FOCUS
on Renewable Natural Resources

Volume 8

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

Forest Industry and the Future

Fiscal year 1983 represents the beginning of a new era in the Department of Forest Products at the University of Idaho. Under the leadership of Department Head Ali Moslemi, the department assessed its role in the College and its relationship with Idaho's forest products industries. This assessment led to the development of research and teaching goals which resulted in revision of curricula and in new direction for individuals and resources in the department. Therefore, it seems appropriate that this year's issue of FOCUS feature Experiment Station research activity in the Department of Forest Products.

There is no other industry in Idaho tied more closely to the people and to the economy of the state than the forest products industry. Thus, this year has resulted in visible change as the state suffered uncertainty and record unemployment when rumored layoffs became reality. The state and its citizens had to learn to do without some things that once had seemed essential. As high interest rates paralyzed the housing industry, the need for homes and wood products did not disappear, but continued, dammed behind a wall of tight money. Although the industries' determination to carry on needed research programs has been severely stressed and substantially reduced in many cases, they have not lost sight of the fact that when the wall collapses, today's research will be needed to breech the flood.

Many of the forest products industries in Idaho have used periods of plant shutdowns creatively, reassessing production facilities and programs to improve their efficiency. In the Forest, Wildlife and Range Experiment Station we are working hand in hand with industry, retooling our research to meet tomorrow's needs. Our cooperative effort with the Idaho Forest Industry Association's Research Advisory Committee provides the College invaluable advice on its forest nursery and applied research programs. This advice has resulted in major changes in our forest nursery operation and is the major factor influencing the direction of our state-funded, applied research program. Our research focuses on identifying new methods and procedures for the more efficient managing and manufacturing of Idaho's forest resources. It is research that assists Idaho's natural resource based industries in identifying policies and practices which inhibit progress and in formulating changes that will result in domestic and international product and market diversification.

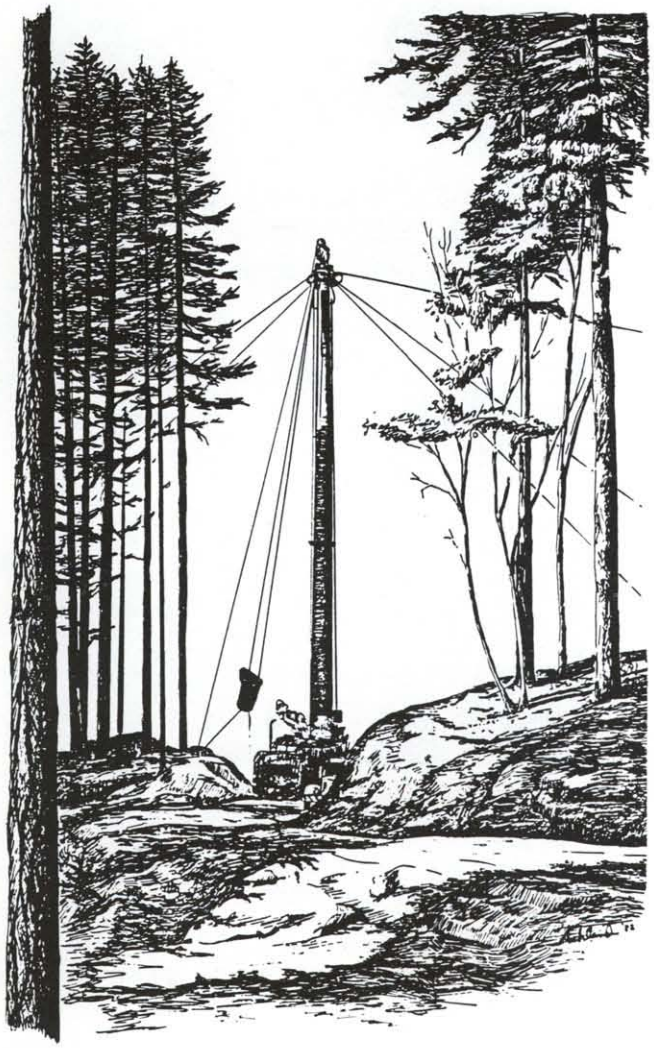
Although these are financially difficult times, they are times filled with high hopes and great promise. During the coming year we will be increasing our efforts to work cooperatively with you in attaining this promise —efforts that we believe can and will result in the continuation of critically needed research programs for Idaho's forest resources. Meanwhile, I invite you to read about the Experiment Station activities described on the following pages and to suggest to me your research needs and priorities.

Charles R. Hatch

Susan Roberts photo

FOCUS

Volume 8



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FOREST, WILDLIFE AND RANGE EXPERIMENT STATION

John H. Ehrenreich, Director

Charles R. Hatch, Associate Director

Howard Loewenstein, Assistant Director

Susan B. Roberts, Editor

Lorraine Ashland, Artist

Cover: The Forest Products industry has come a long way from the day of the tepee burner pictured on the front cover to the skyline logging system sketched on this page. Areas of new research in forest products are highlighted in this issue. The nighttime exposure of the tepee burner was taken in Plummer, Idaho. *Fred Johnson photo*

University of Idaho

Forest Products

MODEL TAKES GUESSWORK OUT OF WARMING LOGS

H. Peter Steinhagen

When veneer and plywood managers have selected the biggest logs with fewest knots for cutting, they expect prime veneer sections. Yet warming the logs to the recommended cutting temperature can be risky. Logs below the proper temperature cannot be cut as well. Overheating the logs can damage and discolor the wood, turning prime logs mushy.

Even in the summertime, few tree species can be sliced or peeled for veneer at ambient temperatures, so mill owners use giant water or steam baths to raise the inner temperature of the log. Using guesswork to tell when a log is "done" and ready for cutting can waste energy, time, and valuable wood. Drilling holes in the logs to test the inner core temperature makes whole sections of the log unusable for veneer.

Forest Products Professor H. Peter Steinhagen has developed a mathematical model to predict the time needed to bring a batch of logs to the proper cutting temperature. Given diameter length of the log, its moisture content, the temperature of the log and the temperature of the bath, Steinhagen can predict the time needed to warm a log to its ideal cutting temperature. A winter-cut pine log 18 inches in diameter, at an initial temperature of - 10°F may take 60 hours in a 130° bath to reach the target temperature of 120°F at the 4-inch core boundary. Veneer sections are taken down to this core, the portion of the log clamped during the cutting process.

Steinhagen's one-dimensional heat transfer model applies to logs which are long, four times the diameter or more. The warming temperatures must reach the log core from the diameter of the log, not from the cut ends. In further research Steinhagen plans to study the effects of warming on shorter logs, which receive heat traveling from the cut ends as well, transferring heat to the log core from two dimensions, ends and diameter.

Steinhagen has received requests for mathematical models which would place frozen logs in cold water and heat logs and water together to the proper veneer cutting temperature. Logs thrown into a hot water bath often split from the sudden, drastic temperature change. He will pursue the cold water bath technique with funds provided by University of Idaho Research Council.

Forest Products Department Head Ali Moslemi, left, and Wayne Wright of Idaho Veneer Company in Post Falls examine log sections ready to be steamed and cut into veneer sections. *Susan Roberts photo*

CELL STRENGTH EVALUATED FOR HONDURAN OCOTE PINE

Ruben Guevara M

The load that a single wood part can carry without suffering structural damage is important, particularly in applications such as housing and construction. Understanding variability within a given tree species, or even within a wooden part, is useful in structural design.

The strength of wood cells of American commercial species, interaction with other wood properties, and origin or location of timber cut for wood products have been studied extensively. This is not true for most commercial species from developing countries, where laboratory facilities and research funding are not readily available. In-

formation on wood properties for ocote pine from Honduras is scarce to nonexistent.

Forest Products Research Assistant Professor Ruben Guevara M has completed the second phase of a study on variability in ocote pine wood quality. Guevara found that differences in climatic, soil, water, and perhaps genetic factors caused regional variation in wood cell strength. Ocote pine wood proved to be strong and resilient, similar to wood from old-growth southern pines.

Results from this study will be valuable to Honduran industry for establishing lumber grades according to the area from which the raw material was obtained, for selecting high quality lumber for a newly opened laminating plant, and for developing design specifications for wooden structural members. The Honduran Forestry Development Corporation, and the University of Idaho Foster Fund for Latin America provided financial support for this project.

FOREST TREE RESIDUE RECOVERED FOR FUEL

Leonard R. Johnson

Limitations to use of forest residues–small trees and branches–have been inexperience with the methods of taking the materials out of the woods and the lack of a solid market. Although generalizations are plentiful about the heating value of wood residue in place of oil for forest products or other industry use, specific market points and prices have been hard to pin down in the intermountain region. Most of the projected costs of recovering forest residue have been taken from existing studies of conventional harvest operations and modified with certain assumptions. The accuracy of the data is questionable when applied to nonuniform wood residue. Another question that needs to be answered is the degree of difficulty that long semi-trailers will have transporting the material over narrow, winding woods roads.

Forest Products Professor Leonard Johnson is working on a project to field test residue recovery equipment after the conventional log harvest is complete, and as an integral part of operations to harvest merchantable wood products. Wood residue is processed into a more manageable commodity, such as chips, and transported to the mill to use as fuel. As part of the same project, Johnson will test residue recovery in thinning operations, and where harvesting is more costly, as on steep slopes. Johnson will study workability of different residue recovery systems and establish a base for comparing their performance. Availability of equipment and cooperators will be major factors in selecting test sites, which to date have taken the researchers to Emida, the University of Idaho Experimental Forest, Orofino, and Headquarters, Idaho; Newport and Chewelah, Washington; and Thompson Falls, Montana. Sites considered are located near current or potential wood fuel users. Funding for this project is through the USDA Forest Service.

Skyline yarder owned by Kludt Brothers Logging carries logged timber to a landing, ready for placement on waiting trucks. With the completion of conventional log harvest on this site on the University of Idaho Experimental Forest, residue recovery of smaller trees and branches will begin. *Leonard Johnson photo*

FOREST INDUSTRY, STUDENTS TAKE NEW TOOL IN HAND

Leonard R. Johnson

Computers, important tools for management, are taking their place in the forest industry. As with many another tool, achieving ease of operation for the user demands hard work behind the scenes for the developer.

Forest Products Professor Leonard Johnson began work on a computer model which could duplicate pulpwood and sawlog harvesting systems in the 1970s while working for the USDA Forest Service Northeastern Forest Experiment Station, Engineering Work Unit. The original program he developed in 1972, SAPLOS (Simulation Applied to Logging Systems), allowed the user to preview ground-based logging systems. Capabilities were expanded to simulate cable yarding systems in 1973, and whole tree chipping in 1974. Cleveland Biller, research mechanical engineer for the Forest Service in Morgantown, West Virginia, worked with Johnson to prepare a case study for the system in 1973. Donald Gochenour, professor of industrial engineering at West Virginia University was involved with early stages of logic formation. Johnson developed model logic, programming and debugging for the model, which has been tested on case studies in all regions of the country.

During workshops held in 1978 and 1979, potential program users learned to work with the computer simulation under supervision. Problems which the users had in entering or reading data were identified for model revision.

In its present form, SAPLOS can duplicate a variety of timber harvesting systems, allowing the user to simulate the total harvest system or to look at a breakdown of specific operations. The user can select manual felling with a chainsaw, or mechanical felling and bunching. Three designations for bucking, or sectioning the timber, can be chosen; bucking in the woods by the faller; bucking at the landing, a level area some distance from the felling; or mechanical bucking and limbing at the landing. To move, or skid the cut timber to a loading area, options include: ground skidding from stump to one or more landings: lifting the logs up or downhill by an overhead cable to one or more landings; or prebunching logs to a main skid trail for movement by a larger machine to the landing.

The user can also select from five skid trail patterns. Loading or chipping of the timber provides options to load trucks from a single loader; to load trucks which carry a self-contained loader; or to grind whole trees into chips on the loading site. Hauling may be designated from landing to mill, or from landing to an intermediate storage point.

Use of the simulation model can help the logger or student anticipate situations which might arise in an actual logging operation. Effects of weather and the balance of different operations in the system can be assessed. Costs of harvesting actual sites can be estimated. Students working with the models and with timber harvesting can use the model in a gaming situation to study planning and management of logging operations. People charged with appraising the value of standing timber can estimate logging costs using the model. Logging planners and researchers introducing new equiment to a region or system can determine how it works with other parts of the logging system, and can anticipate problems before sending the machine to the field. This project is funded through the USDA Forest Service.

Loggers complete work on two post and pole areas using a 40-horsepower Case diesel backhoe. This project achieved a profit from posts and poles while accomplishing thinning. The modified backhoe was scheduled for prebunching operations during the summer. Similar operations or total harvest systems can be simulated using SAPLOS. *Leonard Johnson photo*

PURSUING STUDIES. . .
at the University of Idaho in hydration of cement, Professor Liu Zhengtian arrived for a two-year period as a Visiting Scientist in July 1981. Professor Liu teaches forest products courses on particleboard and fiberboard manufacture methods at the Peking College of Forestry in Hunan Province, China.

During his stay at the University of Idaho, Professor Liu is examining the effect of hotwater soluble substances of larch wood on the hydration of cement, using facilities in the Department of Forest Products and through chemistry.

As wood particles are combined with cement to produce particleboard, attention has been drawn to the sugars in wood which inhibit hardening of cement. Professor Liu has turned his attention to larch and cement combinations because larch has the strongest inhibitor against hardening of cement. By boiling sawdust in water for differing amounts of time, Professor Liu is gathering extractives to combine with cement. Reactions with varying amounts of extractives and percentages of cement are monitored for amount of heat produced when water is added to the mixture, and for the time needed for each mixture to reach its maximum hydration temperature.

By determining ways to improve cement and wood particle binding using larch, Professor Liu expects to find a key for blocking inhibitors which slow the hardening process in a variety of woods.

Susan Roberts photo

WATER ABSORPTION STUDIED AFTER LOGGING

Harry W. Lee

Forest soils hold valuable water, preventing erosion and excessive runoff from rainfall and snow. Logging interrupts the natural pattern by removing trees and by introducing heavy machinery which compacts the soil particles. How extensive are the changes? Do they vary with different logging techniques?

Forest Products engineering professor Harry W. Lee has undertaken a project to measure ability of soil to absorb water after logging. Lee has established 10 study plots on the University of Idaho Experimental Forest. Logged sites have been harvested by shelterwood, seed tree, and clearcut practices, all within the last 6 months to 5 years. Controls are located on natural meadows, pasture, and within the deer exclosure maintained by the Department of Wildlife Resources.

The purpose of the study is to gather information on soil moisture content, bulk density, and any changes in absorption after logging. Results from the study will be available to persons or agencies interested in the data, which Lee hopes will open the way for expanding the research. Funds have been provided for this project by the University of Idaho Research Council.

Study plots have been logged by traditional wheeled skidders, weighing 25,000 pounds distributed over four huge wheels; a crawler tractor weighing 20,000 pounds distributed over two tracks; and a 6000-pound mini skidder, which also has four wheels. Lee wants to compare water absorption on soil logged with different machinery to see which methods are least disruptive to the soil. Several areas of the University Forest have been logged using a line skidder, where compaction and soil disturbance are generated by the weight of logs being dragged to a landing area. Lee hopes to find further funding to include water absorption studies on forest soils where harvesting has been carried out in this manner.

TREE SPECIES TESTED IN WOOD-CEMENT BOARDS

Ali A. Moslemi
Arland D. Hofstrand
Dave Ritter

In this country, particleboard is usually manufactured from wood particles and synthetic adhesives. Dave Ritter, a graduate student in the Department of Forest Products, is working with Forest Products Professors Ali Moslemi and Arland Hofstrand to develop boards which are mixtures of cement and wood particles. Structural use of wood-cement boards is already in practice in Europe and Southeast Asia for wall sheathing, floors and basic panel material. Use of cement in bonding particleboard makes boards more dimensionally stable, more resistant to fungal attack, and less susceptible to fire. Increased weight and added difficulty in machining capabilities must be considered in using the new boards.

Ritter is examining the relationship between properties of finished boards and the hydration reaction of wood-cement compounds to see whether board properties can be predicted using hydration data. The hydration of cement involves the release of heat as water added to the cement triggers crystallization or hardening. An advantage of wood-cement compounds lies in the fact that no external heat source is required to harden the boards. Ritter's project involves testing the reactions of cement and water with two wood species, Douglas-fir and lodgepole pine; and with two chemical additives, sodium chloride and sodium silicate. Use of the chemical additives accelerates the hydration reaction, and could result in superior boards. During the hydration of the wood-cement compounds, Ritter will monitor the temperature of the reaction, as well as the time it takes the reaction to reach maximum temperature. After the boards have been manufactured and allowed to cure for 28 days, Ritter will test them for bending strength, internal bond, and dimensional stability. He will then compare the properties of the boards with their tests during hydration.

Dave Ritter checks the alignment of wood flakes and frame before pressing a sample board in the Forest Products laboratory. *Susan Roberts photo*

Wood for particleboard is usually taken from waste wood or trees so small that other products cannot be manufactured from them. In this case, the wood is taken from trees on the nearby University of Idaho Experimental Forest and flaked in a special process by the Weyerhaeuser Company in Tacoma, Washington. Flakes are air dried in the University of Idaho's wood products laboratory for two weeks before being further broken down into smaller particles by a "flailer" at the Potlatch Corporation in Lewiston. Half-inch 2-foot by 2-foot boards will be manufactured or pressed at the Potlatch Research facilities. Cooperation of companies like Potlatch and Weyerhaeuser is of major importance in the performance of university research. Many projects could not be undertaken without access to specialized equipment made available by these companies. McIntire-Stennis funding has supported this project.

HONDURAN PINE YIELDS QUALITY PARTICLEBOARD

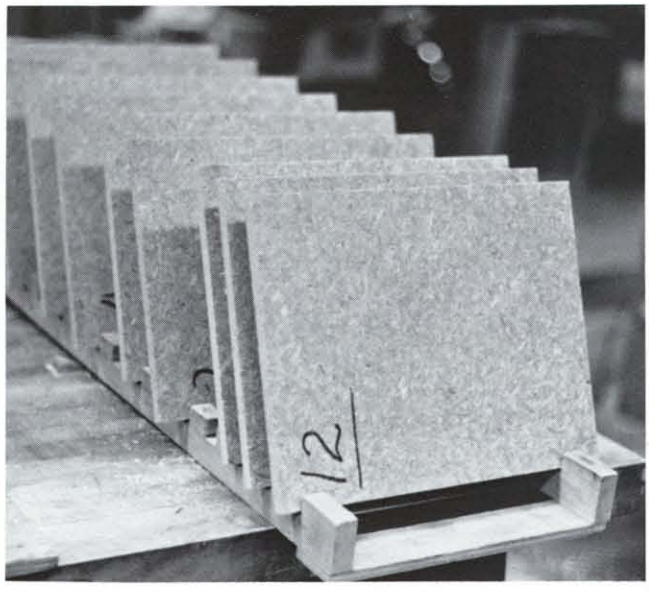
Ruben Guevara M
Abraham S. Guillen

Particleboards, first developed commercially in Germany in the early 1940s, have become the basis for an industry in themselves, providing manufactured boards which meet construction requirements at low cost. However, most of the manufacturing has taken place in North America, Europe, and Australia and New Zealand, where a ready pool of skilled labor exists to turn wood residue into a useful product.

Forest Products Research Professor Ruben Guevara M and undergraduate student Abraham S. Guillen have found that wood residues from Honduran ocote pine, bonded with urea-formaldehyde resin, yield particleboard with excellent physical and mechanical properties. Machinability and resistance to fluctuation with humidity were also good. The researchers studied manufacturing problems as well, and concluded that particleboard manufacture could be undertaken in Honduras.

There are no particleboard plants in Honduras, yet raw materials are abundant. Government statistics

indicate that around two million tons of wood residue are wasted every year in the form of bucking ends, slabs, sawdust, cull lumber and slash. Only a few Latin American countries have begun to use wood residue in particleboard manufacture or for energy production, in part because skilled labor needed to run and maintain sophisticated machinery is scarce. The University of Idaho researchers feel that a market for Honduran-produced particleboard could be established in Honduras and in neighboring Central American countries, which would help to balance trade with Central and Latin American countries. Manufacture of particleboard in Honduras would provide a use for a wasted resource and create new jobs. This project is funded through the University of Idaho Forest, Wildlife and Range Experiment Station.



Samples of particleboard from tropical pine await laboratory testing. Wood residue suitable for particleboard is abundant in Honduras, where particleboard manufacture could provide a valuable marketing asset. *Ruben Guevara M photo*

WOOD-BASE COMPOSITE PANELS –A NEW DEVELOPMENT

Ali A. Moslemi
Ruben Guevara M

Wood-base composite panels, made from pulverized wood or wood fibers, are the newest products developed by the forest products industry. The majority of these panels were developed to make use of low-quality wood or wood residues unsuitable for production of lumber or plywood. While early wood-base panel researchers did not expect to see their products in exterior locations, present uses include such structural and nonstructural applications as floor and roof sheathing, lap siding, and decorator panels.

Applications and design characteristics of wood-base products are expanding as properties are improved and the nature of the raw material and manufacturing processes broaden. Forest Products Professor Ali A. Moslemi and Research Professor Ruben Guevara M are working to produce a strong, low-density, dimensionally stable composite which can be substituted for old-growth, knot-free lumber. The University of Idaho scientists are experimenting with new adhesives, modification of the raw material's characteristics, and improvement of manufacturing techniques such as crushing wood or fibers, blending, and pressing wood mixtures. Preliminary results have encouraged the researchers, who feel that development of such products could hold down escalating lumber prices and ease dependence on the Northwest's old growth forests. This project is funded by the University of Idaho Forest, Wildlife and Range Experiment Station.

CHEMICAL TREATMENTS REDUCE WOOD SWELLING

Ruben Guevara M
Ali A. Moslemi

In its natural state, wood is a hygroscopic material – its moisture content fluctuates with changes in the surrounding atmosphere. As wood gains or loses moisture, its volume swells or shrinks proportionately. These changes are undesirable, particularly where precise dimensions are needed.

Wood scientists and forest products engineers have explored methods ranging from chemical treatments to new product design to reduce wood swelling and shrinking to a minimum. The manufacture of plywood successfully reduces dimensional fluctuations through crosslamination of three or more veneer layers, which restrains free movement.

Forest Products Professor Ali A. Moslemi and Research Professor Ruben Guevara M have chemically modified wood to improve its dimensional behavior and structural properties, and to increase its resistance to attack by insects and microorganisms. The treatments attempt to fill areas accessible to water molecules with another substance, thus blocking the uptake of water. The promoted reaction also produces crosslinks or bridges within the wood structure, restraining swelling and improving wood cell properties. The treatment chemical masks the wood's palatability to insects and some microorganisms. The researchers believe that chemical treatments applied to composite products or wood laminates could lead to strong, durable new wood products with a minimum of shrinking and swelling. This project was supported by the Weyerhaeuser Technology Center and carried out at the Center by the University of Idaho researchers.

Forest Resources

SITE ASSESSMENT NEEDED BEFORE REFORESTATION

James A. Moore
David L. Adams
E. Lee Medema
Stephen Fitzgerald

Reforestation–establishing new trees where old ones used to grow–has been around longer than mankind. Where a forest burned, or was otherwise destroyed, eventually it grew back. With the advent and growth of the forest industry, establishing new trees of the best quality stock as early as possible became a matter of importance.

Clearcutting an area and replanting with prime forest nursery stock became popular in the 1960 s. But foresters are finding that, depending on the site, this method of reforestation may not be the best solution, or the most practical. Stephen Fitzgerald, a graduate student in the Department of Forest Resources, has been working on a set of reforestation guidelines for northern Idaho, with silviculture professors James Moore and David Adams, and forest economics professor Lee Medema. Funding for the project is through the University of Idaho Forest, Wildlife and Range Experiment Station.

According to Fitzgerald and Moore, using seed tree or shelterwood cuts in harvesting often saves money and produces healthy, successful new forest stands. Assessing the area before harvesting and planting is important, Moore said, for choosing the proper reforestation method. Northwest forest nurseries cannot provide enough new trees to replant the hundreds of thousands of acres where reforestation is needed. Where natural vigor is present in a stand, natural regeneration is more likely to have success and be

This grand fir clearcut on a north-northwest slope of the Flat Creek Unit, University of Idaho Experimental Forest is being reforested with Douglas-fir and ponderosa pine seedlings. Planting stock was selected from containerized seedlings grown in the University of Idaho Forest Tree Nursery. Large sections of nearby timberland have been cleared for agricultural use. Wheatfields appear in the upper right portion of the picture. *Susan Roberts photo*

more economical, leaving the planting stock for areas where natural regeneration is less likely to succeed.

The researchers are basing their findings on observation of shelterwood and seedtree cuts made in 1967 and 1974 on 60 plots in northern Idaho, and on computer model projections of future yields. Stands monitored for the study are on grand fir/pachistima or cedar/pachistima habitats, and include mostly grand fir, Douglas-fir, and ponderosa pine.

In terms of economics, Moore said forest managers should not count trees left for seed as lost. Trees left after harvest, if they have a good canopy and are sound, not only produce seed well, but often show tremendous growth after competing trees are removed. Seed tree cuts remove all but about 10 trees per acre; more than 10 trees are left per acre in a shelterwood cut. Trees left for seed are usually about 50 years old, still a prime growth period for trees. Harvesting the seed trees should take place in the first 5 to 7 years, while tree seedlings are small and supple, or at the first thinning, when the new stand is 15 to 20 years old. Seed trees have been left on the study plots, so their growth can be measured against that of trees in control stands. Researchers have also established plots to study the understory vegetation under natural regeneration. Moore said tables will be prepared from the study for forest managers to preview natural regeneration success by species, age, size, and crown of the seed trees left on the site. Attributes of naturally regenerated seedlings through the second year of life will also be contrasted with those of seedlings planted on clearcuts.

By examining the data base, forest managers can determine acres where natural regeneration could be preferred to planting, saving on both labor and planting stock costs, and treating each area to be reforested as a separate investment.

GUIDE SIMPLIFIES WILLOW IDENTIFICATION

Frederic D. Johnson
Steven J. Brunsfeld

Willows constitute the single most valuable group of shrubs in Idaho and certainly the least understood. Over 40 kinds of willows grow in Idaho, ranging in size from mat-forming alpine shrubs less than one inch tall to riverine trees over 100 feet high. Willows are often the dominant vegetation along streams, lakes and rivers. Many other species occur on forested upland sites or in alpine meadows.

The importance of willows is well documented. They are a primary browse for moose and represent a valuable winter food source for elk and deer. Other wildlife–from beavers to grouse–also depend on willows.

More than 40 kinds of willow grow in Idaho. Shown here are catkins of Drummond willow. *Steve Brunsfeld photo*

Both cattle and sheep utilize willows extensively. They are highly significant in providing stream bank stabilization and watershed protection. Foresters, however, regard willows with some concern, since they are often a major component of brushfields which retard growth of young forest trees. Willows do have one thing in common, they are hard to identify. Willow descriptions now available emphasize flower structures which are technically difficult to recognize and are present only for a few weeks each season.

Research Associate Steve Brunsfeld and Professor Fred Johnson of the Department of Forest Resources are compiling a simplified identification guide to Idaho willows, which will provide habitat and community descriptions, and a field key. The pilot area for preparation of the guide centers on the Salmon National Forest. The key will help field personnel identify willows vegetatively--by looking at the form of the plant, the leaves, and the habitat in which they occur. Species can also be sorted out by elevation. Brunsfeld said that while 20 kinds of willows occur in the pilot area, each has a distinctive set of identifying characteristics.

The willow identification key has created interest among wildland managers. Willow habitats are diverse; each has an optimum growing area. They differ in palatability–willows that are preferred by moose may be ignored by sheep. All willows do not root easily, posing problems in watershed and streambank stabilization efforts. Even their sizes, shapes and esthetic appeal are entirely different. Johnson explained that there is no similar willow key in literature in the United States, despite the presence of willows in all parts of the country. With the completion of the guide to willows for the pilot area, Brunsfeld hopes to find funding to work on a regional guide, again using habitat data and vegetative characteristics for identification. Funds were provided by Stillinger Trust.

FUNGI-CAUSED DECAYS ARE COMPLEX PROCESSES

Arthur D. Partridge
Catherine L. Bertagnole
Duane J. LeTourneau

During the life of a tree, numerous organisms exist on nutrients in wood, bark, and leaves, often leading to tree disease and decay. Wood stain and decay-causing fungi, working together in the same tissues and cells, are brought into the tree by insects, root grafts with diseased trees, and/or by growth through soil.

Several fungi, including those in the genus *Verticicladiella*, can be isolated from conifers with black stain root disease, and coexist well on carbohydrates in laboratory media and in wood. Metabolism by two *Verticicladiella* species is being studied by Forest Resources Professor Arthur Partridge, graduate student Catherine Bertagnole, and Biochemistry Professor Duane LeTourneau. Histochemical and biochemical tests will define what carbohydrates are available for fungi in live ponderosa pine root wood, and which carbohydrates are utilized during fungal infection. The tests also will show how fungi interact during the disease process.

In a related study, enzyme interactions among three decay-causing fungi isolated from the mottled-root disease complex in Douglas-fir will be examined. Each fungus will be grown in Douglas-fir wood blocks to discover which wood cells are invaded, and which major fungal enzymes are involved in cell wall degradation. Later, fungi will be combined to simulate the effects of associated decay-causing fungi placed in the same tissues. The study will emphasize development and interactions of enzymes.

Fungal-caused stain and decay of trees are complex processes often involving several organisms. Little is known about the mechanisms of concurrent or synergistic wood degradation. Researchers must understand physiological interactions among disease-causing organisms before they can develop effective control measures. This project has been funded by Forest Utilization Research.

WETLANDS CLASSIFICATION FOR GRIZZLY BEAR HABITAT

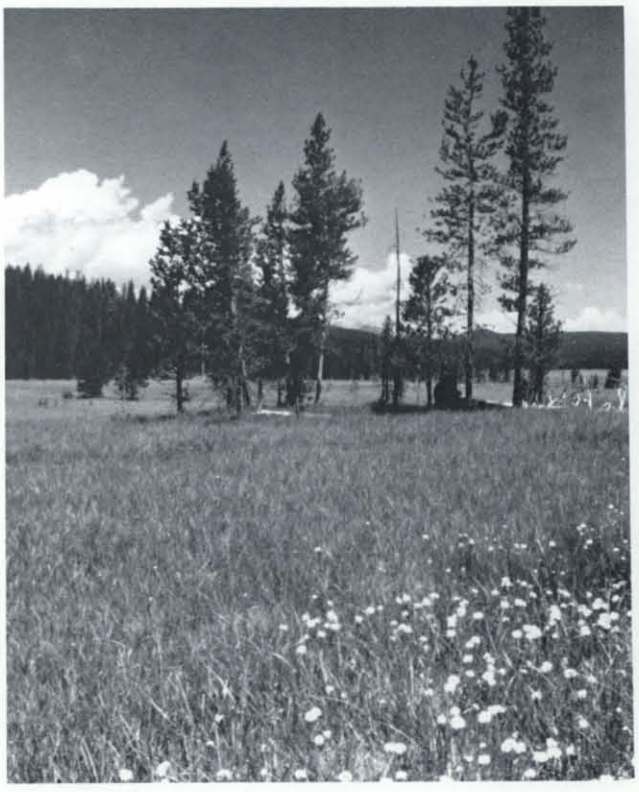
Frederic D. Johnson
David J. Mattson

The central plateaus of Yellowstone National Park embrace some 200,000 acres. Gently undulating terrain supports lodgepole pine forests on the hills, and pot-hole lakes surrounded by lush wet meadows in the extensive bottomlands. The wetland meadows form a critical part of the summer habitat for a wide variety of wildlife: moose, elk, deer, bison, geese, granes, swans, and grizzly bears.

Wildlife managers need data on habitat requirements for grizzly bears, classified as an endangered species. To determine critical habitat for the grizzly, researchers must know what the grizzly is doing on the wet meadows, and what plants have most attraction for the bears. Do bears go from acre to acre searching for a favored plant? Knowing the extent of favored plant communities and populations of selected food plants will aid materially in estimating not only habitat but carrying capacity for grizzly bears.

David Mattson, a graduate student in Forest Resources, studying under Professor Frederic Johnson, is working on a classification of wetland vegetation of the volcanic plateaus which include the shore of Yellowstone Lake and the Hayden and Pelican valleys. A final report will be submitted to the sponsor, the Interagency Grizzly Bear Study.

Mattson, to date, has classified 14 vegetation series, encompassing 35 specific habitat types. The study area, preserved as part of one of the oldest national parks in the country, represents one of a few areas in the west ungrazed by domestic livestock. Classification of these productive wet habitats may be used not only by wildlife biologists interested in grizzly bears, but also by persons interested in any of the animals and in the biologically complex communities of all of Yellowstone Park. Mattson hopes to extend the study to take in all of Yellowstone National Park if funding can be found. The USDI National Park Service has provided funding for this project.



Wetland meadows in Yellowstone National Park are an important part of grizzly bear habitat. *Fred Johnson photo*

WATERSHED MODEL CALIBRATED IN IDAHO

Larry C. Tennyson
Jack King
Bradley Barber

Computer models, developed for particular conditions in one area of the country, can sometimes be modified for use in other regions. Forest Resources Professor Larry Tennyson, graduate researcher Bradley Barber and USDA Forest Service Research Hydrologist Jack King from the Intermountain Forest and Range Experiment Station are working on a cooperative project to test a watershed model in the Horse Creek study area. The project is funded through the Intermountain Station.

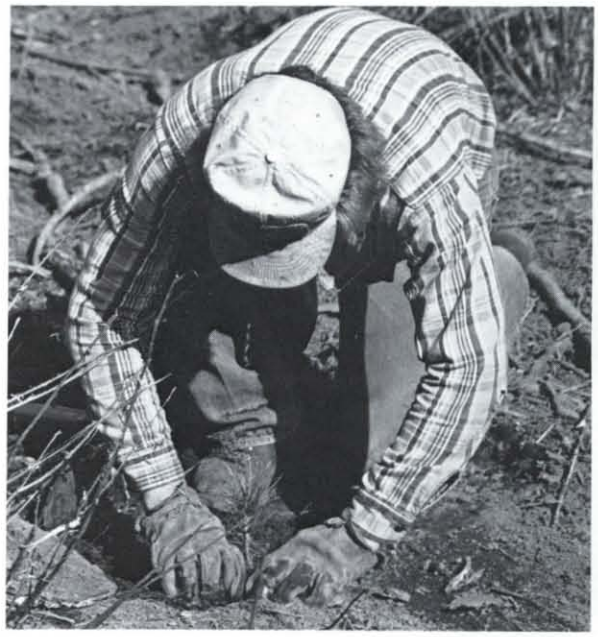
The SNOWSED model, developed at Colorado State University for the USDA Forest Service, can simulate water and sediment yield on watersheds in their natural state, and after clearcutting, site preparation and road construction. Scientists involved in the Horse Creek Administrative-Research Project are calibrating and validating the model for watersheds typical to the Nezperce National Forest. Using a hydrograph–a graphic illustration of streamflow curves over time–and statistical analysis procedures, the researchers map the snowmelt runoff peaks and water flow for the entire year. In calibrating the model, they match computer simulated hydrographs with what has actually occurred in the past. Annual water yield and snowmelt runoff sediment yield will also be calibrated with the model.

If the model can be calibrated for the Nezperce National Forest and other similar forested areas, the Forest Service will have a planning tool for predicting changes in water and sediment yields on watersheds under different harvest treatments. The model can be used on small areas or large drainages, from a single harvest unit on less than 200 acres to a 200,000-acre operation with multiple harvest units.

FISH TANKS USED IN ROOT GROWTH TESTS

David L. Wenny

Growing containerized forest tree seedlings is a full-time occupation for Forest Resources Professor Dave Wenny, who runs the University of Idaho's Forest Tree Nursery. But his concern does not stop there. Until a tree is established and growing on a plantation, many things can go wrong. When a forest plantation fails, the manager does not know whether to blame poor stock, poor storage, or poor planting. Tree seedlings that look healthy may not be of high enough quality for reforestation. Testing the seedlings before planting could rule out two major causes of failure, Wenny said, and head off the expense of planting stock which lacks adequate growth potential.



Forestry worker plants a ponderosa pine seedling in a reforestation project. *Susan Roberts photo*

To protect planters and nurseries alike, Wenny has been working on a system to test tree seedlings for root growth. Using large fish ranks, he plunges 50 tree seedlings per tank into water up to their root collars for a 10-day period. Oxygen is bubbled through the roots. During that time he watches for root development–where the roots come out on the seedlings, how many, and how long. A good seedling should develop 4 to 6 inch roots in 10 days. Bud burst should not occur during the 10-day period, as the roots need all the energy to establish themselves during that time. Wenny examines bud activity with an oscilloscope, monitoring wave patterns that indicate change in growth tissues before the eye can detect bud burst.

Different tree species may exhibit different growth patterns. Wenny is trying to establish a rating system for each tree species he is working with, at present Douglas-fir, ponderosa pine, larch, and white pine. Seedlings which score 8 to 10 points would be considered excellent; ratings of 6 or 7 would be considered good; 4 to 5 points would show marginal quality; below that, trees should not be accepted. He would like to see the University of Idaho develop an independent testing center for tree seedlings. Wenny explained that use of such a center would protect both the nursery and the planter. Ideally, about eight to ten tree seedlings per lot should be tested before purchase and again after storage, just prior to planting.

Wenny has been testing trees grown in the University's Forest Tree Nursery, and has asked industry and agencies which manage tree plantations to send in planting stock as well. Wenny believes that testing is essential to save waste and expense in reforestation. This project has been funded by the University of Idaho Forest Tree Nursery.

Range Resources

Cattle graze on a tree plantation near Waha, Idaho. Grazed and ungrazed plantations are being studied by University of Idaho range scientists to improve coordination of grazing and tree growing. *Jim Kingery photo*

IMPACT DATA SOUGHT ON TREE GROWTH, GRAZING

James L. Kingery

Starting new plantations on freshly logged areas is common forestry practice in the Pacific Northwest. Cattle grazing on meadow land often wander into the newly cut areas to feed on palatable grasses and shrubs released to more rapid growth by removal of the overstory vegetation. In order to coordinate use of forest land to include livestock grazing, the USDA Forest Service, Region 1, and the Intermountain Forest and Range Experiment Station, in cooperation with the University of Idaho have launched a project to measure the actual impact of livestock on tree regeneration.

Range Resources professor James Kingery explained the work he is conducting to obtain data on livestock impact for the Forest Service. "The Forest Service needs the data not to exclude cattle, but to better coordinate grazing with tree growing," Kingery said. During the summer, study sites were located in recently logged areas. Portions of the study sites were fenced as experimental test plots, so that growth of ponderosa pine, Douglas-fir and larch seedlings could be compared on grazed and ungrazed areas. The logged areas will be planted next summer for forest regeneration.

A 3-acre animal exclosure and associated grazed plot were established at light, moderate and heavy grazing intensities on cedar/pachistima, grand fir/pachistima and grand fir/mountain maple habitat types. Animal impacts will be measured at the different use levels. The paired study plots are uniform in elevation, slope, and aspect, and will be kept uniform in stand treatment throughout the test period. Because of the high potential for livestock forage and tree production on these habitats, researchers and land managers are giving more attention to management practices which would avoid conflict.

There is less information available about grazing impacts in these habitat types than there is for the drier, ponderosa pine types. Improved management hinges on obtaining better field information. Three paired exclosure and grazing sites were placed on grand fir/mountain maple sites on the Slate Creek Ranger District, Nezperce National Forest; three on grand fir/pachistima habitat on the Palouse Ranger District of the Clearwater National Forest; and three on cedar/pachistima sites on the St. Maries Ranger District of the Idaho Panhandle National Forest, for a total of 9 pairs of sites. Establishment and study of plantations on these grazed and ungrazed plots will provide some of the first solid data for areas characterized by these habitat types.

As the plantations develop, a time will be designated to reduce the enclosed areas by one-third, so that animal impact can be observed on established tree seedlings. Returning a second enclosed area to grazing as trees reach sapling size will provide further animal use data. Baseline data of this type will allow managers to determine the plantation age which will best coordinate growth of trees and animal use of forage.

The effect of pocket gophers on Douglas-fir seedlings will also be examined in the ungrazed and grazed areas. Test groups of trees will be protected by plastic mesh. It remains to be seen, Kingery said, whether or not livestock grazing has any effect on pocket gopher activity in tree plantations. Tree seedling damage by pocket gophers will be measured on grazed and ungrazed plots during the course of the project.

While still in its early stages, Kingery said, the project is already providing some positive results. "So many people have been brought together to begin the project–people from the Forest Service Region 1, the Intermountain Forest and Range Experiment Station, personnel from cooperating ranger districts, grazing permit holders, and University of Idaho research personnel. Just bringing all those people together to discuss coordinating grazing on prime timber land is a major step."

BRYANT JOINS STAFF

Range Resources welcomed a new department head during the summer with the arrival of David Bryant, who comes to the University of Idaho from the University of Arizona School of Renewable Natural Resources. Bryant has also taught at Humboldt State University in California. A graduate of Washington State University, he holds a master's degree from Texas Tech University and a doctorate from the University of Arizona. Bryant's research interests are in range nutrition and improvement. Lee A. Sharp, a member of the College of Forestry, Wildlife and Range Sciences faculty since 1949 and department head since 1979, will continue to teach, to work with projects at the University's Point Springs range research station, and to participate in range extension activities.

FREQUENCY PLOTS MONITOR CHANGE

Minoru Hironaka
Steven C. Bunting
Stuart D. Smith

Information on plant density and plant cover provide range managers with a base for decision-making. Forest Service and other agency personnel have traditionally used a three-quarter inch loop at spaced intervals to determine plant composition of range communities. Frequency plot sampling, a method which shows spatial distribution based on presence or absence of a plant rather than the number of individual plants present, offers range managers more information on change in vegetation pattern, considering the sampling effort required.

Scientists in the Department of Range Resources are comparing use of the two methods, and trying to determine the limitations of the frequency plot method. Stuart Smith, a graduate student working with Range professors Minoru Hironaka and Steve Bunting, has carried out tests of vegetation change on four different range communities, using both methods. While the loop method did not detect known changes in the vegetation, the frequency plot method showed significant changes in species populations with the three plot sizes that were tested (10 x 25 cm, 15 x 33.5 cm, and 20 x 50 cm). Detection of change was more sensitive with increased plot size for the species involved.

Establishment of the superior sensitivity of the frequency plot method to detect vegetational change led to a subsequent study of nested frequency plots, their analysis and interpretation. Using a basic plot size of 50 x 50 cm, the plot is further divided into 25 x 50 cm, 25 x 25 cm, and 10 x 10 cm. Species presence is recorded on both plant frequency and plant center frequency to determine whether change can be detected in terms of plant density and/or plant basal cover. This added information can provide insight into the nature of plant population change with little additional sampling effort.

Hironaka said that the frequency plot method is especially useful for agencies whose monitoring is done by a changing field staff. The method is rapid, objective and repeatable. Frequency plot sampling is less likely to detect natural yearly fluctuations in vegetation due to growing conditions. Detected vegetational changes are successional or retrogressional responses to management.

The former study is a McIntire-Stennis funded project and the latter is funded through USDA-Science Education Administration-Agricultural Research Service.

Fishery Resources

FISH TESTED FOR MIGRATION READINESS

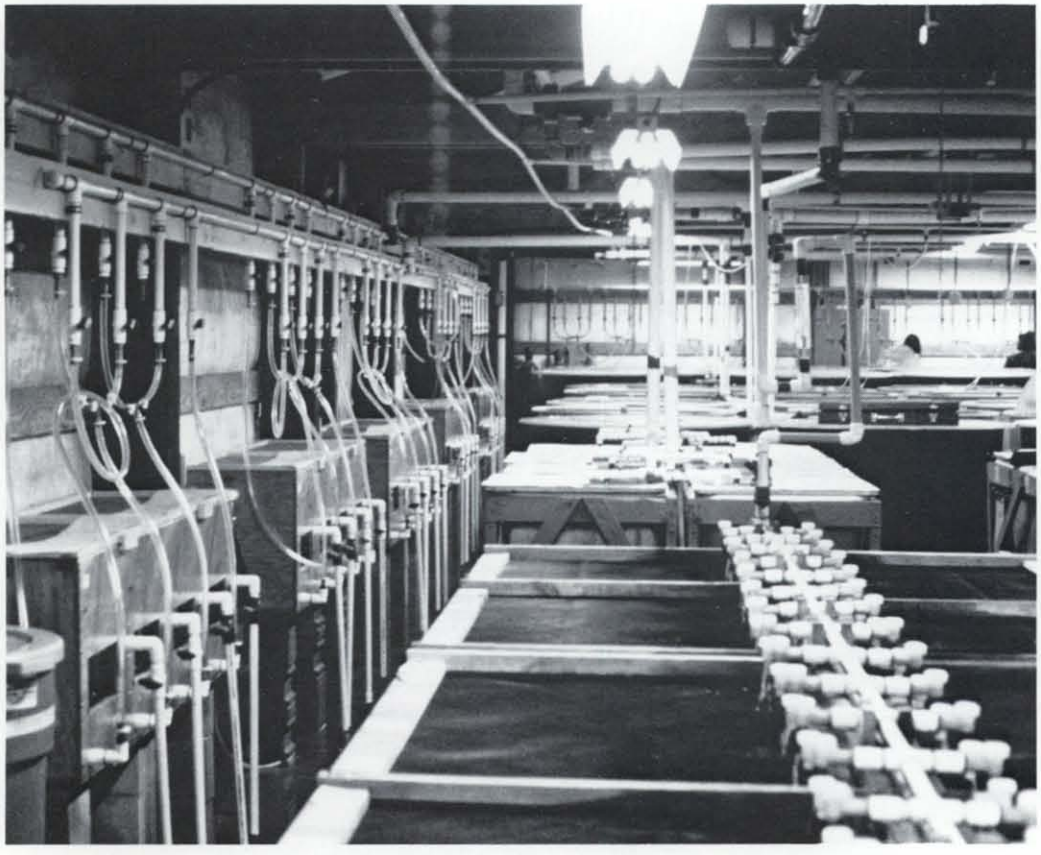
Christine Moffitt
Ted Bjornn
Devona Lam

For centuries, steelhead trout and chinook salmon reared in inland streams, then swam to the ocean to complete the adult phase of their lives. Returning to spawn in the freshwater streams of their birth and die completed their cycle of life and began a new one. The fish migrated on their own built-in timetable, without assistance.

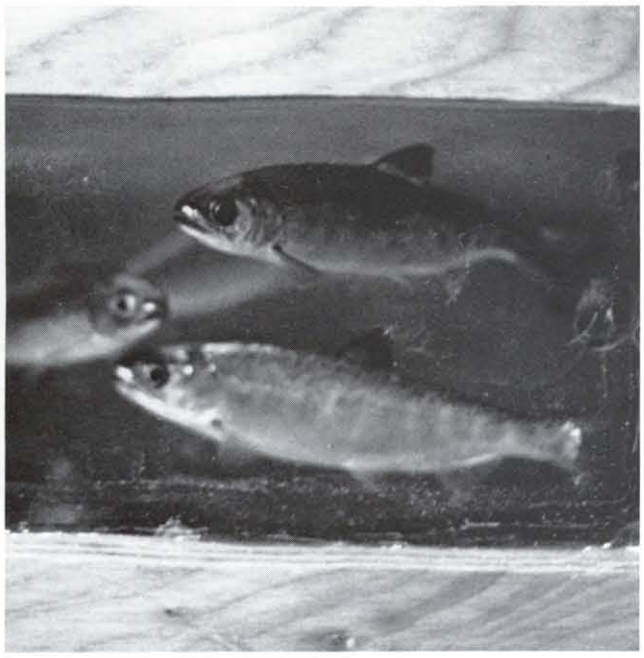
Dams along the Snake and Columbia rivers have changed that. Returning fish are spawned at hatcheries, where the embryos are raised to smolt and released. Even-temperature hatchery waters differ from the wild river conditions. Fish raised in hatcheries may grow faster and mature earlier than their wild counterparts, but what of their internal timeclocks? The miracle of traveling from streams to the ocean and returning is only part of the story. Salmonids raised in fresh water at some point undergo bodily changes which allow them to adapt to a saltwater environment.

Before the dams were built, fish migrated downstream in response to an internal signal in a journey that took perhaps a month. During this time the fish could complete the physiological changes allowing them to survive in sea water. Now, to prevent losses of fish to the spinning turbines housed in the dams, fishery managers collect migrating smolts at the upper dams and transport them by truck or barge below Bonneville Dam, where they can continue their journey in greater safety. Because carrying fish by truck or barge cuts down on migration time, fish may not have time to complete the physiological changes or may enter the sea at a less than advantageous time. Should the fish be held at the hatchery until the latter part of the migration season? What is the optimum size hatchery-reared smolts should reach before release?

Fishery researchers from the University of Idaho are trying to answer these questions by examining fish response during introduction to salt water at the Marrow-



University of Idaho Fishery Research Scientists are working at Marrowstone Field Station in Puget Sound to monitor the reactions of steelhead trout and chinook salmon as they are introduced to salt water. Findings will aid hatchery managers in Idaho with selecting the best time to release smolts. *Ted Bjornn photo*



Window tanks show fish movement as steelhead trout and chinook salmon move through salt water preference tests at Marrowstone Field Station. *Ted Bjornn photo*

stone Field Station in Puget Sound. Department of Fishery Resources graduate student Devona Lam, under the direction of Professors Christine Moffitt and Ted Bjornn, has been working at the National Fisheries Research Center field station since March, and will continue until October. Bjornn, Leader of the Cooperative Fishery Research Unit at the University of Idaho, has contracted with the U.S. Fish and Wildlife Service in Seattle to carry on the study.

At Marrowstone, an old U.S. Coast Guard lighthouse, different groups of steelhead trout, spring and fall chinook salmon from Dworshak, Hagerman and Kooskia national fish hatcheries, representative of various sizes of fish and times of release, are used in an array of tests. Twenty-five circular tanks, 4 and 5 feet in diameter are set up to study tong-term growth and survival of fish introduced to salt water on a gradual, but set schedule. In the long-term tests, fish are monitored for 2 to 6 months.

Using 10 rectangular tanks, 2 feet long by 2 feet wide, by 2 feet deep, short-term survival of the different groups of fish is determined by placing them directly into full strength salt water from a fresh water environment. These tests, termed salt water challenge, assess how rapidly fish can adapt to salt water and then survive for a period of at least 10 days.

Scientists still do not know, Moffitt said, whether fish go directly into salt water as they reach the ocean, or whether they seek out areas where salt and fresh water mix. The researchers are also measuring the level of blood electrolytes in fish introduced to salt water as indicators of the fishes' ability to regulate the amount of salt in their bodies. In fresh water, fish naturally have a higher concentration of salts in their blood than exists in their environment. On entering salt water, fish are bombarded with a higher concentration of salts, which they must be able to regulate, or die.

In a set of behavior tests, five preference tanks 1½ by 6 feet, and 20 inches deep, are set up with four different levels of salt concentration maintained by partitions. Fish moving about in the fresh water at the top of the tanks sample different salinities in the lower portion to determine where they wish to remain. Salt water, heavier than fresh, stays at the bottom of the tanks. Nine additional tanks, 1½ by 3 feet in size and 20 inches deep, are used to test salt water avoidance, to find out whether fish will enter the salt water when they are ready. Researchers are concerned that fish released too early may stay in fresh water too long before heading out to sea, suffering unnecessary predation and other mortality.

Questions answered in the Puget Sound laboratory about migration readiness will aid hatchery managers in Idaho to release smolts when they reach a level of maturity which will improve chances of survival in the next phase of their life cycle.

WARMWATER BASS FISHERY MAY NEED HELP IN IDAHO

David H. Bennett
Edward C. Bowles
Bruce E. Rieman

Fishing in Idaho has primarily meant angling for cold water fish. In recent years, however, bass fishing has become increasingly popular in side lakes in the Coeur d'Alene Lake system. Trophy fish over 9 pounds have been caught, attesting to the high quality of the fishery.

Fishery pressure has increased with more recreational fishing in northern Idaho lakes. Bass, which grow slowly in the colder waters of northern lakes, often take as long as 6 years to grow to maturity. In southern states, bass species reach comparable size in 1 to 3 years. Bass were introduced in northern Idaho lakes in the late 1800s or early 1900s by anglers who enjoyed a fighting sport fish. Now their numbers may be dwindling.

Concern over the possible loss of trophy status of the bass fishery has led Department of Fishery Resources Professor David Bennett to study effects of increased fishing pressure and environmental conditions on bass populations in northern Idaho. Two projects were started a year ago to collect data which will aid managers of warmwater fisheries.

Edward Bowles, a graduate student working under Bennett in the Department of Fishery Resources will assess the numbers of young fish in several lakes by seining along the shore. From the numbers of fish captured in different aquatic habitats he will estimate how many young fish

reach catchable size each year in different-sized lakes. Minute plant and animal life which comprise the diet of juvenile bass, as well as numbers of predators are also being measured. The importance of water temperature, temperature changes, variation in water level, wave action, length of the growing season and habitat suitability will be considered. Bass spawn in shallow water, making their young more susceptible to changes in water drawdowns and waves. Estimates of spawning success and winter survival will be compared between years and among lakes. All fish which are caught and marked will aid in the identification of fish movement when marked fish are caught during another season.

In a related study, Bruce Rieman, a research biologist for the Idaho Department of Fish and Game, will examine the effects of an increased sport fishing population on the fishery. Because bass produce a number of young unrelated to their population size, fishing pressure was not thought of as reducing the supply of fish available for catch. This study will collect baseline data on the relationship of adult fish to fishing pressure. Rieman's study will entail sampling, weighing and measuring fish on several side, or lateral, lakes in the Coeur d'Alene system. Fernan Lake, located near the city of Coeur d'Alene, will provide comparative figures on an urban lake, with heavy fishing pressure. Fish near the shore will be collected by electrofishing, temporarily immobilizing fish in water less than 8-feet deep with an electrical charge. Researchers will take scale samples to estimate age of the fish, and will mark them with a fin clip so that growth changes can be measured in recaptured fish.

Angler effort and harvest will be estimated by counting those fishing at different times of the day during 2-week intervals. Researchers will interview as many anglers as possible to estimate fishing success, one form of fish mortality. A creel census will add further data on length, weight and age of fish. Number of anglers per lake, and harvest estimates for that lake will provide comparable figures on bass caught in lakes with light, moderate and heavy fishing pressure.

Anglers will be asked how willing they would be to go along with regulations aimed at improving the bass fishery. Returning tags found on fish to the Department of Fish and Game will aid researchers in tracing fish mortality and estimating harvest.

Bennett plans to use data collected in the two studies to compare the number of young fish reaching catchable size with the numbers of adult fish harvested in each lake. If fishing pressure is reducing production of young fish, Bennett will be able to provide warmwater fishery managers with recommendations for improving conditions for bass in northern lakes.

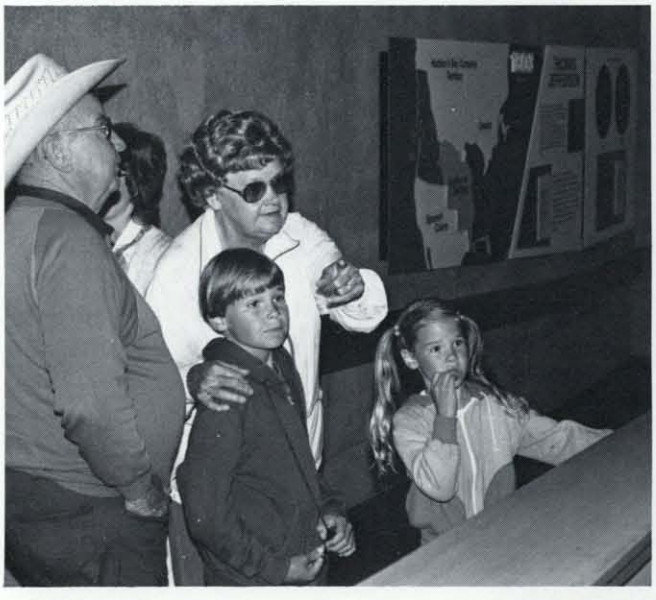
Washington Water Power and the Idaho Department of Fish and Game are providing funding for Bowles and Rieman's projects, respectively.

VISITORS INTERVIEWED AT COASTAL PARK

Sam H. Ham
Mary Beth Downing
Jennifer Frohoff

Part of managing park facilities for visitors means finding out more about the visitors and their interests. Wildland Recreation Management professor Sam Ham, assisted by student researchers Mary Beth Downing and Jennifer Frohoff, has completed a study of visitors to Fort Canby State Park, Washington, funded by the University of Idaho Forest, Wildlife and Range Experiment Station and the Wilderness Research Center.

The study was structured to find out more about the audience attending orientation talks in the Park Visitors Center at Fort Canby, located on the coast in southwestern Washington, at the mouth of the Columbia River. During the 1981 summer travel season, researchers interviewed 552 families to determine the number of visits each family had made to the park and to similar park settings, awareness of available activities within the park and in other similar parks, and the number of times the family had attended interpretive activities. Results from the study will help the Washington State Parks and Recreation Commission determine who their visitors are, and which other segments of the population they would like to reach.



Families constitute the majority of park visitors to Fort Canby State Park, Washington, a high-use coastal park at the mouth of the Columbia River. Here, visitors examine an exhibit telling about the park. *Sam Ham photo*

Wildland Recreation Management

INTERPRETIVE JOURNAL EDITED IN IDAHO

Sam H. Ham
Gary E. Machlis

Current research in interpretation, reports from the field, commentary and book reviews form the core of the *Journal of Interpretation*, a publication of the Association of Interpretive Naturalists (AIN). Editorship of the Journal was turned over to Wildland Recreation Management Professors Sam Ham and Gary Machlis last January. Volume 7, number 1, published by the University of Idaho College of Forestry, Wildlife and Range Sciences in conjunction with the AIN, appeared in May.

Blending the old with the new, Ham and Machlis are changing the review process, in keeping with ideas from the AIN Editorial Committee, to require peer reviews of research articles and field reports. Now with refereed status, the Journal hopes to offer contributors more reason for submitting articles. Ham and Machlis have also initiated a new format, featuring a change from the eight and one-half by eleven inch page size to a more compact six by nine, while retaining the old logo.

The editors are open to receiving articles on interpretation from a variety of disciplines, including outdoor recreation and leisure, park management, marketing, communications, journalism, theater arts, landscape architecture, museology, public relations, education, ecology, sociology, history, and psychology. The main criteria for selection is whether or not the manuscript offers new insights into principles or practices which will be of value to interpreters.

PUBLIC RELATIONS COURSE OFFERED

James R. Fazio

Interest in helping natural resource personnel with the growing challenge of public relations has prompted development of the College of Forestry, Wildlife and Range Science's first correspondence course. Wildland Recreation Management Professor James Fazio, who has taught a number of shortcourses in public relations for natural resource personnel, has put together the course, entitled Public Relations Problems in Natural Resource Management.

Fazio said he anticipates that students taking the course will be administrators, managers or other resource personnel without a background in public relations. It should also be of interest to anyone considering returning to school who would like to ease into a program gradually. The course is offered for two semester-hour credits, and can be taken at the pace of the student, who does not need to conform to the University calendar for on-campus courses.

The course is divided into 11 lessons, based on chapters in the text, *Public Relations and Communications for Natural Resource Managers*, written by Fazio and the late Douglas L. Gilbert, and published by Kendall/Hunt Publishing Company, Dubuque, Iowa.

Fazio said that the course would have a highly applied approach. Students will be required to apply what they are learning to their own situation. Writing assignments will make use of problems and opportunities the student encounters in his or her work situation. Students will learn how to identify their publics, and how to work with people in a variety of situations. They will learn and practice how to put their news into print, or onto radio and television. Other assignments look into the history and principles of public relations, and help the student understand the relationship of natural resources and politics. Guidelines are also offered in preparing to issue information under emergency conditions. Anyone interested in enrolling in this course should contact the University of Idaho Correspondence Study office.

Wildlife Resources

MOOSE, ELK HABITS TO GUIDE GOSPEL-HUMP MANAGERS

James M. Peek
Michael Scott
Louis J. Nelson
John Pierce
Rex Crawford

The Gospel-Hump Wildlife Project began shortly after the Gospel-Hump Wilderness Area was established in 1978 by the Endangered American Wilderness Act. Establishing a wilderness on paper is only a beginning. Managing the wilderness and its surrounding area demands careful study and appropriate guidelines.

The Gospel-Hump area encompasses 200,000 acres in wilderness designation; a peripheral area of 90,000 acres, which has been under a 4-year logging activity moratorium; and a multiple resource development area of 100,000 acres, in which a number of timber sales were made in the late 1970s. The multiple resource area was opened to logging in 1978. Because the boundaries and restrictions apply only to humans, researchers from the University of Idaho are studying the habitat use and migration patterns of elk and moose in all three areas. Results of the study will be reported to the Gospel-Hump Advisory Committee and to the USDA Forest Service along with recommendations for wildlife management guidelines.

Heading the study which began in 1979 is Wildlife Professor James Peek, with research associates Mike Scott and Louis J. Nelson, and graduate researchers John Pierce and Rex Crawford. Funding has been provided by the USDA Forest Service Intermountain Forest and Range Experiment Station. Over a 3-year period, 12 moose and 45 elk were fitted with radio collars and tracked throughout the year. Moose were tracked from the ground and from fixed wing aircraft. Elk, choosing migration routes in unroaded and less accessible areas, were followed only from aircraft. Subpopulation areas were identified both in and outside of wilderness areas, which creates mixed problems for management. Logging roads with year-round use had a negative impact on elk, keeping them away from potential forage areas. Elk might return to those areas if the roads were permanently closed, researchers said.

Moose migrated less than elk, shifting in winter to areas where Pacific yew formed a second canopy beneath grand fir. More forage was available, and the moose moved about more easily where there was less snow. Researchers documented extensive use of Pacific yew stands by moose in winter.

After observing migration patterns, wildlife scientists on the project have constructed a computer model of moose and elk habitat use patterns to study management alternatives proposed for the Gospel-Hump area. The Gospel-Hump Advisory Committee which supervised the research was set in motion by the Endangered American Wilderness Act which established the wilderness area. Committee membership includes personnel from the USDA Forest Service, the timber industry, members of the Grangeville business industry, and environmentalists. The committee will make recommendations on management for the Gospel-Hump area to the USDA Forest Service, using guidelines provided through research.

TEAM MAPS VEGETATION ON NORTH FORK FLATHEAD

R. Gerald Wright
Kurt Jenkins
Bart Butterfield

The North Fork of the Flathead River runs south along the western border of Glacier National Park, in Montana. From Camas Creek to the border, a distance of about 40 miles, the river is bordered on one side by an unpaved logging road, and on the other by Glacier National Park. Increased recreation and land use are bringing change to the North Fork corridor. Some groups have urged paving of the road. Recently, a 4000-acre open pit coal mine has been proposed six miles north of the Canadian border, along the North Fork drainage, at Cabin Creek.

The Environmental Protection Agency, concerned about impacts of a 21-year mine on the North Fork, has contracted with a University of Idaho research team to map vegetation of the North Fork, to identify and assess the habitat requirements of wildlife species in the North Fork Basin, and to monitor their health, providing information on existing wildlife and vegetation resources. Information from this and other studies in the basin will be forwarded to the International Boundary Commission.

While the United States has little say in Canadian development, the Commission deals with environmental impacts which extend beyond national boundaries. For example, sedimentation, the loss of dissolved oxygen, and introduction of heavy metals to the stream could cause serious problems for trout populations in the Flathead Basin, many of which spawn in the tributary streams of the

North Fork. Comprehensive information on habitats and wildlife will help the Environmental Protection Agency predict impacts on those resources.

Although there have in the past been several small studies on specific resources in this area, this is the first effort to synthesize and map the plant communities, land use, and wildlife use throughout the North Fork drainage, explained Gerald Wright, principal investigator for the study. Wright, Cooperative Park Studies Unit Project Leader in biology and professor at the University of Idaho, is preparing a working stage map of the North Fork drainage, using both aerial photographs and ground truth information to verify the accuracy of the data. Detailed photographic overlays are fitted on topographic maps, showing habitat change at different sections of the river. The riverside, or riparian, habitat in the study area provides important winter range for four ungulate species: white-tailed deer, mule deer, elk, and moose. Kurt Jenkins, graduate student in the Department of Wildlife Resources, spent the winter on the North Fork, mapping and observing wildlife use and distribution in the area. Wildlife graduate student Bart Butterfield is relating breeding bird densities to the different habitat characteristics.

The river corridor, with protected lands within the National Park on one side and large sections of private land on the other, offers a study with built-in controls, Wright said. Development along the privately owned side of the river has taken form as 1) population growth, with housing, utilities and road construction; 2) logging, near the river and farther back in the watershed including areas of select cut and clearcut practices; 3) cleared land for pastures or grazing; and 4) increased recreational use of the river. A clear picture of existing plant communities and vegetation patterns will give land managers a starting point for measuring future changes in the area.

At the conclusion of the 18-month study, the information will be turned over to the Environmental Protection Agency. Data will be presented to the International Boundary Commission for use in managing the North Fork basin with respect to energy related developments, including oil and gas leasing, power dams, and the proposed Cabin Creek Coal Mine.

WILDLIFE, TIMBER PRIORITIES ASSESSED IN ALASKA

Winifred B. Kessler

Projected harvest of old-growth timber in southeast Alaska and conversion to second-growth stands are placing reassessment of wildlife needs in a new light. Harvest management priorities require old-growth timber for quality logs, and development of higher wood-fiber production through vigorous second-growth stands. While preserving timber stands 300-years-old or older would be best for old-growth dependent wildlife species, such practices are not practicable in most areas.

In order to protect wildlife and meet harvest priorities, wildlife managers need to determine whether specific needs of Sitka black-tailed deer, bald eagle, black bear, timber wolf, nesting birds, and furbearers can be managed in second-growth forests. Wildlife Resources Professor Winifred Kessler has outlined problems and management potentials for selected wildlife species in second-growth forests in southeast Alaska. Kessler prepared the report while participating in a Faculty Exchange Program between the University of Idaho and the Tongass National Forest, North Prince of Wales Ranger District. Funding was provided by the USDA Forest Service.

The Tongass National Forest administers the majority of commercial forested lands in southeast Alaska. Over 99 percent of Alaskan timber, largely western hemlock and Sitka spruce, is supplied from southeastern forests. Harvesting and processing of timber has become the third largest industry in Alaska, following oil and fisheries.

Kessler's report looks at the relationships of wildlife to timber harvest management, dealing with precommercial and commercial thinning procedures, management of forest residue, and extended harvest rotation.

Continuing Education/Extension

VIDEOTAPE MAY TAKE COURSES INTO FIELD

Ernest D. Ables
Sam H. Ham

Videotaping has come of age at a time when many agencies and companies have been faced with budget cuts. Sending employees to meetings and workshops is expensive, and not everyone can go to the relevant shortcourses. The College of Forestry, Wildlife and Range Sciences is looking into the possibility of sending the courses into the field—on videotape.

Ernest Ables, Wildlife Resources professor who has served as Associate Dean for Academics, lectured on wildlife at the Yellowstone Institute, and traveled in Africa, China, and Korea to study wildlife management in other cultures, and set up a program for students from Honduras, has long held an interest in continuing education. Ables and Sam Ham, Wildland Recreation Management professor, Director of Video Outreach Activities for the college and, interpretive naturalist who has directed slide programs produced by the college, are developing a series of educational packages built around instructional videotapes. Still at the planning level, Ables and Ham plan to prepare about 10 resource management videotape programs on a trial basis, then pretest them on students who have come here to study from other countries, and on high school students who have not yet been exposed to college coursework.

The variety of programs possible could cover any resource management area, according to Ables. Subjects could include reforestation/aforestation, watershed management, silvicultural systems, park management, range management, timber harvest, tree planting methods, plantations for fuelwood production, and wildlife management. Programs can be produced at two levels, the technical level, similar to a training film, and the college course level, which could be offered for credit in universities or land management agencies around the world.

While many students travel to this country to study resource management, many others would also benefit from the programs. It is not possible to send experts all over the world, or to bring every interested international student to this country. Agencies working in resource management around the world need to teach people how to do inventories, and how to draw up and carry out a management plan. In some countries, Ables said, wildlife preserves are set aside in forest areas, where the managers are knowledgeable about forestry, but do not know how to manage the wildlife that have become their responsibility.

After pretesting videotape programs, Ables hopes to make suggested changes, then have the programs translated, probably into Spanish, French and Chinese. Finished packages would be delivered and tried out in four or five selected countries by Ham and Ables before being offered to agencies with international responsibilities.

In this country, the USDA Forest Service has requested course packages that can be given in the field, without taking employees off the job to send them back to school. Agencies with a need for a particular program or shortcourse are invited to contact Ables or Ham with their suggestions.

NEEDS FOR SAGEBRUSH DEFINED IN WORKSHOP

David Bryant
Kenneth Sanders

The role of sagebrush as a weed or plant, and its use by wildlife, livestock, and for watershed were discussed during a two-day workshop on sagebrush-grassland ecology and management held in July at Twin Falls. The Idaho Rangeland Committee sponsored the workshop, with member agencies and organizations and the Idaho Section, Society for Range Management serving as cooperators.

Extension Range Specialist Kenneth Sanders, a member of the Department of Range Resources faculty, developed the program, which brought together ranchers, wildlife biologists and other land managers to establish a common ground for use and management of sagebrush and grasslands in Idaho. Sanders, who works out of Twin Falls, has been working actively on range-use conflicts. The initial workshop grew out of a need to resolve questions on the need for sagebrush in range areas.

Researchers described community classification systems for sagebrush, pointing out that sagebrush common to one habitat would not grow well under conditions in another habitat. Participants discussed the advisability of seeding sagebrush on lands which are being rehabilitated. Professors from the Department of Range Resources at the University of Idaho and a number of former graduates in wildlife, range and forest resources made presentations or appeared as panel members.

Because the workshop was limited in enrollment, the Idaho Section of the Society of Range Management plans to repeat the program during its November meeting in Pocatello.

PLANS UNDERWAY FOR PRODUCTS INDUSTRY DIRECTORY

Robert L. Govett
Paul M. Smith

If you live in Idaho and have been looking for information on a nearby forest products industry, you are not alone. The 1981 Directory of the Forest Products Industry, published by Miller Freeman Publications, omits many smaller companies which are important to the state of Idaho. Forest Products graduate student Paul M. Smith, working under Professor Robert Govett, has laid the groundwork for a directory of Idaho's forest products industry. As planned by Smith, the directory would include all industries in Idaho which are involved in generating forest products, and which produce 0.5 million board feet (500 mbf) annually from their operation in a normal year. The directory would include information on forest products produced and sold, contractors, number of employees, name and address of the company, and major operations, plant managers, major divisions within the company, species used and purchased.

Smith is planning to send out questionnaires through Agricultural Extension agents to forest products firms around the state to collect necessary information. As envisioned, the directory would be used by industry personnel, legislators, land administrators and planners. It would also be available through Agricultural Extension agents. The University of Idaho last published a forest products directory in 1974. The Idaho State Department of Lands published a directory in 1978. At present, there is no up-to-date directory for the state of Idaho. Funds are provided by USDA, Renewable Resource Extension Act.

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.

1981

June 1-2	Fire as a range improvement tool–Shoshone
June 15 - July 24	Land Use Planning in Natural Resource Management Workshop–Moscow
June 22-26	1981 Northwest Summer Institute–Aquatic Toxicology–Moscow
July 14-16	Stand Prognosis Workshop–Moscow
July 21-23	Tree Problem Diagnostic Workshops–Blackfoot, Twin Falls, Boise–in cooperation with UI Coop. Ext. Serv.
October 26 - November 20	Continuing Education in Forest Ecology and Silviculture (CEFES)–Moscow
November 12	Fifth Annual Wilderness Resource Distinguished Lecture–Russell E. Dickenson–Moscow

1982

February 8-12	Seventh Annual Aerial Photo Interpretation and Aerial Photography Workshop–Moscow
March 8-9	Women in Natural Resources: An International Perspective–Moscow
March 9 - April 6	Windbreak Management Workshops–in cooperation with UI Coop. Ext. Serv. and Soil Conservation Serv. March 9–Blackfoot March 10–Twin Falls March 11–Boise April 5–Lewiston April 6–Coeur d'Alene
March 15 - April 2	Continuing Education in Fire Management (CEFM), Part 2: Applied Sciences–Moscow
March 23-24	Forest Pesticides in the Inland Empire–Spokane cooperative program–FWR, UI and WSU Coop. Ext. Serv.
April 19-24	Natural Resources Week–Moscow
April 27-28	Sustained Yield–A Symposium–Spokane–Cooperative project of WSU Dept. Forest. and Range Manage.; WSU Coop. Ext. Serv.; UI College of Forest, Wildl. and Range Sci.; Forest Land Organization and Manage. Working Group, SAF.
May 3-6	Fire Information Officers' Short Course–Boise Interagency Fire Center–Boise
May 24 - July 2	Land Use Planning in Natural Resource Management Workshop–Moscow
June 1	Workshop for Natural Resources Interpreters. Whitman Mission National Historic Site, Walla Walla, WA–Coop. Park Studies Unit
June 14 - 18	Forest Habitat Types of Idaho–A Shortcourse for Land Managers–McCall

Appendix

EXPERIMENT STATION SCIENTISTS

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

DEPARTMENT OF FISHERY RESOURCES

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

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

Bradley, Terrence
Research Associate

Chacko, A. Jim
Research Scientist
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

Corrarino, Charlie
Research Associate

Falter, C. Michael
Department Head and Professor
Reservoir limnology, stream ecology

Irving, John
Research Associate

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

Leonard, James M.
Aquatic Biologist

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

Schaeffer, Andrew
Research Associate

Schaeffer, Leslie
Research Associate

DEPARTMENT OF FOREST PRODUCTS

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

Robert L. Govett
Assistant Professor
Forest products marketing

Guevara, Ruben
Research Assistant Professor

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

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

DEPARTMENT OF FOREST RESOURCES

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

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

Carlton, Maggie
Research Instructor

Crookston, Nicholas L. II
Research Associate

Dennis, Brian
Assistant Professor
Statistical ecology

Deters, Merrill E.
Professor Emeritus
Forest silviculture

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

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

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

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, mensuration

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

Hosman, Kevin
Research Associate

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

Kessler, Bruce
Research Technician

Knox, Diane
Research Technician

Laursen, Steven B.
Research Associate

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 production economics, forest management, forest taxation

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

Mika, Peter G.
Research Associate

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

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

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

Partridge, Arthur D.
Professor
Forest pathology

Pregitzer, Kurt S.
Assistant Professor
Forest ecology, forest soils, ecosystem classification, nutrient cycling

Pym, Geneva
Research Technician

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

Seale, Robert H.
Professor Emeritus
Forest economics

Sheehan-Akers, Katherine
Research Associate

Skille, Jack
Research Scientist

Srivastava, Nilema
Research Associate

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

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

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

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

Tennyson, Larry C.
Assistant Professor
Watershed

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

Vander Ploeg, James
Research Associate

Wang, Chi-Wu
Professor Emeritus
Forest genetics

Wenny, David L.
Forest Nursery Superintendent and Assistant Professor
Silviculture, forest regeneration

DEPARTMENT OF RANGE RESOURCES

Bryant, David
Department Head and Professor
Range and livestock management

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

Hironaka, Minoru
Professor
Range ecology, synecology, autecology

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

Sanders, Kenneth D.
Associate Professor
Range management

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

Smith, Stuart
Acting Instructor

Tisdale, Edwin W.
Professor Emeritus
Range resource evaluation and management, native range vegetation types, ecology of range weeds, 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 Professor
Communication and principles of natural resource management, environmental interpretation, continuing education delivery systems, conservation history

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

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

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

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

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

Montgomery, Malcolm
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 radiotracking 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, predator-prey interactions

Hungerford, Kenneth E.
Professor Emeritus
Wildlife management

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

Nelson, Lewis, Jr.
Department Head and Associate Professor

Nelson, Louis
Research Associate

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

Peterson, Steven R.
Associate Professor
Waterfowl ecology, 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

Bassler, Gregory
Logging Superintendent and Forester

Strong, Allan E.
Assistant Logging Superintendent

Wenny, David L.
Forest Nursery Superintendent and Assistant Professor

Mattson, Brenda
Nursery Technician

Meyer, James
Nursery Manager

Vogtman, Clifford
Nursery Technician

ADMINISTRATIVE SERVICES

Ashland, Lorraine
Graphics Artist/Illustrator

Bottger, Richard F.
Director of Administrative Services

Camp, Olivia
Assistant to the Coordinator of Continuing Education and Employment

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

Roberts, Susan B.
FWR Experiment Station Editor

Sargent, Marilyn
Assistant Coordinator, International Programs

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

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

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

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

Recruitment of largemouth bass in the Coeur d'Alene Lake system. D.H. Bennett

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

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

Studies of larval and post-spawning adult cui-ui in the Lower Truckee River at Marble Bluff Dam Impoundment, Washoe County, Nevada. 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

The use of mineral enrichment for rearing steelhead trout in reuse systems at Dworshak National Fish Hatchery. T.C. Bjornn, T. Bradley

Effects of cottonwood and alder plantings on the habitat and abundance of fish in small logged drainages. T.C. Bjornn, M.A. Brusven

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

Effects of increased fine sediment on incubation and emergence of chinook salmon and steelhead trout embryos and fry. T.C. Bjornn, J.I. Irving

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

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

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

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

Determination of optimum size of fish and time of release for hatchery reared steelhead trout and spring chinook salmon. T.C. Bjornn, J.L. Congleton, C.M. Moffitt, R.R. Ringe

Effects of stress on the viability of chinook salmon smolts transported from the Snake River to the Columbia River estuary. J.L. Congleton, T.C. Bjornn, R.R. Ringe

Chronic effects of heavy metals on cutthroat trout in the Salmon River drainage. C.M. Falter

Aquatic ecology of lakes in the Lewiston Orchards Irrigation district. C.M. Falter

Problem identification and assessment for aquatic plant management. J.M. Leonard

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

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

Aquaculture computerized production. G.W. Klontz

Vertical transmission of infectious pancreatic necrosis virus in rainbow trout. G.W. Klontz

Production forecasting for rainbow trout. G.W. Klontz

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, A.J. Chacko

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

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

Coeur d'Alene River fisheries investigation.

DEPARTMENT OF FOREST PRODUCTS

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

Simulation of logging systems by computer. L.R. Johnson, H.W. Lee

Development of small skidder for small wood recovery. L.R. Johnson

Effects of various logging methods on soil compaction, infiltration capacity and moisture content. H.W. Lee

Biomass energy. A.A. Moslemi

Cement-wood-water particleboard. A.A. Moslemi, A.D. Hofstrand

Evaluating inhibition of 9 Rocky Mountain wood species on setting of cement. A.A. Moslemi, A.D. Hofstrand

Influence of accelerators on cement-wood-water mixtures. A.A. Moslemi, A.D. Hofstrand

Inhibition of selected southern hardwoods on setting of cement-wood-water mixtures. A.A. Moslemi, A.D. Hofstrand

Compatibility of Honduran wood species with inorganic binders. A.A. Moslemi, A.D. Hofstrand

Wood-cement bond development with Korean lignocellulosics. A.A. Moslemi, A.D. Hofstrand

Influence of different techniques on the dimensional stability of birch wafers. A.A. Moslemi, R. Guevara

Chemical stabilization of fiberboards. A.A. Moslemi, R. Guevara

Development of heat-conditioning schedules for frozen and unfrozen veneer logs. H.P. Steinhagen

Improvements in flashdrying wood fibers by better mixing action. H.P. Steinhagen

DEPARTMENT OF FOREST RESOURCES

Use of seed wafers in reforestation. D.L. Adams, C.E. Dirks

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

University of Idaho Experimental Forest. D.L. Adams, H. Loewenstein, H.L. Osborne, L.F. Neuenschwander, J.A. Moore, J.L. Kingery, C.R. Hatch

Forest habitat type identification using large-scale aerial sampling photography. W.A. Befort, J.J. Ulliman

Woody biomass resources in 66 African, Asian and Latin American countries. S.J. Brunsfeld

Identification and ecology of Idaho willows (*Salix*). S.J. Brunsfeld, F.D. Johnson

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

Climatological range and constraints to western spruce budworm. D. Burnell, D. Everson

Dynamics of low density populations. B. Dennis

Population dynamics and statistical catastrophe theory. B. Dennis

Statistical distributions in ecological work. B. Dennis

Models of species abundance and ecological diversity. B. Dennis

Population differences in cold hardiness of giant sequoia trees. L. Fins

Effects of inbreeding on vegetative propagation. L. Fins

Vegetative propagation of western larch. L. Fins

A study of the genetic structure of resistance of western larch to larch casebearer. L. Fins

Understanding firewood use in Idaho. J.E. Force

Effects of fertilization on crown and bole characteristics of coastal Douglas-fir in Washington and Oregon. J. Goudie

Recalibration of the Tree and Stand Simulator to lodgepole pine in British Columbia and Alberta. J. Goudie

Establishment of firewood utilization demonstration area on the University of Idaho Experimental Forest. D.P. Hanley, H.L. Osborne

Windbreak and urban tree diagnostic workshops. D.P. Hanley, A.D.Partridge

Forest survey of Idaho. C.R. Hatch

Evolution, 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

Population dynamics and the effects of natural enemies of the western spruce budworm. C.R. Hatch, and T.R. Torgersen

Survey of exotic tree plantations in northern Rockies. F.D. Johnson

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

Buried seed and successional processes. F.D. Johnson and N.J. Kramer

Evaluation of the effect of operational fertilization on stem form of forest trees. S.B. Laursen

The effect of nitrogen fertilization on stem form development of forest trees. S.B. Laursen

Modeling the effects of spruce budworm defoliation on growth and development of Douglas-fir stands. S.B. Laursen

Effects of fertilization on tree growth in southwestern Idaho. H. Loewenstein

Influence of legumes on growth of coniferous seedlings. H. Loewenstein

Critical levels of nitrogen and phosphorus for satisfactory growth of grand fir. H. Loewenstein

Relation of soil and foliar nutrient levels to fertilizer response. H. Loewenstein

Effect of placement of mycorrhizae and fertilizer in seed wafers. H. Loewenstein

Assessment of site factors, particularly soils, relating to growth of maiden's gum in Rwanda. H. Loewenstein

Separating joint costs in timber sale roads. C.W. McKetta

The effect of the Jones Act on Alaskan forest products trade. C.W. McKetta

The stability rationale: economic implications of an even flow constraint in forest management. C.W. McKetta

The economics of fuel management decisions in the northern rockies. C.W. McKetta, L.F. Neuenschwander

Fuel treatment specifications and economic cost procedures. C.W. McKetta, L.F. Neuenschwander

Use of linear programming on northern Idaho harvest scheduling problems. C.W. McKetta, H.L. Osborne, C.R. Hatch

The short run timber harvest response of nonindustrial forest land owners to changing market conditions. E.L. Medema

Accuracy of economic impact multipliers. E.L. Medema

Social forestry in Maharashtra, India. E.L. Medema

Investment analysis of fuelwood plantations in Sri Lanka. E.L. Medema, C.R. Hatch

Intermountain Forest Tree Nutrition Cooperative. J.A. Moore

Natural versus artificial regeneration: an economic and biologic analysis. J.A. Moore, D.L. Adams, S. Fitzgerald

Modification and parameterization of the Prognosis Model for Boise Cascade Corporation. J.A. Moore, C.T. Stiff

Expansion of the Prognosis Model for stand development to southern Idaho, eastern Oregon, and Washington. J.A. Moore, C.T. Stiff

Intermountain Forest Tree Nutrition Cooperative proposal and study plan for 4-state forest fertilization cooperative in the Northwest. J.A. Moore, J. Vander Ploeg, P.G. Mika

Fire ecology of north Idaho. L.F. Neuenschwander

Fire ecology of the spruce-fir zone of northern Idaho. L.F. Neuenschwander

Continuing education in fire management: applied sciences. L.F. Neuenschwander

Silvicultural use of fire in ponderosa pine. L.F. Neuenschwander

Effect of slash pile burning on soils. L.F. Neuenschwander

Modeling early shrub succession after clearcut and burn treatments in grand fir-cedar forests. L.F. Neuenschwander

Physiological interactions among wood-inhabiting fungi. A.D. Partridge, D.J. LeTourneau

Seed and seedling diseases in nurseries, outplantings, reproduction, and mortality centers. A.D. Partridge

Perenniporia subacida modes of invasion and activity in seedlings and wood. A.D. Partridge

Urban and community trees for the high-desert types. A.D. Partridge, D.P. Hanley

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 times of nitrogen fertilization and nutrient composition of Douglas-fir foliage on insect-caused damage in seed production areas. J.A. Schenk, H. Loewenstein, K. Pregitzer, S. Zimmer

Bioenergetic relationships between cone and seed insects and Douglas-fir host trees. J.A. Schenk, R. Clausen

Program manager, Canada United States Spruce Budworm Program-Western Component, 1981-1983. R.W. Stark

Linkage of spruce budworm model to Prognosis model. R.W. Stark, N.L. Crookston

Integrated pest management in the Colville tribal forests. R.W. Stark, D. Burnell, L.F. Neuenschwander

Population dynamics of the larch casebearer. R.W. Stark, D. Burnell, L.F. Neuenschwander

Development of new Prognosis Model diameter growth equations for western Montana. C.T. Stiff, J.A. Moore

Genetic differences in response to volcanic ashfall among Douglas-fir seedlings. M.W. Stock

Comparison of the genetic composition of populations of *Ips pini* (Coleoptera: Scolytidae) from California, Idaho, and New York. M.W. Stock, G.N. Lanier, P.K. Higby

Boron-stress in coniferous seedlings. K.J. Stoszek

Alternative Douglas-fir evaluating of tussock moth controls through use of simulation models. K.J. Stoszek

Preliminary evaluation of genetic resistance of ponderosa pine to the western pine shoot-borer. K.J. Stoszek

Relationships of 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

Application and evaluation of the Gospel Hump "SNOWSED" model on a small forested watershed. L.C. Tennyson

The use of remote sensing techniques and the universal soil loss equation to determine soil erosion. L.C. Tennyson, K. Schuchard

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

Aerial photo interpretation/cartographic training program for Burmese visiting scholars. J.J. Ulliman

Imagery evaluation and development of viewing equipment for optical bar and large format aerial reconnaissance photography. J.J. Ulliman, W.A. Befort

Photographic reference guide for spruce budworm defoliation levels J.J. Ulliman, B.L.Kessler

Validation of spruce budworm aerial photo/risk model. J.J. Ulliman, B.L. Kessler

Intensive culture of hybrid poplar cuttings. D.L. Wenny

The effects of greenhouse and shadehouse overwinter storage on growth of containerized ponderosa pine seedlings. D.L. Wenny

The growth response of sliced vs. rootbound ponderosa pine seedlings. D.L. Wenny

Fish tanks and forestry: a quick test of nursery stock quality. D.L. Wenny

DEPARTMENT OF RANGE RESOURCES

Fire intensity and vegetational development in Douglas-fir/ninebark habitats. S.C. Bunting

The vegetation of the Guadalupe Mountains. S.C. Bunting

Prescribed burning in specific habitat types. S. C. Bunting

Evaluation of the frequency plot method as an improving technique for the measurement of a successional trend. S.C. Bunting, M. Hironaka

Prescribed burning in western juniper habitats. S.C. Bunting, L.F. Neuenschwander

Influence of fire on the regeneration of curlleaf mountain mahogany. S.C. Bunting, L.F. Neuenschwander

Effect of fire on bitterbrush. S.C. Bunting and L.F. Neuenschwander

Vegetation change analysis by the frequency plot method. M. Hironaka, S.C. Bunting

Management alternatives on state-owned rangelands. J.L. Kingery

Animal use, timber regeneration relationships. J.L. Kingery

High intensity-short duration grazing studies at Point Springs experimental area. K.D. Sanders, L.A. Sharp

Evaluation of range seeding. L.A. Sharp

Ecology of grasslands of the Snake and Salmon River systems in Idaho. E.W. Tisdale

Flathead River riparian habitats study. R.G. Wright, C. Key, B. Griffith

Mule deer population dynamics and habitat use at Craters of the Moon National Park. R.G. Wright

A quantitative study of the soil, vegetation and significant wildlife of the Flathead River riparian habitats in and around Glacier National Park, Montana. R.G. Wright

A nutrient-energy simulation model for ungulates in Olympic National Park. R.G. Wright

DEPARTMENT OF WILDLAND RECREATION MANAGEMENT

Study of family behavior in a leisure setting. S.H. Ham

International satellite outreach programs in forestry for lesser developed countries. S.H. Ham, E.D. Ables

Human-bear interactions at Pack Creek Bear Reserve, Alaska. E.E. Krumpe

Lower Salmon River recreation: an analysis of change in users' perceptions and opinions. E.E. Krumpe

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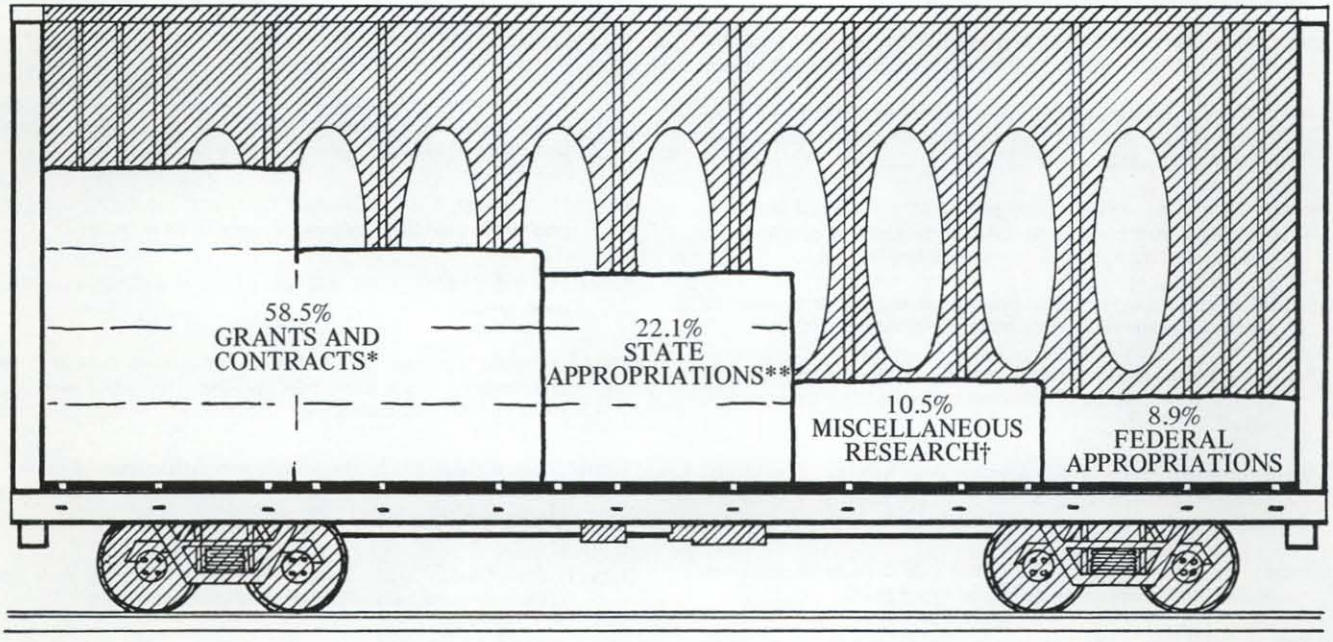
Fiscal Year 1982 Financial Picture



Research expenditures, shown by funding source, totaled $4,870,000 for the Fiscal Year 1981-82.

* 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

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U.S.D.A. Forest Service, Intermountain Forest and Range Experiment Station
U.S.D.A. Forest Service, Northeastern Forest Experiment Station
U.S.D.A. Forest Service, Pacific Northwest Forest and Range Experiment Station
U.S.D.A. Soil Conservation Service
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U.S.D.I. Bureau of Indian Affairs
U.S.D.I. Bureau of Land Management
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Forest, Wildlife and Range Experiment Station
College of Forestry, Wildlife and Range Sciences
Moscow, Idaho 83843