

CRAFTS

Annual Report
1983-84

CRAFTS

**Coordinated Research On
Alternative Forestry
Treatments & Systems**

May 1984

**Department of Forest Science
Oregon State University**

CRAFTS Highlights

This report covers the fourth year of cooperation of the CRAFTS program on vegetation management and forest regeneration research. Highlights of this year include:

- Dr. Steven Radosevich assumed the leadership of the CRAFTS program in August 1984. Former CRAFTS leader Dr. Jack Walstad now heads the southwest Oregon Forestry Intensified Research (FIR) program.
- The cooperative began a search for an additional research assistant or research associate. Responsibilities of this individual will include the establishment and maintenance of several forest regeneration studies, under the direction of Dr. Radosevich. Also, the addition of three to four graduate student assistants is anticipated during the coming year.
- Substantial work was done on summaries of first and second year results that compare competition release treatments in young conifer stands. This study examines similar treatments on six sites in the Pacific Coast Mountain Range.
- Funding was obtained for a research project that will develop a model to assess the severity and competitive impact of brush in young forest plantations. A pilot study for this project also was completed.
- Several new research projects were approved and funded. These include studies on: site preparation alternatives in southwest

Oregon, interference between Douglas-fir and red alder, shrub competition and conifer regeneration in northern California, and the impacts of competing vegetation on Douglas-fir growth on highly productive sites in the Pacific Northwest.

- Five publications containing herbicide prescriptions for various Pacific Northwest plant species were published.

Introduction

The purpose of the CRAFTS program is to help improve the understanding and control of competing vegetation on commercial forest lands of the Pacific Northwest.

CRAFTS furthers these goals by coordinating research on the biological impact of competing vegetation on young conifer plantations, by initiating research and conducting educational activities at Oregon State University (OSU). CRAFTS also provides a forum for research coordination and information exchange among the various organizations participating in CRAFTS.

Research Activity

This year the CRAFTS program was involved in several continuing research projects. The program also began several new projects that examine the impact of competing vegetation on conifer growth.

Coast-Range Release Study Progress Report

This study examines the effects of various competition release treatments on Douglas-fir stands in the Oregon and Washington Coast Range. The study involves six replications, which have been established on 2- to 3-year-old Douglas-fir plantations owned or managed by member organizations of the CRAFTS cooperative. Each plantation was overtopped by various amounts of salmonberry, thimbleberry, red alder, vine maple, elderberry, or bigleaf maple at the time of treatment. Three replications now have completed their first growing season after treatment and three have completed their second.

The study compares six release treatments:

1. Roundup® applied late foliar (August-September) by helicopter at 1.5 qts/A in 10 gals/A aqueous spray.
2. Garlon 4® applied late dormant (February-March) by helicopter at 1.5 qts/A in 10 gals/A diesel oil spray.
3. Garlon 4® applied early foliar (April-May) by helicopter at 1.25 qts/A in 10 gals/A aqueous spray.
4. Manual cutting of vegetation applied late dormant-early foliar (March-April) with chainsaws in a 4-ft radius around each Douglas-fir. All vegetation cut no higher than 6 inches above the ground.

5. All woody and herbaceous vegetation removed for the duration of the study.
6. No treatment.

An analysis of variance of first and second year results failed to indicate a significant increase ($\alpha = .05$) in Douglas-fir height or diameter growth with any release treatment as compared to the untreated control. However, Treatment 5, which removed both woody and herbaceous vegetation, demonstrated a marked second-year increase in diameter increment over all other treatments (Figure 1).

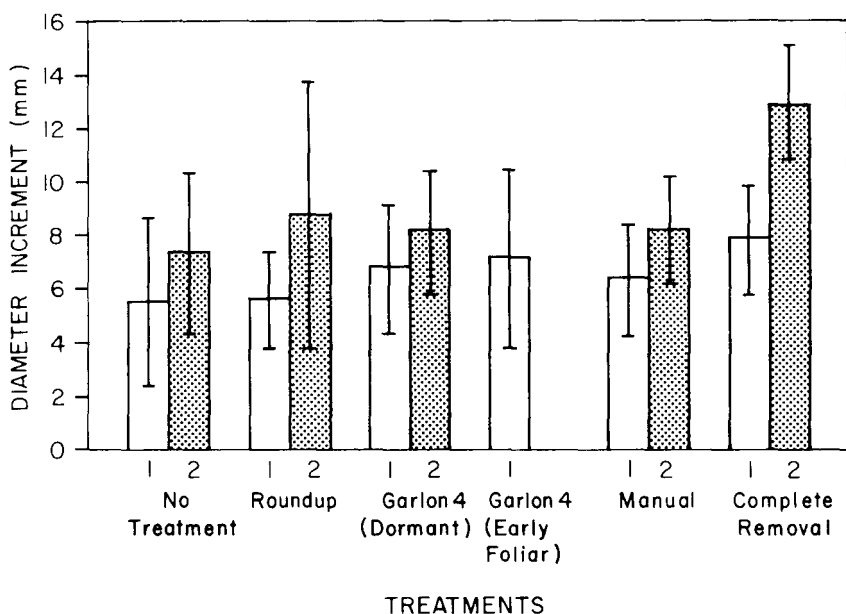


Figure 1. Diameter increment of 3-year-old Douglas-fir, 1 and 2 years after six release treatments in the Oregon and Washington Coast Range. 1-year data averaged from six sites and 2-year data averaged from three sites. Lines on bars represent two standard errors.

The study results thus far have shown that the various release treatments differ greatly in their reduction of shrub and hardwood vegetation (Figure 2a) and herbaceous vegetation (Figure 2b) in the 2 years following treatment. Treatments 1 (Roundup®) and 5 (complete removal) significantly ($\alpha = .05$) reduced shrub and hardwood vegetation over the untreated control for 2 years following treatment. The Roundup® treatment has shown a marked increase in herbaceous cover; this increase is associated with the reduction in shrub and hardwood cover.

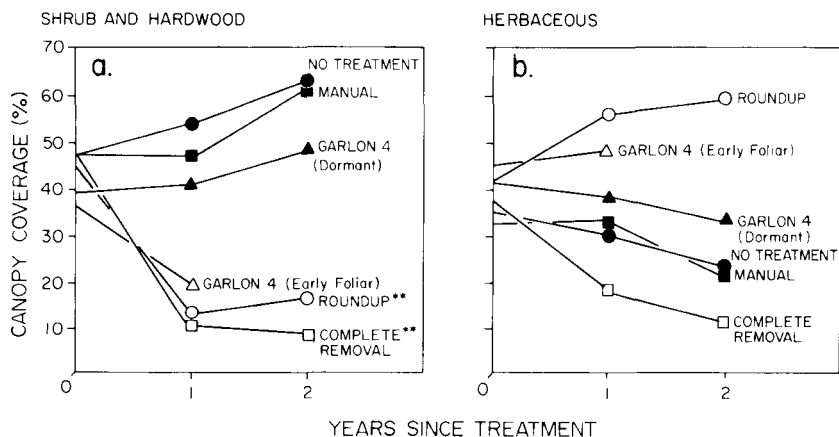


Figure 2ab. Canopy coverage (%) of shrub and hardwood vegetation (a) and herbaceous vegetation (b) before, 1 year, and 2 years after application of six release treatments in the Oregon and Washington Coast Range.

Detailed results from this experiment will be available in early summer and distributed to CRAFTS cooperators. Douglas-fir growth and vegetation recovery on all sites will be measured again during the coming year.

Intermountain Release Study Progress Report

This study compares the effects of aerially applied treatments of Garlon 4® and Esteron 99®, manual cutting, and a complete-removal treatment on varnishleaf ceanothus, thimbleberry, and snowberry. One replication was installed in 1981 on a 4-year-old Douglas-fir plantation in northern Idaho. A search in 1982 and 1983 for additional replications was unsuccessful because there are few CRAFTS cooperators in the Intermountain Region.

In addition, poor performance of the two aerially applied herbicide treatments prompted an on-site screening trial by Dan Miller and Bob Wagner to test the efficacy of six mixtures of Garlon 4® and Esteron 99® on varnishleaf ceanothus. Trial results will determine whether the plots will be retreated this coming season. The future of this study will be determined by next year's results and cooperator interest.

CRAFTS is working to attract more Intermountain cooperators and thus to increase its effectiveness in that region.

A-Level Screening Trials to be Initiated

CRAFTS will initiate its A-level screening program during the coming year. A-level screening provides preliminary information on new and existing vegetation control treatments. This information is used for chemical registration and additional testing, and to improve operational prescriptions. The screening program is designed

to gather data on the effects of timing, method of application, treatment combinations, frequency of application, and rates of application and formulation (for chemicals only) on the efficacy and selectivity of both chemical and non-chemical treatments. The program will also provide CRAFTS cooperators with a coordinated and standardized experimental approach to testing alternative weed control treatments.

Implementation of each screening trial will require substantial cooperation between OSU and the cooperators. The vegetation complex and individual target species to be studied and the treatments to be tested will be selected by OSU and the cooperators. OSU will be responsible for the experimental design, field manuals, training sessions, data analysis, and report preparation. The cooperators, with guidance from OSU, will be responsible for site selection, plot installation, treatment application, and data collection.

Cooperators at the February Technical Committee meeting identified the target species and species complexes they were most interested in addressing during the first A-level trials. They also indicated a desire to install at least one replication on cooperator-owned sites. Trials that generated the most interest are:

<u>Target species or complex</u>	<u>Potential number of replications</u>
Bigleaf maple	7
Rhododendron/huckleberry/ salal	5
Red alder	4
Vine maple/hazel/oceanspray	4
Scotch broom	4

Rocky Mt. maple/varnishleaf	3
ceanothus/ninebark/ oceanspray/huckleberry	
Snowbrush ceanothus	3
Tall herbs/ferns/grasses	3

A prospectus for each of the above trials will be distributed to the members of the Technical Committee to determine the level of interest in each trial. At least three cooperators (or sites) will be required to implement each trial.

The first A-level screening experiments will be selected by the cooperators in the coming months.

Forest Vegetation Management Text Underway

A number of forest scientists across the U.S. are collaborating on a textbook on forest vegetation management. The project is centered at OSU and involves contributors from Auburn University, Virginia Polytechnic Institute and State University, the University of California at Davis, and the USDA Forest Service. Jack Walstad is the project director, and Doug Brodie, Mike Newton, and Steve Radosevich of OSU are contributing key chapters. The project is funded by the Environmental Protection Agency, which plans to use the textbook in future risk/benefit analyses of forestry herbicides. About half of the work has been done, and plans are to publish the textbook in 1986.

The textbook will cover the general principles of forest vegetation management, with emphasis on the Southern Pine Region and the Pacific Northwest.

Topics to be covered include: 1) ecological principles of plant competition, 2) origin of current forest vegetation problems, 3) analysis of forest vegetation management alternatives, 4) survival, growth and yield benefits associated with forest vegetation management, 5) economic analysis of forest vegetation management options, and 6) procedures for developing forest vegetation management prescriptions.

Site Preparation Alternatives in Southwestern Oregon

Darrell Ross, an M.S. degree candidate at OSU, is working on a study that will compare five alternative site-preparation techniques in southcentral Oregon. This study involves the remeasurement of site-preparation research plots established on the Weyerhaeuser Company's Klamath Tree Farm in 1975. The original study was designed to cover 5 years and to compare site-preparation treatments that varied widely in degree of physical disturbance to the site and control of competing vegetation.

Treatments included at each of three sites (along with a logged-only control site) are brushblading, ripping, disking, chemical, and chemical followed by disking. Ponderosa pine was planted at all three sites; lodgepole pine was planted only at the mid-elevation site.

In the original study, Weyerhaeuser scientists observed after four growing seasons that there were significant differences in the various treatments' effects on the survival and growth of planted pines. The most dramatic differences were found at the low-elevation site, where pre-treatment vegetation consisted of an established shrub community.

Height growth at this site was up to 135 percent greater on treated plots than on untreated (control) plots (Figure 3).

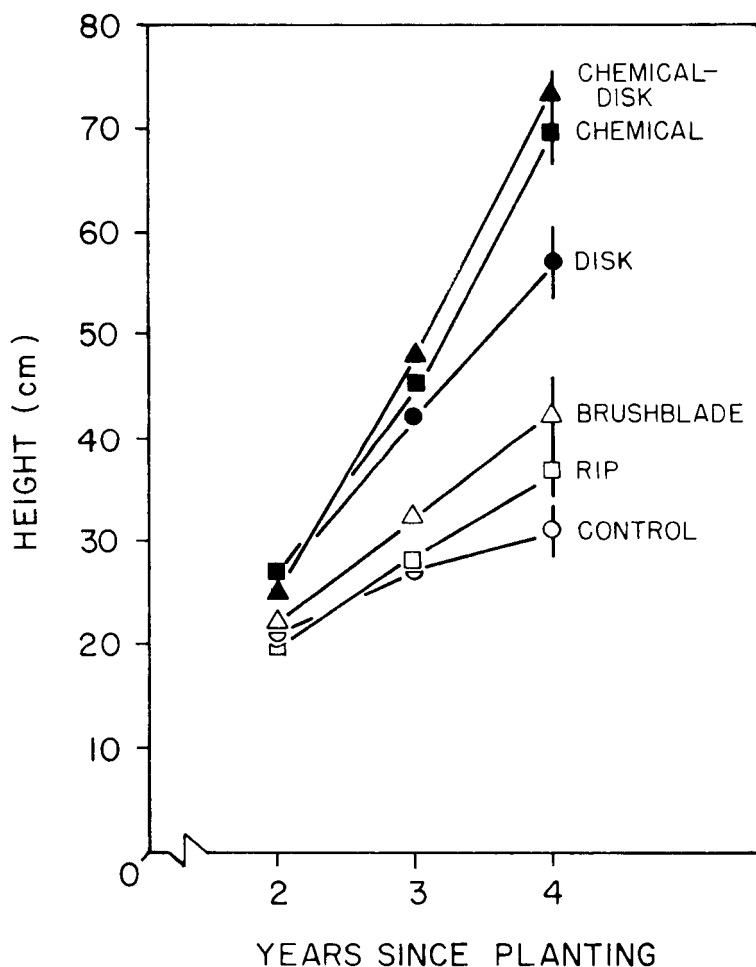


Figure 3. Total height of ponderosa pine following alternative site preparation treatments (based on information from W. Scott of Weyerhaeuser Co.).

Ross' study will provide a basis for predicting whether the early differences in plantation performance will be maintained throughout the rotation. Treatment evaluation will be based on control of competing vegetation, survival and growth of planted conifers, and effects on the nutrient capital in the surface 30 centimeters of soil. This study does not attempt to identify an optimal treatment for all situations, but will characterize the responses following five alternative treatments and thus aid forest managers in selecting the appropriate treatment for a given site.

Field work for this study was completed in 1983. Data gathered is now being analyzed, and research results will be available in the fall of 1984. Recommendations for maintaining these plots for remeasurement also will be developed.

Development of a Competition Index for Vegetation Management

The Siuslaw National Forest has funded a 5-year project to develop a quantitative technique to help foresters make decisions about vegetation management in young Douglas-fir stands. The objective of the study, which will be conducted by Bob Wagner and Steve Radosevich, is to develop an interspecific competition index that will predict the current and future competitive status of Douglas-fir seedlings. The index will be calculated from a simple field survey.

The study will be accomplished in two concurrent phases, the first lasting approximately 2 years and the second approximately 5 years. The

first phase will include a retrospective study of existing site preparation experiments in the Oregon Coast Range; study results will aid in the construction of a model for the competition index. Growth models for the major competing species on each site also will be developed. The second phase will establish new plots to test the models developed in the first phase and will examine light and soil moisture abundance under various levels of competition.

Preliminary work by Bob Wagner in the Cascades and Coast Range indicates that a competition index based on the height, percent canopy cover, and distance of surrounding shrubs and hardwoods can be used to predict the size of young Douglas-fir (Figure 4). This index also can help foresters rank plantations on the basis of competitive status, prescribe release treatments, and evaluate treatments. This study will provide foresters with quantitative tools to evaluate the need for and consequences of vegetation management in young plantations.

Interference Between Douglas-fir and Red Alder in the Oregon Coast Range

A 5-year study to explore the interaction between Douglas-fir and red alder in the Oregon Coast Range has been funded by the U.S. Forest Service's National Agricultural Pesticide Assessment Program (NAPIAP). Principle investigators for this project are Steve Radosevich, Dave Hibbs, Mike Newton and Bob Wagner. The primary objective of the study is to quantify, model and predict the effects of intra- and inter-specific interference of the two

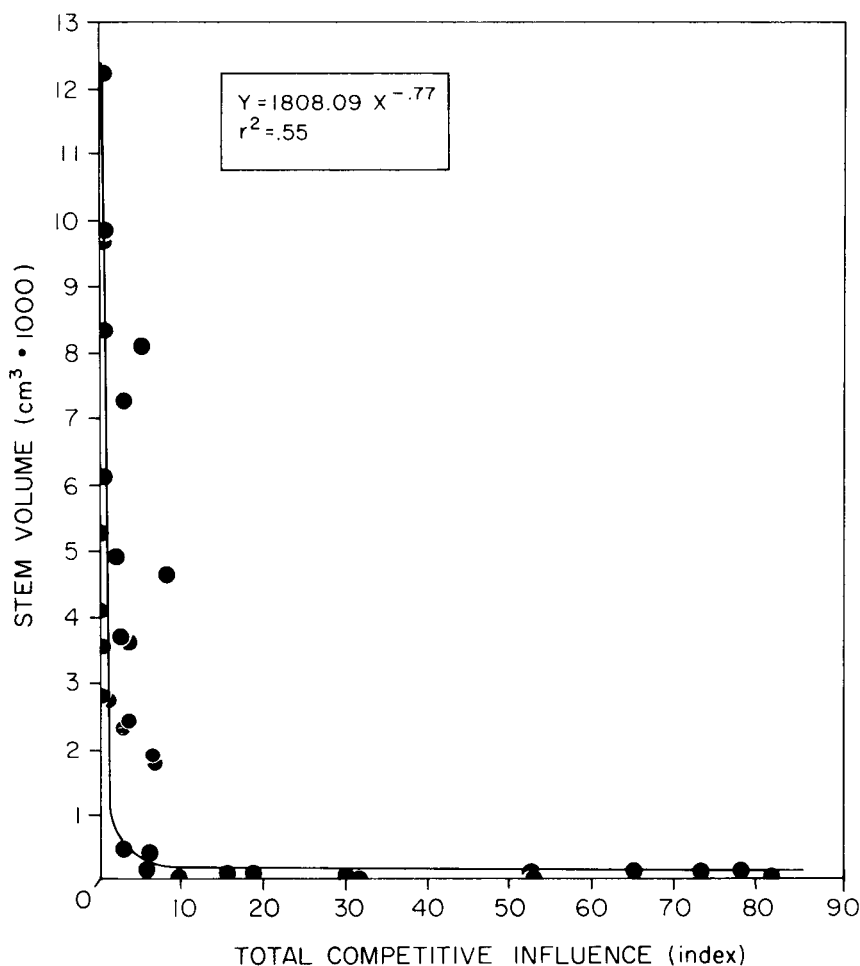
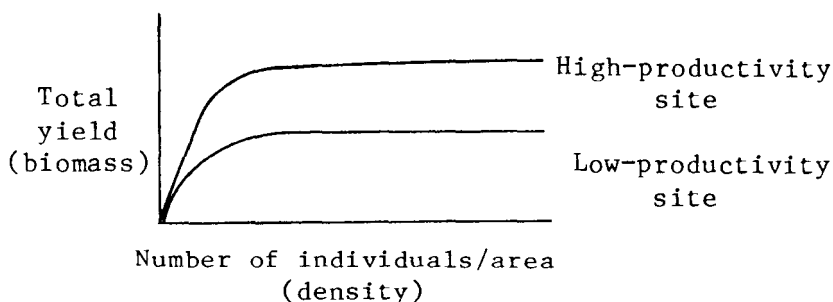


Figure 4. The relationship between the stem volume (cm^3) of 7-year-old Douglas-fir and a competition index based on the height, percent cover, and distance of surrounding shrubs and hardwoods in the Oregon Coast Range.

most common tree species (Douglas-fir and red alder) in the Oregon Coast range. The interaction between the two species will be examined using a special experimental design called a replacement series.

A replacement series experiment assumes that every site has a finite carrying capacity for plant biomass:



The replacement series holds total density constant at a tree density that will eventually maximize the productivity of the site. In this study, total tree density will always be 50 trees per plot (540 trees/acre), but the proportion of Douglas-fir to red alder will vary from all red alder, to all Douglas-fir. This type of study could yield several results, as shown in Figure 5: No effect (Model I), competition (Model IIab), mutual suppression (Model III), or mutual benefit (Model IV). The literature on associations between red alder/Douglas-fir suggests that any of these interactions are possible.

We plan to establish the replacement series under three different experimental conditions after site preparation. These conditions are: with an

understory; without an understory; without an understory, but planting the red alder after 3 to 5 years of Douglas-fir occupancy (i.e., delayed planting of red alder). In addition, the series will be expanded to simulate red alder removal from the 50:50 mixture of the two species after 5 and 10 years of tree growth. Removal of red alder in these two treatments will alter the total tree density and spacing, and thus another pure Douglas-fir treatment of 25 trees per plot (270 tree/acre) must be included. The study will be conducted both on a fertile and infertile site in the Coast Range.

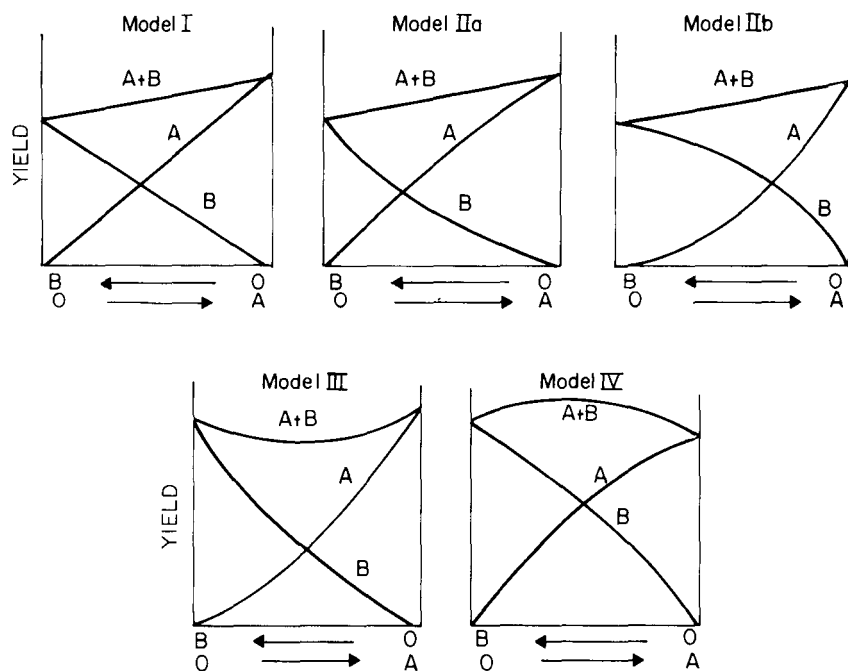


Figure 5. Models for results of replacement series experiments for interference study. Vertical axis represents some measure of plant yield; horizontal axis indicates the proportion (0 to 1) of each species. (A = Species A, B = Species B).

Continued Investigations of Shrub Competition and Conifer Regeneration

The NAPIAP program funded a 3-year study to continue research initiated by Steve Radosevich in the Sierra Nevada mountains. Three experiments have been established in northern California since 1978 to assess competitive interactions between coniferous seedlings and various shrub species. Two studies are at the University of California Blodgett Forest Research Station, and the third is near Foresthill in the Tahoe National Forest.

The two Blodgett Station studies are similar in that they use a replacement series design to assess relative competition between conifers and greenleaf manzanita. One study, established in 1980, examines the interaction between ponderosa pine and sprouting greenleaf manzanita. The other, started in 1981, uses the same design to study the interaction of seedling greenleaf manzanita with both white fir and ponderosa pine. These studies also completed a detailed analyses of soil moisture, light availability, and physiological responses of the shrub and tree species as a result of their interaction.

The study near Foresthill (established 1978) is an additive experiment to examine the impact of site preparation and subsequent shrub control on ponderosa pine, sugar pine, and white fir survival and growth. Final reports on the initial phases of all three studies will be published during the coming year.

It is important to continue to collect tree, shrub, and environmental availability data from each of these studies. Early differences observed

among treatments will probably increase as time progresses; therefore, we are proposing continued measurements of tree and shrub growth and fluctuations in soil moisture and light availability twice a year, for 3 years. Semiannual measurements will allow observations of any changes in shrub and tree biomass accumulation and of periods of maximum and minimum light and soil-moisture availability.

Monitoring of environmental trends, physiological parameters, and competitive dynamics of the conifer-shrub system may allow development of a growth model. A model for predicting gains in growth with various levels of shrub density control and resource manipulation would be extremely valuable to forest managers who want to maximize site productivity. This project will provide our research program with an appropriate data set to build such a model.

Impacts of Competing Vegetation on Growth of High-Site Douglas-fir Plantations

A study to determine the long-term effects of competing vegetation on planted conifers has been funded jointly by the Bureau of Land Management (BLM) and the Weyerhaeuser Company. The study, conducted by Mike Newton, will record growth of Douglas-fir, western hemlock, Sitka spruce, Engelmann spruce, ponderosa pine, noble fir and grand fir for periods of 6-14 years after planting. The plantations on which these measurements will be made have a full history of vegetation conditions, including vegetation management manipulations, as part of the long-term data record.

The study includes: 1) a study of site preparation release and stock type adaptability in the coastal fog belt, 2) a test of four stock types of Douglas-fir, repeated in 5 years under a variety of vegetation conditions, in the central Oregon Coast Range, 3) a test of release in the Cascade Range of Douglas-fir from snowbrush ceanothus at ages 5 and 10 years, 4) a test of six stock types at 4,000 feet in the Cascades on sites that have been prepared by burning, and sites that have not, and 5) seventh-year evaluation of an intensive study of competition in Nelder plots.

The Cascades release study has already been remeasured and analyzed (see Figure 6). A

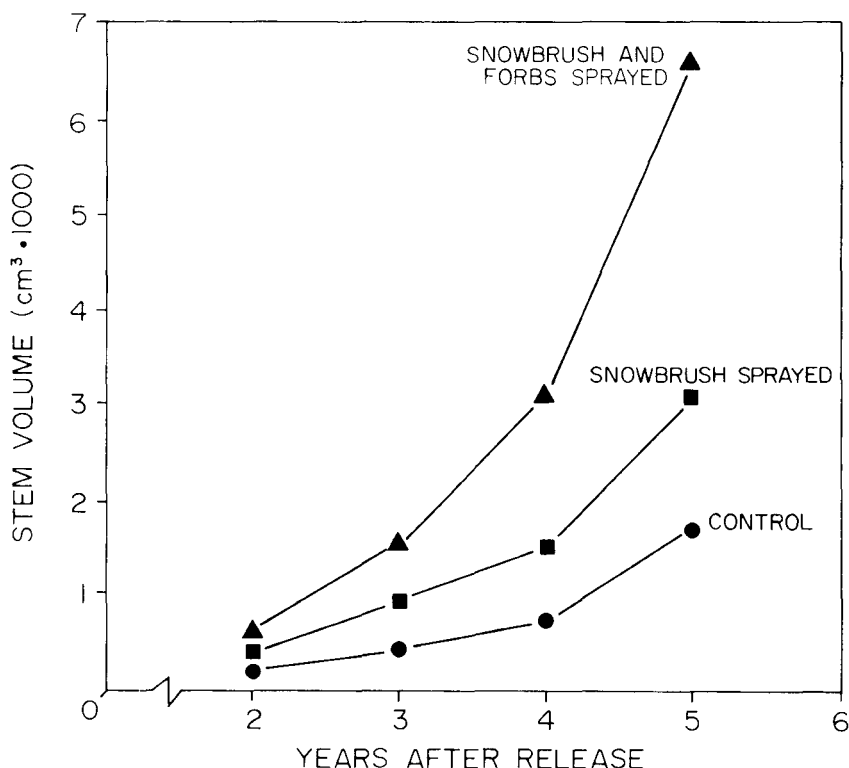


Figure 6. Growth response of Douglas-fir following competition release from snowbrush ceanothus.

manuscript is in press, and another is in the final stages of preparation. Data are being recorded for the Nelder studies and for the coastal site prep/release study. The BLM has committed funding for 2 more years; additional funding will be solicited from external sources, if extension of the measurement period is likely to produce data useful to silviculturists.

Educational Activity

Another important mission of the CRAFTS program is to facilitate the transfer of new knowledge and technology. CRAFTS furthered this transfer through publications, workshops and reports.

Publications on Herbicide Prescriptions

Susan Conard, formerly with the Forest Science Department, and Bill Emmingham, Forestry Extension, prepared five publications on herbicide control of various hardwood and brush species in the Pacific Northwest (Figure 7). These publications, which describe the responses of the major timber and weed species to a variety of herbicide prescriptions, are:

Special Publication 5. Herbicides for Shrub Control on Forest Sites in Northeastern Oregon and Northern Idaho.

Special Publication 6. Herbicides for Forest Brush Control in Southwestern Oregon.

Special Publication 7. Herbicides for Grass and Herbaceous Weed Control in Oregon and Washington.

Special Publication 8. Herbicides for Brush and Fern Control on Forest Sites in Western Oregon and Washington.

Special Publication 9. Herbicides for Clump and Stem Treatment of Weed Trees and Shrubs in Oregon and Washington.

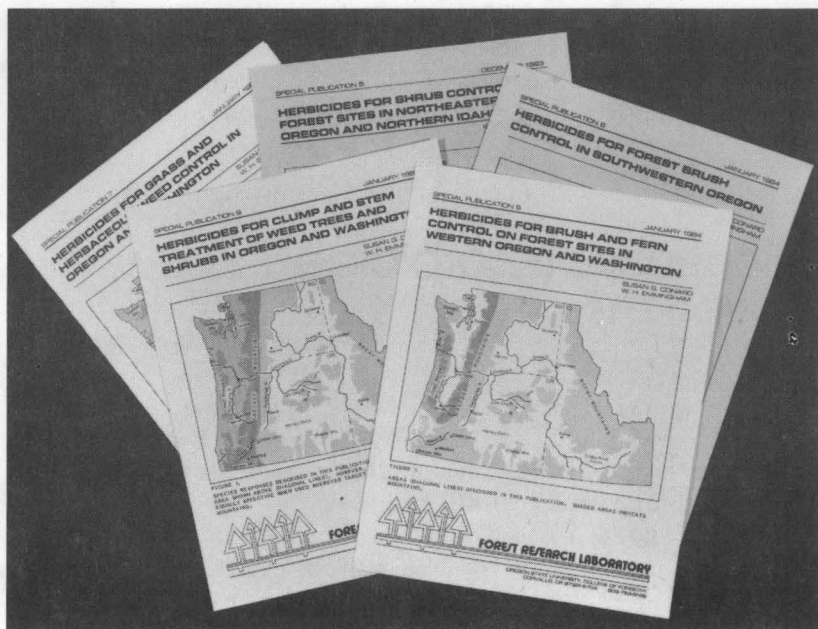


Figure 7. New publications on herbicide prescriptions.

These publications are part of CRAFTS' ongoing effort to disseminate current information to field foresters. They are available from CRAFTS, the OSU Forestry Extension Service, or the OSU Forest Research Laboratory.

Forest Vegetation Management Workshop

More than 170 foresters, land managers, and researchers attended a January workshop on forest vegetation management. This 2-day workshop was organized by OSU Forestry Extension, the OSU Forest Science Department, and CRAFTS. Many CRAFTS participants also presented information at the workshop.

The workshop brought foresters up to date on competition among plant species, vegetation problem identification and control prescriptions, herbicide application technology, and new vegetation management techniques. The program also featured a field demonstration of application equipment.

SAF Working Group Tour of CRAFTS Study Site

The Economics, Policy, and Law Working Group of the Society of American Foresters toured a CRAFTS study site as part of its consideration of the economic and legal aspects of forest vegetation management in the Pacific Northwest (Figure 8). More than 50 foresters, visiting the Northwest during the 1983 SAF national convention, were able to see first-year results of five conifer-stand release treatments on a rehabilitated area of the Tillamook Burn.



Figure 8. The SAF Economics, Policy and Law Working Group tour a CRAFTS study site on the Tillamook Burn during the 1983 National Convention.

Report Available on Herbicide Risks and Toxicology

Jack Walstad and Frank Dost have prepared a thorough scientific review of the health risks associated with herbicide use in forestry. It is a detailed analysis and synthesis of the information compiled on this subject over the past two decades. CRAFTS funded publication of this review.

The review focuses on the phenoxy herbicides 2,4,5-T and 2,4-D, and also evaluates other her-

bicides used in forestry. Toxicologic methods of determining a safe dose and the regulatory mechanisms involved in herbicide registration are explained. The report cites numerous scientific and medical reviews of herbicide safety, indicating that proper use of these materials is unlikely to harm people, animals, or the environment in general.

The report, entitled The Health Risks of Herbicides in Forestry: a Review of the Scientific Record, is available from the OSU Forest Research Laboratory.

Appendix 1

Publications and Papers Prepared by CRAFTS Personnel (1981-84)

Books, Journal Articles, or Other Publications

- Walstad, J. D. 1981. Forest vegetation management: a new discipline for an old ethic. P. 10-13 in Holt, H. A., and B. C. Fischer, eds. Weed control in forest management. John S. Wright Forestry Conference Proceedings, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana.
- Lavy, T. L., J. D. Walstad, R. R. Flynn, and J. D. Mattice. 1982. 2,4-D exposure received by aerial application crews during forest spray operations. *Journal of Agricultural and Food Chemistry* 30:375-381.
- Conard, S. G., and W. H. Emmingham. 1983. Herbicides for shrub control on forest sites in northeastern Oregon and northern Idaho. Forest Research Laboratory Special Publication 5. Oregon State University, Corvallis, Oregon.
- Conard, S. G., and W. H. Emmingham. 1984. Herbicides for forest brush control in southwestern Oregon. Forest Research Laboratory Special Publication 6. Oregon State University, Corvallis, Oregon.
- Conard, S. G., and W. H. Emmingham. 1984. Herbicides for grass and herbaceous weed control in Oregon and Washington. Forest Research Laboratory Special Publication 7. Oregon State University, Corvallis, Oregon.
- Conard, S. G., and W. H. Emmingham. 1984. Herbicides for brush and fern control on forest sites in western Oregon and Washington. Forest Research Laboratory Special Publication 8. Oregon State University, Corvallis, Oregon.
- Conard, S. G., and W. H. Emmingham. 1984. Herbicides for clump and stem treatment of weed trees and shrubs in Oregon and Washington. Forest Research Laboratory Special Publication 9. Oregon State University, Corvallis, Oregon.

Thesis

- Chan, S. B. 1983. Coniferous morphological indicators of the competitive effects of overtopping plant canopies. M.S. thesis, Oregon State University, Corvallis, Oregon.

Progress Reports and Proceedings

- Conard, S. G. 1981. A conceptual model of the influences of environment and species characteristics on glyphosate injury. Northwest Science Association Meeting Proceedings 1981: 43.
- Conard, S. G. 1982. A preliminary study of the influences of environment, phenology, and application variables of the responses of major conifer and brush species to glyphosate. Department of Forest Science, Oregon State University, Corvallis, Oregon. 59 p.
- Conard, S. G. 1982. The physiology of plant competition--an ecological perspective. Western Forestry Conference Proceedings, Dec. 1-3, 1981. Sun Valley, Idaho.
- Wagner, R. G. 1982. Preliminary first-year results of several conifer stand release treatments in the Coast Range of Oregon and Washington: CRAFTS B-level release study status report. Department of Forest Science, Oregon State University, Corvallis, Oregon. 24 p.
- Wagner, R. G. 1982. Preliminary first-year results of several conifer stand release treatments in the northern intermountain region: CRAFTS B-level release study status report. Department of Forest Science, Oregon State University, Corvallis, Oregon. 9 p.
- Walstad, J. D. 1982. Increasing fiber production through intensive forest management: opportunities through vegetation management. P. 46-50 in Increasing forest productivity. Proceedings of the 1981 National Convention of the Society of American Foresters. Orlando, Florida.
- Walstad, J. D. 1982. Enhancing forest productivity through intensive forest management: trials, trends and tribulations. Proceedings of the 3rd Annual Forest Vegetation Management Conference Proceedings, Redding, California.
- Walstad, J. D. and R. G. Wagner. 1982. CRAFTS experimental design manual for B-level studies: release of young conifer stands from uniformly distributed brush competition. Department of Forest Science, College of Forestry, Oregon State University, Corvallis, Oregon. 39 p.

- Conard, S. G., A. Jaramillo, K. Cromack, and S. Rose (eds.). 1983. The role of the genus Ceanothus in western forest ecosystems. Proceedings of a workshop held Nov. 22-24, 1982. College of Forestry, Oregon State University, Corvallis, Oregon. 108 p.
- Wagner, R. G. 1984. A survey of competing vegetation in five young Douglas-fir plantations in the western Oregon Cascades: A new approach. CRAFTS project report. Department of Forest Science, College of Forestry, Oregon State University, Corvallis, Oregon. 28 p.

Abstracts, Workshop Notebooks, and Research Summaries

- Conard, S. G. 1982. New information on herbicide use and registrations. (Abstract plus drafts of herbicide prescription publications for the Pacific Northwest). In Forest Vegetation Management Workshop Notebook, Forest Science Department, Oregon State University, Corvallis, Oregon.
- Conard, S. G. 1982. Effects of weed competition on conifer survival and growth. In Proceedings of the Southwest Oregon Forest Weed Ecology Workshop. Oregon State University Extension Service, Medford, Oregon.
- Kelpas, B. R., and R. G. Wagner. 1982. Concepts of spray equipment calibration. P. 1-12 in Forest Vegetation Management Workshop Notebook. Department of Forest Science, Oregon State University, Corvallis, Oregon.
- Wagner, R. G. 1982. A system to assess weed severity in young forest plantations for making vegetation management decisions. In Forest Vegetation Management Workshop Notebook, Forest Science Department, Oregon State University, Corvallis, Oregon.
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- Walstad, J. D. 1982. An overview of vegetation management. In Forest Vegetation Management Workshop Notebook, Forest Science Department, Oregon State University, Corvallis, Oregon.
- Walstad, J. D., and R. G. Wagner. 1982. Human health and 2,4-D exposure. P. 21 in Proceedings of the 32nd Annual Weed Conference. Washington State Weed Association. Yakima, Washington.
- Conard, S. G. 1983. Forest vegetation management. (Research summary). P. 7 in Women in Forestry. Summer 1983.

- Conard, S. G. 1983. Vegetation control-why, when, and where is it necessary? Abstract. 1983 Annual Meeting of the Oregon Chapter, Society of American Foresters. Corvallis, Oregon.
- Conard, S. G., and A. E. Jaramillo. 1983. The role of Ceanothus in forest ecosystems. Abstract 86. Proceedings of the 56th Annual Meeting of the Northwest Scientific Association.
- Wagner, R. G. 1983. Assessing weed severity in young forest plantations. P. 17 in Proceedings of the 33rd Annual Weed Conference. Washington State Weed Association. Yakima, Washington.
- Kelpsas, B. R., and R. G. Wagner. 1984. Calibrating sprayers for forest vegetation management. In Forest Vegetation Management Workshop Notebook. Department of Forest Science, College of Forestry, Oregon State University, Corvallis, Oregon. 14 p.
- Radosevich, S. R. 1984. Some basic concepts of competition and release. In Forest Vegetation Management Workshop Notebook. Department of Forest Science, College of Forestry, Oregon State University. Corvallis, Oregon.
- Wagner, R. G. 1984. Ground surveys for vegetation management decisions in young forest plantations. In Forest Vegetation Management Workshop Notebook. Department of Forest Science, College of Forestry, Oregon State University, Corvallis, Oregon. 4 p.

Publications and Papers Prepared with Assistance of CRAFTS Personnel (1981-84)

Books, Journal Articles, or Other Publications

- Cleary, B. D., and B. R. Kelpsas. 1981. Five steps to successful regeneration planning. Forest Research Laboratory Special Publication 1. Oregon State University, Corvallis, Oregon. 31 p.
- Nelson, L. R., R. C. Pedersen, L. L. Autry, C. S. Dudley, and J. D. Walstad. 1981. Impacts of herbaceous weeds in young loblolly pine plantations. Southern Journal of Applied Forestry 5(3):153-158.

- Newton, M. 1981. Ecological principles of weed control in forestry. P. 14-25 in Holt, H. A., and B. C. Fischer, eds. Weed control in forest management. John S. Wright Forestry Conference Proceedings, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana.
- Newton, M. 1981. Chemical weed control in western forests. P. 127-138 in Holt, H. A., and B. C. Fischer, eds. Weed control in forest management. John S. Wright Forestry Conference Proceedings, Department of Forestry Conference Proceedings, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana.
- Newton, M., and F. B. Knight. 1981. Handbook of weed and insect control chemicals for forest resource managers. Timber Press, Beaverton, Oregon. 213 p.
- Newton, M., and L. A. Norris. 1981. Potential exposure of humans to 2,4,5-T and TCDD in the Oregon Coast Ranges. Fundamental and Applied Toxicology 1:339-346.
- Newton, M., and S. M. Zedaker. 1981. Excavating roots with explosives. Forest Research Laboratory Research Note 68. Oregon State University, Corvallis, Oregon. 5 p.
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Appendix 2

CRAFTS Cooperative and Financial Support Received in 1983-84

<u>Cooperators</u>	<u>Financial support</u>
Boise Cascade Corporation	3,500
Bureau of Land Management	3,500
Champion International Corporation	3,500
Crown Zellerbach Corporation	3,500
International Paper Company	3,500
ITT-Rayonier, Inc.	3,500
Longview Fibre Company	3,500
MacMillan Bloedel Limited	3,500
Oregon State Department of Forestry	3,500
Potlatch Corporation	3,500
Publishers Paper Company	3,500
Rex Timber	3,500
Scott Paper Company	3,500
Starker Forests, Inc.	1,750
Sun Studs, Inc.	2,000
USDA Forest Service, Pacific Northwest Forest and Range Experiment Station	---1
Washington Department of Natural Resources	3,500
Weyerhaeuser Company	3,500
Willamette Industries, Inc.	3,500
Subtotal	\$ 59,750
Oregon State University	88,458 ²

¹Support given by in-kind contributions.

² Budget estimate for fiscal year 1984; exact figures available at year's end.

Other sources³

EPA/USDA Forest Service, NAPIAP Program (Walstad)	113,289	
USDA, Siuslaw National Forest (Radosevich)	1,540	
USDA, Siuslaw National Forest ⁴ (Radosevich)	34,800	
Weyerhaeuser Company (Newton)	10,000	
Bureau of Land Management (Newton)	5,000	
USDA, Forest Service NAPIAP Program (Radosevich)	22,736	
USDA, Forest Service NAPIAP Program (Radosevich)	13,200	
Subtotal		<u>200,565</u>
Total		\$348,773

³ Leader for project funded shown in parentheses.

⁴ Includes 23% university overhead.

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