Protecting Oregon's Forest Streams

New Hinkle Creek Study Advancing Watershed Science

A Special Report of the Oregon Forest Resources Institute

Controls on timber harvesting to safeguard water quality, aquatic habitat and fish species associated with forest streams are among the most important requirements of the landmark Oregon Forest Practices Act (OFPA), passed by the State Legislature in 1971. These requirements originally were largely based on paired watershed studies that had just been completed. Since then, however, forest practices have improved with new science, changing technologies and growing awareness of environmental concerns, and the law has been strengthened repeatedly over the years to address issues initially identified in that early watershed research. But there is no recent watershed research that pointedly assesses the effect of contemporary forest laws, rules, regulations and practices, making it difficult for policymakers to determine the adequacy of current laws. In 2001, a group of scientists, landowners and regulators undertook the 10-year Hinkle Creek Paired Watershed Study as a first step in a cooperative process to build the new watershed science for contemporary forest practices.

HIGHLIGHTS

- Paired watershed studies involve monitoring two similar stream systems — leaving one untouched while conducting management operations on the other — to measure the effect of such operations on water, soils, wildlife and habitat. Because of their magnitude, duration and cost, such studies have been undertaken only at a few locations in Oregon, and most were conducted years ago.
- The Hinkle Creek study is the first in Oregon to be sited entirely on private forestland that is being intensively managed for timber with state-of-the-art harvesting equipment and techniques.
- Because of the large size of the study area, the critical issues of cumulative effects of management and the links among physical processes and biological impacts can be better addressed, enabling researchers to study multiple harvest activities in headwater areas.
- Roseburg Forest Products has made 5,000 acres of its prime forestland available for the study, agreeing to defer harvest on half of it for 10 years and to alter harvest plans on the other half to meet the study's objectives.
- For the study to realize its full potential, it would cost about $900,000 a year to conduct.
- There is very little current paired watershed research to help guide or validate stream protection policies in the Pacific Northwest. Older studies were conducted when forest practices were dramatically different from today's.
- A unique aspect of the Hinkle Creek study is its use of new monitoring technologies. One key system is what fish biologists call PIT (Passive Integrated Transponder) tags that have been implanted in fish in the watershed. Scientists are able to track movement of hundreds of individual fish in both time and space.
- Implementing additional studies similar to Hinkle Creek is essential to allow the data to support valid and strong conclusions. The Watershed Research Cooperative at Oregon State University, which administers this study, is planning to initiate similar studies at other locations in Oregon.
- A dynamic and expanding educational outreach program makes the work of the scientists available to hundreds of visitors, including local school children, university classes and neighboring landowners.

Oregon Launches Landmark Watershed Study

There is a yellow gate about a quarter mile up Hinkle Creek Road, near where the pavement ends and the logging road begins. The gate — a swinging steel bar across the road at the main entry to the Hinkle Creek watershed — is not unlike thousands of other gates around the state marking the boundaries of private, industrial forestland. Thirty minutes out of Sutherlin in southwestern Oregon and east up the winding road that follows Calapooya Creek as it rises gently into the Cascade foothills, lies some of the most productive Douglas-fir forestland in the state.

However, there is something distinctive about this particular gate, because behind it history is being made. Several years ago, the headwaters of the Hinkle Creek watershed—5,000 acres of prime forestland — was offered by its owner, Roseburg Forest Products (RFP), as the site for a massive, unprecedented, 10-year research project known as the Hinkle Creek Paired Watershed Study. Because of the magnitude, duration and cost of a paired watershed study, it has been some 30 years since a comparable study has been undertaken in Oregon. It also has the distinction of being the first ever carried out entirely on private, industrial forestland, as well as the first to measure the impact of 21st-century forest practices on diverse watershed characteristics.

Leadership In Forestry Research

Given the rarity of such studies, Oregon has once again shown its leadership in innovative forestry research. In addition to the company's work crews and

A Joint Enterprise

No single organization can independently mount a massive research project like the Hinkle Creek Paired Watershed Study and Research Demonstration Area. OSU's College of Forestry has a long tradition of mounting creative partnerships to address large, interdisciplinary research projects like that at Hinkle Creek. The study's funding is coordinated through the College's Watershed Research Council (WRC), an umbrella cooperative for environmental research associated with intensive forest management on commercial forestland. WRC members help shape cooperative goals and research priorities and provide monetary and in-kind support.

Watershed Research Cooperative Members

Oregon State University
Roseburg Forest Products
Oregon Forest Industries Council
Oregon Department of Forestry
National Council for Air and Stream Improvement
Douglas County
Oregon Department of Fish & Wildlife
Oregon Forest Resources Institute
Douglas Timber Operators
Associated Oregon Loggers
Bureau of Land Management
Starker Forests
Boise Cascade
Plum Creek Timber

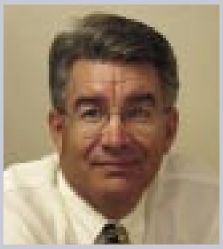
Collaborating Organizations

Besides WRC members listed above, a diverse and committed group of other people and organizations have provided operating funds and in-kind support as well as the infrastructure and hard work essential to the project's success. These collaborators include:

Oregon Watershed Enhancement Board
U.S. Geological Survey's Forest and Range Ecosystem Science Center
Forest Engineering Department, OSU College of Forestry
Forest Science Department, OSU College of Forestry
Department of Fisheries and Wildlife, OSU College of Agricultural Sciences
Resource Management Services

Paul Adams
Professor and Forest Watershed Extension Specialist
Forest Engineering Department
Oregon State University
Corvallis

"Research has clearly shown that timber harvesting and forest roads can affect water quality and quantity. Popular conceptions are that forestry effects are invariably negative and relatively permanent. But research has shown insignificant, positive, negative and combined effects that were greatly influenced by the specific location, treatments and duration of study. Much of the research on forestry and water resources was done years ago, and these results should be considered carefully, especially in light of current management standards and technologies. That's why the Hinkle Creek study is so important."



Steve Tesch
Professor and Department Head, Forest Engineering
College of Forestry
Oregon State University
Corvallis

"When the Board of Forestry assessed how well the current Oregon Forest Practices rules were protecting riparian and aquatic habitats, they found limited science about managing forest headwaters, especially the amount of streamside protection required. The Hinkle Creek study will address that knowledge gap because it operates at a whole watershed scale. We'll be able to determine effects of harvest operations in the headwater areas on water quality, insects and amphibians and then follow any harvesting effects on the fish farther downstream. The exciting part is that the monitoring technology will enable us to literally see instantaneous reactions of fish to the logging within the watershed."

Roseburg Forest Products has provided some 5,000 acres of prime forestland for the new paired watershed study. Half of the watershed will undergo intensive timber harvest, while the other half will remain untouched for 10 years to measure the impact of current forest practices.

professional foresters, legions of scientists, researchers and technicians have been passing through the Hinkle Creek gate since the study began. They are walking streams, counting fish, monitoring state-of-the-art tracking equipment, measuring stream flows, documenting water temperatures, taking samples and gathering data on the movement and abundance of everything from cutthroat and steelhead trout to caddis flies, crickets, spiders and salamanders.

At first glance, the stream system in the watershed seems untouched, but a closer look reveals yellow and red ribbons hanging in overhead trees, each indicating the location of research equipment. Electronic gate readers span various reaches and tributaries at strategic points to track the movement of fish throughout the system. Also not evident at first glance is a series of small sheds next to selected stream reaches, each containing sophisticated sampling equipment that automatically measures—among other things—water temperature, discharge, turbidity and sediment content. The equipment even has the ability to automatically increase or decrease the frequency of samples taken during critical natural events like storms that affect stream levels.

The forestland surrounding the Hinkle Creek watershed is made up mostly of large, 55-year-old Douglas-fir, a size and age that by current industrial rotation standards is ready for harvest. The timber company's offer was particularly generous in that it required a commitment to defer harvest on half its land in the watershed for 10 years and to alter harvest plans on the other half to meet the research objectives.

In other words, by leaving the North Fork and its tributaries as a virtually untouched control area for the next decade, while calling for specific and intensive harvest activities on the South Fork, scientists will be able to compare the two stems of the creek and their tributaries in order to evaluate effects of intensive forest management under current forest practice standards on water quality, aquatic habitat and fish, including downstream effects. That is the essence of a paired watershed study.

Origins of the Study

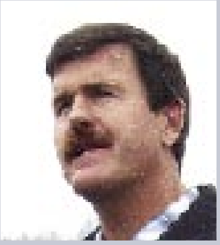
Arne Skaugset, lead scientist for the massive research effort, is a forest hydrologist in the Forest Engineering Department at Oregon State University. "This whole thing started a few years ago on a day when Dan Newton and I were out on the watershed," he recalls. Newton, timberlands manager for Roseburg Forest Products, remembers it well. "Arne had done some water-quality research here at Hinkle Creek focused on stream temperature," he said. "We started talking about determining the adequacy of current forest protection laws for riparian [streamside] areas, and it kept coming back to what is best for the fish. I kept pushing him to draw some conclusions, based on his findings, about recommendations for on-the-ground forest management related to stream protection. Being a good scientist, he was reluctant because he felt more research was needed. I said, 'Well, Arne, what would it take,' and he replied, 'It would take another study like the Alsea.'"

Skaugset was referring to the Alsea Watershed Study, conducted from 1959 to 1973 in Oregon's Coast Range. A paired watershed study is an enormous undertaking, which was enough to give Newton pause, but also to stir his imagination. Newton is a career professional forester charged with major management responsibility for Roseburg Forest Products' 430,000 acres of forestland in Oregon. Although he is a working timberland manager, he has a deep respect for forest science and research that runs in the family — his father is a professor emeritus in the OSU College of Forestry.

What excited him most about a new paired watershed study, however, came from his experience with helping shape forest practices laws in Oregon. For the past decade, Newton has been doing public service in the forest policy arena, having been appointed by the Board of Forestry to state forest practices review committees in 1993 and 1999.

Educational outreach is a major part of the study. Here lead investigator Dr. Arne Skaugset (left) and fish biologist Doug Bateman explain the study to a group of forestry professionals at the confluence of Hinkle Creek's two stems.

"This work," says Newton, "especially as it examines the effects of management on forest streams, has been limited by our dependence on studies completed 20 or 30 years ago. Since then, laws have been enacted to require stream buffers, and those laws have been revised several times to increase the number of conifers left along streams.



Dan Newton
Timberlands Manager
Roseburg Forest Products
Roseburg

"I've been involved in the development of Oregon's stream rules and have seen firsthand how difficult it is to provide the most effective regulatory framework in the absence of definitive research. We need to have good science so that the deliberations of forest policymakers can be reasoned and well informed. In the case of stream protection, I'm convinced that there is a way to improve fish productivity and have good forest management at the same time. Hinkle Creek is the most comprehensive and robust study of forestry and fish I can imagine, and I think it's going to show us the way."

Arne Skaugset
Associate Professor
Forest Engineering
College of Forestry
Oregon State University
Corvallis

"If you're a linear thinker like I am, then you have to wonder about the effects downstream of upstream activities. Because of the spatial scale in the study area, Hinkle Creek will really give us a handle on cumulative effects. For Hinkle Creek, that spatial scale is 2,500 acres, and it is this larger scale that enables us to address cumulative impacts. But the really unique contribution of this study is that it is on private industrial land and reflects 21st-century forest practices."

"Without research to determine what constitutes an adequate buffer, it was commonly assumed that the more shade we provide along stream banks, the better for fish. Because we don't know what fish 'think,' we have had to rely on indicators like the amount of shade and potential for large wood in the streams."

But there is a point of diminishing returns, Newton feels, when larger investments yield little additional gain. He says what we need to better understand are the responses of fish, invertebrates and their food sources to the integrated effect of stream structure, shade and temperature. Then we can examine whether we are doing enough or in fact are requiring landowners to invest in costly measures that tie up thousands of dollars in timber value yet provide little if any additional protection of streams and aquatic habitat and might even reduce stream productivity.

"We can do this research better in Oregon than anywhere else," Newton stated. "We have scientists and other experts from several agencies who are committed to doing the work in a collaborative way. This is a rare opportunity to get answers to some very important questions."

"Without good information," said Jennifer Phillippi, a member of the Board of Forestry, "some argue we should err on the side of precautionary protection or risk avoidance. We all want the best for fish, but professional foresters must deal with stream protection every day, and we need to know what 'best' means in the context of natural disturbance and in practical terms."

It was actually the Alsea-era research results that helped establish the riparian regulations that are still part of the OFPA, yet the forest operations in that study were conducted before the OFPA requirements were enacted. Harvesting, road construction and riparian practices were dramatically different from methods used today. Much larger trees were being harvested then, with a heavier impact on the landscape, and roads were being built for the first time in many watersheds.

Sophisticated gate readers span the creek at numerous locations. As the fish with implanted PIT (Passive Integrated Transponder) tags pass under them, the gate readers can identify the exact fish, enabling scientists to track their movement throughout the watershed and their response to disturbance. This new technology was not available to researchers during the earlier studies that inform current forest practices laws.

By contrast, trees today are smaller, the harvesting equipment is lighter and

Old And New Harvest Practices

The Alsea paired watershed study took place primarily in the 1960s before the inception of the Oregon Forest Practices Act (OFPA) in 1971. The top picture, of Needle Branch in the Alsea study area, illustrates how harvest practices at the time allowed cutting trees all the way to the edge of streams. Today the OFPA calls for riparian zones at water's edge, as with Hinkle Creek (below), to help protect aquatic habitat and water quality.

more nimble, most of the roads have been in place for decades, and road design, location and maintenance have improved. At the same time, forest operators have become more aware of resource concerns and more skillful in addressing them. The overall result has been substantial improvement in controlling the impact on soil and water. But important questions remain, and validation is needed to clarify and confirm general observations.

Clearly, new watershed research could again play a key role in guiding current and future forest practices in Oregon, particularly near fish-bearing streams. Forestland like that surrounding Hinkle Creek is very typical of industrial forestland today, so the results will more directly reflect the impact of practices presently in use. In addition, sophisticated monitoring and tracking equipment being used in the Hinkle Creek study did not even exist 30 years ago.

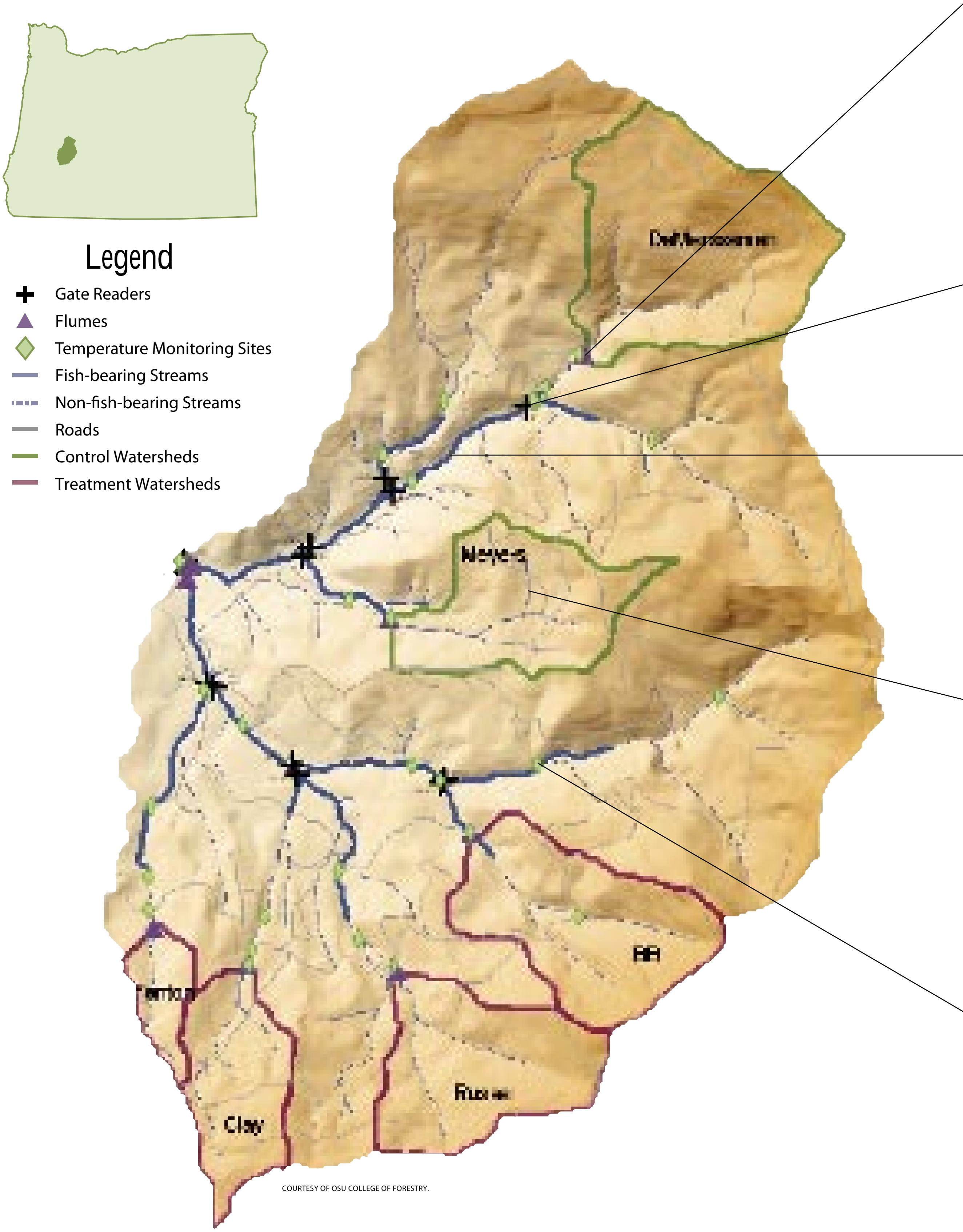
Hinkle Creek also provides an opportunity to look at larger questions surrounding environmental protection in dynamic ecosystems where disturbance and change over time and space is part of the natural process. For example, studies have found that fish biomass has generally increased after timber harvest, but often with some proportional shifts in fish age class or species composition. While these changes may be viewed as either positive or negative, depending on one's perspective, age class and species composition have been found to eventually return to pre-impact conditions at the site level. Hinkle Creek will enable scientists to look at linkages among physical processes and change caused by harvesting. The view that "change is bad" may be common, but the study will provide valuable insights into how we

Doug Bateman
Senior Research Assistant
College of Forestry
Oregon State University
Corvallis

Doug Bateman is the on-the-ground researcher responsible for seeing that the fish dimension of the study operates according to plan. "We're always conscious of the fish perspective," he said. "Fish don't necessarily think like people, but they are capable of complex behaviors and much like people you can expect a variety of responses to the same stimulus. The PIT tag technology allows us to document a range of behavioral responses to forest harvest and the associated consequences, such as changes in location, growth and survival."

The Hinkle Creek Paired Watershed

Five major scientific teams are at work in the Hinkle Creek watershed monitoring stream hydrology, fish, invertebrates, amphibians and water chemistry and soils mapping. The researchers began monitoring in 2001-02 to gather baseline data before the 2005 timber harvest. This massive research project will continue for 10 years in order to track reactions to disturbance over time and measure long-term effects.



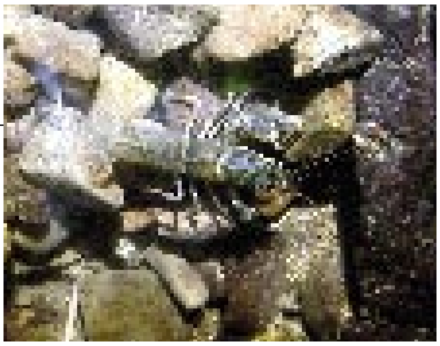
COURTESY OF OSU COLLEGE OF FORESTRY.

Stream Hydrology

The North and South Forks of Hinkle Creek are dotted with water-monitoring stations where sophisticated automated equipment regularly checks stream temperature, discharge and sediment concentrations. The photograph shows a typical water-monitoring installation, which includes an instrument shed to house the electronic data collection equipment, a number of probes on a boom that collect water quality data and a flume to measure discharge.

Fish Biology

Using state-of-the-art PIT (Passive Integrated Transponder) tags, scientists are able to track the movement of fish in the Hinkle Creek watershed and observe their response to disturbance. Here a researcher inserts the tiny tag into a fish. The tag remains in the fish as it grows, and since most of the fish in the watershed are permanent residents, their movement over time may provide valuable insights into fish behavior.

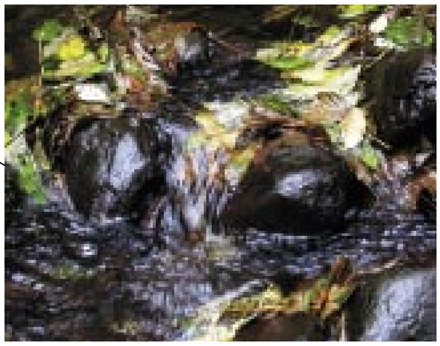


Invertebrate Biology

Invertebrates like this crayfish can be good indicators of change. Scientists are monitoring aquatic invertebrates (like mayflies, stoneflies and caddisflies) and terrestrial invertebrates that fall into the stream. Invertebrate availability to fish is an important comparison that will be made before and after timber harvest.

Amphibian Research

The amphibian research takes place throughout the stream system as well as high up in the headwaters beyond where fish go. The Pacific giant salamander shown here is the most populous species in the system. They tend to take timber harvest in stride, and researchers are monitoring their abundance with interest to assess their reactions.



Streamwater Chemistry and Soils Mapping

Carbon and nitrogen in the soil and key nutrients in the water are being carefully monitored to observe what changes occur as a result of timber harvest. This aspect of the study deals closely with the geology of the area, and scientists will be able to track such things as changes in the nutrient levels in the water as a result of forest management.

can factor natural disturbance or change into resource protection. "Regulations based on a static view of nature will ultimately fail to protect dynamic ecological resources," said Assistant State Forester Ted Lorensen of the Oregon Department of Forestry. "This larger question raises the potential of using Hinkle Creek as a much longer-term study."

Newton saw a paired watershed study as providing answers, and he saw the Hinkle Creek watershed as the perfect site. "If Dan hadn't had that experience on forest practices review committees," said Skaugset, "this whole thing might not have happened." Because the study would have significant economic implications for the company, Newton approached CEO Allyn Ford for permission to offer the company's forestland. "I knew Allyn was committed to sustainable forestry," Newton said, "and it turned out he was all for offering our land. He was more interested in how we could make the study work than in the cost."

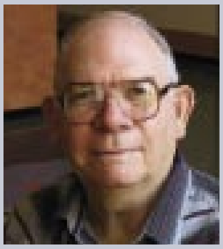
Why Another Watershed Study?

There are numerous ways the Hinkle Creek study has the capacity to address gaps in our knowledge that make it difficult to determine how well contemporary forest practices laws protect environmental resources. Perhaps the most important is the spatial scale. The Alsea study, for example, took place on just one spatial scale — that of the headwater stream, on watersheds of 75, 450 and 750 acres. Hinkle Creek involves two spatial scales. The headwater stream watersheds are being studied, but they are nested in larger-scale watersheds of some 2,500 acres. It is this large scale that will enable scientists to address the issue of cumulative effects as well as provide valuable knowledge about fish mobility. They will be able, for example, to quantify the downstream effects of multiple management activities in the headwaters.

Studying Contemporary Forests

Another major difference has to do with the forest itself. The forest harvested during the Alsea study had been affected by a major stand-replacing wildfire in the mid-1800s — a common fate of native Douglas-fir forests in the nineteenth century. The trees at the time of the study were 120 to 140 years old and quite large. The technology of the time called for high-lead logging. Logs were elevated at one end by aerial cables and dragged up hills to a landing, where they were loaded on trucks. However, by this method the rear of the elevated logs drags along the ground, creating ruts that could remain visible for years.

In contrast, the trees at Hinkle Creek, which regenerated following harvesting around 1948, are smaller and will be harvested with state-of-the-art skyline logging, where the aerial cable is high enough that the entire log being carried usually is elevated — even higher than the treetops in some situations. The environmental



Kermit Cromack, Jr.
Professor, Forest Ecosystem Studies
College of Forestry
Oregon State University
Corvallis

"I'm interested in the geology of the place," says Kermit Cromack, speaking of the Hinkle Creek watershed. Concurrent with other studies, Cromack will be examining streamwater chemistry and conducting soils mapping. "I'm looking at the carbon and nitrogen in the soil, and the key nutrients in the water," he said. "This study is of particular interest because it's taking place in a working landscape and looking at the productivity dimension of the whole watershed."

impact of logging is greatly reduced today due in part to such improved harvest practices. In addition, in Alsea-era studies there were no streamside buffer-width requirements, so logging often took place right along a stream bank. Today, a comprehensive set of forest practices laws mandates protective buffer strips adjacent to fish-bearing streams.

State-of-the-Art Fish Monitoring

One of the unique aspects of the Hinkle Creek study is its use of new monitoring technologies. The key to the system is what fish biologists call PIT (Passive Integrated Transponder) tags. In the fall of 2002, a team of researchers under the direction of Robert Gresswell of the United States Geological Survey (USGS) conducted spatially continuous single-pass electrofishing—temporarily stunning fish—throughout the watershed. In all the captured fish, primarily cutthroat and steelhead trout one year of age or older, technicians implanted tiny PIT tags. At the same time they installed a series of gate readers in various stream sections to detect the passage of fish with PIT tags. Data collection is further enhanced by mobile trackers that can be carried by technicians who walk specific stream segments. Fish with barcodes passing through gate and mobile readers that track their movement is not unlike the checkout at a supermarket. As a result, researchers now have spatially continuous "snapshots" of distribution of the several hundred tagged fish in the study.

A researcher studying invertebrates pumps the stomach of a small fish to monitor its diet and see what kinds of insects it has eaten. Such information will be valuable both in the study of invertebrates and fish.

The PIT tag technology, of course, provides a level of data analysis not possible in the Alsea study, but the fish population itself in the Hinkle Creek watershed also differentiates the study from its predecessors. In the Alsea study, for example, the primary species of interest was coastal coho salmon. The coho, like other salmonids, is anadromous, meaning it spends portions of its life in both fresh water and the ocean. As scientists have learned, salmon abundance varies widely with ocean

Judith Li
Associate Professor
Fisheries and Wildlife
College of Agriculture
Oregon State University
Corvallis

Judy Li and her team of researchers are studying the invertebrates of the Hinkle Creek watershed, like mayflies, snails, caddis flies, stone flies, spiders, camel crickets and caterpillars. "We try to learn to read these 'critters' for pattern," she said. "We are quantifying their numbers and diversity, but also watching them carefully because they respond quickly to change. They have built-in mechanisms to adapt to seasonal change, for example, but human disturbance is less predictable, and we have an opportunity to learn a good deal from them in a managed landscape like Hinkle Creek."

conditions, fishing rates and hatchery practices. Good or poor habitat in forest streams will also affect abundance, but in the Alsea study, ocean, fishing or hatchery conditions made the effect of logging harder to detect.

At Hinkle Creek, on the other hand, the primary fish in the system is the cutthroat trout, which is a permanent resident, so the effect of anadromy is minimized. As a result, researchers will be able to track the reactions of fish to timber harvest activity with a higher degree of certainty. The Oregon Department of Fish and Wildlife is concurrently conducting a complementary study farther downstream, in which coastal coho salmon are being monitored.

A Cross-Disciplinary Mission

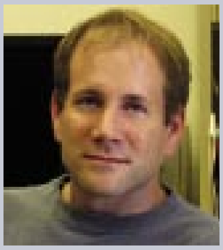
Certainly a study of this magnitude has inherent problems of scale, but it also has the advantage of bringing an unusually wide range of scientists together in a cross-disciplinary mission. As OSU's Skaugset puts it, "We've got the land managers and scientists all working together. You won't find this degree of collaboration anywhere else." Skaugset directs the overall science effort and also manages the hydrology studies.

Research partners involved in the study make it what Skaugset calls "one of a kind." They include the Forest Engineering and Forest Science departments in the OSU College of Forestry, the university's Department of Fisheries and Wildlife of the College of Agricultural Sciences, and the Forest and Rangeland Ecosystem Science Center (FRESC) of the USGS. All of these experts are committed to the 10 years of monitoring and data analysis demanded by the study. Their baseline work now underway is taking place before any logging begins so that they will all be able to detect any changes. The length of the study will ensure that long-term effects do not escape notice. The hope, of course, is that the results will definitively test the adequacy of current forest protection laws in Oregon, precipitating appropriate changes by the Board of Forestry, if necessary, based on the best science.

An Educational Opportunity

Paul Adams, professor and extension specialist in the OSU Forestry Engineering Department, sees Hinkle Creek as a "teachable moment." An expert on forest practices and watershed effects, Adams helps plan the project's dynamic and growing outreach efforts, including those directed at resource managers and policy makers. Many visitors, including state and regional policy leaders, have visited and toured the site and learned about the research efforts underway. University classes in forest engineering and hydrology have studied the work and research protocols.

Roseburg Forest Products also has instituted a series of tours for local groups, and a Roseburg-area forester and education specialist, Javier Goirigolzarri, has



Michael Adams
Research Ecologist
USGS Forest & Rangeland Ecosystem Science Center
Corvallis
Michael Adams' expertise is amphibians. He is conducting studies on the diversity and abundance of amphibians in the Hinkle Creek watershed and the ways they respond to harvest and other forest management activities. "For the most part," he said, "my work takes place way up in the headwaters past where the fish go. Pacific giant salamanders, the most abundant species on the site, seem to persist fairly well with timber harvest, so we'll be interested in their reaction to disturbance."

A research scientist shows a group of school children a fish from the creek. Due to the educational outreach efforts of the project, the Roseburg School District sends numerous classes on field tours to observe the work of the watershed study.

developed and facilitated an active program in cooperation with the Roseburg schools that utilizes the study site. Classes from both public and private schools have visited the project site to learn about stream hydrology, fish biology and upland ecosystems. Elementary and secondary teachers have toured and used Hinkle Creek to develop ecosystem modules and put together workbooks and lesson plans based on the study's rich and diverse research effort. "Roseburg School District developed this program as a pilot concept," Goirigolzarri said, "with the intention that it be shared, so that other school groups can benefit and learn from work already done."

Beyond Hinkle Creek

A Watershed Research Cooperative (WRC) was formed shortly after the study began to provide administrative support and to plan a series of future watershed studies like Hinkle Creek in other parts of Western Oregon, east of the Cascades and perhaps even in other states. The cooperative also hopes to convey the results of these studies to forest managers and policymakers throughout Oregon and the Pacific Northwest. Current cooperators include the Oregon Department of Forestry, the Oregon Department of Fish and Wildlife, the Oregon Forest Industries Council, the Oregon Forest Resources Institute, Douglas County and Roseburg Forest Products Company, among others.

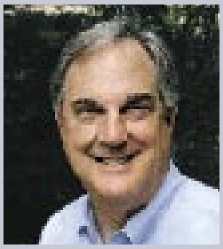
As professor and head of OSU's Department of Forest Engineering, Steve Tesch oversees the administration of the WRC, the Hinkle Creek study, and funding for both. He shares leadership with Carol Schuler, director of the USGS Forest and Rangelands Ecosystem Science Center, and Dan Edge, head of the OSU Fisheries and Wildlife Department. One of Tesch's responsibilities has been leading efforts to obtain federal funding to supplement local contributions. "We're serving Oregonians by filling a major research gap," Tesch said, "but this is an expensive proposition. Thus far, Hinkle Creek has been a 'bottom-up' effort, and Arne [Skaugset], Dan [Newton], the WRC Advisory Committee, and especially

Robert Gresswell
Research Biologist
U.S. Geological Survey
Bozeman, Montana

Hinkle Creek project partners agree that the contributions, initiative and innovation of Bob Gresswell and his USGS team have been pivotal in getting the project up and running smoothly. Gresswell said, "the thing that intrigued me about heading up the fish research in the Hinkle Creek study was, first, its large scale, which enables us to look at fish behavior in a whole system and, second, our ability to see more clearly how fish react to disturbance. We know how fish respond to fire or clearcut at the site level, for example, but in this study we'll be able to see the effects downstream. In the past, we've taken stream sections and monitored them over time and assumed they represent the whole watershed, and that's not always true."

the scientists deserve credit for initiating this project on a shoestring budget. But the cost is about $900,000 a year to obtain the full benefit of the Hinkle Creek study, and we haven't had that amount in any year yet."

Assistant State Forester Ted Lorensen of the Oregon Department of Forestry, who is also involved in seeking cooperative funding, said the group was gratified that Congress felt the research important enough to allocate $500,000 in federal assistance for the project to augment local and regional support in 2005. However, funding the full 10 years of the study and obtaining funding for more paired watershed studies remains a formidable challenge.



Hal Salwasser
Dean, College of Forestry
Oregon State University
Corvallis
"There are many values we want from our forests today, and we need policies that integrate private and public interests. As a result, we can't generate science in the old, slow way one step at a time—our need is too great. That's why we need integrated, interdisciplinary problem-solving projects like Hinkle Creek so that we can get past speculation and correlation to cause and effect, and from there to responsive policy."

Meeting Future Challenges

The Hinkle Creek Paired Watershed Study seeks to fill gaps in our understanding of how forest watersheds respond to changes brought about by contemporary forest management activities like timber harvesting, road construction and maintenance, riparian protection and forest regeneration after harvest. It will give policymakers crucial knowledge for enacting informed and effective protection laws for water quality, aquatic habitat and fish in forest streams using current and highly relevant science.

The study comes at a meaningful time in the evolution of the forest products industry in this country and worldwide. Environmental consciousness over the past few decades has added to what society expects from its forests besides the sustainably produced wood products that have always been a necessary part of our lives. Clean water, good habitat, and diverse and abundant fish and wildlife populations are also things we want from our forests. As Hal Salwasser, dean of the OSU College of Forestry, framed it: "There are many values we want from our forests today, and we need policies that integrate private and public interests. As a result, we can't generate science in the old, slow way one step at a time — our need is too great. That's why we need integrated, interdisciplinary problem-solving projects like Hinkle Creek so that we can get past speculation and correlation to cause and effect, and from there to responsive policy."

Ted Lorensen sees the study as an opportunity to think about things differently. "This research helps us to define protection in a new way," he said, "protecting something by defining a mix of desired values and in the process separating fact from theory." Jason Miner, conservation director of Oregon Trout, toured the site and came away enthusiastic. "The best thing coming out of this research is credible science, and it's great that we can integrate organizations like Oregon Trout into the discussion. Maybe in 10 years we'll all be more confident about what truly benefits fish."

Salwasser sees the work at Hinkle Creek as essential to sustainable forestry in Oregon. "Global forces are at work in the industrial wood market," he said. "We're seeing the end of 'hunter-gatherer' logging from native forests, and over the next few decades we'll see wood from planted forests increasing from its present 35 percent to 80 percent of worldwide supply. Oregon will be a world player in this future, and we need studies like Hinkle Creek replicated in two or three other forest types to help us implement forestry that sustains wood, water quality, native fish and resource-related jobs across the state."

Salwasser pointed out the need to protect the environmental and social values coming from our forests. "That's why we want the best environmental protection," he said. "But we also need to make sure that we don't lose sight of the third leg of the sustainability stool — the economic well-being and quality of life of all our citizens. Take the riparian zone widths and adequate stream protection issues that the Hinkle Creek study is addressing, for example.

"We may right now be taking unnecessary reductions in board feet of timber just because we don't know our science well enough. Even a 1 percent reduction in timber output would mean hundreds of jobs and millions of dollars to Oregon's economy. That is another reason why it is important to base our protection standards on solid research.

"If our watershed studies show this or more is necessary," Salwasser said, "then it will be our obligation to increase protection. But if they show our laws are too restrictive, then we have an obligation to refine them for more optimal outcomes. By these standards, the $900,000 a year it costs to run each replicate of this study is a good buy — a good investment in our future."

Results Question Old Assumptions

Dr. Bob Gresswell and a team of scientists from the USGS Forest and Rangeland Ecosystem Science Center are studying the effects of timber harvest on fish abundance and distribution in the Hinkle Creek watershed. PIT (Passive Integrated Transponder) tags were surgically implanted into fish captured by electrofishing (temporarily stunning the fish) in order to track their movement and abundance in the North and South Hinkle Creek watershed. Patterns of fish distribution and movement will be studied before, during and after timber harvest.

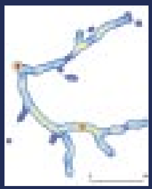
Early results are somewhat surprising and are causing the scientists to rethink their assumptions. The panel to the right displays fish distribution and abundance in North and South Fork Hinkle Creek through time. Warm colors represent areas of relatively high fish densities and cool colors represent areas of relatively low fish densities. Note how some portions of the channel vary dramatically in relative density while other areas are relatively consistent. Initial analysis suggests that relationships between habitat quality and fish density are occurring at spatial scales that are broader than previously recognized. Understanding the causal mechanisms behind these patterns is one of the goals of this research.

SUMMER 2001

SUMMER 2002

SPRING 2003

SUMMER 2004



COURTESY OF OSU COLLEGE OF FORESTRY.

Ted Lorensen
Assistant State Forester
Oregon Department of Forestry
Salem

For Ted Lorensen, the Hinkle Creek study will test the adequacy of stream protection regulations in the Oregon Forest Practices Act. He feels that the new technology used in the study to track responses of wildlife and watersheds to forest management operations will be of great benefit. "This research helps us to define protection in a new way," he said, "protecting something by defining a mix of desired values and in the process separating facts from theory."