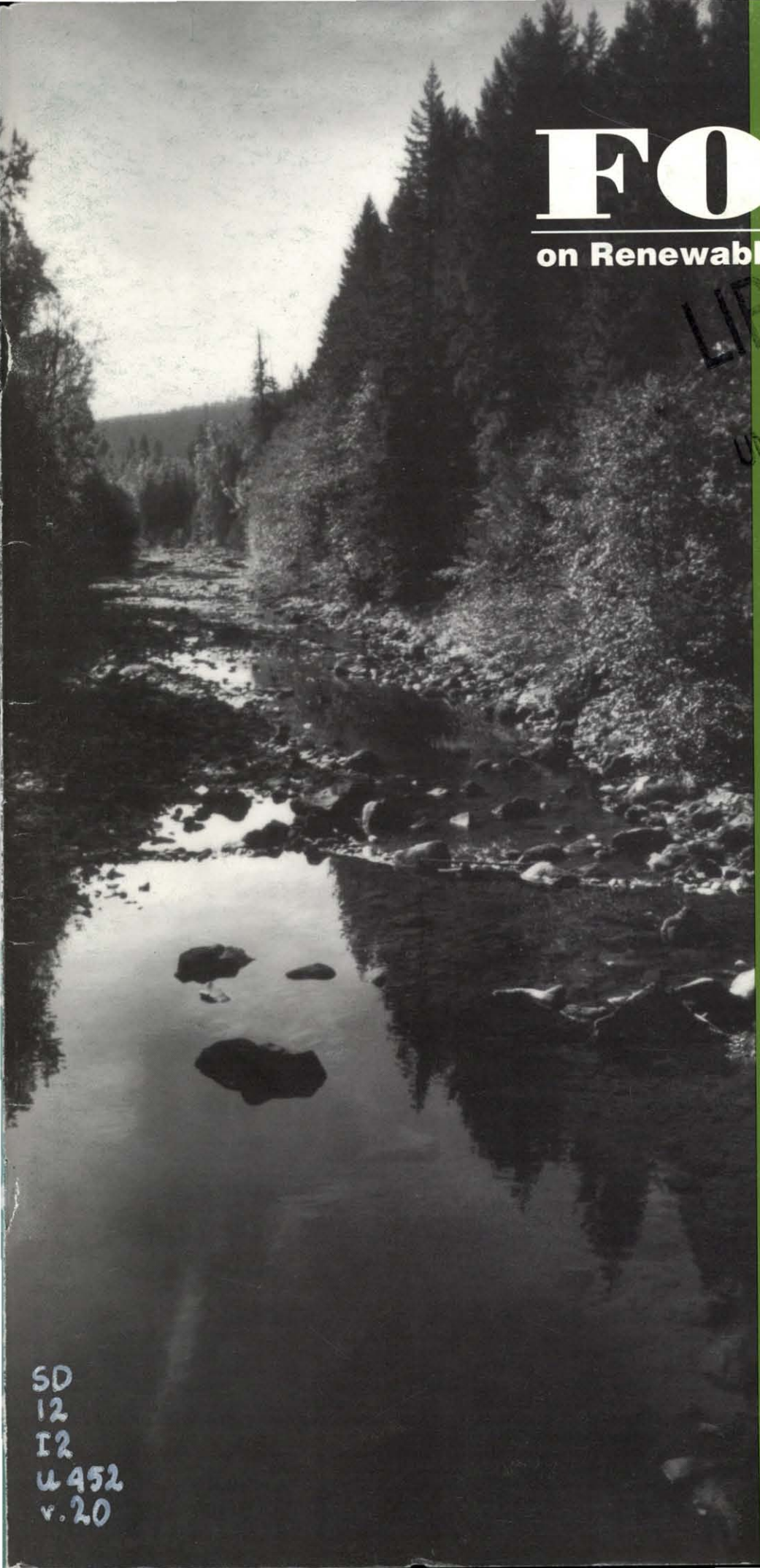

FOCUS

on Renewable Natural Resources

1994/1995
Annual Report

Volume 20

College of Forestry, Wildlife
and Range Sciences

Idaho Forest, Wildlife and
Range Experiment Station

Moscow, ID 83844-1130

University of Idaho

From the Director

Charles R. Hatch

The Hard Side and the Soft Side of Science: It Takes Both

Cooperative. Citizens. Outreach. Interactive. Multi-media. Change. People. Habits. Endangered. Crossroads. Community.

These are words used extensively throughout this year's *FOCUS On Renewable Natural Resources*, the annual report of the College of Forestry, Wildlife and Range Sciences and its experiment station. They are indicative of the emerging themes that guide the research programs of the faculty in all five of the college's departments: Fish and Wildlife Resources, Forest Products, Forest Resources, Range Resources, and Resource Recreation and Tourism. They are the themes of the mid-1990s.

Are the words listed above technical jargon or communication devices? At first glance they may not seem to be words normally emphasized in a natural resources publication. They are here because they indicate themes on the minds of the people that our science programs and our faculty serve. Science has a hard side, one focused on the use and development of technology to solve natural resource problems. But it also has a soft side, one focused on understanding people and their role in solving these problems. Both thrusts are critical components in a comprehensive natural resources research program. They allow us to find out what Idahoans want, to develop technologies acceptable to them, and to help turn their visions into reality.

On the "soft" side the Department of Resource Recreation and Tourism offers reports on how, where, and why increasing numbers of Idahoans bicycle and the implications for how we manage our natural resources, also how Washington and Idaho communities adapt to change. From the Forest Resources Department comes an atlas of social indicators for the Upper Columbia River Basin that features over 30 indicators of current community condition, from poverty and voting rate to sex ratios, physician distribution, and single-parent households. Ecosystem managers can use the atlas and these programs to understand the *people and communities* their land management policies influence: Idaho's "human ecosystem." We also examine Idaho women of the past and the land--their chores, survival techniques, and insights about the land resource and its management.

On the "hard" side, our Department of Forest Products scientists are measuring dry kiln emissions to help the forest products industry meet EPA air quality standards. One of our riparian specialists, jointly appointed in the Departments of Range Resources and Fish and Wildlife, is inventorying amphibians and reptiles so the interaction between proposed drawdowns for salmon recovery and stream aquatic ecosystems is more fully understood. The director of the Idaho Riparian Cooperative is a Department of Forest Resources faculty and a riparian specialist who reports on the partnerships his cooperative has forged with industry, private citizens, and conservationists; together they make statewide headway on riparian improvement. Two professors detail their interactive classrooms, courses augmented by the Internet that help us reach all our clients: industrial and agency managers, natural resource management professionals, citizens, and traditional students.

The Policy Analysis Group feature discusses the need to answer questions surrounding the Endangered Species Act. It previews its newest report which explains the act, its history, and identifies information Idahoans must have to effectively participate in the reauthorization of the ESA.

I believe you will find this year's *Focus* an informative introduction to our problem-oriented research programs designed to serve Idaho and its citizens. Cheers,

Chas R Hatch

FOCUS

on Renewable Natural Resources

Idaho Forest, Wildlife and Range Experiment Station

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Cover: Typical and tranquil Idaho riparian scene, captured by Gerry Snyder.

Annual Report FY 1995

Volume 20 December 1995

Financial Picture

Research Highlights

The Hard Science

The Soft Side

The Policy Analysis Group

Appendix

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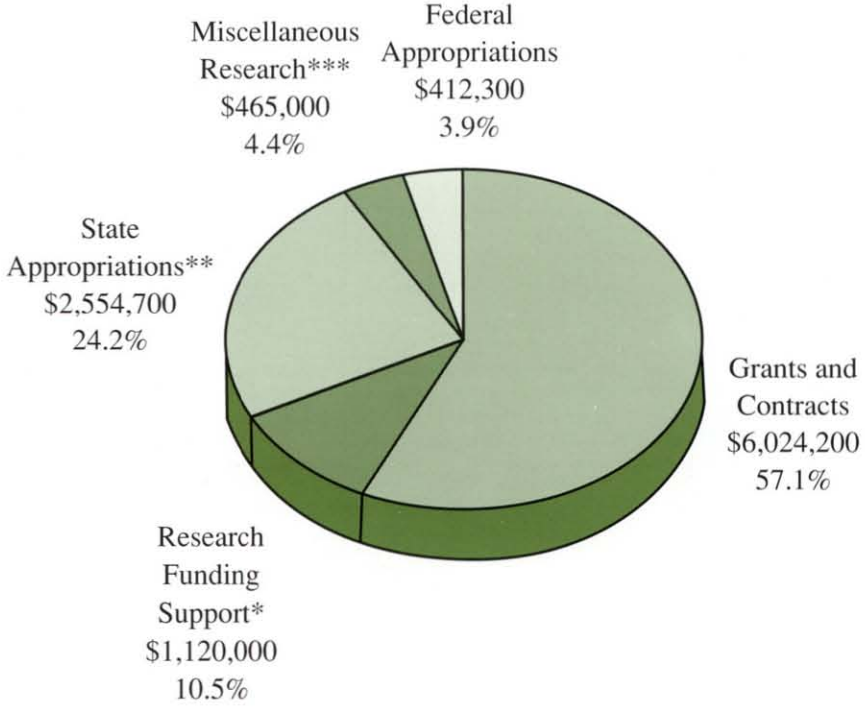
Fiscal Year 1995 Financial Picture

For every state dollar appropriated for our FY 1995 research, faculty grants and contracts brought in $2.79.

Since its inception in 1909, the College of Forestry, Wildlife and Range Sciences at the University of Idaho has become one of the oldest and most highly regarded natural resource schools in the United States. As part of the state's land grant institution, the college serves the state through teaching, research, and service. College research is administered through the Idaho Forest, Wildlife and Range Experiment Station, established by the Idaho legislature in 1939 to conduct research on the state's renewable resources.

The experiment station has the equivalent of 22.88 full-time researchers funded by the state of Idaho. However, all 58 of the college's faculty members conduct research, as do most of its 212 graduate students. The faculty spend about one-third of their time on research, much of it paid for through outside grants and contracts.



Research expenditures, shown by funding source, totaled $10,576,200 for fiscal year 1995.

* Includes overhead allowances, external matching, outside federal unit support, and external cooperative research support

** Includes FWR Experiment Station, Wildlife, Wilderness, and Forest Utilization Research

*** Includes Forest Research Nursery, Experimental Forest, Idaho Research Foundation, Taylor Ranch, and Clark Fork Field Campus

Agency and Funding Support

We had a total 120 partners in research during Fiscal 1995.

Agency for International Development
Agriculture Research Service
Alaska Fish and Game Department
American-Scandinavian Foundation
Bennett Lumber Company
Curt Berklund
Blue Mountain Elk Cooperative
Boise Cascade Corporation
Boise National Forest
Bonneville Power Administration
Champion Timberlands
Clearwater National Forest
Clearwater-Potlatch Timber Protective Association, Inc.
Clearwater Resource Conservation and Development Council
Colorado State University
Colville Confederated Tribes
Consortium for International Development
Cooperative State Research Service
DeVlig Endowment
Energy/Development International
Environmental Protection Agency
Environmental Science and Research Foundation
Evergreen Forest Products
Flathead National Forest
Ford Foundation
Foundation for North American Wild Sheep
Fremont Forest
Glacier National Park
Government of Honduras
Mr. Roger Guernsey
Hoff Companies
Idaho Department of Commerce
Idaho Department of Fish and Game
Idaho Department of Health and Welfare
Idaho Department of Lands
Idaho Department of Parks and Recreation
Idaho Forest Industries
Idaho National Engineering Laboratory
Idaho Nuclear Energy Commission
Idaho Power Company
Idaho Research Foundation, Inc.
Idaho Travel Council
Idaho Water Resources Board
Idaho Water Resources Research Institute
Inland Empire Paper Company
Inland Empire Tree Improvement Cooperative
Inland Northwest Growth and Yield Cooperative
Intermountain Forest Industries Association
Jefferson National Expansion Historical Assoc., Inc.
Konkolville Lumber
Latah County
Martin Marietta
Monsanto
Montana Fish and Wildlife
Montana State University
National Aeronautics and Space Administration
National Council of the Paper Industry
National Fish and Wildlife Foundation
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
National Rifle Association of America
National Science Foundation
National Wildlife Federation
North Atlantic Treaty Organization
North Dakota Fish and Game
North Idaho Forestry Association
Northwest Area Foundation
Oregon Department of Fish and Wildlife
Oregon Hunters Association
Oregon State University
Pacific Northwest Power Company
Pack River Lumber Company
Payette National Forest
Pheasants Forever
Potlatch Corporation
PUD #1, Pend Oreille County
QB Corporation
Riley Creek Lumber
Rocky Mountain Elk Foundation
Shearer Lumber
Simpson Timber Company
South Idaho Forestry Association
Stillinger Trust
TJ International
U.S. Army Corps of Engineers
USDA Cooperative Research
USDA Extension Service
USDA Forest Service, Intermountain Forest and Range Experiment Station
USDA Forest Service, Northeastern Forest Experiment Station
USDA Forest Service, Pacific Northwest Forest and Range Experiment Station
USDA Office of International Cooperation and Development
U.S. Department of Commerce
U.S. Department of Energy
U.S. Department of Navy/Naval Undersea Center
U.S. Office of Naval Research
USDI Bureau of Indian Affairs
USDI Bureau of Land Management
USDI Bureau of Reclamation
USDI Fish and Wildlife Service
USDI National Biological Survey
USDI National Park Service
University of Alaska
University of Arizona
University of Idaho Experimental Forest
University of Idaho Forest Research Nursery
University of Maine
University of Minnesota
University of Montana
University of Washington
Washington State Department of Natural Resources
Washington State University
Washington Water Power Company
Western Forestry and Conservation Association
West One
Weyerhaeuser Company
WILD Foundation
The Wilderness Society
Wildlife Management Institute
The Wildlife Society
Winema Forest

In one year, we work with six national forests, 10 western universities, and 43 government agencies, as well as businesses and individuals.

Idaho Riparian Coop Teams Up with Industry, Citizens, and Conservationists

Bill Ypsilantis, Louise Kellogg, George Belt, and Terry Tindall

Outreach is the name of the game. For the Idaho Riparian Cooperative, headed by Department of Forest Resources faculty member George Belt, that means delivering the important message of water quality and riparian/wetland protection to as large an audience as possible throughout Idaho. Some of the past year's activities have emphasized riparian issues in both the northern and southern parts of the state.

During July 1995 the two-year-old Idaho Riparian Cooperative (IRC) teamed up with a diverse coalition of organizations to put on a public education workshop dealing with water quality and riparian/wetland protection for Coeur d'Alene Lake in Idaho. Almost 200 people attended the workshop entitled "Working Together for the Future of Coeur d'Alene Lake." Participants included state legislators, county and city elected officials and planners, developers, contractors, realtors, lakeshore property owners, boaters, and industry representatives. Coverage of this event by a local newspaper and two television stations helped deliver our important message.

The workshop took place aboard the cruise boat "Coeur d'Alene" which navigated the shorelines while the speakers described the problems and offered solutions. Topics included current water quality status, residential growth around the lake, storm water runoff, lawn chemical use, boat wastewater disposal, wake zones, wetlands management, and shoreline wildlife habitat. Most funding came from the tourism, timber, and mining industries.

In the south of Idaho, the IRC is pairing up with the Nature Conservancy of Idaho to restore and improve riparian health, wildlife habitat, and to demonstrate that these objectives are compatible with a productive cattle operation.

The Nature Conservancy has purchased the 1,450-acre Flat Ranch on the headwaters of the world famous Henry's Fork of the Snake River. Located in the heart of the upper Henry's Fork Basin just west of Yellowstone National Park, the ranch will provide an important base for riparian work in the area. The Conservancy has begun to actively work with irrigators and potato farmers to restore long absent winter flows to the 12 miles of the upper Henry's Fork through a complex series of water acquisitions and exchanges. If successful, this project will help reverse many decades of decline on the river, re-establish the native trout fishery, and provide countless

recreational opportunities for public benefit.

Since ranches in the upper Henry's Fork valley are a key ingredient to the area's local economy and have helped preserve much of the basin's scenic open space and wildlife habitat, the Conservancy will continue to own and manage the Flat Ranch as a productive cattle operation.

This past spring, the IRC and the University of Idaho committed to help design a monitoring program that would carefully evaluate the condition of ranch pastures, the recovery of the riparian areas, and the use of the ranch by wildlife. In late June 1995 several IRC members visited the Flat Ranch to assess its condition. As a result, Bill Ypsilantis, IRC Steering Committee Chair, developed a series of recommended management objectives and monitoring techniques which have been extremely helpful to Conservancy staff in their efforts. The IRC input will continue to be useful in future management plans for the Flat Ranch.

One of the Conservancy's and the IRC's goals is to use the Flat Ranch as a demonstration project, helping to develop new management techniques. The Idaho Forest Stewardship Program is supporting these educational efforts with a $2,500 grant. The grant, under the direction of the University of Idaho, will help fund production of a video, brochure, and a visitor display on the Upper Henry's Fork project, all of which will help educate landowners about successful techniques to reforest and stabilize stream corridors. IRC Outreach Coordinator Terry Tindall (soil scientist, Idaho Cooperative Extension Service) has been heavily involved in this effort.

The Idaho Riparian Coop exemplifies the spirit of "cooperatives" in its philosophy of partnering with various types of organizations to protect the precious water resources of the Northwest.

George Belt is professor of forest resources and director of the Idaho Riparian Cooperative. Bill Ypsilantis is a soil scientist with the Bureau of Land Management in Coeur d'Alene and IRC Steering Committee Chair. Louise Kellogg is the Henry's Fork Project Manager with the Nature Conservancy. Terry Tindall is extension soil specialist-Twin Falls for the College of Agriculture. For additional information on the Idaho Riparian Cooperative, please call Professor Belt at (208) 885-7115.

IRC Members

American Fisheries Society (Idaho)
Idaho Department of Fish and Game
The Nature Conservancy of Idaho
UI Water Resources Research Institute
USDI Bureau of Land Management
USDI Bureau of Reclamation
USDA Forest Service (I, IV)
US Natural Resource Conservation Service

IRC Supporters

Butler Livestock Company
Idaho Cattle Association
Idaho Department of Agriculture
Idaho Department of Water Resources
Idaho Division of Environmental Quality
Idaho Forest Stewardship Program
Latah Soil and Water Conservation District
Donna Maupin
National Park Service
Pocket Water Consulting
Society of American Foresters
Society for Range Management
Soil and Water Conservation Society
University of Idaho
US Fish and Wildlife Service

How and How Much? Measuring Dry Kiln Emissions

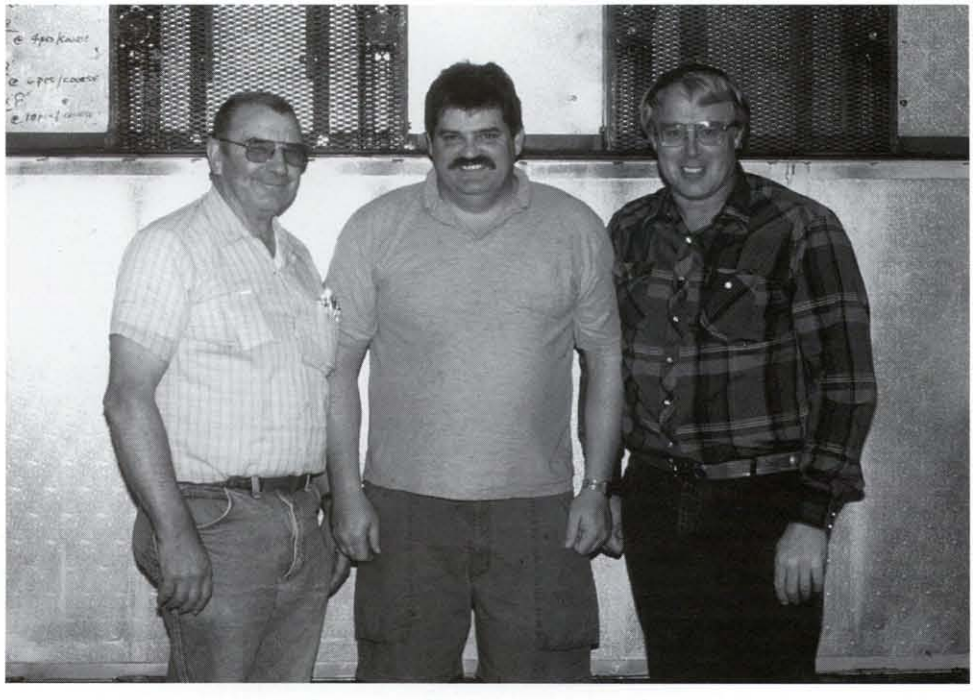
Richard Folk, with Editor

Since the Environmental Protection Agency (EPA) demands information on the emission of volatile organic compounds (VOC's) produced by forest products operations, these operations are finding an increasing need to measure their emissions. Only with this information will the EPA issue the necessary Title V operating permit applications and permit program fee assessments.

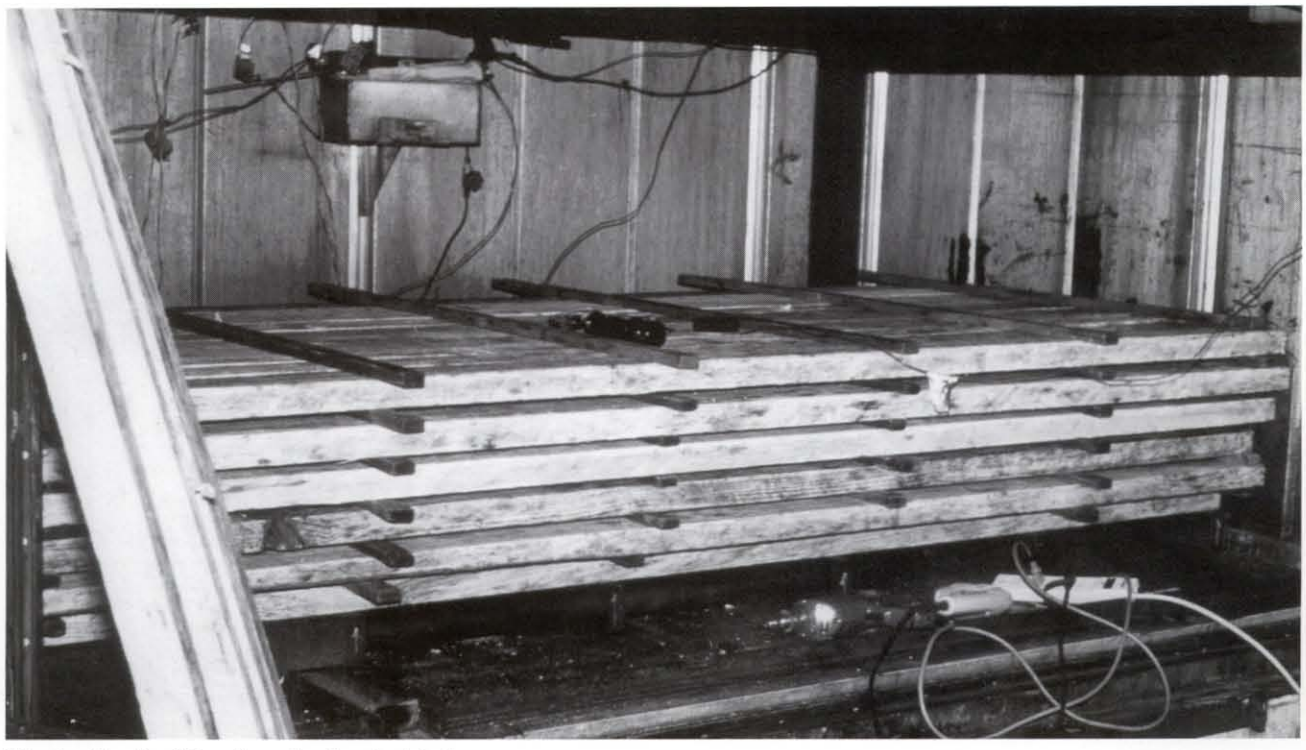
One source of VOC's are the dry kilns that dry lumber at sawmills. Dry kilns are not built to be airtight, so fugitive losses from the walls, doors, and vents must be accounted for. Dry kilns, often more than 150-foot long, are buildings louvred with rows of vents in the roof that permit the escape of water (steam) being removed from the wood. These vents open randomly whenever temperature and humidity conditions inside the kiln warrant opening.

The tasks necessary for conducting VOC emission testing during lumber drying are formidable. A question also exists as to the application of EPA Method 25A to measure and quantify VOC emissions from lumber dry kilns. Method 25A is the approved way to measure emissions from industrial stacks such as boilers, smelters, and combustors, but it has never been tried with dry kilns. Until now.

Method 25A consists of conveying a filtered and heated emission sample through a line to a heated flame ionization detector (FID) where the emissions are measured and reported as carbon atom equivalents. VOC's in themselves are not the primary pollutant of concern, but rather the fact that VOC compounds react with nitrogen/oxygen gases and in the presence of sunlight, deplete ozone. We needed to answer these questions about Method 25A: How does high moisture content affect FID response and what are the effects if the water is removed? How do terpene compounds affect FID response? And does the length of the heated line influence the measurement?



Left to right: *Olin Galloway (Louisiana Pacific), Leonard Smith (National Council for Air and Stream Improvement), and Richard Folk (UI Department of Forest Products).*



The inside of a kiln where lumber is dried.

We attempted to answer these questions in a recent five-month study, still ongoing. The principal investigators are Andre Caron of the National Council of the Pulp and Paper Industry, Richard Folk representing the University of Idaho's Department of Forest Products, and a group of supporting forest products companies including Louisiana-Pacific, Georgia Pacific, Simpson Timber, Weyerhaeuser, Idaho Forest Industries, the Potlatch Corporation, Boise Cascade, and Union Camp Corporation represented by James Evenson and T. Orlin Galloway.

The project is a cooperative effort in every respect. At the University of Idaho pilot dry kiln and using typical lumber drying schedules, we are drying duplicate charges of lumber of different U.S. species from Arkansas to California, supplied by the cooperating companies. A drying schedule consists of a series of temperatures, humidities, and fan speeds programmed into the kiln so that water is removed without degrading the wood.

The pilot kiln can accommodate approximately 140 eight-foot 2"x4" boards, and it is nearly airtight, so fugitive emission losses are relatively low. Kiln operation is controlled with a computerized system designed by the Louisiana-Pacific Corporation. Moisture content and temperature of several sample boards, and the temperature and humidity inside the kiln are monitored throughout the drying schedule. A prototype manifold, designed by Richard Folk and built at the university's Physical Plant Mechanical Shop, has been attached to the kiln's top to deliver outside air to the kiln through the open vents while still allowing emissions to exhaust from the vents into the manifold, and to exit out of the monitoring stack. In other words, we need to understand the differences between what enters and what exits the kiln. The stack contains the heated FID line, two anemometers to measure flow rate, a thermocouple to record temperature, and a hygrometer to measure humidity.

So far, the project has revealed that Method 25A adequately explains air and moisture balance. Moisture and the length of the sampling line did not influence FID operation, and duplicate loads of lumber for nine species showed nearly identical VOC emission amounts; those species were grand fir, white fir, western larch, and Douglas-fir. Further study is now underway to measure additional conifer species and some commercial hardwoods, including aspen, white pine, redwood, western hemlock, southern yellow pine, ponderosa pine, oak, western red cedar, and sugar pine.

In the meantime, the forest products industry will present Method 25A and the emission factors developed thus far to the Environmental Protection Agency for approval and application in Title V.

Richard Folk is a research assistant professor in forest products.

Drawdowns, Amphibians, and Reptiles on the Lower Snake River

Kirk Lohman, with Editor

How would a drawdown of northern Idaho reservoirs affect amphibian reptile populations and their habitat? With drawdowns becoming a major potential management tool in the future for aiding endangered fish species, the U.S. Army Corps of Engineers is in the process of inventorying animal species in the riparian ecosystems of the Lower Snake River. This would be a starting point for measuring how drawdowns impact riparian animals, including amphibians and reptiles.

To that end, wildlife graduate student Susan Small and I have begun surveying amphibians and reptiles in riparian habitats along the Lower Snake River; we started the summer of 1995. Our study will assess the distribution of amphibians and reptiles in riparian areas along the Lower Granite, Little Goose, Lower Monumental, and Ice Harbor reservoirs. We are collecting baseline information on the occurrence and relative abundance of reptiles and amphibians to determine the present population status, and for use in the future as a comparison for potential post-drawdown inventories.

Back in the 1970s, scientists found 18 species of amphibians and 26 species of reptiles in riparian habitats throughout the Columbia and Snake River study areas.

The U.S. Army Corps of Engineers (which is funding this study) inventoried riparian habitats and associated wildlife along the Snake and Columbia Rivers in the mid-1970s to learn of the impacts on vegetation and wildlife of water level fluctuations resulting from power peaking operations. This work included habitat typing of riparian areas, as well as inventories of big game, small mammals, furbearers, upland game birds and mammals, waterfowl, birds of prey, other birds, and amphibians and reptiles.

Back in the 1970s, scientists found 18 species of amphibians and 26 species of reptiles in riparian habitats throughout the Columbia and Snake River study areas. Along the Lower Snake River from Clarkston (Washington state) to the Ice Harbor Dam, they found seven species of amphibians and 12 of reptiles.

Our objectives are: one, to determine amphibian and reptile species richness in riparian habitat along the Lower Snake River; and two, to discover the relative abundance of these species in riparian habitats along the river.

Visual encounter surveys and straight-line drift fences with pitfall trapping will help us determine species richness and relative abundance. We will work at the ten locations used in past surveys and add ten additional sites to more fully describe amphibian and reptile distribution. In particular, we intend to find additional sites in the upper stretches from Clarkston to Lower Granite Dam, and from Lower Granite to Little Goose Dam. Using both the visual encounter and pitfall trapping techniques maximizes our chances of finding species not readily detected by one method or the other.

Visual encounter surveys consist of systematically walking over an area (a transect) and turning over surface objects such as rocks and logs, then recording sightings. We will do this five times over the next year. Drift fences and pitfall traps capture most reptiles alive, allowing us to mark them before releasing them; this technique also will be completed five times. All traps are covered and sealed when not in use.

From this work we will generate a species list for each site, as well as a cumulative list for the Lower Snake River. In addition, we'll be able to calculate at least two estimates of relative abundance for each species at each site. In the end, we will be able to

present to the Army Corps of Engineers a summary comparing species richness and relative abundance among sites, seasons, and habitat types.

Kirk Lohman is assistant professor of fish and wildlife resources and assistant professor of range resources in the college. His research is funded for one year.

The New Multi-Media and Interactive "Classrooms"

http://www.uidaho.edu/cfwr-teaching/

Faculty in the college are using multi-media techniques to advance both teaching and research. One example is Associate Professor Ronald Robberecht's computer-aided instruction of range ecology courses. Melding various media (text, animated graphics, digitized motion video, sound, digitized photos) into one seamless lecture presentation, he has found that this technology considerably enhances lecture quality and student understanding of complicated scientific concepts.

Each course has its corresponding Internet site used to distribute handouts, sample examination study questions, reading assignments, course descriptions, reference lists, course announcements, journal listings, books and articles, and Internet links to other web sites related to ecology. Especially useful to students is the access to career information, bibliographic databases, professional societies, other libraries, and more.

Robberecht has also created an electronic ecology textbook on CD-ROM. The textbook includes such enhancements as interactive self-study exercises, simulation modeling of ecological processes (student input predicts the outcome of a process), and extensive databases for reference materials. Robberecht's programs can be accessed at **http://www.uidaho.edu/ecology**.

In forest resources, graduate student Riyaz Sadiq and faculty members Molly Stock, Dave Wenny, and Ronald Robberecht have created "An Interactive Expert System for Forest Nursery Managers." To be used for computer-aided design of nursery operations and nursery manager training, the program focuses on planning a growing regime for ponderosa pine seedlings.

Professor Stock also uses an expert system-based multimedia program to introduce forest resources freshmen to the department's curriculum and helps them with registration decisions. And she is developing "The Fire Monitoring Navigator" for the Interior Fire Coordination Committee of the USDI Fish and Wildlife Service. Cooperators include Willard Leenhouts, Melanie Miller, and Frank Bodin. Access her at **mstock@uidaho.edu**.

Idaho Women and the Land

Editor

She addressed the 168 students in "Society and Natural Resources" (Forestry/Sociology 235) wearing a long denim skirt, a mutton-sleeved blouse, and a leather vest. She looked like one of Idaho's pioneer women as she gave her guest lecture to Adjunct Assistant Professor Craig Miller's class. On stage in the auditorium of the university's Administration Building, forest resources Professor Lauren Fins presented "Idaho Women and the Land" this past semester.

"Where were the women?" she asks rhetorically at the opening of the dramatic production she wrote and compiled with Kim Bouchard, formerly of the UI Women's Center. The two women have traveled the state giving the performance, and Fins envisions producing it for public television.

A 16-year member of the college's faculty, Fins traces the conscious line of women on the western frontier with photographs, videotape, poetry, diaries, and her own dramatic monologues. "The idea has been to combine theater and forestry," she explains.

Women as well as men were the movers and molders of the Idaho frontier and forests, and it is from their writings that Fins expresses the first Idahoans' messages about connectedness, a collage of voices expressing the same sense of place she draws on within herself, and which initiated her desire to produce this lecture. She enhances the experience for students with slides and a dramatic flare polished by extensive experience in local community and semi-professional theatre.

In 1860, Fins points out, nearly 31,000 non-native Americans lived in the Idaho, Montana, and Wyoming territories. Only about 1,000 were women, many living in the Morman communities of south Idaho. From those 1,000 women to Idaho women today, "what is clear is the importance of place and the land in our lives," she says.

At the beginning of her hour-long drama, Fins reads excerpts from Idaho author Janet Campbell Hale, who expresses "not feeling she belonged anywhere else but in Idaho." One Idaho woman of the past boasts of having put up 1,000 quarts of fruits, vegetables, and meats. Fins reads from Grace Jordan's book *Home Below Hell's Canyon*, recounting her sometimes chaotic life in a cabin above the Snake River. Mrs. Jordan, wife of former Idaho Governor Len B. Jordan, at one point comments that she hopes for only a moment "to lean and think, or just to lean."

Lauren Fins

Professor Fins reads of cellars full of winter provisions—salt, cattle grain, fruit, potatoes—excerpts from the first white settlers of Riggins, Julietta, Granite Creek, and Hells Canyon. She portrays the women's memories of work and more work: of canning, clearing the land, endless washing of dishes, and of the atmosphere in their houses: noisy children, dust, and hardly ever a quiet moment.

One important thing the beautiful Idaho country seems to have given these women was "quiet." Here is where diary entries grow poetic. The women describe resting in their quiet moments under a tree, finding their true selves, and even solving domestic problems. "Unaccustomed thoughts come to one," comments one of the women. "We learned to live...we had found something," proclaims another.

Novelist Carol Ryrie Brink grew up on an aunt's homestead near Moscow, and wrote of battles between the homesteaders and the timber industry and federal land

"These women were hardworking...and practical, but also they understood the value of the moment, precious moments, and their sense of place."

management agencies. The dialogue Fins quotes talks of clearing the land for wood to build ships and houses, of homesteaders making their fortunes, of worry about the potential for clearing *all* the trees, and about the idea of replanting. "Sound familiar?" Fins asks the audience. The class has discussed "intrinsic values" over the past semester.

Then she runs an almost obscure tape of a film made by Nell Shipman, Hollywood starlet of the silent movie era who moved to Priest River to produce a number of conservation-oriented films. Fins sees her movies as an early precursor to today's environmental movement. Shipman wanted to "protect" the forest from developers and manufacturers. "Brink brings a more balanced view," interjects Fins, "recognizing the need to harvest as well as preserve the ideas of wise use. She was a conservationist in a traditional sense."

And there are the historical events these women witnessed. Brink's novel *Strangers in the Forest* recalls the devastating forest fire of 1910 that burned a 60-mile- wide swath from northern Idaho to western Montana—three million acres.

This presentation, which has been a "wonderful venue for teaching ecology" according to Fins, took her one year to put together and is still in progress. While the focus of her original research for the project was women, Fins suspects that one would find the same sense of place and connectedness to the land among the men.

"These women were hardworking," explains Fins, "and practical, but also they understood the value of the moment, precious moments, and their sense of place. To me that is their message. Now," she challenges the class, "where should we take that message?"

Miller says unique speakers like Fins aid in his course's goal of "looking at things from a different perspective." His next speaker on natural resources and society is a Nez Perce.

Lauren Fins is professor in the Department of Forest Resources specializing in forest genetics. She is director of the Inland Empire Tree Improvement Cooperative, and has experience in acting through local Moscow community theater, the university's semi-professional Idaho Repertory Theatre, and the Jewish Children's Theatre in New York. Craig Miller is adjunct assistant professor in forest resources and staff of the Cooperative Park Studies Unit housed within the college. Some of the original diaries Fins read from are housed in the Special Collections section of the University of Idaho Library.

Undated photo from photo archives, College of Forestry, Wildlife and Range Sciences.

Creating *An Atlas of Social Indicators for the Upper Columbia River Basin*

Gary E. Machlis, Jo Ellen Force, and Jean E. McKendry

Ecosystem management is emerging as a new approach to managing federal lands and natural resources. While there is ongoing debate about how to practice ecosystem management, the basic principles are straightforward. They include:

▶ natural resources should be managed as a system of interconnected parts, using the *ecosystem* as an organizing framework

▶ people are part of ecosystems and their needs and activities must be considered in management plans

▶ managers should be concerned with short and long term trends, as well as the local, regional, and national consequences of actions, and

▶ decisions about resources should be made collaboratively, including federal agencies, local governments, and citizens in the process.

Understanding the social, cultural, and economic conditions within a region is crucial for successful ecosystem management. One approach is to use *social indicators*. Social indicators are statistics collected over time and used for making decisions. For example, the Consumer Price Index (CPI) keeps track of changes in the price of a typical group of consumer goods. The CPI is used to monitor inflation, compare the cost-of-living in one region of the country to another, and in economic policy-making.

Social indicators can be effective in presenting the "basic facts" about the people of a region. Such basic facts are important to ecosystem management, and can be used in many ways: assessing the potential impact of government policies, developing effective resource management plans, increasing public involvement in the planning process, and so forth. Like measures of water quality, wildlife populations, or timber supply, social indicators provide managers and citizens with information needed to make sound decisions concerning public resources. Decisions made this decade will have consequences for the people and landscape far into the 21st century.

In our *Atlas of Social Indicators for the Upper Columbia River Basin*, social indicators are defined as an integrated set of social, economic, and ecological measures which are 1) collected over time, 2) taken from available data sources, and 3) useful to ecosystem management and decision-making. The indicators in the atlas are not simply a collection of various statistics displayed in maps, but an integrated set of indicators organized around a key concept—the *human ecosystem*.

The human ecosystem is a useful concept; it is a "model" of how people interact with their environment and each other. The human ecosystem includes a number of important components, from the energy people use to the beliefs and opinions they hold.

By displaying the social indicators, this atlas can be useful to citizens, managers, and decision-makers of the region. Uses include monitoring, comparative studies, trend analysis, social impact assessment, and collaborative decision-making. The 39 social indicators include rates/occurrences of poverty, voting, major religious groups, age, infant mortality, irrigated land, seasonal employment, housing heated with wood, rural population, physicians, industry earnings, divorce, ethnic diversity, and more.

Social indicators for the Upper Columbia River Basin are presented in a series of color maps created according to the most currently available county-level data, in most cases from 1990 or 1992.

The atlas covers the 57 counties of the Upper Columbia River Basin, which includes portions of Idaho and Montana. County-level data were used for several reasons. Good quality data are available at this scale, consistently collected at regular intervals, and comparable across all U.S. counties. Counties are stable geographic units for monitoring trends, as little change in county boundaries occurs over time. In addition, counties are an important administrative unit of government, and finally, county government is the socio-political unit closest to the landscape scale often employed in ecosystem management.

The authors are faculty in forest resources. Jean McKendry is research associate in the cooperative park studies unit, housed in the college. *The atlas is the third of a series of projects on social indicators for the Interior Columbia Basin Ecosystem Management Project. It was compiled with the assistance of these students from Middlebury College, Vermont: Emma J. Ansara, Justin B. Douglas, Stephen T. Engle, Caleb McClennen, Eric S. Nadzo, and Tanya M. Tarar.* ***To order the atlas, please contact the college's Publications Department at (208) 884-6674.***

The Human Ecosystem

While the human ecosystem is an abstract concept, specific human ecosystems are not difficult to identify. For example, a rural community is a human ecosystem—it has identifiable boundaries, includes biophysical and social factors (such as land, water, people, and organizations), and as a system, adapts to changes over time.

Human ecosystems can be described at several spatial scales, from small to large. A family unit, community, county, or region can fruitfully be treated as a human ecosystem. These scales are connected; changes in a region can have impacts on communities and individual families.

While the scale of human ecosystems can vary, there are several essential elements. A set of *critical resources* are required in order to provide the system with necessary supplies. These resources are of three kinds: *natural resources* (such as energy or water), *socioeconomic resources* (such as labor or capital), and *cultural resources* (such as organizations and beliefs). These resources are necessary to keep the human ecosystem functioning; their flow and distribution are critical to ecosystem sustainability.

The flow of critical resources is regulated and used by the *social system*, which has three main components. The first is a set of *social institutions*, defined as collective solutions to universal social challenges or needs.

The second main component of the social system is a series of *social cycles*.

The third part of the social system is the *social order*, which is a set of cultural patterns for organizing interaction among people and groups.

Taken together, social institutions, social cycles, and the social order constitute the human social system. Combined with the flow of critical resources, this creates the human ecosystem.

The atlas is the third of a series of projects on social indicators for the Interior Columbia Basin Ecosystem Management Project headquartered in Walla Walla, Washington.

PEOPLE Make Change Work in the Communities of the Columbia River Basins

Charles C. Harris, with Editor

The Eastside Ecosystem Management Project has looked at more than the issues surrounding natural resources; it has looked at the *people and communities* involved in those issues and resource uses. Faculty in the college recently conducted sociological research as part of the Social Science Assessment of the Interior Columbia River Basin Ecosystem Management Project, the multi-agency resource management planning project being led by the USDA Forest Service. Charles C. Harris, director of the Rural Policy Studies Project, was joined by co-investigators Greg Brown, adjunct assistant professor in the Department of Resource Recreation and Tourism and computer/networking specialist, and William J. McLaughlin, professor in the same department. Our goal was to assess the characteristics and conditions of small, rural communities in the Interior and Upper Columbia River Basins, a region including Washington and Oregon east of the Cascades, all of Idaho, western Montana, and several counties in Western Wyoming.

The more a community had experienced change in the past, the more resilient we found it to be in the present.

We started with several premises. First, the small rural community is an important scale for social assessment, if not the most significant scale. For most residents of rural regions like the study area, the community where they socialize, shop, and perhaps work or go to church is the focus of their social lives. Second, the characteristics and conditions of small rural communities in the region are complex and constantly changing. And finally, community resilience influences how well communities adjust to change. *Resilience* here is defined in terms of a community's ability to respond and adapt to change in the most positive, constructive ways possible for helping mitigate the impacts of change on the community. The resilience of a community is relative, so the study focused on degrees of resilience—the communities can be thought of as representing a continuum from low to high resilience. Our results on resilience reflect residents' perceptions of their communities in early 1995. The research also examined the relation of communities' resilience to factual information about their characteristics, such as their population size, actual response to change, and their actual economic structure in the first quarter of 1995.

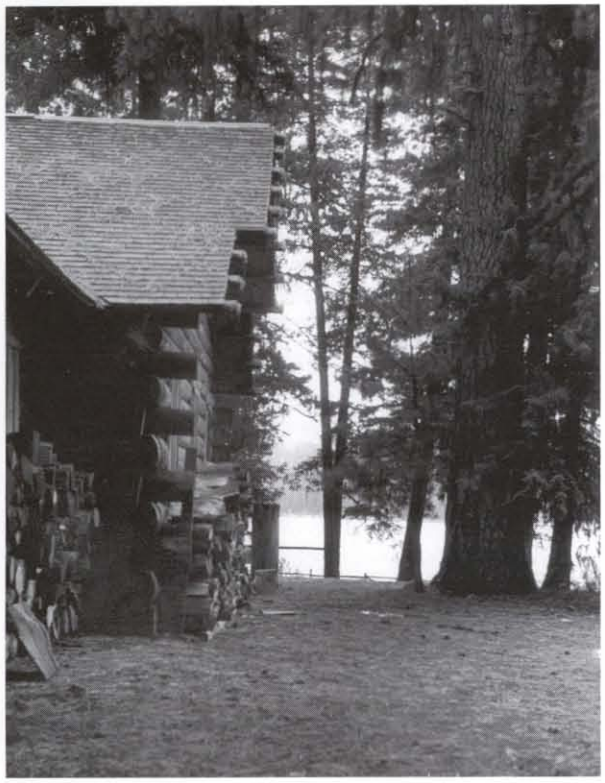
This study examined the characteristics and conditions of the 387 small rural communities that are incorporated towns of less than 10,000 in population. In part, we analyzed 1990 and 1992/1994 data on all communities from the U.S. Census Bureau; we also collected detailed data in 1995 from a survey of a random sample of half (198) of those communities. The data from the current research provide only a snapshot in time, but they are representative of all small rural towns in the region in 1995.

Methods included gathering economic data on all communities, as well as conducting community assessment workshops, surveys of community officials, and surveys of residents' perceptions about change in their communities (145 *significant change communities* or towns impacted by changing government policy).

Key research findings confirmed that:

1) Small rural communities are an important scale for gathering and analyzing social data on human populations. Our results support the premise that community is the most significant level of social organization, and thus the proposition that population and other social data collected at the county level are problematic. In central Washington for example, 38 percent of residents of Chelan County do not live in communities, yet only 18 percent of all county residents reported that their community was unimportant to them; 79 percent said their community was "somewhat" to "highly" important to them.

2) Small rural communities across the region are changing. A large majority (70 percent) of the communities across the region reported that they had experienced a moderate to high degree of change since 1990. The more



a community had experienced change in the past, the more resilient we found it to be in the present.

3) The population sizes and rates of growth of small rural communities vary across the region. The populations of these communities declined in the 1980s by an average of -3 percent. However, in the 1990s, the average populations of rural communities in all the states in the Columbia River Basin have increased, ranging from an average of 3 percent to a high average of 12 percent. The vast majority of all towns in the region (86 percent) have been growing since 1990.

4) The economies of rural communities are complex, and citizen perceptions of them vary in accuracy. When citizens rated the extent to which their towns were dependent on resource-based industries, their perceptions did not always match the actual economic data. In our comparison of perceived and actual resource dependency, we found that 39 percent of all towns in the case of timber and 58 percent in terms of agriculture were considered by residents to be moderately to highly dependent on those industries, although the industries represented less than ten percent of total employment in these communities. The preliminary analysis of the perceptions and realities of these towns finds them to actually be more diversified than their citizen representatives perceive them to be.

We also found that in towns smaller than 10,000 where wood manufacturing or paper product mills have closed since 1980, 52 percent suffered population declines while 48 percent increased in population. In total, the change in population of small towns in which mills have closed has been a net increase of 8 percent since 1980, 11 percent higher than the average for the region in the 1980s.

5) A community resilience index can indicate the ability of small rural towns to manage change. The Community Resilience Index (CRI) was developed as an indicator of a town's ability to manage change and adapt to it in positive, constructive ways; the higher the index, the greater the town's resilience, and the more vital, attractive, and healthy the community.

6) For small rural communities, bigger is better (at least in some ways). A small town's population size is the single best characteristic for predicting its current conditions and likely response to change. The simple conclusion here is one consistent with the basic premise of the community development literature: if members of a small rural community want to "improve" their town (all things being equal), they should work to increase its population and economic base. Large rural communities typically represent a more advanced stage of social and civic development than small ones. An interesting question for future research is: at what size and level of community development are the net benefits of growth maximized beyond which the social costs of further growth begin to exceed its benefits?

To develop constructive strategies for managing change, it is important to assess the current characteristics and conditions of communities in the region, changes in them, and the major factors influencing those changes and communities' responses to them. Residents must deal with the realities and potentialities of their particular community. Importantly, while a community's resources, especially its amenities and attractiveness, can be a factor influencing a community's development, a decisive, major determinant of its resilience clearly is its residents—in particular, the willingness of its people to take the lead, organize, and realize their community's leadership potential. *People* can be central in creating the future of their communities.

Charles C. Harris is associate professor, Department of Resource Recreation and Tourism.

Bicycling Idaho...Residents Reveal Their Habits

Nick Sanyal

...17% of respondents indicated that someone in their household commutes by bicycle to work or school...

Although automobile driving is the most dominant mode of travel in Idaho, as elsewhere, walking is an important alternative, coming in second when Idahoans are asked about their travel habits. However, bicycling, the third most often used form of travel in Idaho, is more important even than public transportation.

From December 1993 to January 1995 the university's Department of Resource Recreation and Tourism collected data as part of the 13-month Idaho Resident Recreation and Travel Study, a project that asked residents about their recreation, leisure, and travel habits. Recreational activities included everything from swimming or golfing to skiing and others. Leisure included visiting family, going to the library or a movie, shopping, even attending church/temple. Travel (and recreation) included walking, bicycling, driving, and air travel.

The study involved administering a mailback diary questionnaire to randomly selected Idaho households all over the state. To attain a representative sample, the researchers sent out 2,200 surveys per region, totalling 15,400 for the state. Respondents kept the diary for four days and were asked to complete the questionnaire based on the habits of their entire household.

Families answering our questions in their diary surveys revealed that, perhaps not surprisingly, the number of bicycles per household is greater for households with teenagers (58 percent own at least one bike) and children (42 percent). Forty-one percent of adult households have two people who own bicycles. Interestingly, our demographic data also showed that household income and size are larger for households owning at least one bicycle compared to households without any bikes. The median income for households having at least one bicycle is $35,000 compared with $19,000 for households without bicycles. Eighty-one percent of Ada County households reported owning at least one bike.

Seventeen percent of respondents indicated that someone in their household commutes by bicycle to work or school during some portion of the year, mostly in the spring and fall. Seventy-five percent of all households responding said they use bicycles for pleasure riding, 65 percent for exercise, 62 percent for paved road biking, 34 percent for gravel/dirt road biking, 25 percent for paved trail biking, 24 percent for running errands, 20 percent for sightseeing, 20 percent for dirt trail biking, 11 percent for off-trail biking, 5 percent for primary transportation, and 3 percent for racing and competition.

Further, bicyclists expressed strong preferences against riding with motor vehicles. Only 20 percent prefer biking on the roadway while 80 percent like to ride on a bike path. Twenty-two percent prefer paths on the side of the road, and 78 percent favor biking paths separate from roadways.

Residents travel by automobile on 75 percent of their trips within the community, and 76 percent outside the community. They walk 19 percent of the time in community, 14 percent out of community. When it comes to bicycling, it's 4 percent in community, and less than one percent out of community.

Region IV is already using our survey data in development planning projects, and results on a county-by-county basis are available in individual reports for these counties: Ada, Bannock, Blaine, Bonneville, Twin Falls, Kootenai, Latah, and Nez Perce.

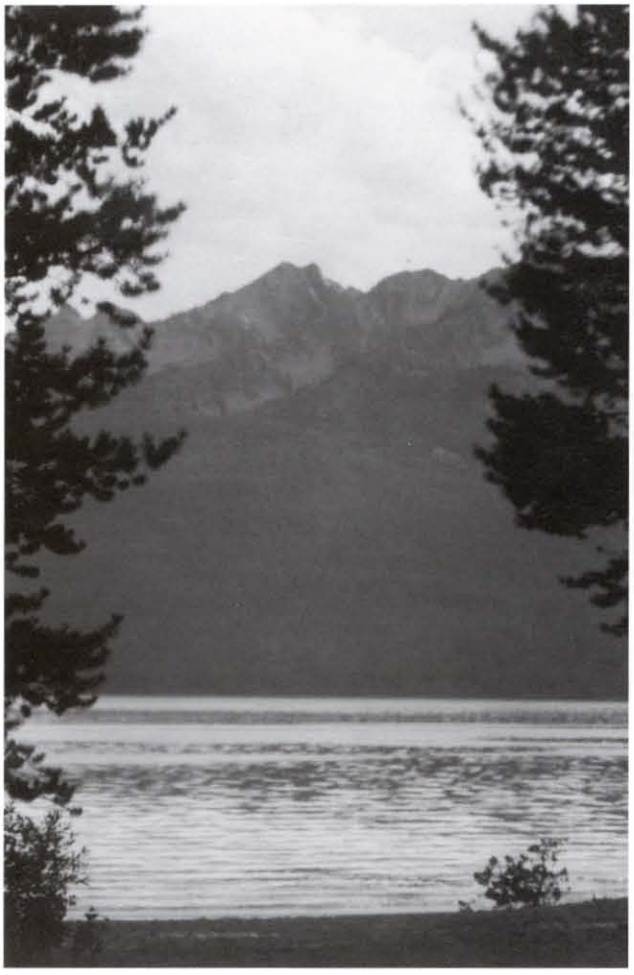
Nick Sanyal is assistant research professor in the Department of Resource Recreation and Tourism. His co-authors for the final report 1994 Resident Travel and Recreation in Idaho: Bicycle Results *(and related reports by county) are Josie Parrish, Krista Morten, Stuart R. Leidner, and (Department Head) John D. Hunt.* *Funding was from the Idaho Transportation Department, the Idaho Department of Commerce, and the Idaho Department of Parks and Recreation.*

Endangered Species Act at the Crossroads: New Directions from Idaho Case Studies

Philip S. Cook, Jay O'Laughlin, and Charles R. Hatch

Few natural resource issues create as much interest in Idaho as those involving threatened and endangered species. Grizzly bears, wolves, caribou, bald eagles, whooping cranes, salmon, sturgeon, and other rare fish, wildlife, and plants make Idaho a special place, and future Idahoans would be poorer without them. The Endangered Species Act (ESA) was devised by the United States Congress to ensure that these species remain with us. The law requires us to consider and provide for these species in our land and resource management practices. That consideration, on occasion, has significantly altered the way we manage our land and natural resources.

What species are on the list and protected in Idaho? Where is the flexibility in the ESA? These and others are questions that Idahoans need to understand and address if they are to be informed participants in current Congressional examination and reauthorization debates about the ESA legislation. The latest report, Report Number 13, of the Idaho Forest, Wildlife and Range Policy Analysis Group or PAG, answers these fundamental questions.



Redfish Lake, Idaho. Photo by Ernie Brannon.

The report is designed to answer a number of questions about the effects of ESA implementation in Idaho, especially legal requirements that might necessitate modification of existing land and resource management practices. The focus questions that guided the analysis were suggested by a committee of leaders of public agencies and private organizations interested in Idaho's natural resources. These 15 questions provide the organizational framework for the report. The body of PAG Report No. 13 consists of 15 chapters, each titled with the particular question. The appendices feature case studies of Idaho species conservation and recovery efforts for salmon, bull trout, and grizzly bear.

It is difficult to overemphasize the importance of habitat in species conservation, thus habitat is a con-

Decisions affecting habitat involve land and resource uses and are thus political. This explains in part why science cannot address all ESA questions.

tinuing theme throughout the report. Decisions affecting habitat involve land and resource uses and are thus political. This explains in part why science cannot address all ESA questions.

Here are the 15 questions addressed in PAG Report No. 13.

1 How does the ESA work?
2 Who is responsible for the ESA?
3 Where is ESA information available?
4 What species are on the ESA list and protected in Idaho?
5 What actions are underway to protect and recover listed Idaho species?
6 What are the prospects for recovering and delisting these species?
7 What species in Idaho are candidates for ESA listing?
8 What actions are underway to prevent the need to list candidate species?
9 What are the major ESA issues?
10 Does the ESA mean a shift of management control?
11 Can the ESA be modified to work better?
12 Is there flexibility in the ESA?
13 Is there an appropriate role for economics in the ESA?
14 What role should agencies play in the ESA?
15 What alternatives are there for changing the ESA?

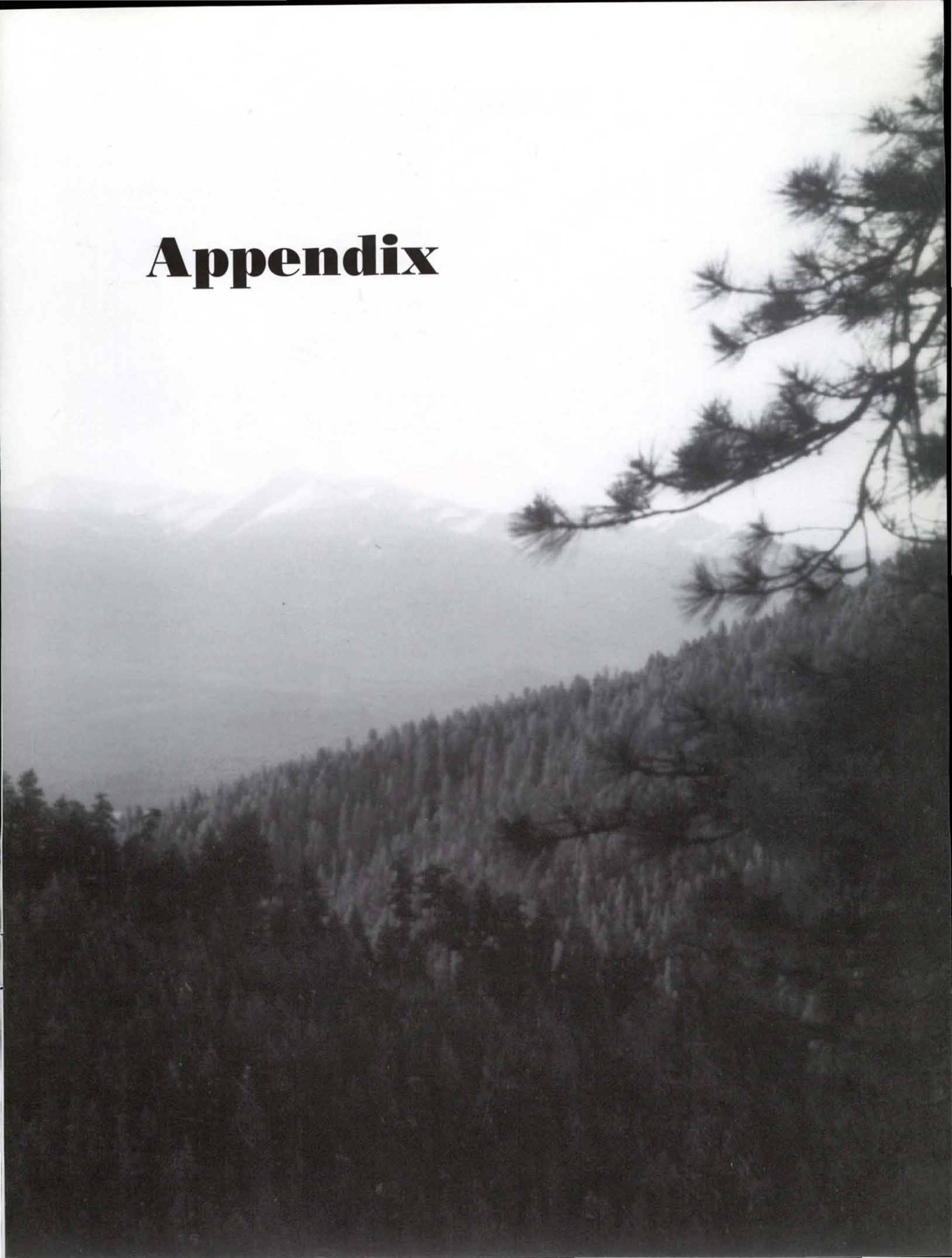
What will Congress do about the ESA? There are no easy biological, economic, social, political, or legal answers, so we should not expect easy policy fixes. Ecosystem-level protection has a potential to avoid some species conservation problems in the future, but the ecosystem-based approach has not yet been adequately developed. Even with ecosystem-level protection, the ESA will still be necessary to protect the most endangered elements of biological diversity. A shift in focus to habitat protection and recovery planning is likely to make the species conservation goal of the ESA more attainable while reducing uncertainty. This may require additional budget resources directed at specific ESA tasks.

The ESA route we have been on for 22 years has nonhuman needs on a collision course with human desires. The ESA was designed to alter that course and give nonhumans the right-of-way. In some cases this ideal has been attained without major problems, but the needs of species that cover large areas, such as the Pacific Northwest, have caused some pile-ups—some call them train wrecks—at the crossroads we now face. The causes of these collisions are species' habitat needs in conflict with perceived human needs. How the ESA could be modified to change this situation is a major focus of the report.

In Idaho, many people are taking actions that will not only solve existing problems, but also keep new problems from arising. PAG Report No. 13 is designed to help move in that direction. The new directions based on ESA implementation in Idaho include approaching species conservation problems by using the flexibility in the current Act, and by adopting a spirit of cooperation rather than confrontation by all parties.

Philip S. Cook is research associate for the Policy Analysis Group (PAG). Jay O'Laughlin is director of the PAG and professor in both forest resources and forest products. Charles R. Hatch is dean of the College of Forestry, Wildlife and Range Sciences, and professor in forest resources.

Appendix



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Director, Natural Resource Communications Laboratory
Environmental education and interpretation, natural resource communication, natural resource tourism, reserve management in developing Latin American countries

Harris, Charles C.
Associate Professor
Resource management, policy, and planning; organizational psychology of resource management; natural resource tourism, impacts, and market analysis; recreation and amenity values

Hendee, John C.
Professor
Director, Taylor Ranch Wilderness Field Station
Director, UI Wilderness Research Center
Human behavior aspects of resource management--public involvement, conflict resolution, social impact analysis; wilderness, recreation, wildlife, and forest policy and management; use of natural environments for personal growth, therapy, and leadership development

Hughett, Harvey
Adjunct Assistant Professor
Director, UI Division of Instructional Media Services
Instructional technology, mediated instruction, distance education, Spanish language pedagogy

Hunt, John D.
Professor and Department Head
Tourism planning, development, marketing, and management; integration of natural resource uses with tourism and recreation development; human behavior aspects of tourism and recreation development

Krumpe, Edwin E.
Professor
Principal Scientist, UI Wilderness Research Center
Wilderness and dispersed recreation management, recreation and tourism behavior and the decision process, interpretation and communication, administration, group facilitation for decision-making

Leidner, Stuart
Research Analyst
Rural community tourism, recreation planning and economic development, survey research, economic impacts of tourism and recreation, applications of economic theories

Machlis, Gary E.
Adjunct Professor
Professor, Forest Resources
Project Leader (Sociology), Cooperative Park Studies Unit
Chief Social Scientist, U.S. National Park Service
Sociology of natural resources, human ecology, community stability, land use planning, social forestry

McLaughlin, William J.
Professor
Regional planning including natural resources, nature conservation, tourism, economic development, group facilitation for decision-making and conflict resolution, social science research methods

Sanyal, Nick
Assistant Research Professor
Recreation planning, recreation behavior, human dimensions of fish and wildlife management, research methodologies, survey research

Scott, J. Michael
Adjunct Associate Professor
Professor, Fish and Wildlife Resources
Leader, Idaho Cooperative Fish and Wildlife Research Unit
Ecosystem management, endangered species ecology and management, systems approaches to conservation biology

Shuman, Dorothea
Post-Doctoral Fellow
Formal and non-formal environmental education, environmental interpretation, influence of significant life experiences on teachers' interest in environmental education, teacher training

Snyder, Gerry
Manager, Natural Resource Communications Laboratory
Media/communications production, environmental interpretation, instructional technology, multi-media outreach

Whiteman, Michael R.
Adjunct Assistant Professor
Director, UI International Programs Office
Natural resources planning, collaborative problem-solving/decision-making, conflict management

Policy Analysis Group (PAG)

Cook, Philip
Research Associate
Natural resource policy

O'Laughlin, Jay
Director
Adjunct Professor, Forest Resources
Adjunct Professor, Forest Products
Natural resource economics and policy analysis, structural changes in wood-based industries

Publications and Reports

The following list contains most works published during 1994-1995. Copies of Idaho Forest, Wildlife and Range Experiment Station publications are available from Forestry Information Services/Publications Department, and reprints of some journal articles are available from the authors. Reports issued to fulfill contracts are generally not available for distribution to the public.

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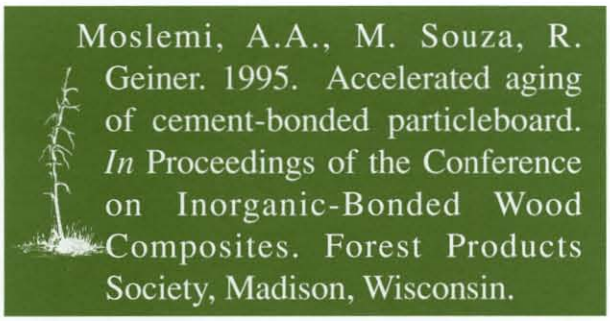

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Research Projects and Investigations

This listing shows the range of work in progress through the Idaho Forest, Wildlife and Range Experiment Station. For additional information, please write to the principal investigators or to the Director, Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho 83843.

Department of Fish and Wildlife Resources

Effects on wildlife communities of disturbance to pinyon-juniper woodlands. E.D. Ables

Food habits of mountain lions. E.D. Ables, H. Quigley

Effects of in-water disposal of dredged materials on fish and benthic communities in Lower Granite Reservoir, Idaho and Washington. D.H. Bennett

Fishery and habitat surveys of the Pend Oreille River. D.H. Bennett, J. Dupont

Monitoring fish community activity at disposal and reference sites in Lower Granite Reservoir, Washington. D.H. Bennett

Water quality, fish and wildlife of Box Canyon Reservoir, Washington. D.H. Bennett, J. Garrett

Plan for determining timing, location, magnitude, and cause of mortality for wild and hatchery spring/summer chinook salmon smolts above Lower Granite Reservoir. D.H. Bennett, et al

Determining incubation success and fry production and potential to enhance fry recruitment from the North Fork Payette River, Idaho. D.H. Bennett, F. Frost

Evaluation of proposed drawdown in Lower Granite and Little Goose Reservoirs and reservoir operations. D.H. Bennett

Thermal and velocity characteristics in the lower Snake River reservoirs, Washington, as a result of regulated upstream water releases. D.H. Bennett

Abundance, habitat, and migration of age 0 fall chinook salmon in the Snake River reservoirs with emphasis on Little Goose Reservoir, Washington. D.H. Bennett, T. Curet

Supplementation of wild salmon and steelhead. T.C. Bjornn

Hatchery versus wild steelhead in supplementation. T.C. Bjornn, S. Rubin

Passage of adult chinook salmon and steelhead at the Lower Snake River Dam and reservoir projects. T.C. Bjornn, J. Hunt K. Tolotti, P. Keniry, R. Ringe

Substrate composition and trout survival relationships. T.C. Bjornn

Interaction of coho salmon with resident cutthroat trout and Dolly Varden in the Slippery Creek Drainage, Kuiu Island, Alaska. P. Porter, T.C. Bjornn

Passage of adult salmon and steelhead through the lower Columbia River. T.C. Bjornn, J. Hunt, K. Tolotti, P. Keniry, R.R. Ringe

Genetic analysis of *Oncorhynchus nerka*. E.L. Brannon, G. Thorgaard

Status of *Oncorhynchus nerka* in Redfish Lake. E.L. Brannon

The effect of the Exxon Valdez oil spill on pink salmon early life history. E. L. Brannon, L. Moulton, L. Gilbertson, A. Maki, J. Skalski

Altered operating practices on fish farms to reduce solid waste. E.L. Brannon, K. Collins

Best Management Practices to reduce fish farm effluent on Billingsly Creek. E.L. Brannon, K. Collins

Effect of initial feeding on otolith growth pattern of pink salmon. E.L. Brannon

Control of bacterial kidney disease: Nonspecific resistance factors in chinook salmon. J.L. Congleton, D. Siegal

Control of infectious hematopoietic necrosis virus: Antiviral effects of the trout macrophage. J.L. Congleton, B. Sun

Stress response of chinook salmon smolts collected and transported from Snake River Dams. J.L. Congleton, W. LaVoie

Influence of growth rate on maturation schedules for kokanee salmon. J.L. Congleton, D.L. Scarnecchia, S. Patterson

Comparison of physiological indices in wild and hatchery chinook salmon smolts. J.L. Congleton

Effects of descaling on viability of juvenile salmonids. J.L. Congleton, W. LaVoie

Gap Analysis of biodiversity protection in Oregon. B. Csuti

Atlas of Oregon wildlife: Distribution, habitat, and natural history. B. Csuti

Comparison of reserve selection algorithms using Oregon data. B. Csuti

Recovery planning for the threatened Marbled Murrelet. B. Csuti

Stochastic population modelling in conservation biology. B. Dennis

Modelling insect phenology. B. Dennis

Nonlinear dynamics and chaos in ecological systems. B. Dennis

Nutrient and sediment processing in the middle Snake River below pollution inputs. C.M. Falter

Aquatic ecology of Craters of the Moon National Monument. C.M. Falter

Distibution of aquatic macrophytes in the Snake River drainage. C.M. Falter, C. Shiflett

Risk assessment of pollution loading to the Middle Snake River. C.M. Falter

Relationship of nuisance aquatic macrophytes to pollution loading in the Middle Snake River. C.M. Falter

Population ecology of great blue herons, trumpeter swans, and whooping cranes. E.O. Garton

Impact of wolf reintroduction on Yellowstone elk, deer, and bison populations. E.O. Garton

Aerial census methods for elk, mule deer, and bighorn sheep. E.O. Garton

Estimating minimum viable meta-populations for rare animals. E.O. Garton

Dietary selection of pocket gophers in north-central Idaho. E.O. Garton

Impact of timber harvests on woodpecker populations. L. Bate, E.O. Garton, E. Bull, B. Carter

Ecology of white-headed woodpeckers in eastern Oregon. R. Dixon, E.O. Garton

Analysis of neotropical migratory bird population trends in the western United States. J. Deal, E.O. Garton, J.M. Scott, D.L. Verbyla

Applying a rapid assessment program for neotropical migrants on the Payette National Forest. A. Rocklage, E.O. Garton, J.M. Scott, P. Morgan

Regulating growth of finfish by feeding regimen. G.W. Klontz

Distribution and abundance of stream amphibians in Clearwater National Forest. K. Lohman

Use of riparian habitats by amphibians and reptiles along the lower Snake River. K. Lohman, S.L. Small

Effects of physiography and disturbance regimes on patterns of distribution and abundance of bull trout and westslope cutthroat trout. K. Lohman, P.E. Green, P. Morgan

Distribution and abundance of bull trout and westslope cutthroat trout in Selway River Basin, Idaho. K. Lohman, A. Abbott, P.E. Green

Use of erythromycin to control bacterial kidney disease in chinook salmon. C.M. Moffitt

Behavioral and physiological components of smoltification in chinook salmon and steelhead trout. C.M. Moffitt

Registration of therapeutic substances in fish. C.M. Moffitt

Environmental assessment of aquaculture chemicals and therapeutic substances. C.M. Moffitt

Ecology of bull elk in Yellowstone National Park. J.M. Peek

Mule deer habitat use in Idaho. J.M. Peek

Bighorn sheep ecology, Middle Fork, Salmon River, Idaho. J.M. Peek

Wolf ecology on the Copper River Delta, Alaska. J.M. Peek

Effectiveness and validation monitoring of the modelling of mule deer habitat and populations in south-central Oregon. J.M. Peek

Evaluation of the C.J. Strike Wildlife Management Area. J.T. Ratti, J. Guidice

Analysis of avian communities using Snake River riparian habitats. J.T. Ratti

Ecology of canyon wrens on the Lower Salmon River. J.T. Ratti, H. Johnston

Pheasant ecology on the Palouse: A case study of local adaptations. J.T. Ratti, J. Guidice

Long term populations analysis of gray partridge. J.T. Ratti, K.P. Reese

Analysis of research bias for North American avian species. J.T. Ratti, J.M. Scott

Winter population ecology of Lesser and Taverner's Canada geese on the Oregon/Washington Columbia River. J.T. Ratti

Vegetation response to fire on the Big Desert of Idaho. K.P. Reese

Ecology of sympatric sage and Columbian sharp-tailed grouse in southeastern Idaho. K.P. Reese, J.W. Connelly, T. Apa

Seasonal habitat use, population characteristics, and management of quail in north/central Idaho. K.P. Reese, P.E. Heekin

Seasonal habitat use, population characteristics, and management of chukar partridge in west-central Idaho. K.P. Reese, A.J. Lindbloom

Habitat ecology and productivity of Columbian sharp-tailed grouse in north central Washington. K.P. Reese, M. McDonald

Pheasant response to intensive environmental management. K.P. Reese, E.S. Antrim, G.A. Nohrenberg

Distribution, movements, and habitats of sage grouse on the upper Snake River plain: Changes from the 1950s to 1990s. K.P. Reese, K.M. Leonard

Predicting sage grouse harvest units and productivity ratios in Idaho from wing collections and weather data. K.P. Reese, J.W. Deal, J.W. Connelly

Life history and ecology of south Umpqua spring coho salmon. D.L. Scarnecchia

Yellowstone River and Lake Sakakawea paddlefish investigations. D.L. Scarnecchia

Rough fish investigations in Bowman-Haley Reservoir. D.L. Scarnecchia

Missouri River benthic fish ecology. D.L. Scarnecchia

Sicklefin and sturgeon chub investigations in the Missouri River. D.L. Scarnecchia

Gap Analysis of biodiversity protection in Oregon. J.M. Scott, B. Csuti

Gap Analysis of biodiversity protection in Idaho. J.M. Scott, T. Merrill, C. Hamer

Proactive approaches to sustaining biodiversity. J.M. Scott

Taxonomic bias in ornithological studies. J.M. Scott, J.T. Ratti

Patterns in range collapse: Implications for managers. C. Lobdell Jr., J.M. Scott

Review and analysis of North American mountain goat literature with emphasis on population dynamics. C. Vogel, C.M. Scott

A Gap Analysis of the significant plant and animal resources contained in and adjacent to proposed northwest national parks. R.G. Wright

Development of a grazing management plan at City of Rocks National Reserve. R.G. Wright, S.C. Bunting

Application of GIS to land use planning and resources management at Lake Chelan National Recreation Area. R.G. Wright

Application of GIS to geologic hazard mapping at Hagerman Fossil Beds. R.G. Wright

Identification and mapping of the plant communities at Hagerman Fossil Beds. R.G. Wright

Development of computerized natural resource data bases for national parks in the Southeast, Southwest, Midwest, and California and Hawaii. R.G. Wright

Analysis of vehicle and visitor use impacts on wildlife behavior along the Denali National Park Road. R.G. Wright

A compilation of fire history and restoration strategies for grassland and shrubland ecosystems in the Great Basin and Southwest. R.G. Wright

An inventory of non-native plants and rehabilitation strategies for parks in the Pacific Northwest. R.G. Wright

Monitoring bio-integrators of terrestrial community condition in the Frank Church-River of No Return Wilderness. J.J. Yeo

Determination of non-forested habitat types of the Salmon River Mountains, Idaho. J.J. Yeo

Patterns of habitat diversity selected by Sitka black-tailed deer in southeastern Alaska. J.J. Yeo

Analysis of long-term management of the Lochsa elk herd, Idaho. J.J. Yeo

Affordable Housing

Root Rot Ecology

Hardwood Field Trials

Rain-on-Snow Melt Recovery

Ecology of Canyon Wrens

Genetic Tree Improvement

Accuracy of GPS Under Tree Cover

Nursery Disease Control

Registration of Therapeutic Substances in Fish

Water Use Efficiency in Conifers

Reseeding Arid Rangelands

Department of Forest Products

Assessment of student needs in the College of Forestry, Wildlife and Range Sciences, University of Idaho. A.G. Campbell

Assessment of wood pellet fuel quality and characteristics for Idaho and the Intermountain West. R.L. Folk, R.L. Govett

Measurement methods and quantities of volatile organic compounds from lumber drying in dry kilns. R.L. Folk

Fabrication and utilization of densified wood combustibles on small-scale applications in Chili. R.L. Folk, H.P. Steinhagen

Properties of laminated veneer lumber made from interior species. T.M. Gorman

Affordable housing. T.M. Gorman

Insulation value of logs for home construction. T.M. Gorman

Simulation and analysis of mechanized harvesting systems. L.R. Johnson

Small scale timber harvesting systems. L.R. Johnson

Costs of wood residue recovery. L.R. Johnson

Soil disturbance from low cost line machines. H.W. Lee

Costs of producing firewood from recovered slash. H.W. Lee

Woodland owners utilization guide. H.W. Lee

Environmental impacts on site productivity from increased utilization of biomass for energy and fiber. H.W. Lee

Market opportunities for inorganic-bonded wood and fiber composites in North America. A.A. Moslemi

Application of low-level carbon dioxide to cement-bonded particleboard. A.A. Moslemi

Technological and economic feasibility of producing gypsum fiberboard in West Virginia. A.A. Moslemi

The use of treated wood as raw material for the production of cement-bonded particleboard. A.A. Moslemi

Auditing Chilean veneer and plywood mills. H.P. Steinhagen

Veneer recovery. H.P. Steinhagen.

Veneer block conditioning. H.P. Steinhagen

Ironing wavy eucalyptus veneer. H.P. Steinhagen

Comparison of wood moisture meter detection equipment in sawmills. H.P. Steinhagen, R.L. Folk

Graphic visualization of pine log data. F.G. Wagner

Impact of log form upon warp in structural grades of softwood lumber. F.G. Wagner

Determination of Idaho's sustainable timber harvest level. F.G. Wagner, J. O'Laughlin

Department of Forest Resources

Survival and growth of fall-planted conifer seedlings. D.L. Adams, R. Graham, T. Jain

Response of advance lodgepole pine regeneration to overstory removal. D.L. Adams, C. Maranto, D. Ferguson

Response of advance Douglas-fir regeneration to overstory removal. D.L. Adams, C. Maranto, D. Ferguson

Implications of Adaptive Forestry practices. D.L. Adams, H.L. Osborne

Evaluation of simulated animal damage of northern Rocky Mountain conifers. D.L. Adams, A. Helgenberg, R. Graham, T. Jain, J. Kingery

Ecology of forest root rots. D.L. Adams, P. Kolb, G. McDonald

Planting stock-type evaluation for northern Rocky Mountain conifers. D.L. Adams, D.L. Wenny, R. Graham, T. Jain

Computer-assisted design of a "LEISA" (Low External Input Sustainable Agriculture) agroforestry system for the production of cacao in the Department of Meta, Colombia. D.L. Adams, B. Barber

Simulation model for rain-on-snow melt recovery. G.H. Belt

Molecular genetics and ecology of bitterbrush. M. Jabbes, S.J. Brunsfeld

Ecology and reproductive biology of *Epipactis gigantea* in the northern Rocky Mountains. M. Mantas, S.J. Brunsfeld

Documenting genetic races of ponderosa pine using ribosomal DNA sequence data. A. Patten, S.J. Brunsfeld

Assessment of the genetic resources of Idaho's relict populations of Pacific dogwood. S.J. Brunsfeld

Genetics and ecology of *Asarum wagneri*. C. Baldwin, S.J. Brunsfeld

Role of understory vegetation in nutrient cycling. J. Nelson, S.J. Brunsfeld, R. Graham

Phylogenetic relationships of *Taxodiacae* and *Cupressaceae*: Evidence from rbcL DNA sequence. S.J. Brunsfeld

Evidence for interspecific recombination of chloroplast DNA in *Salix*. S.J. Brunsfeld

Genetic analyses of chemical variation and resistance to a diverse phytophage community on willow hybrids. S.J. Brunsfeld, R. Fritz

Hardwood field trials. Y. Carree

Nitrogen and phosphorus leaching and runoff from a conifer crop in a container nursery. R.K. Dumroese, D.L. Wenny, D.S. Page-Dumroese

Collecting forest tree seeds and growing your own seedlings. R.K. Dumroese, T.D. Landis, D.L. Wenny

Cylindrocarpon on western white pine seedlings: Effects on survival and growth after outplanting and persistence of the pathogen. R.K. Dumroese, R.L. James, D.L. Wenny

Western white pine seed germination. R.K. Dumroese, D.L. Wenny

Micropropagation plan to conserve *Hackelia venusta*. J.L. Edson, R. Everett, D.L. Wenny, A. Leege-Brusven

Propagation of western white pine by branch cuttings, fascicles, and buds. J.L. Edson, L. Fins, D.L. Wenny, A. Leege-Brusven, R.R. Tripepi

Micropropagating fire-resistant clones of bitterbrush and sagebrush of value to wildlife. J.L. Edson, M. Hironaka, D.L. Wenny, A. Leege-Brusven

Micropropagation of rare plants of the Columbia Basin for a plant adaptability test. J.L. Edson, R. Everett, D.L. Wenny, A. Leege-Brusven

Developing efficient strategies to micropropagate rare and endangered plants of Idaho. J.L. Edson, D.L. Wenny, D.M. Henderson, A.D. Leege-Brusven

Testing cold hardiness of giant sequoia clones. J.L. Edson, L. Fins, D.L. Wenny

Applying a micropropagation strategy to increase planting stock from white pine seed orchards. J.L. Edson, A.D. Leege-Brusven, D.L. Wenny, L. Fins

Micropropagation of difficult-to-root white pine clones from ortet buds, and propagating white pine fascicles from scarce material. J.L. Edson, A.D. Leege-Brusven, D.L. Wenny, L. Fins

Propagation of mountain mahogany and sagebrush. J.L. Edson, D.L. Wenny, A.D. Leege-Brusven, S. Bunting

Evaluating growth and form in western larch stecklings and plantlets. J.L. Edson, L. Fins

Selection of giant sequoia genotypes for ornamental planting in the Inland Northwest. L. Fins

Efficiency of early selection of Douglas-fir for improved growth rates. L. Fins, M. Rust

Genetic variation in nutrient content among Douglas-fir families. L. Fins, V. McKee

Genetic variation in wood-specific gravity of Inland Empire ponderosa pine. L. Fins, L. Koch

Differences in carbon isotope discrimination, photosynthetic exchange and growth among western larch families. J. Zhang, L. Fins, J.D. Marshall

Differences in carbon isotope discrimination among Douglas-fir families. L. Fins, J. Zhang

Genetics, nutrition, and disease susceptibility of Douglas-fir. L. Fins, J.A. Moore

Genetic mapping of white pine blister rust resistance. L. Fins, S.J. Brunsfeld

Empirical studies on public participation in forest planning activities: Who participates, why, and how. J.E. Force, L. Marten, W.J. McLaughlin

Community social change in resource-dependent communities. J.E. Force, G.E. Machlis

Use of wilderness and natural environments for personal growth, therapy, and education. J.C. Hendee

Expanding wilderness use, values, and benefits to multi-cultural urban residents. J.C. Hendee

Benefits and costs of conservation corps programs. J.C. Hendee

Biological control of *Fusarium* root disease in container-grown Douglas-fir seedlings: Evaluation of Mycostop biofungicide. R.L. James, R.K. Dumroese, D.L. Wenny

Evaluation of the efficacy of non-pathogenic *Fusarium* oxysporum to control *Fusarium* root disease of container-grown Douglas-fir seedlings. R.L. James, R.K. Dumroese, D.L. Wenny

Ecology and distribution of Idaho woody plants. F.D. Johnson

Pan-tropical trees--Identification, distribution, and use. F.D. Johnson

Relations between strangers: A new theory of social ecology. G.E. Machlis, B. Burch

Visitor Services Project studies in U.S. national parks. G.E. Machlis

Visitor Services Project pilot database. G.E. Machlis

Anthropogenic factors influencing biodiversity loss: A collaborative research program to extend Gap Analysis. G.E. Machlis

Development of a customer service evaluation card for the U.S. Fish and Wildlife Service and National Park Service. G.E. Machlis

Factors influencing social change in resource-dependent communities. G.E. Machlis

Field trials of elite black cherry. R.L. Mahoney

High value hardwoods for the Pacific Northwest. R.L. Mahoney

Evaluating private forest ecosystems for timber, wildlife habitat, and water quality. R.L. Mahoney

Reforesting marginal farmlands. R.L. Mahoney

Water-use efficiency differences among provenances of western conifers. J.D. Marshall, L. Fins

Use of carbon isotopes in tree rings to detect physiological responses to increasing atmospheric CO_2. J.D. Marshall, R. Monserud

Comparison of leaf-area estimation techniques. J.D. Marshall, G. McDonald

Nitrogen and potassium nutrition in relation to susceptibility of Douglas-fir to *Armillaria* infection. J.D. Marshall, T.M. Shaw

Physiological basis of nitrogen fertilization effects on Douglas-fir forests. J.D. Marshall

Carbon dioxide effects on isotopic composition and stomatal density of tree leaves. J.D. Marshall

Chilean forest industry structure. C.W. McKetta

Econometric analysis of Chilean forest products trade. C.W. McKetta

Elasticities of price transmission in imperfect markets. C.W. McKetta

Fire suppression cost estimation. C.W. McKetta

Alaskan forest products transportation. C.W. McKetta

Investment analysis of fuelwood plantations in Sri Lanka. E.L. Medema

Comparison of tree establishment techniques in south and southeast Asia: Plantlets versus seedlings. E.L. Medema

Cost-effectiveness of applying additional macronutrients to Siberian peashrub, honeylocust, and black locust grown in styro-20 containers. W. Bromley, E.L. Medema, D.L. Wenny

Growth response of forests to intermediate silvicultural treatments. J.A. Moore

Mineral nutrition of forest trees in the Intermountain Northwest. J.A. Moore

Testing and development of forest growth and yield simulators in the Intermountain Northwest. J.A. Moore

Evaluating past and future role of fire in maintaining whitebark pine cone production within a small roadless area. P. Morgan, S.C. Bunting

Collaborative, interdisciplinary learning in ecology. K. Guilgoyle, P. Morgan

Modeling historical fire regimes in the Swan Valley, northwestern Montana. D.G. Long, P. Morgan

Landscape planning for ecosystem sustainability in cedar/hemlock white pine forest. S. McConnell, P. Morgan

Mapping past and potential fire regimes in Rocky Mountain wilderness landscapes. P. Morgan, T. Swetnam, S. Yool, M. Rollins

Evaluation of remote sensing for ecosystem assessment and analysis. P. Morgan, C. McNicoll

Fire, insects, and disease: Disturbance and landscape dynamics in the Entiat Watershed, Washington. P. Morgan, P. Flanagan

Modeling vegetation change in response to natural and human disturbance in the Columbia River Basin. P. Morgan, S.C. Bunting

Fire regimes in the interior Columbia River Basin: Past and present. P. Morgan, S.C. Bunting

Landscape change in rural areas in the interior Columbia River Basin: Human causes and biological consequences. P. Morgan, A. Black

Fire effects and processes in forest ecosystems. L.F. Neuenschwander

Horselogging applied to the Group Selection Harvest Regeneration Method. H.L. Osborne

Herbicide potential for managing forest vegetation: Chemicals suitable for site preparation and conifer release. H.L. Osborne

Vegetation control for ponderosa pine seedling establishment on Conservation Reserve Program lands. H.L. Osborne

Electron microscopy of root-disease fungi. A.D. Partridge

Frequency and damage by urban tree pests in Idaho. A.D. Partridge

Periodicity of root-disease/bark-beetle activity in northwestern forests. A.D. Partridge

Defect estimators for standing timber. A.D. Partridge

Composite estimators for predicting individual tree height. C.T. Stiff, A. Samih, and J.D. Newberry

The northern Rocky Mountain version of the Timber Resource Inventory Model--TRIM. C.T. Stiff, C.W. McKetta, R.O. Barkley

An evaluation and comparison of two distance-independent forest projection models in the Inland Northwest. C.T. Stiff, D.A. Patterson

Growth and yield models for *Pinus oocarpa* Schiede stands in central Honduras. C.T. Stiff, D.N. Perez

Soil-site models for *Pinus oocarpa* Schiede stands in central Honduras. C.T. Stiff, M.C. Valdes

Effects of fugitive cement kiln dust on forest productivity. C.T. Stiff, C.M. Stiff

Simultaneous height and diameter increment models for second-growth Douglas-fir in the Inland Northwest. C.T. Stiff, W. Zhang, J.A. Moore

Simultaneous height, diameter, and crown recession models for Douglas-fir using simulated data from TASS. C.T. Stiff, J.W. Goudie

Development of expert systems for natural resource management. M.W. Stock

Studies of computer use by foresters. M.W. Stock

Effects of stress on the genetics of bark beetle populations. M.W. Stock

Development and demonstration of New Perspective (adaptive, ecosystem, and land-based) forest management approach. K.J. Stoszek

Response of high-graded ponderosa pine stands to simulated uneven-aged and selection silviculture. K.J. Stoszek

Silvicultural guidelines for blister rust-infected white pine stands. K.J. Stoszek

Evaluation of afforestation and reforestation attempts of savannas. K.J. Stoszek

Assessing the causes and effects of deforestation in Panama. K.J. Stoszek

Evaluation selection silviculture prospects in selectively logged ponderosa pine stands of Washington. K.J. Stoszek

Small format aerial photography. J.J. Ulliman

Classification of clearcut harvest activity using remotely sensed data. T.P. Tady, J.J. Ulliman

GIS methods for mapping temperature zones within the University of Idaho Experimental Forest. D.R. Unger, J.J. Ulliman

Accuracy of GPS under tree cover. B.D. Elwell, J.J. Ulliman

Root development in Copperblock, Nature Root, and styroblock containers. D.L. Wenny

Interactions between copper-coated containers, hot water cleaning, and *Fusarium* root disease. D.L. Wenny, R.L. James, R.K. Dumroese

Propagation of mature bitterbrush clones for forest reforestation. A.D. Leege-Brusven, D.L. Wenny

Vegetative propagation and outplanting of native plants in response to the changing role of the forest nursery. D.L. Wenny, J.L. Edson, A.D. Leege-Brusven

Department of Range Resources

Fire ecology of whitebark pine. S.C. Bunting, P. Morgan

Development of palatable resprouting shrubs. S.C. Bunting, M. Hironaka

Use of prescribed fire in young maritime pine (*Pinus pinaster*) forests in Portugal. S.C. Bunting, P. Morgan, F.M.C. Rego, H. Botelho

Fire ecology of caldenal vegetation of central Argentina. S.C. Bunting, R.M. Boo

Heat flow into soils during simulated fire and postfire response of *Agropyron spicatum*. S.C. Bunting

Shrub establishment on lower Snake River plains. S.C. Bunting

Agroforestry development in the Congo. J.H. Ehrenreich

Strategies to improve agroforestry practices in Pakistan. J.H. Ehrenreich, Q. Iqbal

Effect of agroforestry on soils of the coastal plains of the Congo, Africa. J. Mouelle, J.H. Ehrenreich

A vocational agriculture approach to development of agroforestry in the Philipines. J.H. Ehrenreich

Promoting agroforestry through extension. J.H. Ehrenreich, M. Baig

Soil-plant interactions in agroforestry systems in Pakistan. J.H. Ehrenreich, M. Baig

Silvopastoral systems in Iran. J.H. Ehrenreich, S. Yassemi

Silvopastoralism in arid tropics of Cameroon, Africa. J.H. Ehrenreich, S. Olson

Genetic improvement of selected native range shrubs. M. Hironaka

Revegetation of pipeline disturbances. K.L. Johnson

Long-term ecological change of shortgrass prairie. K.L. Johnson

Photographic studies of vegetation change. K.L. Johnson

Animal damage and plantation performance. J.L. Kingery

Grazing effects on reclaimed mine lands in southeastern Idaho. J.L. Kingery, S.C. Bunting

Relationship of animal use to tree establishment, survival, and growth in plantation settings. J.L. Kingery

Assessing production and utilization techniques for herbaceous vegetation. J.L. Kingery

Sheep grazing as a silvicultural tool in conifer plantations. J.L. Kingery, J.C. Mosley, H.L. Osborne, S.D. McCoy

Sheep grazing strategies for deer and elk habitat improvement. J.C. Mosley, J.L. Kingery, K.J. Crane

Forest succession and animal use. J.L. Kingery

Sheep grazing strategies for deer and elk habitat improvement. J.L. Kingery, J.C. Mosley, M.J. Alpe

Influence of social hierarchy on the distribution of rangeland cattle. J.C. Mosley, J.L. Kingery, K.S. Beitelspacher

Private grazing lease arrangements. N.R. Rimbey

Federal grazing fees. N.R. Rimbey

Factors affecting Idaho ranch values. N.R. Rimbey

Cattle disperson methods and riparian ecosystems. N.R. Rimbey

Mechanisms of competition between bunchgrasses and tree seedlings during forest regeneration. R. Robberecht

Freezing stress, cold acclimation, and photosynthetic capacity of coniferous seedlings and bunchgrasses: Consequences for forest regeneration and responses to global climatic change. R. Robberecht

Goal oriented management and planning for forest nurseries: Interactive computer applications for effective use of forest resources. R. Robberecht, M.W. Stock, D.L. Wenny

Effect of enhanced UV-B radiation on carbon dynamics in selected tree species. R. Robberecht, J.H. Bassman, G.E. Edwards

Reseeding arid rangelands. K.D. Sanders

Short duration grazing system on crested wheatgrass. K.D. Sanders

Control of broom-snakeweed on rangelands. K.D. Sanders

Effect of drought on crested wheatgrass. K.D. Sanders, J.C. Mosley, M. Spaulding

Evaluation of salt-desert shrub communities through time. L.A. Sharp, K.D. Sanders

Ecology and classification of Pacific Northwest grasslands. E.W. Tisdale

Department of Resource Recreation and Tourism

Market analysis of summer and spring visitors to Tikal Park, Guatemala. S.H. Ham

Social marketing for selection of ecologically and socially important wildlife species for monitoring programs. S.H. Ham, L. HaySmith

Training needs for environmental interpretation training in El Salvador. S.H. Ham

Application of the Theory of Reasoned Action and Theory of Planned Behavior to site-based environmental interpretation in Central America. S.H. Ham, E.K. Krumpe

Interpretive plan and multi-media prototype for the Wind River Canopy Crane Research Site, Gifford Pichot National Forest. S.H. Ham, G. Snyder

Analysis of differences in perceptions of extensionists and rural community leaders in eastern Guatemala. S.H. Ham, M. Carranza

Environmental ethics in resource management. C.C. Harris

Integration of psychology, economics, and philosophy/religion in valuation of public amenity resources. C.C. Harris

Assessment of the social and economic conditions of rural communities in the interior Columbia River Basin. C.C. Harris, W.J. McLaughlin

Operationalizing place attachment for land management planning. C.C. Harris

Idaho outdoor recreation facility inventory. J.D. Hunt, N. Sanyal

Non-resident commercial air and resident traveler study. J.D. Hunt, N. Sanyal

The Idaho Travel Barometer. J.D. Hunt, S. Leidner, N. Sanyal

Idaho winter recreation. J.D. Hunt, S. Leidner, N. Sanyal

Idaho rural tourism development plan. J.D. Hunt, S. Sanyal, W.J. McLaughlin, C.C. Harris

Frank Church-River of No Return Wilderness Information and Education Planning Project. E.E. Krumpe, L. Matthews

The Limits of Acceptable Change planning process--Perspectives from participants. E.E. Krumpe, L. McCoy

Strategies and methods for local governments to encourage and assess tourism development. W.J. McLaughlin, et al

Case study of the economic development and nature conservation programs used in French regional natural parks. W.J. McLaughlin

Idaho bicycle and walking study. N. Sanyal, W.J. McLaughlin

Statewide comprehensive outdoor recreation plan. N. Sanyal, W.J. McLaughlin, J.D. Hunt

Audit of Big Game Survey Process: Understanding the statistical, sampling, and social biases associated with current surveys of hunters and hunting success. N. Sanyal

Describing the travel and recreation parameters of the Priest Lake ecosystem. N. Sanyal

The Idaho Outdoor Recreation and Tourism Planning Project (SCORTP). N. Sanyal

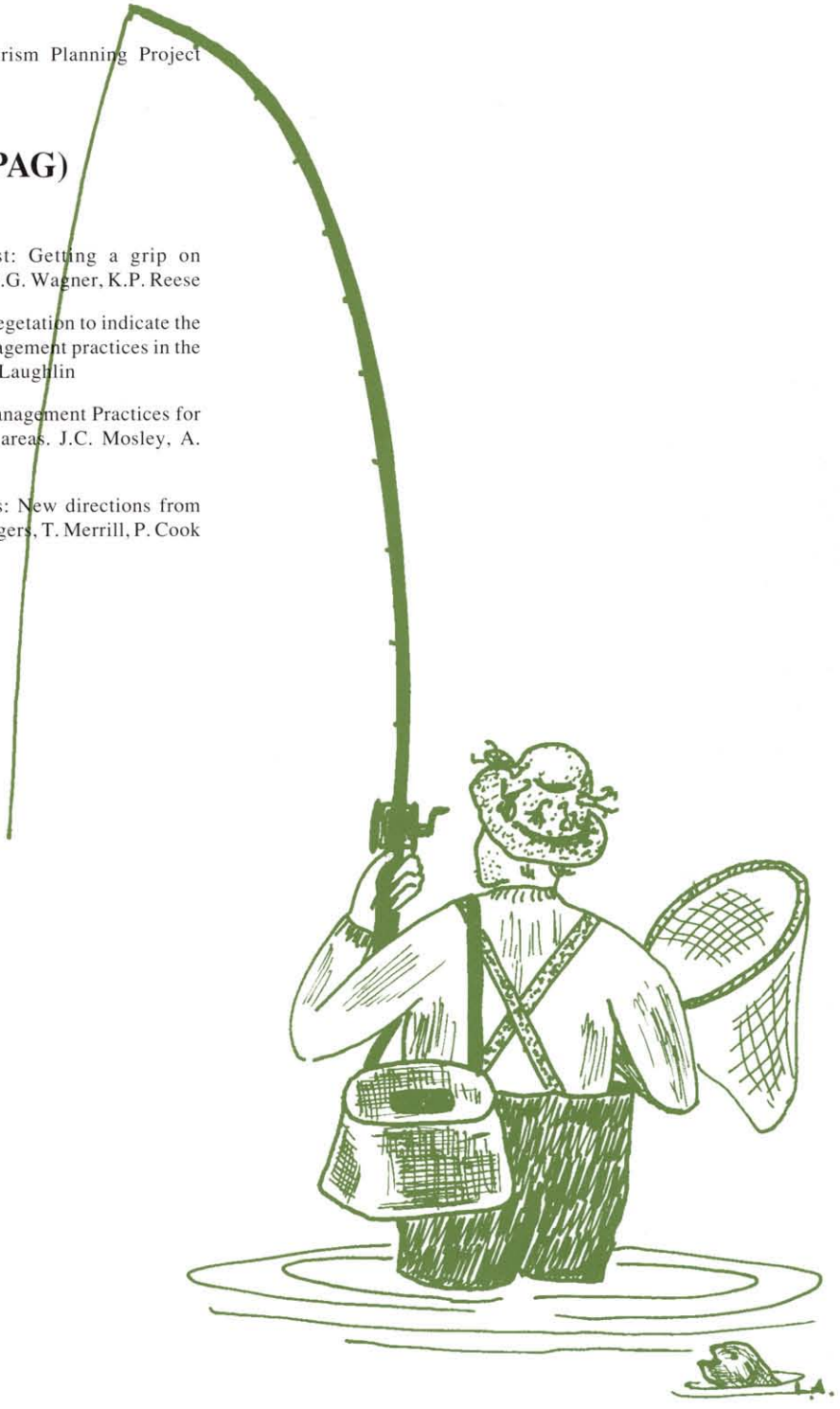
Policy Analysis Group (PAG)

Policies affecting Idaho timber harvest: Getting a grip on sustainability. P. Cook, J. O'Laughlin, F.G. Wagner, K.P. Reese

Analyzing the potential for using aquatic vegetation to indicate the effectiveness of voluntary nutrient management practices in the Middle Snake River. C.M. Falter, J. O'Laughlin

Analysis of the scientific basis for Best Management Practices for managing grazing animals in riparian areas. J.C. Mosley, A. Griffis, J. O'Laughlin, R.L. Mahler

Endangered Species Act at the crossroads: New directions from Idaho case studies. J. O'Laughlin, K. Rogers, T. Merrill, P. Cook



Continuing Education and Outreach

Faculty in the College of Forestry, Wildlife and Range Sciences conduct continuing education programs for natural resource professionals and outreach programs for the public on campus, at the Clark Fork and McCall Field Campuses, and throughout Idaho and the West. The college offered the following continuing education and outreach programs during Fiscal Year 1995 (courses for credit not listed). Unless otherwise noted, courses took place in Idaho.

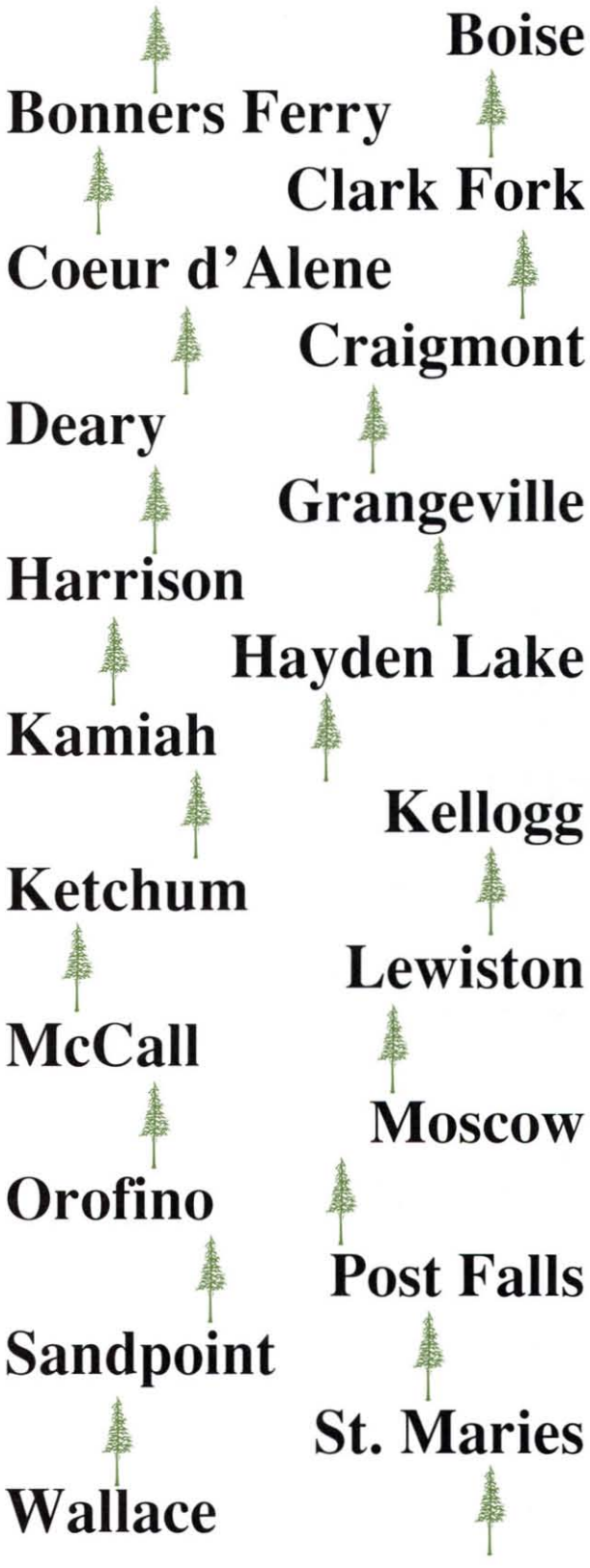
More information is available from Continuing Education, College of Forestry, Wildlife, and Range Sciences, University of Idaho, Moscow, Idaho, 83844-1142, (208) 885-6441.

- **20 communities served *just in Idaho* FY 1995**
- **18 courses delivered to Boise (629 credit hrs.) since 1991**
- **Master's of Natural Resources being developed for professionals**

Continuing Education

July 1-August 2	HOIST Program—Micropropagation Unit—Moscow
July 10-15	Fish and Wildlife Ecology Workshop—McCall
July 11-15	Wood—A Remarkable Fiber—Clark Fork
July 17-23	Project WILD II—McCall
July 23	Bonner County Forest Management Shortcourse Field Tour—Sandpoint
July 26	Workshop: Energy Efficiency in the Wood Products Industry—Coeur d'Alene
August 9-11	Natural Resource Teachers Workshop—Hayden Lake
September 26-28	4th Inorganic-Bonded Wood and Fiber Composite Materials Symposium—Spokane, Washington
October 3-7	13th Annual Dry Kiln Workshop—Moscow
October 17-November	CEEM: Continuing Education in Ecosystem Management—Moscow
November 2	Forestland Taxes—Orofino
November 3	Estate Planning for Forestland Owners—Orofino
November 3, 10, 17	Forest Management Shortcourse—Coeur d'Alene
November 7	Forestland Taxes—Sandpoint
November 8	Estate Planning for Forestland Owners—Sandpoint
November 16	Forestland Taxes—Moscow
November 17	Estate Planning for Forestland Owners—Moscow
November 29	Forestland Taxes—Craigmont
November 30	Estate Planning for Forestland Owners—Craigmont
December 1	Current Topics in Forest Health—Orofino
December 1, 8, 15	Forest Management Shortcourse—Coeur d'Alene

December 2	Current Topics in Forest Health—Lewiston
December 9	Current Topics in Forest Health—Coeur d'Alene
December 13	Special Forest Products—Moscow
January 10	Managing Your Timber Sale—Kamiah
January 12	Managing Your Timber Sale—Deary
January 17	Managing Your Timber Sale—Lewiston
January 20	NIPF Foresters Workshop—Post Falls
January 26	Forestland Grazing—St. Maries
February	Special Forest Products—Wallace/Kellogg
February 2, 9, 16, 23	Forest Management Shortcourse—Bonners Ferry
February 7, 14, 21, 28	Forest Management Shortcourse—Orofino
February 28	Pre-Recovery Planning for *Hackelia venusta* Conference
February 28-March 1	12th Forest Engineering Conference—Moscow
March 2, 9	Forest Management Shortcourse—Bonners Ferry
March 3-4	Ecosystem Management Forum—Post Falls
March 9-10	Southern Idaho NIPF Owner Workshops—Boise
March 14, 21, 28	Forest Management Shortcourse—Orofino
March 16-17	IETIC Annual Workshop
March 20-21	NIPF: Managing the Family Forest—A Workshop for the Private Forest Landowner—Moscow
March 25	Successful Tree Planting—Sandpoint
March 30-31	Logger Education to Advance Professionalism (LEAP)—St. Maries
April 5-May 8	Endangered Species Management—Location TBA
April 10-14	Aerial Photo Workshop—Colville, Washington
April 13	Managing Your Timber Sale—Bonners Ferry
April 20, 22, 24	Measuring Trees—Orofino
April 28	Ecosystem Management Panel—Moscow
May 4, 6, 9	Measuring Trees—Moscow
May 18, 20, 23	Measuring Trees—Grangeville
May 20	Ecosystem Management Video Conference—Boise
May 22-23	Big Game Ecology and Management—Kettle Falls, Washington
June 5-6	Big Game Ecology and Management—Kettle Falls, Washington



June 12-17	Central Idaho Natural Resources Workshop—Ketchum
June 17	Thinning and Pruning Field Day—Sandpoint
June 19	Big Game Ecology and Management—Kettle Falls, Washington
June 19-23	Wood—A Remarkable Fiber—McCall
June 19-24	Inland Empire Natural Resources Workshop—Harrison

Outreach

July 31	The Return of Koani, the Ambassador Wolf—Clark Fork
August 27	Endangered Species in Idaho—Clark Fork
September 24	Fossil Collecting and Geological Tour of the Lake Pend Oreille Area—Clark Fork
September 25	Fossil Collecting and Geological Tour of the Lake Pend Oreille Area—Clark Fork
October 1	Fall Mushrooms—Clark Fork
October 22	The History of Idaho Fur Traders—Clark Fork
November 6	A Woman's Perspective of Native American Kalispell Culture—Clark Fork
March 9	Grizzly Bears! —Clark Fork
March 11	Home Landscape Design—Clark Fork
March 23	History of the Kalispell Tribe—Clark Fork
March 25	The American Indian: Traditional Values in a Contemporary World—Clark Fork
March 30	Floods, Fire, and Stump Ranchers—Clark Fork
April 15	Fishing for the Big Ones—Clark Fork
April 29	Nell Shipman—Her Life, Her Times, Her Movies—Clark Fork
May 6	Basic Bird Identification for Beginners—Clark Fork
May 7	Birds—Beyond the Basics—Clark Fork
May 20	Wildflowers in Watercolor—Clark Fork
May 21	Hard Traveling—A Century of Work Life in the Pacific Northwest—Clark Fork
May 21	Cooking with Chocolate—Clark Fork
June 1	Ethnobotany—Clark Fork
June 10	Wildflowers, Trees, and Shrubs of Northern Idaho—Clark Fork
June 11	All About Plants and Plant Biodiversity—Clark Fork
June 22	Wild Medicinal Plants of North Idaho—Clark Fork
June 23	Wild Medicinal Plants of North Idaho—Clark Fork

Theses and Dissertations

Master's Theses

Alamilla, Lisel. Villagers' beliefs about tourism in San Jose Succotz, Belize. *Major professors: J.D. Hunt, W.J. McLaughlin*

Bate, Lisa J. Monitoring woodpecker abundance and habitat in the central Oregon Cascades. *Major professor: E.O. Garton*

Behrens, Mike A. Modeling the ecological effects of timber harvest and fire management on ponderosa pine/Douglas-fir forests. *Major professor: P. Morgan*

Carlson, John W. Limnological effects of the aquatic macrophyte beds in the Pend Oreille River, Washington. *Major professor: C.M. Falter*

Chacón, Carlos M. Improving environmental law enforcement through education: Design, implementation, and evaluation of an environmental law training program in Costa Rica. *Major professor: W.J. McLaughlin*

Dammann, Carl. Estimating the financial risk of a static suppression organization facing stochastic fire season severities: A case study. *Major professor: C.W. McKetta*

Edelmann, Frank B. Ecology of Merriam's wild turkeys in west central Idaho. *Major professor: K.P. Reese*

Fields, Jeffrey W. A gender analysis of participation in Nepal's community forestry program. *Major professor: J.E. Force*

Fisher, Marla A. Relationship between rooting depth and water uptake in mixed conifer forests. *Major professor: J.D. Marshall*

Garrett, James W. Relationships between substrate compositions and salmonid incubation success. *Major professor: D.H. Bennett*

Garrett, Lisa K. Setting priorities for the research and management of terrestrial mammal species in two U.S. national parks. *Major professor: R.G. Wright*

Gloss, David J. Evaluation of the Nezsed Sediment Yield Model using data from forested watersheds in north-central Idaho. *Major professor: George H. Belt*

Graesser, Paul W. Private forest landowners and forest stewardship plans in northern Idaho. *Major professor: J.E. Force*

Haukenes, Alf H. Characterization of erythromycin depletion in the tissues and plasma of adult chinook salmon (*Oncorhynchus tshwatcha*) following injection. *Major professor: C.M. Moffitt*

Lehman, Katherine S. Disturbance regimes of the southern Elkhorn Mountain landscape. *Major professor: J.L. Kingery*

Leidner, Stuart R. Assessing Idaho residents' attitudes toward tourism development. *Major professor: J.D. Hunt*

Maheia, Will. Case study addressing tourism needs in the Maya Mountain Marine Area Transect Toledo District, Belize. *Major professor: C.C. Harris*

McCoy, Lynn K. The Limits of Acceptable Change planning system: Applications and adaptations. *Major professor: E.E. Krumpe*

McCoy, Scott D. Performance and diets of sheep grazing within a northern Idaho conifer plantation. *Major professor: J.C. Mosley*

Mosey, Thaddeus R. Effects of stressors on leukocyte composition and oxidative burst capacity of neutrophyls in the peripheral blood of juvenile chinook salmon (*oncorhynchus tshawytscha*). *Major professor: J.L. Congleton*

Niemela, Kevin S. Effects of accoustical testing on fish behavior and predator-prey interactions in Lake Pend Oreille, Idaho. *Major professor: D.H. Bennett*

Rodriguez, Jose G. Effects of an aeration system on growth and production of rainbow trout *Oncorhynchus mykiss* at a test-farm. *Major professor: E.L. Brannon*

Saffel, Patrick D. Habitat use by juvenile bull trout in belt-series geology watersheds of northern Idaho. *Major professor: T.C. Bjornn*

Sankovich, Paul M. Distribution and spawning behavior of hatchery and natural chinook salmon in the upper ends of Idaho's South Fork Salmon and Salmon Rivers. *Major professor: T.C. Bjornn*

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Siegal, Deborah. Bactericidal activity of macrophages from juvenile chinook salmon following exposure to stress, hydrocortisone, *renibacterium salmoninarum*, and soluble proteins produced by *R. salmoninarum. Major professor: J.L. Congleton*

Stephenson, Thomas R. Nutritional ecology of moose and vegetation succession on the Copper River Delta, Alaska. *Major professor: J.M. Peek*

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Xavier, Victorino. Stumpage price determination in a market dominated by public forests. *Major professor: C.W. McKetta*

Ph.D. Dissertations

DeFossé, Guillermo D. Germination, emergence, and survival of *Festuca* spp. seedlings in a steppe of Patagonia, Argentina. *Major professor: R. Robberecht*

Kolb, Peter F. Effects of environmental stress and bunchgrass competition on *pinus ponderosa* seedlings. *Major professor: R. Robberecht*

Pitstick, Randall C. Wilderness Discovery: The meaning and effects of a 7-day wilderness experience program for youth at risk in the federal Job Corps program. *Major professor: J.C. Hendee*

Roper, Brett B. Ecology of anadromous salmonids within the upper South Umpqua River Basin, Oregon. *Major professor: D.L. Scarnecchia*

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Shuman, Dorothea Kunz. Factors that influence commitment to teaching environmental education: Development and test of a causal model. *Major professor: S.H. Ham*

Unger, Daniel R. Evaluation of GIS methods for mapping relative temperature zones in forest ecosystems. *Major professor: J.J. Ulliman*

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