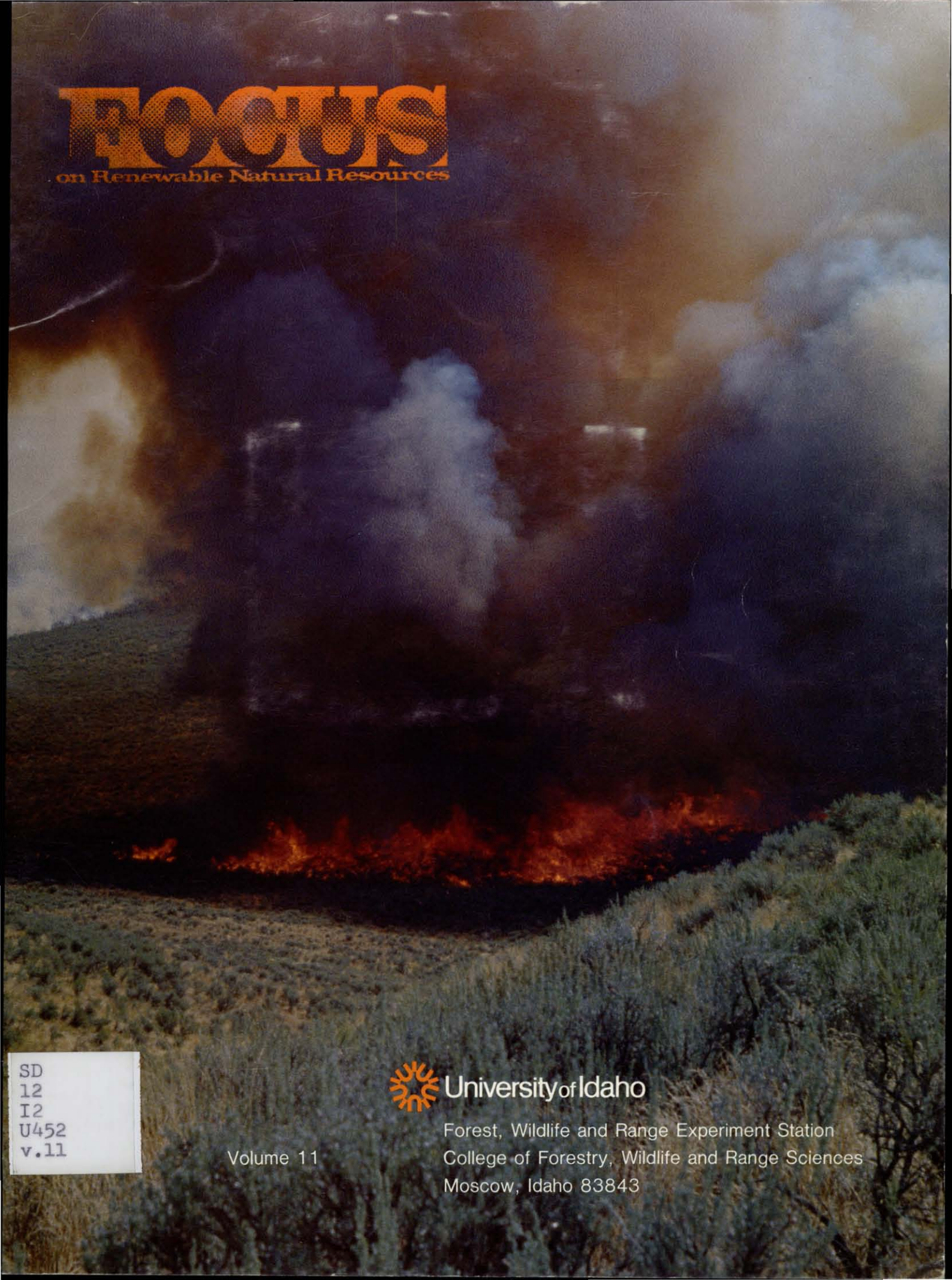
FOCUS

on Renewable Natural Resources



Volume 11

University of Idaho
Forest, Wildlife and Range Experiment Station
College of Forestry, Wildlife and Range Sciences
Moscow, Idaho 83843

FOCUS on Range Research

This edition of FOCUS features the college's Department of Range Resources. Idaho's rangeland, which constitutes 65 percent of the state's land area, is an important multiple-use resource and economic asset. Enabling legislation charges the Forest, Wildlife and Range Experiment Station, and the Range Resources Department, with research into the production, protection, utilization, and management of these resources. Since 1940, the department has focused on problem-oriented research, helping ranchers, land managers and related commercial enterprises to be more productive and yet maintain good stewardship practices. This program has been well received by livestock producers and the land management agencies.

Over the years the research program has moved from general studies of "grazing effects" on various range types to more specialized topics, such as noxious weeds, big sagebrush ecology and reseeding. As the program gained momentum and with increased cooperation from state and federal agencies, research into the effects of fire, of wildlife interactions and the economics of range use were included. In recent years "high-tech" research was added in the context of remote sensing and computer-based planning systems.

In the future, as in the past, the range research program will deal with the variety of production, conservation, and management concerns about Idaho's range resource. For the remainder of the 80s, in response to the needs of the state and as a part of the college's "Quest for Excellence," added emphasis will be given to three goals:

- *Increasing knowledge of range vegetation, its ecology and response to multiple-use management;*
- *Developing and applying grazing systems to optimize use and enhance productivity, and*
- *Designing management programs which integrate public and private responsibilities and land ownerships to promote stewardship and cooperation.*

Reduced budgets continue to challenge productivity in the range program, as well as across the spectrum of Forest, Wildlife and Range Experiment Station activities. But as the following pages indicate, our experiment station scientists remain productive and are contributing in many ways to Idaho's resources and industries. The continued effort and success of these scientists in competing for external research monies to supplement the state's investment has helped maintain our program's initiative.

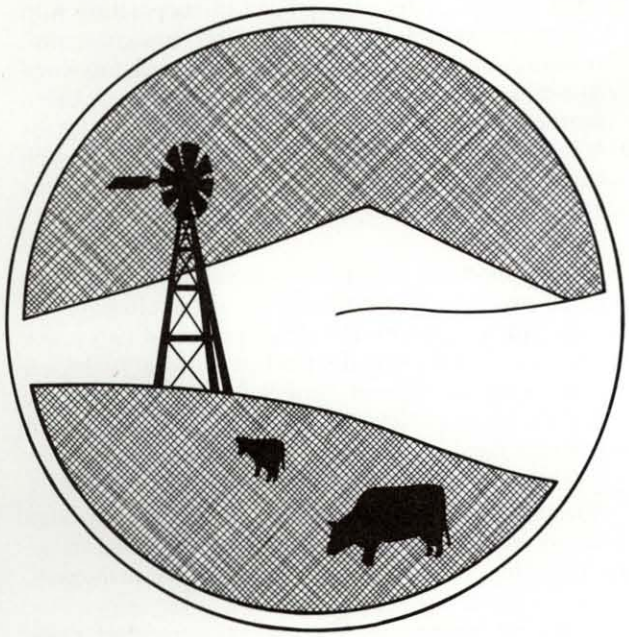
The goodwill, counsel and support from public agencies, industry, professional trade associations and private sponsors of our program are greatly appreciated. Your continued support during these difficult economic times is fast becoming our lifeline. We appreciate your investment in Idaho's future.

George H. Belt, Associate Director
Forest, Wildlife and Range Experiment Station

FOCUS

Volume 11

Fiscal 1985 Annual Report



FOREST, WILDLIFE AND RANGE EXPERIMENT STATION

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George H. Belt, Associate Director
Howard Loewenstein, Assistant Director

Jane Pritchett, Editor
Lorraine Ashland, Artist
Michal Miller, Typesetting

Cover: Prescribed burning of rangelands being used to control sagebrush and to enhance forage production of herbaceous plants. *Steve Bunting photo.*

University of Idaho

Range Research and Service

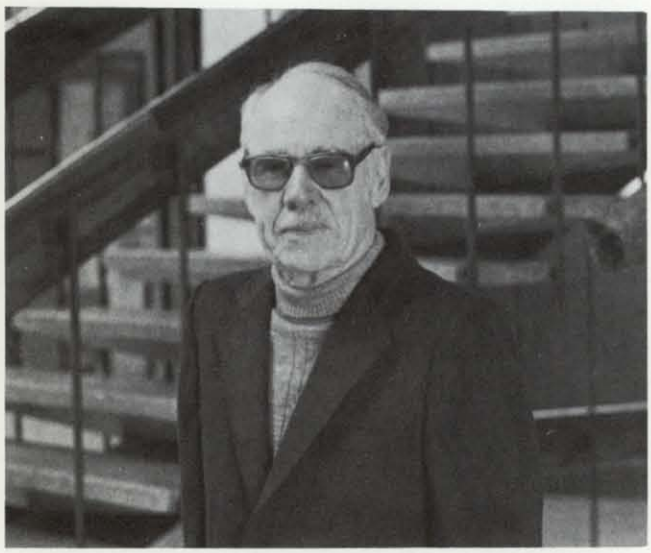
HISTORY OF RANGE RESEARCH AT THE UI

Edwin W. Tisdale

Range research at the University of Idaho swung into gear in 1940 at about the same time as the nation began preparing for World War II, although courses in range management were taught beginning in 1915. The first–and until 1948–the only research project was a study of the effects of sheep grazing on cutover lands of "the white pine type" in the Clearwater River drainage. Initiated by Dr. Vernon Young, this project operated under many difficulties caused by World War II and was finally completed by new staff in 1949.

A second stage in the historical development of range research began in 1948 with the increase of the range staff to two members, and a recognition of research as a major responsibility along with teaching. E.W. Tisdale, who joined the staff in 1947, Lee A. Sharp, who came two years later, and their graduate students gradually developed a sizeable research program. The addition of Minoru Hironaka in 1954 constituted the only further increase in staff until the early 1970s.

The first project in this new era was an investigation of the merits of aerial range reseeding with pelletized seed, conducted with the support of the Bureau of Land Management. Results were mainly negative for this shortcut approach to range seeding, but the work marked the start of a series of cooperative efforts with the bureau. It also led to a broader interest in the sagebrush-grass region of the state.



Edwin W. Tisdale, Professor Emeritus of Range Resources, joined the Department of Range Resources faculty in 1947.

A study of the ecology and productivity of sagebrush ranges, begun in 1949, was conducted on a very small scale until 1954, when increased support was received through a regional Hatch Act project in cooperation with the College of Agriculture. This project was continued, with revisions, until 1969, and developed a much improved understanding of this large and varied range type. Later, the classification portion of the study was supported by the USDA Forest Service. This work culminated in 1983 with publication of a bulletin on the habitat types of the sagebrush-grass ranges of the state.

Other aspects of sagebrush ranges studied within this broad framework were the taxonomy and ecology of big sagebrush and the growth and development of two major grass species of the type (under the International Biological Program). Another offshoot came in the form of a pioneer study of the value of satellite remote sensing imagery for classification and monitoring of sagebrush rangelands.

Starting in 1964, the McIntire-Stennis Act provided support to extend ecological studies to woodland range types, including western juniper and mountain mahogany.

A second major line of study has concerned range weeds, species undesirable due to low palatability and/or toxic properties. The first plant studied, starting in 1950, was halogeton, an introduced species toxic to livestock, which rapidly invaded large areas of depleted sagebrush and salt-desert shrub range. Soon after, work was begun on medusahead, an introduced grass of low palatability which spread on both sagebrush and grassland ranges. The third major species studied was goatweed, a perennial from the Mediterranean area which occupied large areas of depleted grassland and open forest range in northern Idaho. In each case, investigations of the life-history and requirements of these weedy species provided essential information as a basis for their control and management.

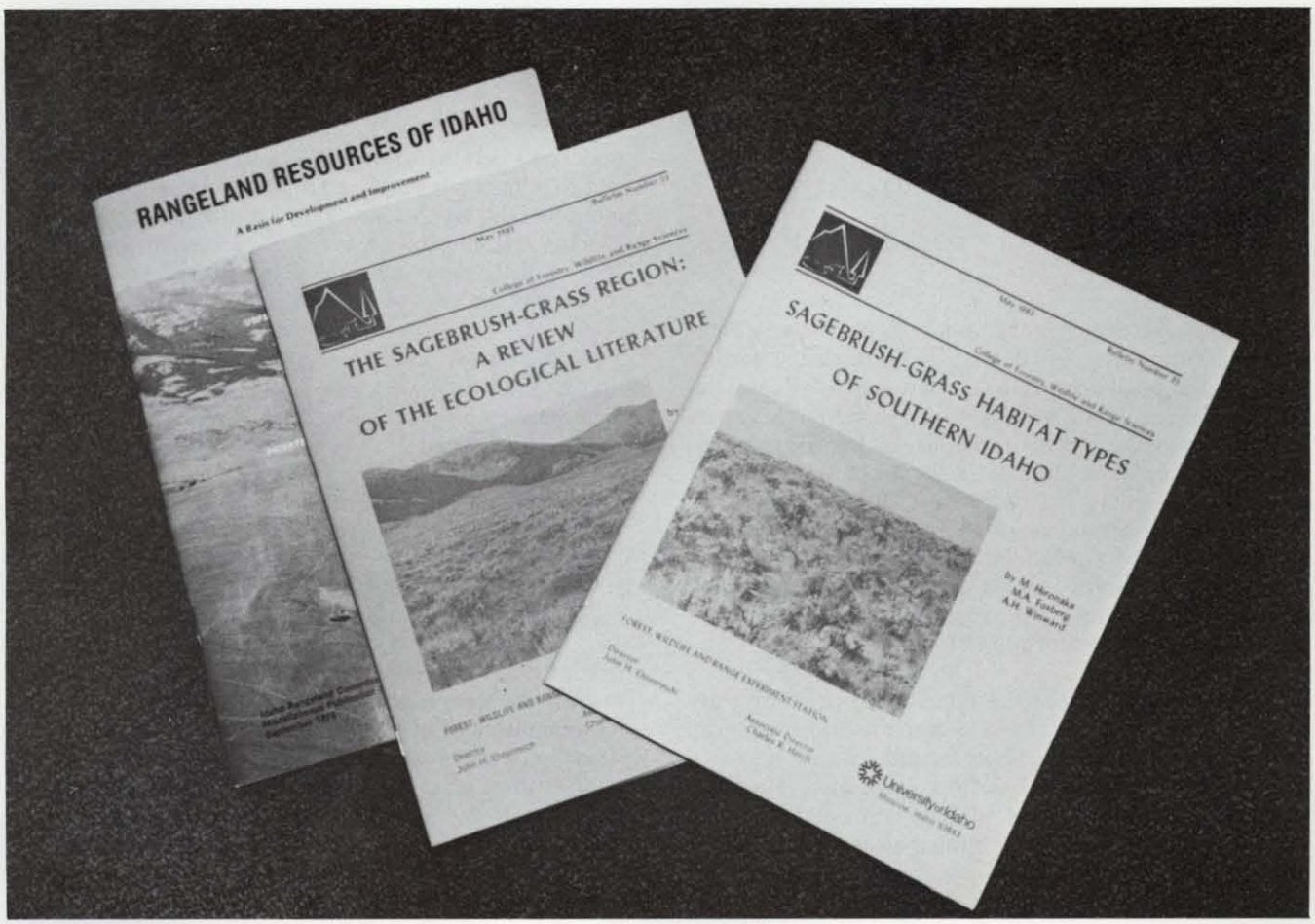
A third major research theme has been the evaluation and management of reseeded ranges. This research started as an offshoot from the halogeton study, as reseeding was increased to meet problems created by this weed. In 1953 a cooperative program with the Bureau of Land Management was initiated which provided for studies of reseeded ranges on public ranges. The Point Springs Field Station (recently designated the Lee A. Sharp Experimental Area) was established in 1954 as headquarters for these studies. Grazing studies of crested wheatgrass seedings on this area have been continued since this time, and have provided a fund of

information regarding the management of this grass which is so widely used for reseeding sagebrush and related range types. Associated studies conducted within this program included effects of livestock trampling on ranges, the relation of carbohydrate reserves to grazing use, and, more recently, studies of high-intensity, short-term grazing.

This second phase, beginning in 1948, lasted until the early 1970s. During this period, major input on the range ecological and range weed studies came from Tisdale and Hironaka, while Sharp developed the reseeding research program.

A third phase began in the early 1970s, as increased staff provided the manpower for an expanded and more diversified research program. Two of the earlier lines of investigation–ecological studies of range types and evaluation of and management of reseeded ranges–were continued, but new lines of research were added. These include studies of the economics of public range management, rehabilitation of mine spoil areas in northern Idaho, and the relationships of livestock and big game use on various range types. Another added field of investigation concerns the use of fire as a tool in range rehabilitation and management, with projects on sagebrush-grass and forested ranges, and on important browse species such as bitterbrush and mountain mahogany. Research on forest grazing has been renewed after a long hiatus, with the objective of maximizing the use of such ranges without damage to tree reproduction. Research on the ecology of grassland ranges in northern Idaho, which had received limited study in the earlier years, has also been revived in a study now nearly completed. Another recent area of investigation concerns improved methodology for monitoring range trend, with emphasis on values of the frequency method. Range vegetation of national parks and monuments in the region are also being studied through a cooperative agreement with the National Park Service. Range plant physiology is another area of study for which expertise has recently been required.

The current staff adds the research expertise of a younger group of investigators, David Bryant, Department Head and range nutrition specialist; Steve Bunting, who specializes in range and fire ecology (see article page 4); Jim Kingery, whose specialty is forestland grazing; Lee Neuenschwander, who studies and teaches fire ecology and fire management; Ron Robberecht, who is in the relatively new field of ecophysiology (see page 6); Ken Sanders, an expert in range extension, nutrition and livestock, and Gerry Wright, who teaches simulation modeling and range systems ecology.



Some of the publications resulting from Department of Range Resources research.

Prescribed burning is often used as a pre-treatment for seeding and to remove sagebrush and other shrub species.

Prescribed Burning Can Provide Management Tool

Investigators:
Stephen C. Bunting
Leon F. Neuenschwander
Ronald Robberecht

Using prescribed burning as a rangeland management tool to improve forage and habitat for livestock and wildlife is a research emphasis of the Department of Range Resources. The use of fire to allow more production of grasses and forbs has taken professors Stephen C. Bunting, Leon F. Neuenschwander and Ronald Robberecht to rangeland sites near Shoshone, Idaho, into the Owyhee Uplands in southwestern Idaho and near Vail, Oregon. They are studying the effects of fire on bitterbush, curlleaf mountain-mahogany, bluebunch wheatgrass and Idaho fescue to determine the best methods to manipulate vegetation with fire to enhance the production of forage.

"Planning prescribed fire requires an interdisciplinary approach," Bunting said. "For example, a burned area can provide forbs for sage grouse in the early stages of succession and grass for livestock 3 to 5 years later. However, livestock need larger tracts of land burned, but grouse require cover and many small burned areas are more suitable for them."

Rangeland managers will need to consider many uses for the lands they manage. A common objective of prescribed burning is using it as a pre-treatment for seeding and to remove sagebrush and other shrub species that might interfere with equipment. However, the investigators have found a major limitation of fire as a successful management tool is that many semiarid areas of the intermountain region lack the fine fuels to carry fire.

"The areas people are most interested in burning are usually those that have been invaded by shrubs, which reduces the amount of herbaceous production and thereby the fine fuels needed to carry a fire," Bunting explained.

Plant communities that would benefit the greatest from prescribed burning are often the most difficult to burn, so land managers need a thorough knowledge of post-fire succession to develop long-term management guidelines.

The replacement of perennial grasses by annual grasses has reduced the applicability of using prescribed burning in many plant communities. Shrub communities dominated by an understory of annual grasses will usually convert to a nearly pure stand of annuals and little would be gained by burning these plant communities unless treatments to control annuals and establish perennials were planned at the same time.

The researchers hope their studies will define guidelines for using prescribed fire to improve forage and habitat for wildlife and livestock and to manage watersheds.

New Approach Makes Analyzing Range Vegetation Trends Easier

Investigator:
Minoru Hironaka

Developing or assessing rangeland management plans requires that land managers have a good idea of range vegetation changes. The early detection of change is particularly important. A significant increase in the frequency of desirable species marks a favorable change, indicating as it does an increase of density, basal area, and/or change in spatial pattern. Each increase, singularly or in combination, represents a desirable change in the species' response to management. If the changes are undesirable, and detected early enough, changes in management practices can be made to correct the situation.

Through research conducted separately by Range Resources Professor Minoru Hironaka and by range specialists of the University of Arizona, an accurate and easily used method for monitoring range species changes has been developed.

In practice, the method involves laying a portable metal frame 20 inches square on the ground and recording the frequency of occurrence of vegetation species inside the frame. The procedure is repeated 100 times on 4 to 6 monitoring locations. After about three years of conducting the procedure and compiling rainfall and livestock use information, the rancher or land manager will have developed a useful profile of the characteristics of his land. Subsequent readings at 3-year intervals will indicate the direction of vegetation change.

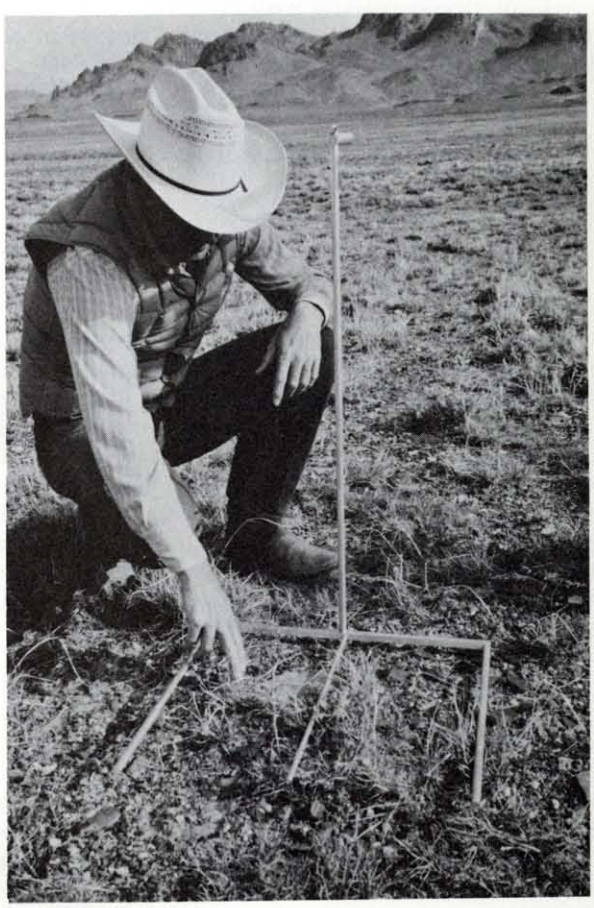
The method is rapid, objective, and simple, and if properly used and understood, provides an effective and sensitive means by which to monitor species changes. Before adopting the method, however, potential users should be aware of its limitations.

The method does only one thing well and efficiently: It can detect whether a change has occurred in a species population's density, spatial pattern and/or basal area between two sampling dates. It cannot identify which of these properties has changed–only that a change has occurred. Further, because species populations are not randomly distributed, no consistent correlation exists between frequency and density. Thus, frequency cannot be used to describe vegetation. Moreover, the method records only the species presence in a quadrat (a sampling plot) and not the number of individuals. Although this presence/absence determination makes the method highly objective and rapid, it limits its suitability to herbaceous vegetation. Other population measures are more meaningful for shrubs and trees.

Significantly, because each species population has an optimum quadrat size within which change in frequency is readily detected, a single quadrat size cannot effectively monitor all species.

Using nested quadrats (sampling plots of varying sizes within the frame of the sampling instrument) not only increases the probability of matching a species with its suitable quadrat, but also provides data that can be analyzed to detect change in species population more sensitively than data from a single quadrat size. The result is that significant changes in species populations can be detected with statistical reliability sooner than from data obtained from a single quadrat size.

Given a proper understanding of the use and limitations of the frequency of occurrence method, land managers and ranchers will find the method of considerable help in developing rangeland management plans, in assessing the effectiveness of the plans, and in expeditiously modifying plans when necessary.



Using nested quadrats provides more sensitive vegetation change data.

Short Duration Grazing System Studied

Investigators:
Kenneth D. Sanders
Mike Siebe
Lee A. Sharp

A study to determine the effects of short-duration grazing on crested wheatgrass pasture in southeastern Idaho will compare this intensive management of range resources to a continuous-use pasture and a two-pasture, deferred-rotation system. The study by Range Resources Professors Kenneth D. Sanders and Lee A. Sharp and graduate student Mike Siebe is located at the Lee A. Sharp Experimental Area south of Burley and is being conducted in cooperation with the Point Springs Grazing Association and the Bureau of Land Management.

A short-duration grazing system consists of the frequent rotation of one herd of livestock through several pastures in repeated cycles. A minimum of eight pastures usually is considered necessary for the system to be effective. The grazing period varies from one day or less to a maximum of about two weeks.

Eight 40-acre pastures were used for two months this spring and for two months this fall, with one herd of yearling cattle grazing one pasture at a time. In spring, the yearlings were rotated from one pasture to another at approximately weekly intervals.

The study, initiated in 1981, used a stock density of about 2.6 yearlings per acre, but this spring the density was increased to 3.8 yearlings per acre to achieve more uniform use of forage and increase the herd effect.

The yearlings are weighed at 28-day intervals to compare gain per head and gain per acre in all three systems being tested. The investigators plan to increase the number of pastures used in the future.

Baseline data on forage production and plant species frequency were obtained when the study started. Last year, soil bulk density and organic matter and water infiltration rates were measured. These measurements will be repeated periodically to determine the effect of the short-duration system on forage production and soil compaction and infiltration.

The investigators have noted immediate benefits of the short-duration system over conventional systems in increased management flexibility and more uniform use of forage. Individual animal gain was slightly lower on the short-duration system in the first four years, but this may have been caused by having both steers and heifers in the same pasture. Several years of study will be required before any conclusions can be made on the effect of short-duration grazing on the range resource.

Plant Physiological Ecology: A New Range Science Field

Investigator:
Ronald Robberecht

Many problems encountered in managing rangelands for such competing uses as livestock grazing, wildlife habitat, recreation and resource development require an understanding of ecology. Range plant physiological ecology is a relatively recent addition to range science that has been called everything from ecophysiology to autecology to environmental or stress physiology. Range physiological ecologists study how and why plant species occur, where they do and how these species respond to new environmental conditions imposed by man's influence on the range.

"Range communities are often characterized by relatively limited soil, water and nutrient resources, and competition for these scarce resources may significantly influence plant spacing, abundance and species composition," explained range ecologist Ronald Robberecht. Research on plant adaptations to drought stress, defoliation, and plant interactions are of particular interest. He and graduate students Guillermo Defosse' and Mauricio Alcocer, are studying the water relations and growth dynamics of bunchgrasses such as Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*) in response to plant competition, grazing, and fire. "One aspect we are particularly interested in is understanding the mechanisms involved in plant competition and their sensitivity to fire and grazing on Idaho rangelands," Robberecht said. The research will examine the simultaneous effects of fire, grazing, and competition on plant growth to help investigators make more realistic predictions of plant response to various environmental stresses.

Research in the past often focused largely on single environmental factors, such as how grazing or water stress alone influenced plants, but physiological ecology studies the whole-plant response to environmental stress factors. These include temperature, water, nutrients and competition from other plants and animals.

"To understand and properly manage rangeland communities, several different levels of integration are required from research on biochemical mechanisms to community and systems ecology," Robberecht said. "The analyses of plant and soil water relations, root and shoot growth dynamics, and plant demography should increase our understanding of the mechanisms involved in plant competition."

Such information should bring new knowledge on how physiological processes influence the establishment, growth, reproduction and survival of plant species in the rangeland ecosystems.

Stewardship Program Seeks to Improve Range Conditions

Lee Sharp

Providing a way to resolve conflicting views about how to use and manage Idaho's range resources has been the focus of nearly 20 years of developing innovative approaches to resource management. Concern about the lack of communication and the poor relationships among ranchers, other users of public range lands and the public agencies administering them led to the formation of the Idaho Range Use Coordinating Committee early in 1965. Initiated by the Idaho Cattlemen's Association, the committee members wanted to develop a solution to the problem of competing uses of the lands. Convinced that resource management could be greatly improved by cooperatively coordinating the activities of all the groups involved, they created a committee comprising individuals in range-related policy and decision-making positions.

The first committee had representatives from the Governor's Office, the Idaho Cattleman's Association, the Idaho Woolgrowers Association, the Bureau of Land Management, the U.S. Forest Service, the Idaho Fish and Game Department, the Idaho Fish and Game Commission, the Idaho Department of Public Lands, the Soil Conservation Service and Soil Conservation Commission, the Idaho Wildlife Federation and the Deans of the University of Idaho's College of Agriculture and College of Forestry, Wildlife and Range Sciences.

The Idaho Range Use Coordinating Committee became the Idaho Rangeland Committee in 1975 without much change in purpose or operating procedure. The committee has been ably chaired first by John A. Pierce of Malta and now by L.N. "Bud" Purdy of Picabo. The author has served as secretary and executive secretary since 1966.

The committee hoped to accomplish its goals through:

- Developing range demonstration allotments to show the benefits of cooperative coordinated management;
- Participating in the resolution of conflicts between range users and agencies when requested;
- Acting in an advisory role to the Governor on range issues; and,
- Participating in the formation and activities of the Challis Experimental Stewardship Program.

The Experimental Stewardship Program encourages users of public range lands to participate in management of those lands. Here members of the Challis Experimental Stewardship group meet to discuss potential management activities on the Challis Planning Unit in central Idaho.

In the view of the author, the background and activities of the Idaho Rangeland Committee were largely responsible for mandating the Experimental Stewardship Program in the Public Rangeland Improvement Act of 1978.

What Is Experimental Stewardship and How Did It Start?

It is difficult to say just when it all started, but an important event leading to the development of the program was the passage of The National Environmental Policy Act of 1969 (NEPA). The Bureau of Land Management prepared a programmatic environmental statement for grazing to meet the requirements of the Act.

The Natural Resources Defense Council and others filed a suit in Federal Court and argued that a programmatic statement was insufficient to meet the requirements of the NEPA. The Court ruled in June of 1975 that the Bureau of Land Management would be required to write site specific environmental impact statements–212 throughout the western states–to be completed in 13 years.

Through an agreement among the BLM, the Defense Council and other plaintiffs, the Challis Planning Unit was designated as the pilot area for subsequent environmental statements. The Challis environmental statement was to be completed by June 30, 1976. When it was finally completed in 1978, substantial reductions in livestock use were indicated that would create a major conflict between the livestock rancher and the BLM. Strong antagonisms developed and the stage had been set for intense conflict.

During the summer of 1978, Congress was considering the Public Rangeland Improvement Act (PRIA) that was sponsored by former Senator Frank Church and strongly supported by Senator James McClure.

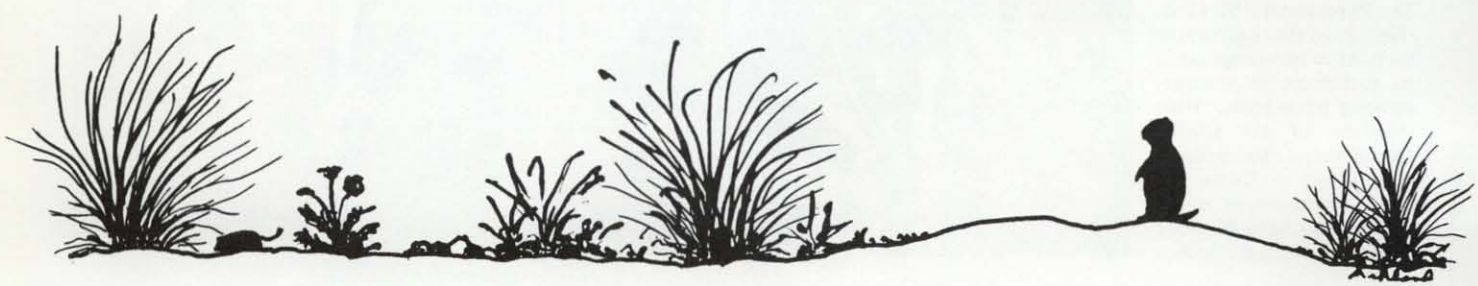
Bud Purdy, chairman of the Idaho Rangeland Committee, and Bill Swan, chairman of the Public Lands Council Livestock Industry, had met with members of Senator Church's staff and suggested that cooperative coordinated management might be a means of resolving some of the conflicts at Challis and other locations.

On October 25, 1978, the Public Rangeland Improvement Act was signed into law. Section 12 of the Act authorized and directed the U.S. Secretaries of Interior and Agriculture "to develop, on an experimental basis, a program which provides incentives to, or rewards for, the holders of grazing permits and leases whose stewardship results in an improvement of the range condition of lands under permit or lease." Innovative grazing programs were encouraged as well as greater cooperation and coordination among federal and state agencies and local private range users.

Six weeks after the law was signed by the President, Governor John Evans requested that the Idaho Rangeland Committee assist in developing the Challis Stewardship Program. The request was accepted with concurrence of the people of Challis. The first meeting of the Challis Experimental Stewardship Group was in February, 1979. Two other Experimental Stewardship Groups were formed during 1980, one in Dillon, Montana, and the other in Modoc and Washoe counties in California and Nevada.

During the last decade, we have begun to see marked changes in the way that natural resource decisions are made, especially in rangeland resources. The process developed in the Experimental Stewardship Program requires participatory approaches to management. This process–whether in natural resources or business corporations–shows more progress is made in achieving the objectives of management if those affected feel that they are an essential part of the decision process. This approach opens the way for a greater exchange of information and directs attention to the information required to develop management strategies and to resolve conflicts. It provides for free and open discussion among individuals with conflicting viewpoints and thus an improved basis for understanding the interrelationships of range uses and user interests.

In the six years that the Stewardship program has operated, livestock reductions have been mitigated, antagonisms and conflicts have subsided, innovative approaches to resource management have been instigated and the future for range resource management looks brighter and more promising than it did in the mid-1970s.



Fish and Wildlife Resources

Bighorn rams on collision course in the Frank Church-River of No Return Wilderness.

Bighorn Sheep Study Looks at Interspecific Behavior

Investigators:
Ernest Ables
Holly Akenson

Documenting the activity and behavior of bighorn sheep wintering on the steep slopes of Big Creek in the Frank Church-River of No Return Wilderness may help determine whether the presence of other species, such as deer or elk, affect their habitat use and behavior. A study by wildlife graduate student Holly Akenson, under the direction of Professor Ernest Ables, is analyzing the movements of bighorn sheep as they range on the southern slopes of Big Creek Canyon.

Akenson is scan sampling with a 15 to 60-power spotting scope from an observation post at Taylor Ranch Wilderness Research Station to analyze the bighorn sheep, deer and elk activity for approach-avoidance movements with respect to topography, temperature, snow condition, herd size and distance to other species.

The research will explore whether the approximately 150 bighorn sheep that winter in the study area compete with the other species for food or space and whether they spend less time feeding when other species are present. Three types of competition will be studied: exploitative, which results when one species decreases the reproduction or survival of another; interference, when one species harms another; and, disturbance, when one species annoys or intimidates another, causing the latter to leave the area.

The results of the study should help the Idaho Department of Fish and Game plan for bighorn management in the Salmon River Mountains where the winter ranges of bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) overlap. Previous studies have indicated that some interspecific competition occurs on almost all bighorn sheep winter ranges. Elk competition is usually more severe than that of deer because of the similarity of elk and sheep winter diets.

The investigators will also look at the social interactions among species that can interfere with feeding, and at snow conditions, since deeper snows may cause more aggression.

Akenson's observations began in January 1985 and continued through May 1. They will resume this winter and again continue through May 1. Her findings should help further the understanding of the competition for food and territory among bighorn sheep, elk, and mule deer.

Bear Lake Study Monitors Fish/Wildlife Response to Flow Changes

Investigators:

Theodore C. Bjornn
C. Michael Falter
James Milligan
Christine M. Moffitt
Kerry P. Reese
Christopher Cleveland
Ronald W. Tressler
Ralph Meyers

Developing a model to predict how fish and wildlife are affected by different water management regimes at Bear Lake National Wildlife Refuge is the goal of an interdisciplinary study by a team from the Idaho Cooperative Fish and Wildlife Research Unit. Bear Lake, which straddles the border of southeastern Idaho and northeastern Utah, is a clear, deep, blue lake that contains several unique fish species due to its geographical isolation in recent geological history.

Since the early 1900s, water from Bear River, which is not a natural tributary of the lake, has been diverted into the Bear Lake National Wildlife Refuge, a 17,000-acre marsh occupying the northern portion of the lake, and then gravity-fed into the lake. Water is stored in the 28-mile long lake in the spring and early summer until it is needed for irrigation. Then the marsh water level is lowered and water drained from the lake in a canal through the marsh and downstream to the Bear River.

The water diverted into the marsh is full of sediments and nutrients, causing lake and refuge managers concern that the sediment-laden water will fill the marsh and cause eutrophication in Bear Lake.

Proposals to dike or otherwise modify the marsh to trap more sediments and nutrients to reduce eutrophication in the lake raised concern that the proposed water regimes might harm the habitat or food sources of fish and wildlife in the marsh.

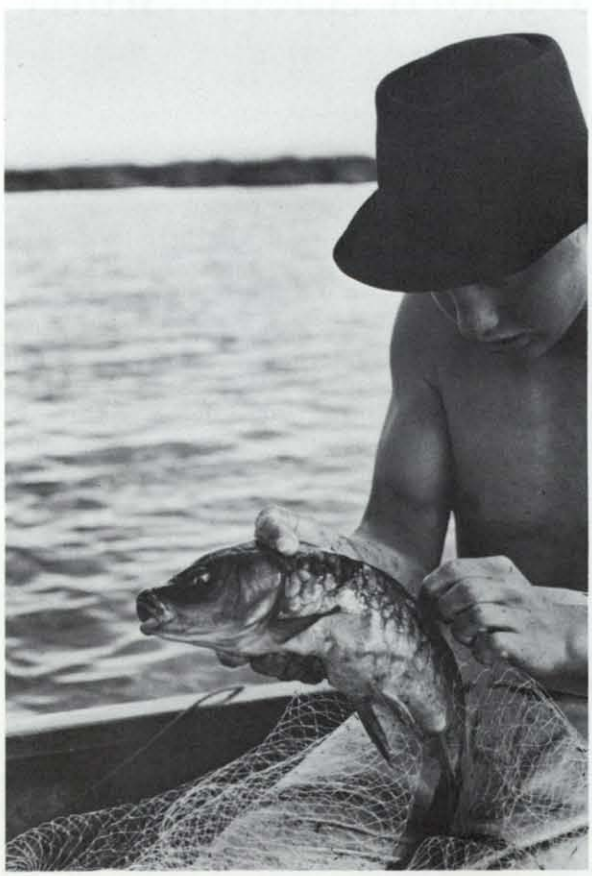
To understand the role the marsh plays in filtering sediments and nutrients coming from the Bear River watershed and to determine how these elements affect the production of fish, wildlife and plants, a multidisciplinary team from the University of Idaho was formed. Funded by a $240,000, two-year grant from the U.S. Fish and Wildlife Service, the team is quantifying the sediments and nutrients flowing into and out of the marsh and studying the plants, birds and fish in the marsh.

"Interrelationships among the plants, fish, invertebrates, birds and mammals using the marsh and the nutrients and sediments cycling through the marsh must be known to evaluate the effects of the different methods of reducing the sediment problems," said Ted Bjornn, of the Cooperative Unit and principal investigator of the study.

The researchers spent this summer field season gathering information on fish and wildlife habitat at the marsh. They established 20 major monitoring sites to record water flow into and out of the marsh and sampled suspended and bedload sediment to evaluate sedimentation during various marsh management operations. Phytoplankton, zooplankton and macroinvertebrates were sampled and nutrient processing was monitored.

The researchers used experimental gill nets to capture and tag fish to determine the species composition, numbers and density of fish in the marsh. Carp (*Cyprinus carpio*), Utah Chub (*Gila Atraria*), and Utah sucker (*Catostomus ardens*) were the three most abundant species of the nearly 4,000 fish captured.

Wildlife researchers located and described nesting sites for various ducks, shorebirds, Canada geese and other birds along 45 miles of transects in the refuge. They made estimates of bird production and how many fish the birds consumed in the study area.



Carp were found to be among the most abundant of Bear Lake Species.

Data collected in the study will be used to develop a model of marsh function to enable managers to know what kind of nutrient processing occurs in the marsh, what is exported as bird or fish biomass and what quantity of nutrient/sediments or biomass stays in the marsh, filters into Bear Lake or is released downstream. This information should allow managers to predict how different water management strategies will affect the fish and wildlife in the Refuge.

Flow monitoring is an important aspect of the Bear Lake study.

Hornocker Directs New Wildlife Research Institute

Maurice Hornocker
Elwood Bizeau

Maurice Hornocker, internationally known for his research on cougars in Idaho's Frank Church-River of No Return Wilderness, will direct a new Wildlife Research Institute at the University of Idaho to conduct long-term research on endangered and sensitive species. Hornocker, a professor of wildlife resources, will cooperate with the Department of Fish and Wildlife Resources, but will delve more into the private sector as he pursues new projects through the nonprofit Institute.

"The Institute will combine the ease of doing business in the private sector with the credibility of an educational institution as we do creative wildlife research to try to make lasting contributions to man's knowledge of the natural world," Hornocker said.

The research will investigate different wildlife species, how they fit with the ecosystem, habitat, conservation and other issues of survival. "Habitat destruction is probably the biggest problem facing wildlife," Hornocker said. "Research effort will be directed on how to successfully perpetuate those species finding it difficult to adjust to man's intrusions on their habitat."

Three of Hornocker's personal projects will be stressed as researchers continue studies of the cougar in the northern Rockies and contrast them with cougar in a new study in the drier habitat of south-central New Mexico. A third project will study lynx in north-central Washington.

"The Institute will look at game and nongame species about which we need new data," Hornocker said. "We may be looking at wolverine, the bobcat, badgers, leopards in Africa, or other species throughout the world."

Maurice Hornocker and tranquilized subject of earlier cougar study.

Hornocker

Hornocker said the people he looks for as researchers are those he calls "naturals–people with desire, intelligence, love for what they are doing, a keen sense of observation and someone who really wants to excel." Researchers today must be aware of all factors in the environment–from the water, soils, wildlife and habitat to the economic, cultural, social and political arenas, Hornocker said. "The Institute will allow us the flexibility and freedom to conduct research without some of the constraints on people in public life," he said.

A major goal of the Institute will be to communicate the results of the wildlife studies to the public through newspapers, television or film much as Hornocker's cougar research was featured in a National Geographic Society television documentary. It showed how Hornocker and his researchers captured, tagged and equipped cougars with radio-tracking collars to discover their home range, feeding and breeding habits and to end the myth that they were bloodthirsty livestock, elk and deer killers that should be shot on sight. His findings led the Idaho Department of Fish and Game to give the animals big game status and the public to recognize them as necessary parts of the wilderness ecosystem.

Hornocker said he will wind up many of the continuing research projects he started as leader of the Cooperative Wildlife Research Unit, but that as the Wildlife Research Institute gears up, graduate students may have opportunities to work in new projects.

Hornocker believes some of his greatest accomplishments with the Research Unit have been in training people how to do wildlife research, then allowing them the freedom to pursue it and later communicate their findings to the public. "Many of my students are now in high professional positions doing excellent work all around the country," Hornocker said. He also had great praise for his colleagues at the College of Forestry, Wildlife and Range Sciences. "It has been people like Ernie Ables, Jim Peek, Oz Garton and others and strong support from the Idaho Fish and Game Department that have helped me gain the reputation and credibility to establish the Research Institute."

Initial financial support for the Institute was provided by a bequest to the National Wildlife Foundation for the specific use of Hornocker, who this year became the senior scientific adviser to the Federation's Institute for Wildlife Resources. Income from the endowment will pay his salary while other costs of research and administration will be funded by private and public funds generated from individual projects. "We'll be wholly self-supporting," he said.

Hornocker will be assisted by biologist Elwood Bizeau and Jeanne Wallace, administrative assistant. Bizeau, former assistant leader of the UI Cooperative Wildlife Research Unit, is the principal investigator in a project to produce more whooping cranes, an endangered species. Bizeau is attempting to start a new flock of whooping cranes by having sandhill cranes hatch and raise whooping crane eggs at nesting sites near Gray's Lake in southeastern Idaho.

The Institute is located in Room 316 of the UI Continuing Education Building and is associated with the University of Idaho Foundation.

Mechanical strength tests being carried out on a wood-cement test specimen.

Reduced Cement Content Produces Versatile Cement-Bonded Particleboard

Investigators:
A.A. Moslemi
Stephen C. Pfister

The commercial acceptability of cement-bonded particleboard would be enhanced by reducing the product's cement content, and thus its weight. But what would be the effect of such a reduction on the strength and dimensional properties of the board? A recently completed Forest Products Department project charted the effects of cement reduction on cement-bonded particleboard and provides the information necessary for manufacturers of such products to engineer cement-bonded particleboard properties to actual use requirements.

Professor A.A. Moslemi and graduate student Stephen C. Pfister used lodgepole pine exclusively, due to its availability and low cost and to the acceptable compatibility of this species with cement hardening.

Their study involved examining the effects of decreasing the cement/wood ratio from 3.0 to 1.5 at 0.5 increments on the flexural and dimensional stability of resulting panels. Two types of portland cement (types I and III) were employed to determine if differences exist between the properties of boards manufactured with the two types. Additionally, two different cement cure periods—14 days and 28 days—were used to determine the effects of different curing times on board properties.

Their results indicated that the modulus of rupture (maximum strength) increases, up to a limit, as the cement/wood proportion is lowered. A cement/wood ratio of 2.0 was found to result in optimum bending strength. The modulus of elasticity (stiffness), however, increases with a higher cement/wood ratio.

When exposed to standard water soak tests (submerging the samples for 24 hours), the wood/cement panels made during the project exhibited a dimensional stability superior to that of conventional particleboards. This result indicates that the product will maintain excellent dimensional stability when exposed to the rigors of exterior applications.

The 14-day cure period resulted in adequate strength development, with no additional significant gains made when the cure period was extended to 28 days.

The project demonstrated that the cement content of cement-bonded particleboard can be lowered significantly without adverse effects, thus producing a lighter, more commercially versatile building product.

Super-Critical Fluid Sought to Remove Wood By-Products

Investigator:
Alton Campbell

Improving the quality of pulp for paper production by removing valuable chemical by-products before wood chips are processed into pulp is the goal of a Forest Products Department research project. Investigator Alton Campbell hopes to find a supercritical fluid—a dense gas under high pressure—capable of extracting turpentine and tall oil, which can be used for chemicals, coatings, and paper additives.

Benefits of the research should include increasing the yield and purity of the turpentine and tall oil, improving the pulp quality, and saving energy by eliminating conventional recovery programs.

The project will identify and quantify the chemical components of the extracts and examine the wood chips microscopically to determine the effect of the gases on the wood chips.

Data collected will be put through a computer simulation to assess the potential impact of the process on a pulp and paper mill and its energy consumption. The data will be used for an economic evaluation of the extraction process using supercritical fluids.

The researcher hopes the process will improve mill effluent quality as well as reduce energy and improve pulp mill production.

If initial tests prove successful, Campbell hopes to obtain a $250,000 grant from the Department of Energy to study the process over a 3 to 4-year period.

Value of Waste Wood Recovery Studied

Investigators:
Leonard Johnson
Harry Lee
Mick Koppang

Forest Products Department scientists are working with officials of the Clearwater-Potlatch Timber Protective Association (CPTPA) to evaluate field studies conducted this summer to test the cost benefits of on-site recovery of waste wood with potential value as an energy source or as firewood.

Funded by a $98,353 grant from the Bonneville Power Administration, the investigators are evaluating field studies using conventional and modified logging equipment to convert slash timber into a more transportable and marketable product. The equipment includes a hydraulic shear for producing 18- or 48-inch firewood and a high-torque, low horsepower grinder to produce hog fuel, the sawdust and wood chips used to fuel boilers or other equipment.

The CPTPA, headquartered in Orofino, Idaho, has the responsibility for fire abatement and control and slash disposal on a large block of state and private land in north-central Idaho. Earlier research studies indicated the potential for removing forest residues from the forest stand. However, high costs were encountered when the material was moved to a landing site, decked and later removed for processing, due to the time requirements for the decking and removal steps. However, the investigators projected a cost benefit if a "hot" processing system was used at the logging site or landing.

To test the projections, a cable yarder was matched with CPTPA's hydraulic shear on one module and a modified ground-based skidder was tested in the second module. Production and time studies at both operations allowed scientists to identify delays and problems in hot processing. Other data collected included the time and cost involved in conventionally disposing of slash at landing sites and in producing firewood with chainsaws. Information gathered at the sites and residue recovery data will be integrated into a microcomputer decision model to compare the recovery costs at given sites.

When all the data have been assembled, modeling efforts will be made to determine whether forest residues can be recovered cost-effectively and used for firewood or for energy.

Students Gain Experience; Help Sawmill

Investigators:
Robert Govett
David Lange
Larry Gregory
Kevin Cooper
Chris Danforth
Eric Godshall
and others

A feasibility study conducted by students in the Department of Forest Products not only helped put a small Elk River, Idaho, cedar mill into operation, but also provided the students an opportunity for unique "real world" experience.

Directed by Professor Robert Govett, the students developed the study through spring and summer of 1984 for Robert Pfiester, Elk River, who had earlier sought the aid of the Clearwater Economic Development Association (CEDA) in acquiring loans for his proposed business. CEDA administers loans made to small businesses through a loan program combining private and public lending agencies and designed to spur development in Clearwater County.

To apply for his loans through CEDA, Pfiester needed to document the existence of a market for his products—cedar fencing, siding, indoor paneling, and specialty items—to demonstrate his business ability, and to submit pro-forma financial statements. This is a complicated process for one man, requiring a myriad of data collection and analysis.

Accordingly, CEDA official Joe Overstreet contacted the Department of Forest Products for possible help for Pfiester in compiling the required pro-forma financial statements. Seeing a great opportunity for practical experience, Govett put together a team of his students, who set out to gather and analyze the necessary data.

Aided by computers, they analyzed the data and generated operation recommendations, methods of assessing lumber output and productivity, estimates of working capital requirements, and financial statements and income projections.

Given this information, CEDA was able to negotiate Pfiester's loans. The mill began operations in September 1984. A study was conducted after the mill's opening to confirm the accuracy of the students' analysis.

Beyond the immediate benefit to the students and to Pfiester is the project's potential economic benefit to the Elk River area. Pfiester purchases cedar locally, from Potlatch Corporation and from other firms and individuals selling cull cedar. Pfiester's operation attracted a shake mill that set up operations next to Pfiester's mill and worked in conjunction with it. Unfortunately, due to the owner's health problems, the shake mill closed recently and is currently for sale.

As an epilogue to the story, Pfiester is currently looking into export opportunities and may soon be sawing for the export market.

Forest Products students collect data at the Robert Pfiester cedar mill, Elk River, Idaho.

Black Bear Damage to Timber Stands Studied

Investigators:
David L. Adams
Andrew C. Mason

Tree damage and mortality caused by insects, disease or fire are widely recognized problems in the Inland Northwest, but less is known about the impact wild animals have on forest regeneration. Andy Mason, a master's degree candidate working with Forest Resources Professor David L. Adams, has been studying bark stripping and sapwood feeding by black bears in northwestern Montana to determine if bear damage is significant and related to certain tree species or stand density.

Three study areas were chosen on the Yaak District of the Kootenai National Forest where bear damage in thinned and unthinned stands of various size classes and species could be compared.

Bear damage was first recognized in this area in the mid-1970s and was most evident in recently thinned stands of wildfire origin. The damage seemed to be restricted to 4- to 7-inch DBH trees primarily in two species, lodgepole pine and western larch. Informal surveys in some damage areas indicated that up to 50 percent of the crop trees were damaged. In one thinned stand, more than 40 percent of the trees were killed by complete girdling.

"The potential impacts to long-term timber management in northwestern Montana are particularly significant due to the large acreage of wildfire origin stands that are reaching the size classes the black bears seem to prefer," Adams said.

Precommercial thinning is an indicated need on many of these overstocked areas, but bear damage seems to be concentrated in thinned stands. Contract thinning costs exceed $100/acre, but this may be a questionable investment if subsequent bear damage results in understocking.

The bear damage study was initiated in 1984 to determine if bear damage is related to stand density, to estimate the effects of bear damage on growth and yield over the period of commercial rotation and to determine whether bears seem to prefer certain species or size classes of timber.

If the researchers find the bear damage is significant, they will recommend management actions for high risk stands.

Black bear did an effective job of girdling and eventually killing this tree.

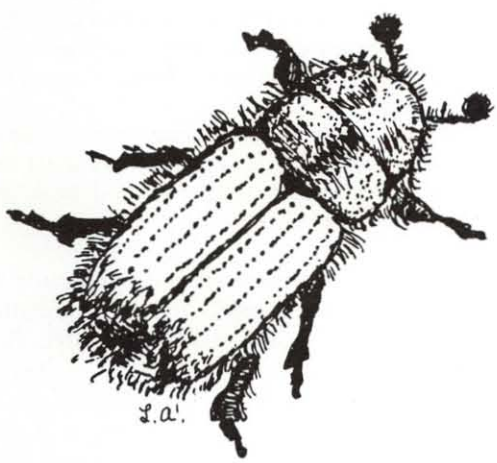
Bark Beetle/Host Relationship Studied

Investigators:
Molly W. Stock — **James H. Cane**
David L. Wood — **Sandra J. Gast**

Bark beetle species in the genus *Ips* are the second most destructive group of insects (after *Dendroctonus* species such as the mountain pine beetle) attacking pines in North America. Both alone and in association with *Dendroctonus* species, *Ips* beetles kill young and mature pines, often over very large forested areas.

Research over the past two decades has resulted in the identification of several chemical compounds involved in communication and group behavior of these and other bark beetle species. These compounds, termed pheromones, are released by beetles penetrating the outer bark of the tree. Hundreds more beetles of the same species are then rapidly attracted to the tree, and through their tunneling activity and introduction of pathogenic fungi into the wood, interrupt the flow of water to the needles, causing death of the tree.

In a cooperative National Science Foundation-sponsored multidisciplinary research project incorporating studies of insect taxonomy, behavior, biochemistry, and genetics, Molly Stock, UI professor of forest resources, David L. Wood, professor of entomology at the University of California, Berkeley, and James H. Cane, assistant professor of entomology, Auburn University, Alabama, are attempting to unravel the mechanisms by which a closely related group of *Ips* species in California distinguish (or fail to distinguish) their close relatives and their host and nonhost pines. At the same time that they develop information on these discrimination behaviors and host associations, they will elucidate the structures of the chemicals that stimulate these complex behaviors. Such chemicals have immediate practical value for controlling damage produced by these insects. The compounds are highly selective in their action, virtually nontoxic, and active in very small amounts. Mass-trapping of *Ips* beetles with attractants, and the use of other compounds as feeding deterrents are two promising tactics that could be developed as a result of this research effort.



Scientists seek to control the destructive bark beetle by learning more of the chemicals that control the insect's behavior.

In a related study, Professor Molly Stock and Sandra Gast, a graduate student in forest resources, are investigating physiological and genetic aspects of host selection behavior in Idaho *Ips pini*. They are particularly interested in determining what types, if any, of differences occur between early- and late-attacking beetles, and beetles attacking live vs. fallen trees.

CHEAPO II Helps Analyze Economics of Silvicultural Alternatives

Investigators:
E. Lee Medema
Joseph E. Horn
Ervin G. Schuster

Public and private forest managers who need to assess the economic implications of different forest management options will have a new tool. A computer-based economic analysis model called CHEAPO II has been developed by researchers at the University of Idaho and the U.S. Forest Service to enable forest managers to analyze economic options of silvicultural alternatives.

CHEAPO (Computerized Help for the Economic Analysis of Prognosis Model Outputs) was developed in 1982 by E. Lee Medema and Charles R. Hatch of the Department of Forest Resources under contract with the Forest Service Intermountain Forest and Range Experiment Station at Missoula, Montana. They linked the economic model to the Forest Service's Prognosis Model, which gave projected growth response resulting from different forest practices on forest stands in north Idaho.

Changes in the Prognosis Model, including the ability to model stand regeneration and outbreaks of the Douglas-fir tussock moth, made the original version of CHEAPO obsolete, but the need to assess economic implications continued.

UI researchers E. Lee Medema and Joe Horn, assisted by Ervin Schuster of the USDA Forest Service, developed CHEAPO II to enable users to undertake economic analyses

with the current version (5.0) of the Prognosis Model and its associated extensions. The researchers have added new features and analytical capabilities as well.

CHEAPO II uses information from two data files—one generated by the Prognosis Model and the other developed by the user. The user-created file uses keyword records to instruct CHEAPO to:

- perform one of three types of economic analyses,
- develop the costs and revenues associated with a variety of silvicultural practices, and
- indicate how to present output and data reports.

The end product is a printout of tabular information with a display of the set of instructions given to the system, the economic analysis results, a listing of the undiscounted cash flow, and optional stand tables.

A user's guide to CHEAPO II provides an overview of the model and information on the model's input requirements. An explanation of the tabular output will be available later this year when it is published as a technical report by the USDA Forest Service Intermountain Forest and Range Experiment Station, Missoula, Montana.

Value Of Advanced Grand Fir Analyzed

Investigators:
James Cathcart
Charles W. McKetta

Multi-storied stands with advanced grand fir regeneration are common on northern Idaho's most productive timberlands. These stands were created by periodic partial cutting since the 1940s that removed species such as western white pine, western larch, and Douglas-fir. The lower valued grand fir remained to provide natural regeneration, causing a stand structure characterized by layered advanced regeneration under a mature overstory.

Forest owners are faced with an interesting problem on these productive sites. Should the stands be managed for the advanced grand fir established on the sites or converted to plantations of more desirable species?

If the advanced grand fir is managed, establishment costs are zero, but product values are low and managers have little control over stand stocking and structure. In replanting, forest managers may select for species and product value and control stocking and stand structure, but lose an established stand and face higher establishment costs, a longer wait, and the possibility of plantation failure.

Two forest economics researchers are testing the hypothesis that immediate conversion of multi-storied grand fir stands to plantations (particularly to western white pine) is financially optimal. A secondary hypothesis is that advanced grand fir management does not justify intensive strategies.

The research, conducted by James Cathcart, under the direction of Forest Resources Professor Charles W. McKetta, is designed to demonstrate how to apply economic analysis techniques to management problems in existing timber stands. Capital theory applications of forest economics have been selected for compatibility with the silvicultural and ecological aspects of advanced grand fir management.

Initially the researchers evaluated the investment potential of releasing advanced grand fir stands and the desirability of incurring higher logging costs that would protect regeneration during overstory removal. Three management options were compared and the results tabulated for both financial and biological rotations:

1. immediate stand conversion to plantations;
2. stand conversion after one grand fir rotation;
3. advanced grand fir management in all future rotations.

The analysis assumes permutations of low (4 percent) and high (7 percent) discount rates, constant prices, and increasing price expectations (2 percent per year). They generated yield tables for different advanced grand fir management regimes based on two inventoried case stands, as well as for suitable plantations on *Thuja plicata/Clintonia uniflora* sites, using the Stand Prognosis Model, version 5.0. Net present value calculations use the prognosis economic analysis package, CHEAPO II. The project should be completed this fall. Preliminary results support both research hypotheses for the cases tested.

Future timber management could rely more heavily on natural stands, but it depends on relative growth rates, product values, practice costs and interest rates. The type of detailed economic analysis used in these cases can be replicated easily to test other stands. Estimating the investment potential for advanced grand fir on a case-by-case basis will help managers evaluate the silvicultural trade-offs associated with managing this regionally important species. It will also help evaluate the trade-offs between timber production goals and the multiple use potentials inherent in these multi-storied stands.

Shrub Succession Model Will Help Resource Managers

Investigators:
Leon Neuenschwander
Kirk Steinhorst
Penny Morgan

A model that will help resource managers predict what successional shrub community will follow clearcutting and broadcast burning has been developed by Forest Resources researchers. Professor Leon Neuenschwander, graduate student Penny Morgan and Kirk Steinhorst, a statistics-math professor, synthesized ideas from a number of research and modeling approaches into a simple diagrammatic model of critical successional processes and influences.

"We show that the current difficulty of predicting early succession can be overcome when simple relationships and causal factors are identified," Neuenschwander said. "Environmental conditions, existing vegetation, regeneration sources, kind and severity of disturbance and chance are important influences on successional patterns." The researchers integrated several modeling approaches with time-dependent stochastic and deterministic equations to create a simulation model that allows multiple successional pathways.

This model will allow the resource manager to predict shrub succession from *preharvest* data. "Given that the tree canopy is closed and the severity of disturbance is known, as well as the sources of propagule density, or cover of the existing preharvest vegetation and habitat type," Neuenschwander noted, "the model will generate compound probability distributions that predict the establishment and growth of individual shrub species following clearcutting and broadcast burning."

The model has many applications. To the forester, shrub competition to conifer regeneration may present a potentially serious problem. Predicting the competing vegetation before prescribing a particular silvicultural treatment may identify alternative silvicultural options to reduce the impact of competition from a particular shrub species on the conifer regeneration. If the rate of high growth is known for the conifer seedling, the time frame in which competition will reduce growth can be determined and, if necessary, conifer release measures can be prescribed based on the shrub composition and growth rates. Release measures can be included in the silvicultural prescription or in the regeneration plan before the stand is harvested.

To wildlife and range managers, desirable plants can be identified and alternative prescriptions can be evaluated to increase the abundance of these species. The time frame for the availability of use can be identified and the carrying capacity, thermal and hiding cover relationships can be determined. Harvest scheduling and secondary treatments can be planned in areas to achieve a better distribution of animals or to increase the diversity and age classes of habitats.

The operational stochastic-deterministic simulation model of shrub succession was developed for the *Thuja-plicata/Clintonia uniflora* habitat type following clearcutting and broadcast burning. The conceptual model is valid in other forest habitat types and with different harvest regeneration and site preparation methods. The U.S. Forest Service, Northern Fire Lab, U.S. Army Corps of Engineers and the University of Idaho have cooperated in the development of this model.

Expert Systems Applied to Natural Resources Management

Investigators:
Molly W. Stock
Jacqueline L. Robertson
Robert N. Coulson

During the last decade, our knowledge base in virtually all areas of forestry has grown dramatically. This knowledge includes complex mathematical models as well as quantitative and qualitative technical information. Finding appropriate answers to practical questions posed by natural resource managers is becoming a more difficult and ambiguous process, and human experts who can help provide these answers are scarce. One of the major challenges for forest science in the near future is to develop better ways to integrate and deliver the available, pertinent information to the user community.

Expert systems, a branch of computer sciences known as artificial intelligence, are some of the most promising tools for achieving this aim. An expert system is the computerized distillation of the knowledge base and the decision-making processes of one or more experts in a field. An expert system is developed specifically to be "user-friendly," requiring the user to know only about his/her problem, not how to use a computer. One well-known expert system, for example, is widely used by physicians to diagnose bacterial infections and to prescribe specific kinds and doses of antibiotics.

In a cooperative effort, Molly Stock, professor of forest resources, Jacqueline Robertson, Principal Research Entomologist with the USDA Forest Service, Berkeley, and Robert Coulson, professor of entomology, Texas A&M

University, are developing an expert system that can be used to help forest managers make decisions concerning chemical control of forest insect pests in western forests. Ultimately, the system will be broadened to include a diversity of potential management techniques.

As part of a long-range commitment to application of expert systems methodology at the University of Idaho, Molly Stock will spend the 1985-86 academic year as an associate in the Boeing Computer Services Artificial Intelligence Program. Of the 10 participants chosen for the 12 months of intensive, advanced training in this new area of technology transfer, Stock is the only non-engineer.

New Book Describes Idaho Willows

Steve Brunsfeld
Fred Johnson

The largest and most widely-distributed group of woody plants in Idaho are the willows. They are important sources of food and cover for many species of wildlife, such as deer, elk and beavers. Willows also provide forage for domestic sheep and cattle. They have a major role in streambank stabilization and watershed protection and their presence along streams is often an important part of the fisheries habitat. Despite the importance of willows, their identification, distribution and ecology remain an enigma to land managers. For east-central Idaho, however, a new publication will take the mystery out of willow identification.

"There are about 35 types of willows in Idaho," according to Steve Brunsfeld, senior author of *A Field Guide to Willows of East-central Idaho*. "Willow identification is difficult for land managers because existing books emphasize short-lived flower and fruit characteristics which are not present during most of the field season." Preliminary studies showed that a regional field guide was feasible and an ecological sampling system was devised. East-central Idaho was the chosen area since great diversity of topography and climate results in a remarkable variety of willows. There are 27 kinds of willows in the guide, which covers an area of just over 5 million acres, essentially, the upper Salmon River watershed.

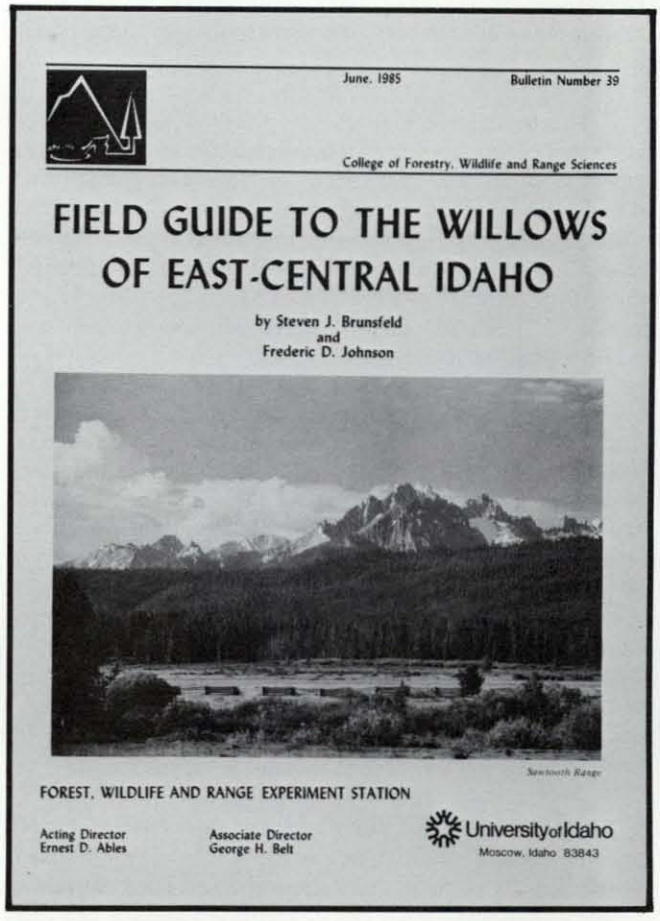
This technical guide includes willow descriptions, identification keys, ecological information, distribution maps and elevational transects. Recognition of species is simplified by 72 color photos.

The authors emphasize that a *Field Guide to Willows of East-central Idaho* is a valuable management aid not only to foresters, but to range, wildlife, and fisheries professionals as well.

Thought to be the only comprehensive willow guide in the U.S. designed for the land manager, the book is the first in a series of region-by-region guides for Idaho willows.

The 95-page book was published by the Forest, Wildlife and Range Experiment Station as Bulletin No. 39. Substantial financial support was provided by the Intermountain Region of the U.S. Forest Service, with field work supported by the Stillinger Foundation. Also cooperating were Idaho offices of the Bureau of Land Management and the Soil Conservation Service.

Copies of the book may be purchased for $20 from the Editor, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID 83843.



This recently published field guide will aid land managers in identifying willows.

Researchers Seek Wilderness Monitoring Indicators

Monitoring for human-caused changes is essential to the preservation of wilderness areas. *Redfish Lake in Idaho's Sawtooth Mountains.*

Investigators:
Edwin E. Krumpe
Linda Merigliano
Jo Ellen Force
William J. McLaughlin
Gerald R. Wright

As wilderness use increases, what indicators give managers the most useful information about unacceptable changes in wilderness conditions? Researchers in the Department of Wildland Recreation Management are identifying and evaluating indicators that can detect and monitor human-caused change in wilderness conditions.

Wilderness managers in the Forest Service are directed "to promote, perpetuate, and, where necessary, restore the wilderness character of the land and its specific values of solitude, physical and mental challenge, scientific study, inspiration and primitive recreation." However, little information is available to help managers select indicators that will provide the most useful information to monitor soil, water, air, wildlife, vegetation and recreation experience conditions, according to Edwin E. Krumpe, associate professor.

For example, should fecal coliform, dissolved oxygen, turbidity or some other variable be used to monitor water conditions? Should the number of campsite encounters, perceived crowding or some other variable be used to monitor recreation experience conditions?

The study, co-sponsored by the Wilderness Research Center and by the McIntire-Stennis fund, is being conducted by Linda Merigliano, Wildland Recreation Management graduate student and research assistant, who calls on a national panel of biological, physical and social scientists to evaluate potential indicators reflecting important wilderness properties. The panel initially suggested over 200 indicators; this list was narrowed to 32 selected most often as the best indicators.

Wilderness Monitoring Indicators

Although research has been done in the past on campsite and trail conditions, water quality, wilderness recreation experiences and human impact on wildlife, this is the first attempt to bring together the expert knowledge on these topics and evaluate the potential indicators in terms of one set of criteria," Krumpe said.

Increasing interest in monitoring programs has been stimulated by new legal mandates that require federal resource agencies to develop monitoring programs to preserve the wilderness.

Assisting in the study are William McLaughlin, head of the Wildland Recreation Department, and professors Gerald Wright of Wildlife Resources, and Jo Ellen Force of Forest Resources.

Wilderness Management Workshop Yields Five-Year Action Plan

Edwin E. Krumpe

In the fall of 1983 the Wilderness Research Center conducted the First National Wilderness Management Workshop, attended by more than 400 wilderness managers, scientists, and citizens, including leaders of all four federal agencies that manage wilderness (see *FOCUS*, 1984). Proceedings of this important conference were published in *Issues in Wilderness Management* (Westview Press, Boulder, Colo.), edited by Michael Frome, noted conservation author and visiting professor. During the conference, Edwin E. Krumpe, director of the University of Idaho Wilderness Research Center and professor of wildland recreation management, was selected to lead a steering committee in developing a National Wilderness Management Action Plan for all the wilderness management agencies.

The national steering committee–made up of representatives from recreation, preservation, commercial, commodity production, state resource management agencies and the four federal wilderness management agencies–defined its purpose as the development of a National Wilderness Preservation System Management Action Program identifying and defining the issues facing wilderness management in the next five years and recommending solutions.

Starting with the ideas emerging from the national workshop, the committee settled upon five broad umbrella issue categories: (1) educating the public, (2) education and training of managers, (3) capacity and concentrated use, (4) interagency coordination and consistency, and (5) acceptable wilderness management practices. Members of the committee drew upon the material generated at the workshop to recommend several actions for each of the five broad categories. Their goal was that the recommended actions should be brief and specific, attainable within five years or less, expressed as actions rather than statements of policy, and, above all, feasible.

The committee discussed at length whether to include "funding" as an issue category. The committee reasoned that funding is an ever-present problem in all areas of resource management. Rather than focusing on the lack of funds, it was decided to concentrate on what actions should be done if the money were available. Their rationale was that a sound program of recommended actions should serve as a strong base to seek adequate funding. Furthermore, the committee decided the action plan would not deal with allocation of additional wilderness areas. Allocation is a separate political issue and the action plan would continue the focus of the workshop: "taking care of what we've got." Finally, they agreed that additional legislation would not be proposed. Existing legislation and directives to protect and perpetuate wilderness are broad and clear.

The committee met for two 2-day workshops. University of Idaho Wilderness Research Center personnel were used as meeting facilitators. After several committee drafts and numerous phone calls and letters, a draft for public comment was developed.

The steering committee's draft action program was distributed to all workshop participants and to others interested in wilderness management. Over 700 copies were sent out, and more than 200 individuals took the time and effort to respond. Although the committee welcomed public involvement, tabulating and summarizing the 1600 individual comments received was a formidable task. Almost 100 pages of summarized comments were produced for the detailed consideration of the steering committee. Their publication, *Wilderness Management–A Five-Year Action Program* (Krumpe 1985), has now been published and made widely available to the public. Out of the 23 actions recommended under the five broad categories, the steering committee chose the following five as the most important.

- Examine existing wilderness education techniques and evaluate their effectiveness. Be sure wilderness education material defines the wilderness resource and its values.

- Institute and revitalize comprehensive in-service wilderness management training, focused on the value of the wilderness resource, wilderness ethics, and low-impact camping, utilizing both agency and nonagency expertise.

- Identify, monitor, and publicly report internal and external threats to wilderness values from whatever source, whether overuse, acid rain, other forms of degraded air quality, visual or sound impairments.

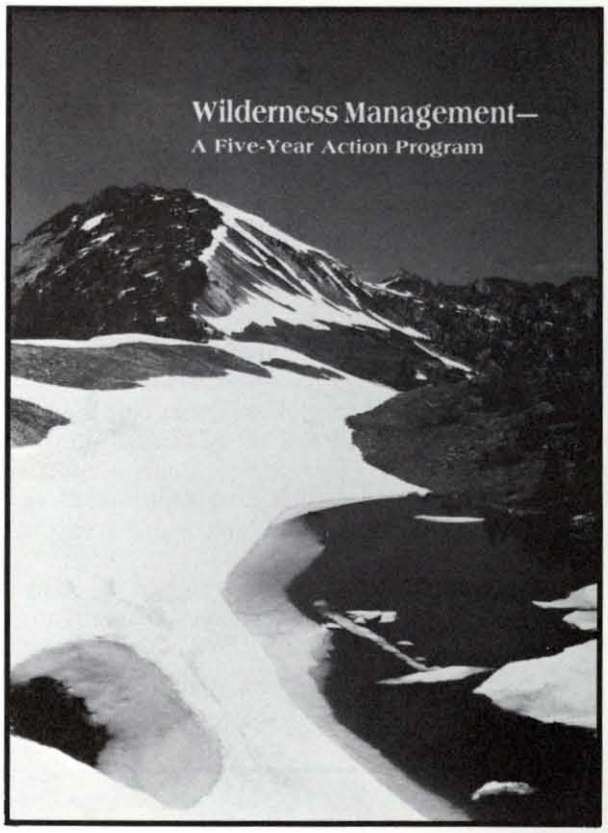
• Manage indigenous plant and animal communities to sustain natural processes, assuring that levels of human use are compatible, rather than detrimental, with emphasis on preserving endangered and threatened species, as required by law.

• Conduct workshops and other programs, nationally, regionally, and locally, as cooperative ventures of agencies, educational institutions, and interest groups in order to share ideas, concerns, and techniques relating to wilderness management.

What Needs To Be Done

Obviously, much remains to be done to ensure effective and responsible management of our priceless wilderness heritage. The national steering committee utilized a process whereby broad public involvement was focused on the problems and issues facing wilderness management. The key to success is that the actions recommended are to be undertaken cooperatively by federal wilderness management agencies, the public, the private sector, and nonprofit organizations.

Throughout the 23 actions are items that no single agency or organization should be responsible for undertaking. Rather, all those interested in wilderness management can play a role and do their part to help accomplish the recommended actions. The challenge is to get on with the cooperative management of wilderness.



This booklet—made available to the public—summarizes the 23 actions recommended for wilderness management.

How Do Native Americans Perceive National Parks?

Investigators:
Sam H. Ham
Carolyn Dragon

Why native Americans are not well represented as national park visitors is the subject of research by Sam H. Ham, assistant professor of Wildland Recreation Management, and Carolyn Dragon, research assistant. Although national parks are considered "available" to all Americans, studies of national park visitors show many ethnic minorities, including native Americans, to be underrepresented in per capita visitation rates.

"There is clearly a need to understand why native Americans aren't, as a group, more enthusiastic about visiting national parks if the National Park Service is going to serve the interests of this important segment of the American population," Ham said. The study, funded by a seed grant from the UI Research Council, is being conducted in cooperation with the Nez Perce Tribal Executive Committee in Lapwai, and the Nez Perce National Historical Park in Spalding.

The study will test two major theories. Dragon said, "Our review of literature seems to boil the problem down to two basic ideas. Either native Americans *can't afford* the costs of national park visits or they simply don't *care much* about going to national parks. Our study will try to ferret out which explanation is best—the economic discrimination model or the cultural choice model."

Ham said whichever explanation is best will tell what, if any, actions might be taken by federal agencies to make national parks more responsive to the needs of native American visitors.

"Nobody is suggesting that native Americans would somehow be better off if they visited national parks more often," Ham said. "In fact, there are many reasons to be-

lieve that national parks don't fit very well into native American cultural views, especially those concerning nature and American history. We simply want to make sure that they aren't being shut out economically, and to find out what specific cultural views they hold concerning national parks."

The study involved household interviews with random samples of residents in Lapwai, Idaho, on the Nez Perce Reservation, and Juliaetta, Idaho, a predominantly white community located less than an hour from Lapwai. Besides examining past visitation to national parks and socioeconomic indicators, the interviews measured native Americans' and whites' perceptions concerning the role of humans in nature, protection of sacred lands, acquisition of lands by the federal government, symbolic meanings attached to national parklands, and depiction of native American culture within national parks.

Other UI faculty members advising in the study are Gary Machlis, associate professor of forest resources and sociology project leader with the FWR Cooperative Park Studies Unit, and William Swagerty, associate professor of history.

Natural Resource Tourism: A New Direction

Charles Harris
William J. McLaughlin
Sam Ham

Tourism is becoming an increasingly important sector of Idaho's diversifying economy, and the Department of Wildland Recreation Management is currently expanding its research activities in recognition of the growing significance of the tourism and outdoor recreation industry for Idaho's economic development. In the past, the department has emphasized behavioral research that facilitates the recreation and people-related management activities of public resource management agencies. Although the Wildland Recreation Management Department has been involved with Idaho's travel and tourism industry for several years through its service activities, it has only been recently that recognition of the opportunities and needs that exist for properly managing natural resource tourism has resulted in an expansion of the department's research efforts to include a focus on activities of the private sector.

One important step in this new direction has been the department's organization and leadership of a Governor's Conference on Outdoor Recreation and Tourism held in October 1984. Co-sponsored by other state agencies, that conference brought together nearly 90 individuals from the private business and public sectors concerned with improving the promotion and management of tourism development in Idaho. In addition to speeches and panel discussions, small group sessions identified the issues perceived by the participants to be most critical for more effective management, planning and promotion of tourism and recreation in the state. For the hundreds of issues suggested, eight major categories were identified, and conference participants proposed actions to resolve those issues. The results of the Governor's Conference were then presented to representatives of Idaho's tourism industry at the state's Annual Travel Conference held in May 1985.

In response to one of the more critical issues identified, a Tourism Industry Coalition of Idaho has been established to continue the dialogue initiated at the conference and, more specifically, to provide the opportunity for coordinating informational and educational exchanges among all agencies and organizations involved in tourism in Idaho. Ideally, the coalition's efforts will yield better understanding and decision-making concerning tourism. Professor Charles Harris of the Wildland Recreation Management Department is a member of the Coalition's steering committee, where he represents the department's willingness to serve as a future center for tourism research and as a data repository.

An interest in continuing education was also expressed at the Governor's Conference, and the department responded to this interest during the summer of 1985, when Professor Sam Ham began organizing a Tourism Training Institute to improve the operations of participants' travel and tourism businesses. The institute's objectives are to increase the skills of owners and managers in tourism management and promotion and to enable those small tourism businesses to better utilize support services for their industry, including tour operators, travel writers, and other members of the travel infrastructure.

Finally, the department has initiated research on assessing the socioeconomic impact of tourism development on Idaho's small communities. A three-year study to identify the economic impacts of wildland recreation and tourism activities on small rural communities began at Riggins, Idaho. Harris will use methods of regional analysis to study the impacts and will monitor changes in attitudes by residents educated about the potential impacts. Their attitudes will be compared with those of people in a similar community where no educational program will be implemented.

Harris hopes the research will contribute to a better understanding of the role of resource-based tourism in community development and help Idaho residents understand the trade-offs that tourism presents for their communities.

Continuing Education/Extension

Department Of Wildland Recreation Management Looks At Environmental Education

Investigators:
Sam Ham
Daphne Sewing
Mary Rellergert-Taylor

Studies of U.S. public schools show efforts to implement environmental education programs are meeting with limited success although the same studies indicate teachers' attitudes toward environmental education (EE) are highly positive. Efforts to explain this paradox and to stimulate greater attention to EE in Idaho and Washington schools are underway in the Department of Wildland Recreation Management under the supervision of faculty member Sam Ham.

This spring and summer, some 100 elementary school teachers in Palouse-area schools were interviewed by graduate student Daphne Sewing to determine their perceptions of the scope and purpose of EE, its role in public school school curricula, obstacles to implementing EE programs (such as costs, transportation and availability of teaching materials) and the teachers' feelings about their own training and preparation relative to EE. According to Sewing, a science teacher for 10 years prior to enrolling at UI, "We suspect that many teachers are reluctant to launch EE programs simply because they don't have a science background. At the elementary level, this may be a critical problem since most teachers in kindergarten through sixth grade do not have strong training in natural sciences."

Sewing says it is generally recognized in the literature that EE is not synonymous with "science education," and that some of the best EE programs can be found in language arts, social studies, and even in music and physical education. Sewing hopes that results of her study will help determine why more nonscience teachers do not become actively involved in EE.

The study involved interviews with a random sample of elementary teachers from Moscow, Genesee,and Troy, Idaho, as well as Pullman, Palouse, and Oakesdale, Washington. Pending results of Sewing's study, and availability of funds, Ham hopes future investigations can be carried out in a wider geographical area.

A related project was a full-day workshop in EE for elementary teachers, held October 3-4 during Idaho school teachers' "Professional Day." According to conference planner and graduate student Mary Rellergert-Taylor, "The workshop was heavily geared toward nonscience teachers so that we could show them some of the virtually unlimited ways EE can be incorporated into the routine subjects they teach in their classrooms every day." Rellergert-Taylor said that the workshop used the results of Sewing's study. "That way we were in a better position to focus program content on those specific barriers to EE identified by Daphne's study," she said.

The workshop will be sponsored by the Department of Wildland Recreation Management in cooperation with the Public Affairs Office of the Idaho Panhandle National Forests in Coeur d'Alene, and University Continuing Education.

Clark Fork Enrichment Series

Four Seasons of Discovery

Cross-country skiing, archaeology, wildflower identification, nature photography—these were only a few of the topics offered this past year through the Clark Fork Enrichment Series, a schedule of programs designed for the general public and sponsored by the College of Forestry, Wildlife and Range Sciences Office of Continuing Education. Held at the Clark Fork Field Campus, near Lake Pend Oreille, the series allows the public to take advantage of the wide array of expertise represented by the university's faculty and staff. The series' offerings attracted over 300 participants, in steadily growing class sizes.

All programs are scheduled for weekends, with lodging available at the field campus for those programs requiring more than one day.

A new series schedule is now being developed. More information on this year's schedule and on the Clark Fork Enrichment Series may be obtained from the Office of Continuing Education, the University of Idaho College of Forestry, Wildlife and Range Sciences.

CONTINUING EDUCATION
College of Forestry
Wildlife and Range Sciences
Moscow, Idaho 83843

SHORT COURSES, WORKSHOPS, AND SEMINARS

Research scientists in the Forest, Wildlife and Range Experiment Station conduct short courses, workshops and seminars on campus and throughout Idaho and the West throughout the year. The following Continuing Education programs were sponsored, co-sponsored or produced in Cooperation with the Experiment Station or departments of the College of Forestry, Wildlife and Range Sciences during the past fiscal year:

1984

July 9	Forest Habitat Types of Northern Idaho–Fenn
July 14	Getting To Know The Plants of Northern Idaho, Part II–Clark Fork
July 22-28	Fish Ecology and Advanced Wildlife Ecology Workshop–McCall
July 24	Windbreak Workshop–St. Anthony
July 25	Tree Diagnosis Workshop–Pocatello
July 26	Tree Valuation Workshop–Twin Falls
July 27	Urban Forestry Workshop–Boise
July 29-August 2	Sagebrush Ecology and Management Workshop–Challis, Boise, Idaho Falls, Twin Falls
July 29-August 4	Elderhostel at Camp McCall: Wild Nature of Idaho–McCall
July 31-August 2	Sagebrush-Grassland Ecology and Management–Dubois, Rogerson and Boise
August 1-3	Inland Empire Forest Products Marketing Conference–Moscow
August 18	On Buying Land–Clark Fork
September 9-10	Range tour of Lee A. Sharp Experimental Area for Montana State University senior class–Malta
September 15	Current Status of Fish & Wildlife Species of Northern Idaho–Clark Fork
October 13	Mushroom Identification–Clark Fork
October 15-18	3rd Annual Inland Empire Dry Kiln Workshop–Moscow
October 28-November 22	Continuing Education in Forest Ecology & Silviculture (CEFES)–Moscow
October 30-November 1	Governor's Conference on Recreation and Tourism Planning–Moscow
November 27-29	Rangeland Fire Effects Symposium, co-sponsored with BLM–Boise.

1985

January 21-23	Pacific Northwest Range Short Course on Interpretation of Monitoring Data–Boise
January 26-27	Winter Life in Northern Idaho–Clark Fork
February 11-15	Aerial Photo Interpretation Workshop–Moscow
February 13-15	Second Annual Inland Empire Forest Engineering Conference–Moscow
February 14	Computers on the Range and Ranch–1-day session at Society of Range Management meeting–Salt Lake City
February 14	Enhancing Productivity: The Marriage of Genetics and Silviculture–Coeur d'Alene
February 20-26	Tree Care Workshop–Boise (February 20-21), Lewiston (February 25), Moscow (February 26).
February 23	Cultural-Historical Look at Northern Idaho–Clark Fork
March 5-29	Forest Estate Planning Workshop–Lewiston (March 5), Moscow (March 12), Coeur d'Alene (March 29), Sandpoint (March 29)
March 7-8	Natural Resources for Youth Leaders–Coeur d'Alene
March 13-14	Pesticide Information and Licensing Workshop–Spokane
March 23	Horticulture Shortcourse for the Home Gardener–Clark Fork
March 25-29	Microcomputer Applications in Wildlife and Fisheries Biology–Moscow
March 29-30	Forest Contracting Workshop–Coeur d'Alene
April 16-18	GENE (Genetics Education for Northwest Ecosystems)–co-sponsored with Washington State University–Pullman
April 18-19	Forest Contracting Workshop–Moscow
April 27	Woodlot Management–Clark Fork
April 28-May 1	Northwest Wood Products Clinic–Coeur d'Alene
May 20-June 28	Land Use Planning in Natural Resource Management–Moscow
May 25-26	For Bird Lovers Only–Clark Fork
June 10-15	Central Idaho Natural Resources Youth Workshop–Sun Valley
June 17-22	Inland Empire Natural Resources Youth Workshop–Coeur d'Alene
June 22	Wildflowers of Northern Idaho–Clark Fork

Appendix

EXPERIMENT STATION SCIENTISTS

Stoszek, Milena J.
Director of the FWR Nutritional Lab

Pym, Geneva
Research Technician

DEPARTMENT OF FISH AND WILDLIFE RESOURCES

Ables, Ernest D.
Department Head and Professor
(Acting Dean, College of Forestry, Wildlife and Range Sciences; Acting Director of FWR Experiment Station, 1984-85)
Wildlife ecology, especially animal behavior and radiotracking techniques

Bizeau, Elwood G.
Professor Emeritus
Birds, principally waterfowl and marsh

Bjornn, Theodore C.
Leader, Cooperative Fish and Wildlife Research Unit
Professor
Fish ecology and management

Chacko, A. Jim
Fishery Research Scientist
Parasites and parasitic diseases of fish, anatomy and histology of fishes

Congleton, James
Assistant Leader, Cooperative Fish and Wildlife Research Unit and Associate Professor
Marine ecology, environmental physiology

Dalke, Paul D.
Professor Emeritus
Wildlife management

Drewien, Roderick C.
Research Wildlife Biologist
Wildlife, migratory birds, endangered species

Falter, C. Michael
Professor
Reservoir limnology, stream ecology

Garton, Edward O.
Associate Professor
Wildlife population biology, systems ecology

Hornocker, Maurice G.
Professor
Population ecology, predator-prey interactions

Hungerford, Kenneth E.
Professor Emeritus
Wildlife management

Klontz, George W.
Professor
Diseases and rearing problems of aquatic animals

MacPhee, Craig
Professor Emeritus
Fish behavior, ecology, toxicology

Melquist, Wayne
Research Wildlife Biologist

Moffitt, Christine M.
Adjunct Assistant Professor
Fish ecology and management, fish passage

Nelson, Lewis, Jr.
Extension Professor
(Acting Department Head, 1984-85)
Continuing education, communications

Peek, James M.
Professor
Big game management, habitat relationships

Reese, Kerry P.
Assistant Professor
Wetland ecology

Ringe, Rudy
Fishery Research Associate

Wright, R. Gerald, Jr.
Cooperative Park Studies Unit Project Leader–Biology
Associate Professor
Wildlife habitat management and National Park wildlife management

DEPARTMENT OF FOREST PRODUCTS

Campbell, Alton G.
Assistant Professor
Wood Chemistry

Christophersen, Kjell A.
Associate Professor
Forest products marketing, production economics

Govett, Robert L.
Assistant Professor
Forest products marketing

Hofstrand, Arland D.
Professor
Anatomy and mechanical properties of wood

Howe, John P.
Professor Emeritus
Wood science and technology

Johnson, Leonard R.
Professor
Forest engineering, industrial engineering, mathematical modeling

Lee, Harry W.
Assistant Professor
Forest engineering

Moslemi, Ali A.
Department Head and Professor
Panel products technology, wood residue utilization

Steinhagen, Peter H.
Associate Professor
Heat and mass transfer applied to wood

DEPARTMENT OF FOREST RESOURCES

Adams, David L.
Department Head and Professor
Silviculture, forest management (growth and yield)

Bassler, Gregory
Logging Superintendent, Forester and Research Associate

Belt, George H.
Associate Dean for Research, FWR Experiment Station
Associate Director, Director of International Programs and Professor
Hydrology, meteorology, planning, forest management

Brunsfeld, Steven
Research Associate

Burlison, Vernon H.
Extension Forester Emeritus and Extension Professor Emeritus

Canfield, Elmer R.
Associate Professor Emeritus
Forest Pathology

Crookston, Nicholas L. II
Research Associate

Dennis, Brian
Assistant Professor
Statistical ecology

Deters, Merrill E.
Professor Emeritus
Forest Silviculture

Fins, Lauren
Executive Director, Inland Empire Tree Improvement Cooperative and Associate Professor
Forest genetics

Force, Jo Ellen
Associate Professor
Modeling, land use planning, biometry

Goudie, James W.
Research Associate

Hatch, Charles R.
Professor (on leave with U.S. AID Joint Career Corps in India)
Mathematical stand modeling, mensuration

Heller, Robert C.
Research Professor Emeritus
Remote sensing, photo interpretation, forest entomology surveys, and evaluation

Johnson, Frederic D.
Professor
Forest ecology, forest communities, forest botany

Loewenstein, Howard
FWR Experiment Station Assistant Director and Professor
Forest soils and tree nutrition

Machlis, Gary E.
Cooperative Park Studies Unit Project Leader–Sociology, and Associate Professor
Interpretation, human ecology, environmental sociology

Mahoney, Ronald
Extension Forester/Assistant Extension Professor

McKetta, Charles W.
Associate Professor (on leave in Chile)
Timber production economics, forest management, forest taxation

Medema, E. Lee
Associate Professor
Forest resource economics, forest policy, stumpage market analysis

Mika, Peter G.
Research Associate

Moore, James A.
Director, Intermountain Tree Nutrition Cooperative, and Associate Professor
Silviculture, quantitative methods, forest production

Neuenschwander, Leon F.
Professor
Fire ecology, fire management, prescribed burning, general ecology

Osborne, Harold L.
Manager, University of Idaho Experimental Forest and Assistant Professor
Silviculture, harvesting

Partridge, Arthur D.
Professor
Forest Pathology

Schenk, John A.
Professor
Forest entomology, insect ecology, silviculture, and biological control of forest insect pests

Seale, Robert H.
Professor Emeritus
Forest economics

Stark, Ronald W.
Professor Emeritus
Population dynamics and integrated pest management of forest insects

Stiff, Charles
Assistant Professor
Mensuration, mathematical tree and stand modeling

Stock, Molly W.
Professor
Forest insect population genetics and biosystematics

Stoszek, Karel J.
Professor
Silviculture, forest protection, forest entomology

Tennyson, Larry C.
Associate Professor (on leave with FAO in Pakistan)
Watershed

Ulliman, Joseph J.
Professor (on leave in Germany)
Aerial photography, mapping, aerial photo interpretation, remote sensing

Vander Ploeg, James
Research Associate

Wang, Chi-Wu
Professor Emeritus
Forest genetics

Wenny, David L.
Forest Nursery Manager and Associate Extension
Silviculture, forest regeneration

DEPARTMENT OF RANGE RESOURCES

Bryant, David A.
Professor and Department Head
Coordinated management planning, range nutrition

Bunting, Stephen C.
Associate Professor
Fire ecology, range ecology, range management

Ehrenreich, John H.
Professor
Range ecology, international forestry

Hironaka, Minoru
Professor
Range ecology, rangeland classification, soil-plant relationships

Kingery, James L.
Assistant Professor
Rangeland rehabilitation, range economics, forest grazing policy

Neuenschwander, Leon F.
Professor
Fire ecology, fire management

Robberecht, Ronald
Assistant professor
Ecophysiology, autecology, range ecology

Sanders, Kenneth D.
Professor
Range extension, range nutrition, range livestock

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

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

Wright, Jr., R. Gerald
Associate Professor
Range systems ecology, simulation modeling

DEPARTMENT OF WILDLAND RECREATION MANAGEMENT

Fazio, James R.
Associate Dean of Academics and Professor
Communication and principles of natural resource management, enviromental interpretation, continuing education delivery systems, conservation history

Frome, Michael
Visiting Associate Professor
Environmental Communications

Ham, Sam H.
Assistant Professor
Interpretation, communication, environmental education, family decision making in recreation, natural resource tourism

Harris, Charles C., Jr.
Assistant Professor
Economic evaluation of recreation resources, consumer behavior, recreation management and planning, natural resource tourism

Krumpe, Edwin E.
Director of Wilderness Research Center and Associate Professor
Ecological impacts of recreation, social psychology, decision processes in recreation, communications and interpretation, wilderness management

McLaughlin, William J.
Department Head and Associate Professor
Regional and recreation planning methods, citizen participation, recreation behavior, and preception of natural resources

ADMINISTRATIVE SERVICES

Akenson, Jim and Holly
Managers, Taylor Ranch

Ashland, Lorraine
Graphics Artist/Illustrator

Bottger, Richard F.
Director of Administrative Services

DeWald, Dan
Manager, Clark Fork Experiment Station

George, Willard L.
Motor Pool Technician and Property Controller

Kersey, Beth
Assistant Director, International Programs

Leinweber, Susan
Coordinator of Continuing Education

Pritchett, Jane R.
FWR Experiment Station Associate Editor

Savage, George H.
Director of Information Services, Managing Editor and Adjunct Associate Professor of Natural Resources Communications

UNIVERSITY OF IDAHO EXPERIMENTAL FOREST

Osborne, Harold L.
Assistant Professor and Manager, University of Idaho Experimental Forest

Bassler, Gregory
Logging Superintendent, Forester and Research Associate

Strong, Allan E.
Assistant Forest Manager and Research Associate

FOREST NURSERY

Wenny, David L.
Forest Nursery Manager and Associate Professor

Worrell, Cindy
Nursery Technician

Quick, Kenneth
Nurseryman

RESEARCH PROJECTS AND INVESTIGATIONS

This listing of projects shows the range of work in progress through the experiment station; it is not a publications listing. To save space, abbreviated project titles are given. If additional information is needed, please write to the principal investigators or to the Associate Director, Forest, Wildlife and Range Experiment Station, University of Idaho.

DEPARTMENT OF FISH AND WILDLIFE RESOURCES

Population estimation techniques for coyotes. E.D. Ables, R.L. Crabtree, M.G. Hornocker

Ecology of the Fennec fox in Egypt. E.D. Ables, G.A. El Attar

A proposed plan for management of nature preserves in China. E.D. Ables, Zhiyong Fan

Habitat partitioning by behavioral mechanisms among bighorn sheep, elk and mule deer. E.D. Ables, H. Akenson

An endangered species management plan for China. E.D. Ables, Y. Song.

Environmental Assessment of the Pend Oreille River with emphasis on a proposed pulp and paper mill near Usk, Washington. D.H. Bennett

Dynamics and ecology of salmonid fishes in the Upper Spokane River. D.H. Bennett

Development of a methodology to evaluate the success and consequences of establishing exotic fishes in Idaho waters. D.H. Bennett, T. J. McArthur

Fish and habitat inventory of the Lewiston levee ponds and development of a management plan. D.H. Bennett, F.S. Shrier

Recruitment growth and survival of largemouth bass (*Microptems salmoides*) in the Coeur d'Alene Lake system. D.H. Bennett, E.C. Bowles

Effects of winter cattle grazing on avian diversity and distribution within a seasonal wetland. E.G. Bizeau, Sara M. Brown

Reestablishment of whooping cranes in western United States. E.G. Bizeau, R.C. Drewien

Habitat use and reproductive success of an introduced population of Rio Grande turkeys in southwestern Idaho. E.G. Bizeau

Evaluation of the feasibility of cross-fostering bald eagle eggs to osprey nests in northern Idaho. E.G. Bizeau

Experimental release of captive greater sandhill cranes at Grays Lake, Idaho. E.G. Bizeau

Survival of hatchery steelhead trout with advanced time of spawning. T.C. Bjornn

Development and testing of models to estimate production of chinook salmon and steelhead trout in streams. T.C. Bjornn

Survival of chinook salmon smolts with stress levels encountered at dams. T.C. Bjornn, J.L. Congleton, R.R. Ringe

Priest Lake tributaries fish habitat study for the Idaho Panhandle National Forests. T.C. Bjornn, David Irving

Evaluation of proposed use of Bear Lake NWR as a sediment and nutrient trap for inflows into Bear Lake. T.C. Bjornn, J. Milligan, C.M. Falter, K.P. Reese, C.M. Moffitt

Land use effects on salmonid habitat. T.C. Bjornn

Evaluation of methods for controlling bacterial kidney disease in Snake River chinook salmon. T.C. Bjornn, C.M. Moffitt

Fish time and size for release. T.C. Bjornn, C.M. Moffitt, D. Lam

Stress in transportation of spring chinook salmon from Snake River dams to the Columbia Estuary. J.L. Congleton, T.C. Bjornn, C.A. Roberson, B.D. Watson, B.H. Burton

Comparison of fishway designs for downstream passage of spring chinook and steelhead trout smolts. J.L. Congleton, R.R. Ringe

Bluegreen algae toxicity in North Idaho lakes. C.M. Falter, J. Kann

Phytoplankton and zooplankton of Dworshak Reservoir. C.M. Falter

Payette Lake limnology. C.M. Falter

Trophic status and eutrophication control of Twin Lakes, Idaho. C.M. Falter

Status of boreal owls in Idaho. E.O. Garton, G. Hayward

Development of aerial census methods for elk and mule deer populations. E.O. Garton

Development of baseline data gathering system for Research Natural Areas in Idaho. E.O. Garton

Avian predation on western spruce budworm. E.O. Garton

Ecology of a reintroduced population of fisher (*Martes pennanti*) in north central Idaho. M.G. Hornocker, Michael Luque

Ecology of endangered ocelot in south Texas. M.G. Hornocker, Michael Tewes

Home range and population ecology of black bears at Priest Lake, Idaho. M.G. Hornocker, J.A. Rohlman

Ecology of the jaguar (*Panthera onca*) in the Pantanal region of Brazil. M.G. Hornocker, H. Quigley

Grizzly bear habitat use, movements and distribution in the Selkirk Mountains of North Idaho and Northeast Washington. M.G. Hornocker, J. Almack

Ecology and demography of a lynx population in north-central Washington. M.G. Hornocker, S. DeStefano

Ecology of the mountain lion in the San Andres Mountains. M.G. Hornocker, K. Logan

Ecology of the bobcat in the River of No Return Wilderness Area. M.G. Hornocker, G. Koehler

Evaluation of ornamental fish diets. G.W. Klontz

Computerized production and economic forecasting in spring chinook and coho salmon hatcheries. G.W. Klontz, D. Chase

Epidemiology of proliferative kidney disease. G.W. Klontz

Citizens Survey–Idaho Nongame Wildlife Program. W.E. Melquist, K.P. Reese

Analysis of user attitudes toward telemetry equipment design, availability, and performance. W.E. Melquist

Analysis of grizzly bear habitat components and grizzly bear occurrence in the Bitterroot Range of Idaho and Montana. W.E. Melquist

Status survey of river otters on Flathead Lake, Montana, and vicinity. W.E. Melquist

Evaluation of wild stock status. C.M. Moffitt, T.C. Bjornn

Umatilla white-tailed deer investigations. J.M. Peek, J. Bell

Habitat use patterns of Sitka black-tailed deer in logged forests. J.M. Peek, J. Mankowski

Colville Indian Reservation mule deer habitat study. J.M. Peek, B. Carson, B. Griffith

Umatilla Indian Reservation mule deer habitat study. J.M. Peek, T. Bodurtha

Pend Oreille Lake mountain goat study. J.M. Peek, K. Naylor

Shrub production in northern California logging areas. J.M. Peek, R. Vora

Moose behavior investigations, Denali National Park. J.M. Peek, D. Miquelle

Status survey of 27 rare nongame bird species in Idaho. K.P. Reese, W.E. Melquist

Nongame habitat development plan for Idaho Department of Fish and Game. K.P. Reese

Avian habitat relationships in riparian zones of northern Utah. K.P. Reese

Analysis of federally supported fish and wildlife research. K.P. Reese, E.D. Ables

Population dynamics of mountain goats at Olympic National Park. R.G. Wright, R. Hoffman

Mountain goat ecology at North Cascades National Park. R.G. Wright, M.K. O'Donnell

Vegetative succession on the lava field at Craters of the Moon National Monument. R.G. Wright

Techniques of organizing data bases for resource management. R. G. Wright

Vegetative succession on the lava field at Craters of the Moon National Monument. R.G. Wright

Glacier backcountry visitor activity study. R.G. Wright, B. Butterfield, S. Baldwin

Goat behavior. R.G. Wright, C. Pedevillano

North Fork-Glacier ungulate carrying capacity study. R.G. Wright

CRMO vegetative succession. R.G. Wright, T. Day

DEPARTMENT OF FOREST PRODUCTS

Supercritical extraction of kraft lignin and kraft black liquor. A.G. Campbell

The effect of kraft lignin molecular weight on lignin-phenol-formaldehyde wood adhesives. A.G. Campbell

Supercritical fluid extraction as a method for isolating resins, waxes, and oils from biomass. A.G. Campbell

Supercritical fluid applications for the pulp and paper industry. A.G. Campbell

The production of phenols by a supercritical pyrolytic extraction of kraft lignin and kraft black liquor. A.G. Campbell

Evaluation of the MyCoR Captor process for decolorization of pulp mill effluent. A.G. Campbell

Economic feasibility of production/use of inorganic binder wood panels for the Philippines. R.L. Govett

Analysis of housing trends related to wood usage. R.L. Govett

Economic feasibility of village scale charcoal productivity methods in the Philippines. R.L. Govett

An assessment of potential markets for composite products from lodgepole pine and cement with preliminary economic feasibility analyses of producing such products. R.L. Govett

Market acceptance of conventional products from small stem softwood timber of the Intermountain West. R.L. Govett

Curing characteristics of some PNW hardwoods on wood-cement mixture. A.D. Hofstrand

Developing and testing wood residue delivery systems. L.R. Johnson

Computer simulation of logging systems. L.R. Johnson

Application of electronic data processing equipment to Forest Engineering. L.R. Johnson

Field testing of Pacific Winch in-place drying of logs. L.R. Johnson

Environmental effects of forest residue recovery. H.W. Lee

Comparison of ring infiltrometer versus rainfall simulator for infiltration tests on forest soils. H.W. Lee

Field testing of Pacific Winch. H.W. Lee

Idaho Jammer as a site preparation tool. H.W. Lee

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Agency and Funding Support

Agency for International Development
AID Bureau for Science and Technology
Alaska Fish and Game Department
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USDA Forest Service, Northeastern Forest Experiment Station
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USDA Office of International Cooperation and Development
U.S. Department of Commerce
U.S. Department of Energy
USDI Bureau of Indian Affairs
USDI Bureau of Land Management
USDI Bureau of Reclamation
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USDI National Park Service
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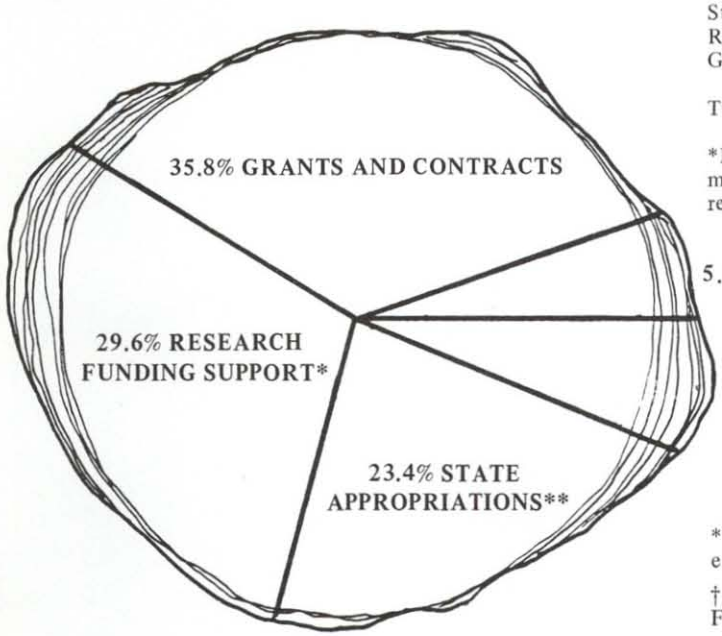
Western Forestry and Conservation Association
Weyerhaeuser Company
Wildlife Management Institute

Fiscal Year 1985 Financial Picture

Research expenditures, shown by funding source, totaled $5,735,000 for the Fiscal Year 1984-85.



SOURCE	AMOUNT	PERCENTAGE OF TOTAL
Federal Appropriations	$ 292,000	5.1
Miscellaneous Research†	350,000	6.1
State Appropriations**	1,343,000	23.4
Research Funding Support*	1,700,000	29.6
Grants and Contracts	2,050,000	35.8
TOTAL	5,735,000	100.0

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

Plan for Excellence Being Developed

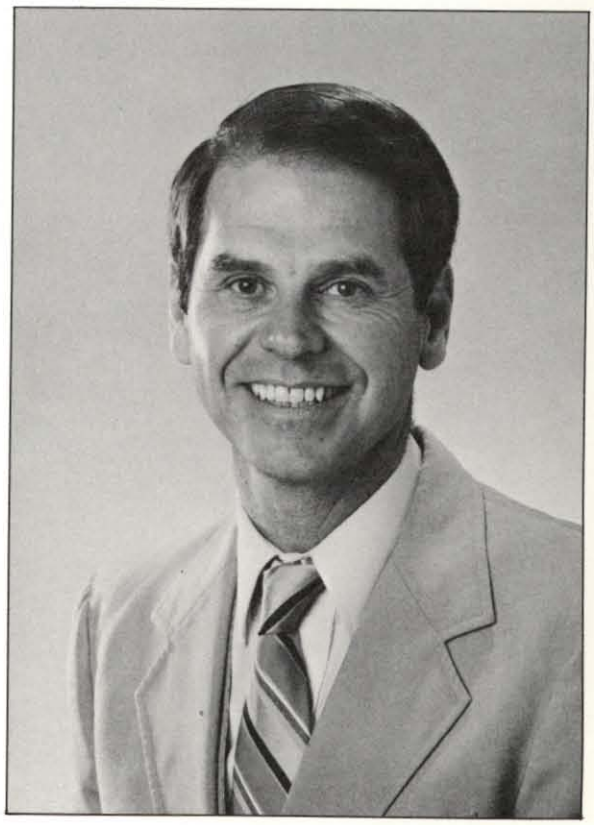
As you review the many excellent contributions of our experiment station scientists, keep in mind our need for your counsel and support. Your insight and comments are useful in helping us focus on Idaho's natural resource problems and opportunities as the key to direction for college programs.

We are now reviewing our college programs to identify areas of need where we can achieve excellence. This "Quest for Excellence," or Q4E as it has been dubbed by the faculty, is a planning effort which we hope will give us a renewed sense of purpose and direction. The faculty has been working diligently over the last three months to identify needs and specific areas (quests) of program emphasis. This has been an important learning process for me. But more important is the energy the faculty has invested to match and prioritize our capabilities in response to the needs of the state. This is not easy given the current fiscal situation, personnel losses and the uncertainties of future state funding. But only with commitment to excellence and to relevance can we make the most of our experience and available resources.

In late November, our draft "Plan for Excellence" will be evaluated by a panel of external reviewers. The panel, consisting of about 40 individuals representing all our constituencies, will meet with us for two days. We anticipate frank comments that will be valuable in adjusting our programs to achieve the excellence and relevance we desire.

The Q4E process could have a significant impact on our research as areas of outstanding need and opportunity are identified. I look forward to updating you on results of the quest in next year's edition of FOCUS. In the interim, if you have questions or comments, please feel free to call or write.

John C. Hendee, Director
Forest, Wildlife and Range
Experiment Station



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