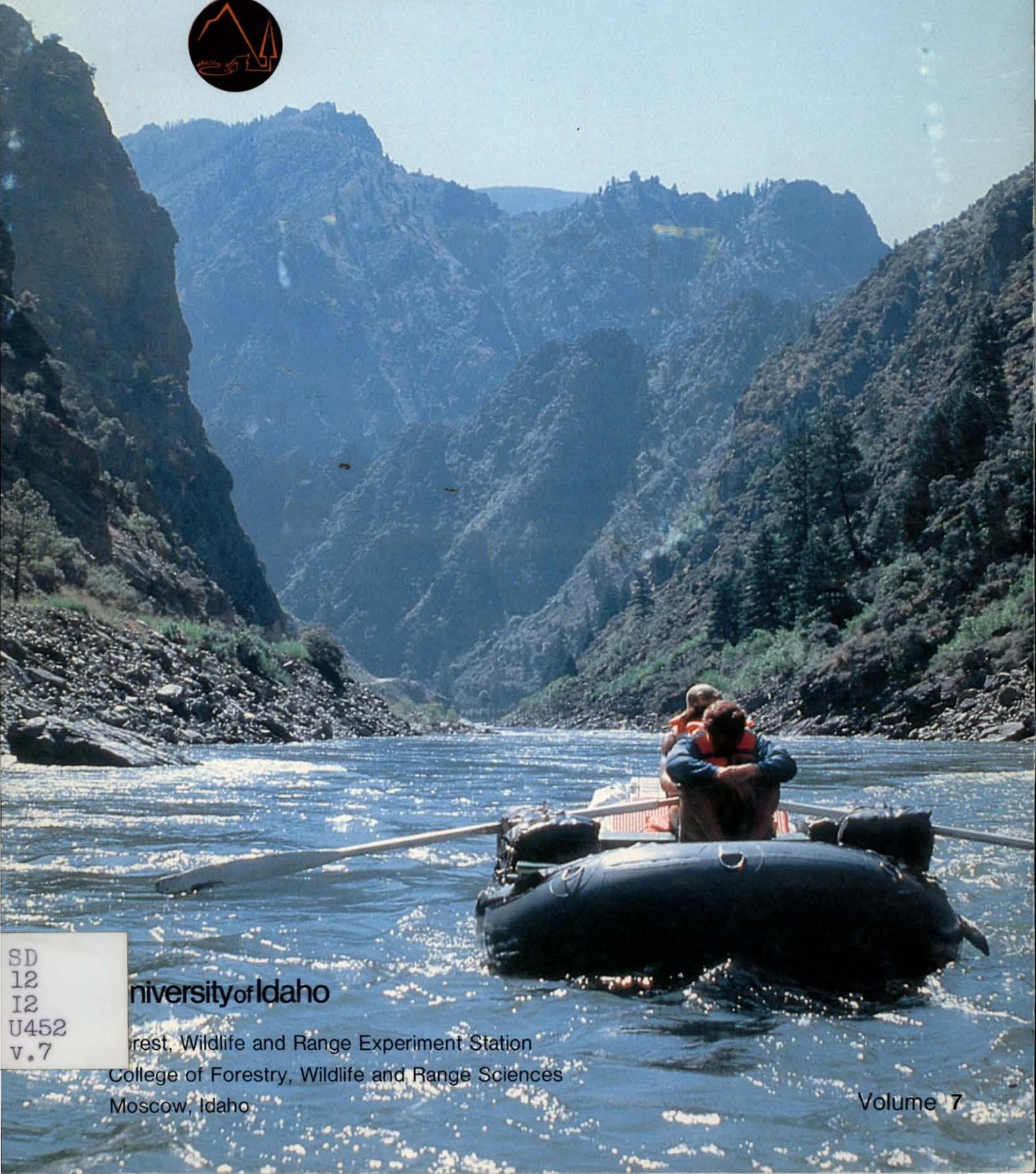


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on Renewable Natural Resources



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University of Idaho

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

Volume 7

Managing Recreation Lands

This year's annual report highlights research activity in the Department of Wildland Recreation Management, the newest of the six departments in the College of Forestry, Wildlife and Range Sciences. Outdoor recreation management was incorporated into the forest management program prior to establishment of the formal Wildland Recreation Management program in 1974. The northwest's mountains, rivers, and forests are highly sought by recreationists. The result, a tremendous growth in outdoor recreation activities over the last two decades, has brought both tourist dollars and management problems to the State of Idaho. Research programs in the FWR Experiment Station directed by Wildland Recreation Management faculty are helping the state's resource managers contend with these new problems.

Managing the natural resource to give visitors the best recreation experience consistent with other resource use, demands an understanding of sociological as well as biological behavior. A study of recreationists on the Flathead River in northwestern Montana typifies work that is needed before land management plans can be devised. A different type of plan is needed in Alaska's Pack Creek Bear Reserve, where human and animal visitors pose a potential conflict. For bears, the attraction is salmon fishing; human visitors come to watch the bears.

Park managers need to learn more about both domestic and international visitors. A slide-tape program on the history of visitors to National Parks has been prepared to train park personnel by members of the University of Idaho Cooperative Park Studies Unit, a National Park Service-University of Idaho cooperative program established here in 1979. Our program in wildland recreation management has resulted in scholar exchange programs with the People's Republic of China, giving us additional first-hand perspectives on international visitors.

Social science research has become a component of other research projects in the Experiment Station. An interdisciplinary study of the life-span of lakes in Idaho takes into account the biological health of the lakes and the recreational, water supply, and agricultural demands that will be made of them. Resource management plans for both public and private forest ownerships now address social and economic factors as well as traditional biological impacts.

Since our research scientists have a commitment to the needs of the state and the management of its natural resources, land management agencies, industry, and private individuals have traditionally looked to the university research community for solutions to their problems. Unfortunately, budget cuts this year, at both the state and federal levels, will visibly reduce the research and service programs in the Forest, Wildlife and Range Experiment Station now and possibly in future years. Following several years of belt-tightening, these funding reductions led to the dismantling of research programs and the cancellation of service and information workshops. Dedicated researchers have had productive, long-term mission oriented projects shelved or discontinued for lack of funding. Strong research programs cannot be maintained on intermittent budgets.

The FWR Experiment Station is legislatively responsible for conducting research on Idaho's renewable natural resource problems. Investment decisions in the public and private sectors require that tradeoffs

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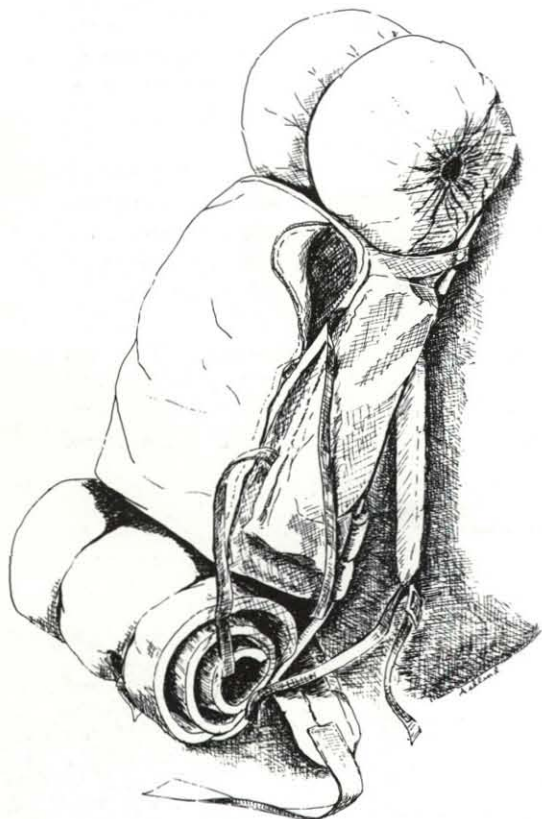


Susan Hieb photo

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Fiscal 1981 Annual Report



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FOREST, WILDLIFE AND RANGE EXPERIMENT STATION

John H. Ehrenreich, Director
Charles R. Hatch, Associate Director
Howard Loewenstein, Assistant Director

Susan R. Hieb, Editor
Lorraine Ashland, Artist

Cover: Rafting on the Middle Fork of the Salmon River in Idaho offers rugged scenery as well as white water excitement for river recreationists. Lauren Fins photo

Wildland Recreation Management

FLATHEAD RIVER PROJECT MEASURES RECREATION PRESSURE

Edwin Krumpe
William McLaughlin

The Pacific Northwest is rich in its legacy of free flowing rivers, some of which have been designated by Congress as wild, scenic, or recreational under the provisions of the Wild and Scenic Rivers Act of 1968. Many future recreationists will choose one of America's wild rivers for a planned outing or vacation trip. This increase in use, coupled with already heavy use of many river corridors, creates the potential for a crisis in river recreation management.

The demand for water-based recreation is expected to increase over 100 percent in this country in the next 40 years, according to a 1979 report by the USDA Forest Service. Both lakes and rivers will feel the impact as recreation pressure increases. Carefully drawn management plans based on sound data collection will be imperative for the continuation of lake and river recreation.

For the past two years, students and faculty members from the Department of Wildland Recreation Management at the University of Idaho have been conducting a survey of recreationists floating portions of the North, Middle, or South forks of the Flathead River system in western Montana. Sampling was conducted at 19 sites on a rotating basis along 219 miles of river. During the summer months, researchers were stationed daily at sites used by the public for the launching or landing of river float craft. If a group of floaters entered or left the river at his or her station, the researcher asked members of the float party to fill out a short questionnaire indicating how far the visitor had traveled to make the float trip, the portions of the river floated, and attitudes toward river recreation management practices.

From the 2062 persons initially surveyed in 1980, 1600 were randomly selected to be mailed a more detailed questionnaire on their river experience. These results, along with 1981 data, will be made available to land management agen-

cies, resource managers, government officials, outfitters, and interested citizens.

This project is a prime example of McIntire-Stennis funding for theoretical research expanded into directly relevant management information, according to Edwin Krumpe, a principal investigator for the research and professor of Wildland Recreation Management. The Flathead River Project's co-director, William McLaughlin, also a professor of Wildland Recreation Management, pointed out that the project represents a high degree of agency cooperation at the local level. In addition to McIntire-Stennis funding, the project is supported by Flathead National Forest and Glacier National Park, which are responsible for managing the three forks of the Flathead River. Both agencies are awaiting completion of the study before going ahead with their river management plan. Krumpe and McLaughlin praised project support they have received from Gerald Stokes, Recreation Staff Officer for the Flathead National Forest, and from Glacier National Park's Supervisory Research Biologist Clifford Martinka and Aquatic Ecologist Leo Marnell. University researchers have received consistent support from Jerry DeSanto and Dave Panabaker, National Park Service Sub-district Rangers at Polebridge and Walton, respectively; and from USDA Forest Service field staff Fred Flint on the Spotted Bear Ranger District, Bob Hurd and Ron Des Jardins on the Glacier View Ranger District, and Marc Childress on the Hungry Horse Ranger District.

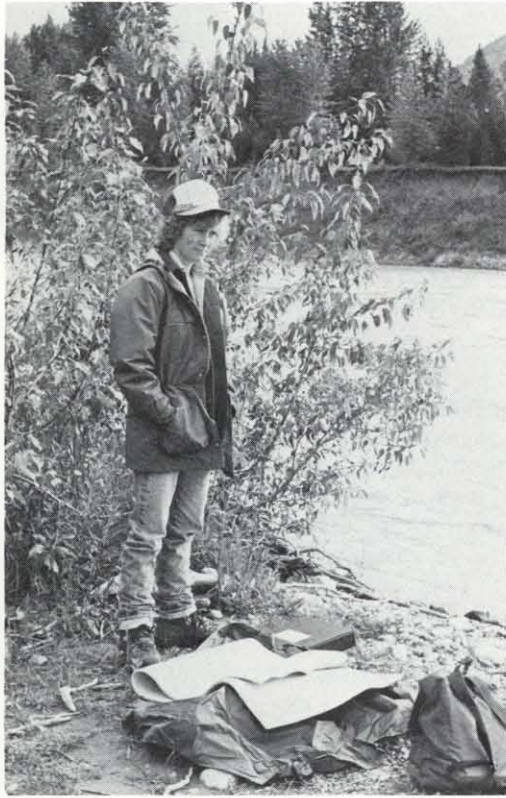
FLATHEAD DESIGNATED

The three forks of the Flathead River were designated as wild, scenic, and recreational rivers in 1976. In 1978 these rivers comprised 8.5 percent of the nation's wild and scenic rivers system. The USDA Forest Service, the main agency responsible for managing the rivers, was concerned that publicity surrounding the wild and scenic river designation would bring an influx of river recreationists. Yet no baseline data existed on current use patterns.

The University of Idaho became engaged in the project because of its interest in river recreation preferences and management in the northwest. An earlier study by McLaughlin and David Cockrell on wild and scenic rivers in Idaho, examined the



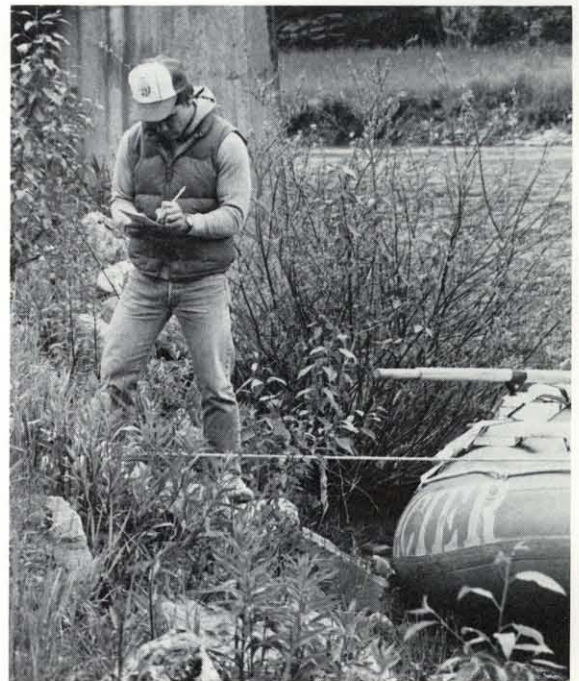
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A Day on the River. *Far left:* Dawn Mehra waits for river recreationists to arrive at her station. *Top left:* Pam Olson brings her gear for a long day by the river. *Right:* Bill Stormont watches as outfitters tip a raft into the river for the start of a float trip. *Bottom right:* Bill records the number of visitors in a rafting party. *Bottom left:* Richard Fedorchak splits firewood to heat the cabin.



Story and Photos
by Susan Hieb



recreationist's criteria for choosing a river, and the factors which made the trip satisfying for the visitor. Because the rivers which they studied, the Upper Selway, the Middle Fork of the Salmon, the main Salmon, and the Snake River in Hells Canyon, already had high use and a recreation permit system was already in effect, conducting the Flathead River Project offers researchers the opportunity to compare a maximum use river system with one on which recreational use is unconstrained but starting to grow.

Participation in the Flathead River Project has provided partial funding for four graduate students in Wildland Recreation Management, as well as making summer employment and field experience available for over 20 undergraduates. A primitive cabin serves as a base camp for the researchers, whose day begins with breakfast at 6:30, and often ends with dinner at 9 p.m., after a full day at a launch site. Cooking and chores are shared by the students. Lectures and discussions of professional articles are also a part of evenings spent around a gas lantern at the cabin,

Designations for the Flathead River include 98 miles of wild rivers, the portion of the Middle Fork which flows through the Great Bear Wilderness, and the section of the South Fork which flows through the Bob Marshall Wilderness. Wild rivers, by definition, are free flowing rivers which are generally inaccessible by road and have primitive shorelines. One or two inconspicuous roads to the area may be permitted. No types of dams or bridges are allowed. Future construction is restricted, although sightings of one or two inconspicuous dwellings may be allowed.

The North Fork of the Flathead River, a 41-mile stretch from the Canadian border to Camas bridge, has been set aside as scenic. This designation is also for free flowing rivers, with limited evidence of man's development. Scenic rivers are accessible by roads which may bridge the river area. Some roads and limited housing may be visible from the river. Agricultural practices are allowed which do not affect the river adversely.

Another 80 miles of the Flathead River system, on all three forks, have been designated recreational. This designation permits small diversion dams, frequent access points, and extensive development.

as students fulfill requirements for a summer session course. The University of California - Santa Cruz had heard about the program's first year and contacted the University of Idaho to ask if students registering for extension credits through the Santa Cruz campus' Wildlands Institute could take part in the program. Nine students enrolled through the Wildlands Institute joined the Idaho researchers for four weeks in July this year. As special lectures and training sessions were included in the program, both Krumpke and McLaughlin have been appointed as affiliate faculty members of the University of California - Santa Cruz.

The Flathead River Project has been marked by cooperation from the beginning. Agency supervisors and field personnel, outfitters representing all three forks of the Flathead River, the North Fork Landowners Association, and interested members of the public were in on the planning of the project from its start. In February of 1981, the researchers spent a full day with representatives of these groups, making changes in the questionnaire and explaining how to use the data collected from the previous summer and computer printouts for information relevant to managing different portions of the three rivers.

In a second portion of the project, researchers studied the impact of camping on land in and along the rivers. Camping impact cannot be considered only in terms of the land, as it affects wildlife movement and behavior of big game, small wild animals and merganser ducks. However, for this study, only the campsite land impacts were monitored. A total of 28 campsites were located along 40 miles of the North Fork, which has been designated scenic. Nearly half of the camps have been made on sand or gravel bars, small islands, or against the shore, where they are washed over by high waters every one or two years. When the project is completed, a map of campsites will be left for resource managers to determine whether campsites are increasing or decreasing in number.

An additional objective added in the second summer has been a study of economic value of recreation for the Flathead Basin Commission. Survey questions have been included to determine travel cost estimates for fishermen and others using the rivers. The Montana Department of Fish and Game has also funded a portion of the project in return for a creel census of anglers, in which fish caught are measured and weighed. A sample of scales is also taken to determine age and growth of the fish. The creel census will supply ground truth data to support an aerial survey of the total fishing pressure by anglers along the river, and a snorkeling count of the fish in the tributary spawning streams.

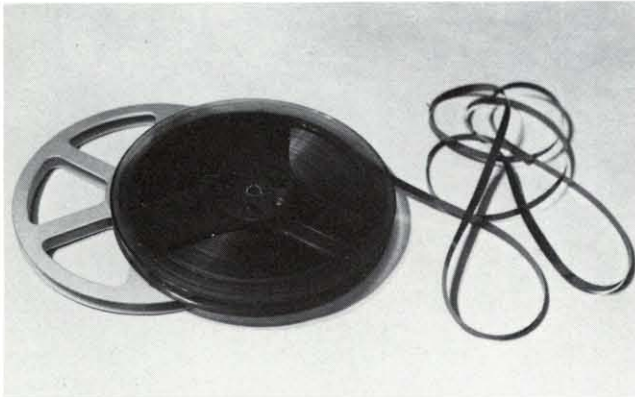
Collecting data and organizing the survey has been a major undertaking for staff and students of the Department of Wildland Recreation Management. Visiting Scholars Yan Ling-zhang and Liang Yong-ji from the People's Republic of China have worked with the group to learn how a major survey project is managed and administered. The final worth of the study, to the funding agencies and to the country's recreationists, will be in the use that is made of the findings in preparing management plans for the Flathead River System. Researchers and coordinators of the project have worked to keep their data usable and to explain it thoroughly to resource managers, outfitters, and interested citizenry at all stages of the project. For the Department of Wildland Recreation Management, the Flathead River Project has afforded an excellent opportunity to combine theoretical and applied research as well as to provide professional training for students.

SLIDE-TAPE PRESENTATION SHOWN AT SAF MEETING

Sam H. Ham
Dan L. White
George D. Davis

More than 3000 persons attending the 1980 Society of American Foresters Convention in Spokane last October were introduced to forest land use in the Inland Northwest through a multi-screen slide program developed in the College of Forestry, Wildlife and Range Sciences.

The 24-minute slide-tape presentation, A Wooden Diary, was developed and produced by Dan L. White, Sam H. Ham, and George D. Davis, Media Technician and Professor for the University of Idaho Department of Wildland Recreation Management, and Deputy Forest Supervisor for the Idaho Panhandle National Forests of the USDA Forest Service, respectively.



The Diary tells the story of the Northwest from the perspective of the forest trees, the timber resource of a westward-moving nation. Forest Resources Professors David Adams and Frederic Johnson of the College of Forestry, Wildlife and Range Sciences provided major assistance for the project.

The production involved coordination of 25 people. The script was prepared by White and Ham, with assistance coming from Portland, Oregon; Seattle and Colville, Washington; Missoula, Montana; and Coeur d'Alene, Idaho. Slides came from all parts of the United States. Joe Mussulman, a professor from the University of Montana, narrated the program.

The project was commissioned by the USDA Forest Service, which had to give final approval. Davis and Forest Supervisor Ralph Kizer of the Idaho Panhandle National Forests were the most critical reviewers of the project. According to Ham, they also solved the most problems and played a major role in the program's success.

The Diary was shown at the Spokane Opera House/Convention Center on the world's largest rear-projection screen, with images projected from behind the screen rather

than from the audience side. Six modified projectors, brought in from Portland, Seattle, and Missoula were set up on a 30-foot scaffolding to show 10- by 12-foot images, three at a time, on the screen. The entire program was automated through a computer by White and Ham.

Response to the slide-tape program has been excellent. Six copies of the Diary have been reproduced and distributed nationwide, for showing on a single screen, using one or two projectors. The success of the Diary is one more example of what can be accomplished as a cooperative project by the USDA Forest Service and the College of Forestry, Wildlife and Range Sciences.

VISITORS WATCH BEARS ON ALASKAN PRESERVE

Edwin Krumpe
Ken Post

Sitting down to a dinner of fresh-caught salmon is a treat for westerners—man and bear alike. On the Pack Creek Bear Reserve, located in southeastern Alaska on Admiralty Island, the bears come to catch salmon, and people come to watch.

Wildland Recreation Management graduate student Ken Post, under the direction of Professor Edwin Krumpe, is conducting a study of visitors to this bear paradise. Roughly 80 miles from Juneau, the preserve is accessible only by boat or plane. Although no hunting is allowed on the preserve, managers are concerned about the increase in visitor traffic, and its effect on the bears.

For his study, Post is conducting a visual scan of the tidal flats at 2 minute intervals, recording the activities of both bears and humans. He has broken the tidal area into 21 zones for the purpose of his study, to determine areas of heaviest use and to indicate patterns of movement.

Bears begin to arrive in June, as the salmon come to these waters to spawn. The number of bears is heaviest in July, then tapers off in August. Bears merely swat the salmon out of the river for their feast, creating an ideal situation for bear watchers. While the bears are occupied with their salmon, they have little interest in humans. As part of his project, Post will examine whether an increase in visitors causes a change in bear behavior. Effects of weather and tides will also be considered. If plane and boat landings disturb the bears, a special area might be set aside for visitor arrival and departure.

Data from the visual scan and from visitor questionnaires will be tabulated and given to preserve managers to aid them in planning the future of the Pack Creek Bear Reserve.



Autos were first allowed to enter the National Parks in 1913, and campgrounds became a part of the park adventure. Park visitors often made the trip a social event, traveling in auto caravans. This early campground picture was taken in Mount Rainier National Park, Washington. *University of Idaho - Cooperative Park Studies Unit collection*

NATIONAL PARKS REFLECT CHANGES IN VISITORS

Gary E. Machlis
Brian K. Gilles

The lure of the West has tantalized the imagination from the first discovery of the new world. Rumors of majestic mountains and wide rivers have turned countless heads westward, beginning with the rugged frontiersmen who sought furs and adventure.

Sociology Project Leader Gary Machlis of the Cooperative Park Studies Unit and Wildland Recreation Management senior Brian Gilles have studied the history of visitors to the national parks for the production of a slide-tape program to be used in training National Park Service personnel. "Roughing It Deluxe" offers a glimpse into the past, and fosters an awareness of changes in national park development and policy caused by the social impact of visitors over the last 100 years. The program has been designed for in-service training at the Albright Training Center, Arizona, and for use in National Park Service "Year of the Visitor" publicity.

When the railroads opened up the West for commerce, they opened it as well for wealthy tourists. Luxury hotels built in or near the parks primarily offered a summer of relaxation in a beautiful setting. Evenings of entertainment

were held in the hotel lounge. Visitors saw the park only from overlooks near the hotel. Often the greatest excitement of the trip centered around the stagecoach ride from the train to the hotel. An early outfitter in Yellowstone began offering portable tent camping tours in 1893. On these 10-day tours, meals were served at tables set with china, silver, and crystal.

As early as 1886, the Army was asked to manage the parks to prevent vandalism. Army personnel found themselves fielding hundreds of questions about the parks. Their efforts in explaining the parks to the public were the first steps toward the information and interpretive services today. In 1908 the first automobile entered a national park—its occupants were asked to leave. Over the next few years auto travel was deemed disruptive of the quiet park atmosphere, and automobiles were banned from the parks until the issue was forced at the National Park Conference of 1912 in Yosemite Valley. President Woodrow Wilson first allowed autos to enter the parks in 1913. Auto caravans to national parks became social events, as the car itself, the highway, hotel, and scenic wonders all became main features of the adventure.

Campgrounds had entered the picture by the time the National Park Service was established in 1916. Also in that year, more people entered Yosemite National Park by car than by rail. Cars were no longer the toys of the rich. A new group of outdoor visitors, termed the sagebrushers, went wherever their cars could take them, staying only a

few days, then moving on to another park. Earlier visitors had spent a month at an established hotel, visiting Old Faithful, or Yosemite Valley. Hotel sundecks and porches now became snackbars. Lounges and card rooms turned into souvenir shops.

Convenience camping began after World War II and continued into the 1960s, to be replaced by visitors seeking a variety of recreation experiences, from backpacking in solitude to group tours and evening campfires. A revitalization of the parks, called Mission 66, brought newer highways and better campgrounds to the parks in a 10-year period beginning in 1957, a response to the growing use of the nation's parks by all segments of the population.

Machlis and Gilles' look at the days of the stagecoach and touring car in national parks carries an important message. The parks were created in part for people, and over the years people have brought about many changes in the management and operation of the parks. Slides of early recreationists for the program have been obtained from books, periodicals and collections from many parts of the country. The project received funding from the Division of Interpretation and Visitor Services of the Pacific Northwest Region, National Park Service in Seattle, from the Horace M. Albright Training Center, and from the University of Idaho Cooperative Park Studies Unit.



Motoring offered visitors a chance to see more of the National Parks than could be viewed from overlooks near the park hotel. This photograph was taken in Colorado's Rocky Mountain National Park. *University of Idaho - Cooperative Park Studies Unit collection*

VISITING CHINESE SCHOLARS STUDY PARK DEVELOPMENT

As cultural relations between the United States and the People's Republic of China have opened up, the University of Idaho has been involved in a number of cooperative exchange programs. China, a nation with a large population and many beautiful parks and gardens, has been especially interested in the Department of Wildland Recreation Management. Following visits to the People's Republic of China last year by Wildland Recreation Management Professors William McLaughlin and Gary Machlis, the Government of China decided to send two of its professionals to Idaho for training programs in wildland recreation and national park development.

The first Visiting Scholar in the program, Yan Lingzhang, arrived in May of 1980, and returned to China in January. During her course of study she attended courses in wildland recreation management and recreation research methods, and both lectured in and attended a course in international wildlands development. Yan, who is Director of Botanical Research for the Shanghai Municipal Garden Administration, recorded and produced an audio-message with Chinese narration and music interpreting the Shanghai Botanical Gardens.

As a researcher, Yan prepared a literature review of documents concerned with the world national park movement. She also wrote a report, National Natural Parks for China, proposing a process for developing a national park system in China. Yan met with forestry, agriculture, horticulture, and tissue culture scientists to obtain seeds and information for the Shanghai Botanical Gardens. She also learned how to analyze recreation visitor data on the University's computer, and worked as a research assistant on the Flathead River Project in northwestern Montana, where she learned how to administer survey research, and how to monitor river recreation use.

While based at the University of Idaho, Yan traveled to attend management presentations at national parks, wildlife refuges, state parks, and other recreation areas in Idaho, Wyoming, and Montana. She visited and lectured at the National Park Service Albright Training Center in Arizona, and prepared a set of slides on American park and recreation areas.

Liang Yong-ji, an associate professor in landscape gardening at Peking College of Forestry, arrived in June as the second Visiting Scholar in the wildland recreation exchange program. Liang, who is scheduled to attend the University of Idaho for nine months, will study park planning and national park development. Liang plans to develop a syllabus for a parkland recreation course he will teach after returning to Peking.

The Department of Wildland Recreation Management is hoping to host eight to ten recreation land managers, park planners and government officials from China in February or March.

Forest Resources

SHOOT BORER IMPACT ASSESSED IN PLANTATIONS

Karel J. Stoszek
Allen Robertson

Steven Laursen
Peter B. Mika

The introduction of intensive management on western forest lands has brought new pest problems, while avoiding others. Forests under intensive, short-rotation management are believed to be less susceptible to epidemic pest outbreaks which plague vast regions of western forests. However, in turning to intensive tree culture, forest managers have improved conditions for lesser pests which can still exact a high cost in damaged trees.

Forest Resources Professor Karel Stoszek, with graduate student Allen Robertson and Research Associates Steven Laursen and Peter Mika, are studying the effects of the western pine shoot borer on intensively managed ponderosa pine sites in central Idaho. This moth, native to the drier portions of several states from California to northern Idaho and Montana, produces larvae which feed on expanding ponderosa pine and lodgepole pine shoots. Larval feeding stunts or reduces the tree height growth and results in reduced overall growth volume. While infestations occur throughout the range of ponderosa pine, researchers have found that the extent and damage differ by sites, occurring only under certain conditions, and not on all plantations.

Models have been developed for central Idaho for rating stands according to their pine shoot borer infestation potential, or hazard, by the University of Idaho research team, with support from Region IV of the USDA Forest Service. Infestation occurrence was correlated to elevation, growth in height, stand density, and the substrate underlying the vegetation. Drier sites and taller tree stands apparently increase the chance of attack by this insect. Using the model, available through the Department of Forest Resources at the University of Idaho, intensive forest managers can estimate damage levels to expect from the pine shoot borer, and also where and when. Given certain site and stand characteristics, managers can decide whether intensive ponderosa pine culture will be profitable, with or without control measures.

The hazard-rating models, as applied on the Nezperce, Payette and Boise national forests in central Idaho, can be used to estimate loss in average annual height growth and cumulative volume per acre for a given infestation rate over an 80-year period. The models can only be applied to the geographic area, soils, elevations and vegetation series studied.

Forest managers in eastern Oregon, California, western Montana, Idaho and eastern Washington who are working with intensive culture on ponderosa pine plantations may in the future find that soil treatments or changes in management practices alter the site suitability for the shoot borer. A program of pheromone-based control developed by the USDA Forest Service and Weyerhaeuser Company proved effective in reducing pine shoot borer damage in ponderosa pine when applied last spring in eastern Oregon.

FUNGUS, BEETLES JOIN TO INFECT TREES

Arthur D. Partridge
Catherine L. Bertagnole

Although only one fungus reportedly causes black stain root disease of conifers, Forestry Resources Professor Arthur D. Partridge and graduate student Catherine Bertagnole have found several other fungi killing trees. These species coexist in heavily black-stained wood.

Healthy and diseased pine roots were examined extensively for causal organisms and their roles in black stain disease. Sequences of organisms were outlined from data gathered in Idaho and Oregon. For example, certain decay fungi enter small roots for the nutrient supply. This weakens wood tissue, which is then easily penetrated and colonized by other fungi, notably those causing black stain. Bark beetles carry fungus spores on their bodies and inoculate wood when constructing brood galleries. The fungi plug the cells of the tree's vascular tissue while the beetles girdle the trunk. The foliage begins to wilt, turns yellow, and the tree dies.

Researchers studied individual roles of black stain fungi by placing live species in mature, live, lodgepole pine roots. After one year, roots were removed and examined for presence of the fungi. Results showed that only one of the five tested species failed to penetrate live root tissue. Although the amount of fungus was small, often less than 8 cm in each root, the diverse fungal structures showed each species' adaptation to host cells and its potential for causing disease.

The researchers concluded that black stain root disease does not result from a single organism, but from several fungi penetrating and plugging wood cells. The diversity of fungal growth structures indicated that fungi often occur in groups, increasing the incidence of disease.

TIMBER YIELD PROJECTIONS TO SERVE WIDER REGION

James A. Moore
Charles Stiff

Success of a model which couples northern Idaho forest stand data with a given management strategy to predict timber yield has encouraged forestry scientists to expand the model for use in other areas. The Stand Prognosis Model (Stage 1973) was developed to predict forest stand growth for commercial tree species in the grand fir/cedar/hemlock ecosystem of northern Idaho.

An economic analysis model developed by University of Idaho Forest, Wildlife and Range Experiment Station scientists in 1978, in cooperation with the USDA Forest Service Intermountain Forest and Range Experiment Station, offered a comprehensive look at forest yield patterns, but still primarily for northern Idaho tree species.

Forestry professors James Moore and Charles Stiff, with graduate students Steve Scharosch, Jessica Josephs, and Joe Horn, have expanded the technology for use in eastern Oregon and Washington, central and southern Idaho. Principal trees which are also common to areas outside of northern Idaho include Douglas-fir, ponderosa pine, grand fir, lodgepole pine, western larch, and western redcedar. To extend the technology, scientists have had to adapt the program for different growing conditions rather than for different tree species. The most important difference, according to Moore, has been accounting for less moisture in the surrounding areas.

To develop the new predictive equations which are needed, data is being collected from state and federal

agencies, including the Forest Service, the Bureau of Land Management, the Bureau of Indian Affairs, and from private industry. The project, supported by funding from the Pacific Northwest Regional Commission, began in December of 1980. The research group expects to have a working computer program ready for use in March of 1982, available to any size organization from land use planning groups to consulting foresters working with small forest owners. The program's main application, Moore said, will be in long-range planning for specific forest stands. The forest owner or manager can submit forest treatments which are being considered. The computer will give yield projections based on those suggestions, which the manager can then weigh for his or her own use. The program will provide yield tables in cubic volume and in board feet for comparison of natural stands and managed stands.

WATER FROM PROCESSING TO HELP TREES GROW

David Wenny

Water in which vegetables are cooked is rich in nutrients. Potato growers, who process their products for fast food chains and grocery stores, create a large volume of waste water which is high in food nutrients, too high to return to nearby lakes and streams, yet too rich to waste.

J.R. Simplot Company, working with the Idaho Potato Commission, is currently funding a project to use the nutrient rich water to irrigate a plantation of hybrid poplar trees on Simplot acreage at Caldwell. Forest Resources Professor David Wenny worked with Simplot personnel this summer to plant 4800 hybrid poplar cuttings as the first step in the project. Wenny, who is working to

A COMMON LANGUAGE . . .

of growing tree seedlings united Professors Cai Canxien, left, and Harold Osborne on a visit to the University of Idaho Forest Tree Nursery. Professor Cai, a silviculturist from the Kwangsi College of Forestry in southern China, was in residence at the University of Idaho as a Visiting Scientist for the 1980-1981 academic year. In this picture, Osborne, Manager of the University of Idaho Experimental Forest, pointed out the developmental differences between the bare root and containerized seedlings grown at the nursery. The seedlings are used to supply state and forest industry and in reforestation on the Experimental Forest. *George Savage photo*



develop hybrid poplar clones at the University of Idaho, hopes to introduce university stock into the project next year.

The young poplars are being irrigated with fresh water until they are established. Later, the plot will be divided into four sections, one control group, which will continue to be irrigated with fresh water, and three using different levels of potato nutrient waste water. The trees will be grown as an energy farm, with a short-term, four to five-year rotation. After that period, the poplars will be cut for use as fuel, cattle feed or for alcohol conversion. Poplars, which propagate vegetatively, will provide their own second generation growth from the already established roots. In the course of the project, Wenny will investigate the effects of different growth densities and nutrient levels.

FUNGI ATTACK CONIFEROUS TREES

Sue Dubreuil

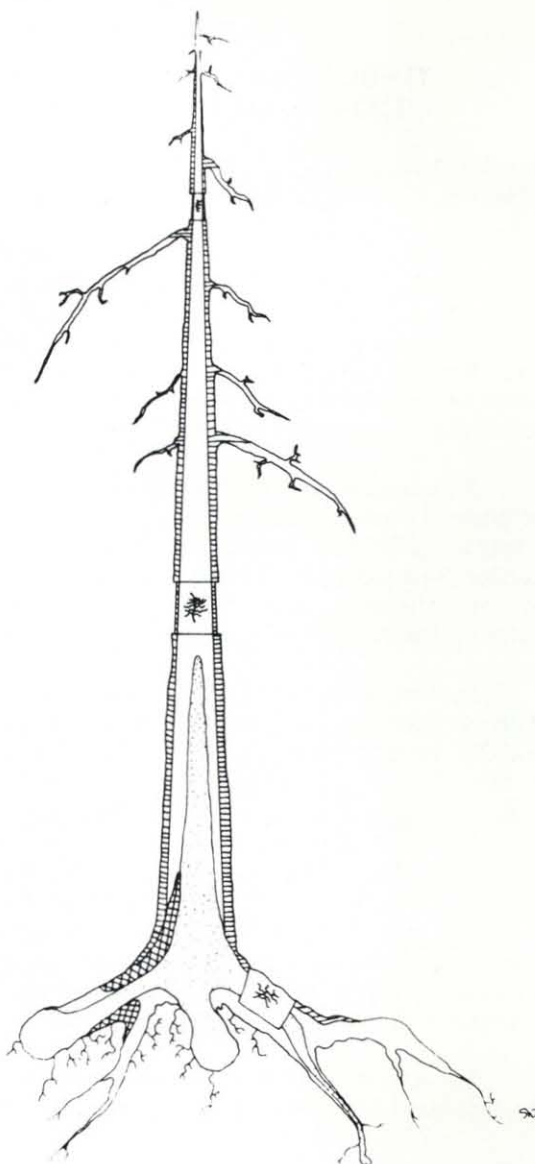
The velvet top fungus has been reported worldwide on conifers of temperate forests and on broadleaf trees of the tropics. It causes root decay and stem heartwood decay. The honey mushroom, also known as a tree and shrub pathogen, often joins with the velvet top fungus in killing temperate conifer trees. In Idaho forests these two fungi are among the most damaging of pathogens, causing losses in valuable timber through decay and death.

Sue Dubreuil, Forest Resources Research Associate and Instructor, has been studying the relationship between these two fungi in causing disease. She has examined other fungi with lesser roles in the destruction of these conifers as well as some which may act as natural biological controls.

All of these fungi are natural components of forest ecosystems. They live saprophytically for all or part of their existence, consuming waste materials and taking part in the continuous process of nutrient recycling in the forest. Why, then, do some occasionally become aggressive pathogens, causing destruction of live trees? By identifying the conditions under which the disease is produced perhaps scientists will be able to improve forest management programs for areas in which the disease is known to be prevalent. By altering the necessary conditions, they may reduce the frequency with which these saprophytes convert to parasitism.

In an effort to answer this question, root systems of trees were excavated and examined. The rhizographic relationships between fungi on the tree roots were determined and fungi interactions were studied in the laboratory.

Main roots of severely infected trees often are reduced to short, resinous stubs by the velvet top fungus. These roots are no longer efficient at supporting the tree and windthrow often results. Even when windthrow does not take



Patterns of root decay and stem heartwood decay are diagramed on a forest tree late in its infection. *Drawing by Sue Dubreuil*

place, the trees are weakened to the point that the honey mushroom and even bark beetles are able to attack and rapidly kill them. The velvet top fungus is able to live within the root system of a live tree for perhaps a century or more. Detection of infected trees poses a difficult problem for forest managers, since the growth rate and general appearance of infected trees are not noticeably altered until a few years before the tree dies.

Douglas-fir and grand fir are the most severely affected, while ponderosa pine and western larch exhibit what may be a high degree of resistance to this disease.

What has been learned of the drama taking place below ground in combination with the symptoms and signs seen above ground has contributed to scientists' ability to recognize problem stands and to make informed management decisions.

Forest Products

WOODS, CEMENT BINDER TESTED FOR PARTICLEBOARD

Ali A. Moslemi
Arland D. Hofstrand
Jose F. Garcia

Binder technology has become increasingly important to the forest products industry as petroleum and natural gas, raw materials used in the formation of particleboard, have become more expensive and harder to obtain.

Researchers at the University of Idaho have completed testing wood from nine northern Rocky Mountain forest tree species in combination with a portland cement binder. Forest Products Professors Ali A. Moslemi, Arland D. Hofstrand and graduate student Jose F. Garcia have monitored the curing process as wood, cement, and water were combined into particleboard. According to Moslemi, lodgepole pine, western white pine, and grand fir species had the highest compatibility with the cement binder among the western tree species. Similar tests are being conducted with 12 species of southern hardwoods in a project supported by the Southern Forest Experiment Station of the USDA Forest Service.

Because the formation of rough-edged, clinging cement crystals plays a major role in bonding, chemical additives, such as calcium chloride, and caustic soda have been added to the bonding mixture in companion studies. Wood technologists suspect that sugars and starches present in wood interfere with basic crystal formation in the cement. Chemical additives can improve the bonding environment and encourage stronger bond formation.

DEVELOPMENT NEEDED FOR WOOD ENERGY

Ali A. Moslemi

Logging mill residues, the sawdust, wood chips and bark left after a tree is sawed into lumber, are increasingly finding their way into wood products or being converted to steam and electricity. Use of these once wasted by-products is extending the raw material base of the forest products industry as the price of logs climbs.

Mill residues are needed for pulp, particleboard, and other wood products, as well as energy. However, the cost

of energy is drawing a high percentage (50-65% nationally) of these residues into various types of boilers for steam and power generation. Economics dictate the most cost-effective use of mill residues. By contrast, only about two percent of logging residues from the forest operation are being used for energy as industrial fuel.

Forest Products Professor Ali A. Moslemi has examined industrial and residential wood fuel use and projected wood fuel supplies to the year 2000, in a study conducted for the U.S. Department of Energy.

Activities such as thinning practices used in forest stand improvement represent another potential source of wood for fuel. The Congressional Office of Technology Assessment has reported that nearly 50 million dry tons of tree biomass are generated each year in this fashion. At present, about five percent of this biomass is retrieved for fuel.

Home use of wood fuel for space heating has caught on rapidly. Approximately 30 million dry tons of wood are now being collected annually for residential heating, a figure that rapidly approaches forest supply capability under current forest management practices. New sources of wood supply will be needed to sustain the present rate of growth in residential space heating over the next few years.

WOOD STABILITY SOUGHT IN CHANGING HUMIDITY

Ali A. Moslemi
Ruben Guevara

Dimensional stability of wood is of prime interest to industries using solid or composite wood products. Because wood responds to fluctuating humidity by absorbing or losing moisture, products made from wood suffer similar problems. A tight-fitting joint in a piece of furniture, a door, or house siding panel installed under high humidity conditions can later crack open. Wood having too low a moisture content on installation can later buckle.

A variety of techniques have been tried with varying success over the last 40 years to reduce or eliminate this instability. Forest Products Professor Ali A. Moslemi and graduate student Ruben Guevara are studying those techniques to determine whether some of them might be adapted for use in fiberboard and particleboard products.

Fishery Resources

LIFE-EXPECTANCY STUDY TO AID LAKE MANAGERS

**C. Michael Falter
Bradley Mitchell
James Milligan
Edwin Krumpe
John Carlson**

**Ashley Lyman
Nancy Hultquist
John Hultquist
Nancy Savage**

Lakes are not forever. Whether natural or manmade, each lake has a life expectancy that depends on a number of different factors. Those factors include size, depth, rate of flow into and out of the lake, siltation, or the amount of soil washed into the lake, chemicals leached into the lake from agricultural land by rain or irrigation, and the algae and plants which the lake produces.

Scientists from several University of Idaho departments are classifying Idaho lakes and studying their life expectancy as part of a nationwide project. The clean lakes study, as the national program is called, is funded by the Environmental Protection Agency through the Department of Health and Welfare. In Idaho, the interdepartmental project is being approached from the ecological perspective by Fisheries Professors C. Michael Falter and Bradley Mitchell, who will concentrate on the limnological and aquatic picture—the physical, biological and chemical aspects of lakes, and the life they support.

Civil Engineering Professor James Milligan will record and examine the hydrologic data—flow volumes into and out of the lakes, and the amount of nutrients carried into each lake. Professors Edwin Krumpe, John Carlson and Ashley Lyman, of Wildland Recreation Management, Agricultural Economics, and Economics, respectively, are evaluating the socio-economic pressures on lakes, and the importance lakes have for industry, recreation, pumping, and water supply. Research Associate Nancy Savage is studying lake biology, while Geography Professors Nancy and John Hultquist are working with geographical data.

The project began with a listing of Idaho lakes—about 2000 of them, ranging in size from 3 to 5-acre high mountain lakes to the 95,000-acre Lake Pend Oreille. Both natural lakes and reservoirs were included in the tabulation. Early last summer, a working list of 120 lakes was selected for field study. Lakes in the working group were chosen for their economic use or ecological significance. To ensure representativeness, a range of lake sizes and elevations was included. Field teams then visited each lake in the working group to collect data, which will be examined this fall. To avoid reaching only some lakes at

the peak of algal bloom in their summer cycle, and knowing the number of frost-free days for each area, Falter planned data gathering trips around seasonal water temperatures. Lowland lakes were studied in June. Lakes at progressively higher climate notches were studied in July and August, so that recorded lake conditions would be more comparable.

As summer temperatures climb, algae and plant materials place heavier demands on lake oxygen, which also supports water insects and fish. If the biological demand for oxygen of all living organisms within the lake exceeds available oxygen, both plant and animal life will begin to die, a process called eutrophication. Because chemicals and nutrients can encourage plant growth beyond the capacity of the lake, researchers were alerted to those areas where human activity might speed up eutrophication.

Field team data will be used to predict rates of change and trophic state, or health of the lake. Pressures on each lake to fulfill recreational, agricultural and economic needs were assessed to determine how well lakes are buffered against destructive effects from human activity and the introduction of nutrients and toxicants.

PATTERNS OF CHANGE

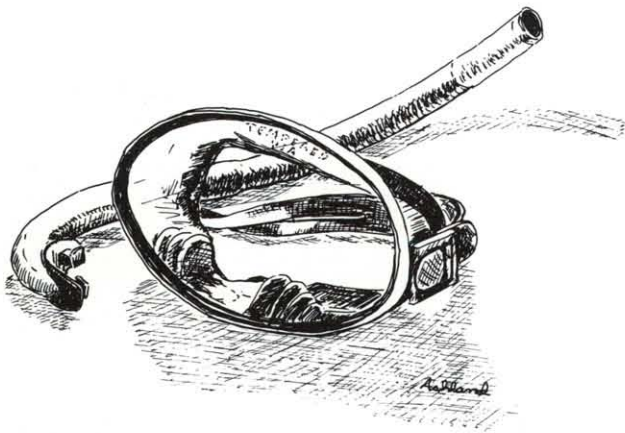
As a part of the study, the team will prepare three-dimensional maps showing water profiles, contours, lake turbidity and algal blooms. Data gathered in the study will allow researchers to rank the lakes according to production, water chemistry, physical aspects and biological characteristics. In going over the data this fall, scientists will determine where each lake is on a continuum of aging—how fast it is changing now, and where it might be in the next few years. In addition to the aging index, which will be available to land managers at the conclusion of the study, the team will prepare an index of stress applied to each lake and the stress capacity for each.

At the completion of the two-year study, researchers will select five or six lakes most important to the state for economic or recreational value. Management plans for these lakes will be worked out to halt the natural trend toward lake death. By artificially deepening a lake or by increasing water flow, Falter said, life expectancy of a lake can be greatly increased. He explained that depth is more important to the life of a lake than size. Removing a build-up of silt in a lake or reservoir can extend its life. The problem of siltation is one which makes hydroelectric power expensive. Reservoirs behind dams do fill up with silt, creating a need for new dams to maintain power supplies. Through the clean lakes program, management plans can accommodate the inevitable changes in water supply and demand.

STREAM FISH POPULATIONS MEASURED BY SNORKELING

Ted C. Bjornn
Brad Shepard

In a study of three streams in the Gospel Peak - Buffalo Hump area on the Nezperce National Forest, researchers are going underwater to count fish. The remote streams, part of the South Fork Clearwater River system which drains north into the Clearwater, are now protected by the Endangered American Wilderness Act of 1978. In two years, logging will proceed in a portion of the area which has been approved for multiple resource development. To keep track of changes which are brought about by opening up the area, the USDA Forest Service has requested an assessment of current conditions on these streams.



Fishery Resources Professor Ted Bjornn and graduate student Brad Shepard have collected data on fish abundance and habitat on the three streams. Shepard has counted the fish by snorkeling, recording the numbers on waterproof data boards. He has assessed conditions of spawning areas and rearing habitat used by the fish by recording the composition of the substrate, stream depth, width, and velocities.

Four stream habitat classifications were used to assess the distribution of fish of each species within the streams recorded in pools, riffles, runs or pocket waters. Pools were classified as areas of more than 30 cm mean depth found in larger streams. Riffles were less than 20 cm in depth. Fast moving sections of stream, with rounded U-shaped channel bottoms and a depth of 20 to 30 cm are called runs. Pocket waters, 20 to 30 cm in depth, are small pools formed behind large boulders.

Fish population estimates derived from the snorkel counts and the habitat measurements can be compared with information collected after logging and with drainages which have already seen road construction and logging. On areas which have similar habitats and substrates, managers can use the data to predict the effects which development will have on fish populations and habitat in the Gospel-

Hump area. The amount of sedimentation that would be generated from logging and road construction can also be predicted using sediment routing models that have been developed by other researchers.

Of the three streams in the study, researchers have found one which supports a chinook population, a second steeper stream with small gravel pockets which has primarily steelhead trout, and a third, above a barrier, which has mainly resident fish which do not migrate.

NEW MEASURE DEVELOPED FOR SPAWNING GRAVEL

Ted C. Bjornn
Paul Tappel

While studying effects of stream siltation on spawning habits of salmon, steelhead and trout, fishery researchers at the University of Idaho began looking for a new measure of spawning gravel composition.

Gravel has usually been classed by traditional particle size, for example, less than 4 mm. Fishery Professor Ted C. Bjornn and graduate student Paul Tappel have found a "percent fines" measure, which records the percentages of different particle sizes present in the sample and gives a better overall measure than does a single size class.

To describe the gravel composition of a given site, Tappel said that two points are placed on a continuum to indicate the range of particle sizes which occur there. Researchers used data from the USDA Forest Service and from the University of Washington on spawning gravel.

Oxygen is carried to egg nests in gravel by the water flow. Siltation of gravel nests inhibits the water flow, and thus the amount of available oxygen for hatching embryos. Good water flow through spawning gravels is known to attract spawning fish. To study the effects of gravel mixtures on egg survival and hatching success, the research team placed salmon and steelhead embryos in channels with gravel in the fishery wet lab. Fifteen different spawning gravel mixtures were tested, with 100 to 200 embryos buried in each test mix.

The researchers counted the number of fry which hatched in each mixture to determine percentage survival and related the percentage back to that gravel mixture. Fry length and weight were also measured at hatching. From the data collected, researchers and resource managers can predict the percentage survival for embryos in different gravel mixtures. Researchers have applied the data to areas of the Idaho batholith, which produce granitic sediment. The study has received funding from the USDA Forest Service Intermountain Forest and Range Experiment Station, out of Boise, and from the National Science Foundation.

Range Resources



Bluebunch wheatgrass makes a strong showing on a year-old burn at Lake Creek, on a Wyoming big sagebrush/bluebunch wheatgrass habitat type. *Steve Bunting photo*

PRESCRIBED BURNING USED TO MANAGE RANGELANDS

Steve Bunting
Leon Neuenschwander
James Peek

Dave Kuntz
Nancy Clifton

Sagebrush is a major plant component of Idaho rangelands, providing forage for big game animals and cover for sagegrouse and other smaller animals. Learning to manage sagebrush grasslands for various uses and finding out more about the reactions of different species of sagebrush to prescribed burning are the objects of projects which involve scientists from several areas of the college.

Range Resources Professor Steve Bunting, range graduate student Dave Kuntz, Forest Resources Professor Leon Neuenschwander, and Wildlife Resources Professor James Peek are studying the effects of prescribed burning

on three major sagebrush habitat types. The study sites are located at several areas in Idaho, including the Salmon, Shoshone, and Boise districts of the Bureau of Land Management and the Salmon National Forest. The three sagebrush habitat types under study include the mountain big sagebrush/Idaho fescue, Wyoming big sagebrush/bluebunch wheatgrass and basin big sagebrush/bluebunch wheatgrass.

The objectives of the prescribed burns are as varied as the locations. The areas on the Salmon National Forest are being burned primarily to develop forb range for elk. The main objective on other areas is to increase the productivity of perennial grasses. In the Owyhee Mountains in southwestern Idaho the prescribed fires are intended to check the invasion of western juniper into the sagebrush communities and thereby maintain the productivity of herbaceous plants. Most of the prescribed burns have been

carried out during the fall after vegetation is dormant. On the Salmon National Forest, however, researchers have had success using prescribed fire during late winter or early spring. The burns have been conducted by Forest Service, Bureau of Land Management and University personnel.

The projects are sponsored by the USDA Forest Service, Bureau of Land Management, Idaho Department of Public Lands, and the Idaho Research Council. The projects are aimed at evaluating the use of prescribed fire in the management of sagebrush grasslands to provide forage and habitat for wild and domestic animals.

RANGE ECOLOGIST VISITS IN IDAHO

Professor Li Bo, a range ecologist from the University of Inner Mongolia, was on campus as a Visiting Scientist from October through May. During his residence, he attended lectures in range management, range ecology and range plant communities to observe teaching methods. He also presented seminars on the vegetation of China, and wrote three papers on China's steppe and desert vegetation.

Range Resources Professor Lee Sharp arranged for Professor Bo to visit with a range extension specialist in Kansas and a range professor in Colorado to expand his view of differing range conditions in the United States. Professor Bo also attended the International Grassland Congress Conference in Lexington, Kentucky, before returning to the People's Republic of China. He expressed an interest in introducing range plant species from China on rangelands in the United States.

RANGE EXTENSION TEAM BASED IN TWIN FALLS

In a new joint program, the College of Agriculture and the College of Forestry, Wildlife and Range Sciences are sponsoring the position of Range Utilization Specialist through the Cooperative Extension Service Office in Twin Falls. Kenneth Sanders is engaged in research and extension activities, with three-quarters of his time in the College of Agriculture, and one-quarter in the College of Forestry, Wildlife and Range Sciences.

In his research on grazing, Sanders is studying the control of undesirable plants on rangeland. He organized the Tri-State Range Workshop held at Boise, in June, for the Department of Range Resources. Workshop presentations examined the use of prescribed burning on rangeland. District Economist Neil Rimbey and Sanders are working as a range extension team, providing assistance for all of southern Idaho. They are engaged in a program to explain to grazing permit holders the environmental impact statement procedures which will be required by the Bureau of Land Management.

MANAGEMENT TO COORDINATE GRAZING, FOREST LAND USE

James L. Kingery

As greater values are placed on resources in the Idaho panhandle, the need to increase emphasis on management grows. To provide timber supplies for the future, foresters are turning more often to artificial regeneration, planting young trees following timber harvest, rather than waiting for natural reseeding from nearby trees or stands. But trees grow for decades before reaching merchantable timber size. Harvesting old growth timber also releases understory vegetation ideal for summer grazing.

The Potlatch Corporation, USDA Forest Service, and the University of Idaho are exploring coordinated forest and grazing use of these lands. James Kingery, a professor in the Department of Range Resources, explained that the areas are known as transitory rangelands, because they are most valuable for grazing over the 20 to 30-year period until the overstory again achieves forest density. Wildlife as well as cattle graze the cutover forest areas, drawing yet another resource use from the same land.

The emphasis of the project, Kingery said, will be to coordinate land use for maximum benefit to all users, while creating the least conflict. Harvested lands within the areas to be studied have traditionally been offered for summer grazing. On clearcut areas, site preparation removes the understory to create better growing conditions for tree seedlings. Until the newly-planted seedlings are established, they can suffer trampling damage. At the same time, there is less understory for browse in the months following site preparation. Once seedlings are established, grazing use serves to keep competing understory vegetation from overpowering the young trees.

Different regeneration methods will be studied on a variety of sites and aspects in the course of the project. An economic analysis of tradeoffs between grazing and tree regeneration will also be performed. Kingery said that cattle exclosures will be employed in certain areas to determine effects of livestock use on tree regeneration. An effort will also be made to distinguish between wildlife and livestock use of young tree plantations. The primary goal of the project is to provide resource managers and land use planners with alternatives for coordinating timber and forage use on forested land in northern Idaho.

Ed. note. More than 370 people attended a Wildlife-Livestock Relationships Symposium held at Coeur d'Alene in April, in conjunction with the Northwest Section of the Wildlife Society Meetings, to discuss this issue. Range, wildlife, fishery, forest land and animal damage control interests all were represented. The meeting serves as a training session for fish and game biologists from Idaho and surrounding states.

Wildlife Resources

GRAZING SYSTEM BENEFITS ELK, CATTLE

James M. Peek
Jeff Yeo

An evaluation of big game use of the Herd Creek rest-rotation grazing system on the East Fork Salmon River, near Challis, is being completed by Wildlife Resources graduate student Jeff Yeo, under the direction of Professor James M. Peek.

Only 38 percent of the area, characterized by steep, rough terrain, has been used by cattle. Five forage species which are common in the diets of both elk and cattle received the most use on gentle slopes, creek bottoms, and areas close to cover. The same species were used least on ridgetops where elk winter.

Data from the study demonstrated that elk shift away from areas where cattle graze, into pastures or areas being rested. While competition for forage was not critical, elk avoidance of areas used by cattle indicated a behavioral constraint to be considered where the two species coexist.

Where there is suitable elk habitat in pastures rested from cattle grazing, no problem exists. However, when suitable habitat is not available elsewhere on the system, adjacent grazing allotments must be coordinated to accommodate elk.

DEER POPULATION DWINDLES— ARE WOLVES TO BLAME?

Ernest D. Ables
Ian Hatter

Between 1971 and 1980, black-tailed deer (*Odocoileus hemionus columbianus*) on the Adam River watershed of Vancouver Island declined by approximately 50 percent. Fertility rates of females were good with 1.47 fetuses per adult doe. Summer survival rates of fawns averaged 29.3 percent during the 1980 season as determined by road spotlight counts. Among the male segment of the population the proportion of yearlings was 33 percent, a figure closely approximating the fawn survival estimate.

According to Wildlife Resources graduate student Ian Hatter and Professor Ernest D. Ables, the deer do not seem stressed by habitat conditions. Body conditions of collected deer were judged fair to good according to kidney and marrow fat criteria. Field dressed weights of hunter-killed

deer in 1980 were greater than the 10-year average for this population. No significant disease organisms were detected that might contribute to reduced survival among the herd.

Thus, because no other factors could be detected that might explain the declining deer numbers, the researchers hypothesized that predation on fawns by wolves (*Canis lupus*) was the contributing factor. Two wolf packs of eight and six individuals, respectively, range in the Adam River watershed. During the summer of 1980, five wolves from the two packs were radio-collared as were 13 deer fawns. Unfortunately, shifts in wolf home-range use took wolves away from the area that contained the radio-collared fawns. Of the six radio-tagged fawns that died during the summer (38 percent mortality), none was killed by wolves.

In August, fawn:doe ratios were lower (33:100) in areas of greater wolf use and higher (52:100) in areas of lesser wolf use. Over 300 wolf scats have been collected for later analysis. Initial impressions are that deer comprise a major dietary item of wolves in summer. Since black bear (*Ursus americana*) also occur on the study area, 150 bear scats were collected. Researchers anticipate that bear predation on fawns is minimal and restricted to the month of June.

Plans for 1981 include radio-monitoring wolf packs to determine their patterns of home range and habitat use. Fawn survival will be studied by spotlight counts and compared with wolf presence and the occurrence of deer remains in wolf scats. The researchers judged that radio-collaring enough fawns to detect causes of mortality was not feasible given the time and cost constraints.

LEAD POISONING STUDIED ON HAGERMAN REFUGE

Steven R. Peterson
Gary Hompland

Information obtained during the 1978 to 1979 hunting season at the Hagerman Wildlife Management Area in southern Idaho suggested that a serious problem of lead poisoning might be occurring. Wildlife Resources Professor Steven R. Peterson and graduate student Gary Hompland have been studying the problem.

Early recommendations resulted in closure of the area to waterfowl hunting so that researchers could evaluate the situation. About 500 gizzards were collected from ducks shot by hunters on the refuge during the 1978 to 1979 hunting season. After the 1979 to 1980 hunting closure, a sample of approximately 700 mallards representing the free



Ducks were bait-trapped for testing on the Hagerman Wildlife Management Area to determine the level of lead poisoning in the free flying population. *Doug Benning photo, courtesy U.S. Fish and Wildlife Service*

flying population were bait-trapped or randomly shot. An additional 400 mallards were recovered dead or incapacitated during the study. Fluoroscopy of whole birds and x-ray analysis of gizzards found about 10 percent of the free flying population contained ingested shot. Additional information, obtained through post-mortem examinations and chemical analyses of liver and kidney tissues, indicated a higher number—about 15 percent—were suffering from lead poisoning.

Sampling for spent shot during both seasons showed that large concentrations of shot existed on dikes, in water impoundments, and along shorelines. Preliminary sampling of hardstem bulrush root masses taken near shooting areas indicated that root masses in areas dominated by dense stands of emergent vegetation may be another source of shot for ingestion by dabbling ducks using the area.

WHITE-TAILED DEER NEED MATURE FORESTS

**James M. Peek
Thomas E. Owens**

An evaluation of white-tailed deer habitat use patterns on the University of Idaho Experimental Forest has been completed by graduate student Thomas E. Owens, under the direction of Wildlife Resources Professor James M. Peek. Radio tracking of nine white-tails from 1977 to 1979 provided the information, which will be useful to foresters

and wildlifers who cooperatively manage resources in northern Idaho cedar, grand fir, and Douglas-fir forests. Home ranges for the white-tails averaged 147 hectares (367 acres) in winter and 284 hectares (710 acres), almost double in summer. The deer chose home ranges which had 21 percent of the total area in forest openings in winter, and 24 percent in summer. The number of forest openings in each home range averaged six both winter and summer; however, the size of openings on winter range averaged 6 hectares, while the size of forest openings on summer range averaged 12 hectares (30 acres).

Critical winter cover for deer was located in Douglas-fir, lodgepole pine, and grand fir stands within the grand fir and redcedar habitat types. The researchers stated that logging on white-tail winter range could be beneficial in providing forage as long as cuts averaged 6 hectares (15 acres) in size and did not exceed a total of 18 hectares (45 acres) for every 200 hectares (500 acres). Resource managers planning the cutting cycle would have to consider the need for mature forests with closed canopy as cover for white-tails in winter. Related studies in the northwest by researchers from a number of institutions have shown that big game need mature forest cover in winter.

While forage supplies need to be maintained through use of prescribed fire or logging, a portion of the winter range must remain in mature forest. This amount varies according to species, with the requirements of white-tails slightly higher than those of other big game species in the region.

Continuing Education/Extension



Faculty and students in the summer land use planning in natural resource management workshop pause at the entrance to the College of Forestry, Wildlife and Range Sciences. From left, back row: Robert Heller, Waziri N. Mnyau of Tanzania, Quintin Cruz of the Philippines, D.G. Premanchandra from Sri Lanka, William McLaughlin; front row: Nick Sanyal, Jo Ellen Force, Liang Yong-Ji of the People's Republic of China, Ezbon Yombek Wani from Sudan, Vicente Sano of the Philippines; on steps: Beni Nasendi from Indonesia. *Larry Gill photo*

LAND USE PLANNING FOCUS OF WORKSHOP

Foreign students coming to the United States to study natural resources met this summer at the University of Idaho for a six-week workshop on land use planning in natural resource management, directed and taught by Forestry Professor Jo Ellen Force. The workshop was sponsored by the International Training Division of the USDA Office of International Cooperation and Development.

The students, potential resource planning leaders from Sudan, Indonesia, Tanzania, Sri Lanka, and the Philippines, discussed planning in their home countries, and similarities in the basic planning process worldwide. Some of the areas covered in the workshop included economic impact analysis, social impact assessment, spatial analysis, population growth and land use planning, and remote sensing—the application of aerial and infrared photography and satellite imagery to land use planning. Field trips to view planning projects were varied, including the Palouse wheat farm of Roger Koller, Moscow Mountain, and a 10-day trip to western Washington. The group visited the Office of Agriculture for the King

County Planning Commission, Weyerhaeuser Company timberlands and tree farms, Olympic National Park, Gifford Pinchot National Forest, the Quinalt Indian Department of Natural Resources on the Quinalt Indian Reservation. At each stop, students met with land use supervisors or representatives who answered questions about their specific land use practices.

Professor Force said the program provided an excellent opportunity for foreign students to learn about land use planning techniques in practice in the United States, and offered a chance “to build peaceful bridges around the world through wise decision making in resource planning.” In addition to Force, who coordinated the program and its curriculum, others teaching workshop sessions included William McLaughlin, Gary Machlis and Nick Sanyal, professors and graduate teaching assistant, respectively, in the Department of Wildland Recreation Management at the University of Idaho; retired foreign service diplomat Sam Butterfield; Robert Heller, Forest Resources Professor Emeritus; Richard Dunford and Paul Barkley, Professors in Agricultural Economics at Washington State University; and Cliff Thompson, Dean of the College of Law at the University of Idaho.

FAZIO COMPLETES YEAR IN NATION'S CAPITAL

James R. Fazio, professor and head of the Department of Wildland Recreation Management, was on leave during the 1980-1981 academic year to serve as public information specialist in the Washington, D.C. Office of the Bureau of Land Management. He worked under the auspices of the Intergovernmental Personnel Act, passed in 1970, to encourage the temporary exchange of personnel between the federal government and state universities or other nonfederal units of government.

Fazio was the first faculty member from any university to serve in this capacity in the Bureau's Office of Public Affairs. There he was responsible for liaison with the Division of Recreation and Cultural Resources as well as serving as acting coordinator of the Bureau's Environmental Education Program. He was specifically charged with revising public affairs plans for the Bureau's off-road vehicle management and cultural resource protection projects. Fazio is the co-author of a new textbook, *Public Relations and Communications for Natural Resource Managers*, Kendall/Hunt Publishing Company, Dubuque, Iowa.

TREE NUTRITION COOPERATIVE BEGINS FERTILIZATION TESTS

Forty-five Douglas-fir forest test sites from the slope of the Cascades in Washington and Oregon, across Idaho, and into western Montana will receive nitrogen fertilizer treatments this fall under the aegis of the newly formed Intermountain Forest Tree Nutrition Cooperative.

The program is designed to study the effects of adding soil nutrients, especially nitrogen, to forest tree stands in the Intermountain Region. Fertilization trials will be established at a rate of 45 sites per year throughout the region. Comparisons are to be made of responses for a range of soils, stand ages, and site qualities within the intermountain area's several rainfall zones. The test sites selected for fall treatment were chosen last spring from areas on which some stocking control has been practiced, and which support stands of 40 to 80-year-old Douglas-fir. Tests in subsequent years will be extended to include grand fir and ponderosa pine sites. Areas for selection were suggested last April in a meeting of Cooperative member representatives and forest nutrition research scientists.

The Cooperative is an outgrowth of a forest tree nutrition project for northern Idaho initiated by the University of Idaho Forest, Wildlife and Range Experiment Station in 1971. The original project was supported by the Idaho Department of Lands, the USDA Forest Service Intermountain Forest and Range Experiment Station, forest industries, and fertilizer companies to gain information on growth and stand response of Douglas-fir and grand fir to nitrogen fertilization.

The Cooperative was formed in January, 1981, as a formal contract base for forest tree nutrition research through the Forest, Wildlife and Range Experiment Station at the University of Idaho. Cooperative members have pledged research funding based on their geographic distribution of ownership within the region. Reports of research results and potential fertilization problems and practices will be made to cooperators on a regular basis. The Cooperative is open to any landowner agency, industry or association needing up-to-date information. Membership fees to date have enabled the hiring of Forestry Professor James A. Moore as project coordinator and James Vander Ploeg as forestry technician. Future plans for the Cooperative include the addition of a data analyst and a scientist specializing in nutrient cycling as funding becomes available. Office, laboratory, and computer facilities are provided by the University of Idaho.

Members of the Cooperative include Boise Cascade Corporation; Potlatch Corporation; Champion Timberlands; Inland Empire Paper; Cominco-American; Flathead Agency, Bureau of Indian Affairs; Washington Department of Natural Resources; and Idaho Department of Lands. Several other groups are working out membership arrangements. Further information on the Cooperative may be obtained through the Experiment Station.

MEDIA LAB STAFF SERVES BROAD COMMUNITY

When students started producing slide presentations, taped messages, and automated slide-tape programs to fulfill class assignments in Wildland Recreation Management classes, people outside the College were impressed. Agencies and organizations began requesting a variety of electronic media services.

A Wooden Diary, a special multi-screen slide-tape production on forest land use in the Inland Northwest, was produced for the USDA Forest Service, and shown in October 1980 at the Society of American Foresters National Convention in Spokane. Enthusiastic response to this and other programs prompted more requests than student term projects could accommodate. Dan L. White, who had worked on producing A Wooden Diary, took on the job of running the Media Lab on a regular basis in the fall of 1980.

To date, the Media Lab has produced electronic programs for the Forest Service, the National Park Service, Idaho State Parks, Washington State Parks, 4-H, The Nature Conservancy, the Society of American Foresters, the University of Washington, and the University of Idaho.

Sam H. Ham, advisor for the Media Lab, and a professor in Wildland Recreation Management, outlined three types of projects undertaken by the Lab—the presentation of research results to scientists and lay audiences, programs

which address a particular management problem, and general interpretation of natural and cultural resources.

In presenting research results, the Media Lab staff prepare a slide-tape program, combining a slide show with a taped sound track. The tape carries both the sound for listening and inaudible signals which control slide changes. Programs using more than one projector and screen can also be prepared in a single projector and single screen package which the agency can then send out. Research results presentations must be scientifically correct, with content scaled for lay audiences. Programs which the Media Lab has prepared in this category include effects of prescribed burning, for the USDA Intermountain Forest and Range Experiment Station in Missoula; mountain goat ecology in Olympic National Park, Washington, for the National Park Service; Flathead River float trips, for the Department of Wildland Recreation Management; and A Wooden Diary, produced for the USDA Forest Service.

Programs dealing with management problems have included campfire safety warnings for hunters, requested by the USDA Forest Service; equal employment opportunities, for the National Park Service; and prevention of fires in wood-stove heated summer homes for the Yakima Rural Home Fire Prevention Council.

For use in interpretive work, the Media Lab has designed a program for visitors to Old Mission State Park, at Cataldo; an audio tape for a diorama at Spokane House, showing archeological discoveries made on or near the site of that early trading post; an explanation of multiple-use management on the Siuslaw National Forest, for the Cape Perpetua Visitors Center on the Oregon Coast; a portable program for high school students on study opportunities in the College of Forestry, Wildlife and Range Sciences; and a special set of slides showing scenes from American National Parks with superimposed captions in Chinese and English.

SHORTCOURSES, WORKSHOPS, AND SEMINARS

Throughout the year, research scientists in the College of Forestry, Wildlife and Range Sciences conduct workshops, shortcourses and seminars on campus and throughout Idaho and the West. Continuing Education programs which were sponsored by the college, or for which college departments served as co-sponsor or cooperator over the last year are shown below. Many of the shortcourses and workshops are offered on an annual basis. Further information may be obtained from the Office of Continuing Education, University of Idaho, Moscow, ID 83843.

1980

July 28 - August 1	Tree Problem Diagnostic Workshops—Lewiston, Weiser, Boise, Fairfield, Gooding, Paris, Preston, American Falls, Hailey
August 6-8	North American Quantitative Forest Genetics Group—Coeur d'Alene
September 7-8	Public Involvement Workshop—Twin Falls
October 20 - November 14	Continuing Education in Forest Ecology and Silviculture (CEFES)

1981

February 9-13	Aerial Photo Interpretation/Aerial Photography Workshop
February 24-25	Biofuel Potential in the Pacific Northwest Workshop
March 3-4	Forest Service Training Program—Portland
March 24-26	Design Support Systems Workshop
March 29 - April 9	Environmental Impacts of Recreation—Short-course
April 2-4	Wildlife Ecology Workshop—Twin Falls
April 3-4	Christmas Tree Shortcourse—Coeur d'Alene
April 9-11	Wildlife Ecology Workshop—Idaho Falls

April 19-24	Northwest Section—The Wildlife Society Meeting and Livestock Symposium—Coeur d'Alene
April 20-22	Wildlife-Livestock Relationships Symposium—Coeur d'Alene
April 22-29	Shortcourse on Recreation Satisfaction
April 30 - May 2	Research Conference on Recreation Satisfaction—McCall
May 26	Forest Owners Workshop—Spokane
June 1-5	Forest Habitat Types of Idaho—A Short-course for Land Managers—Salmon
June 3-5	Tri-State Workshop on Prescribed Burning to Improve Sagebrush-Grass Rangelands—Boise
June 13-20	Large Mammals in the Yellowstone Ecosystem—Yellowstone National Park
June 15-July 24	Land Use Planning in Natural Resource Management Workshop
June 20	Tree Farm Tour—Experimental Forest
June 22-26	Aquatic Toxicology Summer Institute
June 29	Range Workshop—Arco
June 30	Range Stewardship Meeting—Challis

Wilderness Research Center

RESEARCH SUMMARY

The University of Idaho Wilderness Research Center, through the cooperation of state and federal land management agencies, offers access to wilderness research facilities in Idaho and surrounding states. Founded in 1972, the Center operates a permanent field station, Taylor Ranch, located in the River of No Return Wilderness Area, and has direct access to two additional college field stations—on Payette Lake at McCall and the Clark Fork Ranger Station in the northern Idaho panhandle. The Center is coordinated by the College of Forestry, Wildlife and Range Sciences.

Activities for which the Wilderness Center provided partial financial support during fiscal 1981 are as follows:

Owls of the Idaho Primitive Area

Edward Garton, faculty advisor
Greg Hayward, graduate student

Seven species of owls winter in selected habitats along Big Creek and in the Chamberlain Basin within the Idaho Primitive Area. This project addresses niche segregation, especially elevational differences, habitat types and prey selection of this raptor complex. A possible breeding population of boreal owls (*Aegolius funeueus*) was discovered in the Chamberlain Basin. This species has not been reported to breed in Idaho previously and is extremely rare in the lower 48 states.

Bird Study in Idaho Primitive Area

Winifred Kessler, faculty advisor
Susan Tank, graduate student

Almost no information is available on the winter ecology of the smaller nongame birds. This study addresses winter habitat use, resource partitioning, foraging patterns and general behavior of a species complex of small birds in the Idaho Primitive Area. Results will provide base-line data useful for comparison with man-altered systems.

Pack Creek Bear Management Study

Ed Krumpe, faculty advisor
Ken Post, graduate student

Pack Creek Bear Reserve on the upper Seymour Canal of Admiralty Island, Alaska, has become popular for observing and photographing brown bear. The potential for conflicts between bear and people is becoming greater. This study examines bear movements and human use, activity and attitudes in the Pack Creek area. Results will be used by the USDA Forest Service and the Alaska Fish and Game Department to formulate a management plan that minimizes bear/human conflicts (see article, page 5).

A Comparison between Wilderness and Nonwilderness Visitors on Desired Recreation Experiences and Their Social Values

Bill McLaughlin, faculty advisor
Nick Sanyal, graduate student

This study was conducted at the Lostine Canyon entrance to the Eagle Cap Wilderness, Oregon. It explores the social values that wilderness vs. nonwilderness users place on recreational experiences.

Wilderness Evaluation Approaches of the BLM and USFS: A Survey Research Comparison

Ed Krumpe, faculty advisor
Marty Sharp, graduate student

This project examined the different approaches that the Bureau of Land Management and the USDA Forest Service use in evaluating roadless areas for wilderness potential.

Family Decision Making in Forest Recreation Settings

Sam Ham, investigator

This is a study of family interactions and patterns of decision making with respect to allocation of leisure time in a natural resource setting.

Recreational Impacts on the Flathead Wild and Scenic River System

Ed Krumpe, faculty advisor
Richard Converse, graduate student

The two-part study is concerned with characteristics, preferences and attitudes of recreationists who use the Flathead Wild and Scenic River System, and with the impacts of users on the associated riparian environment (see article, page 2).

Wilderness Psychology National Conference

The Wilderness Center is financing the planning stages of this conference which will be sponsored jointly by the Center and the Wildland Recreation Management Department.

Interagency Whitewater Committee National Symposium

The Wilderness Center sponsored faculty members Edwin Krumpe and Bill McLaughlin, who presented papers at this meeting.

Interagency Grizzly Bear Study Team

The Wilderness Center Director, Ernest Ables, serves on the steering committee of the Interagency Grizzly Bear Study Team. This team is conducting an in-depth study of the grizzly population in the Yellowstone ecosystem.

Appendix

EXPERIMENT STATION SCIENTISTS

Stoszek, Milena J.
Director of the FWR Nutritional Lab and Research
Associate Professor

DEPARTMENT OF FISHERY RESOURCES

Beleau, Marshall
Research Scientist
Fish health management

Bennett, David H.
Associate Professor
Warmwater fishery management, fish ecology

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

Cavigli, John
Research Technician

Chacko, A. Jim
Research Assistant Professor
Parasites and parasitic diseases of fish, anatomy and
histology of fishes

Congleton, James
Assistant Leader, Cooperative Fishery Research Unit and
Assistant Professor
Marine ecology, environmental physiology

Falter, C. Michael
Professor
Reservoir limnology, stream ecology

Gay, Robert
Research Associate

Irving, John
Research Associate

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

MacPhee, Craig
Professor Emeritus
Fish behavior, ecology, toxicology

Mitchell, Bradley D.
Visiting Assistant Research Professor
Limnology

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

Ringe, Rudy
Research Associate

DEPARTMENT OF FOREST PRODUCTS

Christophersen, Kjell A.
Assistant Professor
Forest products marketing and production economics

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

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

Howe, John P.
Professor Emeritus
Wood science and technology

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

Lee, Harry W.
Instructor
Forest engineering

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

Sowles, Kenneth M.
Professor
Forest products utilization and marketing

DEPARTMENT OF FOREST RESOURCES

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

Anderson, Hal N.
Research Associate

Bajusz, Barbara A.
FWR Experiment Station Statistician and Instructor
Statistics

Befort, William A.
Research Associate

Belt, George H.
Professor
Hydrology, meteorology, planning, forest management

Brunsfeld, Steven
Research Associate

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

Burnell, Donald G.
Research Scientist

Canfield, Elmer R.
Professor Emeritus
Forest pathology

Crookston, Nicholas L., II
Research Associate

Dennis, Brian
Assistant Professor
Statistical ecology

Deters, Merrill E.
Professor Emeritus
Forest silviculture

Dubreuil, Suzanne
Research Instructor

Fins, Lauren
Executive Secretary, Inland Empire Tree Improvement
Cooperative and Assistant Professor
Forest genetics

Gall, William R.
Assistant Professor
Statistical design and analysis of forest genetics research,
forest tree physiology

Goudie, James W.
Research Associate

Hanley, Donald P.
Extension Forester and Assistant Extension Professor

Hatch, Charles R.
Associate Dean for Research, FWR Experiment Station
Associate Director and Professor
Mathematical stand modeling

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

Johnson, Frederic D.
Professor
Forest synecology, autecology, phytogeography

Kessler, Bruce
Research Technician

Laursen, Steven B.
Research Associate

Leonard, James M.
Aquatic Biologist

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

McKetta, Charles W.
FWR Experiment Station Economist and Assistant Professor
Timber products economics

McMurtray, Maggie
Research Instructor

McNamee, Peter
Research Associate

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

Mika, Peter G.
Research Associate

Moore, James A.
Director, Intermountain Fertilization Cooperative and
Assistant Professor
Silviculture, quantitative methods, forest production

Neuenschwander, Leon F.
Associate Professor
Fire ecology, prescribed burning, general ecology

Osborne, Harold L.
Manager, University of Idaho Experimental Forest and
Research Instructor

Partridge, Arthur D.
Professor
Forest pathology

Pregitzer, Kurt S.
Assistant Professor
Forest ecology

Scanlin, David C.
Research Assistant Professor
Soil fertility and soil-site relationships with tree growth

Schenk, John A.
Professor
Forest entomology

Seale, Robert H.
Professor Emeritus
Forest economics

Skille, Jack
Research Scientist

Srivastava, Nilema
Research Associate

Stark, Ronald W.
Professor
Entomology

Stiff, Charles
Assistant Professor
Mensuration

Stock, Molly W.
Associate Research Professor
Insect physiology, ecology, population genetics

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

Tennyson, Larry C.
Assistant Professor
Watershed

Ulliman, Joseph J.
Professor
Aerial photography, mapping, aerial photo interpretation
and remote sensing

Vander Ploeg, James
Research Associate

Wang, Chi-Wu
Professor Emeritus
Forest genetics

Wenny, David L.
Forest Nursery Manager and Assistant Professor
Regeneration

DEPARTMENT OF RANGE RESOURCES

Bunting, Steven C.
Assistant Professor
Fire ecology, range ecology

Ehrenreich, John H.
Dean, College of Forestry, Wildlife and Range Sciences,
FWR Experiment Station Director and Professor

Hann, Wendel
Acting Instructor
Range communities

Hironaka, Minoru
Professor
Range ecology, synecology and autecology

Kingery, James L.
Assistant Professor
Range improvements and natural resource policy and
economics

Mitchell, John E.
Assistant Professor
Range ecology

Sanders, Kenneth D.
Associate Professor
Range management

Sharp, Lee A.
Department Head and Professor
Grazing practices, rangeland policy considerations,
range improvements

Tidwell, David
Range Coordinator

Tisdale, Edwin W.
Professor Emeritus
Range resource evaluation and management, native range
vegetation types, ecology of range weeds, and vegetation
habitat relationships

Wright, R. Gerald, Jr
Cooperative Park Studies Unit Project Leader—Biology
and Associate Professor
Range systems ecology, simulation modeling

**DEPARTMENT OF WILDLAND RECREATION
MANAGEMENT**

Fazio, James R.
Department Head and Associate Professor
Communication and principles of natural resource management, environmental interpretation, continuing education delivery systems and conservation history

Ham, Sam H.
Assistant Professor
Interpretation, communication, environmental education

Hoffman, Joseph E., Jr.
Associate Professor
Recreation management, economics of recreation, and recreation preferences

Krumpe, Edwin E.
Acting Department Head and Assistant Professor
Social psychology, decision processes in recreation, communications and interpretation

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

McLaughlin, William J.
Assistant Professor
Regional and recreation planning methods, citizen participation, recreation behavior, and perception and visual resource management

White, Dan
Media Technician

DEPARTMENT OF WILDLIFE RESOURCES

Ables, Ernest D.
Associate Dean, College of Forestry, Wildlife and Range Sciences and Professor
Wildlife ecology, especially animal behavior and radio-tracking techniques

Bizeau, Elwood G.
Assistant Leader, Cooperative Wildlife Research Unit and Professor
Birds, principally waterfowl and marsh

Dalke, Paul D.
Professor Emeritus
Wildlife management

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

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

Hornocker, Maurice G.
Leader, Cooperative Wildlife Research Unit and Professor
Population ecology and predator-prey interactions

Hungerford, Kenneth E.
Professor Emeritus
Wildlife management

Kessler, Winifred B.
Assistant Professor
Range management/wildlife relationships

Nelson, Lewis, Jr.
Coordinator of Continuing Education and Employment and Associate Professor
Continuing education

Nelson, Louis
Research Associate

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

Peterson, Steven R.
Department Head and Associate Professor
Waterfowl ecology and nongame wildlife management

Scott, Michael
Research Associate

**UNIVERSITY OF IDAHO EXPERIMENTAL
FOREST AND FOREST NURSERY**

Osborne, Harold L.
Manager, University of Idaho Experimental Forest and Research Instructor

Reggear, Robert C.
Assistant Manager and Forest Supervisor, University of Idaho Experimental Forest

Strong, Allan E.
Assistant Logging Superintendent

Wenny, David L.
Forest Nursery Manager and Assistant Professor

Meyer, James
Nursery Technician

Parkin, Charles
Nursery Technician

Vogtman, Clifford
Nursery Technician

ADMINISTRATIVE SERVICES

Archer, Jeanne M.
Assistant to the Coordinator of Continuing Education
and Employment

Ashland, Lorraine
Graphics Artist/Illustrator

Bottger, Richard F.
Director of Administrative Services

DeWald, Dan
Manager of Clark Fork Experiment Station

Gano, Steven M.
Assistant to the Dean for Development

George, Willard L.
Motor Pool Technician and Property Controller

Hieb, Susan R.
FWR Experiment Station Editor

Merkel, Albert L.
Assistant to the Dean for International Programs

Sargent, Marilyn
Assistant Coordinator, International Grants and Con-
tracts

Savage, George H.
Director of Information Services and Managing Editor

RESEARCH PROJECTS AND INVESTIGATORS

This listing of projects shows the range of work in progress through the experiment station; it is not a publication 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 FISHERY RESOURCES

Isolated fish liver perfusion. M.H. Bealeu

Acute toxicity of selected chemicals to the Colorado squawfish, an endangered species. M.H. Bealeu

Effects of I-90 construction activities on spawning success of kokanee (*Oncorhynchus nerka*) in Coeur d'Alene Lake. D.H. Bennett

Examination of spawning ecology and early life history of kokanee salmon in Coeur d'Alene Lake. D.H. Bennett

Status of the warmwater fishery and the potential of improving warmwater fish habitat in the Lower Snake reservoirs. D.H. Bennett

The fishes of the Savannah River National Environmental Research Park. D.H. Bennett

Juvenile emigration of lahontan cutthroat trout in the Truckee River-Pyramid Lake system. D.H. Bennett, T.C. Bjornn

Wild trout-hatchery trout relationships. T.C. Bjornn

Maintenance of fisheries resources with enlargement of the powerhouse at Minidoka Dam. T.C. Bjornn

Vancouver Island steelhead angler behavior, opinions and preferences toward artificial enhancement. T.C. Bjornn

Biological status report on Columbia Basin spring, summer and fall chinook and coho salmon. T.C. Bjornn

A study of fisheries resources in the Gospel-Hump area of central Idaho. T.C. Bjornn

Abundance, growth, distribution and movements of white sturgeon in the Snake River from Shoshone Falls downstream to C.J. Strike Dam. T.C. Bjornn

Evaluation of pilot rearing programs for steelhead at Dworshak and Hagerman National Fish hatcheries. T.C. Bjornn

Effects of additional peaking from a fourth generator at Dworshak Dam on public recreational use and safety along the Clearwater River. T.C. Bjornn

Habitat selection and species interactions of juvenile bull trout and westslope cutthroat trout in selected tributaries of the upper Flathead River system. T.C. Bjornn

Sedimentation and productivity of salmonid streams. T.C. Bjornn, M.A. Brusven, J.H. Milligan

Effects of sediment on incubation emergence and quality of chinook salmon and steelhead trout embryo and fry. T.C. Bjornn and R.G. White

Coeur d'Alene River fisheries investigation. T.C. Bjornn

Adult fall chinook trapping for Snake River egg bank program. T.C. Bjornn

Forecast of population trend of Snake River fall chinook salmon. T.C. Bjornn

Effects of power peaking at Dworshak Dam on catchability and movements of steelhead trout in the Clearwater River. T.C. Bjornn

Evaluation of wild stock status and development of hatchery plans for use of hatchery salmon in the Snake River. T.C. Bjornn, C.M. Moffitt.

Culture and spawning methods for endangered Colorado River fishes. A.J. Chacko

Habitat selection, spawning behavior and early life history of northern squawfish with inferences to Colorado squawfish. J.L. Congleton, T.C. Bjornn

Development and validation of habitat-standing crop functions for select fish and fish-food organisms. J.L. Congleton, R.G. White, J.H. Milligan, M.A. Brusven, E.O. Garton, T.C. Bjornn

Spokane River limnology. C.M. Falter

Trophic analysis of Idaho lakes. C.M. Falter, B.D. Mitchell

Water quality in the Lewiston Orchards Irrigation District. C.M. Falter

In-stream effects of volcanic ash in northern Idaho. C.M. Falter, B.D. Mitchell

A study to abolish the carrier states of bacterial kidney disease and furunculosis in anadromous salmonids. G.W. Klontz

Monitor and operate the Paterson Unit Study. G.W. Klontz

Control of bacterial kidney disease in chinook salmon. G.W. Klontz

Environmental gill disease in rainbow trout. G.W. Klontz

Use of "Cevasol" as a trout diet supplement. G.W. Klontz

DEPARTMENT OF FOREST PRODUCTS

Energy expansion through biomass production, conversion and use in developing countries. K.A. Christophersen

Analysis of net returns on timberlands vs. agricultural crops in northern Idaho. K.A. Christophersen

A probability model of insecticide efficacy for western spruce budworm and Douglas-fir tussock moth. J.E. Force, M.W. Stock, J. Robertson

Examination of Gospel-Hump models for the Forest Service. J.E. Force

Understanding firewood use in Idaho. J.E. Force

Development of a technical training course—Land Use Planning in Natural Resource Management—for the International Training Division, Office of International Cooperation and Development, USDA. J.E. Force

Skidding systems to match small-log utilization machines. L.R. Johnson

Biomass recovery systems and costs. L.R. Johnson, H.W. Lee

Tree biomass as an energy source: potential and supply limitations. A.A. Moslemi

Structural panels with Korean lignocellulosics and portland cement. A.A. Moslemi, W.Y. Ahn, A.D. Hofstrand

The effect of cross-linking and bulking agents on the dimensional stability of wood wafers. A.A. Moslemi, R. Guevara, W. Lehmann

Inorganic binders for wood panel composites with northern Rocky Mountain wood species. A.A. Moslemi, A.D. Hofstrand, J.F. Garcia

Hydration temperatures for wood-cement-water systems for selected southern hardwoods. A.A. Moslemi, Y.T. Lim, A.D. Hofstrand

DEPARTMENT OF FOREST RESOURCES

The use of seed wafers in reforestation. D.L. Adams

Shade effects on western redcedar seedlings. D.L. Adams, R.L. Mahoney

Local dispersal mechanisms describing spruce budworm population dynamics in western coniferous forest systems. D.G. Burnell

Population dynamics of the larch casebearer. D. Burnell, L. Neuenschwander

Integrated pest management in the Colville tribal forests. D. Burnell, L. Neuenschwander

Annotated plant list of the University of Idaho Experimental Forest. S.J. Brunsfeld, H.L. Osborne

Identification and ecology of Idaho willows (*Salix*). S.J. Brunsfeld

Selection of cold-hardy giant sequoia clones. L. Fins

Comparison of rootability of cuttings from outcrossed and selfed ponderosa pine and Douglas-fir seedlings. L. Fins

Genetic resistance of western larch to larch casebearer. L. Fins

Vegetative propagation of western larch by grafting and rooting cuttings. L. Fins

Assessment of genetic differences between coastal and inland western white pine using electrophoresis of isozymes. L. Fins

A probability model of insecticide efficacy for western spruce budworm and Douglas-fir tussock moth. J.E. Force and M.W. Stock

Genetic variation in western redcedar. W.R. Gall

Parameterization of tree and stand simulator to highly productive stands of coastal Douglas-fir in Washington and Oregon. J. Goudie

Evaluation of density effects on growth, stand and yield dynamics of lodgepole pine. J. Goudie

Plantation development. D.P. Hanley, D.L. Adams

Development of information retrieval system for Pakistan. C.R. Hatch

Evaluation, development and implementation of a forest inventory analysis system. C.R. Hatch

Population behavior and natural enemy studies on the western spruce budworm. C.R. Hatch, R.W. Campbell

Use of photo interpretation and remote sensing to establish hazard rating criteria for spruce budworm susceptible stands. R.C. Heller, J.J. Ulliman, H.N. Anderson

Development of methods for using high altitude aerial photography. R.C. Heller, J.J. Ulliman, W.A. Befort

Classification of wetland vegetation used by grizzly bear in Yellowstone National Park area. F.D. Johnson

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

Regeneration of western redcedar, ecology of cedar groves. F.D. Johnson

- Assessment of the effect of larch casebearer defoliation on growth and development of juvenile western larch using an individual tree growth simulation mode. S.B. Laursen, J.A. Moore, K.J. Stoszek
- Quantifying the impact of shoot borer infestations on ponderosa pine growth and yield in central Idaho. S.B. Laursen, K.J. Stoszek, J.A. Moore
- Bioassay of selected Idaho forest soils. H. Loewenstein
- Legume-conifer interrelationships. H. Loewenstein
- Deficiency symptoms and critical levels of nutrients in Douglas-fir. H. Loewenstein
- Containerized western redcedar seedling establishment and growth. H. Loewenstein
- Tree growth and response to fertilization as indicated by soil and foliar nutrient levels and environmental factors. H. Loewenstein
- Assessment of site factors, particularly soils, relating to growth of maiden's gum in Rwanda. H. Loewenstein
- The stability rationale: economic implications of an even flow constraint in forest management. C.W. McKetta
- Procedure for estimating fire management input costs. C.W. McKetta
- Effect of alternative local tax systems on forest investment. C.W. McKetta
- Use of linear programming on northern Idaho harvest scheduling problems. C.W. McKetta, H.L. Osborne
- Short run timber harvest response of nonindustrial forest land owners to changing market conditions. E.L. Medema
- Investment analysis of fuelwood plantations in Sri Lanka. E.L. Medema, C.R. Hatch
- Expansion of stand prognosis model for stand development to southern Idaho and eastern Oregon and Washington. J.A. Moore and C. Stiff
- Computer simulation of forest growth and yield in support of silvicultural prescriptions. J.A. Moore
- Initiation of the Intermountain Forest Tree Nutrition Cooperative. J.A. Moore
- Evaluating prescribed understory fire in shelterwoods. L.F. Neuenschwander, J.A. Moore, H.L. Osborne
- Elimination of nonproductive shrubfields by chemicals and/or prescribed burning. L.F. Neuenschwander, S.C. Bunting
- Fire ecology of north Idaho. L.F. Neuenschwander
- Fire as a silvicultural tool in ponderosa pine. L.F. Neuenschwander
- Fuel treatment specifications. L.F. Neuenschwander
- Fire ecology of the spruce-fir zone of northern Idaho. L.F. Neuenschwander
- Succession of fuels and vegetation following bark beetle outbreak. L.F. Neuenschwander
- Modeling early successional development following logging and burning. L.F. Neuenschwander, P.M. Lawton
- University of Idaho Experimental Forest: Timber inventory for management planning. H.L. Osborne
- Root diseases in conifer seedlings in mortality centers and their impacts on outplantings. A.D. Partridge
- Histology of western gall rust in ponderosa pine. A.D. Partridge, M-M Chang
- Survey methods for root-disease centers. A.D. Partridge
- Wood-inhabiting fungi. A.D. Partridge
- Disease-insect descriptions and keys. A.D. Partridge
- Disease-insect interactions in forest trees. A.D. Partridge
- Idaho tree diseases and defects. A.D. Partridge
- Techniques to identify, quantify and predict decays and diseases of timber in the inland northwest. A.D. Partridge
- Decays and cavity-nesting birds. A.D. Partridge, E.L. Bull
- Influence of natural stand characters and management practices on fir engraver populations and damage levels and on stand regeneration and growth. J.A. Schenk, D.L. Adams, J.A. Moore, S.B. Laursen
- Influence of grand fir slash condition on success of attack and brood development of the fir engraver. J.A. Schenk, J.A. Moore, S.B. Laursen
- Evaluation of effects of road construction on hydrology and sedimentation. J. Skille
- Evaluation of effects of road construction on aquatic fauna and flora. J. Skille
- Fate, distribution, and limnological effects of volcanic ash in the deltas of Lake Coeur d'Alene, Idaho. J.M. Skille, C.M. Falter
- Program manager, Canada United States Spruce Budworm Program—Western Component, 1981-1983. R.W. Stark
- Toxicological and genetic characteristics of western spruce budworm in relation to previous treatment histories. M.W. Stock
- Genetic indicators of population phase in the mountain pine beetle. M.W. Stock
- Selection of western spruce budworm for resistance to carbaryl. M.W. Stock
- Population structure of western spruce budworms in the Payette/Boise area of central Idaho. M.W. Stock and P.J. Castrovillo
- Genetic relationships between the Jeffrey pine beetle and the mountain pine beetle in northern California. M.W. Stock and P.K. Higby
- Genetic relationships among 7 *Choristoneura* species in North America. M.W. Stock and P.J. Castrovillo
- Genetic and toxicological characteristics of *Argyrotaenia gogana* from Montana. M.W. Stock
- Needle retention characteristics of Douglas-fir, grand fir, subalpine fir and Engelmann spruce. K.J. Stoszek, P.G. Mika, J.A. Moore
- Effects of boron stress on growth of coniferous seedlings. K.J. Stoszek, G.L. Lohse

Western pine-shoot borer on the Nezperce, Payette and Boise National forests. K.J. Stoszek, P.G. Mika

The relationship of western spruce budworm outbreaks to site/stand attributes, development and management history. K.J. Stoszek, P.G. Mika

Disposition of St. Helens tephra in mountain lakes in Idaho. L.C. Tennyson

On-site erosion on natural and disturbed soils in the Gospel-Hump area. L.C. Tennyson

Watershed and stream response after road construction—Horse Creek. L.C. Tennyson

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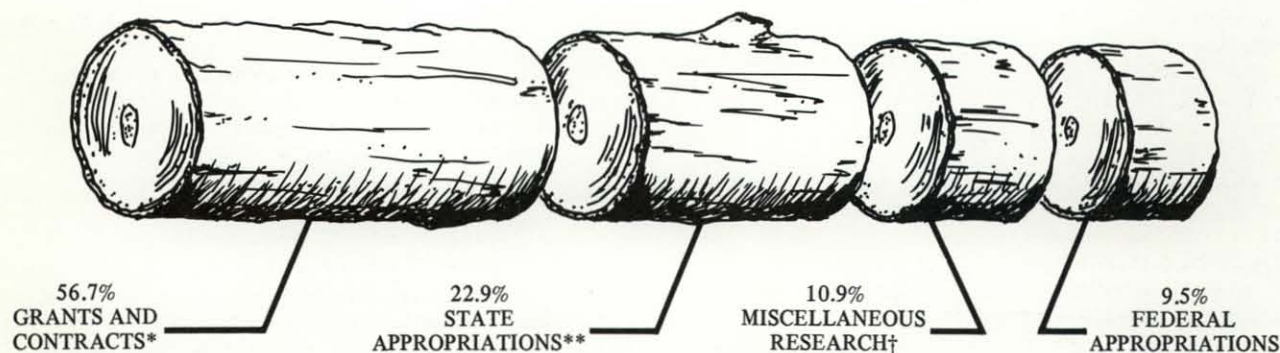
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Fiscal Year 1981 Financial Picture



Research expenditures, shown by funding source, totaled \$4,370,000 for the Fiscal Year 1980-81.

* Includes "in-kind" funds

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

† Includes Forest Nursery, Experimental Forest, Idaho Research Foundation, Taylor Ranch, WICHE, and Alumni Account

Managing Recreation Lands — Continued from inside front cover

between alternative forest uses be defined objectively and clearly. If we are to be responsive to our resource user client, we must provide information you need to have on these tradeoffs to make investment decisions. Knowledgeable decisions will result in improved management and increased revenues to the state.

Your support of Experiment Station programs during the coming years is badly needed. Your support is a small investment to make today to realize the potential of Idaho's natural resources tomorrow. It is not only an investment we should make, it is an investment we cannot afford not to make. Idaho's future demands it.

Charles R. Hatch

Agency and Funding Support

Alaska Fish and Game Department	Nature Conservancy
American Fishing Tackle Manufacturing Association	New York Zoological Society
American Forest Institute	Northern Pacific Railway
Anaconda Forest Products	North Idaho Forestry Association
Bennett Lumber Company	Pacific Northwest Power Company
Boise Cascade Corporation	Pacific Northwest Regional Commission
Boise National Forest	Pack River Lumber Company
British Columbia Forest Service	Payette National Forest
Bunker Hill Company	Potlatch Corporation
Carney Company	South Idaho Forestry Association
CEVA Labs	Stillinger Trust
Champion Timberlands	St. Regis Paper Company
Clearwater National Forest	The Wildlife Society
Colville Confederated Tribes	U.S. Army Corps of Engineers
Crown Zellerbach	U.S.D.A. Cooperative Research
Curtis Berklund	U.S.D.A. Forest Service, Intermountain Forest and Range Experiment Station
Diamond International Corporation	U.S.D.A. Forest Service, Northeastern Forest Experiment Station
Dow Corning	U.S.D.A. Forest Service, Pacific Northwest Forest and Range Experiment Station
Environmental Protection Agency	U.S.D.A. Soil Conservation Service
Flathead National Forest	U.S. Department of Commerce
Glacier National Park	U.S. Department of Energy
Greater Shoshone County, Inc.	U.S.D.I. Bureau of Indian Affairs
Idaho Department of Fish and Game	U.S.D.I. Bureau of Land Management
Idaho Department of Health and Welfare	U.S.D.I. Bureau of Reclamation
Idaho Department of Parks and Recreation	U.S.D.I. Fish and Wildlife Service
Idaho Department of Lands	U.S.D.I. National Park Service
Idaho Fish Food Industry	U.S. Department of Navy/Naval Undersea Center
Idaho Forest Industries	University of British Columbia
Idaho Nuclear Energy Commission	University of Idaho Experimental Forest
Idaho Power Company	University of Idaho Forest Nursery
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