U.S. FOREST SERVICE RESEARCH ON SMALL DIAMETER TIMBER IN THE PACIFIC NORTHWEST: THE CROP PROJECT AND RELATED WORK

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ABSTRACT

Issues, challenges and information needs are identified for improving ecological health and socioeconomic sustainability of overstocked, small-diameter forests in the interior Pacific Northwest. The context, history, goals, approach and accomplishments of the CROP ('CReating OPportunities') Project are reviewed as an example of a comprehensive research effort to generate information relevant to improving understanding, management and ultimate condition/value of overstocked, small-diameter forests. Such information is particularly relevant to wildland fire and forest health issues that are at the forefront of forest management throughout much of the interior West. Research goals of this project are to assess stand and landscape-level treatment effects on ecological function and societal values; quantify economic benefits and constraints of treatments; improve knowledge on ecological roles of CROP stands within the greater landscape; and examine the social effects, stakeholder responses and community stability effects from treating CROP stands. Related research efforts of the U.S. Forest Service Pacific Northwest Research Station are also briefly described.

Keywords: Small-diameter timber; overstocked stands; forest health

INTRODUCTION

Forest management practices over the past century, when combined with weather patterns, have significantly altered historic disturbance regimes throughout much of the interior Pacific Northwest, with consequent impacts on the distribution, structure, composition and ecological health of forests (Agee 1994; Lehmkuhl et al. 1994; USDA Forest Service 1996). In many areas, the interrelated effects of fire control and timber harvest practices have yielded overly dense forests dominated by small-diameter, low-vigor and fire intolerant tree species. In such areas, fire regimes often have shifted from frequent, low-intensity burns to increased susceptibility to high-intensity, stand replacing fires. Quigley and Bigler-Cole (1997) noted that forested areas subject to lethal fire regimes, areas susceptible to insects and disease, and volume of small-diameter timber have all more than doubled in the Interior Columbia Basin over the preceding century. Furthermore, the proportion of forest lands in early and late seral conditions has declined over the past century, with a concurrent increase in mid-seral forests often dominated by fire-intolerant species. Densely stocked, low vigor stands hence have become more common in recent decades, with increased susceptibility to catastrophic fire, insects and diseases (Hessburg et al. 1994).

Historically, management of dense, small-diameter forest stands has received limited attention because the potential economic gains were considered marginal compared to the problems, challenges and costs particular to managing such forests. This is changing, however, because of the current extent of such stands; the significance of the ecologic, economic and social issues associated with such stands; and recent advances in the economics and technologies for small-diameter timber utilization (see Hartmann and Gardner 1998). Improving the health and utilization of overstocked, small-diameter stands has become a high priority for public and private forest land managers in the interior west (Reynolds 1994), and this has created the need for scientifically credible, research-derived information upon which to base management plans. Specific forest health information (and, therefore, research) needs for the interior northwest have been described at length through several regional assessment efforts over the past decade (e.g., Everett et al 1994; Quigley et al. 1996; Jaindl and Quigley 1996). Fundamentally, research needs can be categorized within at least the following areas:

1) Improved understanding of the causes of overstocked, small-diameter forests (e.g. disturbance ecology; historic disturbance regimes and their alteration; etc.),
2) Improved understanding of the effects of such conditions on the composition, structure and function of forest ecosystems and their components, at varying spatial and temporal scales (e.g., impacts on species, populations, ecological processes, environmental quality, etc.),
3) Improved understanding of the processes of ecological restoration, and how they may be accelerated and directed through applied forest management practices to re-establish productive, healthy and sustainable forests (e.g., restoration ecology; succession/stand dynamics; applied silviculture and other managerial sciences; etc.),
4) Development of cost-effective means of deriving sustainable economic values from overstocked, small-diameter stands in a manner that have neutral to (preferably) positive ecological effects (e.g., applied silviculture; harvesting and processing systems; traditional, alternate and/or new forest products; etc.), and
5) Improved understanding of the diversity of societal needs from and values ascribed to overstocked forests, and how such needs/values can be integrated with management to attain improved ecological conditions concurrent with economic benefits (e.g., social assessments; collaborative learning/decision-making; conflict resolution; etc.)

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Substantial research has been initiated over the past decade by university, industry and public agency entities to enhance knowledge in the above areas and its application through adaptive management. As an example of integrated research, this paper will highlight one particular project pursued by the U.S. Forest Service Pacific Northwest Research Station (PNWRS), in concert with the Colville National Forest, cooperating universities and private sector land managers. Other related small-diameter timber research conducted by the PNWRS will also be briefly reviewed.

THE CROP PROJECT
Background and Setting

Northeastern Washington contains extensive areas of small-diameter, overstocked stands, most of which originated from a series of stand-replacing wildfires in the early 1900's, mainly from 1920 through 1936. Evidence suggests these fires, many of human origin, were more extensive and severe than had previously occurred under the inherent regional fire regime. The dense tree regeneration following these fires, coupled with subsequent fire suppression, has created over-dense stands of low vigor and low value trees. These forests are commonly referred to as "CROP" stands, an acronym derived from the CReating OPportunities title of the project to be described below, and occur across all ownerships, including federal, state, tribal and private.

As of 1994, roughly 110,430 acres within the Colville National Forest (CNF) alone were classified as having CROP stand characteristics (USDA Forest Service 1994), i.e., most trees in 60 to 80 year age classes, 4 to 7 inch DBH classes, less than 10.5 thousand board feet per acre, and more than 400 trees per acre. An additional, at least equal acreage of stands with 'CROP-like' characteristics (i.e., still overstocked, but with a higher proportion of larger trees) exists with the national forest. These CROP stands primarily occupy sites within western redcedar (*Thuja plicata*) and subalpine fir (*Abies lasiocarpa*) plant associations, and secondarily western hemlock (*Tsuga heterophylla*) and Douglas fir (*Pseudotsuga menziesii*) plant associations. The degree of departure from potential forest composition is reflected by the fact that over 50% of CNF CROP stands are presently dominated by lodgepole pine (*Pinus contorta*), with other dominant or co-dominant species including western larch (*Larix occidentalis*), Douglas fir and grand fir (*Abies grandis*).

CROP stands are of ecological concern in northeastern Washington because they provide limited habitat and biodiversity benefits, are prone to insect/pathogen infestation, and contribute to increased fuel loads that could precipitate future catastrophic fires. Economic concerns include low productivity coupled with limited opportunities for profitably utilizing small-diameter trees. Developing management and utilization strategies that are ecologically sustainable, technically feasible, economically viable, and socially acceptable is a major challenge for National Forest land managers and others in the region.

As noted by Findley et al. (2000), considerable frustration had developed by the mid-1990's concerning the limited knowledge and resources for effectively managing CROP stands on public lands. Concordant with this frustration occurred a shift in National Forest management policy, wherein emphases changed from managing individual resources/values to managing ecosystems in a holistic manner that incorporates all ecological and socioeconomic issues, with particular attention to health and sustainability of ecosystems at multiple scales (i.e., from stand to landscape). Accordingly, the CNF developed the CROP (again, 'CReating OPportunities') program in 1994 to investigate treatments that would improve the health and vigor of dense forests while producing economic benefits to rural communities in northeastern Washington (USDA Forest Service 1994). Initial research suggested that new harvesting/milling technologies held promise for realizing economic gain from such stands (Barbour et al. 1997), and predicted that desired changes in ecological characteristics of CROP stands (e.g., structure, fire/insect/pathogen risk, wildlife habitat and tree density) was possible with prudent silvicultural intervention (Willits et al. 1996). What remained limited was area-specific, research-derived information on effectiveness and impacts of treatments and technologies. Consequently, a coordinated, comprehensive and long-term research, development and application program was proposed to yield such information for incorporation into adaptive management plans.

Research Project Genesis

In light of the above needs, the U.S. Congress in 1996 (House Report 104-625) recognized that an opportunity existed on the Colville National Forest (CNF) to demonstrate how rural economies might be stimulated while addressing forest health issues. Funding was earmarked both for implementation of adaptive management of CROP stands by the CNF, and for support relevant of research integrated with that management. The resultant CROP Research Project was led and administered through the PNW Research Station, but involved significant collaboration with regional universities (i.e., Universities of Idaho and Washington, and Washington State University); cooperation and integration with CNF adaptive management projects; and communication with private forest land managers and the public in the region. Following extensive discussions with stakeholders and cooperators, a detailed Research Plan was prepared by Quigley (1997) that established goals, an overall framework and short/longer-term plans for this research.

Goals and Objectives

The CROP Research Project is designed to yield insight on how CROP stands might be managed to:

- provide predictable outputs of forest products and other values;
- reduce risks of and effects of catastrophic disturbances; and
- promote improvement of ecological condition and function.

As stated by Quigley (1997), the overall research goal is "...to provide information and technology that allows land managers to better understand CROP and CROP-like stands, and implement treatments that maintain or restore ecological functions and processes while providing sustainable flows of forest products to enhance community stability..." More specific goals are to:

a) Assess stand and landscape-level treatment effects on ecosystem processes and societal expectations,
b) Quantify the economic benefits and constraints of silviculturally treating CROP stands to improve forest health and future productivity,
c) Gain further knowledge about the ecological roles of CROP stands within the greater landscape, and
d) Examine the social effects, stakeholder responses and effects on community stability from treating CROP stands.

Research objectives pursuant to the above goals are tripartite, i.e., to:

1) generate stand-level information on treatment responses, issues, questions and concerns, suitable for designing fine-scale management planning;
2) gain landscape-level information pertaining to the distribution, role and effects of CROP stands, suitable for landscape-scale planning for ecosystem management; and
3) provide information on linkages between landscape and stand-level dynamics as influenced by management (i.e., to determine how landscape-scale desired future conditions might be achieved through aggregated effects of stand-scale treatments).

Achieving the above research goals and objectives will provide information directly applicable to a number of short and long-term management objectives for CROP stands on the CNF, including:

- Restoring vegetation patterns and structures that are sustainable under inherent disturbance regimes and that provide desired ecological conditions and societal values,
- Decreasing risk from catastrophic fire, insects and disease,
- Improving wildlife habitat,
- Improving stand aesthetics, and
- Improving and sustaining economic benefits from timber and other forest products.

Research Approach

The CROP Project has been structured not as a single, all-encompassing study, but rather as an ongoing series of smaller studies, of varying durations, that are integrated with regard to design, implementation, outcomes and relevance to the broad goals and objectives of the Project. This approach is inherently more flexible than that of pursuing a single, larger study design over the long term, and hence is more responsive to unanticipated future opportunities, needs and issues. Individual research projects have been proposed, selected, designed and implemented by PNWRS and collaborating university scientists with a goal of addressing important questions in a comprehensive, integrated fashion (i.e., both multi- and interdisciplinary work). Research therefore has involved input from a variety of basic and applied science fields, including landscape ecology, fire ecology/management, disturbance and restoration ecology, forest plant ecology, wildlife ecology and management, watershed/hydrology/aquatic sciences, soil science, silviculture, forest engineering/harvesting systems, forest economics and natural resource social science.

Several specific studies have been interfaced with operational demonstrations of management practices conducted (or to be conducted) by the CNF. In these studies, responses to or effectiveness of forest management or harvesting practices are discerned by research scientists through both experimental and monitoring activities, with research-derived information fed back to CNF managers in an adaptive management scenerio. Demonstration projects have been designed to apply and evaluate several tree harvesting systems, not only with respect to economic aspects but also in terms of effects on soils; tree damage, growth and stand dynamics; insects and pathogens; fuel dynamics and fire behavior potential; and watershed/riparian zone/aquatic system characteristics.

A second type of investigation involves studies of broader scope, focusing upon regionalization of stand conditions, patterns, disturbance regimes, and social and economic factors. Lastly, efforts to extend outcomes of research, development and application studies to potential users have included education and technology transfer activities in partnership with Washington State University Cooperative Extension (Washington State University) and, more recently, liaison with the Rural Technology Institute (University of Washington/Washington State University).

Current Accomplishments

Progress, products and findings of specific CROP Research Project studies are detailed in other papers within this Proceedings, and therefore will not be reiterated here. Rather, the following paragraphs will briefly describe the studies implemented thus far to illustrate accomplishments within the context of the overall project. A listing of specific past and current studies is presented in Table 1.

Outcomes of broad-scale studies to-date have proven very useful in establishing the social, economic and ecologic context for CROP stands and their management in the project area. The CROP program social assessment (Findley et al. 2000, 2001; Blatner et al. 2002) identified peoples' views on CROP stand management alternatives, the diversity of values local stakeholders attached to small-diameter stands, and perceived impacts of the CROP program. Seven distinct societal groups were identified based upon positions, perceptions and preferred management of CROP stands, and several societal response themes emerged with value for future public involvement in decision making processes. Financial analysis research (Fight 1999, 2002) developed software and models for 'Financial Evaluation of Ecosystem Management Activities' (FEEMA), which evaluates combinations of treatments, stand conditions and harvesting requirements by their estimated financial value to potential timber purchasers. The models have been applied for evaluating CROP stand treatments in the project area. Other broad-scale economic research is nearing completion that will clarify the value, development potential and management implications of non-timber forest products (particularly wild huckleberries) in CROP stands (Carroll et al. 2002).

Ecologically, outcomes of broad-scale, regionalization studies have elucidated historic reference conditions of vegetation groups and spatial patterns for the project area, and estimated current departures from these reference conditions resulting from management over the past century—

Table 1.—Specific investigations, CROP Project, Colville National Forest, 1997-2001.

	Description	Investigators	Status
Broad-Scale Studies:	Assessment of societal issues concerning management of CROP stands	Findley, Carroll & Blatner (WSU)	Completed
	Availability and use of non-timber forest products from CROP stands	Blatner & Carroll (WSU)	Complete
	Financial analysis of feasibility of implementing ecosystem management on CROP stands	Fight (USFS)	Completed
	Wildlife habitat considerations for CROP stands	Creighton, Baumgartner (WSU) & Lehmkuhl (USFS)	Completed
	Regionalization of departures from historic landscape patterns, Okanagon Highlands & South Deep Watershed	Hessburg (USFS)	Completed
	Inherent disturbance regimes and biological legacies associated with CROP stands	Everett & Schellhaas (USFS), Baumgartner (WSU)	Ongoing
Demonstration Area Studies:			
a) Fritz:	Cost and production of alternative harvesting technologies suitable for use in CROP) stands	Johnson (UI)	Completed
	Likely stand development trajectories resulting from alternative silvicultural options	Camp (USFS-Yale)	Nearing Completion
	Residual tree damage from alternate harvesting systems in CROP stands	Camp (USFS-Yale)	Nearing Completion
	Effects of different harvesting technologies on soils	Miller, Tepp, Landsberg (USFS)	Nearing Completion
	Characterizing pre- and post treatment fuel loads and fire risk for CROP stands	Ottmar & Wright (USFS)	Nearing Completion
b) South Deep:	Cost and production of alternative harvesting technologies suitable for use in CROP) stands	Johnson (UI)	Ongoing
	Riparian zone & stream responses to different management and treatment options	Bisson (USFS)	Ongoing
	Application of a management information system (LMS) to evaluate treatment options in CROP stands	Oliver (UW-Yale) Lippke (UW)	Ongoing
	Fire history of South Deep watershed	Schellhaas & Camp (USFS)	Completed
	Regeneration of western larch following silvicultural manipulation of CROP stands	Camp (USFS-Yale)	Ongoing

including specific, in-depth analyses of the South Deep Watershed demonstration area (Hessburg 2000). Another study is nearing completion that will clarify inherent disturbance regimes (including fire) associated with CROP stands in the project area, and their implications for management and sustainable stand legacies (Everett and Baumgartner et al. 2002). A broad survey of wildlife considerations has been completed (Creighton et al. 2001; Lehmkuhl et al. 2002) that includes management implications for CROP stands from the standpoint of wildlife values.

Outcomes of the broad-scale research reviewed above, including the landscape-scale studies, ultimately will be linked to the stand-level research being pursued at the Fritz and South Deep Demonstration Areas. Berube (2002) summarizes the status of these two demonstration areas elsewhere in these proceedings. Silvicultural and harvesting treatments have been implemented by the CNF on the Fritz area, and should be implemented on South Deep in the near future. For the Fritz Demonstration, cost and production studies of harvesting technologies (Johnson 1999, 2002) provided insights on relative efficiencies of 8 harvest systems (4 on steep slopes and 4 on gentle slopes) utilized to achieve silvicultural prescriptions. Through pre- and post-treatment sampling, concurrent studies investigated the effects of harvesting technologies on soils (Tepp 2000a, 2000b; Miller 2002) and fuel/fire risk characteristics (Ottmar 2002). Stand dynamics studies coupled pre- and post-harvesting measurements with growth and yield modeling to compare effects of the applied and alternative silvicultural prescriptions (including a non-treated option) on future stand conditions and their appropriateness to management objectives (Camp 2002). Additional research addressed the extent, severity and nature of damage to residual trees from the various applied harvesting systems (Camp 2002; Camp in press).

Although silvicultural and harvesting treatments have not yet been applied to the second demonstration area (South Deep Watershed), several studies have been initiated to garner pre-treatment information. Schellhaas et al. (2000) completed studies elucidating the fire history of the watershed, and findings will be integrated with those of the broad-scale studies of inherent disturbance regimes/ biological legacies (Everett and Baumgartner et al. 2002) and vegetation regionalization (Hessburg 2000) noted earlier. A major new study has been initiated to investigate the usefulness of a personal computer-based landscape management system (LMS)(McCarter et al. 1998) to assist in planning and assessing management alternatives and the possible future conditions of CROP stands in the South Deep Watershed. As with the antecedent Fritz demonstration, silvicultural prescriptions will soon be implemented on the South Deep demonstration area using a range of harvesting technologies. Effects of prescriptions on forest dynamics will be subsequently monitored, including input of new information into the LMS system for evaluating short and long-term outcomes. An additional new study has been initiated to evaluate effects of commercial thinning treatments within riparian habitat conservation areas (RHCA) in the South Deep watershed (Bisson and Camp 2000), and baseline, pre-treatment watershed and stream data have been collected in 2000 and 2001. Lastly, studies on cost and production of alternative harvesting technology treatments will be investigated by L. Johnson and colleagues at the University of Idaho, with objectives and approaches similar to those of the earlier Fritz demonstration study.

Outreach and technology transfer activities have also been features of the CROP project. Collaborative learning elements of the previously described social assessment study (Findley et al. 2000, 2001; Blatner et al. 2002) were designed not only to facilitate communication and understanding on CROP project goals and objectives among Forest Service scientists, managers and stakeholders, but also public involvement in CROP stand research and management. Collaborative work with Washington State University Cooperative Extension has utilized several modes of communication to transfer information and technology to user groups in the region, including extension publications (e.g., Creighton et al. 2001); structured educational events (e.g., this symposium and its proceedings); and on-the-ground demonstrations of CROP stand management strategies that augment the formal research described previously. A conspicuous example of the latter is the Sherwood Creek Demonstration forest (Griessmann et al. 2000) dedicated late in 2000 on private forest land owned by R. Playfair near Chewelah, Washington. This area is well-positioned to serve as an educational resource for private (and public) forest managers in the region, where findings of CROP research as well as other management strategies may be applied and outcomes demonstrated.

Future Project Directions

Under current levels of project support, near-term emphasis of the CROP Research Project will be to complete current broad-scale studies and those on the initial demonstration area (Fritz), including publishing results and supporting technology transfer efforts. Concurrent efforts will focus on implementing silvicultural/harvesting treatments on the second, South Deep demonstration area in concert with the CNF, and pursuing completion of ongoing and potential new research studies in that area. We also intend to review overall project progress and stakeholder priorities during 2002, to determine how best to focus future research and limited resources to meet clientele needs.

Preliminary assessments suggest opportunities for increased future CROP research efforts in a number of specific areas, including:

- Improved understanding of linkages between stand and landscape-scale CROP management strategies and outcomes important for managing landscapes containing or dominated by CROP stands;
- Increased emphasis on water, watershed and riparian zone issues related to CROP stands;
- Increased attention to issues surrounding the ecology and management of fire and fuels, with particular emphasis on fuel dynamics as influenced by silvicultural treatments;
- Expanded work on the economic elements of managing CROP stands, including incentives, new or value-added products from CROP stands, and associated extraction-processing technologies and marketing issues;
- Improved understanding of the impacts of CROP management strategies on particular resources or

ecosystem components/attributes, for example effects on soils, weedy, invasive species, sensitive plant/animal species or regional biodiversity; and
- The potential for stewardship contracts or other non-traditional methods to economically achieve desired conditions for CROP stands.

Which of the above or other future areas of investigation will be pursued, and in what manner, will depend upon outcomes of Project review in the near future, coupled with availability of financial and human resources.

Outcomes and products from the CROP Research Project will become increasingly valuable to individuals, agencies and organizations, in both public and private sectors, that are charged with meeting the challenges of managing forested landscapes that include CROP stands or derive current or potential socioeconomic value from such stands. These products are currently being or soon will be used by the following stakeholders:

- Nonindustrial private, state and tribal land owners and managers, often on ownerships interspersed with federal forest land, who are coping with similar problems,
- National Forest managers, especially on the Colville National Forest in northeastern Washington (as the project area and primary cooperating Forest) but also on other proximal national forests with similar conditions and problems, and
- Forest products firms who either own/manage industrial forest lands or extract products from federal, state or NIPF forest lands.

Outcomes from the CROP project will also interest and have potential use by organizations and individuals concerned about the condition, values and uses of forest lands in the vicinity of the CROP Project research sites and throughout the inland northwest.

RELATED U.S. FOREST SERVICE RESEARCH EFFORTS IN THE PACIFIC NORTHWEST

The scope and outcomes of the CROP Project should be considered in the context of a much wider spectrum of past and present research on small-diameter timber and related subjects within the Pacific Northwest region. The following paragraphs will briefly describe additional current research programs within the USFS Pacific Northwest Research Station (PNWRS). To these programs must be added a significant array of other relevant work being pursued by several regional universities, other state and federal entities (e.g., Rocky Mountain Research Station) and private industry that is beyond the scope of this paper to review, but which comprises an essential complement to USFS-PNWRS research.

Within the PNWRS, research relevant to ecology, management, utilization and socioeconomic values of small-diameter timber has been or is being conducted by multiple programs and teams, as well as through several Station-wide initiatives (e.g., Sustainable Management Strategies, Reducing Fire Risk, Wood Compatibility, and Forest Health). Key current small-diameter timber research programs of the PNWRS include those of the:

- Ecologically Sustainable Production of Forest Resources Team (Portland Lab; J. Barbour, Team Leader), which focuses upon forest products, markets, values and the analysis, design and implementation of forest management activities—including the utilization and marketing of small-diameter timber (see Barbour et al. 1995; Barbour 2002 for representative research)
- Joint Production in Land Management Team (Portland and Corvallis Labs; R. Fight, Team Leader), which pursues research on financial evaluations and development of analytical tools for assessing management activities and the production of forest products—including the utilization of small-diameter trees (see Fight 1999, 2002 for representative research)
- Westside Silviculture Options Team (Seattle and Olympia Labs; S. Reutebuch, Team Leader), which focuses on developing and evaluating a wide range of silvicultural systems to meet diverse management goals—including silvicultural options for small-diameter stands (see Marshall 2002 for representative research)
- Disturbance Ecology and Management Team (LaGrande Lab; J. Hayes, Team Leader), which includes emphases on developing management options for disturbance-related silvicultural concerns, such as fire, weed and insect/disease risks and fuels reduction, including applications to small diameter stands; and development of landscape analysis systems to assist land managers and policymakers (see McIver 2002 for representative research)
- Fire and Environmental Research Applications Team (Corvallis and Seattle Labs; S. Sandberg, Team Leader), which targets understanding and decision support systems for fire and fuels ecology and management (see Ottmar 2002; Schmoldt et al. 1999 for representative research)
- Eastside Forest Health Restoration Team (Wenatchee Lab; E. DePuit, Team Leader), which focuses on understanding forest disturbance regimes and their effects at multiple scales, and restoration of ecological health/integrity to degraded ecosystems (see Hessburg et al. 1994; Lehmkuhl et al. 1994 for representative research)

Recently, representatives from certain of the above PNW teams (i.e., J. Barbour, R. Fight, S. Reutebuch, R. Haynes) have joined with scientists in the USFS Rocky Mountain Research Station's Moscow, Idaho Laboratory (D. Ferguson and R. Graham) to establish an informal small-diameter timber research oversight group, in an effort to foster collaborative regional research across state and station boundaries. A preliminary plan for coordinated and collaborative research has been developed to:

1) Characterize stand and management differences between Westside (coastal) and Eastside (interior) small-diameter timber resources;
2) Produce a synthesis of past silvicultural research on treatments of overstocked, small-diameter stands; and

3) Identify appropriate technologies and related cost/impact data for the harvest and transport of small-diameter materials.

Potential partners in this work include regional universities, USFS technology development centers, and collaborating research and development entities in Canada and within the industrial sector. It also may be both appropriate and beneficial to integrate this new, coordinated regional work with that of the CROP Project.

SUMMARY

This paper has briefly reviewed the major issues and concerns related to the causes, condition, values, utilization and improvement of small-diameter, overstocked stands in the interior Pacific Northwest. Perceptions on major information needs have been presented, for which basic and applied research-derived knowledge is necessary to promote improvements in the ecologic condition, economic and social values of such stands. The CROP Project of the USFS-PNWRS has been highlighted as an example of a research effort to provide comprehensive, relevant answers to important questions on the management and utilization of small-diameter, overstocked forests; and other related research of the PNW Station has been briefly described.

Although recognition of the magnitude of forest health problems of overstocked interior western forests has been relatively recent in the public and land management policy sectors, the nature and underlying causes of declining forest health has been apparent for decades. As discussed by Mutch (1994), Harold Weaver noted nearly 60 years ago that..."the complete prevention of forest fires...has certain undesirable ecological and silvicultural effects. Conditions are already deplorable and are becoming increasingly serious over large areas." (Weaver 1943). While the causes of forest health problems may be fairly well-understood, however, our knowledge on how to accelerate and direct recovery of unhealthy forests is still very imperfect. In striving to meet the challenges associated with managing overstocked forests, we must remember that such forests have not appeared instantly, but rather have developed over a century of atypical disturbance regimes. Restoring such forests to proper ecological function, concurrent with improved socioeconomic values, consequently may be expected to take time—even if and when optimal management strategies are identified through research, application and evaluation. If re-establishment of forest ecosystems that are ecologically and socioeconomically sustainable is the ultimate goal, then a similarly sustained effort in research and adaptive management would seem necessary.

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