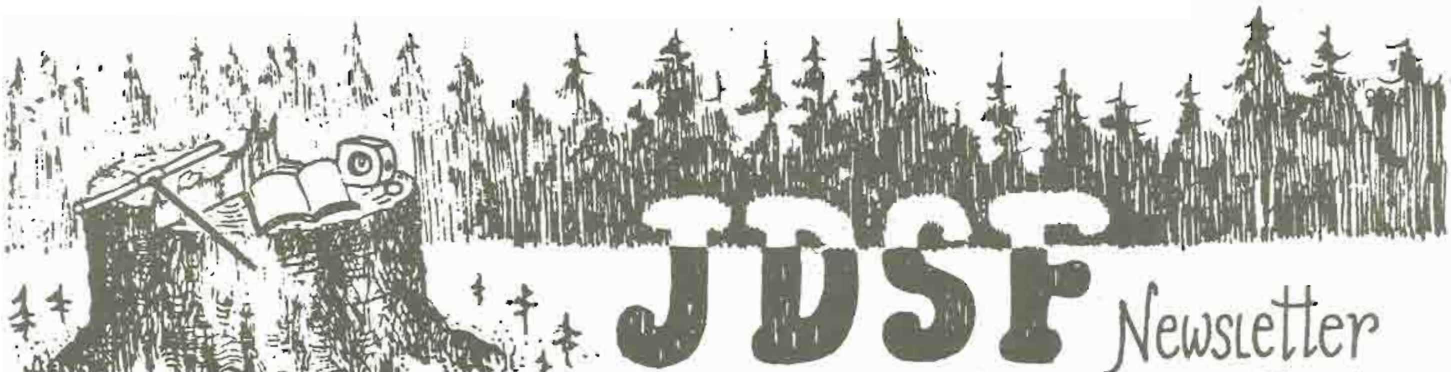

JDSF Newsletter

Jackson Demonstration State Forest

State of California Dept. of Forestry P.O. Box 1185 Fort Bragg, CA. 95437

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CLEARCUTTING VERSUS SELECTION IN COASTAL REDWOOD FORESTS - JDSF'S PERSPECTIVE

Peter Cafferata

In 1990, the State of California finds itself in a period of upheaval over forest practices. One or more initiatives will be on the November ballot which could change how forestry is implemented here. These initiatives call for many changes, including restricting or banning clearcutting. Past experience on Jackson Demonstration State Forest (JDSF) has shown that clearcutting can be a valuable silvicultural tool (see Figure 1). While certainly not appropriate in all situations, it is a silvicultural system which should continue to be an option for California's foresters. Advantages and disadvantages of clearcutting and selective harvesting are outlined here. Additionally, areas where their uses are appropriate in the redwood region are suggested.

<u>Textbook Pros & Cons</u>

Two basic silvicultural systems exist for growing stands of trees: even-aged and uneven-aged management. Even-aged stands contain trees which are about the same age and are created either by clearcutting, or the seed tree or shelterwood methods. Uneven-aged stands have several different ages of trees, ranging from seedlings to trees large enough to be harvested, and are created by either single tree selection, or group selection. Clearcuts usually range in size from two and one-half to 80 acres in California, while group selection cuts range from one-half acre to two and one-half acres.

Even-aged management offers the following advantages: 1) simplicity for managing and harvesting

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CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION
Harold R. Walt, Director

George Deukmejian
Governor
State of California

Gordon K. Van Vleck
Secretary for Resources
The Resources Agency

Figure 1. Jackson's only large clearcut in young-growth prior to 1980. The upper photo shows the 109-acre block after burning (3/29/65); the lower photo shows the stand 25 years later (4/4/90).

blocks of timber, 2) reduced damage to the residual stand when harvesting, 3) a shortened rotation due to regeneration from planted trees, and 4) a faster and more uniform growth rate due to abundant sunlight and intermediate thinnings. Disadvantages include: 1) lower aesthetic and recreational values, 2) increased site exposure with a higher potential for erosion, 3) decreased habitat for certain wildlife species, and 4) infrequent cash flow from a given area.

Uneven-aged management as

implemented with single-tree selection offers several advantages as well. They include: 1) greater certainty of natural regeneration due to an abundance of trees left as seed sources, 2) continuous cover for the site, reducing the potential for erosion, 3) good aesthetic and recreational values, 4) benefits for certain wildlife species, and 4) steady incomes from small holdings. Disadvantages include: 1) higher logging costs, 2) inevitable damage to the residual stand, 3) higher road maintenance costs, 4) the entry of less desirable species into the stand, 5) higher administrative costs, and 6) more frequent disturbance to a greater area.

The Caspar Cutting Trials

In the late 1950's, almost no documented studies existed on how young-growth redwood/Douglas-fir stands should be harvested. Therefore, JDSF started the Caspar Cutting Trials in 1959. The following treatments were tested in an 85-year-old stand: 1) light single tree selection - removing 40% of the volume; 2) heavy single tree selection - removing 52% of the volume; 3) clearcut; 4) group selection - with patch cuts averaging 0.4 acres and taking 32% of volume; and 5) a control unit (uncut). Twenty-five years after logging, Lindquist (1988) drew several conclusions. He found that while most redwood stumps sprouted and provided immediate recovery in the single-tree selection cuts, these areas did not have high enough light conditions for the stems to grow satisfactorily. Most of the conifer regeneration which occurred in these cuts was the more tolerant but less desirable grand fir and western hemlock species.

Among the selection blocks, only the group cuts showed a sufficient number of rapidly growing redwood and Douglas-fir. The clearcut responded the best of all. After 19 years, it had 46 trees/acre greater than 10.5" DBH, and they were almost all redwood and Douglas-fir. In contrast, the heavy selection area at 24 years after logging had 1410 trees/acre 0 to 4.5" DBH, but only 23% were redwood and Douglas-fir. Almost none of the regeneration was larger than 4.5" DBH. Lindquist's conclusion was that clearcutting is the preferred silvicultural system in these types of stands. Where objections to clearcutting are made for environmental or political reasons, group selection should be used. Attempting to convert mature even-aged stands to uneven-aged stands through single tree selection was not felt to be appropriate when attempting to maximize forest productivity. JDSF's staff accepted these conclusions as being valid.

Recently, other analyses of the cutting trials data have yielded somewhat different conclusions from those offered by Lindquist. One paper suggests that the group selection method of harvesting redwood/Douglas-fir stands should be phased in as rapidly as possible, and clearcutting abandoned (Burkhardt 1989). Additionally, Swanson (1989) suggests that clearcutting was not the best performing silvicultural system in the cutting trials. He states that it is the group selection cutting method which is the best approach to harvesting a mature even-aged stand. While there are differences of opinion on the meaning of data collected from the cutting trials, it is apparent that adequate sunlight and growing space is necessary for maximum production.

Current Practices and Recommendations

Results similar to those found in the Cutting Trials were observed throughout the redwood region on industrial forest lands. Therefore, in the 1980's, clearcutting was started in the second-growth stands. Stocking from redwood sprouts and natural seeding is supplemented with planted seedlings. Site preparation is accomplished through broadcast burning when slash concentrations inhibit planting. Stocking surveys show that the clearcuts are adequately stocked and usually growing vigorously.

Clearcutting mature forest causes certain wildlife species to decline when their habitat is lost. Examples of these animals are some owls, woodpeckers, warblers and voles. This harvesting method can benefit other forms of wildlife, however. Large grazing mammals, such as deer, multiply because their food supply is greatly increased. Also, several small mammals and non-game birds move into clearcuts and reproduce rapidly. JDSF plans on implementing studies of small mammal populations and vegetative succession on clearcut areas in the next year.

Researchers have recently suggested that clearcut areas may be made more acceptable for all wildlife species if more snags are left and clusters, or islands, of trees in various areas are left for habitat. Stream protection zones, or buffer strips, are left to shade watercourses, provide riparian habitat and supply future large woody debris for the creek. Due to these types of multiple use considerations, the size of clearcuts should generally be limited to 40 acres or less.

Surface erosion resulting from logging usually is not a serious problem on the North Coast, if yarding is done with care and the harvesting system is appropriate for the terrain. Clearcutting on steep unstable slopes, however, may lead to increased mass erosion. This is particularly true in areas without sprouting redwoods, where tree root systems die completely. Most of the erosion associated with timber harvesting results from the road system installed. Roads increase both surface and mass erosion processes. The Caspar Creek Watershed Study will provide data on erosion and sedimentation resulting from clearcutting and road building, as well as being an outstanding reference base for future studies on the effects of clearcutting.

Large clearcuts are not appropriate on harsh sites where regeneration will be a serious problem. On site class III and lower redwood lands, where hardwoods make up a large component of the stand, other silvicultural systems should be applied. Single tree selection is preferred where aesthetic values are high, such as along scenic corridors, and near sensitive adjacent owners. Additionally, it is to be used where a quality outdoor environment is needed for recreational opportunities and where multistoried canopies are needed for wildlife. Selection may be used in any area where maximum productivity is not a requirement. Small private landowners generally prefer this method.

On JDSF, our mandate is to demonstrate all the various silvicultural options. We believe each has its place, and professional foresters should be allowed to implement the various silvicultural systems where they are appropriate. For more information on clearcutting in the redwoods, look for "A Review of Redwood Harvesting: Another Look in 1990," soon to be published by CDF. Copies will be available at our office in Fort Bragg and other CDF offices.

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Burkhardt, H. G. 1989. The Caspar cutting trials. Unpublished report. 4pp.

Lindquist, J. L. 1988. The Caspar cutting trials: A case study report 25 years after harvest. CA For. Note No. 99. Calif. Dept. of For. & Fire Prot. Sac. CA. 25 pp.

Swanson, E. 1989. Comments on the Caspar cutting trials. Unpublished paper. 2 pp.

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BLACK STAIN ROOT DISEASE IN COASTAL DOUGLAS-FIR: RESULTS OF GRADUATE RESEARCH DONE ON JDSF

Norm Henry, D&E Forester II

Douglas-fir mortality caused by black stain root disease has been of concern to the State Forest staff on JDSF since it was first documented here in the late 1960's (see Figure 1). The disease was already known to affect ponderosa pine in the Sierra Nevada range, where most of the early research effort had been done. The lack of knowledge about black stain in coastal Douglas-fir stands, and the unknown risk for serious mortality, prompted the State to fund a research project in 1981.

Dr. Fields Cobb of UC-Berkeley carried out this study on black stain in the Hare Creek drainage. (see Calif. Forestry Note No. 98). More recently, additional research was done on black stain by graduate students Thomas Lawson and Jill Lownsbery, as part of the requirements for their doctoral degrees at UC-Berkeley. Thom conducted research on JDSF and Georgia-Pacific timberlands and wrote a dissertation entitled "Stand and Site Conditions Associated with <u>Leptographium</u> <u>wageneri</u> var. <u>pseudotsugae</u> in Douglas-fir trees and Effects of Infection on Host Physiology" in 1988. Jill's work dealt with the known vectors of the disease and a synopsis of her dissertation will be presented in a future newsletter.

Thom studied four specific aspects of black stain root disease. First, he looked at the effect of the fungus on the water content of needles on young Douglas-fir seedlings. One hundred-eighty 2-year old seedlings were inoculated in a greenhouse with two different varieties of the fungus, while 90 were kept as controls. He found that as the amount of tissue colonized by the two varieties of the fungus increased, the amount of water conducted to the needles decreased to almost one-half the amount conducted in the uninfected control seedlings. As a result of the colonization of the stems by the fungus, the terminal and lateral buds broke much later on the infected seedlings and leader extension was significantly reduced.

The second aspect of this black stain study dealt with the formation of pathological heartwood and its effect on water movement in infected Douglas-fir trees. Pathological heartwood is in reality discolored sapwood tissue which, because of the tissue reaction to the infection, has characteristics identical to the heartwood of the tree. Thom's study results show significantly more heartwood tissue in pole-sized Douglas-fir which are infected with the pathogen than those which are not. This conversion of sapwood to heartwood reduces the area of conductive

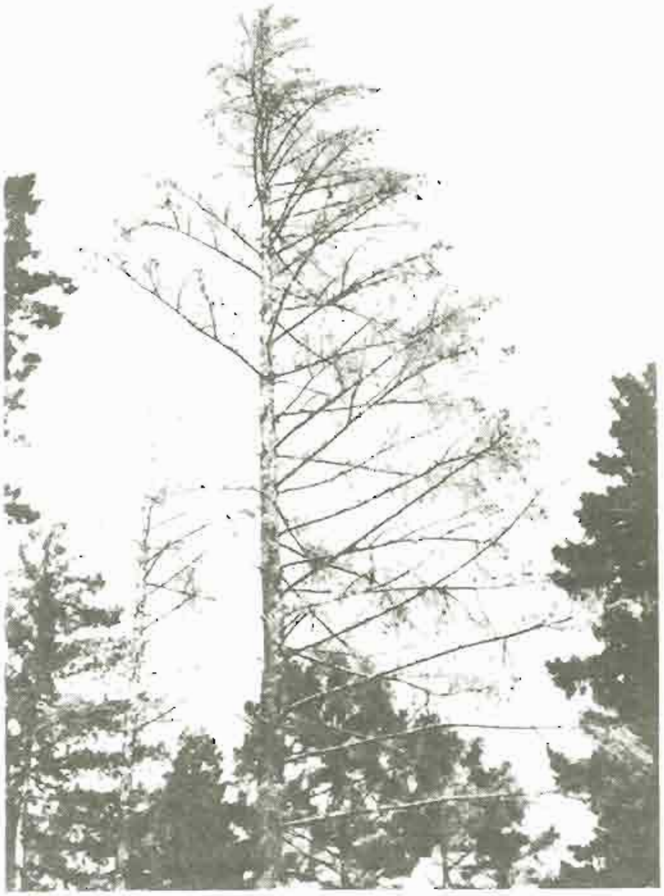

Figure 1. Douglas-fir trees killed by black stain.

tissue in a tree. Therefore, less water can move up the stem, water stress occurs, and a wilting phenomenon is observed. Even though colonization patterns are different from other vascular wilt diseases, Thom suggests that L. wageneri var. pseudotsugae should be regarded as a wilt disease pathogen of Douglas-fir, rather than as a root disease.

Thom studied how black stain can reduce terminal and radial growth rates of Douglas-fir trees, since this is of primary importance to forest managers. Previous work has shown that tree growth may be reduced for years before any visible symptoms of black stain are produced. While tissue is not degraded as is the case in rot type diseases, water stress from the reduction of conductive sapwood tissue can influence plant growth processes. His results from five growing seasons in a 20-year-old plantation show significant reductions in height growth can occur. Terminal growth of infected pole-sized trees was reduced 17 to 24 percent during the years after the fungus reached the root collar of the tree, while uninfected trees had a 5 percent increase.

Height growth was reduced more than radial growth in infected trees. On a year-by-year basis, reductions were seen in radial growth but were insignificant over the four-year period. He suggests that height growth was sacrificed for radial growth. This is consistent with past research which documents that under water stress, plants will increase the surface area of root systems and cut back on the expansion of their aerial shoot systems. However, since board foot volume is much more dependent on height growth, a substantial reduction in stand volume production may occur regardless of eventual mortality rates. The resource manager should not estimate long term volume production based only on observable mortality rates, as the declines in tree growth from live infected trees may be more significant.

The last phase of the study was to determine site and stand conditions associated with the mortality of Douglas-fir caused by black stain. Thom used discriminant analysis procedures to identify the eight most significant variables which could be used in a predictive model. Four of the variables are site related and the remainder are stand related. The four site variables associated with mortality from this pathogen were: a northerly aspect, low position on the slope, low elevation, and disturbance to the site. The stand variables were: a high number of redwood trees per unit area, dense woody vegetation, Douglas-fir with small diameters, and Douglas-fir comprising most of the stems in the stand. Similar to other pest models, this discriminant model can correctly classify areas as infected 85 percent of the time and uninfected areas 77 percent of the time.

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JDSF'S AUSTRALIAN FORESTER - MALCOLM TONKIN

In JDSF Newsletter No. 35 (October 1989), Walt Decker, a forester here on JDSF, described an exchange program in which he and I exchanged jobs for 12 months. My family and I have now been here for six months and have greatly enjoyed and appreciated the hospitality we have received from CDF and Fort Bragg. The organization I work for is also a State Government Department, in this case with the State of Victoria in Australia. It is a Department similar in size to CDF, but has a much broader range of responsibilities.

Victoria is the second smallest of the six states of Australia and occupies the southeast corner of the continent. Its Mediterranean type climate, like much of California, is the best watered of the mainland states and consequently has the most intensive population density, agricultural activity, and also has a large manufacturing base. By virtue of its summer weather patterns, the Eucalyptus forest fuel types, and the grass fuels in the agricultural lands, Victoria, along with the whole southeast corner of the continent, has a very high incidence of bushfire (wildfire) and periodically suffers devastating losses. Victoria produces about 28% of Australia's wood products, although it only accounts for 3% of the nation's land area. Clearly, fire is an important feature in the management of both agricultural and forest lands.

Melbourne, the capital city of Victoria with 3.5 million people, is centrally located in the state and almost all forest areas can be reached by recreationists and others within 1 to 6 hours driving. Forestry and land management is, therefore, necessarily having to become more sensitive to the often conflicting community requirements and expectations.

The area of Australia which is now Victoria was first settled by the British in about 1837 and all lands at that time belonged to the Crown. The land suitable for agriculture, pasture, and settlement were disposed of over a long period of time to new settlers and the land which was not selected remains with the Crown. The lands once considered wastelands, unsuitable for agriculture, are now of course regarded as a vital and valuable public resource to be managed for the optimum benefit of the Victorian community. Management of these lands is the responsibility of the Department of Conservation Forests and Lands (CFL) for whom I work as a forester. The Department has a budget of approximately $210,000,000 and a staff of about 4,000, who are predominantly decentrally based in 16 regions. It is the third largest State Government department in Victoria.

The responsibilities of the Department are very diverse. They include the following areas: parks, fisheries, wildlife, land protection, fire protection, public land administration, and forests. Management and protection of the State's forest and timber resources on State-owned land (Crown Land) falls under the latter category. Almost all of the State's hardwood (eucalypt) timber production of 1.8 million cubic metres per year (approx. 500 million board feet) is supplied from state-owned land and 50% of the 200,000 ha (500,000 acres) of softwood (Monterey Pine) plantations are state-owned and managed by CFL.

I work out of the town of Benalla (population 8000), which is a two and one-half hour drive Northeast of Melbourne. My duties are to manage a 30,000-acre Monterey pine plantation. This plantation will be managed on a 35-year rotation, the oldest trees currently being 26 years old. The plantation will provide sawlogs, while also producing pulpwood as a result of commercial thinnings.

JACKSON DEMONSTRATION STATE FOREST
802 N. MAIN STREET
P.O. BOX 1185
FORT BRAGG, CA 95437