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“In conclusion—let me again assure you that all Forest Service personnel recognize the national crisis in raw material supply, and that we are pledged to do everything humanly possible to meet supply need consistent with our obligations in accord with acceptable standards of environmental quality.”

JOHN R. MCGUIRE
Chief - U.S. Forest Service
Our 1972 Annual Report highlights the role of research in timber supply. The year was unprecedented in terms of timber demand and rising prices for forest products. One of the Nation’s major strategies to deal with timber supply must be research—to develop better ways to reproduce, grow, and protect timber resources and better ways to extend timber supplies through improved utilization.

Does this mean that environmental issues are no longer of concern to the Experiment Station? Not at all. A review of the research items reported here will indicate a growing concern for an improved forest and range environment. And you will see that timber supply and environmental issues are often intertwined. Better use of forest residues, for example, extends timber supplies even as an environmental blight is corrected.

New Research Direction

Funds available to the Forest Service to cope with new and emerging problems of forestry are uncertain at this writing. Certainly, everyone would agree with the President that Government must be responsive, relevant, and close to people.

The Experiment Station, through its Advisory Committee, through citizens’ comments, and through internal reviews, attempts to redirect efforts toward timely and critical problems. Examples of new or redirected efforts include:

—At Fairbanks and Juneau, Alaska, we have created interdisciplinary teams to study the multiresource (as contrasted to single resource) problems of forest land management.

—At Wenatchee, Washington, and Bend and La Grande, Oregon, we are redirecting efforts toward the simultaneous solution of the interrelated problems of range, wildlife habitat, water, and timber—truly multiple use research.

—In anticipation of continued heavy defoliation by the Douglas-fir tussock moth in eastern Oregon and Washington, we are mobilizing insect research projects toward accelerated studies of population dynamics and control methods of that insect pest.

—Project FALCON (in the planning stages) is a research, development, and application program directed toward logging methods with reduced environmental impacts.

—The Residues Reduction Program is also a research, development, and application program seeking better ways to use or otherwise dispose of forest wood wastes. Being completed now as part of the program is a feasibility study for using wood wastes for power generation.
The Station has now strengthened its information activities with the addition of Ms. Louise Parker as Information Officer. Soon an attractive newsletter will be distributed throughout the West called *What's New In Western Forest Research*. We need to further strengthen communications with cooperators and the news media and to put research in a more digestible form.

**Staff Changes**

Dr. Donald C. Schmiege returned to Juneau as program leader of our newly constituted multifunctional research project. Schmiege, who came from the Pacific Southwest Forest and Range Experiment Station in Berkeley, had formerly been stationed at Juneau.

Dr. Arthur R. Tiedemann has been appointed project leader at the Forest Hydrology Laboratory in Wenatchee, Washington, directing efforts of the project to work on problems of water yield and quality and erosion control in eastern Oregon and Washington.

Justin L. Smith, formerly leader of our big-game habitat research project at La Grande, retired in June.

At Seattle, Washington, Dr. Roger N. Clark, has joined the wildland recreation research project, specializing in the incentive approach to litter control.

Dr. Hank Gratkowski has stepped down as project leader for brushfield reclamation work at Roseburg to devote full time to research. Dr. Ron Stewart is acting project leader.

There have been several additions and changes in the forest residues reduction program since last year. Owen Cramer transferred to the program from the Pacific Southwest Station; Dr. Stewart Pickford transferred from the Southeastern Station. Hugh McLean, from Forest Service Region 3 Fire Control, replaced John Dell. Dr. Tom Adams was assigned from PNW Station’s marketing economics unit; and Eldon Estep, a forest products utilization specialist of the Forest Service’s State and Private Forestry program, came to us from the Forest Products Laboratory at Madison, Wisconsin.

James L. Stewart became project leader for forest disease research at Corvallis. Stewart, a plant pathologist, formerly headed the Alexandria Forest Pest Control Zone office in Pineville, Louisiana.

Dr. George P. Markin came from Gulfport, Mississippi, to serve as project leader for research in aerial applications for forest insect control at Corvallis. He had been director of the U.S. Department of Agriculture’s Methods Development Laboratory and had worked extensively in a program to control the fire ant.

Dr. John A. Neisess has been appointed as chemist for the aerial applications unit; he is a recent graduate of Oregon State University and will work on chemistry of insecticides.

Dr. Gary E. Daterman has replaced Valentine M. Carolin as project leader in the research unit assigned to studies of physiology and behavior of forest insects. Mr. Carolin is assisting in revision of the book, *Insect Enemies of Western Forests*.

Dr. Roger Fight is the new project leader for our forest land management economics research work unit, replacing Dr. Dennis Schweitzer who transferred to the Intermountain Station, Missoula, Montana.

Dr. David R. Darr is now acting project leader for marketing economics research, replacing Dr. Thomas E. Hamilton who is transferring to the Northeastern Experiment Station, Upper Darby, Pennsylvania, as Assistant Director.
FALCON PLANNING

Flora, Donald F., Acting Program Manager (P)
Clarke, Edward H., Asst. Program Mgr. (P)
Gonsior, Michael J., Intermountain Area Rep. (P)

BIOMETRICS

Johnson, Floyd A., Station Biometrician (P)
Hazard, John W., Prin. Biometrician (P)

TIMBER AND WATERSHED MANAGEMENT RESEARCH—DOUGLAS-FIR REGION

ROMANCHIER, ROBERT M., Asst. Director (P)

1201 Seeding, Planting, and Nursery Practices in the Pacific Northwest
Stein, William I., Project Leader (P)
Edgren, James W., Plant Ecologist (P)
Owston, Peyton W., Plant Physiologist (C)

1204 Culture of Mixed-Conifer Forests, West-Side Cascades
Ruth, Robert H., Project Leader (C)
Franklin, Jerry F., Prin. Plant Ecologist (C)
Herman, Francis R., Mensurationist (C)
Minore, Don, Plant Ecologist (C)

1206 Brushfield Reclamation, Prevention, and Ecology
Stewart, Ronald E., Acting Project Leader (R)
Gratkowski, Henry J., Prin. Plant Ecologist (R)

1207 Intensive Culture of Douglas-fir and Associated Species
Miller, Richard E., Project Leader (O)
Reukema, Donald L., Prin. Silviculturist (O)
Williamson, Richard L., Mensurationist (O)
<table>
<thead>
<tr>
<th>Project Code</th>
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<th>Project Leader(s)</th>
<th>Principal Co-Worker(s)</th>
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<tr>
<td>1208</td>
<td>Control of Animal Damage to Western Conifers</td>
<td>Crouch, Glenn L.</td>
<td>Dimock, Edward J., II</td>
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<td>Radwan, M. A.</td>
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<td>1401</td>
<td>Breeding Pacific Northwest Trees</td>
<td>Silen, Roy R.</td>
<td>Campbell, Robert K.</td>
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<td>Copes, Donald L.</td>
<td>Sorensen, Frank C.</td>
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<td>1601</td>
<td>Water Yield—Improvement and Erosion Control—Mid-Columbia River Basin Forests</td>
<td>Tiedemann, Arthur R.</td>
<td>Fowler, William B.</td>
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<td>Helvey, Junior D.</td>
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<td>Klock, Glen O.</td>
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<td>1652</td>
<td>Ecology of Southeastern Alaska Forests</td>
<td>Schmiege, Donald C.</td>
<td>Harris, Arland S.</td>
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<td>Meehan, William R.</td>
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<td>Hard, John S.</td>
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<td>1602</td>
<td>Soil Stabilization and Runoff Regulation in Conifer Watersheds of Western Washington and Oregon</td>
<td>Rothacher, Jack S.</td>
<td>Dymness, C. Theodore</td>
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<td>Fredriksen, Richard L.</td>
<td>Swanston, Douglas N.</td>
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<td>1603</td>
<td>Chemicals in the Forest Environment</td>
<td>Norris, Logan A.</td>
<td>Bollen, Walter B.</td>
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<td>Moore, Duane G.</td>
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**FOREST ENVIRONMENT RESEARCH—PEOPLE AND FOREST RESOURCES**

TARRANT, ROBERT F., Asst. Director  (P)

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<td>1203</td>
<td>Silviculture of Western Forest Types</td>
<td>Dahms, Walter G.</td>
<td>Cochran, Patrick H.</td>
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<td>Barrett, James W.</td>
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<td>Ecology and Management of Forest and Related Ranges in the Pacific Northwest</td>
<td>Garrison, George A.</td>
<td>Geist, Jon M.</td>
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<td>Strickler, Gerald S.</td>
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<td>Big-Game Habitat Research</td>
<td>Garrison, George A., Acting Project Leader</td>
<td>McConnell, Burt R.</td>
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<td>Skovlin, Jon M., Prin. Range Scientist</td>
<td>Dealy, J. Edward, Plant Ecologist</td>
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<td>Edgerton, Paul J., Assoc. Plant Ecologist</td>
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<td>Wildland Recreation Uses and Social Interaction</td>
<td>Hendee, John C.</td>
<td>Clark, Roger N.</td>
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<td>Potter, Dale R., Assoc. Recreation Resource Specialist</td>
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<td>Cooperative Forest Recreation Research—University of Washington</td>
<td>Wagar, J. Alan</td>
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<td>Ecology and Management of the Taiga (Subarctic Forests)—Interior Alaska</td>
<td>Cushwa, Charles T., Program Leader (F)</td>
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<td>Beckwith, LeRoy C., Prin. Entomologist (F)</td>
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<td>Helmers, Austin E., Prin. Research Forester (F)</td>
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<td>Viereck, Leslie A., Prin. Botanist (F)</td>
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<td>Zasada, John C., Prin. Silviculturist (F)</td>
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<td>Noste, Nonan V., Assoc. Research Forester (F)</td>
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<td>Martin, Robert E., Project Leader (S)</td>
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<td>Forest Residues Reduction Systems</td>
<td>Pierovich, John M., Program Manager (P)</td>
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<td>Adams, Thomas C., Prin. Economist (P)</td>
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<td>Cramer, Owen P., Prin. Research Meteorologist (P)</td>
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<td>McLean, Hugh R., Prin. Forester (P)</td>
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<td>Pickford, Stewart G., Assoc. Research Forester (S)</td>
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<td>Population Ecology and Impacts of Forest Insects of the Pacific Northwest</td>
<td>Wickman, Boyd E., Project Leader (C)</td>
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<td>Mason, Richard R., Prin. Insect Ecologist (C)</td>
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<td>Mitchell, Russel G., Prin. Insect Ecologist (C)</td>
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<td>Sartwell, Charles, Jr., Insect Ecologist (C)</td>
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<td>Diseases of Western Forest Insects</td>
<td>Thompson, Clarence G., Project Leader (C)</td>
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<td>Martignoni, Mauro E., Chief Microbiologist (C)</td>
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<td>Stelzer, Milton J., Prin. Entomologist (C)</td>
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<td>Hughes, Kenneth M., Entomologist (C)</td>
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<td>2204</td>
<td>Physiology, Behavior and Genetics of Forest Insects of the Pacific Northwest</td>
<td>Daterman, Gary E., Project Leader (C)</td>
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<td>Carolin, Valentine M., Jr., Prin. Entomologist (C)</td>
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<td>Ryan, Roger B., Prin. Entomologist (C)</td>
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<td>Aerial Application of Biological Agents and Other Materials for Forest Insect</td>
<td>Markin, George P., Project Leader (C)</td>
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<td>Maksymiuk, Bohdan, Prin. Entomologist (C)</td>
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<td>Neisess, John A., Assoc. Chemist (C)</td>
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<td>Diseases of Douglas-fir, Ponderosa Pine, and Associated Species in the Pacific</td>
<td>Stewart, James L., Project Leader (C)</td>
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<td>Aho, Paul E., Plant Pathologist (C)</td>
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<td>Biology of Root Diseases and Soil Microorganisms</td>
<td>Trappe, James M., Project Leader (C)</td>
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<td>Lu, Kuo C., Prin. Microbiologist (C)</td>
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<td>Li, Ching-Yan, Assoc. Microbiologist (C)</td>
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RESOURCE ECONOMICS, PRODUCTS, AND ENGINEERING RESEARCH

FLORA, DONALD F., Asst. Director (P)

1301 Timber Measurement and Management Planning in the Northwest
Bruce, David, Project Leader (P)
Curtis, Robert O., Prin. Mensurationist (P)

3101 Timber Quality Research for Western Softwoods
Lane, Paul H., Project Leader (P)
Henley, John W., Prin. Wood Technologist (P)
Woodfin, Richard O., Jr., Prin. Wood Technologist (P)
Pong, Wee Yuey, Wood Technologist (P)
Plank, Marlin E., Assoc. Wood Technologist (P)

3501 Effective Use of Wood in Building Construction
Grantham, John B., Project Leader (S)
Heebink, Thomas B., Prin. Research Engineer (S)
Oviatt, Alfred E., Jr., Prin. Research Architect (S)

3701 Timber Harvesting Systems for the Pacific Coast Including Alaska
Lysons, Hilton H., Project Leader (S)
Carson, Ward W., Prin. Mechanical Engineer (S)
Mann, Charles N., Prin. Mechanical Engineer (S)
Peters, Penn A., Prin. Aerospace Engineer (S)
Burke, J. D., Civil Engineer (S)
Vigna, Carl P., Designer (S)

4101 Forest Survey in the Pacific Northwest
Metcalf, Melvin E., Project Leader (P)
Gedney, Donald R., Prin. Resource Analyst (P)
Berger, John M., Mensurationist (P)
Oswald, Daniel D., Resource Analyst (P)
Wall, Brian R., Economist (P)
Bolsinger, Charles L., Assoc. Mensurationist (P)

4102 Improvement of Forestry Survey Techniques—PNW
Pope, Robert B., Project Leader (P)
Farrenkopf, Thomas O., Mensurationist (P)
MacLean, Colin D., Mensurationist (P)

4103 Forest Survey for Alaska
Hutchison, O. Keith, Project Leader (J)
Hegg, Karl M., Mensurationist (J)
LaBau, Vernon J., Mensurationist (J)
Laurent, Thomas H., Assoc. Mensurationist (J)

4201 Economics of Timber Growing
Fight, Roger D., Project Leader (P)
Randall, Robert M., Economist (P)
Sassaman, Robert W., Assoc. Economist (P)

4301 Marketing Economics
Darr, David R., Acting Project Leader (P)
Austin, John W., Assoc. Economist (P)

RESEARCH SUPPORT SERVICES

PETERSEN, CHAS. J., Assistant Director (P)
Hague, Barbara R., Operations (P)
DiBenedetto, A. P., Architectural and Engineering Services (P)
Knutson, Maurice C., Library Services (P)

Hansen, George M., Editing and Publication Services (P)
Parker, J. Louise, Information Services (P)
Reineke, Dorothy E., Statistical and Data Processing Services (P)

1(P) Portland, Oregon (F) Fairbanks, Alaska
(B) Bend, Oregon (J) Juneau, Alaska
(C) Corvallis, Oregon (L) La Grande, Oregon
(R) Roseburg, Oregon (S) Seattle, Washington
(W) Wenatchee, Washington
1972 brought sharp reminders of the forest's importance in producing wood products for housing. There were more Americans than ever building homes with unprecedented vigor, pushing lumber and plywood use to record heights, paying unrivaled prices, and seeing ever-higher overseas demand for American softwood logs.

We participated in a national Forest Service review of timber supply and demand. It appears that at current prices and management intensity, demand for softwoods will rise 65 percent in the next 30 years, while supplies from U.S. forests will increase only 20 percent.

Indexes of U.S. softwood log exports, housing starts, and roundwood consumed in lumber, veneer, and plywood production, 1960-72. (1967 = 100)

Our Forest Survey analysts estimated that in Washington and Oregon alone, a million acres have been removed from timber production for roads, urban areas, and industry. Another one-third million acres have been put into reserved categories such as wilderness areas and National Parks.

To help produce more timber on fewer acres, the Station is seeking better solutions for problems that will lead toward greater productivity—regeneration, thinning, fertilizing, insect and disease control, genetics, fire control, and repressing competing vegetation.

Researchers are also devising ways to encourage fuller use of trees, through more efficient selling arrangements for public timber, environment-slanted logging systems, methods of predicting the best combination of products from each tree, utilization of logging residues, and economic guides to channel forestry funds into the most productive treatments. New challenges, like a Douglas-fir tussock moth outbreak and emerging logging residue reduction opportunities, required stronger and sometimes redirected research effort.

The highlights in this year's report indicate not only our determination to provide means to meet growing timber needs, but also our continued commitment to solve environmental problems.
BIOLOGICAL CONTROLS
(Publications on page 37)

Microbial Control of Forest Insects

A nuclear polyhedrosis virus for operational biological control of the Douglas-fir tussock moth appears close to realization, as a result of recent field tests on spray formulations. One improvement in formulation is the addition of an ultraviolet screening agent, which prolongs virus activity on sprayed foliage. A substantial field test involving aerial application of the virus as an alternative to chemical controls is planned for 1973.

*Bacillus thuringiensis*, a commercially available microbial insecticide, was also found to have possibilities in biological control of forest defoliators. Small-scale field tests showed western spruce budworm, the pine butterfly, and Douglas-fir tussock moth to have a high degree of susceptibility to this bacillus, thus suggesting a second alternative for chemical control.

SOME HIGHLIGHTS OF 1972 DEVELOPMENTS

Douglas-fir Roots Protected by Mycorrhiza

*Thelephora terrestris*, a common mycorrhizal fungus in nurseries, protects Douglas-fir roots from rot caused by *Fusarium oxysporum* f. *pini*. Seedlings were grown in large flasks in the laboratory. Some were inoculated with *Thelephora* which then

Douglas-fir seedlings after 2 months exposure to *Fusarium* root rot. Left: Healthy mycorrhizae formed with *Thelephora terrestris*. Right: Stunted rootlets of nonmycorrhizal seedling.
formed mycorrhizae with the seedling roots; others were not inoculated. After 3 months, *Fusarium* was added to all flasks. Two months later, the mycorrhizal seedlings had remained healthy. The nonmycorrhizal seedlings, in contrast, had stem cankers above the root collar; many roots were decayed; and most living rootlets were stunted. Inoculation of nursery soils or seedling containers with selected, highly protective mycorrhizal fungi may well provide the most dependable method for control of seedling root rots.

The chemical insecticides investigated were experimental formulations of Zectran and pyrethrin; they were also tested against Douglas-fir tussock moth at airport sites. Results were similar to those obtained in previous extensive field tests and demonstrate the advantage of conducting this type of relatively inexpensive test prior to field experiments. Zectran was more promising than pyrethrins; however, a higher dosage and better spray coverage at feeding sites of the insect is needed for effective control.

**CHEMICALS**
*(Publications on page 38)*

**Granular Herbicides for Red Alder Communities**

Granular picloram, karbutilate, dicamba, bromacil, and fenuron-TCA were tested on pole-sized red alder communities at five locations in the Coast Ranges of Oregon and Washington. Herbicides were applied on four dates between mid-February and mid-May at rates varying from 0.5 to 15 pounds per acre. Results, observed 15 to 19 months later, showed that picloram and karbutilate were effective at high application rates on overstory and understory species. Dicamba was effective on red alder while bromacil and fenuron-TCA did not control any species. Picloram, karbutilate, and dicamba killed existing Sitka spruce and Douglas-fir saplings. However, in one study area, Douglas-fir seedlings planted during the first winter after treatment did not show herbicidal damage at the end of growing season.

Red alder communities occupy more than 2 million acres of high-site forest land. Liquid herbicidal formulations are commonly used to convert...
much of this land to more desirable conifers. However, many species in red alder communities are resistant to these herbicides and penetration of liquid sprays through the overstory is inadequate to control understory plants. Development of economic and environmentally safe granular herbicide treatments may overcome these problems.

Current research is investigating lower application rates and combinations of granular picloram and karbutilate.

Herbicide Movement and Toxicity After Spills

Monosodium methane arsonate (MSMA) and cacodylic acid are organic arsenic containing herbicides which are injected into tree stems to thin precommercial-size stands. During handling and application, small quantities of highly concentrated herbicide fall to the forest floor. Foresters are concerned that the chemical might be available to small animals, leach to ground water, or harm soil microbes.

In leaching experiments, both MSMA and cacodylic acid moved rapidly through the forest floor but were moderately to strongly adsorbed on mineral soil. The ready movement of both MSMA and cacodylic acid from the surface of the forest floor to the soil interface is particularly important in minimizing the exposure of small animals to these herbicides. Although cacodylic acid is more mobile than MSMA in soil, it is not sufficiently mobile to pose a threat to the quality of ground water.

The rate of organic matter decomposition by soil micro-organisms is an indicator of their well-being. We measured organic matter decomposition occurring in 28 days after adding various amounts of MSMA or cacodylic acid to forest floor material and soil from three areas in Oregon and Washington. Slight reductions in organic matter decomposition occurred in both forest floor and soil treated with high concentrations of arsenic, but these are not considered to be biologically significant reductions. Arsenic concentrations in spill areas are unlikely to exceed 1,000 p.p.m., and this level poses no threat to soil micro-organisms in forest floor and soil.

Fertilization Decreases Poria weirii

Ripping up roots on recently harvested Poria weirii infection centers, followed by nitrogen fertilization, may markedly reduce the amount of P. weirii surviving to infect the succeeding stand.

Past experiments have indicated that nitrogen fertilization reduces the time that P. weirii survives in buried wood in the laboratory. Followup studies in the forest now provide further reason for optimism about nitrogen fertilization as a control method.

Two-inch cubes of Douglas-fir wood infected with P. weirii were buried in a second-growth Douglas-fir stand. Urea was broadcast at the rate of 600 lb./acre of nitrogen on some plots and mixed around the cubes for a rate of 600 lb./acre-ft. on others.

After 6 months, both methods of fertilization had markedly reduced survival of P. weirii compared with that of unfertilized plots.

<table>
<thead>
<tr>
<th>Cubes with zone lines</th>
<th>viable Poria Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea broadcast</td>
<td>11</td>
</tr>
<tr>
<td>Urea mixed in soil</td>
<td>0</td>
</tr>
<tr>
<td>No treatment</td>
<td>69</td>
</tr>
</tbody>
</table>

Moreover, zone line formation by the fungus was greatly impeded. Called “lines” because they appear as such on the cut surfaces of infected wood, these structures are actually envelopes of dense, dark tissue formed by the Poria colony around itself as protection against antagonists. If a colony in an infected root is broken apart during logging or postharvest treatment, it will be overwhelmed by antagonists unless it can form a new zone line at the exposed surface.
ECONOMICS IN FOREST MANAGEMENT
(Publications on page 38)

Thinning Stagnated Ponderosa Pine—Marginal

An economic analysis of alternatives in the management of stagnated ponderosa pine stands shows that the costs of spacing control are not recovered by returns from increased yields in timber and forage when a 5-percent cost of capital is assumed. Only when harvest regulation policies permit an immediate increase in harvesting (the allowable cut effect) and these receipts are included in the economic analysis, do any of these regimes yield returns in excess of 5 percent.

ECONOMICS IN WOOD INDUSTRY
(Publications on page 39)

Stand Diameter and Stumpage Price

A study of average stand diameter and stumpage price on three National Forests in western Washington and western Oregon showed little relationship between these two variables when stand diameter exceeded 20 inches. Stand diameter tended to account for more variation in stumpage price when timber sales included stands with an average diameter of less than 20 inches. However, other variables such as expectations of end-product market conditions and bidder competition can have an overriding influence on stumpage price.

Cost-reducing technologies specifically adapted to smaller diameter timber are being adopted by Pacific Northwest timber processors. In time, we expect a changing diameter distribution in the timber resource; and adoption of these specialized processing techniques will alter the relationship between stumpage price and average stand diameter in a timber-market area.

Because the relationship between average stand diameter and stumpage price can vary by area, evaluation of the economic feasibility of increasing timber supplies through commercial thinning should include local as well as regional market factors.

Prices for Pulpwood Drop

A survey of pulp, board, and felt mills in Washington, Oregon, and California documented prices for chips, sawdust, shavings, utility grade logs, and other pulpwood consumed by these mills during 1970-71. Prices were updated for 1972 by return calls to survey participants.

In the period 1970-71, chip prices varied widely depending on mill location and type of mill. Prices were generally highest in Washington and lowest in California, and pulpmills paid higher prices for chips than did board mills. Pulpmills paid $3 to $5 more per bone dry ton (B.D.T.) for whitewood chips than for Douglas-fir. Sawdust and shaving prices averaged $3.00 to $7.25 per B.D.T., and utility grade logs averaged from $12.50 to $23.00 per B.D.T. Whitewood utility grade logs carried a $3 to $4 per B.D.T. premium compared with Douglas-fir.

In 1972, fiberwood prices reversed an upward trend and drifted downward. With the exception of whitewoods in the Puget Sound area, this was true for all forms of fiberwood in all areas. Mills reported that the decline in prices was due to weakening pulpwood demand in 1971 and an expanding lumber and plywood market which increased mill residue supplies.

The wide range in prices indicates that the market for residues is localized, and efforts to evaluate the economic feasibility of increased residue use should consider local as well as regional market factors.
Evaluating Water and Retardant Drops

A simple, inexpensive method was developed by the Institute at Fairbanks, Alaska, to measure ground distribution patterns of water or other fire control retardants dropped from aircraft. A contour mapping computer program was used, without modification, to plot concentrations of liquid throughout the drop zone. These maps provided an efficient means to evaluate drop patterns from fire retardant aircraft. Fairbanks district, Bureau of Land Management, used the method during the 1972 fire season and became the first operational organization to quantitatively determine the capabilities of its fire retardant aircraft.

Fireproofing Residues We Can’t Use

Since avoidance of conflagrations which cause drastic losses is their first concern, an initial thrust of the Forest Residues Reduction Program has been to work with land managers to this end. Five pilot test areas have been established on northwestern National Forests and a Regional (fire) Preattack Guide published by cooperative work. In the pilot test areas, we are developing improved prefire cost estimating and procedural aids and even underburning methods for standing Douglas-fir timber.

Measuring the Growth of Fish in Tanks

Growth is a good indicator of the effect of chemical or environmental stresses on fish. The usual weighing procedures for obtaining growth measurements of live fish cause significant stress, and the values are affected by the amount of water on their skin. These problems are most severe for small fish. A photographic technique of determining fish growth has been developed which reduces stress by minimizing handling and eliminating anesthetizing and blotting the fish. The area
of the fish image obtained from a side-view photograph is used to estimate the dry weight of the fish from a previously determined correlation between fish area and dry weight.

To obtain adequate side-view photographs of the fish, a plexiglass device was constructed which positions the fish in side view in an aquarium before a camera and electronic flash unit. The area of the fish in each photograph is measured with a polar-planimeter which is calibrated against a reference area appearing in each photograph. With this technique, the continuing growth patterns of a large number of fish in aquaria can be accurately determined with minimum stress to the fish.

Progress on Research Natural Areas

Work on the Federal system of Research Natural Areas progressed well during 1972. A major contribution was our publication of "Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators." This book describes in detail the biological and environmental features of each of the 48 existing Research Natural Areas on Federal lands in these two States. In cooperation with the Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, National Park Service, and Region 6 of the Forest Service, several scientists were hired and worked under Station leadership during the summer on various aspects of the Research Natural Area program. Permanent plots and photo points were established within selected areas and new candidate areas identified.

New natural areas established during 1972 included Bagby and Wheeler Creek on National Forest lands and Lost Forest on Bureau of Land Management land. Bagby provides representation of 250-year-old Douglas-fir-western hemlock forests in the western Cascades of northern Oregon. Wheeler Creek is the first Federal reserve established for redwood, provides a representation of the species as it occurs near the northern limits of its range.

Old-growth redwoods dominate the Wheeler Creek Research Natural Area on the Siskiyou National Forest near Brookings. This Research Natural Area, the first established for redwood, provides a representation of the species as it occurs near the northern limits of its range.

Mature 250-year-old Douglas-fir-western hemlock forests characterize the Bagby Research Natural Area on the Mount Hood National Forest. This is the first Federal reserve established for this type in the western Oregon Cascade Range.

tract, on the Chetco Ranger District of the Siskiyou National Forest, includes 135 ha. (334 acres) of mixed redwood and Douglas-fir stands near the northern limits of the redwood range in southwestern Oregon. Lost Forest Research Natural Area provides scientific protection for an isolated stand of ponderosa pine located on sandy soils far out in the sagebrush steppe of central Oregon.

Evidence that results from seedling tests likely will apply to older trees comes from two sources. First, a growth model which related volume of seedlings to spacing was also found to be appropriate for 43-year-old trees. Second, the same type of variety-spacing interaction that appeared in our experiment has appeared in spacing tests involving species of such widely divergent growth types as forage herbs and grasses, grain crops, and root crops. These facts suggest that plants respond similarly to spacing regardless of type or size.

**Culling to Reduce Self-pollinated Seedlings**

Self-pollinated Douglas-fir plants are undesirable for reforestation because they are generally smaller and less vigorous. One of the reasons for nursery culling of small seedlings is to remove plants which have arisen from self-pollination. However, these plants are not uniformly small. They do grade into normal seedling sizes and, consequently, culling by size cannot remove them all. Optimally, such culling should remove as many of the selfs as possible without discarding too many normal plants.

**GENETICS**
*Publications on page 41*

**Good Genotypes Perform Well at All Spacings**

One of the concerns for tree breeding is that genotypes selected to be used in improved strains may not be superior at all spacings.

In a recent test of seedling Douglas-fir grown at four spacings, it was found that varieties of highest average wood volume per tree performed best at all spacings, i.e., a variety 50 percent better than another at the closest spacing was also 50 percent better at the widest spacing.
In order to study the effect of culling, we constructed two artificial nursery populations. They contained 5 and 10 percent of self-pollinated seedlings and were based on measured size distributions of pure self- and cross-pollinated progenies. These populations were then culled by removing the shortest 10, 20, 30, and 40 percent of the seedlings. Approximately 40, 60, 70, and 80 percent of the self-pollinated plants were removed from both populations at these culling levels. Thus, culling beyond 10 percent and certainly beyond 20 percent removes mostly cross-pollinated plants.

**INSECTS**

*(Publications on page 41)*

**Parasites of Larch Casebearer Imported**

In cooperation with the Intermountain Forest and Range Experiment Station and Regions 1 and 6 of the Forest Service, the use of insect parasites is being tested as a method for controlling an introduced pest, the larch casebearer. Starting in 1957, this pest spread quickly through western Montana, northern Idaho, and northeast Washington, where it is causing severe growth reduction of western larch. Since 1967, it has invaded 168,000 acres in southeast Washington and northeast Oregon. Its early invasions of northeast United States and Canada were effectively controlled by liberations of introduced parasites.

In 1972 two species of parasites, *Chrysocharis laricinellae* and *Dictadocerus westwoodii*, were obtained from Austria and England through the Commonwealth Institute of Biological Control and released in infested stands in southeast Washington and northern Idaho. It is expected that these parasites will supplement the effects of a previously released parasite, *Agathis pumila*, which is showing promise in some areas. It will be several years before the results of the parasite liberation effort can be fully evaluated.

**Tussock Moth Population Dynamics**

Research on the present, extremely virulent Douglas-fir tussock moth outbreak in eastern Oregon and Washington confirmed findings of studies during the past several years by our scientists working on outbreaks in California and Arizona.

![Graph showing population change in an outbreak of the Douglas-fir tussock moth in central Arizona.](image)

A typical cycle of a tussock moth outbreak lasts about 3 years. Severest defoliation and damage usually come in the second year. In the third year most infestations decline naturally to a low level after causing only minor additional defoliation. If tussock moth damage is to be prevented,
incipient outbreaks must be detected and evaluated during the first year of the outbreak cycle. Effective control measures can then be initiated the second year to reduce population density before significant defoliation occurs. Knowledge of how population densities fluctuate in different environmental conditions is fundamental to predicting tree damage and developing pest management strategies.

LOGGING
(Publications on page 42)

Logging Can Favor Environment

The increasing environmental restraints on logging practices are accelerating technological developments to overcome the economic impact of these restrictions.

The trend to irregular-shaped timber harvest settings dictated by landscape considerations prompted the development of a means of quickly determining the average yarding distance on non-geometric shapes via a digitizer and desk-top programmable calculator. The calculator also displays the area, maximum yarding distance, and slope correction.

The emphasis on aerial logging systems, which have critical weight limitations, induced the development of a practical method of log weight estimation following light sampling. The method is suitable for any species or location.

The trend to running skylines for grapple or choker yarding results in less damage to forest environment by reducing the size of landings. To further the application of these advanced yarding systems, information was published on road and landing criteria for mobile crane yarders.

MENSURATION
(Publications on page 43)

Fall, Buck, and Scale Cruising

Years of research in cooperation with the Bureau of Land Management and the Administrative Branch of the Forest Service has led to an exciting new method for cruising timber. The method calls for selecting sample trees by the now-familiar 3P sample selection procedure and for measuring these sample trees after they have been felled and bucked. This combination of 3P sampling and down-tree measurement has drastically reduced both sampling error and technique error. It offers Federal agencies an opportunity to sell timber lump sum and still protect the interests of the purchaser. The method has been widely tested throughout the West and is already being used on a production basis.
PATHOLOGY
(Publications on page 43)

Dwarf Mistletoe Responds to Fertilizer

Seedling height increased as level of fertilization increased. Infected seedlings grew only half as much as healthy ones at all levels of fertilization.

Dwarf mistletoe aerial shoot growth also increased proportionally to the level of fertilization, that is, the more vigorous the seedling, the more vigorous the dwarf mistletoe.

These results indicate short-term impacts on seedlings. Several more years will be needed to evaluate the long-term impact of nitrogen fertilization of dwarf-mistletoe-infected ponderosa pine.

Christmas Tree Foliage Disease

A damaging Lophodermium sp. foliage disease in Scots pine Christmas tree plantations has recently appeared in western Oregon and Washington. We are cooperating with Rocky Mountain Station pathologists to work out the life cycle of the organism and possible control measures. The fungus apparently originated from infected Scots pine seedlings shipped to the Northwest from infected midwestern tree nurseries.

Spore traps in a Siletz, Oregon, Scots pine plantation indicate that sporulation of the organism is closely correlated with rainy periods and is seasonal in nature. During the dry summer months, few to no spores were recorded for weeks at a time; however, with the onset of October rains, the count increased with a peak reached in early November of 1972. Spore casts have continued at a lower level through mid-December and will be monitored through the spring of 1973.

Nitrogen-fixing Bacteria Found in Decaying Wood

Station pathologists, in cooperation with Oregon State University scientists and using newly developed techniques, have discovered bacteria that fix nitrogen in decayed white fir heartwood. This finding may answer a question that has puzzled pathologists for many years. Wood is very
low in nitrogen, yet fungi require nitrogen to cause decay. Where does the nitrogen come from?

Large numbers of nitrogen-fixing bacteria were found in wood just beginning to decay. It is likely these bacteria provide the nitrogen for the decay fungi. Studies are now under way to verify this.

Such studies may lead to a more thorough understanding of the decay process and possible ways of preventing decay. Decay in Oregon and Washington causes an annual loss of 110 million cubic feet of wood. This would be enough lumber to build 61,000 average-size homes.

PHYSIOLOGY
(Publications on page 44)

Nutrient Budget of a Douglas-fir Forest

Nutrients essential to the productivity of the forest are cycled between air, trees, soil, and stream. For a 2-year period in an undisturbed, old-growth Douglas-fir forest, nitrogen was in balance in precipitation and streamflow while loss of phosphorus exceeded gain by 0.34 kilogram per hectare (0.30 pound per acre). Both these nutrients move predominantly as dissolved forms. Nitrogen loss in sediment accounted for 60 percent of the total nitrogen loss.

These data suggest that productivity of Douglas-fir forests is maintained by the efficient retention of nitrogen and phosphorus. Losses of nitrogen would be larger when catastrophic erosion events remove large amounts of soil by landslides. Because a large proportion of nitrogen is lost in sediment, control of erosion is essential in managed forests if nitrogen levels are to be kept in balance. The small phosphorus loss in the natural forest suggests that it is replaced by mineral weathering.

PLANT ECOLOGY
(Publications on page 44)

Seeding and Fertilizing Improve Plant Cover on Burned Watersheds

Two years of study have been completed on the recovery of native vegetation and the success of erosion control seeding and fertilizing after fire on the Entiat Experimental Forest. Plant cover, of which native species comprise about two-thirds, has more than doubled since the first-year measurements were taken. Artificial seeding has been shown to improve plant cover by as much as one-third in both years of study, but ammonium sulfate and urea fertilizers were not of benefit until the second year. Observations made the second year indicate that both ammonium sulfate
Vegetation transect on the Entiat Experimental Forest 1 week after the fire in 1970, 1971, and 1972. This transect was in a watershed that was seeded and fertilized with ammonium sulfate.

and urea fertilizers were essential to continued growth and vigor of seeded species that had become established the first year. Of five seeded species, orchard grass, hard fescue, and timothy were most successful. Perennial ryegrass and yellow sweet clover grew so poorly that they can be eliminated from the mixture, resulting in a savings of $0.50/acre on seeding costs. On the four watersheds involved in this study, this would represent a savings of $3,150.
Towards Ecologically Sound Management Decisions

The H. J. Andrews Experimental Forest has been selected as an intensive study site for the Coniferous Biome of the International Biological Program (IBP) because of our well-established, small-watershed studies and the wealth of background ecological data accumulated over the years. In cooperation with the IBP, the initial effort is the development of knowledge of water and nutrient cycling within the Douglas-fir ecosystem with emphasis on linkages between terrestrial and aquatic environments. Later, emphasis will be placed on understanding how these cycles are affected by commonly used land management practices. During the first years, studies by a number of scientists of many disciplines have been largely concentrated on one 25-acre watershed. Basic data on as many as possible of the compartments and transfers in old-growth Douglas-fir ecosystems are being developed and linked, using mathematical models. The ultimate objective is to describe the dynamics of material and energy flows in the complete ecosystem.

Because we have considerable data on streamflow and precipitation, hydrologic models are already being formulated. Research has begun on other elements of the ecosystem. Intensive vegetation mapping of the 25-acre watershed has been completed in unprecedented detail and will be a basis for stratification and a key element in determining biomass and nutrient capital. Japanese IBP scientists assisted in collecting a large quantity of such data on natural forests of Douglas-fir, noble fir, and western hemlock-Sitka spruce. Such information is basic to quantification of other aspects of the ecosystem such as the cycling of nitrogen and other chemicals important to site productivity, release of chemicals to streamflow, use and distribution of water within the system, and the total production and decomposition cycles of organic matter. Currently, Station scientists are working with scientists from Oregon State and other universities to develop a preliminary model describing these relationships on the intensively studied watershed. This will be verified through application to our other experimental watersheds on the South Umpqua drainage and in the Bull Run drainage near Portland. In a few years, we hope to have a basis for predicting the effects of management practices on the total system, for ecologically sound management decisions, and for a more complete understanding of how changes in one or more elements of the ecosystem will influence other elements.

Alaska Trees and Shrubs

The publication of the U.S. Agriculture Handbook No. 410, Alaska Trees and Shrubs, culminated several years of work. This handbook identifies the native woody plants of Alaska. The 33 species of trees and 94 species of shrubs are described in nontechnical terms and illustrated by drawings. Also included are notes on the occurrence and uses of each species and a small map showing its range. There are keys for identification in both summer and winter. A large, folded map, in color, shows the generalized types of forests and tundra.
Senator Ted Stevens and Dr. Viereck discuss use of the new book.

Prepared by the USDA Forest Service, the book is in response to the urgent need for information on the natural resources of Alaska. It will be especially useful for scientific and conservation groups, land-use planners, and all who are interested in environmental problems such as resource allocation, alteration of vegetation, and pollution control. *Alaska Trees and Shrubs* is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $3.25.

**RANGE ECOSYSTEMS**

*(Publications on page 45)*

**A Key to Managing Browse Species**

Analyses of carbohydrate reserves in shrub crowns and results of simulated browsing studies help in determining and understanding the proper season and intensity of shrub use for perpetuation of the browse resources. Fall and winter browsing are less detrimental to the plant. The more damaging periods of use are late spring and mid-growing season, when carbohydrate reserves are lower. Intensity of use which different species can tolerate is quite variable and may be related to magnitude of reserves as well as morphology of each species.

Most carbohydrate storage in browse species seems to be in the smaller roots, and next greatest in oldest portions of crowns. Browsing animals prefer and use the young portions of crowns and thus do not normally remove the major carbohydrate storage areas. This finding may in large part account for the remarkable tolerance of particular rangeland shrubs to browsing by big game and livestock.

**Damaged Subalpine Rangelands Heal Slowly**

In 1905, great areas of depleted subalpine grasslands in the Wallowa Mountains of eastern Oregon were allotted to the Forest Service for management. In 1907, Dr. Arthur W. Sampson, pioneer plant ecologist, was hired by the Forest Service to study these important range-watersheds and recommend procedures for their improvement. Sampson initiated grass reseeding studies...
and proposed modification of grazing management for the areas.

Formal remeasurements of Sampson's original study plots were begun in 1955. They show that maximum recovery and dominance of green fescue occurred only on or around remnant stands. Secondary plant succession on eroded and barren areas was apparently aided by introduced species trials of 1907. Even though these introduced species are not present today, Sampson's plots now have 50 to 80 percent as much ground cover of native vegetation as those which regenerated from remnant stands of green fescue. Apparently, plant succession on these eroded and barren areas was aided by the introduced species trials. However, ground cover on unseeded and unstable plots is so inferior that they are being invaded by white bark pine and subalpine fir trees.

RECREATION
(Publications on page 45)

What Happens to Litterbags?

One might assume that litterbags provided in recreation areas will be used for litter disposal and that, through their use, the amount of litter on the ground will decrease. However, a study conducted in Mount Rainier National Park indicated that only a very small proportion of the litterbags handed out were put in Park trash cans. Furthermore, most of the remaining unused litterbags were carried away unused. This study indicates that litterbags may be used to dispose of waste material which otherwise might end up on the ground (garbage), but they do not by themselves encourage litter pickup.

Incentives for Controlling Litter

Recreation research in Seattle, Washington, was given a merit award this year by the Keep America Beautiful organization for its innovative research on litter control through the use of incentives. The incentive system, developed over 3 years of experimentation, has proven to be extremely effective and well liked by campground rangers and the public. The system rewards children and adults who pick up litter in specified areas. Rewards include educational items such as patches, badges, posters, and bookcovers available from the Smokey Bear fire prevention campaign and the Woodsy Owl anti-pollution campaign.

During 1972, rangers in six districts on three National Forests in Washington and Oregon used the incentive procedures to control their litter problem in campgrounds and some dispersed recreation areas. Future plans call for extended use of the program in other recreation areas in the two States. Several other local, State, and Federal agencies have expressed interest in the program and, hopefully, will use a similar approach in conjunction with other litter control efforts.

REGENERATION
(Publications on page 46)

Pine Seedlings Storage and Field Survival

Often tree seedlings are held in cool storage for a limited period between lifting at the nursery and planting in the field. When extended, such storage materially affected survival of ponderosa pine planted on two sites in southwestern Oregon. One year after planting in early April, pine survival was best, 57 percent, for trees planted immediately after lifting; and poorest, 18 percent, for those stored 19 weeks. Survival was intermediate for
trees subjected to a combination of storage and holding in soil trenches at the nursery for 19 weeks. Clearly, ponderosa pines should not be subjected to lengthy storage if destined for planting on difficult sites.

**Douglas-fir Regenerates Under Shelterwood**

There is currently much interest in examining alternatives to clearcutting in coastal Douglas-fir. This interest arises from silvical and environmental concerns. Examination of 21 operational shelterwood harvests at high elevations in the western Oregon Cascade Range showed that such harvests lead to satisfactory stocking of natural regeneration within 2 to 3 years after harvest. Where seedbed preparation was adequate, Douglas-fir seedlings were in about the same proportion as in the overstory. Without adequate seedbed preparation, seedlings of other species outnumbered Douglas-fir seedlings about 2½ to 1.

Overstory survival was good, averaging 98 percent of the initial residual number of trees. Mortality was greater (maximum 17 percent of number of trees) in several units where overstory density actually fell within the seed-tree category. Within the feasible range of shelterwood densities for Douglas-fir, greater shelterwood densities are recommended for southerly slopes than for northerly and for severe sites than for mesic.

**Heat-induced Germination of Scotch Broom Seeds**

Scotch broom is spreading on forest lands at low elevations west of the Cascade Range. The shrubs suppress young conifers by shading and competing for soil moisture during the dry seasons. Preliminary studies indicated that scotch broom seeds are anatomically similar to *Ceanothus* seeds, which germinate after exposure to high soil temperatures. A laboratory-greenhouse experiment has demonstrated that dormant scotch broom seeds in forest soils can also be induced to germinate by heat of wildfires or logging slash fires.

Soil temperatures of 45°C or less did not cause the seeds to germinate. A few seeds germinated after exposure to 60°C soil temperatures, but maximum germination was obtained from seeds buried in soil heated to 90°C. Duration of exposure from 4 minutes (minimum) to 40 minutes (maximum) had little effect on germination at soil temperatures up to 90°C. Mortality occurred in seeds exposed to 105°C soil temperatures, and number of seeds killed increased with length of exposure. Exposure in soil heated to 120°C killed all scotch broom seeds of the seed sample tested. A total of 7,000 seeds were involved in this experiment.

Germination can occur from soil temperatures generated during burning of light logging slash or when burning chemically killed brush to prepare sites for reforestation. Greater amounts of slash would raise soil temperatures to lethal levels.
Performance of Containerized Seedlings

Pulling a “plug” seedling from the 4½-inch-deep cavity in a Styroblock used for greenhouse production of Douglas-fir.

Vigorous, uniform container stock can now be grown in a few months on a variable greenhouse schedule and be available at optimum times for outplanting on particular sites. First-season results suggest that “plug” seedlings have both advantages and limitations compared with conventional bare-root nursery stock.

Survival of Douglas-firs grown in Styroblock containers and planted as “plugs” on clearings in southwestern Oregon varied substantially by aspect. On north aspects, survival was slightly higher for container-grown stock than for 2-0 or 1-1 bare-root stock. On south aspects, where survival of all stocks was substantially lower, survival of container stock was lowest. It appears that small container stock may prove very useful on favorable sites but should not yet be relied on to reforest the more unfavorable sites.

<table>
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<tr>
<th>Type of Stock</th>
<th>Survival by aspect</th>
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<tr>
<td></td>
<td>North</td>
<td>South</td>
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<td>Containerized</td>
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<td>49</td>
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<tr>
<td>2-0 seedlings</td>
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<td>55</td>
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<td>1-1 transplants</td>
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RESIDUES

(Publications on page 47)

Estimating Residue Volumes on Specific Tracts

Extensive surveys have established that logging residues have the potential for supplying substantial amounts of wood for fiber production. These surveys have provided information on the total volume of residues, their distribution by owner class and geographical area, by diameter and length classes, and by relative suitability for pulping. However, good management of residues requires that the land manager have some means of quickly and accurately determining the amount and characteristics of residues left on a specific tract and of estimating the volume of residues likely to be produced prior to actual harvest.

We are currently designing a study to determine the relationship between logging residues and (1) stand factors such as age, species, and defect; (2) terrain factors such as slope, roughness, and elevation; and (3) economic factors such as type of purchaser, distance to processing plant, kind of sale arrangement, and general price picture of wood products. A primary need for such a study is a method of determining with confidence the volume of residues actually associated with these variables. We have been developing an efficient and accurate sampling technique applicable to harvesting operations on the west coast. The results indicate that the line intersect method combined with a systematic grid sampling design will produce valid estimates for a specific tract. Three configurations of sample line transects were tested, and the analysis gives an estimate of the number of sample units needed to achieve given levels of precision for each.
Increasing Wood Resource Through Use of Residues

In an examination of management alternatives, the Station’s Forest Residues Reduction Program has concluded that residue reduction through increased use of wood fiber: (1) is likely to increase and be most influenced by shrinking timber supplies relative to demand for wood products; (2) might come in time, due to increase in timber demand, from public reaction to environmental pollution resulting from processing of competing materials; (3) will require incentives for logger and processor for residues to be received at an accelerated rate in a given locality. A trade-off of reduced revenue to obtain a cleaner site for forest regeneration is consistent with intensive forest management and suggests a change in the timber seller’s emphasis from maximum initial revenue to that of replacing the harvested stand with a site ready for regeneration. Feasibility analyses through simulation and examination of market expansion opportunities are in progress which should indicate to landowners the kinds of residues to remove and the processes which should be encouraged. Priority in this work has been directed toward the growing needs for energy and raw materials.

SOILS, SITE, AND GEOLOGY
(Publications on page 47)

Helicopter Logging After the Entiat Fire

Helicopter salvage logging after fire on the Entiat Experimental Forest near Wenatchee, Washington, caused significantly less surface soil disturbance than high-lead cable skidding or tractor logging methods. Although slopes were generally steeper and soils more unstable in areas logged
with helicopter, about 88 percent of the soil surface remained undisturbed by this logging method. Comparable amounts of undisturbed soil surface were 65 percent for tractor skidding over snow, 26 percent for tractor skidding over bare ground, and 23 percent for cable skidding. Areas of severe soil disturbance were negligible after helicopter logging, whereas cable skidding and tractor over bare ground left severely disturbed areas. In the fall of 1972, soil erosion associated with logging activity was evident on only 2 percent of the helicopter-logged area. Comparable soil erosion was 41 percent on the cable skidding area, 30 percent for tractor skidding over bare ground, and 13 percent for tractor skidding over snow.

SUPPLY AND DEMAND
(Publications on page 48)

Washington and Oregon Log Exports Reach Record High in 1972

Softwood log exports from Oregon and Washington totaled 2,637.1 million board feet in 1972, up 43.5 percent from the 1971 volume and up 19 percent from the previous annual high recorded in 1970. Shipments from northern California declined 24.4 percent to 77.5 million board feet. Alaska exports reached a new annual high of 65.8 million board feet in 1972, 54.5 percent more than 1971 volume. The relatively low volume from Washington, Oregon, and northern California in 1971 reflects in part labor disputes which closed ports in these three States during July-September 1971.
The average value of log exports from Washington and Oregon was $136.02 per thousand board feet, up 7.1 percent from the previous annual high in 1971.

Area Available for Timber Declines

Between 1945 and 1970, there was a net physical loss of 1 million acres of commercial forest land in Oregon and Washington to other land uses. The single greatest loss was from road construction; urban and industrial expansion was second most important. Other losses resulted from agricultural clearings, powerline clearings, and construction of reservoirs. Also since 1945, about 362,000 acres of productive forest lands, mostly in National Forests, have been set aside in reserved areas.

California Forest Survey Fieldwork Completed

This year, fieldwork for the inventory of California’s 8 million acres of commercial forest land outside the National Forests was completed. A report on the timber resources of Mendocino and Sonoma Counties was also issued this year, and subsequent reports for the remainder of the State will follow as data are compiled.

The report for Mendocino and Sonoma Counties indicates a total commercial forest area of 1,560,000 acres, a total sawtimber volume of 17.8 billion board feet, and an average annual harvest of approximately 600 million board feet for the past 5 years. Future timber harvests depend on the level of management practiced. Intensified management practices such as planting, precommercial and commercial thinning, and conversion of hardwood stands to conifers are needed to maintain timber harvest at about the current level. However, since over half the commercial forest area is in farmland and miscellaneous private holdings—small parcels, short tenure, and little interest in timber production—this level of production is not likely to be sustained. The long-term future of timber production is likely to be determined primarily by the management efforts applied to public and forest industry land holdings; and consequently, total sustained production is likely to be somewhat lower than at present.

Foreign Trade in Wood Products

The role of foreign markets in U.S. wood products trade has been increasing. Today, about 10 percent of our wood products production is exported and 20 percent of what the United States consumes comes from foreign countries. Our marketing research has identified areas of the world that can be expected to have significant impact on the U.S. timber supply-demand situation in the future.

Prospects for large additions to world softwood supplies are limited to the U.S.S.R. and Canada. Future imports of softwood material should come mainly from Canada because of its proximity and because its domestic needs are small relative to volumes available. Large, untapped hardwood inventories are found in most of the world’s tropical areas; southeast Asia, with its more uniform quality timber, is expected to play a dominant role in hardwood supply expansion.

Increases in wood products consumption should be substantial in western Europe, Japan, and the U.S.S.R. Exports from the United States are expected to rise despite increasing domestic requirements. Major export activity from the United States is forecast to be log shipments to Japan and pulp and paper exports to western Europe.
Huckleberry Research

A new Station research program was established during 1972 to study ecology and management of wild mountain huckleberries. Initial emphasis is on control of competing vegetation: Many huckleberry fields in Oregon and Washington are dwindling in size and productivity through invasion by low-value trees and brush. Most huckleberry fields occupy land that is marginal for timber production. In 1972, Station researchers measured berry production and species composition on representative plots, then applied cutting, burning, sheep grazing, and borax treatments. The plots will be remeasured later to determine which method is most effective for controlling competing plants. Station researchers also will study huckleberry ecology and physiology to provide a scientific base for management of this important but little known resource.

A Simple Technique for Sampling Streambed Gravel

Freezing a sample of streambed gravel and sediments with liquid $\text{CO}_2$ under pressure.

A simple, reliable freezing technique has proven to be a better method of sampling rocky stream gravels. A pointed copper pipe is inserted in the streambed, and liquid carbon dioxide is delivered from a storage bottle through a small delivery tube to the bottom of the pipe. The resulting heat absorption causes 1 to 2 inches of surrounding streambed to freeze and cling to the pipe in about 3 minutes. When the pipe is retrieved, a streambed sample, averaging 500 grams, comes out with it. Flowing water has no apparent effect on sample size or quality.

The new technique makes it possible to collect all materials of various size classes present at the sample location, since even the very finest sediments are locked into the frozen sample. Biologists are interested in the composition of streambed gravels, particularly in the amounts of fine sediments, since this is where salmon and trout...
eggs are deposited and develop. Further modifications of the technique may facilitate collecting aquatic bottom fauna for productivity studies.

Frozen gravel and sediment sample removed from the streambed.

Hydrologic Effects of Wildfire

The timing, volume, and temperature of streamflow from the Entiat Experimental Forest were drastically altered following the severe wildfire of August 1970. Flow during the first year after the fire averaged 3.5 inches (50 percent) greater than predicted flow based on prefire conditions. Stream temperature was increased by as much as 10° F. during late summer when streams were exposed to direct insolation.

The streams were much more responsive to water input (snowmelt or rainfall) during the second year after the fire. Intense rainstorms on July 9 and August 14 produced extensive overland flow with peak discharge exceeding 50 cubic feet per second—five times greater than the maximum peak recorded during prefire calibration. These storms eroded much soil, resulting in debris tor-

Debris flow from McCree Creek, Entiat Experimental Forest, in March 1972. This flow completely obliterated the stream gaging station and covered the highway to a depth of 3 to 6 feet.

Water Quality After Fertilization

Water on the Entiat Experimental Forest prior to the August 1970 fire was extremely pure. For example, nitrate-N concentration was normally less than 0.005 parts per million (p.p.m.). The Federal Water Pollution Control Administration (FWPCA) has set 10 p.p.m. as the upper permissible limit for municipal water supplies.

Fire and fertilization with urea and ammonium sulfate caused increases in nitrate-N concentrations over background levels, but the highest concentration observed of 0.7 p.p.m. is well within...
water quality standards set by the FWPCA and represents a very small loss of nitrogen (less than 10 lb./acre/year) from the watersheds.

Concentrations of the four major cations, Ca, Mg, K, and Na, have increased only slightly since the fire, but because of increased discharge resulting from fire, losses during spring runoff have increased threefold.

Results indicate that neither fire nor erosion control fertilization at 50 lb. of nitrogen/acre has adversely affected water quality for municipal purposes.

WILDLIFE AND TIMBER
(Publications on page 50)

Chlorogenic Acid and Deer Browsing

During our search for chemical factors influencing deer feeding preference for conifers, we discovered chlorogenic acid in Douglas-fir foliage. Previously, the compound was known to occur widely in angiosperms, but its presence in gymnosperms was reported in only two tropical genera.

Using foliage from different grafted Douglas-fir clones from a seed orchard, we found that chlorogenic acid was associated with browsing preference of black-tailed deer. Additionally, analyses of progeny of the same clones showed that concentration of chlorogenic acid in the foliage is apparently an inherited characteristic. These results suggest that parent trees can be selected in breeding Douglas-fir for resistance to deer browsing. Resistant parents can be identified by their low level of chlorogenic acid. This technique may also prove useful for screening for resistance among open-pollinated seed trees where only the female parent is known.

WOOD UTILIZATION
(Publications on page 50)

Noise Transmission Rating of Floors

A major cause of annoyance to multistory apartment dwellers is the noise produced by walkers on the floor above. We have developed a subjective method for ranking apartment floor-ceiling systems for their resistance to sound transmission due to footfalls. Results show that the current international standard of rating impact noise transmission (using a tapping machine) incorrectly ranks many floor-ceiling systems, especially those of wood joist construction.

Some of the equipment used for acoustical measurements.

With the new method, the sound of a person walking in an upstairs apartment is recorded on tape. In a playback, the level of the background and footfall noise is then adjusted by the listener so that the walking becomes just inaudible. The level of the adjustment required is used to rank the sound transmission of various floor-ceiling systems. Research is underway to develop an objective method that will correlate with this subjective method and thereby provide a needed research tool to improve acoustical privacy in wood-framed apartment buildings.
Maple Sirup from Bigleaf Maple

Sap flow and the quality of sirup from bigleaf maple were investigated during the winter of 1971-72. Sap flow ranged from none to 16.9 gallons per taphole and sugar content from 1.0 to 2.6 percent. Sugar content also varied seasonally, with the sweetest sap flowing in late January. The sirup was very flavorful, although not as strong in typical maple flavor as that made from eastern sugar maple. Sirup production from bigleaf maple appears feasible as a hobby. Commercial production may be possible as additional local experience is gained.

Lumber Yield and Timber Grading

Western forests produce slightly more than half the Nation's softwood timber used annually for lumber, plywood, particle board, pulp, and other forest products. To make the fullest possible use of this softwood resource, more information is needed on the physical characteristics and wood properties of trees and logs—particularly as they relate to the yield and value of various end products.

Timberland managers need timber quality and product yield information to help produce more usable wood and fiber from the available stands of timber and to appraise the value of timber to be harvested. The processors of timber also need such information for appraisal and for making manufacturing decisions that will optimize the yield and value of their raw material supplies.

Studies were conducted for several important softwood species to determine the effect of specific timber characteristics on product value and yield under various manufacturing conditions. An investigation of Alaskan Sitka spruce provided updated lumber yield information and an improved timber grading system. A lumber recovery study of commercial thinnings from young Douglas-fir timber provided yield information for three types of sawmills and data for completing a new grading system. Two studies of wetwood in white fir provided information on this particular defect that has application in stand management and lumber seasoning.
Forest Service cruisers and scientists identify log and tree characteristics that are used to develop prediction systems for product grade and volume. In these photographs, standing tree and log surface characteristics are being recorded. Log identity for each tree is maintained from the woods through bucking, scaling, and all phases of the processing operations. During processing, certified graders assist in determining product grade recovery.
ANOTATED LIST OF PUBLICATIONS BY GENERAL SUBJECTS—1972

This is a list of all publications by station staff and cooperators during the year 1972, including published talks and addresses (federal, state, or private cooperators are indicated by an asterisk). Available publications may be ordered by the five-digit number at the end of author line from Pacific Northwest Forest and Range Experiment Station, P.O. Box 3141, Portland, Oregon 97208.

BIOLOGICAL CONTROLS

G. E., DATERMAN
09 72157
EFFECTS OF HIGH TEMPERATURE AND VAPOR PRESSURE DEFICIENT ON EUROPEAN PINE SHOOT MOTH, "RYHACIONIA BUOLIANA," IN ENVIROMENTS OF PHYTOPHYSRACIOUS EGG PRODUCTION AND SURVIVAL.
CAN. ENTOMOL. 104, P. 1387-1396, ILLUS.

G. E., DATERMAN
01 72002
LABORATORY BIOASSAY OF SEX PHEROMONE OF THE EUROPEAN PINE SHOOT MOTH, "RYHACIONIA BUOLIANA." ANN. ENTOMOL. SOC. AMER. 65(11), P. 120-123, ILLUS.
SEX PHEROMONE OF "RYHACIONIA BUOLIANA" (SCHIFFERMLILLER) WAS BIOASSAYED FROM OBSERVING NUMBER OF MALES DISPLAYING DIRECTED UPWIND ORIENTATION IN AN AIRSTREAM CONTAINING THE PHEROMONE. INCIDENCE OF RESPONSE DEPENDED ON PHEROMONE QUALITY AND LENGTH OF TIME MALES WERE CONDITIONED AT A HIGH INTENSITY ILLUMINATION. A PHEROMONE QUANTITY EQUIVALENT TO 0.005-0.01 FEMALES WAS NECESSARY TO INDUCE DIRECTED ORIENTATION.

J. R., HUGHES, KENNETH W.
03 72200
FINE STRUCTURE AND DEVELOPMENT OF TWO POLYPHORESIS VIRUSES. J. INVERTEBRATE PATHOL. 19, P. 190-207, ILLUS.
DEVELOPMENT OF TWO NUCLEAR-POLYPHORESIS VIRUSES STARTS WITH THE FORMATION OF CAPSID TUBES WHICH BECOME FILLED WITH VIAL VIRAL NUCLEOPROTEIN. FILAMENTS BELIEVED TO BE DNA MOLECULES CAN BE DEMONSTRATED. SOME EARLIER CONCEPTS OF VIRAL STRUCTURE ARE DISCUSSED.

K. C., LIU; J. M. TRAPP: AND W. B.
01 72016
BIOLOGY OF "PORIA WINTERI" INHIBITING AND OTHER PHENOLIC COMPOUNDS IN PINE OF ACID ALGAE AND DOUGLAS-FIR.
WESTJ. RES. 10(4), P. 65-82.
TWO INHIBITORY COMPOUNDS WERE DETECTED IN THE "PORIA"-RESISTANT ALDER ROOTS BUT NOT IN SUSCEPTIBLE DOUGLAS-FIR ROOTS. SUCH COMPOUNDS MAY BE IMPORTANT IN ROOT DISEASE RESISTANCE MECHANISMS.

G. E., DATERMAN
03 72021
A NEW METHOD FOR THE IDENTIFICATION OF NUCLEOPHARYSEUS VIRUS. J. INVERTEBRATE PATHOL. 19, P. 281-283, ILLUS.
A NEW MICROSCALE PROCEDURE PERMITS INDIVIDUAL EXAMINATIONS OF LARGE NUMBERS OF NUCLEOPHARYSEUS VIRUS. THE PROCEDURE IS BASED ON THE FORMATION OF A PH GRADIENT IN A MICROSCOPE SLIDE, BY MEANS OF A BUFFER AND A SOLUTION OF SODIUM HYDROXIDE IN COLLOIDAL HYDROXYETHYL CELLULOSE.

K. C., LIU;
03 72003
R. H.
INTERACTION BETWEEN TWO PARASITES, "APERCHNIS ONTARIO" AND "ITOPLECTIS QUADRINCULATUS" IN PRUNUS spp. PRODUCTION IN LIGHT-STRATIFIED POPULATION, ILLUS.
ANN. ENTOMOL. SOC. AMER. 65(11), P. 172-177, ILLUS.
"I. QUADRINCULATUS" MATURED PATEL, MORE Ftc AND SEXED AT HIGHER LIGHT INTENSITIES THAN "A. ONTARIO." "A. ONTARIO" LIVED LONGER, MEASURED BY HOSTS KILLED AND PARCHED PRODUCED IN POPULATION CAGES. "I. QUADRINCULATUS" WAS THE BETTER SPECIES, ALTHOUGH MIXED-SPECIES PERFORMANCE WAS AT LEAST AS GOOD. "A. ONTARIO" ASSUMED DOMINANCE AFTER "I. QUADRINCULATUS" EXHAUSTED POPULATION.

J. M. TRAPP; AND JAMES M.
04 7198
A SUMMARY OF THE ROOT DISEASES OF FLORIDA TREES AND A TREATMENT OF THE DIFFERENT METHODS OF CONTROL.

R. B.
01 71221
BIOLOGICAL CONTROL—FOREST DISEASES. 1ST ANNUAL MEET. WEST. FOR. PEST CONF. PROC. 1971, WEST. FOR. CONS. ASSOC., 292.
CURRENT TRENDS IN THE CONTROL OF "PORIA WINTERI" ROOT DISEASES.

K. C., LIU;
04 71221
BIOLOGICAL CONTROL—FOREST DISEASES. 1ST ANNUAL MEET. WEST. FOR. PEST CONF. PROC. 1971, WEST. FOR. CONS. ASSOC., 292.
CURRENT TRENDS IN THE CONTROL OF "PORIA WINTERI" ROOT DISEASES.

K. C., LIU;
04 71221
BIOLOGICAL CONTROL—FOREST DISEASES. 1ST ANNUAL MEET. WEST. FOR. PEST CONF. PROC. 1971, WEST. FOR. CONS. ASSOC., 292.
CURRENT TRENDS IN THE CONTROL OF "PORIA WINTERI" ROOT DISEASES.

K. C., LIU;
04 71221
BIOLOGICAL CONTROL—FOREST DISEASES. 1ST ANNUAL MEET. WEST. FOR. PEST CONF. PROC. 1971, WEST. FOR. CONS. ASSOC., 292.
CURRENT TRENDS IN THE CONTROL OF "PORIA WINTERI" ROOT DISEASES.

K. C., LIU;
04 71221
BIOLOGICAL CONTROL—FOREST DISEASES. 1ST ANNUAL MEET. WEST. FOR. PEST CONF. PROC. 1971, WEST. FOR. CONS. ASSOC., 292.
CURRENT TRENDS IN THE CONTROL OF "PORIA WINTERI" ROOT DISEASES.

K. C., LIU;
04 71221
BIOLOGICAL CONTROL—FOREST DISEASES. 1ST ANNUAL MEET. WEST. FOR. PEST CONF. PROC. 1971, WEST. FOR. CONS. ASSOC., 292.
CURRENT TRENDS IN THE CONTROL OF "PORIA WINTERI" ROOT DISEASES.
CHEMICALS

*Anderson, Harry W., Richard E. Miller, and Robert T. Bergland (eds.)

PROCEEDINGS. FOREST FERTILIZATION WORKSHOP.
WASH., STATE DEP., NAT. RESOURCE. G.M.W. REP. NO. 18, 72 P. (NO COPIES AVAILABLE)

DURING EACH OF THE PAST SEVERAL YEARS, APPROXIMATELY 90,000 ACRES OF DOUGLAS-FIR FORESTS IN WESTERN WASHINGTON AND OREGON HAVE BEEN FERTILIZED. FERTILIZATION HAS BECOME AN OPERATIONAL PRACTICE REQUIRING CLOSE COORDINATION BETWEEN THE APPLICATOR, SUPPLIER, AND OPERATIONAL FORESTER. MEANS ARE BEING DEVELOPED FOR EVALUATING AND IMPROVING BENEFIT-COST RATIOS OF FOREST FERTILIZATION.

KEYWORDS. FERTILIZATION (PLANTS), FERTILIZER APPLICATION, FERTILIZER SPREADERS, AERIAL FERTILIZERS.

*Bolling, W. B., and C. M. Tu.

12 72202

ROLE OF HUMIC SUBSTANCES IN DDT MOVEMENT THROUGH FOREST SOIL.
SOC. SOC. AMER. PROC. 35, 11, P. 146-147. (NO COPIES AVAILABLE)

THESE EXPERIMENTS INDICATE THAT HUMIC SUBSTANCES CAN ACT AS QUANTITATIVELY IMPORTANT CARRIERS OF DDT IN THE ORGANIC LAYER OF A FOREST SOIL, BUT THAT THEY MAY BE RELATIVELY INEFFECTIVE IN THE MINERAL SOIL PROFILE.

KEYWORDS. DDT, HUMUS, HUMIC ACIDS, SOIL.

Bollen, W. B., and G. M. Tu.

12 72202

EFFECTS OF AN ORGANOTIN ON MICROBIAL ACTIVITIES IN SOIL.
TINT AND ITS USES, V. 94, P. 13-15, ILLUS.

TINT (TIN (IV)-N-BUTYLTIN) OXIDE IS A WATER-INSOLUBLE LIQUID HAVING A HIGH AFFINITY FOR CELLULOSE. LEVELS OF TINT TO 100 PPM IN SOIL HAD NO BIOLOGICALLY SIGNIFICANT IMPACT ON SOIL MICRO-ORGANISMS.

KEYWORDS. SOIL MICROBIOLOGY, ORGANOTIN, PEST CONTROL.

Crouch, G. L., and M. A. Radwan

03 72020

DOUGLAS-FIR SEED FROM DEER MICE. (ABSTRACT)
NORTHWEST SCI. ASSOC. 45TH ANNUAL MEET., P. 3. (NO COPIES AVAILABLE)

KEYWORDS. SEED TREATMENT, ENDIN, ARASAN.

Crouch, G. L., and M. A. Radwan

07 72068

ARASAN IN ENDIN TREATMENTS TO PROTECT DOUGLAS-FIR SEED FROM DEER MICE.

TOTA FOREST SEED. RES. PAP. PNW-136, 7 P. ILLUS.

COATING WITH ENDIN REDUCED CONSUMPTION OF DOUGLAS-FIR SEED BY DEER MICE. ARASAN DID NOT LOWER SEED CONSUMPTION, BUT ENDIN PLUS ARASAN REDUCED FEEDING TO LEVELS COMPARABLE WITH ENDIN ALONE. ENDIN HAD LITTLE EFFECT ON GERMINATION, BUT ADDITION OF ARASAN CAUSED A SIGNIFICANT REDUCTION, INCREASING AMOUNTS OF ADHESIVE DECREASED THE PROTECTIVE EFFECTS OF ENDIN TREATMENTS.

KEYWORDS. ENDIN, THIRAM, RODENTICIDES, DOUGLAS-FIR, BIOASSAY.

Dartman, G. E., G. D. Davies, Jr., and H. Jacobson

06 72068

INHIBITION OF PHEROMONE PERCEPTION IN EUROPEAN PINE SHOOT MOTH BY SYNTHETIC SCENT.
ENVIRON. ENTOMOL. 113, P. 382-383.

SEVERAL SYNTHETIC ACETATES WERE EFFECTIVE IN MASKING THE NATURAL SEX PHEROMONE OF THE EUROPEAN PINE SHOOT MOTH, 'RHYACIUMIA BUNLAJANI,' MALE ORIENTATION TO PHENOME SOURCES WAS SUCCESSFULLY BLOCKED IN BOTH LABORATORY AND FIELD SITUATIONS. ONE OF THE COMPOUNDS, 'CIS-1,7-DODECENYL ACETE,' WAS ACTIVE AT LOW CONCENTRATIONS, SUGGESTING THAT IT HAS POTENTIAL VALUE AS A BEHAVIORAL CONTROL AGENT IN THE FIELD.

KEYWORDS. CHEMICAL CONTROL (INSECTS), REPRODUCTION.

Gratkowski, H.

12 72200

ANNUAL VARIATION IN SUSCEPTIBILITY OF PONDEROSA PINES TO PHENOXY HERBICIDES. (ABSTRACT)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 20. (NO COPIES AVAILABLE)

KEYWORDS. HERBICIDES, PONDEROSA PINE.

Gratkowski, H.

12 72199

FIELD SCREENING OF STEM APPLIED HERBICIDES ON COAST RANGE RED ALDER.

FIELD SCREENING OF GRANULAR HERBICIDES ON POLE-SIZE RED ALDER. (ABSTRACT)
WEST. Soc. WEED SCI. RES. PROG. REP. 1972, P. 19. (NO COPIES AVAILABLE)

KEYWORDS. HERBICIDES, BRUSH CONTROL.

Gratkowski, H.

12 72199

FIELD SCREENING OF FOLIAGE APPLIED HERBICIDES ON WESTERN PINE.

FIELD SCREENING OF GRANULAR HERBICIDES ON POLE-SIZE RED ALDER. (ABSTRACT)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 14. (NO COPIES AVAILABLE)

KEYWORDS. HERBICIDES, BRUSH CONTROL.

Gratkowski, H.

12 72195

FOLIAGE APPLIED HERBICIDES FOR CONTROL OF OREGON COAST RANGE BRUSH SPECIES. (ABSTRACT)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 48. (NO COPIES AVAILABLE)

KEYWORDS. HERBICIDES, BRUSH CONTROL.

Tarrant, Robert F., and Jack Allard

04 72018

ASYMPTOMATIC LEVELS IN URINE OF FOREST WORKERS APPLYING SILVICIDES.
ARCH. ENVIRON. HEALTH 24, P. 277-280.

FOREST TREE THINNING WORKERS ABSORB ARSENIC FROM SILVICIDES, MUCH OF THE CHEMICAL APPEARS TO BE EXCRETED FROM THE BODY IN A SHORT TIME WITH NO EVIDENCE OF A CONTINUING INCREASE IN ARSENIC LEVELS OVER A PERIOD OF MORE THAN 2 MONTHS. PERSONS USING THESE MATERIALS SHOULD MINIMIZE THEIR EXPOSURE.

KEYWORDS. SILVICIDES, ARSENIC, HEALTH.

Tarrant, Robert F., D. G. Moore, W. B. Bollen, and B. M. Lopez

06 72085

DET RESIDUES IN FOREST FLOOR AND SOIL AFTER AERIAL SPRAYING. OREGON-1965-68.
WEST. SOC. WEED SCI. RES. PAP. 65-72, ILLUS.

DOT WAS APPLIED AERIALLY TO AN EASTERN OREGON FOREST AT THE RATE OF 12 OUNCES PER ACRE OVER THE FOLLOWING 3 YEARS. DOT CONTENT OF THE FOREST FLOOR DECREASED BY MORE THAN 50 PERCENT, BUT DID NOT LEACH FROM THE FOREST FLOOR INTO THE SURFACE MINERAL SOIL. OF THE 12 OUNCES OF DOT APPLIED PER ACRE, ABOUT 26 PERCENT REACHED THE GROUND SURFACE ORIGINALLY, AND, OVER 36 MONTHS, ABOUT 6 PERCENT MORE WAS BROUGHT TO THE GROUND SURFACE.

KEYWORDS. PESTICIDE RESIDUE, DOT, ENVIRONMENT.

ECONOMICS IN FOREST MANAGEMENT

Sassaman, Robert W.

08 72107

ECONOMIC RETURNS FROM PLANTING FORAGE IN NATIONAL FORESTS.
J. FOREST. 70, 1, P. 497-498, ILLUS.

ECONOMIC RETURNS FROM PLANTING FORAGE ARE SUMMARIZED FOR A VARIETY OF PLANTING COSTS AND FORAGE VALUES PRESENTLY IN EFFECT ON NATIONAL FORESTS IN THE PONDEROSA PINE-GRASS AREAS OF EASTERN WASHINGTON.

KEYWORDS. FORESTRY BUSINESS ECONOMICS, RANGE MANAGEMENT, SHELFIELD SYSTEM, FORAGE PLANTING.
ECONOMICS IN WOOD INDUSTRY

FAHEY, THOMAS D., AND DOUGLAS L. HUNT* 06 72052
LUMBER RECOVERY FROM DOUGLAS-FIR THINNINGS AT A RANDMILL AND TWO CHIPPING CENTERS.

SASSAMAN, ROBERT W., JAMES W. BARRETT, AND JUSTIN G. SMITH 12 72187
ECONOMICS OF THINNING STAGNATED PONDEROSA PINE SAPLING STANDS IN THE PINE-GRASS AREAS OF CENTRAL WASHINGTON.

SCHALLAU, CON H. 09 72176
PONDEROSA PINE, FORESTRY BUSINESS ECONOMICS, THINNING (TREES), ALLOWABLE CUT.

SCHREITZER, DENNIS L. 7 72090
FORESTRY BUSINESS ECONOMICS. ECONOMICS OF THINNING STAGNATED PONDEROSA PINE SAPLING STANDS ARE REPORTED FOR THREE STOCKING LEVELS. THIRTEEN TIMBER MANAGEMENT REGIMES ARE RANKED ACCORDING TO THEIR RETURNS FROM TIMBER ONLY, AND 22 REGIMES ARE RANKED ACCORDING TO THEIR RETURNS FROM TIMBER AND FORAGE, WITH AND WITHOUT THE ALLOWABLE CUT EFFECT.

KEYWORDS. PONDEROSA PINE, FORESTRY BUSINESS ECONOMICS, THINNING (TREES), ALLOWABLE CUT.

SCHULTZ, CON H. 09 72176
FORESTRY BUSINESS ECONOMICS. A NUMBER OF ECONOMIC STUDIES OF HOW FOREST MANAGERS CAN REALIZE MAXIMUM RETURN ON THEIR YOUNG GROWTH ARE REVIEWED.

KEYWORDS. DOUGLAS-FIR, FORESTRY BUSINESS ECONOMICS, TIMBER MANAGEMENT.

ECONOMICS OF THINNING STAGNATED PONDEROSA PINE SAPLING STANDS IN THE PINE-GRASS AREAS OF CENTRAL WASHINGTON. USDA FOREST SERV. RES. PAP. PNW-157, 17 P., ILLUS.

TREES CUT IN THINNING A DOUGLAS-FIR STAND WERE PROCESSED INTO LUMBER BY THREE ALTERNATIVE METHODS--A SQUARE CANT CHPPER, A PROFILED CANT CHPPER, AND A RANDMILL. RESULTS REPORTED INCLUDE LUMBER RECOVERY BY GRADE AND DIMENSION, RECOVERY FACTORS FOR LONG LOG, SHORT LOG, SCRAMBLE AND CURVATURE, AND TOTAL CHIP RECOVERY. KEYWORDS. LUMBER, RECOVERY RATIOS, THINNING (TREES), SAMPLING EQUIPMENT.

KEYWORDS. PONDEROSA PINE, FORESTRY BUSINESS ECONOMICS, TIMBER MANAGEMENT.

FIRE

Buckman, Robert E. 11 72149
WHERE DO WE GO FROM HERE? PROGRAMS AND OBJECTIVES, PACIFIC NORTHWEST.

Buckman, Robert E. 11 72149
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.

50TH ANNU. WASH. STATE FOR. CONF. PROG., P. 19-24, ILLUS.

SCHMITZ, DENNIS L. 7 72090
FOREST FERTILIZATION IN THE PACIFIC NORTHWEST--A CASE STUDY IN TIMBER PRODUCTION UNDER UNCERTAINTY. 

SCHMITZ, DENNIS L. 7 72090
INCOMPLETE PHYSICAL RESPONSE INFORMATION, DIFFICULTIES IN OBTAINING RESEARCH RESULTS IN FIELD APPLICATIONS, AND A CONCERN FOR ENVIRONMENTAL IMPACTS CHARACTERIZE INVESTMENTS IN FOREST FERTILIZATION. FOR THE PRESENT, THE PRACTICE IS ECONOMICALLY JUSTIFIED IN THE NORTHWEST BY THE ADVANTAGES OF THE ALLOWABLE CUT EFFECT.

KEYWORDS. PONDEROSA PINE, TIMBER MANAGEMENT, ECONOMICS, TIMBER MANAGEMENT.

Buckman, Robert E. 11 72149
INCOMPLETE PHYSICAL RESPONSE INFORMATION, DIFFICULTIES IN OBTAINING RESEARCH RESULTS IN FIELD APPLICATIONS, AND A CONCERN FOR ENVIRONMENTAL IMPACTS CHARACTERIZE INVESTMENTS IN FOREST FERTILIZATION. FOR THE PRESENT, THE PRACTICE IS ECONOMICALLY JUSTIFIED IN THE NORTHWEST BY THE ADVANTAGES OF THE ALLOWABLE CUT EFFECT.

KEYWORDS. PONDEROSA PINE, TIMBER MANAGEMENT, ECONOMICS, TIMBER MANAGEMENT.

Buckman, Robert E. 11 72149
INCOMPLETE PHYSICAL RESPONSE INFORMATION, DIFFICULTIES IN OBTAINING RESEARCH RESULTS IN FIELD APPLICATIONS, AND A CONCERN FOR ENVIRONMENTAL IMPACTS CHARACTERIZE INVESTMENTS IN FOREST FERTILIZATION. FOR THE PRESENT, THE PRACTICE IS ECONOMICALLY JUSTIFIED IN THE NORTHWEST BY THE ADVANTAGES OF THE ALLOWABLE CUT EFFECT.

KEYWORDS. PONDEROSA PINE, TIMBER MANAGEMENT, ECONOMICS, TIMBER MANAGEMENT.

Buckman, Robert E. 11 72149
INCOMPLETE PHYSICAL RESPONSE INFORMATION, DIFFICULTIES IN OBTAINING RESEARCH RESULTS IN FIELD APPLICATIONS, AND A CONCERN FOR ENVIRONMENTAL IMPACTS CHARACTERIZE INVESTMENTS IN FOREST FERTILIZATION. FOR THE PRESENT, THE PRACTICE IS ECONOMICALLY JUSTIFIED IN THE NORTHWEST BY THE ADVANTAGES OF THE ALLOWABLE CUT EFFECT.

KEYWORDS. PONDEROSA PINE, TIMBER MANAGEMENT, ECONOMICS, TIMBER MANAGEMENT.

Buckman, Robert E. 11 72149
INCOMPLETE PHYSICAL RESPONSE INFORMATION, DIFFICULTIES IN OBTAINING RESEARCH RESULTS IN FIELD APPLICATIONS, AND A CONCERN FOR ENVIRONMENTAL IMPACTS CHARACTERIZE INVESTMENTS IN FOREST FERTILIZATION. FOR THE PRESENT, THE PRACTICE IS ECONOMICALLY JUSTIFIED IN THE NORTHWEST BY THE ADVANTAGES OF THE ALLOWABLE CUT EFFECT.

KEYWORDS. PONDEROSA PINE, TIMBER MANAGEMENT, ECONOMICS, TIMBER MANAGEMENT.
HENDEE, JOHN C. 10 71217
BOOK REVIEW OF 'PLANNING RESEARCH FOR RESOURCE DECISIONS,' BY CARL H. STOEYENDREN, KENNETH W. MARE, ROBERT J. MARTY, ROBERT C. Wray, AND J. D. WELLONS.
J. LEISURE RES., 2641, P. 281-284.
PLANNING AND REPORTING RESEARCH IN NATURAL RESOURCES ARE EMPIASIZED IN A SYSTEMATIC OVERVIEW OF RESEARCH PLANNING AND REPORTING. KEYWORDS: RESOURCE PLANNING, NATURAL RESOURCES, RESEARCH.

MORRIS, WILLIAM H. 08 72101
SCIENCE 177(4047), P. 396-400. DEFINITIONS AND HISTORY OF NATURAL AREA CONCEPT IS OUTLINED. KEYWORDS: NATURAL AREAS, WILDERNESS AREAS, ENVIRONMENT, ECOSYSTEM.

REPORT OF ACTIVITIES, PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, FOR THE YEAR 1971.
REPORTS OF ACTIVITIES, PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, FOR THE YEAR 1971.
LIST OF AVAILABLE PUBLICATIONS, NO. 1 1972.
LIST OF AVAILABLE PUBLICATIONS, NO. 2 1972.
LIST OF AVAILABLE PUBLICATIONS, NO. 3 1972.

GENETICS
CAMPBELL, ROBERT K. 08 72111
SOME CONCEPTS OF QUANTITATIVE GENETICS. ABSTR.
USDA FOREST SERV. RES. PAP. PNW-39, 1 P.
(3 COPIES AVAILABLE)
A BASIC VARIANCE IS PRESENTED, THE PARTITIONING OF VARIANCES WAS EXPLAINED IN AN EXAMPLE WHICH USED FAMILY EVALUATION TESTS AS A DESIGNED EXPERIMENT. COMPONENTS OF VARIANCES WERE EXTRACTED AND PRACTICAL USE DEMONSTRATED IN A TREE BREEDING SITUATION. KEYWORDS: GENETICS, STATISTICS.

COPE, DONALD L. 10 72172
INHERITANCE OF MEGASTROBILI COLORS IN DOUGLAS-FIR (*PSEUDOTSUGA MENZIESII*). LAM. Z. HOF. R901, P. 2045-2048.
MEGASTROBILI COLOR WAS EXAMINED IN 395 PROGENY RESULTING FROM CROSS POLLINATIONS OF PARENTS WITH GREEN, LIGHT PINK, LIGHT RED, OR DARK RED MEGASTROBILI. CROSSES OF GREEN X GREEN PARENTS PRODUCED 49 PERCENT GREEN AND 21 PERCENT LIGHT OR DARK RED PROGENY, WHEREAS CROSSES OF LIGHT RED X DARK RED PARENTS PRODUCED 7 PERCENT GREEN AND 71 PERCENT LIGHT OR DARK RED PROGENY. KEYWORDS: PLANTS, GENETICS, DOUGLAS-FIR, COLORS.

SILEN, ROY R. 08 72122
PROGRESSIVE SYSTEM OF TREE IMPROVEMENT FOR DOUGLAS-FIR. ABSTR.
USDA FOREST SERV. RES. PAP. PNW-189, 1 P.
(3 COPIES AVAILABLE)
A WIDELY ADOPTED DOUGLAS-FIR TREE IMPROVEMENT PROGRAM INVOLVES LARGE NUMBERS OF SEED PARENTS AND FAMILY SELECTION TO GAINS FROM PHENOTYPIC SELECTION. KEYWORDS: TREE GENETICS, DOUGLAS-FIR.

SOERENSEN, FRANK C. 05 72065
THE SEED ORCHARD TREE AS A POLLEN SAMPLER--A MODEL AND EXAMPLE.
USDA FOREST SERV. RES. NOTE PNW-175, 11 P.
A MODEL IS DEVELOPED WHICH USES THE SEED TREE AS A POLLEN SAMPLER AND ATTEMPTS TO PARTITION THE POLLEN IT RECEIVES INTO SELF AND PARENT POLLEN FROM SLIGHTLY MORE DISTANT NEIGHBORS, AND BACKGROUND POLLEN. AN EXAMPLE, USING DATA FROM SEVERAL SOURCES, IS USED TO ILLUSTRATE THE USE OF THE MODEL. KEYWORDS: POLLEN, POLLEN DISSEMINATION, SEED ORCHARDS, DOUGLAS-FIR.

INSECTS
BECKWITH, ROY C. 09 72180
THE BEECH TREE AS A PUBLICATION: A MODEL AND EXAMPLE.
USDA FOREST SERV. RES. NOTE PNW-189, 6 P.
A SCOLYTIDAE COMMONLY FOUND IN WHITE SPARCE STANDS IN INTERIOR ALASKA INCLUDING THE KENAI PENINSULA. SCHEMATIC DRAWINGS ARE INCLUDED. KEYWORDS: SCOLYTIDAE, BARK BEETLE, PICEA GLAUCA, WHITE SPARCE, ALASKA.

CAROLIN, V. M., AND W. P. COULTER 12 72220
SAMPLING POPULATIONS OF WESTERN SPARCE BUDDWORM AND PREDICTING DEFOLIATION ON DOUGLAS-FIR IN EASTERN OREGON.
USDA FOREST SERV. RES. PAP. PNW-149, 38 P.
SAMPLING OF TWO LIFE STAGES, EGGS AND LARVAE IN BUDS, WAS THE BASIS FOR DEVELOPING SURVEY RECOMMENDATIONS AND FOR PREDICTING DEFOLIATION ON DOUGLAS-FIR. FOR SURVEYS, OPTIMUM SIZE AND ALLOCATION OF SAMPLES WERE DETERMINED FOR VARIOUS PRECISION AND CONFIDENCE LEVELS. KEYWORDS: WESTERN SPARCE BUDDWORM, CHORISTONEURA OCCIDENTALIS, DOUGLAS-FIR, DEFOLIATION.
LOGGING

Buckman, Robert E., and Rexford A. Resler 07 72156
THE FALCON PROGRAM—RESEARCH AND DEVELOPMENT OF ADVANCED FOREST TRANSPORT SYSTEMS

Main, Charles N. 12 72123
BALLOON-RUNNING SKYLINE SYSTEM—'IN' SYMPOSIUM ON FOREST OPERATIONS IN MOUNTAINOUS REGIONS

Peters, penn A., and Judy E. Resler 09 72104
AVERAGE YARDING DISTANCE ON IRREGULAR-SHAPED TIMBER HARVEST SETTINGS

Buckman, Robert E., and Rexford A. Resler 07 72156
THE FALCON PROGRAM—RESEARCH AND DEVELOPMENT OF ADVANCED FOREST TRANSPORT SYSTEMS

Peters, penn A., and Judy E. Resler 09 72104
AVERAGE YARDING DISTANCE ON IRREGULAR-SHAPED TIMBER HARVEST SETTINGS
MENSURATION

*BRUCE, DONALD
06 72062

MENSURATION

CURTIS, ROBERT 01 72004
AND JOHN E. FIRTH

HERMAN, FRANCIS R., CLARK E. SMITH, AND JOHN E. JOHNSON. FLOYD A., AND GEORGE B. HARTMAN
12 72158

MACLEAN, COLIN D. 12 72216

PHOTO STRATIFICATION IMPROVES NORTHWEST TIMBER VOLUME

ESTIMATES

USD A FOREST SERV. RES. PAP. PNW-150, 10 P.

DATA FROM EXTENSIVE TIMBER INVENTORIES OF 12 COUNTIES IN WESTERN AND CENTRAL WASHINGTON WERE ANALYZED TO TEST THE RELATIVE EFFICIENCY OF DOUBLE SAMPLING FOR STRATIC-

IFICATION AS A MEANS OF ESTIMATING TOTAL VOLUME. PHOTO-

AND FIELD PLOTS, WHEN COMBINED IN A STRATIFIED SAMPLING

DESIGN, PROVED ABOUT TWICE AS EFFICIENT AS SIMPLE FIELD

SAMPLING. ALTHOUGH SOME GAINS WERE MADE BY STRATIFYING

INTO ONLY TWO CLASSES—FOREST AND NONFOREST—SUBSTAN-

TIALLY GREATER GAINS ACCRUED WHEN THE FOREST PLOTS WERE

FURTHER STRATIFIED (IN MATHEMATICAL) TO TIMBER VOLUME CLASSES.

OPTIMUM ALLOCATION OF FIELD PLOTS WAS ONLY SLIGHTLY MORE EF-

FICIENT THAN PROPORTIONAL ALLOCATION.

KEYWORDS. DOUBLE SAMPLING, PHOTO SAMPLING, TIMBER VOLUME

ESTIMATES.

HARRY, CHARLES N., AND HILTON H. LYSONS
9 72100

AND A METHOD OF ESTIMATING LOG WEIGHTS.

USD A FOREST SERV. RES. PAP. PNW-138, 75 P., ILLUS.

PRESENTS A PRACTICAL METHOD ESTIMATING THE WEIGHT OF

LOGS BEFORE THEY ARE YARDED. THE METHOD IS BASED ON

OBTAINING AN INITIAL SAMPLE FOR A CURVE-DENSITY INDEX

AND THEN APPLYING THE INDEX TO LOG DIMENSIONS FOR

WEIGHT ESTIMATES. THE USE OF THIS METHOD SHOULD

FACILITATE THE APPLICATION OF AERIAL LOGGING SYSTEMS.

KEYWORDS. LOGS, WEIGHTS, LOGGING.

POPE, ROBERT B., BIJAN PAYANDEN,* AND DAVID P. PAINE
12 72210

PHOTO PLOT BIAS.

USD A FOREST SERV. RES. PAP. PNW-145, 8 P., ILLUS.

NONUNIFORM SPACING OF AERIAL PHOTOS CAN SERIOUSLY BIAS

FOREST INVENTORY RESULTS IF PLOTS ARE SYSTEMATICALLY

LOCATED ON PHOTOS. A MAP-TRANSFER PROCESS AVOIDS THIS.

KEYWORDS. AERIAL PHOTOGRAPHY, FOREST SURVEYS, PHOTOGRAPHY.

PATHOLOGY

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN.
05 72055

FOREST DISEASES OF THE PACIFIC NORTHWEST.

2 P., ILLUS.

THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL,

NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS

OF THE RESEARCH PROJECT.

KEYWORDS. TREE DISEASES, RESEARCH, DISEASE MITES.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN.
03 72038

ROOT DISEASES AND SOIL MICROBIOLOGY.

2 P., ILLUS.

THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL,

NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS

OF THE RESEARCH PROJECT.

KEYWORDS. PLANT DISEASES, MICRO-ORGANISMS, FUNGUS,

FUNGUS DISEASES (PLANTS).

*GODB, L. P., H. B. RYNN,*, AND E. C. NELSON
8 72099

PHOTOPHOTOMORPHOID ROOT ROT OF PORT-ORFORD-CEDAR.

U.S. DEP. AGR. FOREST PEST LEAFL. 131, 7 P., ILLUS.

PORT-ORFORD-CEDAR SHOWS NO RESISTANCE TO THIS LETHAL

PATHOGEN, WHOSE SPORES SPREAD IN FLOWING WATER OR

WITH MOVEMENT OF SOIL. UNINFECTED STANDS MAY BE

PROJECTED BY RESTRICTING ACCESS BY MEN, ANIMALS, AND

MACHINES.

KEYWORDS. CHAMAECYPARIS LAWSONIANA, POR-T-ORFORD-CEDAR,

SOIL FUNGE, ROOTS, TREE DISEASES.

SHEA, KEITH R., AND JAMES L. STEWART*
10 72178

HEMLOCK DWARF MISTLETOE.

U.S. DEP. AGR. FOREST PEST LEAFL. 133, 6 P. ILLUS.

THE DISTRIBUTION, HOSTS, LIFE CYCLE, SYMPTOMS, SPREAD,

AND INTENSIFICATION OF AND CONTROL OF THIS

PARASITE OF HEMLOCK IN THE WEST IS SUMMARIZED.

KEYWORDS. HEMLOCK DWARF MISTLETOE, ARCEUTHOBIUM TSUGENSE.

HEMLOCK, PARASITIC PLANTS.

*SMITH, ALEXANDER W., AND JAMES W. TRAPPE*
10 72175

THE HIGHER FUNGI OF OREGON'S CASCADE HEAD EXPERIMENTAL

FOREST AND VICINITY—I. THE GENUS PHAECODICHLA.

ACARICIALES, AND NOTES AND DESCRIPTIONS OF OTHER SPECIES

IN THE ACARICIALES.

ACROCOCCUS 64(5). P. 1138-1153, ILLUS.

STUDIES OF THE FUNGI OF THE NORTHEASTERN WASHINGTON COAST

HAVE REVEALED A GREAT UNIVERSITY OF SPECIES, MANY MORE

TO-FORE UNKNOWN TO BOTANISTS AND FORESTERS. THE EIGHT

NEW SPECIES DESCRIBED IN THIS INITIAL REPORT ARE EITHER

DECOMPOSERS OF SOIL ORGANIC MATTER OR MYCORRHIZAL

ASSOCIATES OF CONIFERS, GROUPS OF GREAT IMPORTANCE

TO THE FOREST ECOLOGIC SYSTEM.

KEYWORDS. FUNGI, ACARICIALES, NOPENCATEGIORE, OREGON COAST.

43
TRAPPE, JAMES M. 12 72215
PARASITISM OF HELVELLA LACUNOSA BY GLICTOCYBE SCLEROTOIDEA.

MITCHELL, R. G. 03 72026
NEEDLE POPULATION ON YOUNG DOUGLAS-FIR IN WESTERN OREGON AND WASHINGTON. (ABSTRACT.)

NEEDLE POPULATION YOUNG WESTERN OREGON ALKALINE MASHING/0N, (ABSTRACT.)

ZAK, B. 05 72040
"YOUNG, J. L., WICKMAN, BOYD E., AND ROBERT F. SCHARPF* 12 72097
TRAPPE, JAMES M. 12 72215
WILCOX, W. WAYNE, AND NANCY D. OLDHAM*
KEYWORDS. RESEARCH, ENVIRONMENT, ECOSYSTEM, FOREST RESEARCH ON CONIFEROUS FOREST ECOSYSTEMS--A SYMPOSIUM.

WICKMAN, BOYD E., AND ROBERT F. SCHARPF* 9 72097
TRANS. BR. MYCOL. SOC. 59(3), P. 403-407, ILLUSTRATION.
KEYWORDS. "ENDOGONE FLAMMICORONA" SP. NOV., TAKEDONY, MYCORRHIZAE.

TRANS. BR. MYCOL. SOC. 59(3), P. 403-407, ILLUSTRATION.
KEYWORDS. "ENDOGONE FLAMMICORONA" SP. NOV., TAKEDONY, MYCORRHIZAE.

TRACE, ALICIA D. 07 71968
DISTRIBUTION AND GENETIC DIVERSITY OF CHLOROGENIC ACID IN DOUGLAS-FIR PINE.

RICKMAN, BOYD E., AND ROBERT F. SCHARPF* 9 72097
ATOM, PAP, PNM-139, 9 P., ILLUSTRATION.
NO DECAY RESULTING IN CULL OCCURRED IN TREES TOP-KILLED BY DOUGLAS-FIR TUSCROSS MOTH, AND ONLY ONE TREE TOP-KILLED BY GROWING ENGRAVER BEETLES CONTAINED DECAY WHICH RESULTED IN CULL. HOWEVER, A DISCOLORATION OF THE HEXOHIST KNOTHEX KNEW AS WOOD WOOD IN STAN ONLY
KEYWORDS. WOOD DECAY, "HEMEROCAPPA PSEUDOSUGATA," DOUGLAS-FIR TUSCROSS MOTH.

WILCOX, W. WAYNE, AND NANCY D. OLDHAM*
BACTERIUM ASSOCIATED WITH WOOD IN WHITE FIR.

PHYSIOLOGY 62, P. 284-303.
COOP-AID STUDY OF PNM-UNIVERSITY OF CALIFORNIA, ENCODES THE OCCURRENCE AND CHARACTERISTICS OF BACTERIA FOUND IN WOOD IN WHITE FIR. AVAILABLE ONLY FROM CALIFORNIA UNIVERSITY, FOREST PRODUCTS LABORATORY, RICHMOND, CALIFORNIA 94804.

KEYWORDS. WOOD, BACTERIUM, "ABIES CONCOLOR," WHITE FIR, TREE CLES.

WILCOX, W. WAYNE, AND CHEUNG G. R. SCHLINK* 12 72102
ASSOCIATION BETWEEN INSECT AND WOOD IN WHITE FIR.

WOOD AND FIBER 2(41, P. 373-379, ILLUSTRATION. (NO COPIES AVAILABLE)
NO ALTERATIONS IN WOOD STRUCTURE, SUCH AS DECOMPOSITION OF RAY PARENCHYMA CELL WALLS OR BORDERED PIT FORM, WERE OBSERVED IN ANY OF THE SAMPLES. APPARENTLY THE BACTERIUM IN WOOD IS THE SAME KIND AS OTHER BACTERIA KNOWN TO BE WOOD ATTACKERS.

KEYWORDS. "ABIES CONCOLOR," WHITE FIR, WOOD, WEATHER, WOOD STRUCTURE.

WICKMAN, BOYD E., AND ROBERT F. SCHARPF* 9 72097
Wickman, Boyd E., and Robert F. Scharpf* 9 72097
FOREST SCI. 18(1), P. 34-40, ILLUSTRATION. (NO COPIES AVAILABLE)
POST OAK WAS THE MOST DROUGHT RESISTANT OF FOUR SPECIES; PRIMARILY BECAUSE OF GREATER DROUGHT TOLERANCE OF LEAF AND ROOT CELLS. BLACK OAK AND WHITE OAK DIFFERED LITTLE IN TOLERANCE AND AVOIDANCE, DROUGHT AVOIDANCE OF RED OAK LEAVES WAS SIGNIFICANTLY LOWER THAN THAT OF THE OTHER SPECIES. BED OF RED OAK ROOTS WAS THE LOWEST OF THE FOUR SPECIES.

KEYWORDS. QUERCUS, OAK, DROUGHT RESISTANT PLANTS, TRANSPIRATION.

SEIDEL, KENNETH W. 03 72070
DUROCHT RESISTANCE AND INTERNAL WATER BALANCE OF OAK SEEDLINGS.

FOREST SCI. 18(1), P. 34-40, ILLUSTRATION. (NO COPIES AVAILABLE)
A DISCOLORATION AND NO ALTERATIONS IN WOOD STRUCTURE WERE OBSERVED IN ANY OF THE SAMPLES. APPARENTLY THE BACTERIUM IN WOOD IS THE SAME KIND AS OTHER BACTERIA KNOWN TO BE WOOD ATTACKERS.

KEYWORDS. "ABIES CONCOLOR," WHITE FIR, WOOD, WEATHER, WOOD STRUCTURE.

WICKMAN, BOYD E., AND ROBERT F. SCHARPF* 9 72097
FOREST SCI. 18(1), P. 34-40, ILLUSTRATION. (NO COPIES AVAILABLE)
POST OAK WAS THE MOST DROUGHT RESISTANT OF FOUR SPECIES; PRIMARILY BECAUSE OF GREATER DROUGHT TOLERANCE OF LEAF AND ROOT CELLS. BLACK OAK AND WHITE OAK DIFFERED LITTLE IN TOLERANCE AND AVOIDANCE, DROUGHT AVOIDANCE OF RED OAK LEAVES WAS SIGNIFICANTLY LOWER THAN THAT OF THE OTHER SPECIES. BED OF RED OAK ROOTS WAS THE LOWEST OF THE FOUR SPECIES.

KEYWORDS. QUERCUS, OAK, DROUGHT RESISTANT PLANTS, TRANSPIRATION.

VAN CLEVE, KEITH, AND LESLIE A. VIERERCH 09 72102
DISTRIBUTION OF SELECTED CHEMICAL ELEMENTS IN EVEN-AGED ALDER (ALNUS) ECOSYSTEMS NEAR FAIRBANKS, ALASKA. ARCTIC AND ALPINE RESEARCH 4(3), P. 237-258, ILLUSTRATION. (NO COPIES AVAILABLE)
TEMPERATURE AND THE OCCURRENCE OF SEVERAL SPECIFIC WAYS. THIS STUDY REPORTS THE DISTRIBUTION OF SELECTED NUTRIENT ELEMENTS IN UNDER 5-, 15- AND 25-YEAR-AGED ALDER ECOSYSTEMS DEVELOPING ON THE TANANA RIVER FLOODPLAIN IN CENTRAL ALASKA. DISTRIBUTION OF EL 0N FOLIAGE, BRANCHES, LEAVES, LITTER, HIND, AND SOIL BY PERCENTAGE AND ON A KILOGRAM PER HECTARE BASIS.

KEYWORDS. ALDER, "ALNUS," PLANT NUTRITION, POTASSIUM, ECOSYSTEM.

PLAN ECOLOGY

FRANKLIN, JERRY P. 03 72024
WHY A CONIFEROUS FOREST BIOME. (ABSTRACT.)

NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 5. (NO COPIES AVAILABLE)
KEYWORDS. ECOLOGY, RESEARCH.

FRANKLIN, JERRY P. 03 72024
WHY A CONIFEROUS FOREST BIOME. (ABSTRACT.)

NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 5. (NO COPIES AVAILABLE)
KEYWORDS. ECOLOGY, RESEARCH.

PLANT ECOLOGY

FRANKLIN, JERRY P. 03 72024
WHY A CONIFEROUS FOREST BIOME. (ABSTRACT.)

NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 5. (NO COPIES AVAILABLE)
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FRANKLIN, JERRY P. 03 72024
WHY A CONIFEROUS FOREST BIOME. (ABSTRACT.)

NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 5. (NO COPIES AVAILABLE)
KEYWORDS. ECOLOGY, RESEARCH.
VIERECK, LESLIE A., AND ELBERT L. LITTLE, JR.* 8 72046
ALASKA TREES AND SHRUBS.
U.S. DEP. AGRIC. HANDBOOK NO. 410, 165 P., ILLUS.
KEYWORDS. TREES, SHRUBS, TREE IDENTIFICATION, WOODY PLANTS, ALASKA.

RANGE ECOSYSTEMS

DEARY, J. EDWARD 04 72046
LIDO FESCUE PREFERENCE.
WEST. LIVESTOCK J. 50(12), P. 40-64, ILLUS.
IN CENTRAL OREGON, COWS PREFERRED TO SIMULATING 100% FESCUE GROWING UNDER PONDEROSA PINE. WHEN THE MIXTURE OF ACCUMULATED DEAD LITTER AND PINE NEEDLES WAS REMOVED FROM THE FESCUE CLUMPS, THE GREEN GRASS WAS EATEN READILY. TECHNIQUES OF LITTER REMOVAL ARE DISCUSSED.
KEYWORDS. FESCUE, RANGE MANAGEMENT, LIVESTOCK.

GARRISON, GEORGE A. 8 72053
CARBOHYDRATE RESERVES AND RESERVE USE. "IN" CYRUS M., MCKELL, J. P., BLAISDELL, AND JOE R. GOODIN (EDS.), ALASKA TREES AND SHRUBS.
KEYWORDS. TREES, SHRUBS, TREE IDENTIFICATION, WOODY PLANTS, ALASKA.

TIEDEMANN, A. R., AND H. W. BERNDT 01 72010
VEGETATION AND SOILS OF A 30-YEAR DEER AND ELK ENCLOSURE IN CENTRAL WASHINGTON.
NORTHWEST SCI. 46(1), P. 59-66, ILLUS.
KEYWORDS. RANGE MANAGEMENT, SOILS, VEGETATION, SNOWBUSH CEANOTHUS.

RECREATION

*BULTENA, GORDON L., AND JOHN E. HENDEE 6 72053
FOREST RESIDENTIAL GROUP POLICIES ON FOREST POLICY.
J. FOR. 70(1), P. 337-342, ILLUS.
DEVELOPMENTS ON FIVE NATIONAL FORESTS IN THE PACIFIC NORTHWEST, WHEN IDENTIFYING SPECIAL INTEREST GROUP POSITIONS ON TIMBER CUTTING, ALIGNED THEMSELVES WITH COMMERCIAL VS. RECREATIONAL-ESTHETIC INTERESTS, VIEWING THE LATTER AS HAVING UNJUSTIFIED EXPECTATIONS.
KEYWORDS. RECREATIONAL POLICY, FOREST POLICIES, FORESTERS, ENVIRONMENT, RECREATION.

CLARK, RODER M., ROBERT L. BURGESS,* AND JOHN C. HENDEE 05 72047
THE DEVELOPMENT OF ANTI-LITTER BEHAVIOR IN A FOREST CAMPGROUND.
J. APPL. BEHAV. ANAL. 4(3), P. 1-5, ILLUS.
CHILDREN WERE OFFERED A REWARD FOR PICKING UP AND PROPERLY DISPOSING OF LITTER, RESULTING IN A SIGNIFICANT DECLINE IN FOUR TYPES OF LITTER PLANTED IN THE CAMPGROUND.
KEYWORDS. LITTER (PUBLIC PLACES), FOREST RECREATIONAL USE, CAMPING, NATIONAL FORESTS.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN.
RECENT REPORTS OF INTEREST TO PLANT ECOLOGISTS.
9 72108
A BIBLIOGRAPHY OF PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENTATION PUBLICATIONS ON PLANT ECOLOGY.
KEYWORDS. PLANT ECOLOGY BIBLIOGRAPHY.

TARRANT, R. F. 09 72173
THE ROLE OF ALDER IN IMPROVING SOIL FERTILITY AND GROWTH OF ASSOCIATED TREES. "IN" ALAN B. BERG (ED.), MANAGING YOUNG FORESTS IN THE DOUGLAS-FIR REGION.
SCN. FOR. OREG. STATE UNIV., VOL. 3, P. 17-33, ILLUS.
NO COPIES AVAILABLE.
WORLDWIDE EXPERIENCE WITH A NUMBER OF "ALNUS" SPECIES INDICATES THAT ALDER CONTRIBUTES SIGNIFICANTLY TO THE SUPPLY OF NITROGEN IN THE FOREST ECOLOGY. THIS CONTRIBUTION IS A SIGNIFICANT, BENEFICIAL IMPACT ON SOIL FERTILITY AND, IN TURN, ON VEGETATION ASSOCIATED WITH ALDER.
KEYWORDS. ALDER, "ALNUS," SOIL FERTILITY, NITROGEN-FIXATION.

VIERECK, L. A. 12 72120
THE IBP-PT PROGRAM IN THE TAIGA OF ALASKA. "IN" SYSTEMS ANALYSIS IN NORTHERN CONIFEROUS FORESTS--IBP WORKSHOP.
SWM. NAT. SCI. RES. COUNC. BULL. ECOL. RES. COMM., 14, P. 58-61.
NO COPIES AVAILABLE.
GENERAL DETAILS ABOUT THE IBP-PT PROGRAM ARE GIVEN INCLUDING BIOENVIRONMENTAL GRADIENTS, HYDROLOGICAL STUDY, PUSHER-CARIBOU CREEK WATERSHED, NUTRIENT CYCLES IN INTERIOR ALASKA FOREST TYPES, WHITE SPRUCE REGENERATION, AND FIRE EFFECTS IN THE TAIGA.
KEYWORDS. ECOLOGY, ALASKA, TAIGA, VEGETATION.
CLARK, ROGER M., JOHN C. MENDEE, AND ROBERT L. BURGESS
THE EXPERIMENTAL CONTROL OF LITTERING
TRADITIONAL APPROACHES TO LITTER CONTROL INCLUDING DIRECT APPEALS, ANTILITTER MESSAGES, ADDITIONAL TRASH CANS, AND LITTERBAGS WERE MUCH LESS EFFECTIVE THAN SMALL INCENTIVES IN EFFECTS ON ANTILITTER BEHAVIOR.
KEYWORDS: LITTER (PUBLIC PLACES), ENVIRONMENT, FOREST RECREATIONAL USE.

CLARK, ROGER M., JOHN C. MENDEE, AND RANDALL P. WASHBURN
LITTERBAGS—AN EVALUATION OF THEIR USE
USDA FOREST SERV. RES. NOTE PNM-184, 5 P.
A STUDY CONDUCTED IN MOUNT RAINIER NATIONAL PARK INDICATES THAT ONLY A VERY SMALL PROPORTION OF THE LITTERBAGS HANDED OUT END UP IN PARK TRASH CANS. FURTHOREMORE, MOST OF THE LITTERBAGS ARE CARRIED AWAY UNUSED FROM THE PARK. OF THE TWO TYPES OF LITTERBAGS TESTED, PLASTIC BAGS WERE USED MORE OFTEN THAN PAPER BAGS.
KEYWORDS: LITTER (PUBLIC PLACES).

MENDEE, JOHN C.
CHALLENGING THE FOLKLORE OF ENVIRONMENTAL EDUCATION
PROPOSALS INCLUDE THREE OBJECTIVES FOR ACTIVITY TO INITIATE MORE RELEVANT ENVIRONMENTAL EDUCATION RESEARCH, AND SEVERAL BASIC RESEARCH ISSUES.
KEYWORDS: ENVIRONMENT, EDUCATION, NATURAL RESOURCE CONSERVATION, RESEARCH.

WAGAR, J. ALAN
THE RECORDING QUIZBOARD—A DEVICE FOR EVALUATING INTERPRETIVE SERVICES
USDA FOREST SERV. RES. PAP. PNW-135, 12 P., ILLUS.
DESIGN AND USE OF RECORDING QUIZBOARD WHICH RECORDS RIGHT AND WRONG ANSWERS TO QUESTIONS BASED ON VISITOR CENTER EXHIBITS DERMINES HOW WELL EXHIBIT MESSAGES ARE RECEIVING VISITORS. INITIAL RESULTS INDICATE THAT TAPED MESSAGES ARE MORE EFFECTIVE THAN THOSE A VISITOR MUST READ.
KEYWORDS: EXHIBITS, EDUCATION, NATURAL HISTORY.

COCHRAN, P. H.
REGENERATION
USDA FOREST SERV. TREE PLANTERS' NOTES 23(11), P. 1-20.
A YEAR AFTER FIELD PLANTING IN APRIL, SURVIVAL OF 3-0 PONDEROSA PINE SEEDLINGS THAT WERE FREMLY LIFTED AVERAGED 57 PERCENT COMPARED WITH 18 PERCENT FOR THOSE STORED 5 WEEKS AND THEN HEELLED IN AT THE NURSERY FOR 14 WEEKS AND 24 PERCENT FOR THOSE STORED 16 WEEKS AND HEELLED IN FOR 3 WEEKS PRIOR TO PLANTING.
KEYWORDS: NURSERY STOCK (FORESTRY), SEEDLINGS, PONDEROSA PINE.

GRAFKEWSKI, M.
SORPTION OF DEERBRUSH (CEANOTHUS) SEEDS
WEST. SOC. WILDL. PROT. RES. REP. 1972, P. 25. (NO COPIES AVAILABLE)
KEYWORDS: SEED GERMINATION, SEED GERMINATION, Ceanothus.

HARRIS, A. S.
NATURAL REFORESTATION AFTER LOGGING ON AFOGNAK ISLAND
USDA FOREST SERV. RES. NOTE PNM-139, 18 P., ILLUS.
TYPE OF ORGANIC SEED BED PROBABLY DOES NOT AFFECT SPECIES COMPOSITION OF FOREST REGENERATION UNDER COASTAL SHELTERWOOD STANDS. PRESERVING DUFF ACUMULATIONS UNDER SHADE IS IMPORTANT TO DECREASE BENEIT OF EARLY GROWTH OF ALL Conifer SPECIES.
KEYWORDS: SEED GERMINATION, GROWTH FACTORS.

OWSTON, PEYTON W., AND WILLIAM I. STEIN
GERMINATION AND EARLY GROWTH OF COASTAL TREE SPECIES ON ORGANIC SEED BEDS AGAINST DRYING CONDITIONS
USDA FOREST SERV. RES. PAP. PNW-139, 18 P., ILLUS.
DOUGLAS—FIR AND NOBLE FIR SEEDLINGS WERE DRY FOR 3 WEEKS PRIOR TO PLANTING. THEY ARE NOT YET RECOMMENDED, HOWEVER, FOR COATING ROOTS OF SEEDLINGS DESTINED FOR EXTENDED STORAGE.
KEYWORDS: NURSERY STOCK (FORESTRY), SEEDLINGS, ROOTS, DOUGLAS—FIR, PSEUDOTSUGA MENZIESII, NOBLE FIR, ARBES PROCERA.

OWSTON, PEYTON W., AND WILLIAM I. STEIN
FIRST-YEAR PERFORMANCE OF DOUGLAS—FIR AND NOBLE FIR SEEDLINGS AGAINST DRYING CONDITIONS
USDA FOREST SERV. RES. PAP. PNW-139, 18 P., ILLUS.
DOUGLAS—FIR AND NOBLE FIR SEEDLINGS WERE DRY FOR 3 WEEKS PRIOR TO PLANTING. THEY ARE NOT YET RECOMMENDED, HOWEVER, FOR COATING ROOTS OF SEEDLINGS DESTINED FOR EXTENDED STORAGE.
KEYWORDS: NURSERY STOCK (FORESTRY), SEEDLINGS, ROOTS, DOUGLAS—FIR, PSEUDOTSUGA MENZIESII, NOBLE FIR, ARBES PROCERA.

STEIN, WILLIAM I.
THE LISTING OF SELECTED PUBLICATIONS ON REFORESTATION
IN "WESTERN REFORESTATION."
WEST. REFOR. COORD. COMM.
PROC. 1971, P. 61-71.
A COMPILED LIST OF RECENT PUBLICATIONS ON ANY PHASE OF REFORESTATION IN THE WESTERN UNITED STATES AND CANADA PLUS ADDITIONAL Pertinent REFERENCES FROM THE WORLDWIDE LITERATURE.
KEYWORDS: REFORESTATION.

WILSCN, BOYD C., AND ROBERT K. CAMPBELL (CAMPBELL)
SEEDBED DENSITY INFLUENCES HEIGHT, DIAMETER, AND DRY WEIGHT OF 3-0 DOUGLAS—FIR
USDA FOREST SERV. TREE PLANT. NOTES 23(2), P. 322-331, ILLUS.
A STUDY CONDUCTED IN MOUNT RAINIER NATIONAL PARK INDICATES THAT ONLY A VERY SMALL PROPORTION OF THE DYNAMICS PREDICTED FOR OPTIMUM PLANTING STOCK.
KEYWORDS: DOUGLAS—FIR, NURSERY STOCK (FORESTRY), SEEDLINGS, SEEDBEDS.
SOILS, SITE, AND GEOLOGY

BUFFO, JOHN LEO J. FRITSCHE N AND JAMES L. MURPHY 12 72221

DIRECT SOLAR RADIATION UN VARIOUS SLOPES FROM 0 TO 90 DEGREES NORTH LATITUDE.

KEYWORDS. SOLAR RADIATION, SLOPES, ASPECTS.

DYNESS, C. T. 7 72161

SOIL SURFACE CONDITIONS FOLLOWING BALCON LOGGING.

KEYWORDS. SOIL SORPTION, BALCON LOGGING, WETTING AND DRYING, EFFECTS ON PLANTS.

EFFECTIVE CONSEQUENCES OF TIMBER HARVESTING—AN APPRAISAL.

KEYWORDS. FOREST MANAGEMENT, SOIL MANAGEMENT, TIMBER MANAGEMENT, WATERSHED STABILITY.

FRICE, R. M., J. S. ROTHACHER AND W. F. MEGHAN 5 72174

IN WATERSHEDS IN TRANSITION.

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EFFECTIVE CONSEQUENCES OF TIMBER HARVESTING—AN APPRAISAL.

IN WATERSHEDS IN TRANSITION.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN., ST. 2 P., ILLUS.

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EFFECTIVE CONSEQUENCES OF TIMBER HARVESTING—AN APPRAISAL.

IN WATERSHEDS IN TRANSITION.
BUCKMAN, ROBERT E. 12 71218

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PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 04 72054

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SCHWEITZER, DENNIS L., ROBERT W. SASSAMAN, AND CON H. SCHALLAU

WESTERN FORESTRY SPEAKS.

ON RESEARCH NEEDS FOR FUTURE FOREST MANAGEMENT. IN:

GROWTH AND SOIL MOISTURE IN THINNED LODGEPOLE PINE.

USDA FOREST SERV. RES. REP. PNW-757, 20 P., ILLUS.

A LODGEPOLE PINE LEVELS-OF-GROWING-STOCK STUDY SHOWED THAT INDIVIDUAL TREES GROWN MORE RAPIDLY, AND ADDED MORE WOOD TO POTENTIALLY MERCHANTABLE TREES AT LOWER STAND DENSITIES, BUT TOTAL WOOD PRODUCTION WAS LESS.

EVAPOTRANSPERSION DRAINAGE ON BUCK, R. G., AND T. D. TRESTLE

SOIL MOISTURE WAS ALSO LESS AT THE LOWER STAND DENSITIES.

KEYWORDS. SOIL MOISTURE, STAND DENSITY, LODGEPOLE PINE, FOREST MEASUREMENT.

KOJIMA, RICHIMASA, AND J. ALAN MAGER 05 72041

COMPUTER-GENERATED DRAWINGS OF GROUND FORM AND VEGETATION.

J. FOR. 70(71), P. 415-418, ILLUS.

A DESCRIPTION OF THE APPLICATION OF TWO COMPUTER PROGRAMS THAT GENERATE PERSPECTIVE VIEWS OF THE LANDSCAPE. USING THESE VIEWS, THE EFFECTS OF PROPOSED LANDSCAPE MODIFICATIONS TO BE EXAMINED.

KEYWORDS. LANDSCAPE MANAGEMENT, COMPUTERS.

MINDRE, DON 8 72092

THE HUCKLEBERRIES OF OREGON AND WASHINGTON-A

UNRESEARCH RESOURCE.

USDA FOREST SERV. RES. PAP. PNW-143, 20 P., ILLUS.

THE 12 NORTHWESTERN 'VACCINIUM' SPECIES ARE DESCRIBED. MANAGEMENT PROBLEMS ARE OUTLINED, AND PERTINENT LITERATURE IS REVIEWED. EFFECTIVE MANIPULATION TECHNIQUES ARE UNKNOWN, BUT SOME OF THE METHODS USED IN MANAGING EASTERN BLUEBERRIES MAY BE APPLICABLE.

KEYWORDS. HUCKLEBERRIES, 'VACCINIUM' SPECIES, BILBERRY, BLUEBERRY, WHORTLEBERRY, FOREST MANAGEMENT, EXPLORATION, FOREST BUREAUCRACY, MARACAS, PRUNING.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 04 72054

CULTURE OF MIXED CONIFERS IN WEST-SIDE CASCADES.

2 P., ILLUS.

THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.

KEYWORDS. TIMBER MANAGEMENT, RESEARCH, FOREST MULTIPLE USE.

RANDALL, ROBERT M. 12 72219

AN OPERATIONS RESEARCH APPROACH TO DOUGLAS-FIR THINNING.

USDA FOREST SERV. RES. PAP. PNW-141, 23 P., ILLUS.

A ZERO-ONE INTEGER PROGRAMMING PROCEDURE IS USED AS THE BASIS FOR A SYSTEMATIC FRAMEWORK FOR PLANNING COMMERCIAL THINNING OPERATIONS IN YOUNG-TO- MATURE DOUGLAS-FIR. THIS NEW APPROACH, TERMED THE 'UNIT APPROACH,' IS DEMONSTRATED, TESTED, AND COMPARED TO EXISTING RULE-OF-THUMB METHODS ON A CASE STUDY AREA IN WESTERN OREGON.

KEYWORDS. THINNING (TREES), PROGRAMMING (COMPUTER), DOUGLAS-FIR, FOREST MANAGEMENT.

REKEMA, CONRAD L. 10 72179

TWENTY-ONE-YEAR DEVELOPMENT OF DOUGLAS-FIR STANDS REPEATEDLY THINNED AT VARYING DENSITIES.

USDA FOREST SERV. RES. PAP. PNW-141, 23 P., ILLUS.

OVER AN 18-YEAR PERIOD, BEGINNING AT AGE 38, LIGHT THINNINGS AT 3-YEAR INTERVALS, MODERATE THINNINGS AT 5-YEAR INTERVALS, AND HEAVY THINNINGS AT 9-YEAR INTERVALS ALL RESULTED IN SUBSTANTIAL CUBIC VOLUME GROWTH BY ABOUT 20 PERCENT. THIS LOSS OF GROWTH WAS LARGELY OFFSET BY SALVAGE OF MORTALITY.

KEYWORDS. THINNING (TREES), FOREST IMPROVEMENT CUTTING, DOUGLAS-FIR.

SAASSAMAN, ROBERT W., EC HOLT, AND KARL BERGSVIK 11 72183

USER'S MANUAL FOR A COMPUTER PROGRAM FOR SIMULATING INTENSIVELY MANAGED CUBIC VOLUME GROWTH ('SIMAC').

USDA FOREST SERV. GEN. TECH. REP. PNW-1, 50 P., ILLUS.

DETAILED OPERATING INSTRUCTIONS ARE DESCRIBED FOR SIMAC, A COMPUTERIZED FOREST SIMULATION MODEL WHICH CALCULATES THE ALLOWABLE CUT ASSUMING VOLUME REGULATION FOR FORESTS WITH INTENSIVELY MANAGED STANDS. A SAMPLE PROBLEM ILLUSTRATES THE REQUIRED INPUTS AND EXPECTED OUTPUT.

SIMAC IS WRITTEN IN FORTRAN ON A CDC 6400 COMPUTER WITH A SCOPE 3.3 OPERATING SYSTEM. THE CONCEPTUAL BASIS OF THE SIMAC METHOD IS NOT DISCUSSED IN DETAIL.

KEYWORDS. ALLOWABLE CUT, PROGRAMMING (COMPUTER).

SCHMITZ, DENNIS L., ROBERT W. SASSAMAN, AND CON H. SCHALLAU 7 72079

ALLOWABLE CUT EFFECT-SOME PHYSICAL AND ECONOMIC IMPLICATIONS.

J. FOR. 70(71), P. 415-418, ILLUS.

THE ALLOWABLE CUT EFFECT IS INTRODUCED. SEVERAL PHYSICAL AND ECONOMIC CONSEQUENCES OF THE CONCEPT ARE ILLUSTRATED AND DISCUSSED.

KEYWORDS. ALLOWABLE CUT, TIMBER MANAGEMENT.
TIEDEMANN, A. R.

STREAM CHEMISTRY FOLLOWING THE SAFETY HARBOUR FOREST FIRE AND EROSION CONTROL FERTILIZATION IN NORTH CENTRAL WASHINGTON. (ABSTR.)

NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., p. 13. (NO COPIES AVAILABLE).

KEYWORDS. STREAMS, FOREST FIRES, WATERSHEDS, UREA.

WILDLIFE AND TIMBER

RADWAN, M. A.

DIFFERENCES BETWEEN DOUGLAS-FIR GENOTYPES IN RELATION TO BROWNING DISEASE BY BLACK-TAILED DEER.


RESULTS SUGGEST THAT ONE OR MORE OF THE DEER BROWNING RESISTANCE CHARACTERISTICS FOUND IN THE STUDY MIGHT BE USEFUL TO SCREEN DOUGLAS-FIR BREEDING STOCK FOR RESISTANCE TO DEER BROWSING.

KEYWORDS. DOUGLAS-FIR, "PSEUDOTSUGA MENZIESII", BLACK-TAILED DEER, "ODOCOILEUS HEMINUS COLUMBIANUS", BROWSE.

RADWAN, M. A.

PHYSIOLOGICAL RESISTANCE TO MAMMALS. IN SECOND NORTH AMERICAN FOREST BIOLOGY WORKSHOP. (ABSTR.)

ONG., STATE UNIV., SOC. AM. FOREST., PROGRAM ABSTR., p. 20. (NO COPIES AVAILABLE)

INDIVIDUAL AS WELL AS GROUPS OF CHEMICAL COMPOUNDS HAVE BEEN SUGGESTED AS CAUSES OF RESISTANCE OF FOREST TREES BECAUSE OF THEIR TOXICITY OR UNDESIRABLE EFFECTS ON AN ANIMAL'S TASTE, SMELL, NUTRITION, OR DIGESTION.

KEYWORDS. MAMMALS, PLANT PHYSIOLOGY, FEEDING.

WOOD UTILIZATION

ANONYMOUS

PREDICTING DAMPING IN WOOD STRUCTURES.


SMALL AMPLITUDE VIBRATIONS IN FLOORS OR OTHER ELEMENTS OF WOOD BUILDINGS CAN BE DAMPED EFFECTIVELY WITH PROPERLY CHOOSEN NAILED AND GLUED JOINTS, THE REPORT REFERRED TO IN THIS TECHNICAL NOTE DEVELOPS METHODS FOR PREDICTING THE DAMPING OF WOOD STRUCTURES. ONLY SIMPLE TESTS ON SMALL SPECIMENS ARE NEEDED. THE THEORIES ARE CONFIRMED BY EXPERIMENTS ON SCALDED STRUCTURAL MEMBERS.

KEYWORDS. STRUCTURAL DESIGN, WOOD CONSTRUCTION, VIBRATION.

GRANTHAM, J. R.

INSULATING NOISE CONTROL IN WOOD-FRAMED BUILDINGS.

INSULATING NOISE CONTROL IN WOOD-FRAMED BUILDINGS.

GRANTHAM, J. R. AND R. B. HEEBINK.

SOUND INSULATION IN A MODULAR HOTEL.

USDA FOREST SERV. RES. NOTE PNW-193, 8 P.

FIELD-MEASURED RESISTANCE TO SOUND TRANSMISSION IN A TWO-STORY MODULAR MOTEL ASSEMBLED FROM 102 FACTORY- BUILT, THREE-DIMENSIONAL WOOD-FRAMED UNITS GENERAL EFFECTS TO BE PREDICTED. LABORATORY TESTS INDICATED THAT THE EXTERIOR SHEATHING, USES TO OBTAIN HIGH STRUCTURAL RIGIDITY. DURING TRANSPORTATION AND ERECTION, WAS NOT EFFECTIVE IN INSULATING AGAINST NOISE TRANSMISSION.

KEYWORDS. ACOUSTIC INSULATION, PREFABRICATED BUILDINGS, WOOD CONSTRUCTION.

HARRIS, A. S.

ALASKA-CEDAE. (REV.)

USDA FOREST SERV. RES. NOTE PNW-193, 7 P.

A NONTECHNICAL DESCRIPTION OF THE DISTRIBUTION, CHARACTERISTICS, AND USES OF THE TREE AND ITS WOOD.

KEYWORDS. CEDAR, ALASKA.

HENLEY, J. O.

GRADING SUGAR PINE LOGS IN TREES.

USDA FOREST SERV. RES. NOTE PNW-132, 8 P.

A STUDY OF SURFACE CHARACTERISTICS AND LUMBER RECOVERY INFORMATION OBTAINED FOR 426 LOGS FROM 44 TREES INDICATES THAT PROBLEMS ENCOUNTERED IN APPLYING A LOG GRAADING SYSTEM TO SUGAR PINE TREES CAN BE ALEVIATED BY MODIFICATIONS IN THE SPECIFICATIONS. THE MODIFICATIONS DO NOT APPEAR TO DECREASE THE PERFORMANCE OF THE GRAADING SYSTEM.

KEYWORDS. SUGAR PINE, LOG GRADES.

OVIALE, A. E.

MOISTURE IN WOOD STRUCTURES FOR ICE SKATING.

FOREST PROD. J. 22(3), p. 50-54.

CONCENTRATION ON INDOOR SURFACES IS A SPECIAL PROBLEM IN INDOOR SKATING Rinks, WHERE TIMBER FRAMEING SYSTEMS ARE WIDELY USED. TWO RINK BUILDINGS OF DIFFERENT TYPES ILLUSTRATE THE CONTROL OF CONDENSATION BY VENTILATION, INSULATION, DEMHYDRIFICATION, AND HEATING.

KEYWORDS. HUMIDITY, CONDENSATION, CONSTRUCTION MATERIALS.

*ROSGNAAR, ARNOLD S.

SCHOOL BUILDING DESIGN AND CONSTRUCTION.

SCHOOL DISTRICTS IN GREAT BRITAIN COOPERATE TO SAVE TIME AND EXPENSE IN CONSTRUCTING NEW SCHOOL BUILDINGS. THE BRITISH CONSORTIA (COOPERATING DISTRICTS) ACHIEVE ECONOMIES THROUGH SUCH ACTIONS AS: (1) PURCHASING MATERIALS IN LARGE VOLUMES, (2) ADOPTING A BUILDING SYSTEM, AND (3) CONTRACTING SERIALLY.

KEYWORDS. SCHOOL BUILDINGS, CONSTRUCTION ECONOMICS.

RUTH, ROBERT H. AND CLYDE UNDERWOOD.

MAPLE SIROP IN OREGON. (ABSTR.)

PROCEEDINGS OF THE EIGHTH CONFERENCE ON MAPLE PRODUCTS.

ARIS. RES. SERV., U.S. DEP. AGRIC., ARIS 73-73 (EMN PUBL. NO. 3613), (NO COPIES AVAILABLE).

BIGLEAF MAPLE PRODUCED GOOD SAP FLOWS BUT THE SAP WAS LOW IN SUGAR CONTENT AND THE SYRUP ONLY FAIR TO POOR IN PRESENCE OF TYPICAL MAPLE FLAVOR.

KEYWORDS. MAPLE SYRUP, "ACER MACROPHYLLUM", BIGLEAF MAPLE, OREGON.

RITCH, ROBERT H. AND CLYDE UNDERWOOD.

MAPLE SIRUP PRODUCTION FROM BIGLEAF MAPLE.

USDA FOREST SERV. RES. NOTE PNW-181, 12 P.

BIGLEAF MAPLE SAP FLOW DURING THE 1970-71 SEASON RANGED FROM NONE TO 16.9 GALLONS PER TAPHOLE AND SUGAR CONTENT OF THE SAP FROM 1.0 TO 2.6 PERCENT. THE SIRUP WAS VERY FLAVORFUL, AS A HOBBY.

KEYWORDS. MAPLE SUGAR, BIGLEAF MAPLE, "ACER MACROPHYLLUM", SAP.

*WESTERN WOOD PRODUCTS

WOOD FRAME WALLS: FLOORS FOR SOUND INSULATION.

CAREK. K SOUND CONTROL, P. KFA, ILLUS.

THE WALL AND FLOOR CONSTRUCTIONS ILLUSTRATED IN THIS BROCHURE HAVE BEEN TESTED AND RATED FOR SOUND INSULATION BY RECOGNIZED ACOUSTICAL LABORATORIES. THEY PERMIT SELECTION OF A WALL OR FLOOR CONSTRUCTION TO PROVIDE A DESIRED LEVEL OF SOUND INSULATION AND FIRE RESISTANCE AT REASONABLE COST.

KEYWORDS. ACOUSTIC INSULATION, WALLS, FLOORS, WOOD-FRAME CONSTRUCTION.

WOODFIN, RICHARD C., JR. AND W. Y. PONG.

DRY VENEER VOLUME LOSSES IN PRODUCTION OF RED AND WHITE FIR PLYWOOD.

USDA FOREST SERV. RES. NOTE PNW-191, 12 P.

LOSSES OF ROUGH, DRY VENEER BETWEEN DRYING AND PANEL TRIMMING EXPRESSED AS PERCENTAGES PROVIDE A MEANS TO ESTIMATE OUTPUT FROM DRYER PRODUCTION VOLUMES. APPROXIMATELY 16 PERCENT OF THE DRY VENEER VOLUME WAS LOST IN DRYING PRODUCTION OF PLYWOOD.

KEYWORDS. VENEERS (RECOVERY), PLYWOOD, "ABIES MAGNIFICA", RED FIR, "ABIES CONCOLOR", WHITE FIR.
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The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

- Fairbanks, Alaska
- Juneau, Alaska
- Bend, Oregon
- Corvallis, Oregon
- La Grande, Oregon
- Portland, Oregon
- Olympia, Washington
- Seattle, Washington
- Wenatchee, Washington

Mailing address:
Pacific Northwest Forest and Range Experiment Station
P.O. Box 3141, Portland, Oregon 97208
The FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple-use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.