CFIRP: What we learned in the first ten years

by Carol L. Chambers[1], William C. McComb[2], John C. Tappeiner, II[3], Loren D. Kellogg[4], Rebecca L. Johnson[5] and G. Spycher[6]

In response to public dissatisfaction with forest management methods, we initiated the College of Forestry Integrated Research Project (CFIRP) to test alternative silvicultural systems in Douglas-fir (*Pseudotsuga menziesii*) stands in western Oregon. We compared costs and biological and human responses among a control and three replicated silvicultural alternatives to clearcutting that retained structural features found in old Douglas-fir forests. Treatments were applied within 8- to 15-ha stands and attempted to mimic crown fires (modified clearcut), windthrow (green tree retention), and small-scale impacts such as root rot diseases (small patch group selection). We also compared costs in three unreplicated treatments (large patch group selection, wedge cut, and strip cut). Each treatment included differences in the pattern of retained dead trees (snags), as either scattered individuals or as clumps. Good communication among researchers and managers, a long-term commitment to the project, and careful documentation of research sites and data are important to the success of long-term silvicultural research projects. To date, over 30 publications have resulted from the project.

Key words: alternative silviculture, data management, Douglas-fir, green tree retention, harvesting costs, human dimensions, Oregon, *Pseudotsuga menziesii*, recreation, wildlife

En reponse au mecontentement du public face aux methodes d'amenagement forestier, nous avons mis sur pied le College of Forestry Integrated Research Project (CFIRP) pour mettre a l'essai des regimes sylvicoles alternatifs dans les peuplements de sapin Douglas (*Pseudotsuga menziesii*) de l'ouest de l'Oregon. Nous avons compare les couts et les reactions biologiques et humaines entre un temoin et trois repetitions d'alternatives sylvicoles a la coupe a blanc qui maintenaient les caracteristiques structurelles retrouvees dans les vieilles forets de sapin Douglas. Les traitements ont ete realises dans des peuplements de 8 a 15 ha et tachaient de reproduire les feux de cime (coupe a blanc modifiee), les chablis (retention d'arbres verts), et les impacts a petite echelle comme les pourritures des racines (coupe progressive par trouee). Nous avons egalement compare les couts de trois traitements uniques (coupe progressive par grosse trouee, coupe en V, et coupe par bande). Chacun des traitements comprenait des differences dans le plan de retention des arbres (chicots), soit en tant qu'individus isoles, ou en tant que groupe d'arbres. Il est important d'obtenir une bonne communication entre les chercheurs et les amenagistes, un engagement a long terme envers le projet, et une documentation detaillee sur les sites de recherche et les donnees afin de reussir dans le cas de projets de recherche sylvicole a long terme. A ce jour, plus de 30 publications ont decoule de ce projet.

Mots-cles: sylviculture alternative, gestion des donnees, sapin Douglas, retention d'arbres verts, couts d'exploitation, dimensions humaines, Oregon, *Pseudotsuga menziesii*, loisirs, faune

Introduction

During the past 30 years, environmental concerns and a growing dissatisfaction with the scale and intensity of land management have triggered legislative changes in federal, state, and private forest management (National Forest Management Act of 1976, Oregon Forest Practices Act of 1971, Washington Forest Practices Act of 1974, Thomas *et al.* 1993). Conservation of plant, invertebrate, and vertebrate species associated with old-growth forests in combination with increasing demands for timber products have led to a broad array of management options, ranging from no management to even-aged, two-aged, or uneven-aged management (Forest Ecosystem Management Assessment Team 1993). Alternative silvicultural systems can be used to retain structural features found in old forests and may more closely imitate natural disturbance regimes (McComb *et al.* 1993, 1994).

In 1989, we initiated the College of Forestry Integrated Research Project (CFIRP) to test alternative silvicultural systems in Douglas-fir (*Pseudotsuga menziesii*) stands in western Oregon. We compared costs and biological and human responses among a control and three silvicultural alternatives to clearcutting that retained structural features found in old Douglas-fir forests. Treatments were applied within 8- to 15-ha stands and attempted to mimic crown fires (modified clearcut), windthrow (green tree retention), and small-scale disturbances (small patch group selection). We also compared costs and monitored wildlife in three additional unreplicated treatments (large patch group selection, wedge cut, and strip cut). Each treatment included differences in the pattern of retained dead trees (snags), as either scattered individuals or as clumps. Our objectives were to:

1. Identify the logging design and layout requirements for six different stand management treatments.
2. Determine logging productivity and cost for each of the six treatments.
3. Assess the growth rates of residual mature Douglas-fir in each treatment.
4. Monitor growth and survival of planted and naturally-regenerated Douglas-fir seedlings within each treatment.

[1]School of Forestry, College of Ecosystem Science and Management, Northern Arizona University, Flagstaff, AZ 86011-0001, phone 520-523-0014, fax 520-523-1080, E-mail: Carol.Chambers@nau.edu

[2]Department of Forestry and Wildlife Management, Holdsworth Natural Resources Center, P.O. Box 34210, University of Massachusetts, Amherst, MA, 01003, E-mail: bmccomb@forwild.umass.edu

[3]United States Geological Survey, Forest and Rangeland Ecosystem Science Center, 3200 Jefferson Way, Corvallis, OR 97331, E-mail: tappeinerj@fsl.orst.edu

[4]Department of Forest Engineering, College of Forestry, Oregon State University, Corvallis, OR 97331, E-mail: kelloggl@ccmail.orst.edu

[5]Department of Forest Resources, College of Forestry, Oregon State University, Corvallis, OR 97331, E-mail: johnsonr@ccmail.orst.edu

[6]Department of Forest Science, College of Forestry, Oregon State University, Corvallis, OR, 97331, E-mail: spycherg@fsl.orst.edu

Table 1. Number of stands for silvicultural and snag treatments by replicate on the College of Forestry Integrated Research Forest Project (CFIRP), Corvallis, Oregon. Treatments were used to test effects of forest management on response variables such as wildlife, vegetation, and human attitudes. Silvicultural treatments replicated among all replicates were small patch group selection (*n* = 14), 2-story (*n* = 6), and modified clearcut (*n* = 6). Unreplicated treatments on the Dunn replication were large patch group selection (*n* = 2), wedge cut (*n* = 1) and strip cut (*n* = 1). Snag treatments were clumped (CL) and scattered (S). Control stands were unharvested. No snags were created in control stands. Replicates were established on McDonald-Dunn Research Forest between 1989 and 1991

		Silvicultural treatment											
		Small patch		Two-story		Clearcut		Large patch		Wedge		Strip	
Replicate	Control	CL	S	CL	S	CL	S	CL	S	CL	S	CL	S
Lewisburg Saddle	1	3	3	1	1	1	1	0	0	0	0	0	0
Peavy	1	3	3	1	1	1	1	0	0	0	0	0	0
Dunn	1	1	1	1	1	1	1	1	1	0	1	1	0
Total	3	7	7	3	3	3	3	1	1	0	1	1	0

5. Compare the relative abundance of terrestrial vertebrates among modified clearcut, two-storied, small patch group selection and uncut stands, both pre- and post-treatment.
6. Compare snag use by cavity-nesting birds between two spatial arrangements of snags on all treatments.
7. Determine aesthetic, recreation, and adjacent landowner responses to treatments.

Study Area

We selected three replicate sites (Lewisburg Saddle, Peavy, Dunn) representing 33 stands (11 stands per replicate) in Oregon State University's (OSU) 4800 ha McDonald-Dunn Forest located on the eastern edge of the Coast Range, approximately 24 km north, northwest of Corvallis (Township 11S, Range 5W, Willamette Baseline and Meridian (W. M.), Sections 4, 8, 9, 16, 17, Township 10S, Range 5W, W. M., Sections 14, 22, 23, 25, 27, 35, 36). Replicates were approximately 3 to 5 km apart. Elevation ranged from 120 to 400 m. Prior to treatment, stands were similar in species composition and habitat characteristics (Chambers 1996). Douglas-fir basal area averaged 38 m^2/ha in each stand prior to harvest; grand fir (*Abies grandis*) basal area averaged 1 m^2/ha. Hardwoods, including bigleaf maple (*Acer macrophyllum*), Oregon white oak (*Quercus garryana*), Pacific madrone (*Arbutus menziesii*), Pacific dogwood (*Cornus nuttallii*), red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*), and bitter cherry (*Prunus emarginata)* comprised the remaining basal area (14 m^2/ha). Live tree densities (trees ≥ 20 cm dbh) averaged 537 trees/ha for conifers and 165 trees/ha for hardwoods. Snag densities (hardwood and/or conifer snags ≥ 30 cm dbh) averaged ≤ 1.9 snags/ha prior to treatment. Stands were 80 to 120 years old and were the outcome of natural regeneration following Euro-American settlement and the subsequent elimination of prairie and hillside burning by Native Americans. We selected an average stand size of 10 ha, which was similar to the 10- to 12-ha stand sizes typically managed on public lands and large enough to sample diurnal breeding birds and small mammals (most species have home ranges that would allow several individuals to occupy stands of this size [Brown 1985]).

Treatments applied to both the Lewisburg Saddle and Peavy replicates were (1) small patch group selection (1/3 wood volume removed in 0.2-ha circular patches; in an 8-ha stand, for example, we created approximately 13 0.2-ha patches), (2) two-story (3/4 volume removed with remaining green trees [20 to 30/ha] scattered uniformly throughout the stand), and (3) modified clearcut (1.2 green trees/ha retained). Three additional unreplicated treatments to compare harvesting costs were added to the Dunn replicate: (4) large patch group selection (1/3 wood volume removed in 0.6-ha circular patches; in an 8-ha stand, for example, we created approximately 5 0.6-ha patches); (5) wedge cut (0.8- to 2-ha wedge cuts removing approximately 1/3 volume); and (6) strip cut (linear strips removing approximately 1/3 volume in 0.8- to 2-ha strips). One control (unharvested) stand was designated in each replicate (Table 1). One replicate was harvested each year for three years. Harvesting began in fall 1989 and completed by early spring 1991. Snags were created at an average density of 3.8 snags/ha in all but control stands (Chambers *et al.* 1997).

Results

Harvesting costs increased 2.5 to 32% for two-story and small patch group selection prescriptions compared to clearcutting (Kellogg *et al.* 1991, Edwards *et al.* 1992, Edwards 1993, Kellogg *et al.* 1996). We did not detect a difference in plant species composition after treatment, although we noted an increase in species richness due to inclusion of early successional species. Seedling growth did not appear to differ between the two-story and the clearcut treatments, but was variable in small patch group selection stands; influenced by aspect, competing vegetation, and height of overstory trees (Ketchum 1995).

Bird species composition in the small patch stands was most similar to the control stands. Bird communities in the two-story treatment were more similar to those in the modified clearcut treatment (Chambers 1996, Chambers and McComb 1997, Chambers *et al.* 1999). Birds used 50% of created snags within five years, but we found no difference in use of clumped versus scattered snags (Chambers *et al.* 1997). Small mammal communities in small patch stands were most similar to those in control stands, and small mammal communities in clearcut stands were most similar to communities in two-story stands (Chambers 1996).

People preferred uncut control and gap-cut stands to two-story and clearcut stands for aesthetics and hiking (Brunson 1991; Brunson and Shelby 1992a, 1992b; Johnson *et al.* 1993; Balfour 1996). Evaluation of the stands continues. Every year, students from an OSU forest recreation class rate the stands for scenic quality and recreation use.

Discussion

Project Design

The CFIR Project was designed as a randomized complete block, stand-level experiment. The degree of replication and stand size have allowed us to statistically test hypotheses about the effects of forest management on a variety of variables. Because the design is replicated, other researchers have established additional projects using CFIRP stands (e.g., Kelsey 1994, Shimizu and Adams 1993, Vance *et al.* 1994, Adams *et al.* 1998).

Project Coordination and Support

Oregon State University Research Forest staff manage McDonald-Dunn Research Forest. The Forest has a designated Research Coordinator, however, researchers often work directly in the field with research forest staff. This close coordination enabled us to avoid conflicts between management and research activities. We were able to work cooperatively to develop timetables for management activities and held periodic research reviews to update forest staff and researchers on project accomplishments.

Forest staff have permanently monumented research sites. Stand boundaries, snag locations, vegetation and wildlife sampling points, trails, streams, and other topographic features have been stored using a geographical information system. Inventories of overstory, understory, and habitat features (e.g., logs, snags) were conducted by forest staff post-treatment.

Logging revenues have initially covered the cost of operations and we anticipate that future entries will also be self-supporting. Some research funding was generated by logging revenues; however, funding for research primarily comes from other sources.

Data Management

CFIRP is a complex project involving many investigators from diverse fields collecting both qualitative and quantitative data. Data are being archived in the Oregon State University Databank using standard metadata to document data sets. Data are proofed, documented, and are accessible to researchers for immediate analyses. Because information is stored long term, it also will be available in the future for secondary analyses conducted by researchers who want to link CFIRP data to their own research (Michener 1986). Wildlife data, for example, have been used in at least three landscape modelling projects.

Data management seemed costly and time-consuming, particularly during times when researchers had the least amount of time to devote to this task (early in the development of the project). However, archiving data will provide a complete and long-term research record. Information about the research site and the data being collected (e.g., abstract, legal description of site location, definitions of coded variables, precision of measurement for each variable) is critical to complete documentation if the data are to be of long-term value. A long history of active research may be meaningless if data are not available for new comparisons.

Project Deliverables

The CFIR Project is relevant to a broad audience because of the variety of research represented and the strong public interest in forest management in the Pacific Northwest. Technology transfer and site promotion are achieved by publications (currently over 30), course instruction for university and Continuing Education students throughout the Pacific Northwest, and site visits by resource managers and researchers representing federal, state, and private management agencies throughout the United States. We also have received many visits from international resource managers and researchers (e.g., IUFRO Uneven-Aged Management Conference, Oregon State University, Corvallis, September 1997). Graduate students in the field of outdoor recreation have prepared activities for elementary and high school teachers to use in conjunction with CFIRP (Kristen Babbs, Forest Resources Department, Oregon State University, pers. comm.; Burback 1998) and an OSU English professor published a book of essays about the project (Anderson 1993). We also intend to publish a book summarizing initial findings from CFIRP.

Project Pitfalls, Concerns, and Challenges

Potential pitfalls for any long-term project include lack of communication, lack of planning, lack of coordination between research data collection and management treatments, and inadequate documentation of research results. Communication between researchers and managers is critical, especially when implementing new research. New research projects should not conflict with or compromise established projects. We have been fortunate to have had a high degree of communication, cooperation, and coordination between managers and researchers to date, which has led to the success of so many CFIRP research projects. If collaboration had been top-down, rather than interdisciplinary, we believe the progress on CFIRP would have been much slower or the project may have even failed.

Although our stand sizes (8 to 15 ha) are adequate for measuring many response variables, stands are relatively small. Our comparisons are limited to the stand rather than to the landscape level. We are restricted to one location (east-central Oregon Coast Range), which limits our scope of inference. Replicating these treatments on a regional scale would strengthen our scope of inference. It is also possible that the project will lose relevancy as changes in human values occur. Projects that target broad audiences and are well replicated will have higher long-term value.

Conclusions

What have we learned in our first 10 years? With good communication among researchers and managers, a long-term commitment to the project in terms of planning (e.g., developing 100-year management plans), technology transfer, and careful documentation of research sites and data, long-term silvicultural research projects can work very well. A shared vision, trust among all parties, and collaborative field work helped make this project interdisciplinary, NOT multidisciplinary.

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