Communique

MAY 1993

CASCADE CENTER FOR ECOSYSTEM MANAGEMENT

YOUNG MANAGED STANDS

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The purpose of this communique is to share information, to promote understanding and familiarity with young stands, and to facilitate further communication between those managing and studying young stands. Ecology and management of managed Douglas-fir forests 30-50 years of age are the main focus; however, much information discussed may apply to stands 20-120 years. Although some information is derived specifically from the Willamette National Forest, the topics discussed and information presented are widely applicable to forest management throughout western Oregon and Washington.

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INTRODUCTION

Young forests have been a part of forested landscapes in the Pacific Northwest for centuries because fire and other disturbances have initiated succession at various times and at various scales. Three things have brought about intense interest in management of young managed forests today:

1) Land area covered by complex old-forest ecosystems has been reduced, while young managed stands now form a significant portion of many landscapes. The bulk of this transformation has occurred in the last 50 years, and is currently highlighted by concerns for viability of species associated with old-forest characteristics.

2) Existing young managed stands are not "equivalent" to similar-aged unmanaged stands (Spies and Franklin 1991), and the former and existing trajectory intended for many of these stands would neither contribute to nor perpetuate old-forest characteristics on landscapes.

3) Management of ecosystems is considered by some managers and scientists to be a better long-term approach to public land management than strict designation of set-aside and intense wood production land.

A BRIEF HISTORY OF MANAGED STANDS ON THE WILLAMETTE NATIONAL FOREST

Approximately 350,000 acres of mature and old-growth forest have been harvested in the last 50 years on the Willamette National Forest (Jim Mayo pers. comm.). **Figure 1** displays the acre distribution for stands up to 50 years old on land suitable for timber production in 1989. On the majority of these acres, Douglas-fir dominates the regeneration. These young stands will be a significant part of the landscape for decades to come.

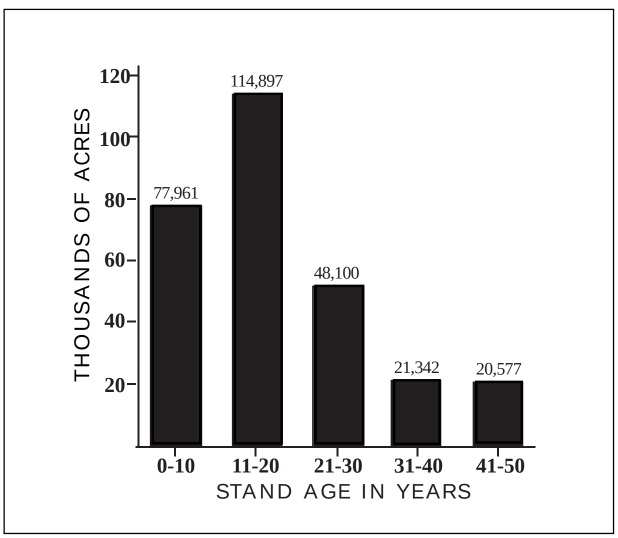
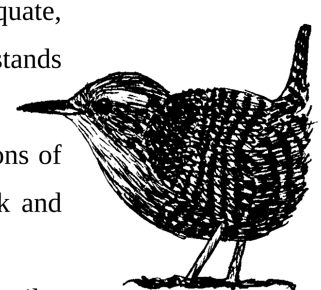


Figure 1. Acres by stand age for managed stands on suitable soils, Willamette NF, 1989. (USDA Forest Service 1990, p. IV-43)

Management practices have changed over the past five decades, and have contributed to visible variations in structure and composition of present-day young managed stands. In the 1940s, 50s and 60s, stands were chosen for harvest based on accessibility, size of trees, and the perceived degree of decadence. The intention was to convert these forests into faster-growing timber lands. These old forests had a considerable amount of wood not economically valuable at the time. That wood was left on site. Burning typically took place in the fall. Fires were hot and often burned most slash and duff off the units except for larger wet logs or more moist sites in the units. In the earliest times, reforestation was more dependant upon timing and success of natural regeneration. Replanting efforts were often delayed with the intention of supplementing natural regeneration. Pre-commercial thinning west of the Cascades began during the 1960s, but not all stands were thinned because of limited funding.

In the 1970s, several things began to change. Concern developed over smoke put in the air from slash burning and over soil scorching caused by hot fires. In response to these concerns, burning periods became shorter and were changed to be primarily in spring. During spring, the woody material usually contained more moisture than in the fall and so would burn cooler. Utilization standards for material on the sites became more strict, requiring operators to take out smaller logs than previously required. Unusable material began to be required to be removed from the unit and piled, which lessened the need for hot fires, reduced the time needed for burning, and reduced the likelihood of restarts from large logs. The wood market changed such that previously nonvaluable material became economically worthwhile to remove. With the enactment of NFMA (1976), adequate, timely stocking of harvest units became a high priority. Since the late 1970s, most stands needing stocking level control have been pre-commercially thinned.



Winter Wren

Currently, woody material is left on the site, both down and standing, for reasons of structural diversity, animal habitat needs, and long-term site productivity. Quick and thorough stocking of conifer seedlings, and pre-commercial thinning is routine.

Differences in practices over time (and variances among stand treatments during similar time periods) have contributed to visible variations in structure and composition of present-day young managed stands. Site-specific characteristics, such as soil type, weather factors, and presence of root rots, have also contributed to the character of existing stands. Stands differ in amounts of large woody material, snags, variation in tree size, species and spacing.

Examples of completely unmanaged young forests less than 50 years of age are scarce. Most areas burned within the last 50 years have been salvaged. Natural regeneration in fire areas was often supplemented by manual planting. Even naturally regenerated areas were often precommercially thinned. Unmanaged forests 50-100 years old are probably more numerous; however, origins and extent of early management are not as easily determined for these stands. (Much of this section was developed through personal communication with Bob Sanders, Phil Jaspers, Jim Mayo, John Dewitz, Sam Swetland, and Lowell Nelson).

WHAT WE THINK WE KNOW

Both young unmanaged and managed forests show variation in structure and composition (Spies and Franklin 1991, Spies 1991, unpublished data from Young Stand Study, Willamette NF, elsewhere in this communique). A comprehensive and precise comparison of vegetative attributes between unmanaged and managed stands has not been made, probably because many of the existing data are not comparable. However, the following text from Spies and Franklin (1991) gives a good overview of present understanding:

"Many natural young and mature stands have some of the attributes of old-growth stands that may not be present in young, managed stands. Perhaps the greatest difference between natural and managed stands is the lower number and volume of large snags and logs in managed plantations (Spies and Cline 1988). Many young natural forests less than 80 years old have high amounts of carry-over of woody debris, although some young natural stands have little carry-over (Spies and others 1988). Other structural differences between young and mature natural forests and their managed equivalents are less well known. Managed plantations, however, generally will have fewer tree species, more uniform tree sizes and spacing, and no large remnant overstory trees."

Studies and observations to date suggest that certain structural and compositional aspects present in some young stands make them habitable by some "older forest" animal species. These features include remnant large trees; dead wood in the form of snags and logs; vertical and horizontal variation in tree canopies; and presence of broadleaf trees and shrubs. Most managed stands contain very few of these features. Current studies are investigating plant and animal presence in young managed stands and their response to a wide variety of structural manipulations (see elsewhere in this communique).

It may be possible to develop desired forest structures and compositions through specific and timed actions in managed stands.

Most studies in young stands have gathered data only on species presence and abundance, and not on population dynamics or reproductive success (with the exception of Irwin et. al. 1991, Rosenberg 1991, and the current study by Sang-Don Lee at University of Washington; also see Lee and West 1992). The difficulty of gathering demographic and genetic data makes it difficult to know the fitness of individuals using these stands, but this difficulty is applicable to any forest age. Changes in site productivity may also play a role in how ecosystems function over long time periods (See Long-term Research on Forest Productivity under Other Current Studies in this communique).

Successive short rotations of young forest will serve to reduce and eventually eliminate large-diameter snags and down wood in these stands, unless trees from existing stands are retained and allowed to grow through more than one rotation. Spies and Franklin (1991) reported regional variability among old-growth forests and stated that, "variability in old-growth forest structure strongly suggests varied developmental histories." A lesson to learn here is that it may be possible to develop desired forest structures and compositions through specific and timed actions in managed stands. Models that can simulate growth and manipulation of multi-species and multi-layer forests in western Oregon and Washington are currently in development.

Rationale for specific objectives at various scales is sparse. Nevertheless, objectives are necessary. Young stands are often looked at as being of little value to wildlife, however, Spies and Franklin (1991) stated "...natural young and mature forests have also provided important habitat and ecosystem functions that may be lost if only old-growth forest areas are used to provide habitat diversity for an entire landscape." Managing within the range of natural variation, as suggested by recent developments in ecosystem management, may be a context with which to develop specific objectives. Objectives for stands should be developed within the context of landscape objectives. Landscape objectives should be developed within regional and sub-regional settings. Probably, objectives will not be identical for all stands, nor for all landscapes or regions.

Costs of developing diversity in stands and landscapes are unknown. Published information exists on costs of thinning stands to traditional spacings and using traditional equipment. Much less is known about costs of thinning to lower residual densities or creating patches or other variations in structure. There are also few data on costs of using more modern equipment, such as the harvester-forwarder, and recent mid-sized yarders (Loren Kellogg pers. comm.). Feasibility, benefits, and costs of designing structure and composition into managed stands are being investigated in several current studies. Long-term and landscape-scale benefits and costs will be more complex to estimate, particularly when many costs and benefits are not necessarily monetary.

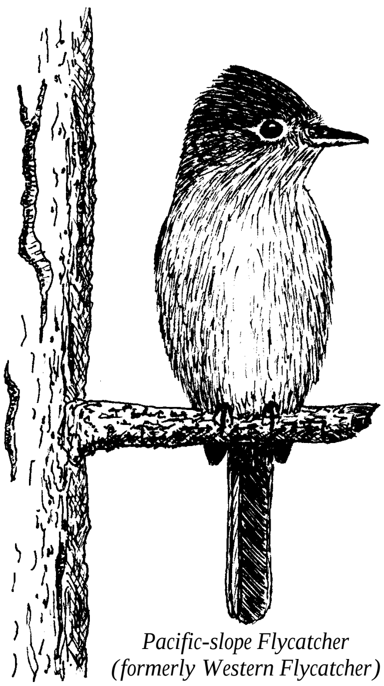
McComb et. al. (In press) and Hansen et. al. (1991) are highly recommended reading for detailed background and summaries of current knowledge regarding development of diversity in young managed stands. The many contributions on unmanaged stands in Ruggiero et. al (1991) give data on character and variation of unmanaged forests, and insight into management of existing and future forests.

IDEAS FOR INCREASING HABITAT AND ANIMAL DIVERSITY IN EXISTING AND FUTURE YOUNG MANAGED STANDS

This section can be thought of as a tool box. Tools are generally used in particular combinations and in particular sequences to achieve specific purposes. The ideas presented discuss ways to develop the specific feature mentioned, or discuss potential changes induced by a particular practice. Most would agree that implementing any of the following ideas would likely increase both diversity and logging costs. However, few quantitative data are available on economic and ecological consequences of implementing these ideas. Many of the practices and parameters presented here are currently being investigated in stratified designs in several places in western Oregon and Washington. Others are not, and could be operationally tested in demonstration areas or in scientifically designed studies. Some of the ideas are appropriate for current management and are currently being implemented.

Broadleaf Trees. Species regularly occurring at dominant and co-dominant size in managed stands are black cottonwood, bigleaf maple, and red alder; occasionally golden chinquapin and Pacific madrone are present. Smaller trees not often present in the dominant or co-dominant layer include: Pacific dogwood, California hazel, vine maple, cascara, and bitter cherry. Encouragement of deciduous and evergreen broadleaf trees in young managed stands may result in population increases in bird species such as warbling vireos, black-headed grosbeaks, and, at low elevations, black-throated gray warblers and Hutton's vireos. Other species may be tied to the presence and abundance of deciduous trees as well. Deciduous trees, by nature, will allow more light to the forest floor in winter, and provide a different type of detritus to the forest floor.

On the Willamette National Forest, the primary factor needed for maintenance of broadleaf trees is light. Maintenance or enhancement of broadleaf trees in young managed stands may be accomplished by 1) allowing prominence of these species in early regeneration stages, and 2) thinning conifers from around broadleaf trees, or simply opening the conifer canopy.



Pacific-slope Flycatcher (formerly Western Flycatcher)

Snags and Down Woody Material. Young forests are at the age when trees are becoming large enough to be excavated by woodpeckers. However, most trees in young stands contain little decay above the base of the bole. Topping of some trees in these stands may create potential nesting substrate. Topping would probably be most feasible after thinning so that the topped portion would be less likely to get caught in adjacent canopies. Since these trees are likely to decay rather rapidly, leaving several whorls of green limbs below a de-limbed portion of the bole may make for longer-lasting snag habitat. Another approach to long-term development of decayed bole habitat might be to deeply injure live trees at some mid-point up the bole, leaving the tree live and allowing development of rot in the bole. In the long term, it seems most feasible to consistently retain trees from former stands to act as large tree and snag habitat within regenerating stands.

As with snags, young managed stands typically do not have large diameter trees as a source for the forest floor. Some young managed stands have high levels of large woody material remaining from harvest activities in the previous stand. Others have very little. In those stands with little down wood, it may benefit some ground-dwelling species to leave some boles on site during thinning operations. In the long run, as with snags, it seems most reasonable to retain trees in successive generations to act as large tree and log habitat.

Root Rot and Other Fungus. Root rots weaken and kill particular species of trees in a patchlike manner. Unaffected tree species usually prevail in these "pockets." Succession in an area of root rot typically goes something like this: susceptible trees are killed, producing snags for a short period before they fall; root rot tolerant species, such as cedars or broadleaf species, often seed in or continue growth in the infected areas. Sometimes susceptible species reseed in as well. The rot travels over time through susceptible hosts.

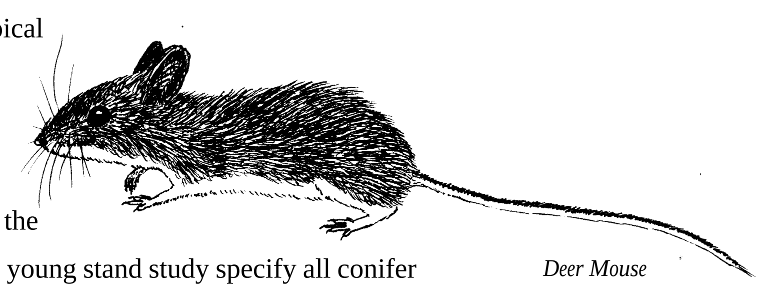
The result in the stand is an increase in complexity of both vegetative structure and species composition. Both root and stem-rotting fungi may be valuable agents of diversity in managed landscapes (see Van der Kamp 1991).

Slash Piles. Piling of limbs and other debris produced during thinning operations may provide cover and nesting/denning habitat for small and medium-sized mammals, amphibians, and a few birds (mice, voles, squirrels, weasels, skunks, salamanders, grouse, winter wrens). Piles 5-10 feet tall would probably provide the best habitat and be the most feasible to create.

Underburning. A burn on the forest floor would likely effect a change in herb and shrub composition. The specific vegetative response would likely depend upon the timing and intensity of the burn, the seed or sprout source, and the percent canopy cover. Considerations in using fire in these stands include the ladder fuels and thin bark of these young trees. Controlled burns may be most feasible in heavily thinned areas where stems are farther apart. Spot burning or pile burning may be more reasonable options to put effects of fire in these stands. An occasional fire-killed tree may provide foraging and possibly nesting habitat (depending on size) for cavity-nesting species.

Planting. There are a variety of plantings that could be done. Planting conifer species could form another structural layer. Depending on the openness of the canopy, these may be shade tolerant, intolerant, or a mixture of coniferous species. Indigenous broadleaf and/or fruit-bearing trees and shrubs (black cottonwood, willow, bitter cherry, blue elderberry, indian plum) may be planted in areas after conifers have been thinned to provide a very open canopy, particularly near streams, ponds, and seeps. At the herb layer, mixes of indigenous grasses and forbs might be planted in areas where the ground has been disturbed or the canopy has been opened up significantly. Methods for collecting seed and seedlings from local areas could be explored. "HORTUS NORTHWEST—A Pacific Northwest Native Plant Directory and Journal," editor Dale Shank, lists a wide variety of species and sources. A copy can be obtained by calling 503/266-7968, or by writing P. O. Box 955, Canby, OR 97013. Cost for directory is about $9.

Variations in Thinning Practices. The Young Stand Study on the Willamette National Forest is implementing two variations from the typical practice (three if you count non-thinning): a heavy thinning (50tpa) with conifer underplanting, and a typical thin (100-120tpa) with inclusions of 1/2 ac gaps (every 5 acres) where all trees are cut and the patch is replanted with conifers. Prescriptions in the young stand study specify all conifer species as being acceptable "crop trees" to be left and allowed to grow in proportion to their presence. Species could be favored in selection of crop trees if a change in composition is desired. Understory trees will be left which may form a shade tolerant understory layer. Another practice not yet demonstrated on the Willamette National Forest is a variable thin.



Deer Mouse

There are some stands that have had some unevenness implemented in the thinning, but I am referring to something a bit more drastic and noticeable (See **Figure 2**). This pattern would likely result in a wide variety of tree growth rates, sizes, crown shapes, and understory response. Also see McCalmon and Franklin (1992).

Edge Meshing. An occasional large tree from an adjacent older forest could be felled into the younger managed stand. This would put some newer large woody material into the stand, make a "trail" from one stand into the other, and injure some of the younger regenerating trees for future dead and decaying tree habitat.

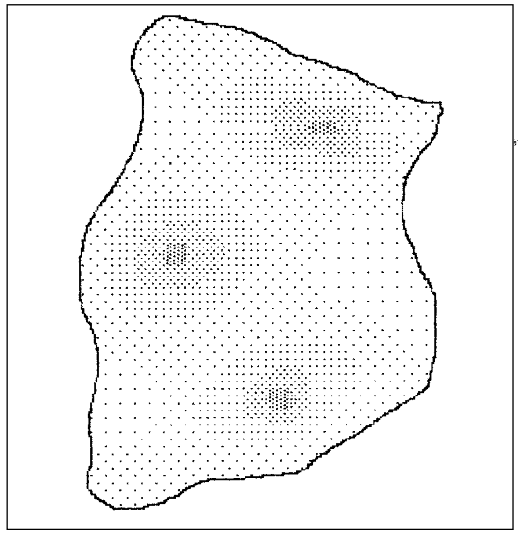


Figure 2. Illustration of variable thin proposed as an alternative in Think Thin Sale, Blue River Ranger District.

Retention of Characteristics in Succeeding Stands. Most previous ideas are applicable to development of structure and composition in existing young managed stands. However, many of the things discussed above can be enhanced, or initiated in the "restart" of a stand to gradually build diversity into stands. Live and dead trees and logs can be retained from previous stands, adding valuable diversity to young growing stands. If large tree structure is desired in areas of short rotation, live trees may be retained from each generation of forest and allowed to grow through several rotations.

Alternative Methods of Management of Early Seral Vegetation. Heavier dependance upon natural regeneration may introduce some natural variability into stands. Allowing herbaceous and broadleaf growth early in stand development may enhance diversity in tree sizes and species composition through more significant competition for resources. Pre-commercial thinning practices could include more variability and selection for diverse characteristics present on sites.

A Cooperative
Research/Management Venture
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THE YOUNG STAND STUDY
WILLAMETTE NATIONAL FOREST:

Monitoring the Effects of Several Young Stand Management Regimes on Vegetation and Wildlife –

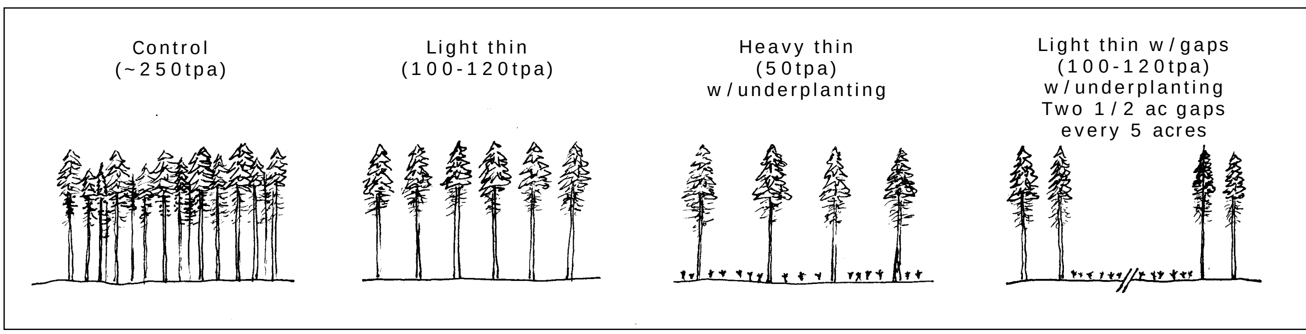
The overall objective of the study is to provide an ecological and managerial basis for future management of western Cascade forests. Below is a brief description of the study, followed by brief summaries from the first year of data collection prior to treatment.

Sites: 16 managed 30-50 year old Douglas-fir stands: 4 in Mill Creek Area, McKenzie RD; 4 west of Cougar Reservoir, Blue River RD; 4 on Christy Flats, Oakridge RD; and 4 in the Tumble Creek area, Oakridge RD.

Design: Four thinning regimes (illustrated below) will be tested, each with four replicates.

Response Variables: 1) Vegetation diversity, structure, growth and mortality; 2) Bird, ground-active mammal, and herpetile abundance, richness, and diversity; 3) Economics of different logging systems.

Status: Pre-treatment vegetation data were collected in 1991 and 1992; small mammal and herp data collected fall 1991 and 1992; bird data collected spring 1992 and 1993. Stands will be treated in 1994 and 1995. Post-treatment data collection will begin 1-3 years after treatment and continue periodically for an indeterminate period of time. The study may be expanded to investigate vertebrate food



In thinning treatments, all species of conifers of adequate size will be considered potential trees to be left. The likely result of this is that hemlocks, cedars, and any other conifers of adequate size will remain in proportion to their presence in the stands through the thinning operation. Attempts will be made to equalize deciduous tree densities between stands to avoid confounding the test of thinning regimes with an additional significant variable. Vine maple cover will be reduced only in areas where necessary to insure regeneration of underplanted conifers. Two of the largest trees (probably 14-16" dbh) on each acre will be topped to create snags after thinning has been completed. Another stratification is a comparison of alternative logging systems: cable, ground-based skidding, and mechanized (harvester-forwarder).

landscape perspective of young stands.

Project coordinator has been John Cissel. John is passing responsibility to Jim Mayo who recently moved from the Supervisor's Office to Blue River RD (541/822-3317). Primary scientist contacts at Oregon State University are Bill McComb (wildlife biologist; 541/737-6589), John Tappeiner (silviculturist; 541/750-7307), and Loren Kellogg (harvesting specialist; 541/737-2836). Primary district contacts are Matt Hunter (wildlife biologist, Blue River RD), Bob Obedzinski (silviculturist, McKenzie RD; 541/822-3381), Jim Mayo (silviculturist, Blue River RD), John Dewitz (silviculturist, Oakridge RD; 541/782-2291), and Iden Asato (timber sale officer, Oakridge RD). Many others are involved.

THE YOUNG STAND STUDY

WILLAMETTE NATIONAL FOREST

1ST YEAR SUMMARY

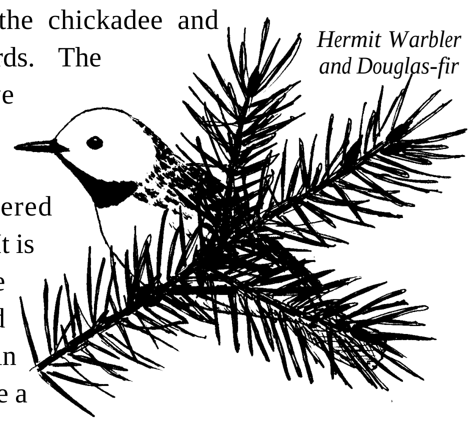
Following are some vegetative characteristics of the stands. Age of stands is 30 to 50 yrs old. Conifer trees per acre larger than 5" dbh average about 235 (range 169-334), >95% of which are Douglas-fir; the others are western red cedar and western hemlock. Average dbh of stems over 5" dbh is about 11"; few trees up to 14-16". Height of most dominant canopy trees is 60 to 90 ft. Conifer canopy closure average about 82% (range 71-94%). There are a few openings in portions of some stands due to roads, wet areas, bark foraging by bears, and root rot. In a few areas, bear-killed trees are the most common mortality in the dominant canopy. Deciduous trees are relatively few in number. Some stands have bitter cherry scattered throughout. However, the cherry in these stands either has been or is currently being shaded out. Patches of black cottonwood or red alder exist primarily in wet areas where conifer cover is light. Bigleaf maple is present in many stands. The larger individuals are usually in areas of root rot. Percent of trees that are deciduous average about 7% (range 0-21%). Relative canopy volume contributed by these trees would be less than this figure. Snags produced by the regenerating stand are numerous and mostly less than 7" dbh. A few snags from the dominant canopy (11-13") were observed, but these are scarce. Large snags from the former stand are extremely scarce and only present in a few stands. These large, old snags are generally as tall as or shorter than the live canopy and have diameters of 2-6 feet. A few old, tall (6-8 feet) stumps can be found in these stands. Quantitative data for down logs have not yet been analyzed. All stands have some down wood. Densities and sizes of down wood vary considerably between stands. Some stands have noticeably more large logs than other stands.

The chestnut-backed chickadee was the only cavity-nester found in all stands.

Root rot and other fungi are present. Armillaria and Phellinus are present to different degrees in all stands. These create small openings in the canopy. Some heartrots are present in larger hardwoods (Obedzinski pers. comm.). Ground cover data have not yet been analyzed. The stands show quite a variation in ground cover types including: sparse herb; dwarf Oregon grape; thick salal; thick patches of vine maple; thick patches of rhododendron.

Forty-eight bird species totalling 2651 detections were recorded within 100m of survey points in these stands in spring and early summer, 1992. Twenty-one of these species comprised over 90% of all detections. The average number of species detected in each stand was 21 (range 16-25). The four most abundant species represent over 50% of all individuals detected: hermit warbler (23%), winter wren (11%), golden-crowned kinglet (9%), and Swainson's thrush (9%). The next six most abundant species bring the total to over 75% of individuals detected: western flycatcher (5%), chestnut-backed chickadee (5%), hermit thrush (5%), black-throated gray warbler (4%), dark-eyed junco (3%), and Hutton's vireo (3%). All these species were detected in all stands, with the exception of the black-throated gray warbler (12 stands), and the dark-eyed junco (15 stands).

The chestnut-backed chickadee was the only cavity-nester found in all stands. The red-breasted nuthatch was detected in only nine stands (32 detections; 1.2% total), and one-third of the detections were from a single stand. It is unknown if either species actually nested in these stands. Both the chickadee and nuthatch are small birds. The chickadees may have excavated cavities in the small, highly decayed snags scattered through these stands. It is also possible that the few red-breasted nuthatches that exist in these stands may create a

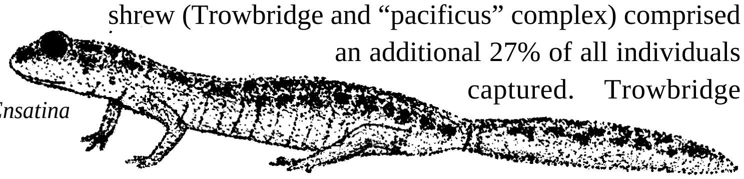


Hermit Warbler and Douglas-fir

source of cavities for the chickadees. Woodpeckers were scarce (3 species totalling only 12 detections). Pileated woodpeckers were detected six times total in four stands. Subsequent searches of areas where the woodpecker was heard revealed evidence of foraging on dead Douglas-fir in the regenerated cohort and on old, high-cut stumps. Northern flickers and hairy woodpeckers were detected only 4 and 2 times respectively. No red-breasted sapsuckers were detected.

Several bird species found niches in specific stand microsites. Song sparrows found small wet areas with brush and a less dense forest canopy. MacGillivray's warblers were found in areas with adequate brush under more open canopy or at stand edges produced by a road or powerline corridor. Seventeen of 27 total detections of warbling vireos were in one stand that had areas of significant deciduous canopy and sub-canopy.

Thirteen species of small mammals were identified in the stands. One species, the Douglas squirrel, was detected only during the bird surveys, and was not captured in either the Sherman live traps or pit traps. The deer mouse comprised over 60% of all (507) individuals captured in live traps. Townsend's chipmunks, red-backed voles, northern flying squirrels, and two or more species of shrew (Trowbridge and "pacificus" complex) comprised an additional 27% of all individuals captured. Trowbridge shrews comprised 77% of all (184) individual mammals captured in pit traps. Shrews of the "pacificus" complex contributed another 10%. Other species captured in the stands in very low numbers included Richardson's vole, marsh shrew, ermine, shrew-mole, and coast mole. The Richardson's vole and marsh shrew (one each) were captured in microhabitats typical to those species adjacent to small streams.



Ensatina

Interestingly only the deer mouse, Trowbridge shrew, and Douglas squirrel were captured or detected in all stands. The red-backed vole, Townsend's chipmunk, and northern flying squirrel were captured only in 12, 6, and 6 stands respectively.

Additional species evidenced or observed incidentally during field work in some stands include black bear, coyote, bobcat, spotted skunk, elk, deer, mountain beaver, snowshoe hare, brush rabbit, and silver gray squirrel (twice at Christy Flats). Densities and frequency of occurrence of these species in these stands is unknown.

Five species of amphibian were captured in pit traps in the stands, totalling only 35 individuals: ensatina (30), clouded salamander (2), northwestern salamander (1), pacific giant salamander (1), and rough-skinned newt (1). The ensatina was captured in 13 of 16 stands. Other species not captured, but observed in the stands include rubber boa, a species of garter snake, red-legged frog, and tree frog. The pit traps were too few in number (and without drift fences) to capture significant numbers of herpetiles.

OTHER CURRENT STUDIES AND EFFORTS

The following briefings are given to help increase awareness of current research and demonstration efforts in young stands of western Oregon and Washington, and to promote communication between people studying and managing young forests.

EXPERIMENTAL MANIPULATION OF MANAGED STANDS TO PROVIDE HABITAT FOR SPOTTED OWLS AND TO ENHANCE PLANT AND ANIMAL DIVERSITY. Andy Carey (Principle Investigator) 206/956-2345, Forest Science Lab, PNW Research Station, 3625 93rd Ave. SW, Olympia, WA 98512-9193. **Sites:** Ft. Lewis Military Reserve. 55-65 yr old managed stands. 16 stands, 32 acres each. Half of stands previously twice commercially thinned; half not. **Design:** 4 treatments/4 replications: 1) Control, 2) Silvicultural manipulation (about 15% area in root rot patches which will be opened up; remaining area in 2:1 ratio of heavy thin and light thin, both with variable spacing), 3) Cavities added to unmanipulated stands (cavities cut out and covered with face plates, and artificial nest boxes), and 4) Combination of treatments 2 and 3. Open areas in treatments will be planted with conifers. **Response Variables:** Fungi, vascular plants, forest floor small mammals, and arboreal rodents. **Status:** Have three seasons of pre-treatment data; cutting mostly complete. Post-treatment data collection beginning 1993; some work every year; major sampling every 5 years. See Kerschke and Carey (1992), Thomas and Carey (1992), Wilson and Carey (1992). Call for an excellent written summary of the background and rationale for the study design.

RESPONSES OF SMALL MAMMALS TO HIGH AND LOW LEVELS OF COARSE WOODY DEBRIS IN YOUNG MANAGED DOUGLAS-FIR STANDS. Sang-Don Lee (PhD. Student) 206/543-7232, Wildlife Biology Program, College of Forest Resources, AR-10, University of Washington, Seattle, WA 98195. **Sites:** Ft. Lewis Military Reserve. 60 yr old managed unthinned Douglas-fir stands; 1 ha each; 6 stands. **Design:** 3 stands with high levels of course woody material, 3 stands with low levels of course woody material. **Response variables:** Small mammal relative abundance, diversity, and demographics. **Status:** Trapping began June 1991, will be completed May 1993.

COMPARISON OF WILDLIFE COMMUNITIES AND TREE RESPONSE AMONG THREE SILVICULTURAL SYSTEMS IN THE EAST-CENTRAL COAST RANGE, OREGON. Bill McComb (Wildlife Biologist) 541/737-6589, Department of Forest Science, John Tappeiner (Silviculturist) 541/750-7359, Department of Forest Resources, Carol Chambers (Research Assistant, Forest Ecology) 541/737-2384, Department of Forest Resources, Oregon State University, Corvallis, OR 97331. **Sites:** Oregon State University McDonald-Dunn Research Forest, 80-120 year old >70% Douglas-fir Stands (<30% bigleaf maple, Oregon white oak, grand fir). 33 stands. **Design:** 3 replications of 4 silvicultural treatments with 2 snag density treatments nested within each silvicultural treatment. Silvicultural treatments are 1) Control, n=3; 2) Group selection (1/3 of the stand volume removed in 1/2ac circular patches), n=14; 3) Two story (8-12 green trees per acre retained), n=6; 4) clearcut (modified to leave 1.5 snags and .5 green trees per acre), n=6. Nested snag treatments are 1) Clumped (8-12 snags/clump), and 2) Scattered. **Response Variables:** Natural seedlings of Douglas-fir and bigleaf maple, planted Douglas-fir and grand fir seedlings, and residual tree growth; seedling response to vegetation control using no treatment, manual, herbicides, and a combination of herbicides and vexar tubing; diurnal breeding bird abundance; small mammal abundance; vegetation characteristics. **Status:** One year pretreatment data collected for all replications, 1-3 yrs post treatment data collected for all replications (Rep 1 was harvested in 1990, Rep 2 in 1991, and Rep 3 in 1992). Project to run through 1999. Data now available on harvesting costs, social and recreational ratings, ambrosia beetle colonization of snag tops.

LONG-TERM RESEARCH ON FOREST PRODUCTIVITY—INTEGRATED RESEARCH SITES. Mike Amaranthus (Program Leader) 541/476-1292, Siskiyou NF, P.O. Box 440, Grants Pass, OR 97526. **Sites:** This study is being duplicated near Forks, WA; the Wenatchee NF, WA; the Umatilla NF, OR; the Willamette NF, OR, and the Siskiyou NF, OR. Each area consists of about 16 study sites of about 15 acres each, in mature forest typical of the subregion. **Design:** Sites will be stratified by three created seral stages and a control and four levels of above-ground biomass. **Response Variables:** Wide variety of data to be collected: below-ground biology, vegetative response, bird and other animal response. **Status:** Study sites chosen in all five locations in Oregon and Washington. Stand manipulation intended to begin 1994 and 1995. Monitoring intended for the next 200 yrs.

RETROSPECTIVE STUDY OF COMMERCIALLY THINNED AND UNTHINNED YOUNG-GROWTH DOUGLAS-FIR. John Tappeiner (Research Forest Ecologist) 541/750-7307, John Bailey (Research Forest Ecologist) 541/737-6585, both at Forest Science Department, OSU, Corvallis, OR 97331. **Sites:** 50+ sites currently being selected on BLM land in western Oregon; several age groups and former treatments to be compared. **Design:** Will be iteratively developed; stands may be characterized vegetatively and stratified for wildlife study. **Response Variables:** Numerous vegetative parameters; wildlife variables to be developed. **Status:** Currently developing study plan and selecting sites.

COMMERCIAL THINNING AND UNDERPLANTING TO ENHANCE STRUCTURAL DIVERSITY IN YOUNG DOUGLAS-FIR STANDS IN THE OREGON COAST RANGE. Gabe Tucker (Assistant Professor, Senior Research Silviculturist, Adaptive COPE Team) 541/867-0145, COPE Program, Hatfield Marine Science Center, Newport, OR 97365; Stu Johnston (Silviculturist) 541/268/4473, Mapleton RD, Siuslaw NF, P.O. Box 67, Mapleton, OR 97453. **Sites:** Siuslaw NF (Mapleton, Waldport, and Hebo RDs), 20-40yr old stands. **Design:** 4 treatments, each to have 3-6 replications: control (225 tpa), and thinnings to 100, 60, and 30 tpa. All four treatments will be located in different areas of the same 30 acre stand. All four treatments will be underplanted with a combination of alder, hemlock, and Douglas-fir, with the exception of a one-acre no-plant patch in each treatment. **Response Variables:** Canopy structure, growth and yield of merchantable timber, understory development, microsite change. **Status:** Pretreatment data collection and harvest completed for one set; pretreatment data to be collected 1993 on second and third sites. Post-treatment data collection to continue through 1997.

PROMOTING OLD-GROWTH CHARACTERISTICS IN YOUNG STANDS IN THE CEDAR RIVER DRAINAGE OF SEATTLE'S MUNICIPAL WATERSHED. Marc McCalmon (Forest Resources Manager) 206/888-1507, Seattle Water Department, 19901 Cedar Falls Rd. NE, North Bend, WA 98045. **Sites:** In Cedar River drainage; 55-70 yr old managed stands. **Design:** Implemented as trial/demonstration units. 4 dispersed green tree retention (8-17tpa remaining), 2 aggregated peninsular design (wedge-shaped leave areas in units), 1 modified group selection (scattered 1-4 acre openings connected by matrix of 200-400ft wide strips of heavy thin). Adjacent stands being examined in retrospective fashion. **Response Variables:** Operational costs, presence of particular bird species, blow down, elk and deer usage, tree geometry changes, crown structure, ground cover. **Status:** Began harvest winter 1990-91, completed harvest August 1992. Data collection ongoing. Intend to implement experimental design with similar treatments in next few years. See McCalmon and Franklin (1992) for brief article and illustrations.

SUCCESSIONAL DYNAMICS AND FUNCTIONAL DIVERSITY OF ECTOMYCORRHIZAL FUNGI IN DOUGLAS-FIR FORESTS. Jane E. Smith, 541/750-7392, Forest Science Department, Oregon State University, Corvallis, OR 97331. **Sites:** 9 sites on and near H. J. Andrews Experimental Forest. **Design:** 3 replications of 3 stand types (30 yrs, 60 yrs, 200+yrs). **Response variables:** Relative biomass, abundance and diversity of ectomycorrhizal fungi. **Status:** Data collection began fall 1991 and spring 1992; to be continued in fall and spring through spring 1994.

EFFECTS OF MATURE FOREST FRAGMENTATION ON BREEDING BIRD COMMUNITIES IN THE CENTRAL OREGON COAST RANGE. Kevin McGarigal (PhD. Student, Wildlife Biologist) and Bill McComb (Wildlife Biologist) 541/737-6589, Department of Forest Science, Oregon State University, Corvallis, OR 97331. **Sites:** 30 subbasins (250-300ha each) in the Drift Creek, Lobster Creek, and Nestucca River basins. **Design:** Ten subbasins are sampled in each of the three basins. In each basin, the 10 subbasins are stratified by percent mature forest remaining and degree of fragmentation of remaining mature forest. **Response Variables:** Diurnal and nocturnal bird abundance and diversity at point, patch, and subbasin scales; vegetation parameters and snag densities and distributions at various scales. **Status:** Field work completed 1990-1992. Analysis continuing.

CHARACTERISTICS OF SERAL COMMUNITIES AND SUCCESSIONAL PATHWAYS ON THE SIUSLAW AND WILLAMETTE NATIONAL FORESTS. Jane Kertis (Ecologist) 541/750-7192, Siuslaw NF, P.O. Box 1148, Corvallis, OR 97339. **Sites:** All districts on Siuslaw and Willamette NFs. **Design:** Sampling by plant association. First phase sampling in western hemlock series—primarily salmonberry and sword fern associations on the Siuslaw NF, and rhododendron and dwarf Oregon grape associations on the Willamette NF. **Response Variables:** Numerous compositional and structural parameters on vegetation and dead and down wood. **Status:** Western hemlock series sampling 1991-93; data analysis on this series 1993-94. Sampling of other series to begin 1994 and continue probably to 1997.

HOSKINS SITE—EXPERIMENTAL THINNING OF YOUNG, EVEN-AGED DOUGLAS-FIR TO DIFFERENT LEVELS OF DENSITY. David Marshall (Assistant Professor) 541/737-3013, Department of Forest Resources, OSU, Corvallis, OR 97331-5703. **Sites:** 27 0.2ac plots in one stand 22 miles west of Corvallis, Oregon, on land owned by Starker Forests of Corvallis. The study was begun in 1962 in a uniform, high density, high site 20-year old natural stand. The objective of the study was to determine how the amount of growing stock retained in repeatedly thinned stands of Douglas-fir affects cumulative wood production, tree size, and growth-growing stock ratios. This study is part of a 9 installation cooperative in Oregon, Washington and British Columbia (Oregon State University, Weyerhaeuser, Washington State DNR, US Forest Service and Forestry Canada). **Design:** Eight thinning treatments and an unthinned control are replicated three times. The thinning regimes include an initial calibration thinning (PCT type treatment) on the thinned plots and five treatment thinnings. Thinning regimes differ by the amount of residual basal area retained after each thinning and include fixed, increasing and decreasing amounts. **Response Variables:** Both stand and tree level information has been summarized in Marshall et. al. (1992). **Status:** Calibration (1963-66), first treatment (1966-70), second treatment (1970-73), third treatment (1973-75), fourth treatment (1975-79), final treatment (1979-83); data collection continues; also used as demonstration area.

A companion installation (same treatment, lower site) is at Stampede Creek, Tiller District, Umpqua National Forest. Robert O. Curtis, 206/956-2345, Forestry Sciences Lab, 3625 93rd Avenue SW, Olympia, WA 98512. See Curtis (1992) for recent summary.

VARIOUS THINNING TREATMENTS IN OLDER DOUGLAS-FIR ON DIFFERENT SITE POTENTIALS ON THE BLACK ROCK EXPERIMENTAL FOREST. David Marshall (Assistant Professor) 541/737-3013, Department of Forest Resources, OSU, Corvallis, OR 97331-5703. **Sites:** The Black Rock Experimental Forest is located about 40 miles northwest of Corvallis, Oregon, near Falls City on land owned by the Oregon State Department of Forestry. Research has been carried out since the early 1950s by OSU. The stand was naturally regenerated after railroad logging about 1908. The primarily Douglas-fir stand is now about 80 years old and ranges in site from II to IV. **Design:** There have been over 60 plots representing a wide range of thinning regimes established. One study represents three thinning regimes and an unthinned control replicated four times on a range of sites over an approximate 1000 foot elevation gradient. The thinning regimes maintain constant levels of growing stock between 100-130, 130-160 and 160-190 square feet of basal area. Of particular interest are two plots that have been thinned to 50 and 40 crop trees per acre and underplanted with western hemlock. **Response Variables:** Currently tree and stand growth. Past studies have looked at understory response to thinning and root rot impacts. **Status:** Last thinnings done in mid-1970s. Data being collected on key plots and area is being used for demonstration.

LITERATURE CITED AND OTHER RELEVANT PUBLICATIONS

Anthony, R. G; Forsman, E. D.; Green,G. A.; Witmer G.; Nelson, S. K. 1987. **Small-mammal populations in riparian zones of different-aged coniferous forests.** The Murrelet 68:94-102.

Anthony, R.G.; Green, G. A.; Forsman, E. D.; Nelson, S. K. 1984. **Avian communities in riparian zones of Douglas-fir forests, western Oregon.** A report on Contract no. PNW-83-343. Submitted to Len Ruggiero and Andrew Carey, Old Growth Wildlife Relationship Program, U.S.F.S., Olympia, Washington.

Artman, V. L. 1990. **Breeding bird populations and vegetation characteristics in commercially thinned and unthinned western hemlock forests of Washington.** University of Washington, Seattle, WA. MS Thesis. 55pp.

Black, H. C., tech. ed. 1992. **Silvicultural approaches to animal damage management in Pacific Northwest forests.** Gen Tech. Rep. PNW-GTR-287. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 422p.

Brown, E. R., tech. ed. 1985. **Management of wildlife and fish habitats in forests of western Oregon and Washington.** Publ. R6-F&WL-192-1985. Portland, OR: U. S. Department of Agriculture, Forest Service, Pacific Northwest Region. 332p.

Curtis, R. O. 1992. **Levels-of-Growing-Stock Cooperative Study in Douglas-fir: Report No. 11 — Stampede Creek, A 20-year Progress Report.** USDA Forest Service, Pacific Northwest Research Station. Research Paper PNW-RP-442. 47p.

Forsman, E. D. 1988. **A survey of spotted owls in young forests in the northern Coast Range of Oregon.** Murrelet 69(3):65-68.

Forsman, E. D.; Meslow, E. C.; Straub, M. J. 1977. **Spotted owl abundance in young versus old-growth forests, Oregon.** Wildl. Nat. Soc. Bull. 5:43-47.

Hagar, J. 1992. **Bird communities in commercially thinned and unthinned Douglas-fir stands of western Oregon.** Oregon State University, Corvallis, Oregon. MS Thesis. 110pp.

Hansen, A. J.; Spies, T. A.; Swanson, F. J.; Ohmann, T. L. 1991. **Conserving biodiversity in managed forests.** Bio. Science 41(6):382-392.

Irwin, L. L.; Fleming, T. L.; Speich, S. M.; Buchanan, J. B. 1991. **Spotted owl presence in managed forests of southwestern Washington.** Technical Bulletin No. 601, National Council of the Paper Industry for Air and Stream Improvement.

Kerschke, W. L.; Carey, A. B. 1992. **Experimental manipulation of managed stands to provide habitat for spotted owls and to enhance plant and animal diversity.** Northwest Science 66(2):128.

Lee, Sang-Don; West, S. D. 1992. **Relationships between coarse woody debris and the demography of deer mice in managed forests of western Washington.** Peromyscus Newsletter 14:27.

Mannan, R. W.; Meslow, E. C.; Wight, H. M. 1980. **Use of snags by birds in Douglas-fir forests, western Oregon.** J. Wildl. Mange. 44:787-797.

Marshall, D. D.; Bell, J. F.; Tappeiner, J. C. 1992. **Levels-of-Growing-Stock Cooperative Study in Douglas-fir: Report No. 10 — The Hoskins Study, 1963-83.** USDA Forest Service, Pacific Northwest Research Station. Research Paper PNW-RP-448. 65p.

Maser, C.; Tarrant, R. F.; Trappe, J. M.; Franklin, J. F.; tech. eds. 1988. **From the forest to the sea: a story of fallen trees.** Gen. Tech. Rep. PNW-GTR-229. Portland, OR: U. S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 153p.

McCalmon, M.; Franklin J. 1992. **"Bioforestry" on Seattle Water Department Cedar River Watershed.** COPE Report 5(4): 7-9.

McComb, W. C.; Spies, T. A.; Emmingham, W. H. In press. **Stand management for timber and mature forest wildlife in Douglas-fir forests.** J. Forestry X(X):XX-XX. (Paper No. 2724, Oregon State University Forest Research Laboratory).

Newton, M.; Cole, E. C. 1987. **A sustained-yield scheme for old growth Douglas-fir.** West. J. Appl. For. 2:22-25.

Nyberg, J. B.; Harestad, A. S.; Bunnell, F. L. 1987. **"Old Growth" by design: Managing Young Forests for Old-growth Wildlife.** Trans. N. Am. Wildl. Nat. Res. Conf. No. 52:70-81.

O'Hara, K. L. 1990. **Twenty-eight years of thinning at several intensities in a high-site Douglas-fir stand in western Washington.** West. J. Appl. For. 5(2):37-40.

Rosenberg, D. K. 1991. **Population characteristics of northern flying squirrels and Townsend's chipmunks in second- and old-growth forests.** M.S. thesis, Department of Fisheries and Wildlife, Oregon State University, Corvallis. 61 pp.

Rosenberg, D. K.; Anthony, R. G. 1992. **Characteristics of northern flying squirrel populations in young second- and old-growth forests in western Oregon.** Can. J. Zool. 70(1):161-166.

Rosenberg, D. K.; Anthony, R. G. 1993. **Differences in Townsend's chipmunk populations between second- and old-growth forests in western Oregon.** J. Wildl. Manage. 57(2):365-373.

Ruggiero, L. F.; Aubry, K. B.; Carey, A. B.; Huff, M. H., tech. eds. 1991. **Wildlife and vegetation of unmanaged Douglas-fir forests.** Gen. Tech. Rep. PNW-GTR-285. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 533p.

Skirvin, A. A. 1981. **Preliminary investigation of breeding bird communities in four forest stands in the Cascade Mountains of Oregon.** Unpublished report submitted to the Sweet Home Ranger Station, Willamette National Forest, March 31, 1981.

Spies, T.A. 1991. **Plant species diversity and occurrence in young, mature, and old-growth Douglas-fir stands in western Oregon and Washington.** In Ruggiero et. al. (1991): 111-121.

Spies, T.A.; Cline, S.P. 1988. **Coarse woody debris in forests and plantations of coastal Oregon.** In Maser et. al. (1988): 5-24.

Spies, T.A.; Franklin, J.F. 1991. **The structure of natural young, mature, and old-growth Douglas-fir forests in Oregon and Washington.** In Ruggiero et. al. (1991): 91-109.

Spies, T.A.; Franklin, J.F.; Thomas, T.B. 1988. **Coarse woody debris in Douglas-fir forests of western Oregon and Washington.** Ecology 69(6):1689-1702.

Thomas, T. B.; Carey, A. B. 1992. **Enhancing vegetation and structural diversity by manipulating forest stands.** Northwest Science 66(2):129.

USDA Forest Service. 1990. **Willamette National Forest. Land and Resource Management Plan.**

Van der Kamp, B. J. 1991. **Pathogens as agents of diversity in forested landscapes.** The Forestry Chronicle 67(4): 353-354.

Wilson, T. M.; Carey, A. B. 1992. **Nest sites of northern flying squirrels in managed second-growth forests.** Northwest Science 66(2):129.

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