FISH AND WILDLIFE HABITAT IN MANAGED FORESTS RESEARCH PROGRAM

PROGRAM OF RESEARCH

FY 2004
(July 1, 2003 - June 30, 2004)

College Of Forestry
Forest Research Laboratory
OREGON STATE UNIVERSITY
Corvallis, Oregon

February 20, 2004
Foreword

The 1993 Oregon Legislature added $0.10 per thousand board feet to the Oregon Forest Products Harvest Tax rate for research through the Forest Research Laboratory (FRL) to provide new information about meeting the needs of fish and wildlife in managed forests of Oregon. The FISH AND WILDLIFE HABITAT IN MANAGED FORESTS RESEARCH PROGRAM (F&W Program) was established on November 1, 1994, with recommendations from a Technical Advisory Committee comprised of fish and wildlife specialists and forest managers from government, industry, and non-industrial land owners to the FRL Director. The F&W Program is primarily conducted within the College of Forestry Forest Engineering, Forest Resources, and the Forest Science Departments, with collaboration from scientists residing in other OSU units and federal agencies not uncommon.

Based on the harvest level at the time, the F&W Program was initially funded with $457,485 in increased Harvest Tax revenues annually. Research, technology transfer, and service activities were selected by College program leaders based on advice received from the Technical Advisory Committee and in consultation with key faculty. When this new program was initiated in 1994, the overall FRL research program already included numerous research projects on fish and wildlife in managed forests. These efforts were funded with revenues from the State and grants obtained from various sources. The establishment of this new program unfortunately coincided with reduced State appropriations to the FRL as a result of the passing of Measure 5 and decreased timber harvest on federal lands. Thus, in the first few years of the F&W Program, the revenues from the increased Harvest Tax rate were critical in ensuring the timely completion of those existing fish and wildlife studies.

In recent years, all activities funded through the F&W Program are new efforts that address timely issues identified collaboratively by the Technical Advisory Committee, College program leaders, and the faculty. Since 2002, new projects have been selected with a priority towards those that contribute to the scientific information base that supports the Oregon Forest Practices Act.

The budget for FY2004 is $349,000, a result of the projected harvest of 3.49 billion board feet. The FY2004 program of work reflects several changes from FY2003. Two research projects were completed, providing resources for reallocation to new activities. Based on the advice of the F&W Program’s Technical Advisory Committee, these resources are sufficient to initiate three new projects and continue five research projects.

Many of the F&W Program’s activities have been conducted with additional funds from several sources, making their “value” far greater than the funds from the Harvest Tax. This is not duplication of funding, but illustrates how Harvest Tax funds are leveraging other resources, making “the dollars go farther.” Without the FRL funds AND the other funds, many of these projects would not be possible. Other FRL programs continue to contribute to or complement the goals of the F&W Program. Funded from a variety of sources, these activities are not included in documents describing this F&W Program because they are not explicitly part of the effort funded by the increase in Harvest Tax rate.

I am confident this program will help with both policy and management - to the benefit of the people of Oregon.

Hal Salwasser, Dean and Director
College of Forestry and Forest Research Laboratory
July 1, 2003
Historically, fish, wildlife and timber have been managed largely independently. With increasing demands for more of all of these resources from a common land base, it has become essential to find ways in which their individual productivities can be optimized in aggregate. Current forest resource management, policy, and regulation attempt to do this, but they are hampered by serious gaps in knowledge. In some cases these are very specific gaps, requiring testing of a specific strategy. In other cases it is a larger and more fundamental gap, requiring the development and testing of new concepts. This enhanced program of research, service and technology transfer was developed to fill at least a portion of these gaps. The goal is to provide the information needed by forest managers and policy makers in the establishment and evaluation of forest policy, and the active management of Oregon forests, with a specific focus on the science needed to support the Oregon Forest Practices Act.

The purpose of this document is to describe the Fiscal Year 2004 activities of the FRL that comprise the program funded by the 1993 legislative increase in the Oregon Forest Products Harvest Tax rate. This document is organized by new and continuing projects and activities, which can be sorted into three areas: a) Research, b) Service and c) Technology Transfer. Oregon Forest Products Harvest Tax revenues fund projects and activities wholly or in part. A description of each active project follows this introduction.

Research: There are five continuing research projects that are funded by this program in FY2004. The initial project objectives were completed for two studies in FY2003 including:

1) Snags and Reserved Green Trees: Mortality Rates and Primary Cavity Nester Use
2) The Magnitude and Timing of Surface Runoff from Forest Roads Relative to Stream Flow in Live Stream Crossing Culverts in the Oak Creek Watershed

Three new research projects are being initiated in FY2004. The first new project addresses the contribution of riparian vegetation to the nutritional needs of organisms in riparian terrestrial and aquatic food chains. It builds on ongoing CFER studies of riparian food chains by assessing the biological availability of different leaf litter types in both terrestrial and aquatic riparian environments. The second project will assess riparian function and water quality in both agricultural and forestry settings in order to help promote basin-wide natural resource management aimed to improve water quality and aquatic habitat in the Calapooia River. The third project will investigate how the direct and cumulative effects of intensive forest management activities interact with landform, surface geology, and other habitat characteristics to influence distribution and abundance of stream amphibians within a watershed, where contemporary industrial management practices are used.

Service: The service area includes activities that are not research, but which support current forest management and policy development activities. There are no active service activities planned for FY2004.
Technology Transfer: Technology transfer is a function that is an integral part of the research process. No active projects are underway this year. The fish passage design guide and the stream habitat improvement manual are in preparation for printing in College of Forestry publications shop.
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## New Projects

### Research

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## Continuing Projects and Activities

### Research Projects

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List of FRL Technical Advisory Committee Members
New Projects

Following guidance by the Technical Advisory Committee and final approval by the FRL Director, three new activities were initiated in FY2004. New projects are intended to meet high priority needs identified during the annual advisory committee meeting.

New Research Project 1

Title: Contributions of Riparian Vegetation to Terrestrial and Aquatic Food Chains: Contrasting Alder and Douglas-fir Riparian Forests

Principal Investigators: Steven Perakis, USGS Forest and Rangeland Ecosystem Science Center, OSU, & CFER program, David Hibbs, OSU Forest Science Department & CFER program

Relevance to program mission: This research addresses the contribution of riparian vegetation to the nutritional needs of organisms in riparian terrestrial and aquatic food chains. It builds on ongoing CFER studies of riparian food chains by assessing the biological availability of different leaf litter types in both terrestrial and aquatic riparian environments.

Objectives: In both alder- and conifer-dominated riparian reaches, characterize
1) the biological availability of plant litter in both riparian forest and stream ecosystems
2) how stream and soil chemical characteristics further regulate biological availability of litter.

Overview: Vegetation plays many critical roles in the productivity of riparian terrestrial and aquatic habitats. Two roles have received much attention in previous studies: large wood and shade. While both of these issues are far from completely understood, enough understanding has been generated that they are being used as the basis for current and new riparian management regulations.

An ignored yet critical role of riparian vegetation is as a source of nutrition for riparian consumer organisms including insects, birds, bats, rodents, amphibians and fish. With the main exception of insects, however, only a few organisms feed directly on riparian vegetation. Instead, most organisms derive their nutrition from food chains, which are supported at their base by the breakdown and incorporation of leaf litter into fungi, insects, etc. In small headwater streams, riparian leaf litter inputs provide essential subsidies that fuel in-stream productivity of insects and fish. Leaf litter inputs can also be important in subsidizing food chains of terrestrial habitats. For example, our ongoing CFER research in coastal Oregon riparian zones indicates that the most abundant birds in these habitats feed primarily at the ground leaf litter surface.

Plant species vary greatly in the nutritional quality of their leaf litter, and these variations translate directly to differences in the timing and rates of leaf litter breakdown. Given the potentially critical role that riparian vegetation plays in subsidizing the productivity of terrestrial and aquatic riparian food chains, there is a risk that current riparian management strategies based solely on large wood and shade needs may be creating a new set of riparian problems, a new set of limiting conditions. Intuitively it makes sense to balance large wood and shade needs with the nutritional values provided by riparian vegetation, yet information on the nutrition role is sorely lacking.
The CFER program has initiated a large, multi-year program to address this nutritional issue. It has ongoing studies to examine how vegetation composition and physical characteristics of riparian zones influences the delivery of leaf litter to riparian soils and streams in both alder- and conifer-dominated riparian systems. This information is being related to the diets and fitness of birds, bats, insect, amphibians and fish. In all cases, the association with the vegetation is through correlation with the abundance of different vegetation types. A critical connection missing in this study is a direct measure of the availability of different plant-derived nutritional food sources in both riparian forest and aquatic environments. We propose here to do that study.

**Approach:** The CFER riparian food chain study has for one year examined a series of sites within the Coast Range located in the Nestucca, Alsea, and Siuslaw drainages. We propose to focus this work on those reaches where studies are currently examining the magnitude and timing of vertical and lateral leaf litter inputs to riparian soils and streams. Most of these sites overlap with reaches being used for the aquatic insect and amphibian studies.

The rate of leaf litter breakdown (measured as the loss of mass and specific biochemical compounds) provides an integrative measure of the nutritional quality of different leaf litters in terrestrial and aquatic food chains. We propose to measure seasonal rates of alder and conifer leaf litter breakdown in riparian soil and stream environments to determine differences in these two important litter types. We will compare rates of alder vs. conifer breakdown in both terrestrial and aquatic habitats, and in alder vs. conifer dominated riparian zones. Direct biochemical measures of litter nutritional quality (lignin:nitrogen ratio) during breakdown will also be assessed in order to understand the cause for differences among plant species and habitats. Finally, since the nitrogen concentration of the surrounding soil and stream water environment can affect litter breakdown, we will contrast results for nitrogen rich vs. nitrogen poor areas of the Coast Range. Areas of contrasting nitrogen richness will be selected on the basis of historic and contemporary alder abundance using aerial photos, with direct measurement of soil and stream water nitrogen concentrations at the sites chosen for decomposition experiments. This will support one master’s student project.

New Research Project 2

Title: Managed Forests and Their Role in Maintaining Water Quality in a Multi-land Use River Basin

Principal Investigator: Stephen H. Schoenholtz, Associate Professor, Department of Forest Engineering


Relevance to Program Mission: The Calapooia River is a tributary of the Willamette River that flows 65 miles from headwaters in the west-central Cascade Range to its confluence with the Willamette River near Albany. The headwaters of the Calapooia are forested and occur within the Willamette National Forest. The river then flows through land predominately occupied by industrial forestry landowners, which is subjected to intensive, contemporary forest management designed to provide a long-term source of wood while sustaining soil and water resources and long-term productivity. As the river flows into the Willamette Valley, land use changes from forest management to agriculture, with a primary emphasis on production of grass seed.

Winter steelhead and cutthroat trout occur in the Calapooia River. However, the river is 303(d)-listed for impaired water quality because of dissolved oxygen, temperature, and fecal coliform levels that do not comply with federal and state water quality standards The success of eliminating impairment of water quality for rivers such as the Calapooia depends on availability of scientific information specific for the river, including data on water quality in relation to land use within the watershed, and the role of the riparian zone which functions as the interface between terrestrial processes and aquatic properties and processes. The multiple land use types within the Calapooia Watershed offer an outstanding opportunity to evaluate the role of contemporary forest management regarding water quality in relation to other types of land management within the river basin.

Although investigations of riparian function in relation to nitrogen and phosphorus dynamics have occurred and are ongoing within the Willamette Valley, research to date in the Calapooia watershed has focused exclusively within an agricultural setting. Thus, there is a lack of information that integrates the relative role of different land uses within this multi-landuse basin, where contemporary forest management plays a significant role. This project will assess riparian function and water quality in both agricultural and forestry settings in order to help promote basin-wide natural resource management aimed to improve water quality and aquatic habitat in the Calapooia River.
Objectives:
- Evaluate the relative contribution of current forest management practices to water quality, with an emphasis on dissolved nitrogen and temperature, in the Calapooia River.
- Investigate relationships between land use and river water quality throughout the watershed.
- Contribute to development of integrated river basin management that will improve habitat for aquatic species, particularly winter steelhead and cutthroat trout.
- Collaborate with ongoing investigations within the watershed.

Approach: The above objectives will be achieved by assessing dissolved nitrogen and water temperature along the length of the river in relation to adjacent land use and riparian conditions. River water and groundwater samples collected at monthly intervals will be analyzed for total N, organic N, nitrate-N, and ammonium-N in the USDA-ARS laboratory on the Oregon State University campus. The USDA-ARS has agreed to provide laboratory analyses as in-kind support for this project. Nitrogen processes, including net mineralization/immobilization and denitrification within the riparian zone will be assessed at monthly intervals in representative land use settings. Shallow groundwater wells will be installed to a depth of one meter in transects across the riparian zones under study and will be sampled monthly for depth of water table and dissolved nitrogen. Water temperature in relation to riparian zone characteristics (i.e., shade) and adjacent land use will also be explored through continuous direct measurements using recording temperature probes. A graduate research assistant will be recruited specifically for this project.

The outcome of this three-year investigation will contribute to our understanding of 1) the relative roles of riparian zones, in terms of dissolved nitrogen and water temperature, along a river continuum of land uses and 2) the relative role of active forest management within a multi-use river basin in terms of these two key water quality variables that influence aquatic habitat. This project is designed to integrate with ongoing research of water quality, aquatic habitat, and aquatic communities of macroinvertebrates and fishes being conducted by collaborators listed above.

New Research Project 3

Title: Habitat Conservation for Stream Amphibians in a Managed Forest Landscape

Principal Investigators: Michael J. Adams and John P. Hayes, USGS FRESC and Department of Forest Science, OSU.

Relevance of topic to program mission: Although numerous studies have suggested negative effects of timber harvest on headwater stream amphibians in the Pacific Northwest, other studies show that stream amphibians remain common in many second- and third-growth forests. This apparent discrepancy may be a matter of scale and regional differences in timber harvest effects. We propose to investigate how forest management interacts with landform, surface geology, and other regional characteristics to influence distribution and abundance of stream amphibians in a multi-age forest landscape. This study will include participation in the Hinkle Creek paired watershed study where amphibians will be monitored before and after timber harvest on control and treatment plots. The proposed work will be an important step toward understanding the physical, biological, and management factors influencing distribution and abundance of stream amphibians in western Oregon. The work will build on previous work on amphibians in the Oregon Coast Range funded by the FRL Fish & Wildlife Habitat in Managed Forests Research Program.

Objectives:
1. To assess influences of forest management practices in the Hinkle Creek drainage on abundance and distribution of stream amphibians.
2. To test the efficacy of existing habitat association models for stream amphibians in the Oregon Cascades.
3. To develop forest management recommendations for stream amphibians.

Overview: The Hinkle Creek study will assess the effects of riparian tree retention on headwater streams. It will provide an unprecedented opportunity to examine within basin variability of stream conditions and stream organisms. Amphibians are not currently being examined in the Hinkle Creek study, but it would be highly desirable to add them to the study because of the important role they play in stream ecosystems and their indicator status. We will use data from Hinkle Creek to assess spatial and temporal variation in the distribution and abundance of stream amphibians, and the influences of forest management activities on stream amphibians. We will expand these results by also surveying stream amphibians throughout the Oregon Cascades to determine the ability of existing models to predict amphibian density.

Approach:
1. Monitor stream amphibians in North and South Forks of Hinkle Creek from 2004-2006. Six stands will be harvested in the South Fork in 2005 and we will analyze how stream amphibians respond spatially and numerically to the change in the forest mosaic.
2. Sample managed forests in Oregon Cascades (non-wilderness FS lands, state lands, timber company lands). We will randomly chose stream reaches and relate stream amphibian density to landform, surface geology, substrate, and forest characteristics. Habitat associations of stream amphibians in the Oregon Cascades have not been previously studied.
3. Compare and synthesize models that predict stream amphibian density; produce region-specific recommendations for habitat conservation in managed forests. Increasing evidence suggests that the sensitivity of stream amphibians to timber harvest varies...
greatly among and even within regions. We will use a GIS to produce adaptive management recommendations.

**Timeline:** Field work would begin in Fall 2003, and continue during spring and fall 2004, 2005, and spring 2006. Data analysis and reporting will take place in 2006 and 2007, with final publications published in 2008.
Continuing Projects

These projects continue from last year’s program. They contribute directly to the goals of this research program and are funded at least partially by Oregon Forest Products Harvest Tax and reflect the FRL’s commitment to learning more about how to enhance the compatibility between timber, fish and wildlife values in managed forests. These studies include the following:

Study 4: Influence of Silvicultural Treatments and Manipulation of Downed Wood on Abundance and Demographics of Small Mammals (1999-2002)

Principal Investigator: John P. Hayes, Forest Science Department

Our understanding of the quantitative relationships between fallen dead wood and wildlife is poor. Most of the existing information is based on observational, correlative studies that lack predictive power. As a result, it is not possible to fully evaluate the ecological costs and benefits of different management strategies. The objectives are: 1) to determine the influence of selected silvicultural activities on the abundance and demographics of small mammals. 2) To determine the response of small mammals to manipulation of downed wood in different stand conditions.

This study will take place on the McDonald-Dunn Research Forest in uncut stands and stands harvested in 1990 using patch cut, clearcut, and green tree retention. Logs will be added to half of the study sites in the winter of 2001; the quantity, distribution, and source of logs is under development. Survival and abundance of small mammals will be determined using the robust model with program MARK. This work will form the foundation of a long-term effort to address questions concerning the function of fallen wood.

Duration: FY2000 – FY2003

Budget: This research is partially funded by the Cooperative Forest Ecosystem Research program.

Study 5: The Role of Perennial, Non-Fish-Bearing Streams in the Temperature and Flow Regimes of Small, Fish-Bearing Headwater Streams During Summer in Western Oregon (2001-2004)

Principal Investigator: Arne Skaugset, Forest Engineering Department

Introduction: As a part of the Forest Practice Advisory Committee (FPAC) process, a subset of the small, perennial, non-fish-bearing streams (type N streams) have been identified as potentially temperature sensitive. These streams are called type NT streams and they are identified as small, perennial, non-fish-bearing streams whose discharge makes up more than 30 percent of the discharge in the receiving small, fish-bearing stream (small type F). It is proposed that timber harvesting adjacent to unbuffered type NT streams can result in temperatures that are unacceptable in small, type F streams even though the small, fish bearing stream itself is adequately buffered. In that case, the process governing temperature increases in the buffered small, type F stream is increased temperatures in the unbuffered, type NT streams that, when mixed with water in the small, type F stream, cause stream temperatures that are unacceptable. The data on this subject in the literature is virtually non-existent. The purpose of this project is two fold.
Objectives:
1. To characterize the thermal regimes and low flow hydrology of small, non-fish bearing perennial streams draining both recently harvested and shaded headwater streams.
2. To investigate the processes that influence the temperature of small, perennial fish bearing streams during summer low flows, namely the effects of shade and low flow hydrology.

Research Plan: The research plan is to investigate the temperature, flow, and shade for roughly 10 small, type F streams throughout Oregon. Each study site, which will be centered on a small type F stream that has a recently harvested type NT stream draining into it. In addition, the study site will also consist of one fully shaded type NT or N stream draining into the small, type F stream.

Three levels of data will be collected. First of all, thermometers will be located at the mouth of the recently harvested type NT stream, the mouth of the fully shaded type N or NT stream, and the downstream extent of the small, type F stream. These sensors will provide a sample of the thermal regimes of harvested and unharvested type N streams and small, type F streams throughout the summer. Secondly, high resolution stream temperature and discharge profiles will be determined for each small, type F stream on at least two occasions during the summer. For these synoptic studies, stream temperature will be determined using a handheld temperature-sensing device and discharge will be determined using a steady state tracer injection method. A conservative tracer will be injected at the head of the small, type F stream and the concentration of the tracer in the stream will be determined at the same time that stream temperature is measured. The dilution of the tracer in a downstream direction will be a function of increasing discharge. Finally, stream shade and width will be determined to account for the influence of incoming solar radiation.

The data collected will allow characterization of the temperature regimes for recently harvested type NT streams, fully shaded type N and/or NT streams, and small, type F streams and a crude energy balance of the two major processes affecting stream temperature. It is expected that incoming groundwater and surface water from upslope and solar radiation will control the energy budget for these streams. These data will allow quantification of the processes that influences stream temperature the most for each of the study streams.

Duration: FY2002 – FY2004

Budget: This research is partially funded by the Oregon Forest Industries Council.
Study 6: Examining Linkages Between Multi-Scaled Riparian Data, Fish Habitat Characteristics and Coastal Cutthroat Trout (Oncorhynchus clarki clarki) Populations (2001-2003)

Co-Principal Investigators: Barbara Schrader, Forest Resources Department and Lisa M. Ganio, Forest Science Department

Collaborating Scientist: Robert Gresswell, USGS Forest and Ecosystem Science Center

Introduction: Riparian vegetation is an important component of a stream network influence on fisheries and wildlife habitat. To analyze the effect of forest management on riparian habitats, researchers and managers need reliable data from the multiple spatial scales of riparian habitat. However, it is difficult to obtain this information because of the complexity of riparian systems. Riparian vegetation influences fish habitat in a variety of ways - providing shade, litter inputs, increasing stream habitat complexity with inputs of wood, and channel stabilization by streamside roots of trees. It is unclear what level of detail about riparian vegetation is most important in explaining variability of fish habitat and fish abundance. For example, is the composition and variation in vegetation characteristics at the fine scale (fish habitat unit) more important than the vegetation characteristics at a medium (reach, segment) or large (landscape) scale? Does large-scale vegetation data in a Geographic Information System (GIS) layer help explain fish abundance? How well does large-scale vegetation information in GIS layers match the vegetation characteristics on the ground?

In this study we are examining linkages between riparian data from fine, medium and large scales in order to answer questions relating to fish habitat distribution, and eventually contributing to biological questions about population distributions of coastal cutthroat trout (Oncorhynchus clarki clarki).

Objectives: Devise a sampling scheme to characterize riparian vegetation to analytically link existing instream fish habitat data to landscape characteristics.

1. Develop a hierarchical analysis examining the relationships between riparian characteristics at small to large scales.
2. Link and aggregate the riparian information developed in this project to the CFER Landscape Study of coastal cutthroat trout distribution and abundance above barriers to fish passage.

Methods: Research is focused in the upper portion of Camp Creek in the Oregon Coast Range. This watershed has been intensively sampled by CFER scientists studying cutthroat trout above barriers to fish passage. Replicate study sites in Camp Creek are being selected in reaches previously sampled for fish presence. Spatially explicit, fine-scale fish habitat data and cutthroat abundance estimates have been collected in this watershed. Riparian vegetation is being sampled at large scale (watershed) and fine-medium scales (habitat unit/reach) using existing GIS vegetation data layers and field sampling techniques. Field sampling will focus on the reach scale, characterizing the width and geomorphic classification of the riparian zone and the vegetation composition and structure adjacent to surveyed streams. A hierarchical modeling approach will be employed as an analysis tool to establish linkages between the data from multiple scales to indices of fish abundance. This study provides a unique opportunity to create
a multi-scale riparian data set to link with geo-referenced patterns of known fish habitat and cutthroat trout abundance.

We will be analyzing data to characterize reach-level vegetation patterns relative to fish habitat and abundance using geomorphology characteristics as an integrator between the two. We will compare three levels of existing vegetation data: dominant cover collected during fish surveys, riparian vegetation collected in the field, and from remotely sensed GIS vegetation layers. We intend to characterize reaches by geomorphic classification and assess the variability of vegetation, fish habitat units, and wood levels in the stream. We will explore relationships of habitat at various scales using hierarchical analysis techniques.

Duration: FY2002 – FY2003

Budget: This research is partially funded by the Cooperative Forest Ecosystem Research Program.


**Principal Investigator:** John P. Hayes, Forest Science Department

Introduction: Understanding the influences of a diversity of silvicultural approaches on wildlife is central to the program's mission. The proposed research would fill some of the gaps in our understanding of the influences of alternative silvicultural practices and green tree retention practices on wildlife.

**Objectives:** To determine the relative influences of clearcutting and two uneven-age management approaches (group selection and two-story stands) on abundance and diversity of songbird populations in western Oregon.

**Methods:** This study will be conducted on the CFIRP research sites in Oregon State University's McDonald-Dunn Forest. The CFIRP sites consist of sets of control stands and three silvicultural treatments (clearcut, two-story stands, and patch cuts) replicated in three blocks; patch cuts are a form of group selection where 1/3 of the stand's basal area was removed in 0.2-ha openings, two-story stands are similar to a form of green tree retention. Treatments for this study were implemented between 1989 and 1991. Response of bird populations to treatment during the first 2 years following treatment was studied by Chambers et al. (1999; Ecological Applications 9:171-185). Chambers et al.'s work is extremely valuable and provides the only available information on the influences of uneven-age forest management on songbirds in western Oregon, and some of the only information available on the implications of uneven-age management on birds in conifer systems anywhere. However, the management implications of their work are limited by the temporal limitations of their study. As structural development of these sites progresses, habitat conditions at the sites differ considerably from those at the time of treatment. For example, the patch cuts have developed considerable structural complexity in the ten years since the stands were harvested; this increased structural diversity may have important implications to songbirds that were not evident during the initial years following harvest. Our proposed study would examine longer-term implications of these management approaches to songbirds, examining songbird response 11 to 14 years post-treatment. The combination of the work completed by Chambers et al., work in progress on the sites on small mammals by Waldien and Hayes, and this proposed study would provide a solid base of understanding of the
influences of these silvicultural approaches on wildlife.

Abundance of birds will be assessed during the breeding season using variable radius point counts. Point count stations will be established in each stand, and each point will be visited a minimum of five times each year during the breeding season. Habitat assessments will be conducted to assess the vegetative and structural characteristics of the stands, and these will be related to observed distributions and abundances of songbirds. Approaches to statistical analysis will be developed with assistance from the Department of Forest Science's Quantitative Sciences Group.

Duration: FY2002 – FY2005

Study 8: Forest Management Strategies in Hinkle Creek Watersheds: Evaluation of Baseline Seasonal Stream Water Nutrient Concentrations and Soil Resources

Principal Investigator: Kermit Cromack, Jr., Forest Science Department, OSU

Co-Principal Investigators: Dave Hibbs, Forest Science Department, OSU; Arne Skaugset and Stephen Schoenholtz, Forest Engineering Department, OSU

Relevance to program mission: This research addresses the need to obtain baseline data for both stream chemistry and soil resources for two forest watersheds, the North and South Forks of Hinkle Creek Research and Demonstration Area Project. Current forest management practices are designed to promote sustainable silvicultural systems on these two paired watersheds, which are productive for timber, water, fish, and wildlife resources. A solid representative database for both stream and soil nutrients in these watersheds would provide a model upon which to help gauge the effects of current and expected intensive forest management practices on industrial forest land. It would be particularly worthwhile to obtain such data from the Hinkle Creek watersheds prior to initiation of an anticipated 10-year study of intensive forest management.

Objectives: There are two main objectives: 1) to obtain seasonal water nutrient concentration data for two consecutive years in six headwater streams, and in the North and South forks of Hinkle Creek. Stream nutrients to be measured include: total N, P, and base cations (Ca, K, Mg, Na), inorganic carbon (DIC), dissolved organic N (DON), and inorganic N (DIN), plus stream pH, collected seasonally; 2) to obtain data for soil resources on these watersheds (with emphasis on those for riparian zones), including soil physical properties (porosity and bulk density), pH, soil texture, and soil C, N, P, S, base cations (Ca, Mg, K, Na), cation exchange capacity, and availability of soil N and P. This research is designed to integrate with the Hinkle Creek Research and Demonstration Area Project on Hydrology and Water Quality being led by Arne Skaugset, Forest Engineering Department at OSU.

Overview: Oregon has highly productive forests growing on soils that can be effectively managed for timber resources while maintaining stream water quality suitable for fish and wildlife resources. In addition to maintaining productive forests, one goal of current forest management is to maintain stream water of high quality for fish and wildlife. The same nutrients which are essential in adequate quantities for tree growth (N, P, and base cations, plus micronutrients) also are required by both fish and wildlife species. This project would provide a valuable initial database of stream nutrient concentrations and soil resources for the proposed new Hinkle Creek Research and Demonstration Area Project.
**Approach:** To accomplish the first objective for obtaining seasonal nutrient concentration data, we will collect samples directly from streams seasonally, while minimizing disturbance to stream sediment. Samples will be transported in coolers on ice and taken within 24 hrs. to the Co-operative Chemical Analytical Laboratory at OSU for water analysis. The second objective, to collect soil samples in riparian zones and upslope forest areas, will be accomplished using soil coring at sites selected by stratified random sampling within each paired watershed area. In addition, representative soil pits will be dug to obtain soil descriptions and soil parent materials.

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FRL FISH AND WILDLIFE HABITAT IN MANAGED FORESTS RESEARCH PROGRAM

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