

Area VIII- BLM Westside Salem District,
Polk County, T.9S.,R.7W.

Tract size 309 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 309

Area IX - BLM Westside Salem District,
Polk County, T.9S.,R.7W.

Tract size 330 acres

Inventory reduction:

Poorly Stocked Old-Growth Acres	
(TREES Age 12)	211
(TREES Age 10)	51
(TREES Age 7)	68

Alternative #3 - Old-Growth Area Locations and Acreages (continued)

Area X - BLM Westside Salem District,
Polk County, T.7S.,R.7W.

Tract size	322 acres
Less withdrawn acres	- 2 acres
Alternative acreage reduction	320 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 320

Area XI - BLM Westside Salem District,
Polk County, T.7S.,R.8W.

Tract size	307 acres
Less withdrawn acres	- 17 acres
Alternative acreage reduction	290 acres

Inventory reduction:

Medium to Well Stocked Old-Growth Acres = 236
Poorly Stocked Old-Growth Acres
TREES Age 10 54

ALTERNATIVE #4 - SUMMARY OF INVENTORY REDUCTIONS[1]

Alternative #4 - All Old-Growth Tracts Withdrawn

Siuslaw National Forest		
	Mixed Old-Growth Acres (MO)	= 1,756
	Conifer Old-Growth Acres (DO)	= 6,124
	Acres Removed from Initial Inventory	7,880

New Initial Inventory Acreages, TREES Model

TREES Age 13 (DM + DO) = 80,669 - 6,124 = 74,545 acres
TREES Age 12 (MM + MO) = 33,453 - 1,756 = 31,697 acres

BLM Westside Salem District

Medium to Well Stocked Old-Growth Acres	= 7,596
Poorly Stocked Old-Growth Acres	= 6,151
Acres Removed from Initial Inventory	13,747

New Initial Inventory Acreages, TREES Model

TREES Age 5	= 1,113	- 29	= 11,084	acres
TREES Age 6	= 32,624	- 824	= 31,800	acres
TREES Age 7	= 20,883	- 342	= 20,541	acres
TREES Age 8	= 9,955	- 431	= 9,525	acres
TREES Age 9	= 6,177	- 349	= 5,828	acres
TREES Age 10	= 8,552	- 767	= 7,785	acres
TREES Age 11	= 9,890	- 963	= 8,927	acres
TREES Age 12	= 18,875	- 612	= 18,253	acres
TREES Age 13	= 11,459	- 942	= 10,517	acres
TREES Age 14	= 3,813	- 541	= 3,272	acres
TREES Age 15	= 5,045	- 196	= 4,849	acres
TREES Age 16	= 4,564	- 66	= 4,498	acres
TREES Age 17	= 1,170	- 69	= 1,101	acres
TREES Age 18	= 1,206	- 20	= 1,276	acres

[1] Locations and acreages for the individual old-growth areas in Alternative 4 are not provided here because the listing is too lengthy. Figures 3 and 4 in the text depict the old-growth distribution in this alternative.

APPENDIX B - YIELD TABLES

Yield tables are displayed here for each of the BLM and USFS model components used in harvest scheduling models, either TREES or HARVEST. Yields are displayed by component and management intensity. A discussion of silvicultural treatments implied in each management intensity is found in the text.

Management Intensity 3 yields were generally derived from agency empirical yield tables which were updated, if necessary, using cubic regression equations.

Yields for Management Intensities 6 and 7 were derived using DFSIM, a stand simulator for Douglas-fir (Curtis et al 1981). These volumes were adjusted to net volumes using reduction factors of 15 to 19 percent based upon Siuslaw National Forest planning data. For management intensity 7, increases in yields of 15 percent were assumed due to planting of genetically improved stock (N. Graybeal, personal communication, 1984).

Average conifer site indices (100 years) of 161 and 145 and red alder site indices of 90 and 80 were used for yield projections on USFS and BLM lands, respectively.

USFS Mature Conifer Component Yields

Age at Midpoint of First Decade: 101 Management Intensity: 3
Harvest Scheduling Model: TREES

Source of Table: Derived from Siuslaw National Forest empirical yield table. Updated to midpoint of first decade and projected using formula:

$$V = 6634.20 + .267329A + .647689A^2 - .00159744A^3$$

V = volume/acre in cubic feet
A = age in years

Age Class	Cubic Volume/acre
101	11,622
111	12,459
121	13,319
131	14,193
141	15,071
151	15,943
161	16,799
171	17,632
181	18,429
191	19,183

USFS Mature Conifer/Mixed Component Yields

Age at Midpoint of First Decade: 92 Management Intensity: 3
Harvest Scheduling Model: TREES

Source of Table: Derived from Siuslaw National Forest empirical yield table. Updated to midpoint of first decade and projected using formula:

$$V = 10453.80 + 316.225A - 1.23068A^2 + .00153224A^3$$

V = volume/acre in cubic feet
A = age in years

Age Class	Cubic Volume/acre
92	9,416
102	10,623
112	11,678
122	12,591
132	13,369
142	14,022
152	14,560
162	14,991
172	15,325
182	15,571

USFS Immature Conifer Component Yields

Age at Midpoint of First Decade: 60 Management Intensity: 3
Harvest Scheduling Model: TREES

Source of Table: Derived from Siuslaw National Forest empirical yield table. Updated to midpoint of first decade and projected using formula:

$$V = -864.110 + 124.114A + .00230882A^2 - .000517369^3$$

V = volume/acre in cubic feet
A = age in years

Age Class	Cubic Volume/acre
60	6,463
70	7,635
80	8,785
90	9,910
100	11,007
110	12,072
120	13,102
130	14,095
140	15,047
150	15,955

USFS Immature Conifer Component Yields

Age at Midpoint of First Decade: 39 Management Intensity: 3
Harvest Scheduling Model: TREES

Source of Table: Derived from Siuslaw National Forest empirical yield table. Updated to midpoint of first decade and projected using formula:

$$V = -1464.25 + 90.566A + .0343843A^2 - .000567667A^3$$

V = volume/acre in cubic feet
A = age in years

Age Class	Cubic Volume/acre
39	2,086
49	2,989
59	3,882
69	4,762
79	5,625
89	6,468
99	7,288
109	8,081
119	8,843
129	9,572

USFS Existing Conifer Plantation Yields

Age at Midpoint of First Decade: 15, 25, 35[1] Management Intensity: 6
Harvest Scheduling Model: TREES

Source of Table: Derived from DFSIM, stand simulator for Douglas-fir yields. Adjusted to net volumes per acre.

Age Class	Cubic Volume/acre	Thinning Volume/acre
25	1,169	
35	3,868	
45	6,775	2,183
55	6,980	
65	9,254	
75	11,262	
85	13,194	
95	14,840	
105	16,100	
115	17,066	

1 Existing plantations were subdivided into three age categories. All three of these access the same yield table, each beginning at the appropriate age.

USFS Regenerated Conifer Component Yields

Harvest Scheduling Model: TREES   Management Intensity: 7

Source of Table: Derived from DFSIM, stand simulator for Douglas-fir yields. Adjusted to net volumes per acre. Includes assumed yield increase due to use of genetically improved planting stock.

Age Class	Cubic Volume/acre	Thinning Volume/acre
25	1,375	
35	4,550	
45	7,970	2,568
55	8,212	
65	10,887	
75	13,273	
85	15,550	
95	17,490	
105	18,975	
115	20,114	

USFS Mature Red Alder Component Yields

Age at Midpoint of First Decade: 77 Management Intensity: 3
Harvest Scheduling Model: TREES, HARVEST[1]

Source of Table: Derived from Siuslaw National Forest empirical yield table. Updated to midpoint of first decade and projected using formula:

$$V = -5366.65 - 284.973A + 2.09829A^2 + .0048333A^3$$

V = volume/acre in cubic feet
A = age in years

Age Class	Cubic Volume/acre
77	6,342
87	6,727
97	6,944
107	7,023
117	6,882

1 The mature red alder acreage was subdivided into two components - a nonriparian component (modelled in TREES) which was converted to conifer management after regeneration harvest, and a riparian component (modelled in HARVEST) which remained in hardwood management. Both of these components used the same existing yield table.

USFS Immature Red Alder and Regenerated Red Alder Component Yields[1]

Age at Midpoint of First Decade: 20 Management Intensity: 3
Harvest Scheduling Model: HARVEST

Source of Table: Derived from Siuslaw National Forest riparian red alder (Site Index 90) yield table.

Age Class	Cubic Volume/acre
20	680
30	1,780
40	2,920
50	4,030
60	5,040
70	5,940
80	6,660
90	5,850
100	3,510

1 This yield table was used for both the existing immature red alder component and to project future yields for all regenerated stands remaining in hardwood management.

BLM Mature Conifer Component Yields

Age at Midpoint of First Decade: 55+[1] Management Intensity: 3
Harvest Scheduling Model: TREES

Source of Table: Derived from BLM Westside Salem District empirical yields by age class. Updated to midpoint of first decade and projected using formula:

$$V = -1246.72 + 141.964A - .293247A^2 + .0000268A^3$$

V = volume/acre in cubic feet
A = age in years

Age Class	Cubic Volume/acre
55	5,679
65	6,749
75	7,762
85	8,718
95	9,616
105	10,458
115	11,242
125	11,969
135	12,640
145	13,254
155	13,812
165	14,314
175	14,760
185	15,150
195	15,484
205	15,763
215	15,987
225	16,155
235	16,268
245	16,327
255	16,330
265	16,280
275	16,174
285	16,015
295	15,801
305	15,534

1 All existing conifer stands 55 years of age or more access this yield table each beginning at the appropriate age.

BLM Immature Conifer Component Yields

Age at Midpoint of First Decade: 5 to 45[1] Management Intensity: 6
Harvest Scheduling Model: TREES

Source of Table: Derived from DFSIM, stand simulator for Douglas-fir yields. Adjusted to net volumes per acre.

Age Class	Cubic Volume/acre	Thinning Volume/acre
25	574	
35	2,886	
45	5,565	1,785
55	5,976	
65	7,963	2,128
75	7,662	
85	9,342	
95	10,975	
105	12,626	
115	14,100	

1 All existing conifer stands with an average age 5 to 45 access this yield table, each beginning at the appropriate age.

BLM Regenerated Conifer Component Yields

Harvest Scheduling Model: TREES   Management Intensity: 7

Source of Table: Derived from DFSIM, stand simulator for Douglas-fir yields. Adjusted to net volumes per acre. Includes assumed yield increase due to use of genetically improved planing stock.

Age Class	Cubic Volume/acre	Thinning Volume/acre
25	675	
35	3,395	
45	6,547	2,100
55	7,030	
65	9,369	2,504
75	9,030	
85	11,010	
95	12,935	
105	14,881	
115	16,618	

BLM Existing Red Alder Yields

Age at Midpoint of First Decade: 10+[1]   Management Intensity: 3
Harvest Scheduling Model: HARVEST

Source of Table: Derived from empirical inventory data for BLM loggable hardwood component.

Age Class	Cubic Volume/acre
30	2,424
40	3,254
50	3,944
60	4,463
70	4,471
80	4,193
90	3,578
100	2,962

1 All existing red alder stands access this yield table, each beginning at the appropriate age.

BLM Regenerated Red Alder Yields

Harvest Scheduling Model: HARVEST   Management Intensity: 3

Source of Table: Siuslaw National Forest riparian red alder (Site Index 80) yield table.

Age Class	Cubic Volume/acre
20	430
30	1,370
40	2,350
50	3,290
60	4,140
70	4,860
80	5,310
90	4,500
100	2,700

APPENDIX C - TREES DATA FILES

TREES model user-generated data files are included for the base level and alternative runs. These files provide a compact description of the assumptions embodied in the TREES model harvest schedules.

The user-generated files are organized in three groups - the INV files, the CTL files, and the ACC files. Of these files, only the INV data varies between the base level and the alternative runs. These files contain the initial inventories, management intensities, and existing volumes per acre organized by inventory components termed basic resource units (BRU's).

The CTL files contain yield information by management intensity. These files are organized by grouped resource units (GRU's), which are collections of basic resource units with similar management and yield characteristics.

Harvest flow objectives and constraints are found in the ACC files. In these projections, each agency is considered an allowable cut unit (ACU).

Keys to each of the three types of data files are provided. Each type of file is referenced by sets of columns of input data or data fields and card types, which determine the types of data contained on each line. These keys are only intended to show data and options selected in these harvest projection. Therefore, they do not provide a comprehensive listing of modelling options available in the TREES model. For this purpose, refer to the TREES users' manual (Tedder et al 1980).

KEY TO INV FILES

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6
Basic resource unit	Card 1	1=even aged management		Unstocked acres	
Basic resource unit	Card 3	Management intensity	Starting age	Acres in stocking level 1	Volume per acre

INV FILE - BLM BASE LEVEL

Data Fields:

1	2	3	4	5	6
11121	1	1		9976.0	
11121	3	3	8	9955.0	5177.0
11121	3	3	9	6177.0	6197.0
11121	3	3	10	8552.0	7251.0
11121	3	3	11	9890.0	8177.0
11121	3	3	12	18865.0	9069.0
11121	3	3	13	11459.0	9978.0
11121	3	3	14	3813.0	10745.0
11121	3	3	15	5045.0	11591.0
11121	3	3	16	4564.0	12359.0
11121	3	3	17	1170.0	12671.0
11121	3	3	18	1296.0	13418.0
11121	3	3	20	519.0	14615.0
11121	3	3	22	1392.0	15420.0
11121	3	3	24	456.0	16011.0
11121	3	3	25	912.0	16226.0
11121	3	3	28	4317.0	13438.0
11121	3	6	3	13380.0	0.0
11121	3	6	4	21559.0	0.0
11121	3	6	5	11113.0	0.0
11121	3	6	6	32624.0	2894.0
11121	3	6	7	20883.0	4032.0

INV FILE - BLM ALTERNATIVE #1

Data Fields:

1	2	3	4	5	6
11121	1	1		9976.0	
11121	3	3	8	9955.0	5177.0
11121	3	3	9	6177.0	6197.0
11121	3	3	10	8498.0	7251.0
11121	3	3	11	9890.0	8177.0
11121	3	3	12	18827.0	9069.0
11121	3	3	13	11459.0	9978.0
11121	3	3	14	3813.0	10745.0
11121	3	3	15	5045.0	11591.0
11121	3	3	16	4564.0	12359.0
11121	3	3	17	1170.0	12671.0
11121	3	3	18	1296.0	13418.0
11121	3	3	20	519.0	14615.0
11121	3	3	22	1392.0	15420.0
11121	3	3	24	456.0	16011.0
11121	3	3	25	912.0	16226.0
11121	3	3	28	3419.0	13438.0
11121	3	6	3	13380.0	0.0
11121	3	6	4	21559.0	0.0
11121	3	6	5	11113.0	0.0
11121	3	6	6	32624.0	2894.0
11121	3	6	7	20883.0	4032.0

INV FILE - BLM ALTERNATIVE #2

Data Fields:

1	2	3	4	5	6
11121	1	1		9976.0	
11121	3	3	8	9955.0	5177.0
11121	3	3	9	6165.0	6197.0
11121	3	3	10	8413.0	7251.0
11121	3	3	11	9793.0	8177.0
11121	3	3	12	18602.0	9069.0
11121	3	3	13	11074.0	9978.0
11121	3	3	14	3668.0	10745.0
11121	3	3	15	5045.0	11591.0
11121	3	3	16	4564.0	12359.0
11121	3	3	17	1170.0	12671.0
11121	3	3	18	1296.0	13418.0
11121	3	3	20	519.0	14615.0
11121	3	3	22	1392.0	15420.0
11121	3	3	24	456.0	16011.0
11121	3	3	25	912.0	16226.0
11121	3	3	28	1979.0	13438.0
11121	3	6	3	13380.0	0.0
11121	3	6	4	21559.0	0.0
11121	3	6	5	11113.0	0.0
11121	3	6	6	32380.0	2894.0
11121	3	6	7	20815.0	4032.0

INV FILE - BLM ALTERNATIVE #3

Data Fields:

1	2	3	4	5	6
11121	1	1		9976.0	
11121	3	3	8	9955.0	5177.0
11121	3	3	9	6165.0	6197.0
11121	3	3	10	8447.0	7251.0
11121	3	3	11	9819.0	8177.0
11121	3	3	12	18640.0	9069.0
11111	3	3	13	11112.0	9978.0
11121	3	3	14	3813.0	10745.0
11121	3	3	15	5045.0	11591.0
11121	3	3	16	4564.0	12359.0
11121	3	3	17	1170.0	12671.0
11121	3	3	18	1296.0	13418.0
11121	3	3	20	519.0	14615.0
11121	3	3	22	1392.0	15420.0
11121	3	3	24	456.0	16011.0
11121	3	3	25	912.0	16266.0
11121	3	3	28	3097.0	13438.0
11121	3	6	3	13380.0	0.0
11121	3	6	4	21559.0	0.0
11121	3	6	5	11113.0	0.0
11121	3	6	6	32611.0	2894.0
11121	3	6	7	20815.0	4032.0

INV FILE - BLM ALTERNATIVE #4

Data Fields:

1	2	3	4	5	6
11121	1	1		9976.0	
11121	3	3	8	9524.0	5177.0
11121	3	3	9	5828.0	6197.0
11121	3	3	10	7785.0	7251.0
11121	3	3	11	8927.0	8177.0
11121	3	3	12	18253.0	9069.0
11121	3	3	13	10517.0	9978.0
11121	3	3	14	3272.0	10745.0
11121	3	3	15	4849.0	11591.0
11121	3	3	16	4498.0	12359.0
11121	3	3	17	1101.0	12671.0
11121	3	3	18	1276.0	13418.0
11121	3	6	3	13380.0	0.0
11121	3	6	4	21559.0	0.0
11121	3	6	5	11084.0	0.0
11121	3	6	6	31800.0	2894.0
11121	3	6	7	20541.0	4032.0

INV FILE - USFS BASE LEVEL

Data Fields:

1	2	3	4	5	6
11111	1	1		00000.0	
11111	3	3	9	20039.0	6463.0
11112	1	1		00000.0	
11112	3	3	6	2101.0	2086.0
11113	1	1		00000.0	
11113	3	3	13	80669.0	11622.0
11114	1	1		00000.0	
11114	3	3	12	33453.0	9416.0
11115	1	1		00000.0	
11115	3	3	10	28139.0	6342.0
11116	1	1		16726.0	
11116	3	6	4	16726.0	0.0
11116	3	6	5	21409.0	1169.0.
11116	3	6	6	12043.0	1169.0

INV FILE - USFS ALTERNATIVE #1

Data Fields:

1	2	3	4	5	6
11111	1	1		00000.0	
11111	3	3	9	20039.0	6463.0
11112	1	1		00000.0	
11112	3	3	6	2101.0	2086.0
11113	1	1		00000.0	
11113	3	3	13	76439.0	11622.0
11114	1	1		00000.0	
11114	3	3	12	32363.0	9416.0
11115	1	1		00000.0	
11115	3	3	10	28139.0	6342.0
11116	1	1		16726.0	
11116	3	6	4	16726.0	0.0
11116	3	6	5	21409.0	1169.0
11116	3	6	6	12043.0	1169.0

INV FILE - USFS ALTERNATIVE #2

Data Fields:

1	2	3	4	5	6
11111	1	1		00000.0	
11111	3	3	9	20039.0	6463.0
11112	1	1		00000.0	
11112	3	3	6	2101.0	2086.0
11113	1	1		00000.0	
11113	3	3	13	75993.0	11622.0
11114	1	1		00000.0	
11114	3	12		32044.0	9416.0
11115	1	1		00000.0	
11115	3	3	10	28139.0	6342.0
11116	1	1		16726.0	
11116	3	6	4	16726.0	0.0
11116	3	6	5	21409.0	1169.0
11116	3	6	6	12043.0	1169.0

INV FILE - USFS ALTERNATIVE #3

Data Fields:

1	2	3	4	5	6
11111	1	1		00000.0	
11111	3	3	9	20039.0	6463.0
11112	1	1		00000.0	
11112	3	3	6	2101.0	2086.0
11113	1	1		00000.0	
11113	3	13		80105.0	11622.0
11114	1	1		00000.0	
11114	3	3	12	33051.0	9416.0
11115	1	1		00000.0	
11115	3	3	10	28139.0	6342.0
11116	1	1		16726.0	
11116	3	6	4	16726.0	0.0
11116	3	6	5	21409.0	1169.0
11116	3	6	6	12043.0	1169.0

INV FILE - USFS ALTERNATIVE #4

Data Fields:

1	2	3	4	5	6
11111	1	1		00000.0	
11111	3	3	9	20039.0	6463.0
11112	1	1		00000.0	
11112	3	3	6	2101.0	2086.0
11113	1	1		00000.0	
11113	3	3	13	74545.0	11622.0
11114	1	1		00000.0	
11114	3	3	12	31697.0	9416.0
11115	1	1		00000.0	
11115	3	3	10	28139.0	6342.0
11116	1	1		16726.0	
11116	3	6	4	16726.0	0.0
11116	3	6	5	21409.0	1169.0
11116	3	6	6	12043.0	1169.0

KEY TO CTL FILES

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10	Field 11
Grouped resource unit	Card 01				Basic Resource Units (BRU's) included in this GRU					
Grouped resource unit	Card 02				Type of GRU 1=even-aged management	GRU site index (1-7)	Original species code	Original fiber type 1=softwood	GRU site class (1-7)	
Grouped resource unit	Card 03, first type, equation coefficients	Management intensity	Type of equation 1=total volume/acre in cubic ft. 2=thinning volume/acre in cubic ft. 3=mortality volume/acre in cubic ft. 4=softwood proportion of volume		Type of equation constraint (3=$\geq$0 and free)	If equation type (Field 4)= 1=total volume/acre 2=thinning volume/acre 3=mortality volume/acre 4=softwood proportion of volume				
Grouped resource unit	Card 03, second type, tabular values	Management intensity	Type of equation 1=total volume/acre in cubic ft. 2=thinning volume/acre in cubic ft.	Beginning age for tabular values	Tabular Values by Decades If equation type = 1, entries are standing volumes/acre If equation type = 2, entries are thinning volumes/acre					
Grouped resource unit	Card 05, first type				Mortality salvage indicator 0=no 1=yes	Salvable proportion mortality volume/acre	Minimum salvable volume/acre to initiate salvage	Type of regeneration 1=seed 2=plant 3=other	Proportion unstocked acres re-stocked each period	
Grouped resource unit	Card 05, second type	Management intensity			Proportion cutover acres to unstocked each period	Regeneration lag as proportion of period	Stocking level 1	Stocking level 2	Stocking level 3	
							Proportion of regenerated acres distributed to stocking levels			

KEY TO CTL FILES

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10	Field 11
Grouped resource unit	Card 08	Management intensity			Intermediate proportion of acres to management intensity	Long run proportion of acres to management intensity				
Grouped resource unit	Card 12, first type, equation coefficients	Management intensity			Type of equation constraint (3=≥0 and free)	Average stand diameter				
Grouped resource unit	Card 12, second type	Management intensity		Beginning age for tabular values	Tabular values by decades Average stand diameters					
Grouped resource unit	Card 16, first type				Type of growth indicator 1=approach to normal 2=yield equation	Type of approach to normality 1=growth 2=volume	Type of growth after thinning 1=approach to normal 2=% gross growth 3=% net growth			
Grouped resource unit	Card 16, second type		1=Approach to normality applied		Maximum age class for full approach to normality	Maximum age class for half approach to normality	Linear coefficient for approach to normality function	Constant term for approach to normality function		
Grouped resource unit	Card 17, first type				Proportion of standard volume/acre to enter stocking level 1	Proportion of standard volume/acre to enter stocking level 2				

KEY TO CTL FILES

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10	Field 11
Grouped resource unit	Card 17, second type			Age classes for management intensity shifts	Minimum management intensity entered	Maximum management intensity entered				
Grouped resource unit	Card 18, first type				Type of thinning 1=proportion of total volume 2=from table					
Grouped resource unit	Card 18, second type	Managment intensity			Minimum age class for thining	Maximum age class for thining				

CTL FILE - BLM

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11120101	01				11121					
11120101	02				1	1	1	1	1	
11120101	03	3	1		3	15534.0				
11120101	03	3	1	01	1.0	1.0	1.0	1.0	1.0	3360.0
11120101	03	3	1	07	5140.0	5679.0	6749.0	7762.0	8718.0	9616.0
11120101	03	3	1	13	10458.0	11242.0	11969.0	12640.0	13254.0	13812.0
11120101	03	3	1	19	14314.0	14760.0	15150.0	15484.0	15763.0	15987.0
11120101	03	3	1	25	16155.0	16268.0	16327.0	16330.0	16280.0	16174.0
11120101	03	3	1	31	16015.0	15801.0	15534.0			
11120101	03	3	2		3	0.0				
11120101	03	3	3		3	0.0				
11120101	03	3	4		3	1.0				
11120101	03	6	1		3	14868.0				
11120101	03	6	1	01	1.0	1.0	1.0	1.0	574.0	2886.0
11120101	03	6	1	07	5565.0	5976.0	7963.0	7662.0	9342.0	10975.0
11120101	03	6	1	13	12626.0	14100.0	14868.0	14868.0	14868.0	14868.0
11120101	03	6	2		3	0.0				
11120101	03	6	2	07	1785.0	0.0	2128.0	0.0	0.0	0.0
11120101	03	6	3		3	0.0				
11120101	03	6	4		3	1.0				
11120101	03	7	1		3	17621.0				
11120101	03	7	1	01	1.0	1.0	1.0	1.0	675.0	3395.0
11120101	03	7	1	07	6547.0	7030.0	9369.0	9030.0	11010.0	12935.0
11120101	03	7	1	13	14881.0	16618.0	17621.0	17621.0	17621.0	17621.0
11120101	03	7	2		3	0.0				
11120101	03	7	2	07	2100.0	0.0	2504.0	0.0	0.0	0.0
11120101	03	7	3		3	0.0				
11120101	03	7	4		3	1.0				
11120101	05				0	0.0	0.0	2	.2	
11120101	05	3			0.0	0.0	1.0	0.0	0.0	
11120101	05	6			0.0	0.0	1.0	0.0	0.0	
11120101	05	7			0.0	.2	1.0	0.0	0.0	
11120101	08	3			0.0	0.0				
11120101	08	6			0.0	0.0				
11120101	08	7			1.0	1.0				
11120101	12	3			3	44.5				
11120101	12	3		01	0.0	0.0	0.0	0.0	4.0	6.4
11120101	12	3		07	8.3	10.0	11.6	13.1	14.5	15.8
11120101	12	3		13	17.1	18.3	19.5	20.7	21.9	23.1
11120101	12	3		19	24.4	25.6	26.9	28.2	29.6	31.0
11120101	12	3		25	32.3	33.8	35.2	36.7	38.2	39.7
11120101	12	3		31	41.3	42.9	44.5			
11120101	12	6			3	32.2				
11120101	12	6		01	0.0	0.0	0.0	0.0	7.1	9.8
11120101	12	6		07	12.5	16.4	18.4	22.8	24.9	26.9
11120101	12	6		13	28.7	30.5	32.2	32.2	32.2	32.2
11120101	12	7			3	32.2				
11120101	12	7		01	0.0	0.0	0.0	0.0	7.1	9.8

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11120101	12	7		07	12.5	16.4	18.4	22.8	24.9	26.9
11120101	12	7		13	28.7	30.5	32.2	32.2	32.2	32.2
11120101	16				1	2	1			
11120101	16		1		7	13	.9	.11		
11120101	17				.20	.10				
11120101	17			33	7	7				
11120101	18				2					
11120101	18	6			7	9				
11120101	18	7			7	9				

CTL FILE - USFS

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11110101	01				11111					
11110101	02				1	1	1	1	1	
11110101	03	3	1		3	19727.0				
11110101	03	3	1	01	1.0	1.0	1.0	1.0	1.0	1.0
11110101	03	3	1	07	1.0	1.0	6463.0	7635.0	8785.0	9910.0
11110101	03	3	1	13	11007.0	12072.0	13102.0	14095.0	15047.0	15955.0
11110101	03	3	1	19	16816.0	17627.0	18384.0	19086.0	19727.0	19727.0
11110101	03	3	2		3	0.0				
11110101	03	3	3		3	0.0				
11110101	03	3	4		3	1.0				
11110101	03	7	1		3	20398.0				
11110101	03	7	1	01	1.0	1.0	1.0	1.0	1375.0	4550.0
11110101	03	7	1	07	7970.0	8212.0	10887.0	13273.0	15550.0	17490.0
11110101	03	7	1	13	18975.0	20114.0	20398.0	20398.0	20398.0	20398.0
11110101	03	7	2		3	0.0				
11110101	03	7	2	07	2568.0	0.0	0.0	0.0	0.0	0.0
11110101	03	7	3		3	0.0				
11110101	03	7	4		3	1.0				
11110101	05				0	0.0	0.0	2	0.0	
11110101	05	3			0.0	0.0	1.0	0.0	0.0	
11110101	05	7			0.0	.2	1.0	0.0	0.0	
11110101	08	3			0.0	0.0				
11110101	08	7			1.0	1.0				
11110101	12	3			3	47.5				
11110101	12	3		01	0.0	0.0	0.0	0.0	5.0	7.2
11110101	12	3		07	9.3	11.2	12.9	14.5	15.9	17.4
11110101	12	3		13	18.7	20.0	21.2	22.5	23.7	25.0
11110101	12	3		19	26.4	27.7	29.1	30.5	31.9	33.3
11110101	12	3		25	34.8	36.3	37.8	39.3	40.9	42.5
11110101	12	3		31	44.2	46.8	47.5			
11110101	12	7			3	30.4				
11110101	12	7		01	0.0	0.0	0.0	0.0	7.9	10.7
11110101	12	7		07	13.5	18.0	20.1	21.9	23.6	25.3
11110101	12	7		13	27.0	28.7	30.4	30.4	30.4	30.4
11110101	16				1	2	1			
11110101	16		1		7	13	.9	.11		
11110101	17				.20	.10				
11110101	17			33	7	7				
11110101	18				2					
11110101	18	7			7	7				
11110102	01				11112					
11110102	02				1	1	1	1	1	
11110102	03	3	1		3	13447.0				
11110102	03	3	1	01	1.0	1.0	1.0	1.0	1.0	2086.0
11110102	03	3	1	07	2989.0	3882.0	4762.0	5625.0	6468.0	7288.0
11110102	03	3	1	13	8081.0	8843.0	9572.0	10264.0	10916.0	11523.0
11110102	03	3	1	19	12084.0	12593.0	13049.0	13447.0	13447.0	13447.0
11110102	03	3	2		3	0.0				

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11110102	03	3	3		3	0.0				
11110102	03	3	4		3	1.0				
11110102	03	7	1		3	20398.0				
11110102	03	7	1	01	1.0	1.0	1.0	1.0	1375.0	4550.0
11110102	03	7	1	07	7970.0	8212.0	10887.0	13273.0	15550.0	17490.0
11110102	03	7	1	13	18975.0	20114.0	20398.0	20398.0	20398.0	20398.0
11110102	03	7	2		3	0.0				
11110102	03	7	2	07	2568.0	0.0	0.0	0.0	0.0	0.0
11110102	03	7	3		3	0.0				
11110102	03	7	4		3	1.0				
11110102	05				0	0.0	0.0	2	0.0	
11110102	05	3			0.0	0.0	1.0	0.0	0.0	
11110102	05	7			0.0	.2	1.0	0.0	0.0	
11110102	08	3			0.0	0.0				
11110102	08	7			1.0	1.0				
11110102	12	3			3	47.5				
11110102	12	3		01	0.0	0.0	0.0	0.0	5.0	7.2
11110102	12	3		07	9.3	11.2	12.9	14.5	15.9	17.4
11110102	12	3		13	18.7	20.0	21.2	22.5	23.7	25.0
11110102	12	3		19	26.4	27.7	29.1	30.5	31.9	33.3
11110102	12	3		25	34.8	36.3	37.8	39.3	40.9	42.5
11110102	12	3		31	44.2	46.8	47.5			
11110102	12	7			3	30.4				
11110102	12	7		01	0.0	0.0	0.0	0.0	7.9	10.7
11110102	12	7		07	13.5	18.0	21.1	21.9	23.6	25.3
11110102	12	7		13	27.0	28.7	30.4	30.4	30.4	30.4
11110102	16				1	2	1			
11110102	16		1		7	13	.9	.11		
11110102	17				.20	.10				
11110102	17			33	7	7				
11110102	18				2					
11110102	18	7			7	7				
11110103	01				11113					
11110103	02				1	1	1	1	1	
11110103	03	1			3	19883.0				
11110103	03	3	1	01	1.0	1.0	1.0	1.0	1.0	1.0
11110103	03	3	1	07	1.0	1.0	1.0	1.0	1.0	1.0
11110103	03	3	1	13	11662.0	12459.0	13319.0	14193.0	15071.0	15943.0
11110103	03	3	1	19	16799.0	17632.0	18429.0	19183.0	19883.0	19883.0
11110103	03	3	2		3	0.0				
11110103	03	3	3		3	0.0				
11110103	03	3	4		3	1.0				
11110103	03	7	1		3	20398.0				
11110103	03	7	1	01	1.0	1.0	1.0	1.0	1375.0	4550.0
11110103	03	7	1	07	7970.0	8212.0	10887.0	13273.0	15550.0	17490.0
11110103	03	7	1	13	18975.0	20114.0	20398.0	20398.0	20398.0	20398.0
11110103	03	7	2		3	0.0				
11110103	03	7	2	07	2568.0	0.0	0.0	0.0	0.0	0.0
11110103	03	7	3		3	0.0				
11110103	03	7	4		3	1.0				

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11110103	05				0	0.0	0.0	2	0.0	
11110103	05	3			0.0	0.0	1.0	0.0	0.0	
11110103	05	7			0.0	.2	1.0	0.0	0.0	
11110103	08	3			0.0	0.0				
11110103	08	7			1.0	1.0				
11110103	12	3			3	47.5				
11110103	12	3		01	0.0	0.0	0.0	0.0	5.0	7.2
11110103	12	3		07	9.3	11.2	12.9	14.5	15.9	17.4
11110103	12	3		13	18.7	20.0	21.2	22.5	23.7	25.0
11110103	12	3		19	26.4	27.7	29.1	30.5	31.9	33.3
11110103	12	3		25	34.8	36.3	37.8	39.3	40.9	42.5
11110103	12	3		31	44.2	46.8	47.5			
11110103	12	7			3	30.4				
11110103	12	7		01	0.0	0.0	0.0	0.0	7.9	10.7
11110103	12	7		07	13.5	18.0	20.1	21.9	23.6	25.3
11110103	12	7		13	27.0	28.7	30.4	30.4	30.4	30.4
11110103	16				1	2	1			
11110103	16		1		7	13	.9	.11		
11110103	17				.20	.10				
11110103	17			33	7	7				
11110103	18				2					
11110103	18	7			7	7				
11110104	01				11114	11116				
11110104	02				1	1	1	1	1	
11110104	03	3	1		3	15836.0				
11110104	03	3	1	01	1.0	1.0	1.0	1.0	1.0	1.0
11110104	03	3	1	07	1.0	1.0	1.0	1.0	1.0	9416.0
11110104	03	3	1	13	10623.0	11678.0	12591.0	13369.0	14022.0	14560.0
11110104	03	3	1	19	14991.0	15325.0	15571.0	15739.0	15836.0	15836.0
11110104	03	3	2		3	0.0				
11110104	03	3	3		3	0.0				
11110104	03	3	4		3	1.0				
11110104	03	6	1		3	17211.0				
11110104	03	6	1	01	1.0	1.0	1.0	1.0	1169.0	3868.0
11110104	03	6	1	07	6775.0	6980.0	9254.0	11262.0	13194.0	14840.0
11110104	03	6	1	13	16100.0	17066.0	17211.0	17211.0	17211.0	17211.0
11110104	03	6	2		3	0.0				
11110104	03	6	2	07	2183.0	0.0	0.0	0.0	0.0	0.0
11110104	03	6	3		3	0.0				
11110104	03	6	4		3	1.0				
11110104	03	7	1		3	20398.0				
11110104	03	7	1	01	1.0	1.0	1.0	1.0	1375.0	4550.0
11110104	03	7	1	07	7970.0	8212.0	10887.0	13273.0	15550.0	1749.0
11110104	03	7	1	13	18975.0	20114.0	20398.0	20398.0	20398.0	20398.0
11110104	03	7	2		3	0.0				
11110104	03	7	2	07	2568.0	0.0	0.0	0.0	0.0	0.0
11110104	03	7	3		3	0.0				
11110104	03	7	4		3	1.0				
11110104	05				0	0.0	0.0	2	1.0	
11110104	05	3			0.0	0.0	1.0	0.0	0.0	

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11110104	05	6			0.0	0.0	1.0	0.0	0.0	
11110104	05	7			0.0	.2	1.0	0.0	0.0	
11110104	08	3			0.0	0.0				
11110104	08	6			0.0	0.0				
11110104	08	7			1.0	1.0				
11110104	12	3			3	47.5				
11110104	12	3		01	0.0	0.0	0.0	0.0	5.0	7.2
11110104	12	3		07	9.3	11.2	12.9	14.5	15.9	17.4
11110104	12	3		13	18.7	20.0	21.2	22.5	23.7	25.0
11110104	12	3		19	26.4	27.7	29.1	30.5	31.9	33.3
11110104	12	3		25	34.8	36.3	37.8	39.3	40.9	42.5
11110104	12	3		31	44.2	46.8	47.5			
11110104	12	6			3	30.4				
11110104	12	6		01	0.0	0.0	0.0	0.0	7.9	10.7
11110104	12	6		07	13.5	18.0	20.1	21.9	23.6	25.3
11110104	12	6		13	27.0	28.7	30.4	30.4	30.4	30.4
11110104	12	7			3	30.4				
11110104	12	7		01	0.0	0.0	0.0	0.0	7.9	10.7
11110104	12	7		07	13.5	18.0	20.1	21.9	23.6	25.3
11110104	12	7		13	27.0	28.7	30.4	30.4	30.4	30.4
11110104	16				1	2	1			
11110104	16		1		7	13	.9	.11		
11110104	17				.20	.10				
11110104	17			33	7	7				
11110104	18				2					
11110104	18	6			7	7				
11110104	18	7			7	7				
11110105	01				11115					
11110105	02				1	1	1	1	1	
11110105	03	3	1		3	6882.0				
11110105	03	3	1	01	1.0	1.0	1.0	1.0	1.0	1.0
11110105	03	3	1	07	1.0	1.0	1.0	6342.0	6727.0	6944.0
11110105	03	3	1	13	7023.0	6882.0	6882.0	6882.0	6882.0	6882.0
11110105	03	3	2		3	0.0				
11110105	03	3	3		3	0.0				
11110105	03	3	4		3	0.0				
11110105	03	7	1		3	20398.0				
11110105	03	7	1	01	1.0	1.0	1.0	1.0	1375.0	4550.0
11110105	03	7	1	07	7970.0	8212.0	10887.0	13273.0	15550.0	17490.0
11110105	03	7	1	13	18975.0	20114.0	20398.0	20398.0	20398.0	20398.0
11110105	03	7	2		3	0.0				
11110105	03	7	2	07	2568.0	0.0	0.0	0.0	0.0	0.0
11110105	03	7	3		3	0.0				
11110105	03	7	4		3	1.0				
11110105	05				0	0.0	0.0	2	0.0	
11110105	05	3			0.0	0.0	1.0	0.0	0.0	
11110105	05	7			0.0	.2	1.0	0.0	0.0	
11110105	08	3			0.0	0.0				
11110105	08	7			1.0	1.0				
11110105	12	3			3	22.0				

Data Fields:

1	2	3	4	5	6	7	8	9	10	11
11110105	12	3		01	0.0	0.0	0.0	0.0	8.0	9.0
11110105	12	3		07	10.0	11.0	12.0	13.0	14.0	15.0
11110105	12	3		13	16.0	17.0	18.0	19.0	20.0	21.0
11110105	12	7			3	30.4				
11110105	12	7		01	0.0	0.0	0.0	0.0	7.9	10.7
11110105	12	7		07	13.5	18.0	20.1	21.9	23.6	25.3
11110105	12	7		13	27.0	28.7	30.4	30.4	30.4	30.4
11110105	16				1	2	1			
11110105	16		1		7	13	.9	.11		
11110105	17				.20	.10				
11110105	17			33	7	7				
11110105	18				2					
11110105	18	7			7	7				

<u>KEY TO ACC FILES</u>

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9
Allowable cut unit	Card 01		Type of ACU 1=even-aged managment		Type of fixed harvest method 0=not used	Type of variable harvest method 1=even-flow of volume		
Allowable cut unit	Card 02		Initial discount rate 1.0=no discounting	First period for initial discount rate 0=no shift in discount rate	Final discount rate 1.0= no discounting			
Allowable cut unit	Card 06		Number of periods for look-ahead optimization cycle	Number of periods for optimization period (planning period)	Type of ending ending condition 1=exhaust all volume above specified age class at end of the planning period			
Allowable cut unit	Card 07		Trial volume harvested in period 0 to begin optimization cycles	Proportion of initial harvest level to set binary-search increment	Proportion of present harvest level to set difference tolerance	Proportion of present harvest level to set increment (step size) tolerance	Proportion of volume decrease allowed from period to period 0.0=not active	Proportion of volume increase allowed from period to period 0.0=not active
Allowable cut unit	Card 10		Even-aged management harvest priority 1=age	First age class available for harvest	Age class for checking ending condition type 1			
Allowable cut unit	Card 11	Age	Proportion of harvest volume requested by age class					

ACC File - BLM

Data Fields:

1	2	3	4	5	6	7	8	9
11120000	01		1		0	1		
11120000	02		1.0	0	1.0			
11120000	06		8	10	1			
11120000	07		275250000.	.10	.10	.01	0.0	0.0
11120000	10		1	5	10			
11120000	11	33	1.0					

ACC File - USFS

Data Fields:

1	2	3	4	5	6	7	8	9
11110000	01		1		0	1		
11110000	02		1.0	0	1.0			
11110000	06		8	10	1			
11110000	07		375000000.	.10	.10	.01	0.0	0.0
11110000	10		1	5	11			
11110000	11	33	1.0					

APPENDIX D - HARVEST SCHEDULES AND ECONOMIC EFFECTS

Harvest schedules for the USFS, BLM, and combined projections are displayed for the base level and alternative runs.

Revenue and present net value calculations related to these harvest levels are shown for the USFS and BLM projections. Although the intent of the analysis was to show relative changes in these economic measures, reported stumpage price data was used to approximate an average value for the hardwood and conifer harvests (Ruderman 1984). Values of $200 per thousand board feet for conifer harvests and $25 per thousand board feet for hardwood harvests were used. Average board foot to cubic foot conversion factors from existing mature stand data were used to convert these values to a cubic foot basis. For the conifer value, the factor was 5 board feet per cubic foot. A factor of 4 board feet per cubic foot was used for the hardwood value (Derived from USDA Forest Service Planning Records 1984). No real price increases were assumed in these projections. The basic methods for determining revenues and present net values are illustrated below.

Revenue Projections

$$R_j = V_h H_j + V_c C_j$$

Where R_j = Revenue in period j at the midpoint of the period, j = 1 to 10

V_h = Value of hardwood harvest (in millions of dollars, MM$) per million cubic feet (MMCF) = .10 MM$/MMCF

V_c = Value of conifer harvest (in millions of dollars, MM$) per million cubic feet (MMCF) = 1.0 MM$/MMCF

H_j = Hardwood harvest level in period j, from HARVEST model projections

C_j = Conifer harvest level in period j, from TREES model projections

Present Net Value Projections

$$PNV = \sum_{j=1}^{10} R_j/(1 + i)^n$$

Where n = 10j - 5, to allow for discounting the total value of the harvest for the period from the midpoint of that period

i = Discount rate of 6% or .06

USFS Revenues and Present Net Values

Base Level and Alternatives

Revenues (MM$)

Decade	Base Level	Alt. #1	Alt. #2	Alt. #3	Alt. #4
1990	348.31	334.24	334.24	343.62	329.56
2000	339.50	329.95	325.79	334.93	325.32
2010	356.30	346.27	341.91	351.50	341.41
2020	356.22	346.19	346.09	355.80	341.33
2030	356.17	346.14	346.04	355.75	345.54
2040	360.55	354.71	350.29	360.13	349.78
2050	369.50	359.09	358.98	364.58	354.10
2060	369.48	359.07	358.96	369.10	354.08
2070	378.66	368.00	367.88	378.28	362.88
2080	383.37	372.57	372.45	378.26	367.39
Present Net Values (MM$)	589.04	569.44	566.48	582.26	561.77

BLM Revenues and Present Net Values

Base Level and Alternatives

	Revenues (MM$)				
Decade	Base Level	Alt. #1	Alt. #2	Alt. #3	Alt. #4
1990	262.54	259.10	252.22	255.66	231.57
2000	255.90	252.55	245.84	249.19	228.59
2010	249.45	249.32	242.70	246.01	225.66
2020	246.28	243.05	239.61	242.88	219.98
2030	243.16	239.97	236.58	239.81	218.57
2040	240.09	239.93	236.54	239.77	218.53
2050	243.06	239.91	236.52	239.75	223.95
2060	243.06	239.91	236.52	239.75	223.95
2070	243.02	245.85	242.37	239.71	223.91
2080	243.00	245.83	242.35	245.66	229.47
Present Net Values (MM$)	431.80	427.03	416.58	422.21	384.76

Harvest Schedules

BLM

Harvest Levels (MMCF)

Run Title	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080
	Midpoint of period									
Base Level										
Conifer	261.49	254.95	248.58	245.47	242.40	239.37	242.36	242.36	242.36	242.36
Hardwood	10.45	9.50	8.73	8.10	7.56	7.22	6.98	6.75	6.56	6.43
Total	271.94	264.45	257.31	253.57	249.96	246.59	249.34	249.11	248.92	248.79
Alt. #1										
Conifer	258.05	251.60	248.45	242.24	239.21	239.21	239.21	239.21	245.19	245.19
Hardwood	10.45	9.50	8.73	8.10	7.56	7.22	6.98	6.75	6.56	6.43
Total	268.50	261.10	257.18	250.34	246.77	246.43	246.19	245.96	251.75	251.62
Alt. #2										
Conifer	251.17	244.89	241.83	238.80	235.82	235.82	235.82	235.82	241.71	241.71
Hardwood	10.45	9.50	8.73	8.10	7.56	7.22	6.98	6.75	6.56	6.43
Total	261.62	254.39	250.56	246.90	243.38	243.04	242.80	242.57	248.27	248.14
Alt. #3										
Conifer	254.61	248.24	245.14	242.07	239.05	239.05	239.05	239.05	239.05	245.02
Hardwood	10.45	9.50	8.73	8.10	7.56	7.22	6.98	6.75	6.56	6.43
Total	265.06	257.74	253.87	250.17	246.61	246.27	246.03	245.80	245.61	251.45
Alt. #4										
Conifer	230.52	227.64	224.79	219.17	217.81	217.81	223.25	223.25	223.25	228.83
Hardwood	10.45	9.50	8.73	8.10	7.56	7.22	6.98	6.75	6.56	6.43
Total	240.97	237.14	233.52	227.27	225.37	225.03	230.23	230.00	229.81	235.26

Harvest Schedules

USFS

Harvest Levels (MMCF)

Run Title	Midpoint of period 1990	2000	2010	2020	2030	2040	2050	2060	2070	2080
Base Level										
Conifer	346.88	338.20	355.11	355.11	355.11	359.55	368.54	368.54	377.75	382.48
Hardwood	14.31	12.98	11.85	11.08	10.63	9.99	9.62	9.35	9.14	8.93
Total	361.19	351.18	366.96	366.19	365.74	369.54	378.16	377.89	386.89	391.41
Alt. #1										
Conifer	332.81	328.65	345.08	345.08	345.08	353.71	358.13	358.13	367.09	371.68
Hardwood	14.31	12.98	11.85	11.08	10.63	9.99	9.62	9.35	9.14	8.93
Total	347.12	341.63	356.93	356.16	355.71	363.70	367.75	367.48	376.23	380.61
Alt. #2										
Conifer	332.81	324.49	340.72	344.98	344.98	349.29	358.02	358.02	366.97	371.56
Hardwood	14.31	12.98	11.85	11.08	10.63	9.99	9.62	9.35	9.14	8.93
Total	347.12	337.47	352.57	356.06	355.61	359.28	367.64	367.37	376.11	380.49
Alt. #3										
Conifer	342.19	333.63	350.31	354.69	354.69	359.13	363.62	368.16	377.37	377.37
Hardwood	14.31	12.98	11.85	11.08	10.63	9.99	9.62	9.35	9.14	8.93
Total	356.50	346.61	362.16	365.77	365.32	369.12	373.24	377.51	386.51	386.30
Alt. #4										
Conifer	328.13	324.02	340.22	340.22	344.48	348.78	353.14	353.14	361.97	366.50
Hardwood	14.31	12.98	11.85	11.08	10.63	9.99	9.62	9.35	9.14	8.93
Total	342.44	337.00	352.07	351.30	355.11	358.77	362.76	362.49	371.11	375.43

Combined Harvest Schedules

BLM and USFS

Harvest Levels (MMCF)

	Midpoint of period									
Run Title	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080
Base Level										
Conifer	608.37	593.15	603.69	600.58	597.51	598.92	610.90	610.90	620.11	624.84
Hardwood	24.76	22.48	20.58	19.18	18.19	17.21	16.60	16.10	15.70	15.36
Total	633.13	615.63	624.27	619.76	615.70	616.13	627.50	627.00	635.81	640.20
Alt. #1										
Conifer	590.86	580.25	593.53	587.32	584.29	592.92	597.34	597.34	612.28	616.87
Hardwood	24.76	22.48	20.58	19.18	18.19	17.21	16.60	16.10	15.70	15.36
Total	615.62	602.73	614.11	606.50	602.48	610.13	613.94	613.44	627.98	632.23
Alt. #2										
Conifer	583.98	569.38	582.55	583.78	580.80	585.11	593.84	593.84	608.68	613.27
Hardwood	24.76	22.48	20.58	19.18	18.19	17.21	16.60	16.10	15.70	15.36
Total	608.74	591.86	603.13	602.96	598.99	602.32	610.44	609.94	624.38	628.63
Alt. #3										
Conifer	596.80	581.87	595.45	596.76	593.74	598.18	602.67	607.21	616.42	622.39
Hardwood	24.76	22.48	20.58	19.18	18.19	17.21	16.60	16.10	15.70	15.36
Total	621.56	604.35	616.03	615.94	611.93	615.39	619.27	623.31	632.12	637.75
Alt. #4										
Conifer	558.65	551.66	565.01	559.39	562.29	566.59	576.39	576.39	585.22	595.33
Hardwood	24.76	22.48	20.58	19.18	18.19	17.21	16.60	16.10	15.70	15.36
Total	583.41	574.14	585.59	578.57	580.48	583.80	592.99	592.49	600.92	610.69