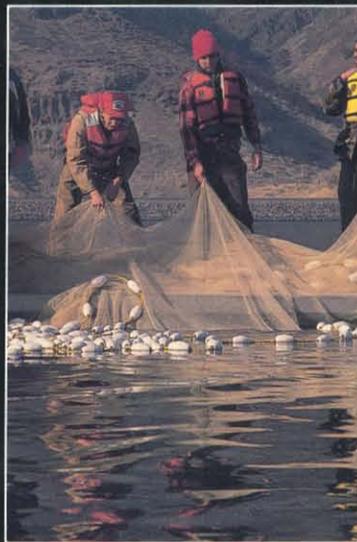
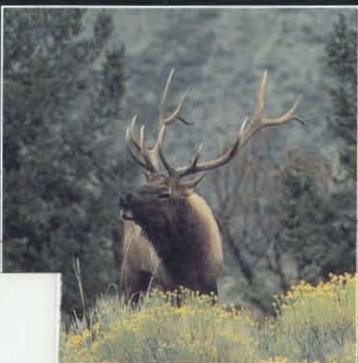
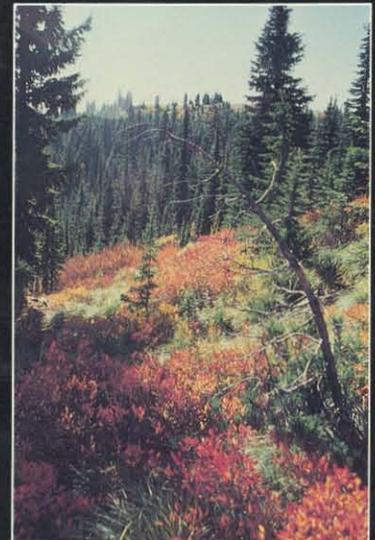
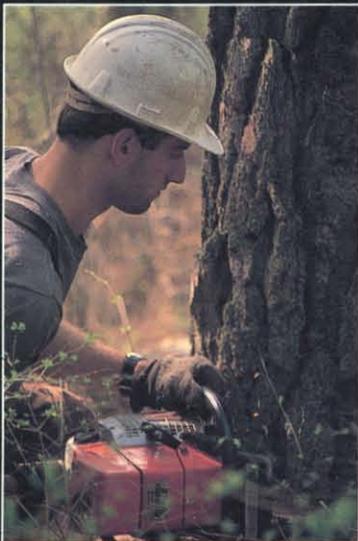
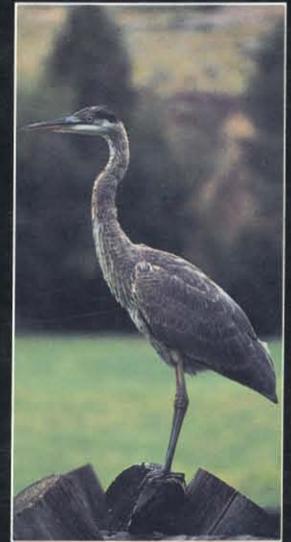
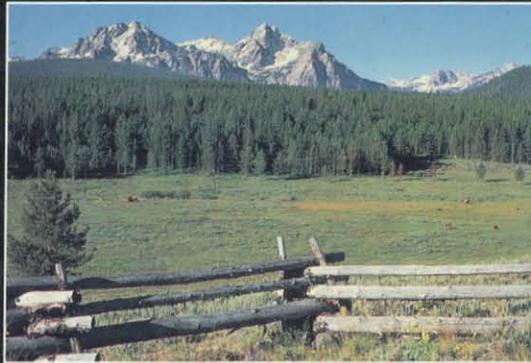


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College of Forestry, Wildlife and Range Sciences

Idaho Forest, Wildlife and Range Experiment Station

Moscow, ID 83844

Volume 18 / 1992

 University of Idaho

From the Associate Director



Leon F. Neuenschwander

A Melting Pot of Ideas

Contrasts represent differences, but also the opposite ends of a range: a spectrum of methods, viewpoints, or options. That is how contrasts work in the College of Forestry, Wildlife and Range Sciences. *Focus* is the annual report of the college, representing the work of over 70 faculty in five diverse departments: Fish and Wildlife Resources, Forest Products, Forest Resources, Range Resources, and Resource Recreation and Tourism.

“Spectrum” also means the continuous range or extent of opinion, as in this year’s 12 articles which feature vast differences in problems and problem-solving, from the Range Department’s monitoring of crested wheatgrass survival in prolonged drought, to those same scientists as they assess how grazing impacts rangeland watersheds, whether adversely, beneficially, or both. The Forest Resources Department features two articles that span research from the soil to the stars: the Forest Tree Nutrition Cooperative nurses seedlings and their natal soil to raise healthier northwest trees, while our remote sensing specialists map changes in forest climates via satellite-measured temperatures. Literally, the sky’s the limit for this “space age” forest technology.

Our fisheries scientists travel a different kind of spectrum. At one end is the delectable salmon dish served at an uptown restaurant. At the other is the quest of steelhead and chinook salmon to migrate upstream past Idaho’s dams and reservoirs. Fisheries department head George Klontz looks at “Producing a Marketable Fish.” Ted Bjornn and research associate Joel Hunt report their third-year results on how many chinook salmon and steelhead make the gamut past eight dams from the ocean to their spawning streams in the Snake River basin.

Natural resources affect our everyday lives too, from the mill to our living rooms. Forest Products researcher Fran Wagner x-rays logs so that sawmills know which way to cut for minimum waste and maximum profit. Tom Gorman tells how he broke 16-foot laminated beams to create standards for log home building codes.

Adding to our melting pot is Sam Ham’s book *Environmental Interpretation, A Practical Guide for People with Big Ideas and Small Budgets*. Published in both English and Spanish, the book will aid resource and recreation managers worldwide in helping people appreciate and care for their environmental heritage. Back home in Idaho, Nick Sanyal and the college’s resource recreation and tourism faculty study the most important species of all to the state’s natural beauty and resources—Idahoans. He summarizes his recent facilitation of the black bear public task force, a graduate student’s fishing clinics for Boise elementary school students, and an ongoing investigation of why people fish in Idaho.

We invite you also to read some of the textbooks our faculty produced over the last two years. They extend natural resource knowledge from the field to the classroom, and back to where it’s most needed—in the hands of professionals in the national parks, forests, scenic rivers . . .

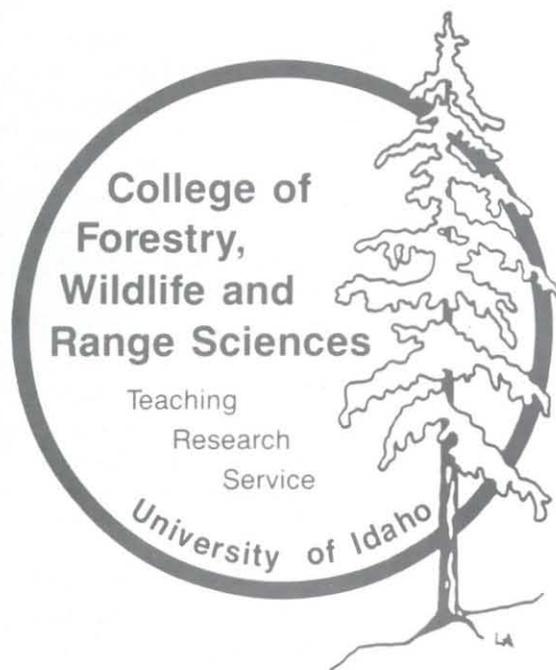
Please enjoy this year’s *Focus*.

University of Idaho



FOCUS

on Renewable Natural Resources



Idaho Forest, Wildlife and Range Experiment Station

John C. Hendee, *Director*
Leon F. Neuenschwander, *Associate Director*
Richard F. Bottger, *Assistant Director*

Denise Ortiz, *Editor*
Lorraine Ashland, *Artist*
Gerry Snyder, *Photographer*
Vanessa Dobbins, *Typesetting and Layout*

Cover: How can we sustain the natural beauty and resources we have come to take for granted? Through good policy based on sound scientific research. Fortunately, Idaho is one of the first states to recognize the need for unbiased information about the impacts of natural resource proposals on the state's resources, economy, and people. That source is the Idaho Forest, Wildlife and Range Policy Analysis Group (PAG), featured on page 1.

1992 Annual Report

Volume 18

August 1993

Research Highlights

Good Policy Needs Good Information—The PAG	1
Can Crested Wheatgrass Survive Drought?	4
How Does Grazing Affect Water Quality?	5
The Tree Nutrition Cooperative	6
Space Age Forest Climate Mapping	7
Chinook Salmon and Steelhead Migration	8
Producing a Marketable Fish	9
Look Inside the Log for More \$\$\$	10
Standards That Strengthen Log Homes	11
Environmental Education in Latin America	12
People Projects in Idaho	13
Special: Book Feature	14

Appendix

Experiment Station Scientists	20
Publications and Reports	25
Research Projects and Investigations	33
Theses and Dissertations	40
Continuing Education and Outreach	41
Agency and Funding Support	45
FY 1992 Financial Picture	45
Director's Score Card	46

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Good Policy Needs Good Information— The PAG Provides It

Jay O'Laughlin

In recent years, tension between various groups over the uses and management of Idaho's natural resources has increased, leading to confusion and conflict that affects everyone in the state. To help ease the tension, the legislature in 1989 established a nonpartisan, nondepartmental unit that would provide citizens and lawmakers with unbiased and expert information on controversial natural resource proposals so they can make informed management decisions. That unit is the Idaho Forest, Wildlife and Range Policy Analysis Group (PAG), housed in the college and scheduled for reauthorization in 1994. As is the case with any new and unique program, the PAG has evolved since its birth in 1989. Has the PAG lived up to its expectations?

To answer this question, the PAG's Citizen Advisory

Committee—representing a variety of citizen interests, government agencies, and industry concerns—suggested a program review during 1992-1993 to assess the PAG's performance. The first two phases of the review have been completed. They are a self-assessment or self-study led by the dean of the college, and a client survey to discover how the individuals requesting or using PAG studies judge the PAG's performance. Based on this information and their own experiences, the Citizen Advisory Committee will evaluate the PAG's performance. Then a group of legislators and other state leaders in natural resource policy will be invited to review the findings and offer their reactions and advice. The complete results of this review will be published in late 1993.

The key focus questions included in the first two



Gerry Snyder

The PAG nucleus: Besides directing the interdisciplinary and first-of-its-kind policy analysis unit, flyfishing enthusiast Jay O'Laughlin (center) recently published a text on forest policy, and is a fellow of the university's Martin Institute for Peace Studies and Conflict Resolution. Jim MacCracken (right), full-time PAG research scientist, has a Ph.D in wildlife resources and enjoys hunting. And Idaho native Troy Merrill (left), expert whitewater kayaker, is the PAG's part-time research assistant and a Ph.D student in geography.

phases of the program review were: What has the PAG accomplished? Has the PAG met the assigned legislative mission? And, have PAG products been useful?

What has the PAG accomplished?

PAG efforts have resulted in a variety of substantive products, plus intangible offshoots such as the better decisions resulting from focused communications among natural resource agencies, interest groups, and university experts. PAG Citizen Advisory Committee meetings take place five times a year, bringing together key agency and interest group representatives to discuss existing and emerging natural resource issues in Idaho, and the university's role in these issues.

The more tangible PAG accomplishments are its eight reports published between 1990 and 1992: **1. Idaho's Endowment Lands: A Matter of Sacred Trust;** **2. BLM Riparian Policy in Idaho: Analysis of Public Comment on a Proposed Policy Statement;** **3. Idaho Department of Fish and Game's Land Acquisition and Land Management Program;** **4. Wolf Recovery in Central Idaho: Alternative Strategies and Impacts;** **5. State Agency Roles in Idaho Water Quality Policy;** **6. Silver Valley Resource Analysis for Pulp and Paper Mill Feasibility;** **7. A National Park in Idaho? Proposals and Possibilities;** **8. Design of Forest Riparian Zone Buffer Strips for the Protection of Water Quality: Analysis of Scientific Literature.** (These may be ordered by number from the PAG at no charge.) Reports 4 and 8 are the most popular, attracting broad national audiences.

These reports provide accurate and objective information to the public and to decision-makers on natural resource issues, most affecting the entire state. And findings from the PAG's impartial analyses have been widely disseminated by the press, further enhancing public understanding of the role of natural resources in Idaho.

Another benefit from the PAG is involvement by university scientists in current natural resource policy issues. Fifty-five university faculty members have worked on PAG projects. Sixteen are college faculty who provided original analyses. Twelve more have served as technical reviewers of PAG work. Fifteen faculty from elsewhere in the university have served the PAG as analysts or reviewers. Twelve faculty at nine different universities, including Boise State University and Idaho State University, have worked on PAG projects. As well as the obvious scholarly contribution of faculty expertise to PAG reports, the involvement of professors in current issues has enhanced their teaching. And these educational benefits to our students reach far beyond the classroom. Because of the increasing need for unbiased cross-disci-

plinary analysis of natural resource policies, students need some background in policy analysis. Having the PAG in an academic college helps them get it.

The PAG director receives many invitations to lecture in the college and elsewhere. The perceived success of the PAG within academic circles is accompanied by many student requests for a course in natural resource policy analysis and by prospective graduate students who would like to earn graduate degrees in policy analysis working in association with the PAG. As an adjunct faculty member, the PAG director now supervises a Ph.D. student. The college is further meeting the teaching need with a course in Boise starting in 1993, taught by the PAG director using the new textbook he co-authored (*Forest Resource Policy*, John Wiley & Sons, New York).

Future plans include more involvement in forums where proponents of different viewpoints can discuss them in a public setting provided by the university, such as the June 1992 forum in Twin Falls on national park potential in Idaho. The PAG has helped to bring to campus excellent speakers to address important natural resource policy issues, including Dennis Kelso, former commissioner of the Alaska Department of Environmental Conservation; Jane Difley, president of the Society of American Foresters; and Karen Budd, an attorney specializing in western public lands issues who has been prominently featured in *Newsweek* and *High Country News*.

The PAG has earned a reputation for itself and for Idaho as a national leader in natural resource policy analysis. This is documented by numerous requests for information from around the country, invitations to the PAG director to speak to a variety of audiences, and the establishment of comparable efforts at other universities.

Has the PAG met the assigned legislative mission?

Yes. The PAG's mission is "to provide timely, scientific and objective data and analysis pertinent to such resource and land use questions which are of general interest to the people of Idaho and which are suggested as worthy of the group's attention by the advisory committee" (Idaho Code § 38-714). Responses to the client survey indicate a high degree of satisfaction with both the timely and unbiased nature of PAG reports.

Have PAG products been useful?

Yes. Responses to the client survey show that PAG reports have been useful in policy deliberations, for educational purposes, and as reference documents. In response to open-ended questions, clients offered many

comments, with the great majority reflecting well on the operation of the PAG, the quality and unbiased nature of the reports, and the perceived value of the PAG.

"[The] PAG is a needed institution," asserted one respondent to the client survey, and it "has helped to alleviate some of the controversy on several resource issues" added another. One client found the report on Idaho's endowment lands to be "very well researched and explained with unslanted language . . . Legal and technical, but easily understandable." Another felt "the report presents the concept . . . as it is . . . It takes no position on 'what is right' [but rather] 'what is!'" Said another, "This report should be required reading for all legislators."

The wolf recovery report was "absolutely professional and . . . presented facts without bias," according to one respondent. Another liked the "well documented, easy-to-follow format. Quite concise for such a complex issue." A client for the report on state agency roles in Idaho water quality policy was impressed that the report "did not allow pressure from special interest groups" and was "therefore able to remain professional." Another summarized the view of many that "with controversial issues continuing to escalate, a tool such as the PAG becomes increasingly important and necessary."

Resource policy affects all Idahoans and its conflicts cut sharp divisions among the state's citizens. Because the PAG has fostered better policies, it is viewed by many as a necessity for Idaho. One respondent said it should have been formed "much earlier to help resolve resource management issues." Perhaps, as another optimistically pointed out about the PAG, "Every state should have one!"

Jay O'Laughlin is director of the Policy Analysis Group, and adjunct professor in both forest products and forest resources. He has a Ph.D. in forest policy and economics, is a fellow of the University of Idaho's Martin Institute for Peace Studies and Conflict Resolution, and a member of the Tri-State University Task Force on Salmon and the Columbia River System. Jim McCracken is full-time research scientist with the PAG, and earned a Ph.D. in wildlife resources in 1992. Troy Merrill is part-time PAG research assistant and a Ph.D student in Geography; he holds an M.S. in resource recreation and tourism.

At right: Current PAG research projects. Dark titles indicate projects in progress; light titles indicate projects still in the planning stages.

Grizzly Bear
Recovery

Endangered
Species Policy
in Idaho

Idaho Forest
Health
Conditions

Idaho Timber
Harvest Policies

Quantifying
Instream Flows
for Recreation

BMPs for
Grazing in
Riparian Areas

Wilderness
Designation for
Roadless Areas

We're on the Rangelands . . .

Can Crested Wheatgrass Survive Prolonged Drought?

Jeffrey C. Mosley, Kenneth D. Sanders,
Mathew V. Spaulding

Covering about 14.5 million acres in North America, crested wheatgrass (*Agropyron cristatum*, *A. desertorum*, and related taxa) is one of the most important rangeland plants on the continent. A perennial bunchgrass native to eastern Europe and Asia, crested wheatgrass was first brought to the United States from Siberia in 1898, and has since been widely seeded across southern Idaho and throughout the West.

This grass is especially important in southern Idaho where the state's largest and most economically important industry—the range livestock industry—profoundly depends upon crested wheatgrass seedings for spring and fall forage. Furthermore, this source of forage enables ranchers to avoid grazing their livestock on rangelands during spring and fall when native vegetation is more vulnerable to defoliation. Crested wheatgrass also is an important forage source for many of Idaho's deer, elk, and pronghorn populations. Thus, the long-term health of crested

wheatgrass seedings is vitally important to the citizens of Idaho.

However, during the past five to seven years of intense drought, many crested wheatgrass seedings in southern Idaho experienced high levels of mortality and have shown little or no signs of recovery. Has this prolonged drought sapped the energy and vitality from crested wheatgrass, or is some other cause to blame? A close inspection of the mortality pattern suggests that the problem indeed is drought-related, but drought is probably only a catalyst. This is because not all crested wheatgrass seedings in the drought-stricken region were affected, and because not all crested wheatgrass plants died within the affected seedings. Only varying sizes of irregularly shaped patches of grass died. The crested wheatgrass plants within the adjacent live patches exhibit perfect health, resulting in a mosaic pattern of live and dead patches within the affected wheatgrass seedings. Previous short-term droughts have killed off crested wheatgrass before, but never to the present degree of severity or geographical extensiveness, and not in the mosaic pattern.

In spring 1991 we visited 50 crested wheatgrass seedings across southern Idaho and extreme northern Nevada, and sampled soil chemistry and crested wheatgrass plant density within the dead and live patches on each site. We also examined the genetic makeup of crested wheatgrass plants adjacent to the dead patches and any crested wheatgrass plants still growing inside the dead patches.

Preliminary results from our data analyses in 1992 suggest that high levels of sodium in the soil decreased water availability for the crested wheatgrass plants, thereby intensifying the water stress caused by drought. Mortality was not affected by livestock grazing or intensity or season of use. Preliminary results also indicate that standard crested wheatgrass (*A. desertorum*) and Siberian wheatgrass (*A. fragile*) were the species that best coped with the combined impacts of sodium and drought. Final results should be available by December 1993.

Jeffrey Mosley is associate professor of range resources. Kenneth Sanders is professor of range resources and extension range specialist at the UI Twin Falls Research and Extension Center. Mathew Spaulding is a research assistant and master's degree candidate in range resources. Their project is funded by the Bureau of Land Management.



Mathew Spaulding

... And in the Watershed

How Does Grazing Affect Water Quality?

Jeffrey C. Mosley, Thomas A. Lance, John W. Walker, Daniel E. Lucas, C. Michael Falter

Rangeland is the largest single category of land worldwide, occupying about 47 percent of Earth's land surface. Similarly, about 50 percent of the land area in Idaho is rangeland. The long-term supply of clean, plentiful water from rangelands is vitally important to the economic and environmental health of Idaho and the West. Accordingly, we need to understand how riparian ecosystems (i.e. stream-sides and shorelines) function so that the negative impacts of any rangeland use can be mitigated or eliminated.

The most pervasive use of rangeland watersheds is ungulate grazing, and unfortunately, improper grazing by both wild and domestic animals is occurring along many streams and lake shorelines throughout the West. Fortunately, streams, lakes, and reservoirs have inherent capacities to assimilate some pollution without becoming degraded. The challenge facing riparian area managers is to employ practices that limit the amount of water pollutants contributed by grazing animals. The corresponding challenge facing research scientists is to formulate scientific principles upon which effective grazing management guidelines can be developed.

The primary chemical contaminants contributed by grazing animals are nitrogen and phosphorus from soil erosion and from the animals' excrement. Nitrogen and phosphorus are essential nutrients for all plants and animals, but excessive amounts in surface waters can stimulate toxic algal growth, accelerate eutrophication (aging) of lakes, and contribute to the depletion of oxygen in the water needed by fish and other aquatic organisms. Contaminations can be severe when grazing animals are concentrated near surface waters, but when animals are well-dispersed, riparian zones appear able to inhibit nutrients from entering rangeland waters.

The prevailing perception is that riparian vegetation is a physical filter, trapping nutrients

before they enter surface waters. If this is true, one might conclude that fewer nutrients will reach the water when large amounts of vegetation are present along a streambank or shoreline. But the filtering role of vegetation may not be so straightforward. Some evidence suggests that too much standing vegetation actually may contribute more nutrients when compared to riparian vegetation that is mowed or grazed. Mowing or grazing may promote more rigid plant stems that better slow runoff and filter nutrients. Also, mowing or grazing may stimulate plant uptake of nutrients from the soil.

We began our study in June 1991 along Medicine Lodge Creek near Dubois, Idaho. We are measuring the import and export of nitrogen and phosphorus from riparian meadow sites having different amounts of vegetation remaining at the end of the growing season. The amount of vegetation is regulated in one set of plots by haying, and in another set by cattle grazing. Levels of vegetation removal vary from 0 to 90 percent. Runoff water, groundwater, precipitation, airfall, vegetation, soils, and cattle feces are all being monitored for nitrogen and phosphorus content. Data analyses are underway, but preliminary results indicate that in 1991-1992 soil nutrient levels were not influenced by the mass of standing vegetation nor its height. This was true for both the hayed and the grazed plots. We are continuing our study and expect final results in December 1993.

Jeffrey Mosley is an associate professor and Thomas Lance is a research assistant and master's degree candidate in the Department of Range Resources. John Walker is a range scientist with the Idaho Agricultural Research Service. Daniel Lucas is Clark County Extension Agent. C. Michael Falter is a professor in the Department of Fish and Wildlife Resources. Funding for this project is from USDA's National Research Initiative Program and the university's David Little Range Livestock Endowment.



Thomas Lance

Studying an Acre . . .

The Tree Nutrition Cooperative

James A. Moore

Even trees have to watch their diet. In the Inland Northwest, there is increasing concern that our forests are experiencing extremely high tree mortality rates and growth loss; in some regions these losses far exceed growth over large areas of land. This might be because the trees are not soaking up enough nutrients, or the proper amounts of the right nutrients. What kind of diet do trees need to stay healthy, productive, and resistant in the face of pest and climatic attacks? The IFTNC, or the Intermountain Forest Tree Nutrition Cooperative has for the last ten years studied tree nutritional requirements, and recently has attempted to crack the puzzle of high tree mortality. Specifically, the IFTNC pursues evidence for links between forest nutritional status and forest health problems.

The goal of the IFTNC is to promote forest longevity, resilience, and productivity through understanding of nutrient cycles, conservation of native nutrients through appropriate forest management practices, and amelioration of nutrient deficiencies through stand culture or the addition of fertilizers or other amendments.

The Department of Forest Resources has served as host institution for the cooperative since January 1981. IFTNC addresses the forest concerns of 11 industrial, federal, and state forest land management organizations in Idaho, western Montana, eastern Washington, and eastern Oregon. The cooperative has conducted research at more than 100 experimental fertilization sites throughout the Intermountain Northwest.

With the information we gather, the IFTNC works to improve the member agencies' ability to diagnose nutrient deficiencies and their consequent effects on forests; to improve their ability to efficiently conserve and enhance nutrients; to develop prescriptions for nutrient management; and to communicate this vital new information to the profession, the public, and various regulatory agencies.

Recently, we discovered that Douglas-fir stands in our geographic region were showing tree potassium status to have a significant influence on tree growth response to nitrogen fertilization. Based on these findings, the cooperative hypothesized that potassium fertilization could help protect trees from disease and insect-caused mortality.

We set up a series of greenhouse trials and field experiments in second-growth even-aged managed ponderosa pine



In search of the innocuous inoculation: With tubes to keep roots untangled and sand as a nutrient-neutral medium, the IFTNC infected these Douglas-fir with Armillaria to learn how tree nutrition and different fertilizer concentrations help seedlings fight off disease.

stands in western Montana, consisting of plots both treated and untreated with nitrogen fertilizer, and treated with a combination of nitrogen fertilizer and potassium. Fertilization with nitrogen alone produced a negative, non-significant net volume response, but plots receiving both nitrogen and potassium responded positively. Eventually we found a fertilizer regime that combined nitrogen fertilizer with potassium to prevent an increase in tree mortality.

Because of this, the IFTNC's steering committee has shifted its focus to fertilizer experiments that could: 1. reduce root pathogen infections in Douglas-fir and ponderosa pine; 2. reduce root-rot mortality in *Armillaria* infestations; 3. increase ponderosa pine resistance to mountain pine beetle attack; and 4. estimate optimum mix of nitrogen and potassium for increased tree growth and decreased mortality.

James A. Moore is professor of forest resources and director of the Intermountain Forest Tree Nutrition Cooperative (IFTNC). The IFTNC is funded by dues from its ten agency members.

... or the World

Space Age Forest Climate Mapping

David L. Verbyla and Daniel R. Unger

Wanted: A Method to Map Climatic Zones in Any Forest in Idaho. Must be efficient in terms of both time and dollar cost. Must be accurate enough to allow comparison of the relative climates of various areas of a forest.

Changes associated with climate due to global warming are big news these days. For instance, the current drought with its associated forest health impacts is altering the Boise and Payette National Forests. Scientists do not yet know how forests will respond to climate warming: will bark beetles become more of a problem in lodgepole pine forests as global warming continues? Will bird communities change within the forest? Will trees grow at different rates?

As a first step in climate warming research we are developing a tool to efficiently map forest temperature zones where the initial effects of global warming on forests will be detectable. One approach would be to set up weather stations scattered throughout a forest to measure stand temperature, but this would be very expensive and not applicable to large or inaccessible areas. We are looking for a method to map climatic zones in any Idaho forest, a method that could be applied to small as well as large and inaccessible areas, and we think we have it.

Since 1982 a satellite mapping system called Landsat Thematic Mapper has been orbiting the earth with its thermal sensor and shooting computer images of Idaho. We surmised that these images might be useful for forest temperature mapping.

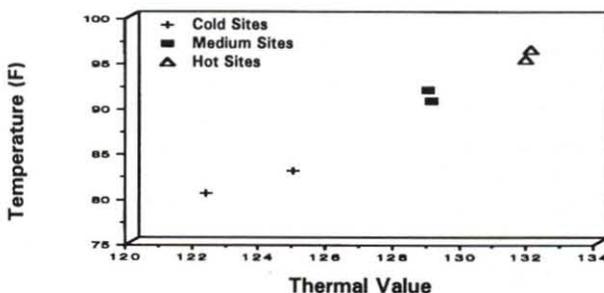
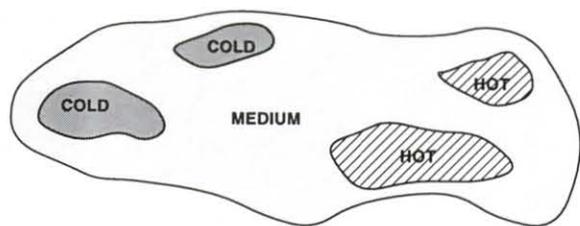
However, the thermal radiation the satellite sees is "radiant temperature," not necessarily the same kinetic temperature we all commonly measure with thermometers. Because of this and other complexities, there was no guarantee that thermal images would prove useful to us for mapping forest temperature zones. Satellite thermal images have been used in the past to map surface water temperatures with an accuracy of plus or minus 1° Celcius, but they had not been applied to more complex environments like forests.

We decided to test the utility of satellite thermal images for mapping forest temperature zones on the University of Idaho Experimental Forest. Using Landsat thermal images from July 1990, we predicted "cool," "medium," and "hot" zones for four different forested areas (Figure 1). We also systematically placed ten minimum/maximum thermometers at two sites within each predicted temperature zone. We then tested the validity of the satellite-based predictions by correlating satellite thermal values with the forest stand temperatures recorded by the thermometers.

We found that in all four areas, there was a strong correlation between maximum daily temperature measured in the field and thermal values recorded by the satellite (Figure 2). This means that satellite thermal data can be used to accurately map forest temperature zones—both small and large—from space, and it can do so more efficiently.

This summer we are testing another method of predicting forest temperature zones using a computer simulation model based on digital elevation data. The results of our research will be useful to scientists attempting to answer the numerous questions now being raised by changes in our planet's climate.

David L. Verbyla has been visiting assistant professor in forest resources for the past three years, now assistant professor at the University of Alaska. Daniel R. Unger is a Ph.D. candidate in forest resources. Scheduled for 1990-1994, their project is funded by the U.S. Fish and Wildlife Service Gap Analysis Program and a McIntire-Stennis grant.



Left: Temperature zones predicted with satellite thermal data within the UI Experimental Forest.

Right: Correlation between satellite thermal value and maximum daily forest stand temperature for one of four forested areas tested.

From Upstream . . .

Chinook Salmon and Steelhead Migration Past Snake River Dams

Joel P. Hunt and Theodore C. Bjornn

The Columbia River watershed historically produced more chinook salmon than any other river system in the world, with significant contributions from the Snake River basin. However, chinook and sockeye salmon have recently become so depleted that they have been listed as "threatened" and "endangered," respectively, under the Endangered Species Act. Adult spring and summer chinook salmon and steelhead migrating to their spawning streams in the Snake River basin must pass eight dams and as many reservoirs, four of which are in Idaho's lower Snake River. The ability of these fish to pass the dams and reservoirs with minimal losses will help maintain native runs and achieve the Northwest Power Planning Council's goal of doubling fish abundance in the future.

We are in the third year of a four-year study examining the upstream migration of adult chinook salmon and steelhead. Our objectives are to evaluate the effect of spill, powerhouse operation (discharges), and river flows on: rates of fish passage at dams and reservoirs, fallback (when upstream-migrating fish swim *downstream* past a dam), and distributions in the tributaries upstream from the reservoirs.

This study is funded by the U.S. Army Corps of Engineers and Bonneville Power Administration, and extends from John Day to Priest Rapids dams on the Columbia River, the Snake River from the mouth upstream to Hells Canyon Dam, and all of the major Snake River tributaries.

To assess migration rates and success in 1991, we placed radio transmitters in 531 spring and summer chinook salmon and 728 steelhead, and released them near Ice Harbor Dam. The transmitters emit a signal every seven seconds which is recorded as fish pass the permanent

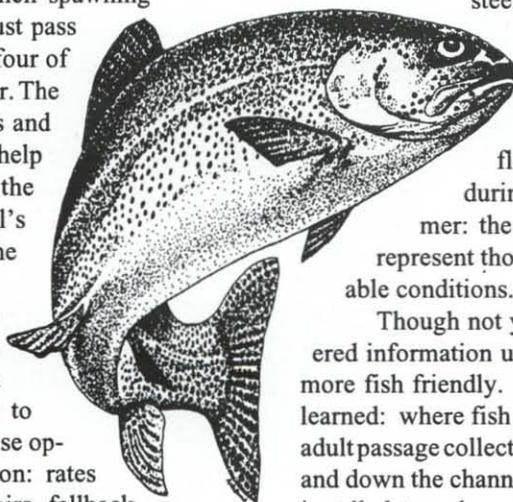
receiver stations at each of the dams and mouths of the major tributaries. The longest average time it took chinook salmon to pass any of the four Snake River dams was 7.9 days (at Ice Harbor Dam) and the shortest was 1.8 days (at Little Goose Dam). Most fish passed through the lower three reservoirs in less than two days per reservoir (55-58 km a day) and took between 2 and 3.7 days (47 and 34 km a day) to pass the Lower Granite pool. An estimated 87 percent of the spring and summer chinook salmon released at Ice Harbor Dam successfully passed upstream of Lower Granite Dam.

The distribution of chinook salmon outfitted with transmitters in the Snake River drainage was 25 percent into the Clearwater River, 9 percent into the Grande Ronde, 4 percent into the Imnaha, and 62 percent into the Salmon River. We do not yet have final results for steelhead movements.

Overall, conditions for upstream migration of adult chinook salmon in the lower Snake River were favorable in 1991 because of the low flows, lack of spill, and low turbidities during most of the spring and early summer: the migration rates observed probably represent those that can be expected under favorable conditions.

Though not yet complete, we have already gathered information useful in managing dams so they are more fish friendly. In 1992 at Lower Granite Dam we learned: where fish prefer to enter the dam to access the adult passage collection channel, that some fish wander up and down the channel for up to 16 hours, and that fences installed to enhance passage were not working as designed.

Field season 1993 is presenting different research conditions than the previous two seasons. Near normal snowpacks and spring precipitation have caused higher spring runoffs, more spill at the dams, and more turbid water. In addition, this year marks our first season working with chinook salmon listed as a threatened species.



Theodore C. Bjornn is professor of fishery resources and assistant leader of the Idaho Cooperative Fish and Wildlife Research Unit. Joel P. Hunt has a master's degree in fishery resources and is currently Professor Bjornn's research associate.

. . . to Uptown

Producing a Marketable Fish

George W. Klontz and Horst Kaiser

How can a fish farmer produce the proper sized fish for a year-around market? Though this may seem like a relatively simple issue, three types of fish farmers commonly struggle with how to answer this question: the farmer producing tablefish from eggs, the farmer producing tablefish from fingerlings, and the farmer growing fingerlings for year-around sale to foodfish producers.

Typically, the farmer who grows fish from the egg phase must buy several thousand eggs each month to ship a certain number of tons to market per month, but since it takes a year for the fish to grow to desirable size, it can require some meticulous and often error-prone calculations to assure there is the proper monthly tonnage of fish ready for market. The farmer producing fish from fingerlings faces the same dilemma, except that, in addition, fingerlings are not available year-around, so he or she must purchase large numbers and maintain them over several months. The farmer producing fingerlings for year-around sale confronts the problem of having a year-around supply of fingerlings to be started from eggs during times of the year when such eggs are not available from the same hemisphere. The difficulty these farmers all share is one of *timing*.

The currently practiced method most fish farmers use is to slow fish growth rate by reducing the amount of feed given each day. They then grade the fish to remove the appropriately sized fish. However, the method has shortcomings such as increased fish size variation, fin-nipping, fin-fraying, and darkened bodies. These shortcomings result when some fish consume more feed than their pondmates and because the entire population tends to experience chronic stress. This stress response—a series

of physiological changes occurring when fish perceive changes in their surroundings as a threat—contributes to virtually all the gill disease problems farm fish exhibit during the grow-out stage.

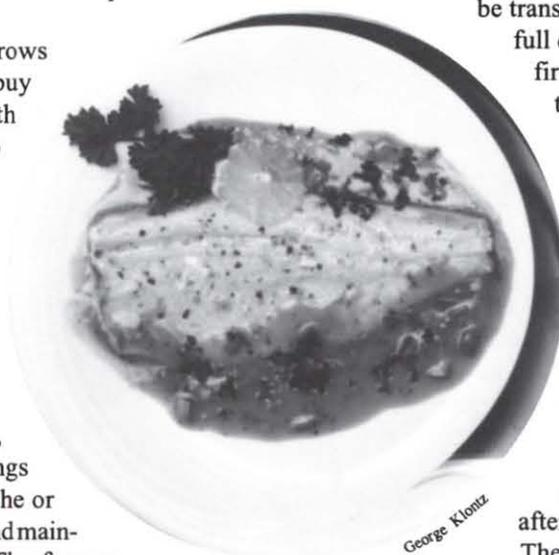
A better method of reducing the growth rate is to feed intermittently, that is seven days of feeding followed by seven days of not feeding, or combinations thereof. According to the results of our recent two-year controlled growth study, the following regimen could be implemented to provide fish of uniform size over a period of four to six months.

Specifically, the fish should at first be fed all they can eat, several times a day. When they reach two to three grams in weight, one-sixth of the population should be transferred to another deep tank and fed full daily rations—these fish will be the first to reach maturity even though all the fish started at the egg stage at the same time. Meanwhile, the remainder of the population is fed 50 percent of the daily ration for seven days, followed by seven days of starvation.

At monthly intervals, a certain number of these fish are removed from the reduced feeding population and fed full daily rations so that they reach market size next. The last group will be the appropriate market size six months after the first full-fed group.

The main hurdle to overcome in intermittent feeding programs is to decide when to put the fish back on full feed to bring them to market size and condition, and we have devised a formula that works. Our regimen results in months of production of virtually the same sized fish year-around, and with very little grading needed.

That should save many fish farmers a little extra time to enjoy the good things in life—like going fishing . . .



George "Bill" Klontz is a professor of aquatic animal medicine in the Department of Fish and Wildlife Resources. Horst Kaiser is a visiting scientist from Germany in the same department.

Forest Technology at the Mill . . .

Look Inside the Log for More Dollars

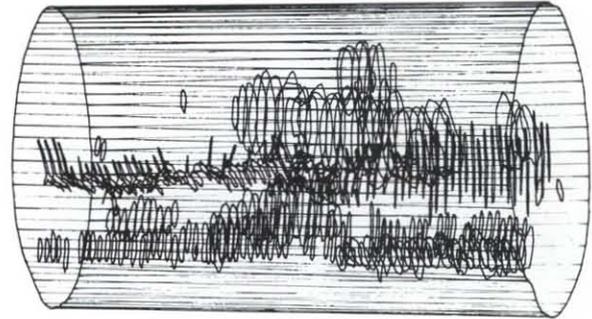
Fran Wagner

In many hospitals across the country, scanners routinely look inside of patients to find tumors, ruptures, and other maladies. Hospital scanner technologies include Magnetic Resonance Imaging (MRI), ultrasound, and Computed Tomography (CT). What if we could use similar technology to discover what "tumors" might exist inside logs--hidden flaws that for a sawmill or veneer plant could mean thousands of lost dollars?

It so happens that some modern sawmills and veneer plants are now using laser or video scanners to determine the size and shape of logs to improve the production of their sawing and slicing machines. Scan information is processed by computer to select the sawing or slicing pattern and sometimes the angle of the log that will maximize volume recovery. However, these scanning systems are not capable of maximizing lumber or veneer *grade*, which is where lumber businesses make or lose money. The next technological step may be the development of scanners that can look inside a log, view internal defects (knots, holes, bark pockets, etc.) that reduce the value of lumber or veneer, position the log so that the impact of internal defects is minimized, and saw or slice the log to maximize the grade and value of lumber or veneer recovered.

Over the last several years, my associates and I have experimented with an electron beam CT scanner manufactured by Imatron, Inc. of South San Francisco to scan oak and pine log sections. Normally used to monitor the beating hearts of cardiac patients, this particular scanner collects information to compute pictures of up to 34 cross-sectional log slices per second.

We scanned seven two-foot log sections at .31-inch intervals for a total of 541 cross-sectional scans. Visual inspection of the scan images and log slices showed that literally all significant log defects could be detected. At the rate of 34 cross-sectional scans per second, a 20-foot log could be scanned at 1-inch intervals in just over seven seconds.



Computer-detecting flaws like the knots, holes, and pith mapped in the log above—before sawing—could increase the value of veneer lumber by as much as 10 percent.

The next logical question then is: how much can the value of lumber or veneer be improved if the location of internal defects is known before processing?

We answered this question by crosscutting 40 logs into quarter-inch sections and by mapping defects found on each section to emulate CT scanning. We assembled log data into individual log files and used computer simulation techniques to saw data logs into lumber. By this technique, each log could be sawn into lumber at multiple angles and with multiple sawline placements so that the value of lumber produced from each sawing of the same log could be compared. Ultimately, the maximum value of lumber that could be produced from each log was compared to the value of lumber that conventional sawing methods would have produced. Our results show that a 10 percent increase in value could be expected if logs were scanned for internal defects and then positioned and sawn for maximum value.

This means that a CT log scanner costing as much as \$1.5 million would be a financially sound investment for a medium or large sawmill. Additionally, with decreasing log supplies and increasing log costs, CT log scanners may be one way of extracting much needed high grade lumber and veneer from a dwindling timber resource. As technology advances, don't be surprised if you see this type of scanner at sawmills and veneer mills across the U.S. within the next 10 years.

Fran Wagner is professor of forest products specializing in operations research and management science techniques applied to primary and secondary wood products manufacture. This is his first year with the college since coming from Mississippi State University in July of 1992.

... And in Our Living Rooms



Gerry Snyder

The home of Ed and Charlene Krumpe near Moscow, Idaho.

The earliest European settlers built the first log homes in North America, and the origin of log construction predates even these early structures. Centuries-old log buildings are still standing in the broad region bounded by Scandinavia, Switzerland, and the Balkans. Yet even with a history as old as this, continuing research in new technologies and processing methods can contribute to safer, more resource-efficient, and more energy-efficient log homes.

One new technology is the laminated house log. During 1992 we tested the structure and strength of a new laminated log product, a “log” of ponderosa pine or western redcedar sandwiched together with a phenol-formaldehyde adhesive. Rather than dedicate an entire tree to manufacture house logs, some companies are laminating low-grade dimension lumber into solid beams, then machine profiling the beam to give it the traditional log cabin look on one side (the other side is flat). This technique enables the better grades of lumber from a tree to be saved for applications where high quality lumber is really needed.

But will a “log” of low-grade laminated lumber have enough strength to hold up a snow-laden roof over a wide picture window? Our structural tests demonstrated that these glued and laminated logs are actually stronger than solid logs because knots and other strength-reducing defects are not continuous in a laminated log. Instead, knots affect only a

Standards That Strengthen Log Homes

Thomas M. Gorman

single lamination. In natural logs, a knot can continue into a larger part of the cross-section of the log, causing a weak spot. By bending 12- to 16-foot glued and laminated logs until they broke, we found that laminated logs could tolerate greater bending stress than ponderosa pine logs of the same size.

Funded in part by the two log home companies of Glulam-Log (Florence, Montana) and Lodge Logs (Boise), I, Forest Products graduate student Nathan Hesterman, and UI Civil Engineering Assistant Professor Robert Linderman bent 60 logs until they snapped. We supported either end of each laminated log under a hydraulically powered loading device and added progressively heavier loads to the log to discover the log’s maximum load capacity and the statistical distribution of its strength properties. The average load required to break each log was 12,000 lbs.

This information permitted us to determine allowable—or safe—loads for use in the design of log buildings as needed for building code standards for manufactured logs for log home kits. This kind of information, because it is provided by an independent testing group such as the University of Idaho, is useful to the International Conference of Building Officials in California (ICBO), the agency responsible for additions to the national Uniform Building Code.

Manufactured logs are a good example of a value-added manufacturing process, one of the goals of our Wood Use and Design Program. Compared to making traditional logs, it’s a more complex process with more steps. Each step adds value to the product and creates jobs. It’s the type of new product we like to encourage for Idaho mills. Our research is helping the growing log home manufacturing industry remain efficient, competitive, and on the cutting edge of that increasingly “modern” construction material we call *wood*.

Thomas M. Gorman is assistant professor in the Department of Forest Products, specializing in wood construction and design, secondary wood products manufacturing, and moisture problems in wood-frame houses. He and his colleagues utilized the nearby Washington State University Materials and Engineering Laboratory to break their logs.

Teaching Our Neighbors . . .

Environmental Education in Latin America

Editor

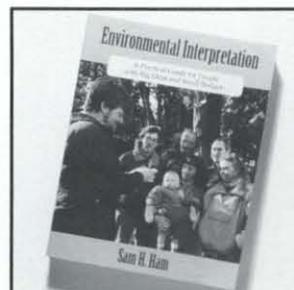
It is like a Latin American recreation manager's dream come true. Basically a book about communication, *Environmental Interpretation* by professor of resource recreation and tourism Sam H. Ham covers not only basic interpretation concepts, but also information on developing exhibits, trails, brochures, audio-visual programs, photographs, and preventative maintenance of equipment and materials—especially important in the tropical environments of Latin America.

Simultaneously published in Spanish and English editions, the text features an appendix—organized by region and by country—of 200 “Key Organizations in Interpretation and Environmental Education” in all Latin American nations (and Canada and the U.S.) to guide Latin American interpreters to local information sources and technical assistance.

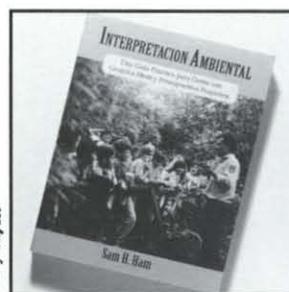
Environmental interpretation means making the environment understandable to lay people, comments Jeffrey McNeely of the International Union for Conservation of Nature and Natural Resources in the book's Foreward. Ham has indeed provided instructions for people who work in forests, parks, protected areas, extension sites, zoos, museums, and other settings in which there is such a need to communicate technical information to non-technical audiences. He guides, tips, teaches, and advises on how to promote understanding of environmental resources, from how to create sophisticated colored background slides with superimposed text to putting flannel boards together with homemade glue and rice chaff. He offers notes on handling angry and difficult visitors, and even how to prevent damage to slides by packing them with baking soda or saltine crackers that absorb moisture.

There are guidelines on preparing and presenting a talk, a guided tour or walk, or an inexpensive slide and tape program, also guidelines for other more unique educational opportunities like living history demonstrations, mobile information stations, puppet shows, role playing, community theater, and various fun ways of “Taking

Ham, S.H. 1992. *Environmental Interpretation, A Practical Guide for People with Big Ideas and Small Budgets*. North American Press, Golden, Colorado. 456 pp.



Gerry Snyder



Gerry Snyder

Ham, S.H. 1992. *Interpretación Ambiental, Una Guía Práctica para Gente con Grandes Ideas y Presupuestos Pequeños*. North American Press, Golden, Colorado.

Wildlife to Children.”

Add to this Ham's easy style, accessible format, case studies, glossary of terms, hand-drawn exhibit models, and lettering aids, and you have a first-of-its-kind volume for which Ham received literally thousands of requests before either edition was yet published.

Orders for the book are rolling in from organizations like CARE, the World Wildlife Fund, the World Bank, the United Nations Environment Program, and USAID in Costa Rica, Honduras, and Guatemala.

“My philosophy is that true ‘professional’ interpreters are like liquids—they take the shapes of their containers . . .” prefaces Ham at the volume's start. “Their work is too important to let anything get in the way of it. To them, lack of money isn't an obstacle to doing their jobs, nor to doing them well. It's merely an inconvenience.”

That is, until a book came along for people with big ideas and small budgets.

Cover photographer for English edition: Gerry Snyder

Cover photographer for Spanish edition: David Sutherland

... Teaching Ourselves

People Projects in Idaho

Nick Sanyal

There is a new species for the biologists and managers of the Idaho Department of Fish and Game (IDFG) to study and manage. The species is not rare or endangered, it does not, and never will be, the subject of hunting seasons, and it is one which natural resource managers and other decision-makers need to know the most about. The species? *Homo sapiens*.

Learning about, managing, and responding to people is a major objective of Idaho's fish and game managers for the 1990s and beyond, and several of us in the Department of Resource Recreation and Tourism are playing a major role in that changing focus.

In response to strong public and political pressure surrounding the hunting of black bear in Idaho, IDFG created a 26-member citizens task force to examine the issues and develop biologically sound and socially acceptable recommendations for the agency to use in re-writing its 1992-2000 black bear management plan.

I and the department's John Hunt, Bill McLaughlin, Ed Krumpe, and graduate student Lynn McCoy led the facilitation team that would help the citizen task force reach consensus. In addition, we coordinated task force meetings and town meetings, recorded and consolidated information gathered at these meetings, and facilitated open and civil discussions among task force members and with the public. We did not write the management plan, contribute to the recommendations, nor offer biological and social expertise to the task force. We were there to help participants achieve consensus.

At its first meeting the task force identified values associated with black bears and bear hunting, and identified the existing threats to those values. At its second meeting, it developed a set of biological management criteria and developed potential management actions with which IDFG could address the threats and protect the values.

At 15 town meetings held between January 14 and February 5, 1992 across Idaho, each citizen attending was given the opportunity to comment on 85 specific management actions using a response

form we developed for the project. We also solicited new management ideas from the public at these meetings. Nearly 700 Idahoans attended these meetings and contributed their written opinions, generating almost 60,000 specific comments on the potential management actions. Most expressed pleasure at being given this opportunity to air their opinions and to know their remarks would actually be used.

At its final meetings, the citizen task force debated more than 500 potential management actions generated throughout the process. This innovative approach on the part of IDFG in developing a species management plan demanded over 700 person hours, and allowed us to introduce several graduate students to the complex realm of facilitation and public involvement, and to the realities of conflict resolution in the real world.

Another project in cooperation with IDFG's Terry Thompson, a college alum in recreation management, provided a testimony to the caliber of students from our department. Student Jim O'Conner conducted a first-ever survey of visitors to the Morrison-Knudsen Nature Center in Boise, including creating the sampling and statistical analysis plan, analyzing the data, and drafting the final report. In the process, Jim even managed a volunteer staff, developed interpretive brochures and activities for Kathryn Albertson Park, and developed the curriculum for fishing clinics aimed at elementary school



Richard Folk

children.

"What puts smiles on the faces of anglers," and "how can we make those smiles bigger?" commented one IDFG biologist about the overriding objective of our next study. Our major effort during 1992 was the Idaho Angler Project. Actually a series of several related studies, the project was the idea of IDFG's Virgil Moore and Al Van Vooren, and is being directed by myself and Professor McLaughlin, with student Mark Walker as project assistant. It has so far produced several exhaustive literature synopses on aspects of angler management that heretofore have been a source of much confusion and myth. It has resulted in a survey of the social science needs of the staff of the Bureau of Fisheries, a pilot study of Henry's Lake and of angler competitiveness, and three survey research projects involving angler motivations.

Because little is known about the angling experiences desired by Idaho's anglers and how these preferences originate and sustain the activity, growing pressure and competition for the state's limited angling resources cannot now be adequately accommodated and integrated by managers. Furthermore, there is little data with which to gauge how specific angling regulations affect the nature of the fishing opportunities provided, or how regulations impact individual fishing experiences. This still-ongoing series of studies is designed to provide data that compliment traditional biological management data by offering meaningful indicators of angler sentiment and motives.

Our major goal is to address a question prevalent in studies of consumptive recreation (i.e. fishing, hunting, etc.), namely determining the relative importance of harvesting (catching) within the broad range of outcomes sought by fishermen. Our search of 100 empirical works has suggested that the outcomes or "satisfactions" that people derive from fishing can be reduced to nine major groups: 1. escape/relaxation/change; 2. consumption/trophy; 3. skills/achievement; 4. challenge/thrill/excitement; 5. social opportunities; 6. solitude/introspection/privacy; 7. nature/natural/wild; 8. explore/learn; 9. teach/control. Most studies find the need for escape, relaxation, and change, and for the role of nature to be the most important motivational factors. Based on these studies, we intend to formulate an approach for measuring and using angler segmentation in Idaho to understand why some Idahoans choose to fish, why some do not, and why some never start fishing at all.

Nineteen ninety-two was indeed an important year for studying the human dimensions of Idaho's fish and wildlife resources, and the one species most important in preserving those resources.

Nick Sanyal is assistant research professor for the Department of Resource Recreation and Tourism.

From Field . . .



Hendee, J. C., G. H. Stankey, and R. C. Lucas. 1993. *Wilderness Management*. 2nd ed. North American Press, Golden, Colorado. 546 pp.

Managing America's 95-Million-Acre Wilderness System

The U.S. National Wilderness Preservation System has increased more than six-fold in the 28 years since the Wilderness Act was passed, and additional areas under consideration for wilderness classification may ultimately increase the system to 120-140 million acres. Mindful of the importance of wilderness to the American people and the management changes of the last 15 years, the college's dean and two colleagues have revised their classic text addressing the breadth of wilderness management alternatives and their implications.

The 18-chapter book, first published in 1978 by the Government Printing Office (GPO), was inspired by the lack of any comprehensive, one-volume synthesis of information about wilderness management. Sale of 50,000 copies of the first edition and the growth of the wilderness system led to this revised second edition, six years in preparation. The book is the standard reference for wilderness managers, students, scientists, educators, natural resource developers, consultants, planners, policy-makers, citizens—anyone interested in the management of our National Wilderness Preservation System.

The volume's six appendices are especially valuable, including a comprehensive list of designated wilderness areas by acreage, state, and managing agency; a comparison of federal agency wilderness wildlife policies, column-style for easy comparison between the U.S. Forest Service, National Park Service, Fish and Wildlife Service, or Bureau of Land Management; a fold-out map of the National Wilderness Preservation System; and a copy of the Wilderness Act of 1964.

... to Textbook ...

Machlis, G.E., and D.R. Field, eds. 1992. *On Interpretation, Sociology for Interpreters of Natural and Cultural History*, rev. ed. Oregon State University Press, Corvallis, Oregon. 320 pp.



Gerry Snyder

Children, Tourists, Parks, and More—Sociology for Interpreters

“... [D]on’t fail to pick it up if you hunger for a little cerebral nourishment in an easy-to-use-and-enjoy anthology” insists *Ranger Magazine* about the revised edition of *On Interpretation, Sociology for Interpreters of Natural and Cultural History*.

Gary E. Machlis, professor of forest resources and sociology and (sociology) project leader of the Cooperative Park Studies Unit has joined co-editor Donald R. Field to re-publish their 1984 text now used by the National Park Service and other organizations nationwide to train recreation professionals. Field is associate dean of the School of Natural Resources at the University of Wisconsin, Madison.

In leisure settings, “interpretation” is agency communication, through signs and other media, of information to the public on natural resources to provoke understanding and appreciation.

The *Journal of Interpretation* calls *On Interpretation* “... an excellent overview.” *Appalachia Magazine* describes its essays as “provocative” and “... a must for any manager or experienced career interpreter-educator.”

Published at the Oregon State University Press, the volume offers a wide-ranging series of essays on such topics as “A Sociological Look at the Japanese Tourist,” “Interpretation for the Elderly,” “Children and Gender-Based Behavior at a Science Museum,” “Ethnography as a Research Tool in Understanding Park Visitors,” as well as approaches to interpretation in developing countries.

As *Rural Sociology* has proclaimed, *On Interpretation* “should be read by all who are involved in the area of interpretation.”

Cubbage, F.W., J. O’Laughlin, and C.S. Bullock, III. 1993. *Forest Resource Policy*. John Wiley and Sons, Inc., New York.



The Politics of Forest Resource Management

“Our success at managing scarce resources in the future will depend on our skill at divining, responding to, and guiding public demands as reflected in the political process,” assert the authors of a new comprehensive and interdisciplinary forest policy text.

The three scholars—two specialists in forest policy and economics and a political scientist—have produced a much-needed book for graduate students and professionals. Six years in the making, the book provides illustrative case examples throughout, breathing life into otherwise abstract material. Some examples are very current (spotted owls and wetlands), but not at the expense of historical high points and important characters in forest resources policy development, for instance Gifford Pinchot, President Theodore Roosevelt, and Aldo Leopold, among many others.

Eighteen straightforward, well-referenced chapters are divided into sections addressing the *Processes, Participants, and Programs* in forest resource policy. The theme of interplay between the public and private sectors weaves its way throughout the text while an analytical framework adapted from political science helps the reader understand the process by which public policy is formed and modified. The key participants are the institutions involved in the policy-making process—legislatures, courts, executive agencies, and interest groups—each featured in separate chapters. Chapters on wildlife policy, environmental policy, conservation ethics, mass media, and a global perspective make the 562-page text the most comprehensive approach available. Professionals will also appreciate the appendix on how to read legal citations and locate legal materials.

This spring, natural resource policy students at the University of Idaho in Moscow and at the university’s center in Boise are using the book as a class text.



Wright, R. G. 1992. *Wildlife Research and Management in the National Parks*. University of Illinois Press, Urbana and Chicago, Illinois.

Caretakers of Our Wildlife Heritage

Did you know that one-third to one-half of rare and endangered species in the U.S. live within the National Park System, and are thus managed by the NPS?

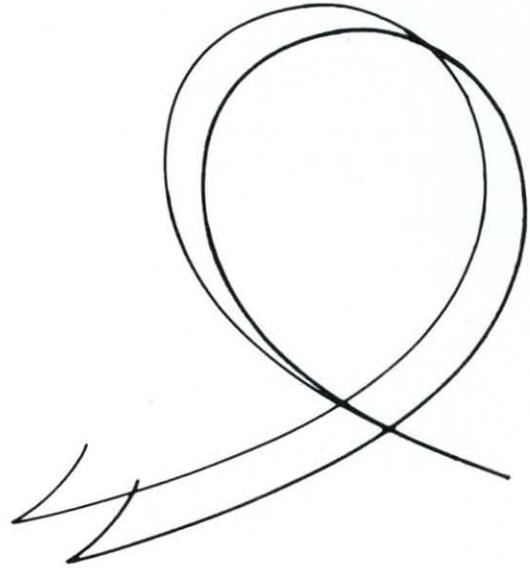
National parks are among the most revered institutions in America, but the policies governing their management are unclear to most people. At issue is also a history of controversy over the conflicting requirements of preserving the nation's natural and cultural resources while at the same time providing for the needs of visitors.

Using previously unpublished information and at times working from poorly maintained old documents, wildlife professor R. Gerald Wright has written a book on NPS management policies and their historical background.

Wright emphasizes that the history of animal management in national parks has been inexorably linked with the evolution of a program of scientific study in that agency. The book follows the somewhat slow development of the NPS's scientific research and natural resource management starting from the agency's establishment in 1916. Not until the 1930s did the public begin to question predator control activities and programs which exploited animals for visitor entertainment, the decade that marked the start of wildlife research in parks and the initiation of some contemporary management policies.

Wright's diagrams range from a table showing the dates, numbers, parks, and references documenting species killed or removed (categorized by animal), to a table listing "Visitor Injuries and Deaths by Bears."

Now more than ever, maintains Wright, the NPS needs guidance from a strong science program that inventories and monitors park resources to protect them from assaults—and such guidance works best from the base of policy history that Wright has contributed in *Wildlife Research and Management in the National Parks*.



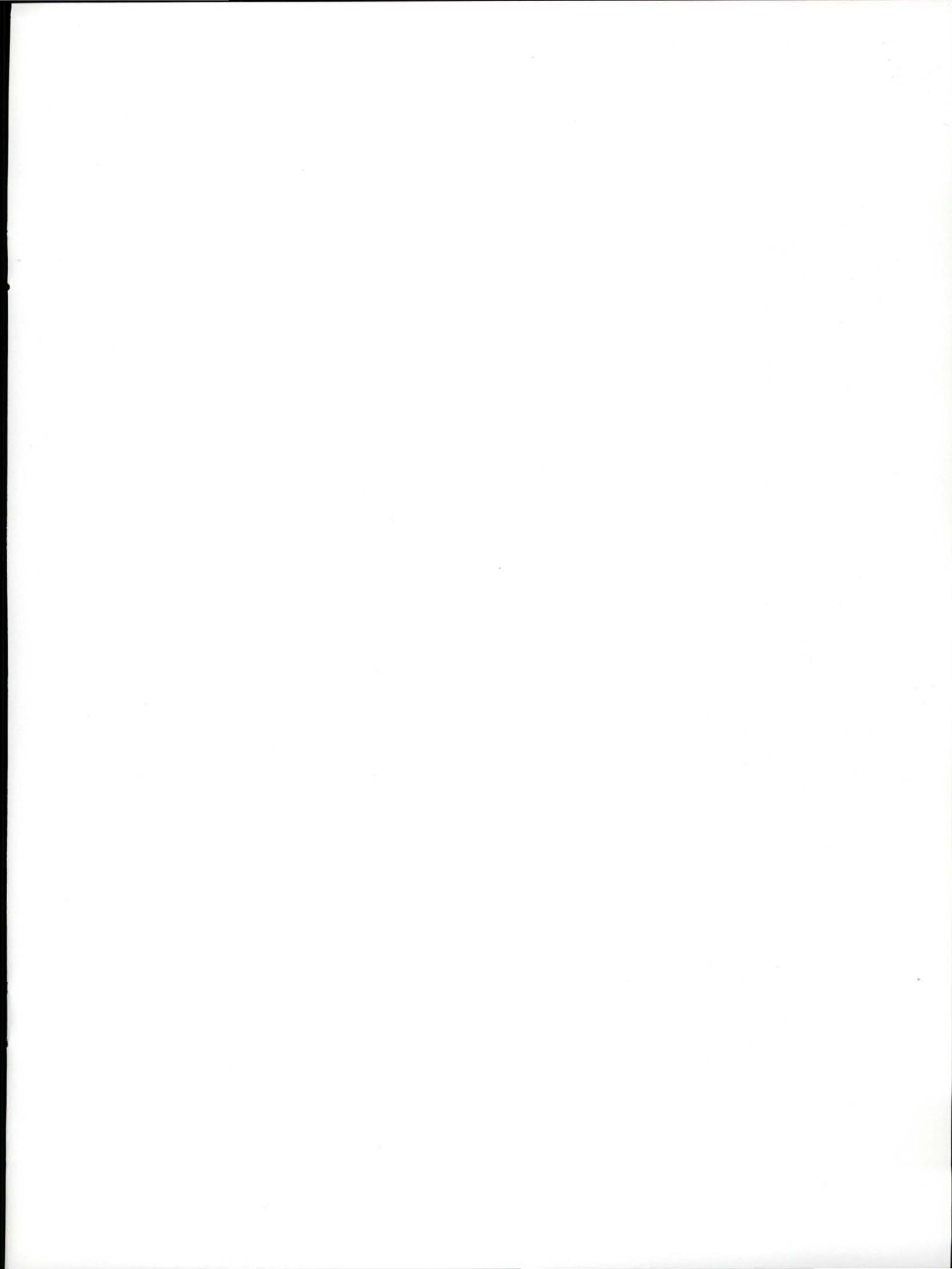
... And Back Again

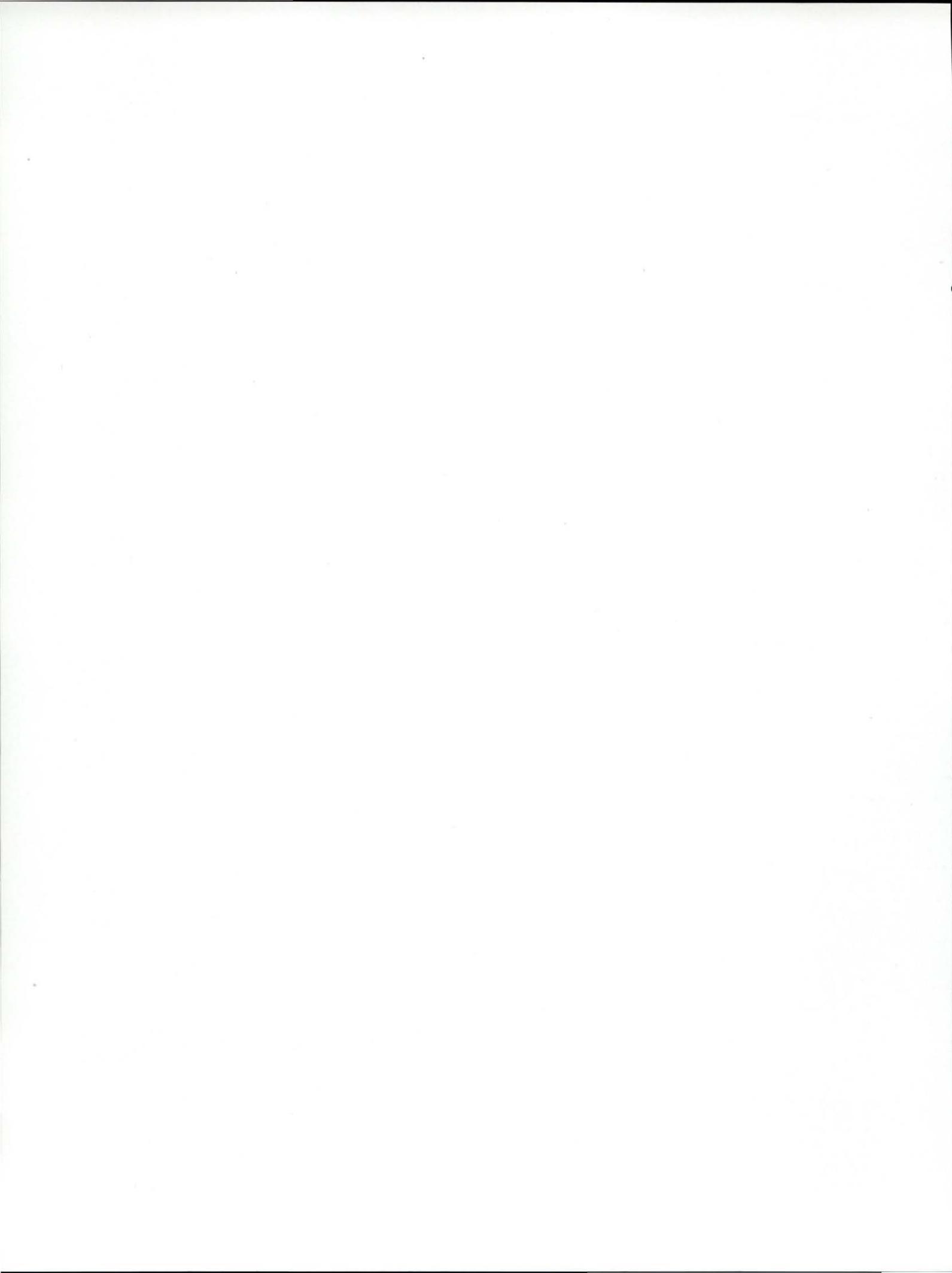
Wilderness Management, 2nd ed. John C. Hendee is dean of the College of Forestry, Wildlife and Range Sciences, and professor in both forest resources and resource recreation and tourism. George H. Stankey is senior research professor of forest resources at Oregon State University. Robert C. Lucas, now retired, was Wilderness Management Research Unit leader at the Forest Service's Intermountain Research Station in Missoula, Montana.

On Interpretation, Sociology for Interpreters of Natural and Cultural History, rev. ed. Gary E. Machlis is sociology project leader of the Idaho Cooperative Park Studies Unit (housed in the college) and professor in sociology, forest resources, and resource recreation and tourism. D.R. Field is associate dean of the School of Natural Resources at the University of Wisconsin, Madison.

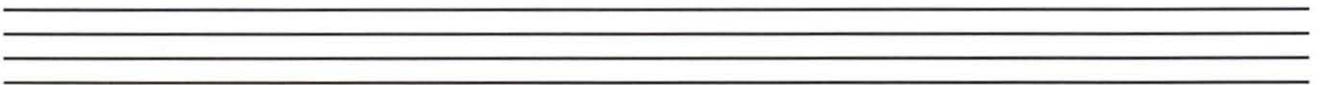
Forest Resource Policy. Jay O'Laughlin is director of the Idaho Forest, Wildlife and Range Policy Analysis Group, and a professor in both forest resources and forest products. Frederick W. Cabbage is research project leader of the Economics of Forest Protection and Management Research Work Unit (USDA Forest Service Southeastern Forest Experiment Station). Charles S. Bullock III is Richard B. Russell Professor of Political Science at the University of Georgia.

Wildlife Research and Management in the National Parks. R. Gerald Wright is biology project leader of the Idaho Cooperative Park Studies Unit (housed in the college) and professor of wildlife resources.





Appendix



Experiment Station Scientists

Department of Fish and Wildlife Resources

- Ables, Ernest D.
Professor
Wildlife ecology, especially animal behavior and radiotelemetry techniques
- Bennett, David H.
Professor
Warmwater fishery management, fish ecology, fish population dynamics
- Bizeau, Elwood G.
Professor Emeritus
Associate, Wildlife Research Institute
Birds, principally waterfowl and marsh
- Bjornn, Theodore C.
Professor
Assistant Leader, Idaho Cooperative Fish and Wildlife Research Unit
Management and ecology of wild and hatchery salmonids, endangered species management
- Brannon, Ernest L.
Professor
Director, University of Idaho Aquaculture Program and Idaho Aquaculture Institute
Finfish culture, fish behavior, salmonid life histories, sturgeon life histories
- Congleton, James L.
Associate Professor
Assistant Leader, Idaho Cooperative Fish and Wildlife Research Unit
Fish immunology, stress physiology
- Csuti, Blair A.
Adjunct Associate Professor, Idaho Cooperative Fish and Wildlife Research Unit
Strategies for the selection and design of nature reserves, endangered species conservation, Geographic Information System (GIS) analysis
- Dennis, Brian
Associate Professor
Statistical ecology, biometrics, theoretical population biology
- Dresser, Tom
Research Associate
- Falter, C. Michael
Professor
Reservoir limnology, stream and lake ecology and management, aquatic pollution ecology
- Garton, Edward O.
Professor
Wildlife population biology, systems ecology, wildlife census methods, statistical analysis
- Homocker, Maurice G.
Professor
Director, Wildlife Research Institute
Population ecology, predator-prey interactions
- Hungerford, Kenneth E.
Professor Emeritus
Wildlife management
- Hunt, Joel
Research Associate
- Jepson, Michael
Scientific Aide
Fish physiology, statistical analysis
- Kaiser, Horst
Visiting Scientist
- Keith, Robert M.
Research Associate
Fishery biology, statistical analysis
- Klontz, George W.
Professor and Department Head
Aquatic animal medicine, aquaculture
- Kress, Albert (Duke)
Research Technician
- MacPhee, Craig
Professor Emeritus
Fish behavior, ecology, toxicology
- Moffitt, Christine M.
Adjunct Associate Professor
Research Scientist
Biology and management of anadromous fish, fish chemotherapeutants
- Nelson, Lewis, Jr.
Extension Professor
Continuing education, communications/public relations, environmental education
- Peek, James M.
Professor
Big game ecology and management, habitat systems
- Peery, Chris
Research Associate
Adult salmon and steelhead passages at dams
- Ratti, John T.
Adjunct Professor
Avian ecology; behavioral, evolutionary, and population ecology; habitat analysis
- Reese, Kerry P.
Associate Professor
Wetland, waterfowl, and upland game ecology and management; nongame wildlife

Experiment Station Scientists

Riggers, Brian
Scientific Aide
Limnology, river ecology

Ringe, Rudy R.
Research Associate, Idaho Cooperative Fish and Wildlife Research Unit
Anadromous fish ecology and management

Rubin, Stephen A.
Research Associate
Salmonid ecology

Scarnecchia, Dennis L.
Associate Professor
Salmon, trout, and paddlefish ecology and management; fish populations and community ecology in large rivers, streams, and natural lakes

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

Setter, Ann L.
Research Associate
Fish culture, sturgeon life history, electrophoresis

Volkman, Jed
Research Technician

Wright, R. Gerald, Jr.
Professor
Project Leader (Biology), Cooperative Park Studies Unit
Wildlife habitat management, national park wildlife management, natural resource data management and geographic information systems

Yeo, Jeffrey J.
Adjunct Assistant Professor
Scientist/Field Manager, Taylor Ranch Wilderness Research Station
Big game ecology and management, wilderness ecology and management

Department of Forest Products

Bottger, Richard F.
Adjunct Associate Professor
Director of Administrative Services
Assistant Director, Idaho Forest, Wildlife and Range Experiment Station
Business and personnel management

Campbell, Alton G.
Associate Professor
Associate Dean for Academics and Continuing Education
Pulp and paper science, waste treatment and resource recovery

Folk, Richard L.
Research Assistant Professor
Bioenergy, silviculture/wood quality, utilization of wood products wood processing wastes

Gorman, Thomas M.
Assistant Professor
Wood construction and design, physical properties of wood, secondary wood products manufacturing, moisture problems in wood-frame houses

Johnson, Leonard R.
Professor and Department Head
Timber harvesting systems, wood energy, recovery and processing of forest residues

Lee, Harry W.
Assistant Professor
Harvesting systems, road design, site productivity, soil-water relationships

Moslemi, Ali A.
Professor
Director, Graduate Programs
Wood particle composites, wood technology

O'Laughlin, Jay
Adjunct Professor
Adjunct Professor, Forest Resources
Director, Policy Analysis Group
Natural resources economics and policy analysis, structural changes in wood-based industries

Steinhagen, H. Peter
Associate Professor
On leave of absence in Chile
Drying of lumber and wood particulates, heat transfer in frozen and nonfrozen wood systems, wood energy, wood preservation

Wagner, Francis G.
Professor
Operations research and management science techniques applied to primary and secondary wood products manufacture

Department of Forest Resources

Adams, David L.
Professor
Silviculture, growth and yield, New Forestry (Adaptive Forestry)

Appelgren, Ross
Assistant Manager/Logging Superintendent, University of Idaho Experimental Forest
Logging systems

Belt, George H.
Professor
Director, Idaho Riparian Cooperative
Forest hydrology and watershed management, social forestry, agroforestry

Brunsfeld, Steven J.
Assistant Professor
Director, Forestry, Wildlife and Range Sciences Research Herbarium
Vegetation ecology, autecology, molecular genetics, rare plant biology

Experiment Station Scientists

- Burlison, Vernon H.
Extension Professor Emeritus
- Canfield, Elmer R.
Associate Professor Emeritus
Forest pathology
- Carree, Yvonne
Forestry Extension Associate
Forestry extension, hardwood growth and management
- Dumroese, R. Kasten
Research Associate
Forest nursery technology and production, nursery management
- Edson, John L.
Research Associate, Forest Research Nursery
Vegetative propagation, biotechnology, seedling production
- Fins, Lauren
Professor
Director, Inland Empire Tree Improvement Cooperative
Genetic improvement of forest trees, effects of forest management on genetic resources, genetic architecture of forest tree species and populations
- Force, Jo Ellen
Professor
Forest planning and policy, particularly the role of people and other social science aspects; social forestry and international development
- Hatch, Charles R.
Professor
On leave in Islamabad, Pakistan, for Winrock Consulting Agency
Forest mensuration and statistics
- Hendee, John C.
Professor
Professor, Resource Recreation and Tourism
Dean, College of Forestry, Wildlife and Range Sciences
Director, Idaho Forest, Wildlife and Range Experiment Station
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
- Johnson, Frederic D.
Professor Emeritus
Autecology, synecology, and phytogeography—emphasis on northern Rockies and on forest lands and woody plants, dendrology—temperate and tropical
- Littlejohn, Margaret E.
Western Coordinator, Visitor Services Project
(National Park Service duty stationed in Cooperative Park Studies Unit)
- Loewenstein, Howard
Professor Emeritus
Forest soils and tree nutrition
- Lotan, James E.
Adjunct Professor
Research Scientist
Silviculture and fire management
- Machlis, Gary E.
Professor
Adjunct Professor, Resource Recreation and Tourism
Project Leader (Sociology), Cooperative Park Studies Unit
Sociology of natural resources, human ecology
- Madison, Dwight
Eastern Coordinator, Visitor Services Project
(National Park Service duty stationed in Cooperative Park Studies Unit)
- Mahler, Robert
Adjunct Associate Professor
Associate Professor, Soil Sciences (Department of Plant, Soil, and Entomological Sciences, College of Agriculture)
Soil fertility, plant nutrition
- Mahoney, Ronald L.
Associate Extension Professor
Extension Forester, UI Cooperative Extension Service
Silviculture and management of non-industrial private forests, natural resources education for youth
- Marshall, John D.
Assistant Professor
Tree physiology, ecophysiology
- Mattson, Kim G.
Research Assistant Professor
Forest ecology
- McKetta, Charles W.
Associate Professor
Economist, Idaho Forest, Wildlife and Range Experiment Station
Timber investments, forest policy, international forestry, fire and fuel management economics, forest taxation
- Medema, E. Lee
Associate Professor
Natural resources economics (investment analysis, agroforestry, international forestry)
- Mika, Peter G.
Research Associate
Biometrics, forest nutrition
- Moore, James A.
Professor
Director, Intermountain Forest Tree Nutrition Cooperative
Various aspects of forest growth and yield modeling, mineral nutrition of forest trees, influence of nutritional status on primary forest productivity
- Morgan, Penelope
Associate Professor
Director, Prescribed Burning Program
Fire ecology and management, silviculture and forest ecology, ecological modeling
- Neuenschwander, Leon F.
Professor
Associate Dean for Research and International Programs
Associate Director, Idaho Forest, Wildlife and Range Experiment Station
Forest and range ecology, fire management, prescribed burning, site preparation for conifer release

Experiment Station Scientists

- O'Laughlin, J.
Adjunct Professor
Adjunct Professor, Forest Products
Director, Policy Analysis Group
Natural resource economics and policy analysis, structural changes in wood-based industries
- Osborne, Harold L.
Associate Extension Professor
Manager, University of Idaho Experimental Forest
Rocky Mountain silviculture, log scaling and timber cruising, forest resource inventories
- Partridge, Arthur D.
Professor
Insect/disease interactions, nursery problems, urban tree problems
- Pym, Geneva E.
Research Technician
Quantitative and qualitative analysis
- Quick, Ken
Greenhouse Assistant, University of Idaho Forest Research Nursery
- Robison, M. Henry
Adjunct Assistant Professor
Assistant Professor, Agricultural Economics (Department of Agricultural Economics and Rural Sociology, College of Agriculture)
Urban and regional economics, natural resources and environmental economics
- Rust, Marc
Research Associate
Genetic improvement of forest trees, application of computer technology to forestry
- Schenk, John A.
Professor Emeritus
Forest entomology (insect bionomics, silviculture, and biological control)
- Schnepf, Chris
Adjunct Assistant Extension Professor
- Seale, Robert H.
Professor Emeritus
Forest economics
- Shaw, Terry M.
Research Associate, Intermountain Forest Tree Nutrition Cooperative
Forest resource inventories and data base management, forest nutrition, nutrition/disease interaction
- Stark, Ronald W.
Professor Emeritus
Population dynamics and integrated pest management of forest insects
- Stiff, Charles T.
Assistant Professor
Mensuration, growth, and yield modeling and simulation; forest inventory; site productivity; international forestry
- Stock, Molly W.
Professor
Artificial intelligence/expert systems applications in natural resource management, human-computer interactions, biosystematics and population genetics of forest insects
- Stoszek, Karl J.
Professor
On leave in Vienna, Austria
Forest protection, silviculture
- Ulliman, Joseph J.
Professor and Department Head
Co-Director, UI Remote Sensing Research Unit
Director, Forestry, Wildlife and Range Sciences Remote Sensing Center
Aerial photographic interpretation, mapping and remote sensing
- Wenny, David L.
Professor
Manager, University of Idaho Forest Research Nursery
Forest nursery technology and production, seedling physiology and quality, forest regeneration

Department of Range Resources

- Bunting, Stephen C.
Professor
Fire ecology, range ecology, range management
- Ehrenreich, John H.
Professor
Agroforestry, international forest and range management, range ecology
- Hironaka, Minoru
Professor Emeritus
Range ecology, rangeland classification, soil-plant relationships
- Johnson, Kendall L.
Professor and Department Head
Shrubland ecology and management, range extension
- Kingery, James L.
Assistant Professor
Forest grazing policy and management, rangeland rehabilitation, range management
- Mosley, Jeffrey C.
Associate Professor
Grazing management of wild and domestic ungulates, foraging behavior, livestock-wildlife relations
- Rimbey, Neil R.
Adjunct Professor
Extension Range Economist, Southwest Idaho Research and Extension Center
Rangeland economics and policy
- Robberecht, Ronald
Associate Professor
Ecophysiology, autecology, range ecology

Experiment Station Scientists

Sanders, Kenneth D.
Professor
Extension Range Specialist, Twin Falls Research and Extension Center
Manager, Lee A. Sharp Experimental Area
Range extension, range livestock nutrition, grazing systems

Sharp, Lee A.
Professor Emeritus
Integrated range resource management, range management planning, grazing systems

Tisdale, Edwin W.
Professor Emeritus
Vegetation classification, vegetation habitat relationships

Department of Resource Recreation and Tourism

Fazio, James R.
Professor
Resource communication, environmental interpretation, conservation history, urban and community forestry, continuing education

Ham, Sam H.
Professor
Director, Natural Resources Communication 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 economics

Hendee, John C.
Professor
Professor, Forest Resources
Dean, College of Forestry, Wildlife and Range Sciences
Director, Idaho Forest, Wildlife and Range Experiment Station
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

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

Krumpe, Edwin E.
Associate Professor
Principal Scientist, UI Wilderness Research Center
Wilderness and dispersed recreation management, recreation and tourism behavior and the decision process, interpretation and communication, administration, facilities management

Machlis, Gary E.
Adjunct Professor
Professor, Forest Resources
Project Leader (Sociology), Cooperative Park Studies Unit
Sociology of natural resources, human ecology

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

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

Savage, George
Adjunct Associate Professor
Managing Editor and Director, Information Services
Natural resource literature, scientific writing, report preparation, and other aspects of print media communication

Policy Analysis Group (PAG)

MacCracken, James G.
Research Scientist
Natural resource policy, wildlife-habitat relationships, plant ecology, predator-prey interactions

Merrill, Troy
Research Assistant

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

Publications and Reports

The following list contains most works published during 1992. Copies of Idaho Forest, Wildlife and Range Experiment Station publications are available from Forestry Publications, 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.

Department of Fish and Wildlife

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- Bennett, D.H., D. Hatch, and M. Liter. 1992. Managing largemouth bass in the Pacific Northwest: A game of recruitment, protection and patience. *In* Warmwater Fisheries Symposium I, Phoenix, Arizona.
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- Bennett, D.H., and T.J. Underwood. 1992. Dynamics of the rainbow trout population in the Spokane River, Idaho, affected by flow fluctuations. *N.W. Science* 66(4):261-268.
- Bjornn, T.C., and S.C. Kirking. 1992. Relation of cover alteration to the summer standing crop of young salmonids in small southeast Alaska streams. *Transactions of the American Fisheries Society* 120:562-570.
- Bjornn, T.C., and C.A. Peery. 1992. A Review of Literature Related to Movements of Adult Salmon and Steelhead Past Dams and Through Reservoirs in the Lower Snake River. Technical Report 92-1, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow.
- Bjornn, T.C. 1992. Survival of Chinook Salmon Smolts as Related to Stress at Dams and Smolt Quality. Report for U.S. Army Corps of Engineers, Walla Walla, Washington.
- Bjornn, T.C., R.R. Ringe, K.R. Tolottie, P.J. Keniry, J.P. Hunt, C.J. Knutson, and S.M. Knapp. 1992. Migration of Adult Chinook Salmon and Steelhead Past Dams and Through Reservoirs in the Lower Snake River and Into Tributaries—1991. Report submitted to U.S. Army Corps of Engineers, Walla Walla District.
- Bowles, E.C., B.R. Rieman, G.R. Mauser, D.H. Bennett. 1992. Effects of mysid introductions on fishery resources in northern Idaho. *In* Special Symposia Series: Mysids and Their Impacts on Fisheries, America Fisheries Society.
- Brannon, E.L., and A.L. Setter. 1992. Movements of White Sturgeon in Lake Roosevelt (1988-1991). Final report to Bonneville Power Administration, Division of Fish and Wildlife, Portland, Oregon.
- Brannon, E.L. 1992. Develop improved techniques for identifying and separating hatchery fish from wild fish. Pages 6-7 *in* Alternative Actions for Restoring and Maintaining Salmonid Populations on the Columbia River System, L. Eisgruber, ed. The University Task Force on Salmon and the Columbia River System, Pacific Northwest Extension Publication (Oregon-Washington-Idaho) PNW 407.
- Brannon, E.L. 1992. Improved hatchery management to increase rate of return of adult fish. Pages 8-11 *in* Alternative Actions for Restoring and Maintaining Salmonid Populations on the Columbia River System, L. Eisgruber, ed. The University Task Force on Salmon and the Columbia River System, Pacific Northwest Extension Publication (Oregon-Washington-Idaho) PNW 407.
- Brannon, E.L. 1992. Reducing hatchery output. Pages 11-12 *in* Alternative Actions for Restoring and Maintaining Salmonid Populations on the Columbia River System, L. Eisgruber, ed. The University Task Force on Salmon and the Columbia River System, Pacific Northwest Extension Publication (Oregon-Washington-Idaho) PNW 407.
- Brannon, E.L. 1992. Release wild stock (or brood stock for hatchery programs). Pages 12-14 *in* Alternative Actions for Restoring and Maintaining Salmonid Populations on the Columbia River System, L. Eisgruber, ed. The University Task Force on Salmon and the Columbia River System, Pacific Northwest Extension Publication (Oregon-Washington-Idaho) PNW 407.
- Brannon, E.L., M. Satterwhite, and C. Keller. 1992. Columbia River bypass channel. Pages 14-16 *in* Alternative Actions for Restoring and Maintaining Salmonid Populations on the Columbia River System, L. Eisgruber, ed. The University Task Force on Salmon and the Columbia River System, Pacific Northwest Extension Publication (Oregon-Washington-Idaho) PNW 407.
- Brannon, E.L., J. Cloud, C.M. Moffitt, and B. Jacobsen. 1992. Fish, fishermen, and fisheries: The Cooperative UI Aquaculture Program. *FOCUS on Renewable Natural Resources* 17:18-20.
- Bryan, M.D., and D.L. Scarnecchia. 1992. The importance of nearshore aquatic vegetation to larval and juvenile fishes in a midwestern glacial lake. *Environmental Biology of Fish* 35:329-341.
- Byrne, A., T.C. Bjornn, and J.D. McIntyre. 1992. Modeling the response of native steelhead to hatchery supplementation programs in an Idaho river. *North American Journal of Fisheries Management* 12:62-78.
- Cassirer, E.F., D.J. Freddy, and E.D. Ables. 1992. Elk responses to disturbance by cross-country skiers in Yellowstone National Park. *Wildlife Society Bulletin* 20(4):375-381.

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- Congleton, J.L., ed. 1992. Report to Cooperators 1992. Idaho Cooperative Fish and Wildlife Research Unit, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow.
- Csuti, B. 1992. Nature conservation: Cost effective biological surveys and data analysis (review). *Journal of Wildlife Management* 56:621-622.
- Dennis, B. 1992. Bear market for Yellowstone grizzlies. *FOCUS on Renewable Natural Resources* 17:17-18. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
- Dunsmoor, L.K., D.H. Bennett, and J.A. Chandler. 1991. Prey selectivity and growth of a planktivorous population of smallmouth bass in an Idaho reservoir. Pages 14-21 in *First International Smallmouth Bass Symposium*, D.C. Jackson, ed. Mississippi Agricultural and Forestry Experiment Station, State College, Mississippi.
- Falter, C.M., D. Olson, and J. Carlson. 1992. The Nearshore Trophic Status of Pend Oreille Lake, Idaho. Final report to the Idaho Division of Environment, Boise. College of Forestry, Wildlife & Range Sciences and the Idaho Water Research Institute, Moscow.
- Falter, C.M., B. Riggers, and J.W. Carlson. 1992. Physical and Chemical Water Quality of the Spokane River Outlet Reach of Lake Coeur d'Alene, Kootenai County, Idaho. Final report to the Idaho Division of Environmental Quality, Boise. Idaho Forest, Wildlife & Range Experiment Station and the Idaho Water Resources Research Institute, Moscow.
- Falter, C.M. 1992. Review of Technical Issues Relevant to Listing of Five Taxa of Snake River Mollusks Under the Federal TESA of 1973. Final report to the U.S. Fish & Wildlife Service, Boise.
- Falter, C.M. 1992. Loving our lakes to decay. *FOCUS on Renewable Natural Resources* 17:14-15. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
- Garton, E.O., L. Ramberg, and S.D. Schemnitz, eds. 1992. Training to Meet the Challenges Facing Wildlife Management in Kenya. Proceedings of a Workshop Held at Moi University and Kakamega, Kenya.
- Hornocker, M.G. 1992. Wildlife Research Institute Interim Report. College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow.
- Klontz, G.W. 1992. Epidemiology in fish diseases. Pages 210-213 (Chapter 16) in *Fish Medicine*, M.K. Stoskopf, ed. Saunders, New York, New York.
- Klontz, G.W. 1992. Environmental diseases of salmonids. Chapter 33 in *Fish Medicine*, M.K. Stoskopf, ed. Saunders, New York, New York.
- Klontz, G.W. 1992. Producing a marketable fish: Part I. A step-by-step planner. *Northern Aquaculture* 8(2):22-23.
- Klontz, G.W. 1992. Producing a marketable fish: Part II. Determining your production potential. *Northern Aquaculture* 8(3):21-25.
- Klontz, G.W. 1992. Producing a marketable fish: Part III. Developing a production schedule. *Northern Aquaculture* 8(4):21-28.
- Klontz, G.W. 1992. Producing a marketable fish: Part IV. Implementation. *Northern Aquaculture* 8(5):19-21.
- Klontz, G.W. 1991. Rainbow Trout Production on the Family-Owned Farm. Nelson and Sons, Murray, Utah.
- Martinsen, C., B. Lauby, A. Nevissi, and E.L. Brannon. 1992. The influence of crude oil and dispersant on the sensory characteristics of steelhead (*Oncorhynchus mykiss*) in marine waters. *Journal of Aquatic Food Product Technology* 1(1):37-54.
- Meints, D.R., J.W. Connelly, K.P. Reese, A.R. Sands, and T.P. Hemker. 1992. Habitat Suitability Index Procedure for Columbian Sharp-Tailed Grouse. Idaho Forest, Wildlife and Range Experiment Station Bulletin 55, University of Idaho, Moscow.
- Miquelle, D.G., J.M. Peek, and V. Van Ballenberghe. 1992. Sexual segregation in Alaskan moose. *Wildlife Monographs* 122. 57 pp.
- Moffitt, C.M. 1992. Guest editorial. *Women in Natural Resources* 13(4):i.
- Moffitt, C.M. 1992. Survival of juvenile chinook salmon challenged with *Renibacterium salmonarum* and administered oral doses of erythromycin thiocyanate for different durations. *Journal of Aquatic Animal Health* 4:119-125.
- Nelson, S.K., M.L.C. McAllister, M.A. Stern, D.H. Varoujean, and J.M. Scott. 1992. The marbled murrelet in Oregon 1899-1987. Pages 61-91 in *Status and Conservation of the Marbled Murrelet in North America*, Proceedings of the Western Foundation of Vertebrate Zoology 5(1):(October), H.R. Carter and M.L. Morrison, eds.
- Noss, R.F., S.P. Cline, B. Csuti, and J.M. Scott. 1992. Monitoring and assessing biodiversity. Pages 67-85 in *Achieving Environmental Goals: The Concept and Practice of Environmental Performance Review*, E. Lykke, ed. Bellhaven Press, London and Florida.
- Peek, J.M., R.J. Mackie, and G.I. Dusek. 1992. Over-winter survival strategies of North American Cerbidae. *ALCES Supplement I* (1992):156-161.
- Ratti, J.T., and E.O. Garton. 1992. Research and experimental design. Chapter 1 in *Wildlife Management Techniques Manual*, 5th ed., T.A. Bookhout, ed. The Wildlife Society, Washington, D.C.
- Ratti, J.T., and J.A. Kadlec. 1992. Intermountain West Waterfowl-Wetland Concept Plan. U.S. Fish and Wildlife Service, Office of Migratory Bird Management, Portland, Oregon.
- Scarnecchia, D.L., and J.R. Wahl. 1992. Fifty years of fisheries management in an obstinate prairie lake. *Journal of the Iowa Academy of Science* 99:7-14.
- Scarnecchia, D.L. 1992. A reappraisal of gars and bowfins in fishery management. *Fisheries (Bethesda)* 17:6-12.
- Scott, J.M., B. Csuti, and E.T. LaRoe. 1992. Protecting biodiversity. *Issues in Science and Technology* 8(4):21.
- Scott, J.M., B. Csuti, D. Stoms, and F. Davis. 1992. Remote sensing for nongame wildlife habitat management. Pages 134-140 in *Transactions of the 56th North American Wildlife and Natural Resources Conference* (56).

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- Scott, J.M., and B. Csuti. 1992. Gap analysis: Blueprint for proactive conservation. *FOCUS on Renewable Natural Resources* 17:1-2. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
- Setter, A.L., and E.L. Brannon. 1992. A Summary of Stock Identification Research on White Sturgeon of the Columbia River (1985-1990). Final Report to Bonneville Power Administration, Division of Fish and Wildlife, Portland, Oregon.
- Stoms, D.M., F.W. Davis, C.B. Cogan, M.O. Painho, B.W. Duncan, J. Scepan, and J.M. Scott. 1992. Geographic analysis of California condor sighting data. *Conservation Biology* 7(1):148-159.
- Vales, D.J., and J.M. Peek. 1992. Projecting the effects of wolf predation on elk and mule deer in the east front portion of the Northwest Montana Wolf Recovery Area. *In Proceedings, 2nd North American Symposium on Wolves*, Edmonton, Canada.
- Wakkinen, W.L., K.P. Reese, and J.W. Connelly. 1992. Sage grouse nest location in relation to leks. *Journal of Wildlife Management* 56:381-383.
- Wakkinen, W.L., K.P. Reese, J.W. Connelly, and R.A. Fischer. 1992. An improved spotlighting technique for capturing sage grouse. *Wildlife Society Bulletin* 20:425-426.
- Wright, R.G., and S.L. Maganga. 1992. Relationship between fig fruiting and bark stripping of plantation trees by blue monkeys. *Quarterly Journal of Forestry* 86:168-172.
- Yeo, J.J., and J.M. Peek. 1992. Habitat selection by female Sitka black-tailed deer in logged forests of southeastern Alaska. *Journal of Wildlife Management* 56(2):253-261.
- Yeo, J.J. 1992. Wilderness—Assessing change in a changing world. *FOCUS on Renewable Natural Resources* 17:20-22. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
- Gorman, T.M., P.C. Gomben, and R.L. Folk. 1992. Directory of Idaho Wood Products Manufacturers. Idaho Forest, Wildlife and Range Experiment Station Miscellaneous Publication 17. University of Idaho, Moscow.
- Gorman, T.M. 1991. Designing, engineering, and testing wood structures. *Journal of Materials Education* 13(5/6):473-485.
- Gorman, T.M. 1992. Designing, engineering, and testing wood structures. *In National Educators Workshop: Update 91. NASA Conference Publication 3151. National Aeronautics and Space Administration*, Washington, D.C.
- Gorman, T.M., ed. 1992. Forest Products Society Quarterly Newsletter, Inland Empire Section. Forest Products Society, Madison, Wisconsin.
- Hesterman, N.D., and T.M. Gorman. 1992. Mechanical properties of laminated veneer lumber made from interior Douglas-fir and lodgepole pine. *Forest Products Journal* 42(11/12):69-73.
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- Lee, H.W. 1992. Back to the future: The gentle gallop of forestry's new "Iron Horse." *FOCUS on Renewable Natural Resources* 17:6-7. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
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- Moslemi, A.A. 1992. World-wide opportunities for wood-mineral boards. *Wood-Based Panels International (United Kingdom/Switzerland)* (March):27-30.
- Wagner, F.G. 1992. Development and use of an expert system for problem-solving in particleboard manufacturing. *In Proceedings of the National Particleboard Association Pressline Technology Seminar*.

Department of Forest Products

- Campbell, A.G., and R. Tripepi. 1992. Log yard waste: Products, markets, and research needs. *Forest Products Journal* 42(9):60-64.
- Campbell, A.G. 1992. Recipe for the forest products industry—Composting. *FOCUS on Renewable Natural Resources* 17:7-8. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
- DuBois, M.R., W.F. Watson, and F.G. Wagner. 1992. Chip Quality Survey for Sawmills in the Southeastern United States. *Mississippi Agricultural and Forestry Experiment Station Bulletin* 983.
- Folk, R.L., and R.L. Govett. 1992. A Handbook for Small-Scale Densified Biomass Fuel Pellets Manufacturing for Local Markets. USDOE, Bonneville Power Administration.
- Gorman, T.M., N.D. Hesterman, and R.D. Linderman. 1992. Bending strength of vertically laminated house logs. *Forest Products Journal* 42(6):27-29.
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Department of Forest Resources

- Adams, D.L. 1992. New Forestry in the Inland Northwest. Idaho Forest, Wildlife and Range Experiment Station Miscellaneous Publication 16. University of Idaho, Moscow.
- Belt, G.H. 1992. Development of Water Balance Studies for Forested Catchments and Application of Hydrologic Simulation Models. Report submitted to Indian Institute of Hydrology, UNDP Program, Roorkee, India. 18 pp.

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- Belt, G.H. 1992. The new Idaho Riparian Cooperative. FOCUS on Renewable Natural Resources 17:5. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.
- Benkelman, C.A., D.L. Verbyla, and W. Cohen. 1992. Application of high resolution digital imagery to forestry studies. Pages 28-35 in 1992 ASPRS/ACSM Annual Convention Technical Papers.
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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 Associate Director, Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho 83843.

Department of Fish and Wildlife Resources

- Development of social systems among Arabian oryx reintroduced into Oman. T. Tear, E.D. Ables
- Effects on wildlife communities of disturbance to pinyon-juniper woodlands. E.D. Ables
- 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
- Habitat features that affect stream productivity. T.C. Bjornn
- Supplementation of wild salmon and steelhead. T.C. Bjornn
- Hatchery versus wild steelhead in supplementation. T.C. Bjornn, S. Rubin
- Survival of salmonid embryos in natural redds. T.C. Bjornn
- Passage of adult chinook salmon and steelhead at the Lower Snake River Dam and reservoir projects. T.C. Bjornn, K. Tolotti, R. Ringe, P. Keniry, J. Hunt
- Assessment of fish abundance and habitat in the Coeur d'Alene River. T.C. Bjornn, J. Hunt
- Substrate composition and trout survival relationships. T.C. Bjornn
- Response of salmonids to riparian vegetation and instream cover modification in second-growth forest streams of southeast Alaska. T.C. Bjornn, M. Brusven, R.M. Keith, N. Hetrick
- Spawning behavior of wild and hatchery salmon. T.C. Bjornn, P. Sankovich
- Interaction of coho salmon with resident cutthroat trout and Dolly Varden in the Slippery Creek Drainage, Kuiu Island, Alaska. P. Porter, T.C. Bjornn
- 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. 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, T. Mosey
- Influence of growth rate on maturation schedules for kokanee salmon. J.L. Congleton, D.L. Scarnecchia, S. Patterson
- Stochastic population modelling in conservation biology. B. Dennis
- Modelling insect phenology. B. Dennis
- Effects of underwater sound simulating the Intermediate Scale Measurement System on fish and zooplankton of Pend Oreille Lake, Idaho. C.M. Falter, D.H. Bennett, K. Niemela, J. Kenney
- Ecology and management of Pend Oreille River limnology in northeastern Washington. C.M. Falter
- Nutrient and sediment processing in the middle Snake River below pollution inputs. C.M. Falter
- Effects of Auger Falls on water quality of the Snake River. C.M. Falter
- Artificial wetland for high level treatment of Moscow waste water effluents. C.M. Falter, R. Mink

Research Projects and Investigations

- Aquatic ecology of Craters of the Moon National Monument, Idaho, U.S. C.M. Falter
- Population ecology of 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. E.O. Garton, E. Bull, B. Carter, L. Bate
- 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
- 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
- Development of methods to assess smolt quality in hatchery-reared salmon and steelhead trout. C.M. Moffitt
- Fish and Wildlife Ecology Workshop. L. Nelson
- Advanced Project Learning Tree Workshop. L. Nelson
- Principles of Wildlife Management workshops. L. Nelson
- Seasonal habitat use and group dynamics of translocated woodland caribou into the southern Selkirk Mountains of Idaho. J.M. Peek, L. Allen-Johnson
- Ecology of bull moose in Copper River Delta, Alaska. J.M. Peek
- Ecology of bull elk in Yellowstone National Park. J.M. Peek
- Development of "Type A" risk assessment and response procedures for wetlands and inland waters of ecoregions of the United States. J.T. Ratti
- Analysis of wetland biodiversity and development of a wetlands evaluation and restoration techniques manual. J.T. Ratti
- Determining the impact of climate change on the distribution of Pacific Northwest plants and animals. J.T. Ratti, R.A. Black, J.M. Scott
- Habitat suitability index model for Columbian sharp-tailed grouse. K.P. Reese, D. Meints, J.W. Connelly, T.P. Hemker, A.R. Sands, S. Gardner
- The effects of prescribed fire on sage grouse ecology in southeastern Idaho. K.P. Reese, R. Fischer, J.W. Connelly
- Ecology of Merriam's wild turkeys in southwestern Idaho. K.P. Reese, W.L. Bodie, J. O'Neill
- Winter ecology and nutritional status of Columbian sharp-tailed grouse in southeastern Idaho. K.P. Reese, J. Schneider, M. Ulliman, J.W. Connelly, J. Klott
- 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
- Ecology of Merriam's wild turkey in west-central Idaho. K.P. Reese, F. Edelmann
- Seasonal habitat use, population characteristics, and management of quail in north/central Idaho. K.P. Reese, P.E. Heekin
- Northern spotted owl nesting habitat use in California. K.P. Reese, L.B. Folliard
- Wildlife use of the Pend Oreille River Reservoir in northeast Washington. K.P. Reese
- Life history and ecology of south Umpqua spring chinook salmon. D.L. Scarnecchia
- Yellowstone River and Lake Sakakawea paddlefish investigations. D.L. Scarnecchia
- Kokanee maturation. D.L. Scarnecchia, J.L. Congleton
- Bull trout ecology in northern Idaho. D.L. Scarnecchia
- Analysis of life history strategies of Icelandic stocks of Atlantic salmon in relation to environmental factors. 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, S. Caicco, H. Anderson, C. Groves
- Review of endangered species recovery planning. J.M. Scott, P. Hayward
- Proactive approaches to sustaining biodiversity. J.M. Scott
- Preserve design in North America. J.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 population models and tests of population control techniques on mountain goats at Olympic National Park. R.G. Wright
- Development of computerized natural resource data management systems for Pacific Northwest parks. R.G. Wright
- Analysis of historic vegetational change at Craters of the Moon National Monument. R.G. Wright
- A conceptual model of factors regulating ungulate populations in U.S. national parks. R.G. Wright
- A synthesis of research and knowledge about non-ungulate non-migratory vertebrates in national parks. R.G. Wright

Research Projects and Investigations

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

A riparian zone/water resources study at Craters of the Moon National Monument. R.G. Wright, C.M. Falter

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

Analysis of the management implications of the long-term moose/wolf research program at Isle Royale National Park. 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

History of the Lochsa elk population and management. J.J. Yeo

Long-term wildlife population and habitat monitoring. J.J. Yeo

Bighorn sheep range carrying capacity. J.J. Yeo

Department of Forest Products

Land application and composting of pulp and paper sludge. A.G. Campbell, R. Tripepi

Composting of bluegrass residues. A.G. Campbell, R. Tripepi

Land application of log yard waste. A.G. Campbell, R.L. Folk

Wood ash as soil additive and liming agent on agricultural lands. A.G. Campbell, R.L. Folk

Log yard residues for reclamation of the Silver Valley. A.G. Campbell, S. McGeehan, D. Naylor

Wood ash as an amendment for composting municipal sludge and yard waste. A.G. Campbell, R.L. Folk, R. Tripepi

Composting of log yard residues. A.G. Campbell, R.L. Folk, R. Tripepi

Growth of cottonwood clones in kraft pulp and paper sludge compost-amended soil. R. Tripepi, A.G. Campbell, X. Zhang

Pulp and paper sludge as a substitute for peat moss. R. Tripepi, A.G. Campbell

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

Cubic measurement implementation in tomorrow's management of the nation's forests. R.L. Folk

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

Value-added wood products. T.M. Gorman

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

Simulation and analysis of mobile merchandizing centers. L.R. Johnson

Recovery and processing of forest residues. L.R. Johnson

Timber harvesting under adaptive forestry prescriptions. 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

The use of kraft and TMP pulp sludge in mineral-bonded composites. A.A. Moslemi

The use of carbon dioxide gas injection on the properties of cement-bonded fiber composites. A.A. Moslemi

Durability of cement-bonded particleboards. A.A. Moslemi

Development of a computerized heat transfer model for frozen and nonfrozen logs. H.P. Steinhagen

Heat conditioning of veneer blocks. H.P. Steinhagen

Production economics and process control: Computer-based expert systems. F.G. Wagner

Use of short waves for wood defect detection. F.G. Wagner

Wood property enhancement: Predicting warp in southern pine lumber. F.G. Wagner

Graphical analysis of forest products. F.G. Wagner

Development of Micro-MSUSP: Microcomputer-based simulation program for sawmills. F.G. Wagner

Department of Forest Resources

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

Physiological relationships between low light intensity, foliar nitrogen, and susceptibility of Douglas-fir to *Armillaria ostavae*. D.L. Adams, A. Koehn, G. McDonald

Effects of residual overstory tree retention on establishment and growth of natural regeneration. D.L. Adams, A. Schlenker, D. Ferguson

Effects of pocket gophers and plant interference on regeneration success in grand fir habitat types. D.L. Adams, D. Ferguson

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

Silvopastoral systems in the Ecuadorian highlands. D.L. Adams, M. Garrison

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

The role of carbon storage in forest habitat types of the Rocky Mountain ecosystems. D.L. Adams, T. Jain, R. Graham

Riparian buffer strip design. G.H. Belt

Research Projects and Investigations

- Development of a physical process model for predicting evotranspiration from rangeland. 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. 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 *Taxodiaceae* 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
- Evaluating waste water from a container nursery and subsequent treatment in a constructed wetland. R.K. Dumroese, D.L. Wenny
- Pathogenicity of selected *Cylindrocarpon* isolates. R.K. Dumroese, R.L. James, D.L. Wenny
- Cylindrocarpon* on western white pine seedlings: Effects on survival and growth after outplanting and persistence of the pathogen. R.K. Dumroese, D.L. Wenny
- Gliocladium* for biocontrol of *Fusarium* root disease in container-grown Douglas-fir. R.K. Dumroese, D.L. Wenny
- Efficacy of a streptomycete to control *Fusarium* root disease. R.K. Dumroese, D.L. Wenny
- Evaluating the biocontrol agent Mycostop for control of *Fusarium* root disease on container-grown Douglas-fir. R.K. Dumroese, R.L. James, D.L. Wenny
- Persistence of *Fusarium* inoculum in copper-treated containers. R.K. Dumroese, D.L. Wenny
- Root regeneration of ponderosa pine grown in various containers treated with various copper compounds. R.K. Dumroese, D.L. Wenny
- The oxygen and carbon dioxide levels in western white pine seed and subsequent germination. R.K. Dumroese, D.L. Wenny
- Evaluation of some physical properties of the papery membrane in western white pine. R.K. Dumroese, D.L. Wenny
- Efficacy of sodium metabisulfite for sterilizing growing containers. R.K. Dumroese, D.L. Wenny
- Nitrogen leaching and runoff from a conifer crop in a container nursery. R.K. Dumroese, D.L. Wenny
- Evaluating growth and form in western larch stecklings and plantlets. J.L. Edson, D.L. Wenny, L. Fins
- Micropropagation to conserve *Hackelia venusta*. J.L. Edson
- Rooting branch cuttings of juvenile grand fir. J.L. Edson
- Selection of giant sequoia genotypes for ornamental planting in the Inland Northwest. L. Fins
- Creating a clone bank of cold-hardy giant sequoia. L. Fins, D.L. Wenny, J.L. Edson
- Response of western larch clones to hexazinone. L. Fins, D.L. Wenny, J.L. Edson, J. Mandzak
- Comparisons of cone production on grafts, root cuttings, and seedlings of western larch. L. Fins, V. Reedy
- Efficiency of early selection of Douglas-fir for improved growth rates. L. Fins, M. Rust
- Genetic variation in shoot growth in western larch. L. Fins, J.W. Zhang
- 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
- 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, D. Alpe
- Use of non-timber forest products in Mali. J.E. Force, M. Gakou
- Use of wilderness and natural environments for personal growth and leadership development. J.C. Hendee
- Benefits and costs of conservation corps programs. J.C. Hendee
- Relationship between site productivity and vegetation in the upland pine forests of central Honduras. F.D. Johnson, C.T. Stiff, and D.O. Hernandez
- Ecology and distribution of Idaho woody plants. F.D. Johnson
- Pan-tropical trees--identification, distribution, and use. F.D. Johnson
- Galapagos Islands Human Ecosystem Project. G.E. Machlis
- Relations between strangers: A new theory of resource use. G.E. Machlis
- Socioeconomic forces influencing biodiversity loss. G.E. Machlis
- The sociology of risk. G.E. Machlis
- Visitor Services Project studies in U.S. national parks. G.E. Machlis
- Three-season visitor study at the White House. G.E. Machlis
- Field trials of elite black cherry. R.L. Mahoney
- High value hardwoods for the Pacific Northwest. R.L. Mahoney
- Computer-assisted learning for environmental education. R.L. Mahoney

Research Projects and Investigations

- Gas exchange and carbon budgets of xylem-tapping mistletoes and their hosts. J.D. Marshall
- Water-use efficiency differences among provenances of western conifers. J.D. Marshall, L. Fins
- Differences in water sources among tree species in northern Idaho. J.D. Marshall
- Scaling of root respiration estimates to partition root respiration from soil respiration. J.D. Marshall, K.G. Mattson
- Use of carbon isotopes in tree rings to detect physiological responses to increasing atmospheric CO₂. 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
- 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
- Fire ecology of whitebark pine. P. Morgan, S.C. Bunting
- Modelling early succession following logging and burning of dense coniferous forests. P. Morgan
- Fire ecology of whitebark pine: Stand development, cone production, and future forest health. P. Morgan, S.C. Bunting
- Protecting people and developments from wildland fires in Grand Teton National Park. P. Morgan
- Wildlife habitat under alternative timber harvest and fire management regimes in ponderosa pine-Douglas-fir forests. P. Morgan, E.O. Garton
- Cedar-hemlock ecosystem (ecology handbook). P. Morgan
- Ecology and management of interior Douglas-fir. P. Morgan
- Assessing future abundance and cone production of whitebark pine in the Bob Marshall Wilderness Complex. R.E. Keane, P. Morgan
- Hardwood sprout control. W. Wilkinson, P. Morgan
- Modelling succession in two forest habitat types in northern Idaho. A. Zack, P. Morgan
- 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
- Seedling problems in nurseries and plantations. A.D. Partridge
- Frequency and damage by urban tree pests in Idaho. A.D. Partridge
- Root bag damage to "dimension stock." 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

Research Projects and Investigations

- 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
- Model to correct for topographic effects on digital remotely sensed data. A. Fahsi, J.J. Ulliman
- Use of Landsat thematic mapper data for updating Idaho Gap Analysis Vegetation Map. D.L. Verbyla, L. Halbrook
- Automated delineation of climatic zones within Gap Analysis vegetation polygons. D.L. Verbyla, D. Unger
- Application of thermal satellite data to climate warming research. D.L. Verbyla, D. Unger
- Monitoring of sediment sources within the Priest Lake Watershed. D.L. Verbyla
- Chemical root pruning of seedlings to enhance egress. D.L. Wenny
- Nursery management software. D.L. Wenny
- Plantation microsite selection. D.L. Wenny
- Effective fertilizer rates for containerized Siberian peashrub, honeylocust, and black locust grown in styro-20 containers. W. Bromley, D.L. Wenny
- Effectiveness of Anipel™ in reducing gopher damage to *Pinus monticola* and *Pinus ponderosa*. J. Bucher, D.L. Wenny
- Vegetative propagation of western white pine by rooted branch cuttings and rooted fascicles. D.L. Wenny, L. Fins, J.L. Edson, R. Tripepi
- Micropropagation and rooting stem cuttings of Scouler willow. D.L. Wenny, J.L. Edson
- Comparing biomass and root plug development of plantlets and rooted cuttings of arctic willow, golden willow, and hybrid poplar. D.L. Wenny, J.L. Edson
- Micropropagation of fire-resistant clones of desert bitterbrush, antelope bitterbrush, and mountain big sagebrush. D.L. Wenny, M. Hironaka, J.L. Edson
- Micropropagation and rooting cuttings of Rocky Mountain juniper. D.L. Wenny, J.L. Edson, R.K. Dumroese
- Conserving Idaho's Pacific dogwood through micropropagation, layering, and rooting of shoot-tip cuttings. D.L. Wenny, J.L. Edson
- Developing cultural practices to promote growth and survival of micropropagated plantlets. D.L. Wenny, J.L. Edson
- 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
- Evaluation of shrub utilization methods. S.C. Bunting, J.L. Kingery
- Agroforestry development in the Congo. J.H. Ehrenreich
- 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 Philippines. J.H. Ehrenreich
- Promotion of agroforestry through community involvement in Pakistan. J.H. Ehrenreich, G. Keerio
- Livestock grazing, wildlife, and recreation interactions in Balouchistan. J.H. Ehrenreich, M. Taj
- * Tree legume-grass interactions on the productivity of rangelands in Kashmir. J.H. Ehrenreich, A. Ishfaq
- Tree-forage interactions under seasonal grazing in the northwest frontier province of Pakistan. J.H. Ehrenreich, G. Khan
- Tree-agricultural crop interactions in agroforestry systems in Punjab, Pakistan. J.H. Ehrenreich, G. Khan
- Arid tropical agroforestry in Cameroon, Africa. J.H. Ehrenreich, S. Olsen
- Silvopastoral systems in Iran. J.H. Ehrenreich, S. Yassemi
- 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
- Evaluation of methods to monitor herbaceous utilization. J.L. Kingery, S.C. Bunting
- Animal damage and plantation performance. 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
- Influence of riparian herbage on water quality of rangeland streams. J.C. Mosley, C.M. Falter, T.A. Lance
- Habitat use and diet selection by Chihuahuan pronghorns. J.C. Mosley, E.L. Smith
- Diet nutrient quality of elk inhabiting a semi-arid environment. J.C. Mosley, D.C. Strohmeier, J.M. Peek
- Sheep grazing strategies for deer and elk habitat improvement. J.C. Mosley, J.L. Kingery, K.J. Crane
- Factors influencing mortality of crested wheatgrass. J.C. Mosley, K.D. Sanders, M.V. Spaulding

Department of Range Resources

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

Research Projects and Investigations

Fecal bacterial ratios for quantifying riparian utilization by sympatric ungulates. J.C. Mosley, G.A. Bohach, N.W. Darby

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

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

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

Department of Resource Recreation and Tourism

Antecedents to environmental education commitment among elementary school teachers. S.H. Ham

Development of program evaluation methods for forest interpreters. S.H. Ham

Environmental ethics in resource management. C.C. Harris

Organizational change and its impact on resource management policy analysis and decision-making. C.C. Harris

Integration of psychology and economics in valuation of public amenity resources. C.C. Harris

A system to measure Idaho travel and recreation participation: Phase I—The non-resident motor vehicle traveler. J.D. Hunt, N. Sanyal

The 1992-1993 Idaho Outdoor Recreation Facilities Inventory. J.D. Hunt, 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. Krumpke, L. Matthews

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

Lower Salmon River visitor information planning. W.J. McLaughlin, S. Perin

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

Development of procedures and methodologies to expand and replicate the Idaho Leisure Travel and Recreation Study. W.J. McLaughlin, J.D. Hunt, N. Sanyal, C.C. Harris

Lower Salmon River planning. W.J. McLaughlin

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

Segmentation and specialization of Idaho anglers: Understanding angler preferences for experience and setting. N. Sanyal, W.J. McLaughlin

Venture 20--Integrating habitat and population management. N. Sanyal, W.J. McLaughlin

Public task force facilitation to recommend management actions for the Idaho Department of Fish and Game in developing the Black Bear Species Plan. N. Sanyal, J.D. Hunt, E.E. Krumpke, W.J. McLaughlin, L. McCoy

Policy Analysis Group (PAG)

Analysis of forest health conditions in Idaho. J. O'Laughlin, D.L. Adams, S.C. Bunting, K.A. Blatner, C.E. Keegan, J.G. MacCracken

Analysis of the status of grizzly bear recovery in Idaho. J.G. MacCracken, J. O'Laughlin, D. Goble

Analysis of Idaho roadless areas and wilderness proposals. J.G. MacCracken, T. Merrill, J. O'Laughlin

Program review of the PAG. J.C. Hendee, J. O'Laughlin

Case studies in water quality policy and natural resource management. J. O'Laughlin, et al

Case studies of Endangered Species Act recovery plans and natural resource management. J. O'Laughlin, K. P. Reese, S. J. Brunsfeld

Determining timber harvest levels in Idaho's forests. F.G. Wagner, J. O'Laughlin, K. P. Reese, C. M. Falter, L. Hay Smith

Scientific basis for Best Management Practices for managing grazing animals in riparian areas. J. C. Mosley, J. O'Laughlin, R. L. Mahler

Master's Theses

- Akenson, H.A. Spatial relationships and behavior of bighorn sheep sharing a winter range with mule deer and elk in central Idaho. *Major professor: E.D. Ables*
- Arthaud, D.L. Size selectivity and capture efficiency of electrofishing, gillnetting and beach seining in Lower Granite Reservoir, Washington. *Major professor: D.H. Bennett*
- Clark, L.E. Factors affecting involvement with alternative forest enterprise in northern Idaho. *Major professor: G.H. Belt*
- Forester-Tear, D.J. Human impact on biodiversity loss in developing countries: A preliminary analysis. *Major professor: G.E. Machlis*
- Gakou, M. Non-timber forest products in rural Mali: A study of villager use. *Major professor: J.E. Force*
- Griswold, R.G. Development of indices of yellow perch abundance in Cascade Reservoir, Idaho. *Major professor: T.C. Bjornn*
- Hesterman, N.D. A flexure model and strength properties of vertically glue-laminated composites. *Major Professor: L.R. Johnson*
- Hunt, J.P. Catchability and vulnerability of westslope cutthroat trout to angling and movements in relation to seasonal changes in water temperature in northern Idaho rivers. *Major professor: Ted Bjornn*
- Jazouli, R. Updating forest road maps using satellite data. *Major professor: D.L. Verbyla*
- Kenney, D.M. The soil-vegetation relationship in the vicinity of Fairbanks, Alaska. *Major professor: M. Hironaka*
- Marten, L.M. National forest planning participants: Have they changed since the early 1980s? *Major professor: J.E. Force*
- Mncube, D.M. A business feasibility plan for a new value-added wood product in Clearwater County, Idaho. *Major professor: T.M. Gorman*
- Mousseaux, M.R. Efficacy of *Trichoderma harzianum* as a biological control of *Fusarium oxysporum* in container-grown Douglas-fir. *Major professor: D.L. Wenny*
- Nedoma, J.O. Modelling thinning regimes in three north-central Idaho Douglas-fir plantations. *Major professor: J.A. Moore*
- Patterson, M.A. Development and evaluation of a computer tutorial on fire ecology. *Major professor: E.E. Krumpke*
- Rich, B.A. Population dynamics, food habits, movement and habitat use of northern pike in the Coeur d'Alene River system. *Major professor: D.H. Bennett*
- Schlenker, A.M. Effects of overstory residual trees on the establishment and growth of natural regeneration. *Major professor: D.L. Adams*
- Sedney, D.G. Simulation of a log merchandising and sorting yard. *Major professor: L.R. Johnson*
- de Souza, M.R. Effect of carbon dioxide gas in manufacturing cement-bonded particleboard. *Major professor: A.A. Moslemi*
- de Souza Mendes, A. Grouping of six tropical wood species for drying based on temperature, thickness, and predicted drying times from a new soaking test. *Major professors: A.A. Moslemi, H.P. Steinhagen*
- Strohmeier, D.C. Elk use of sagebrush desert in southeastern Idaho. *Major professor: J.M. Peek*
- Tear, T.H. Range use patterns and the development of a natural grazing system in reintroduced Arabian Oryx (*Oryx leucoryx*) in the sultanate of Oman. *Major professor: E.D. Ables*
- Townsend, L.R. A soil-site study of three major windbreak species in North Dakota. *Major professor: D.L. Adams*
- Wakinen, V.D. Snag site characteristics and their associated use by avian wildlife in ponderosa pine forests. *Major professor: K.P. Reese*
- Zeng, M. Log yard fines as a soil amendment: Pot, field and column studies. *Major professor: A.G. Campbell*
- Zhang, X. RMP/CMP pulp and paper sludge as a soil amendment for growth of alfalfa and bluegrass: Greenhouse study. *Major professor: A.G. Campbell*

Ph.D. Dissertations

- Brown, G.G. The changing paradigm of national forest management. *Major professor: C.C. Harris*
- Choung, S.H. Wetland change detection using LANDSAT-5 Thematic Mapper data in Jackson Hole, Wyoming. *Major professor: J.J. Ulliman*
- Green, D.W. The Yakima Basin Fishery Enhancement Project: A bioeconomic analysis. *Major professor: D.L. Adams*
- Khattabi, A. A simulation model of heating frozen and non-frozen short logs. *Major professors: H.P. Steinhagen, A.A. Moslemi*
- MacCracken, J.G. Ecology of moose on the Copper River Delta, Alaska. *Major professor: J.M. Peek*
- Oswald, B.P. Microsite variability, safe site description and seedbed requirements for western larch germination and initial seedling establishment on a grand fir/ninebark habitat type. *Major professor: L.F. Neuenschwander*
- Sims, G.S. Spreadsheet financial decision support system for a small forest products business. *Major professor: R.L. Govett*
- Tangen-Foster, J.W. A motivational study of Outward Bound participants. *Major professor: W.J. McLaughlin*

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 1992. Most programs scheduled for 1993 are also listed.

More information is available from Continuing Education, College of Forestry, Wildlife, and Range Sciences, University of Idaho, Moscow, Idaho, 83843, (208) 885-6441.

Continuing Education

1992

January 27-31	Biostatistics Workshop (with U.S. Fish and Wildlife Service and National Fisheries Academy)—Albuquerque, New Mexico	March 12	Conference—Moscow
February 3	Native American Natural Resource Leadership Workshop—Moscow	March 21-22	IETIC Annual Meeting and Workshop: To Breed or Not to Breed: Options for the Next Generations—Post Falls
February 4	Wilderness Management Workshop—Boise	March 23-24	Fish Farming Workshop—British Columbia, Canada
February 4, 6, 7, 25, 26, 27	Forage Winter Schools (UI Extension Service)—Fairfield, Mountain Home, Caldwell, Preston, Blackfoot, Mud Lake	March 23-24	Regional Non-Industrial Private Forestry (NIPF) Woodland Marketing Workshop—Moscow
February 4-7	Executive Leadership of Political and Social Forces in Tribal Natural Resources Management—Moscow	March 23-24	Stewardship Planning Workshop—Moscow
February 18	Wilderness Management Workshop—Boise	March 23-27	14th Annual Aerial Photography/Remote Sensing Workshop—Moscow
February 21, 22, 28	Principles of Wildlife Management Workshop—Colville	March 24	Wilderness Management Workshop—Boise
February 24	Living with the Wind (windbreaks)—Pocatello	March 30-April 2	Vegetation Management Workshop: Managing Herbs and Shrubs for Multiple Uses—Boise
February 24-28	Statistical Methods and Data Analysis for Fish and Wildlife Biologists—Boise	March 30-April 10	Leadership and Communications Workshop (for USFS Professionals)—Moscow
February 26-28	Workshop on Passage and Survival of Chinook Salmon Smolts Migrating from the Snake River Basin—Moscow	April	Wildlife Management Workshop—Boise
February 27	Genetics Education in Northwestern Ecosystems (G.E.N.E.), USFS Region I-Inland Empire—Pullman, Washington	April	Fish Management Workshop—Boise
February 27-28	Wood Products Academy: Marketing and New Products—Coeur d'Alene	April 1-12	Leadership and Communications Workshop—Moscow
March 2-6	Applications of Multivariate Statistical Methods to Fish and Wildlife Biology (with Idaho Power Co. and Idaho Dept. of Fish and Game)—Boise	April 3-5	Interpersonal Communication Skills for Resource Professionals—Clark Fork
March 3	Wilderness Management Workshop—Boise	April 6-10	Wood Products Academy: Basic Course—Moscow
March 3-4	Ninth Annual Inland Empire Forest Engineering	April 7-10	Windbreak Workshop—Twin Falls
		April 10	Information Exchange and Future Management Direction of Box Canyon Reservoir (Workshop)—Newport, Washington
		April 27-May 1	Workshop: Application of GIS to Desktop Computers (for National Park Service personnel)—Moscow
		May 16	Symposium on Ecology, Management, and Restoration of Intermountain Annual Rangelands (with BLM and USDA Forest Service)—Boise
		May 18	Logger Safety Training Workshop (for Boise Cascade)—Emmett
		June	Central Idaho Natural Resource Conservation Workshop—Ketchum
		June-August	Logger Safety Training Workshops—Idaho State
		June 1-5	1992 Satellite Remote Sensing for Natural Resources Management—Moscow
		June 1-July 10	Training Program for Southeast Asia Wildlife Preserve Managers (for World Wildlife Fund)—Moscow

Continuing Education and Outreach

June 8- July 17	Land Use Planning for Community Forestry and Natural Resource Development—Moscow	October 9-11	Interpersonal Skills for Natural Resource Managers—McCall
June 9-10	Wood Panel and Lumber Composites: Technology and Market Opportunities—Spokane, Washington	October 12-16	Eleventh Annual Inland Empire Dry Kiln Workshop—Moscow
June 15-19	Aerial Photography/Remote Sensing Workshop—Keller, Washington	October 15	Living with the Wind (windbreaks)—Grangeville
June 17-18	Wood Pellet Quality Control Workshop—Moscow	October 16	Living with the Wind (windbreaks)—Coeur d'Alene
June 22-26	Forest Habitat Types of Northern Idaho and Basic Community Ecology (for USFS)—Shoshone Station, Wallace	October 21	Firescaping—Priest River
July	Environmental Campaign Planning for El Salvador Managers (USAID and University of Southern Carolina)—McClellanville, South Carolina	November 1-6	Aerial Photography/Remote Sensing Workshop—Nespelem, Washington
July 5-6	Wilderness Ecology: UI Wilderness Research Institute—McCall	November 12-13	Workshop: Hardwoods in the Pacific Northwest—Moscow
July 6-10	Forest Habitat Types of Northern Idaho and Basic Community Ecology (for USFS)—Fenn Ranger Station	November 17	Exotic Weeds in Forests—Lewiston
July 7	Southern Idaho Insect and Disease Workshop—American Falls	November 18	Exotic Weeds in Forests—St. Maries
July 7-13	Fish and Wildlife Ecology Workshop (for teachers)—McCall	November 19	Exotic Weeds in Forests—Coeur d'Alene
July 8	Southern Idaho Insect and Disease Workshop—Preston	November 19	Exotic Weeds in Forests—Bonners Ferry
July 9	Southern Idaho Insect and Disease Workshop—Idaho Falls	December 8	Forestland Grazing—Kooskia
July 23-24	We Grow Full Circle—A Field Tour of Working Forests—McCall	December 10	Forestland Grazing—Orofino
July 23-24	Adaptive Forestry Workshop—Moscow	December 15	Forestland Grazing—Potlatch
July 30- September 26	UI/Honduras Forestry Field Training Course—Moscow		
August 2-8	Advanced Project Learning Tree—Clark Fork		
September (tentative)	Wood Products Academy Shortcourse: An Introduction to Quality Control—Moscow		
September 12-13	Capturing Public Judgement (Planning and Facilitation Skills for Successful Public Involvement)—McCall		
September 17-18	Public Involvement and Meeting Facilitation Skills—McCall		
September 26	Community Forest Stewardship Day—Moscow		
September 27-30	3rd International Inorganic-Bonded Wood & Fiber Composite Materials Conference—Spokane, Washington		
October (tentative)	Wood Products Academy: Basic Course—Moscow		
October	Hardwood Conference—Moscow		

1993

January 12	Managing Your Timber Sale—Orofino
January 12	Cassia/Minidoka County Pasture Management School (UI Extension Service)—Burley
January 14	Clark County Range Workshop (UI Extension Service)—Dubois
January 14	Managing Your Timber Sale—Lewiston
January 21	Managing Your Timber Sale—Coeur d'Alene
February 1-5	Environmental Education Planning Seminar for Park and Wildlife Refuge Managers (World Wildlife Fund)—El Triunfo Biosphere Reserve, Mexico
February 2- March 2	Planning Forest Stewardship—Orofino
February 4- March 4	Planning Forest Stewardship—Lewiston
February 4- March 4	Planning Forest Stewardship—Sandpoint
February 6- March 6	Planning Forest Stewardship—Bonners Ferry
February 24	South Idaho Windbreak Workshop—Pocatello
March	Wood Products Academy—Moscow

Continuing Education and Outreach

March	Stewardship Planning—What's Next?—A Workshop for the NIPF Landowner—Moscow	June 7- July 16	Land Use Planning for Community Forestry and Natural Resource Development—Moscow
March- April	Wood Products Academy: Timber Harvesting Series—McCall, Orofino, Sandpoint	June 15	Protecting Riparian Areas—Dubois
March 2-3	Tenth Annual Inland Empire Forest Engineering Conference—Moscow	June 22	Southwest Idaho Tree Care Workshop—Emmett
March 9	Special Forest Products—St. Maries	June 24-25	We Grow Full Circle Stewardship Workshop—McCall
March 10	Managing Your Timber Sale—Sandpoint	July	Southwest Idaho Tree Care Workshop—Pocatello, Soda Springs, Burley
March 11	IETIC Annual Meeting and Workshop: Ecosystem Stability, Genetic Diversity, and Other Sacred Cows—Post Falls	Sept./Oct./Nov.	Range Monitoring Workshops—Location TBA (eastern Idaho)
March 16	Special Forest Products—Orofino	October 11-15	Twelfth Annual Inland Empire Dry Kiln Workshop—Moscow
April 5,7	Idaho Department of Lands Road Shortcourse—St. Maries	October 18- November 5	CEFES: Continuing Education in Forest Ecology and Silviculture—Moscow
April 5-9	Aerial Photography/Remote Sensing Workshop—Moscow		
April 8-9	LEAP Silviculture Workshop (Logger Education to Advance Professionalism)—Moscow		
April 12-13	LEAP Water Quality Workshop (Logger Education to Advance Professionalism)—Moscow		
April 14-15	LEAP Silviculture Workshop (Logger Education to Advance Professionalism)—Sandpoint		
April 19-20	LEAP Water Quality Workshop (Logger Education to Advance Professionalism)—Sandpoint		
April 20-21	National Cubic Measurement Symposium—Spokane, Washington		
April 27-28	LEAP Water Quality Workshop (Logger Education to Advance Professionalism)—McCall		
April 29-30	LEAP Silviculture Workshop (Logger Education to Advance Professionalism)—McCall		
May	Range Monitoring Workshops—Almo, Twin Falls		
May 8	Workshop on Environmental Interpretation (Saskatchewan Outdoor and Environmental Education Association)—Saskatoon, Canada		
May 24	Workshop on Environmental Interpretation (USDA Forest Service)—Pingree Park, Colorado		
June	Monitoring Riparian Areas (Range) (UI Extension Service)—Stanley		
June 1-3	Forest Health in the Inland Northwest Conference—Boise		
June 1-4	Workshop on Environmental Interpretation (USDA Forest Service)—Cispus, Washington		
June 7-12	Central Idaho Natural Resources Workshop—Ketchum		

Outreach

1992

February 23-28	National Urban Forestry School (Session I)—Nebraska City, Nebraska
March 7	Dinosaurs—Clark Fork
April 11	Fishing for the Big Ones—Clark Fork
May 8-9	For Bird Lovers Only (Beginners)—Clark Fork
May 21-22	Modern Aborigiculture—Kansas City, Missouri
June 6	Mushrooms—Clark Fork
June 12-14	New Writers Workshop: How to Write About the Good Earth for Publication—Nebraska City, Nebraska
June 27	Wildflower Identification—McCall
June 27	Ethnobotanic Aspects of Alien Plant Species, The Wonderful World of Weeds—Clark Fork
June 28	Ethnobotany—Clark Fork
July 8	History and Archeology of Warren's Chinese Occupation—McCall
August 1-2	Water Color Painting from Nature—Clark Fork
August 1-5	Drawing from Nature—McCall
August 2-9	On the Trail of Lewis and Clark—Lolo Trail
September 17-18	Solving Management Dilemmas—McCall
September 19	Fossil Collecting and Geologic Tour of the Lake Pend Oreille Area—Clark Fork
September 20	Fossil Collecting and Geologic Tour of the Lake Pend Oreille Area (repeat)—Clark Fork

Continuing Education and Outreach

September 27- October 2	National Urban Forestry School (Session II)— Nebraska City, Nebraska	April 17	Successful Tree Planting—Bonners Ferry
October 3-4	Getting Published—Clark Fork	April 25	History of North Idaho—Clark Fork
October 9	Building with Trees Workshop—Newport Beach, California	May 4	Forest Stewardship Field Tour—Orofino
October 13	Building with Trees Workshop—Sacramento, California	May 8	Forest Stewardship Field Tour—Lewiston
October 15	Building with Trees Workshop—Seattle, Wash- ington	May 11	Forest Stewardship Field Tour—Grangeville
October 17	North Idaho Folklore—Clark Fork	May 15-16	For Bird Lovers Only (Intermediate, Ad- vanced)—Clark Fork
October 18	Native American Culture and Myths—Clark Fork	May 29-31	Birding Malheur National Wildlife Refuge— Malheur National Wildlife Refuge, Oregon
November 8	The Fascinating World of Rocks and Minerals— Clark Fork	June 5	Native Flowers, Trees and Shrubs—Clark Fork
November 12	Building with Trees—Chicago, Illinois	June 12	Forest Stewardship Field Tour—St. Maries
November 16	Building with Trees—Orlando, Florida	June 19	Forest Stewardship Field Tour—Bonners Ferry
		June 19	Tree Identification, Tree Diseases and Insects That Invade Trees—Clark Fork
		June 24	Forest Stewardship Field Tour—Sandpoint
		June 25	Forest Stewardship Field Tour—McCall
		June 26	Forest Stewardship Field Tour—Coeur d'Alene
		July 11	Nature Photography—Clark Fork
		August 8	Wolf Behavior and Ecology—Clark Fork
		September 26	Flora of North Idaho—Clark Fork
		October 2	Fall Mushrooms—Clark Fork
		November 6	Dynamic Dinosaurs—Clark Fork
1993			
March 13	Successful Tree Planting—Orofino		
March 20	Successful Tree Planting—Sandpoint		
March 27 (or Apr. 10)	Fishing for the Big Ones—Clark Fork		
March 27	Successful Tree Planting—Grangeville		
April 10	Successful Tree Planting—Plummer		

Agency and Funding Support

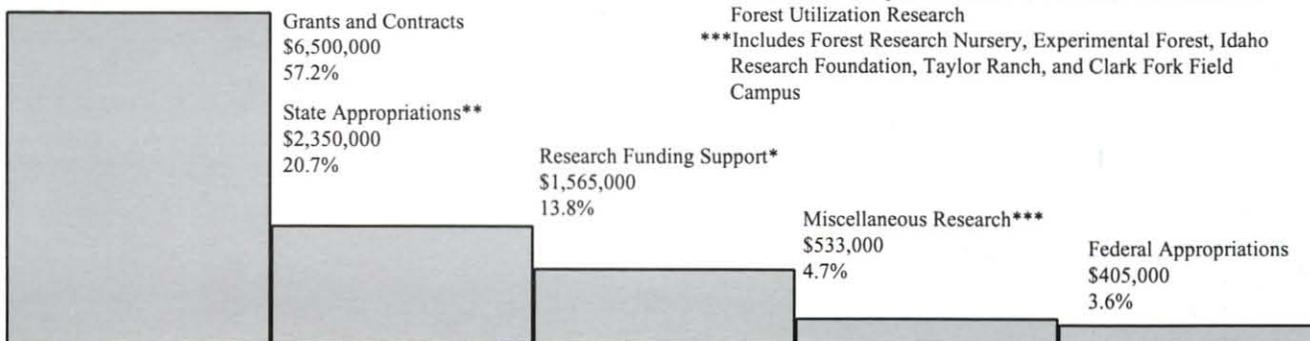
Agency for International Development
 Agriculture Research Service
 Alaska Fish and Game Department
 American-Scandinavian Foundation
 Bennett Lumber Company
 Blue Mountain Elk Cooperative
 Boise Cascade Corporation
 Boise National Forest
 Bonneville Power Administration
 Caribou College
 Champion Timberlands
 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
 Curt Berklund
 Energy/Development International
 Environmental Protection Agency
 Evergreen Forest Products
 Flathead National Forest
 Foundation for North American Wild Sheep
 Glacier National Park
 Government of Honduras
 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 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 Association, Inc.
 Konkolville Lumber
 Latah County
 Montana Fish and Wildlife
 Montana State University
 National Aeronautics and Space Administration
 National Arbor Day Foundation
 National Fish and Wildlife Foundation
 National Marine Fisheries Service
 National Oceanic and Atmospheric Administration
 National Rifle Association of America
 National Wildlife Federation
 North Atlantic Treaty Organization
 North Dakota Fish and Game
 North Idaho Forestry Association
 Northwest Area Foundation
 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
 Roger Guernsey
 Shearer Lumber
 Simpson Timber Company

South Idaho Forestry Association
 Stillinger Trust
 St. Regis Paper Company
 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
 USDI Bureau of Indian Affairs
 USDI Bureau of Land Management
 USDI Bureau of Reclamation
 USDI Fish and Wildlife Service
 USDI National Park Service
 University of Alaska
 University of Idaho Experimental Forest
 University of Idaho Forest Research Nursery
 University of Minnesota
 University of Montana
 University of Washington
 Washington State Department of Natural Resources
 Washington State University
 Washington Water Power Company
 Rob and Bessie Welder Wildlife Foundation
 Western Forestry and Conservation Association
 West One
 Weyerhaeuser Company
 The Wilderness Society
 Wildlife Management Institute
 The Wildlife Society
 Winrock International Institute

Fiscal Year 1992 Financial Picture

Research income, shown by funding source, totaled \$11,353,000 for fiscal year 1991-92.



*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

Director's Score Card

Productivity: 1989-1992

	Departments					Total
	Fish & Wildlife Resources	Forest Products	Forest Resources	Range Resources	Resource Recreation and Tourism	
1989						
Research FTE's ¹	2.5	1.9	6.4	1.5	0.7	13
Books	0	0	2	0	0	2
Chapters in Books	6	7	11	9	3	36
Refereed Publications	18	9	23	4	7	61
Other Publications	30	11	46	5	26	118
1990						
Research FTE's	3	1.9	6.9	1.5	1.3	14.6
Books	0	2	3	0	0	5
Chapters in Books	1	0	2	1	2	6
Refereed Publications	26	13	34	4	8	85
Other Publications	31	23	72	10	25	161
1991						
Research FTE's	4.85	3.62	9.99	4.27	2.88	25.61
Books	2	2	3	0	0	7
Chapters in Books	16	6	19	4	6	51
Refereed Publications	23	21	23	3	3	73
Other Publications	32	7	44	3	25	111
1992						
Research FTE's	4.85	3.62	9.99	4.27	2.88	25.61
Books	2	2	4 ²	0	4	13 ³
Chapters in Books	21	2	12	3	11	49
Refereed Publications	21	8	10	3	9	54
Other Publications	17	6	47	6	20	104

¹ FTE = the equivalent of one full-time faculty employee paid from CFWR Experiment Station state funds.

² The CPSU's 1 book and 6 miscellaneous publications have been added to the Forest Resources total.

³ Also reflected in the totals are the PAG's 1 book, 3 refereed publications, and 8 miscellaneous publications.

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 25.61 full-time researchers funded by the state of Idaho. However, all 70 of the college's faculty members conduct research, as do most of its 190 graduate students. The faculty spend about one-third of their time on research, much of it paid for through outside grants and contracts.

During the 1992 fiscal year, income from outside grants and contracts totalled \$6.5 million. State appropriations for research at the experiment station amounted to an additional \$2.35 million. For every dollar appropriated by the state for experiment station research during fiscal 1992, faculty grants and contracts brought in \$3.60.

Changes: 1988-1992

	1988 vs. 1992 Percent Change	5-year Total
Graduate Student Enrollment	+12%	887
Outside Grants & Contracts ⁴	+292%	\$24.72 million
Books	+650%	29
Chapters in Books	+1,225%	146
Refereed Publications	-8.5%	332
Other Publications	-11%	608

⁴ Fiscal years

From the Director

George Savage



John C. Hendee

Research Is Hands-On Education

There really isn't a better way for students to learn about natural resources than to get out there, hip-deep in river water if necessary, and study. The world they enter to practice their trades will be one of forests, rangeland, and fish and wildlife habitat. So at the College of Forestry, Wildlife and Range Sciences, that's where we put them.

Whether our students learn from their professors' research, their own research, or both, their education rests on a foundation of scientific principles that interact constantly with changing methods and new information. Our future resource managers must enter their fields with the best and latest knowledge collected from classrooms, textbooks, laboratories, and the field. Our growing student enrollment matches the substantial increases in research funding we have earned in recent years, proving the appeal of educational programs based on teaching and research. In fact, last year our college showed the largest percent increase in credit hour production in the university, climbing 72 percent over the past five years.

The Fish and Wildlife Resources Department offers several examples of the benefits of combining teaching with research. At the moment, students are participating in more than 10 bird studies, plus studies on elk vulnerability, wolves, spotted owls, and salmon. Most of these are first-of-their-kind studies. The graduate and undergraduate students working on these studies will truly learn at the discovery edge of knowledge in their field.

One of our 190 graduate students is on the Payette National Forest studying relationships between timber and forest birds, especially neotropical migrants like warblers and thrushes. Another student is analyzing migratory bird population trends in 11 western states. In southeastern Idaho, four graduate students are conducting the first comprehensive study of the winter ecology of Columbian sharp-tailed grouse, a sensitive subspecies indigenous to the Pacific Northwest.

All over Idaho—in the Coeur d'Alene River, Weiser River, the north and south forks of the Salmon River, the Clearwater River, the St. Joe, the Lochsa, and the Lemhi Rivers, students are on the discovery edge of what concerns Idahoans now: the management of natural chinook salmon stocks with hatchery fish, and the effects of dams on chinook and sockeye salmon migration.

In resource recreation and tourism, a student is evaluating visitor needs on the lower Salmon River near Riggins. Another is evaluating the effects of wilderness work and experience on the motivation of poverty youth to complete their training with the federal Job Corps and find a productive future. In forest products, an undergraduate is looking at the effect of variables on drying grand fir lumber. Another is studying cement-bonded particleboard, one of the building materials of the future. Students in range are studying everything from indicators of cattle and deer use of streams, to the influence of prescribed sheep grazing on deer and elk winter forage.

In natural resources, hands-on learning is an essential part of a good education. In our college, research provides the opportunity for such education.

John C. Hendee



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