

Idaho Forester

1971



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Air Pollution Problem in Lewiston

Acknowledgements

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Peterson deserves special thanks for the many hours of work he gave to the magazine.

As editor, I would like to extend my personal thanks to Professor Elwood Bizeau for his invaluable advice and suggestions and the many hours he spent helping both me and the magazine.

PHOTOGRAPHS

The front cover photo was contributed by Potlatch Forests, Inc. The back cover photo was donated by Professor Fred Johnson.

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TABLE OF CONTENTS

Club Report	3
Faculty	4
Forestry Building	5
The Air Pollution Problem in Lewiston — Three Views	
Our Continuing Commitment To Pollution Control Potlatch Forest, Inc.	7
The State of Idaho's Position on Air Pollution in the Lewiston-Clarkston Area Arthur W. Van't Hul	8
The Smell of Money? Jack O'Connor	9
Fire for Elk in Northern Idaho Thomas A. Leege	12
1970 Summer Employment Survey William L. Scrivner	14
Forestry in Chile Charles G. Johnson	15
Bobcats Theodore N. Bailey	17
Western Red Cedar Bark — A Pollutant or a Product? Roy Adams	18
Water Quality and Steelhead Migration Studies on the Lower Snake River C. M. Falter	21
Range Sheep Production and Nutrition Wally Butler	23
Alumni Directory	26

Editorial

Steven C. Wilson

The last few years have been years of change in the College of Forestry, Wildlife, and Range Sciences. It is no longer just the 'College of Forestry'. Wildlife, fisheries, and range are rightfully demanding their own identities within the College. The IDAHO FORESTER, as the official student publication of the **entire** College, has tried to reflect this trend with a wide range of articles concerning all aspects of wildland resource management.

However, there has arisen a conflict between different segments of the College who are so intent in achieving their own identities that they are fragmenting the College. Each option in the College of Forestry, Wildlife, and Range Sciences is separate because of its specialized nature, but there is a common bond which should be just as strong. All are concerned with the better utilization of our natural environment for the benefit of as many people as possible. This should be our overriding consideration — **not** whether one is a wildlifer, or a range manager, or a fisheries expert.

The 1971 IDAHO FORESTER does represent the entire College. We hope that our efforts show that common grounds of interaction and communication do exist.

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Club Report

7 1/2"
3 1/2"

The College of Forestry, Wildlife, and Range Sciences has been very active this year. Its three principal student organizations, The Society of American Foresters, The Wildlife Society, and Xi Sigma Pi, have all had a full calendar of events.

This third year of operation for the Wildlife Society saw a greatly increased membership, now over 70 members. During the year there was also a vast expansion in the Society's activities. A first place trophy for the top team in the Wildlife Bowl was brought back by the U. of I. group which attended the 1970 Western Student's Wildlife Conclave held in Corvallis, Oregon. The shotgun raffle held during the year was successful, and the money raised was used to send 14 members to the 1971 Western Student's Wildlife Conclave in Fort Collins, Colorado. Monthly meetings were held and a wide range of interesting topics were discussed by guest speakers. Attendance at meetings has been good throughout the year, a large contingent of WSU Wildlifers attend each Idaho chapter meeting to hear the guest speakers.

In September, 1970, the University of Idaho Chapter of the Society of American Foresters was installed as the ninth student chapter of the Society. When the first membership drive was completed, there were forty-two charter members.

Meetings of SAF this year have dealt with organizational

and business matters, such as the ratification of the chapter's by-laws. Guest speakers and evening field trips have also built a spirit of professionalism within the membership. The future of the new organization is bright.

Xi Sigma Pi opened the year by bringing together graduate and undergraduate students in an apprenticeship program designed to give undergrads some practical education by assisting the graduate students in their research. A second project that Xi Sigma Pi undertook this year was to offer its services for liaison and communication between students and faculty. Students were elected to the faculty-student committees and several productive meetings were held. The students now realize that they have a voice in determining the curriculum and organization of the College of Forestry, Wildlife, and Range Sciences. An innovation in the format of the chapter's meetings is the seminar type of gathering instead of the former "business only" type of meeting. This helps promote interest in the activities of the chapter and will help the members continue their important work.

The activities of these three groups is indicative of their desire to enhance the stature of all students in the College. Concern by everyone involved will make this goal a reality.



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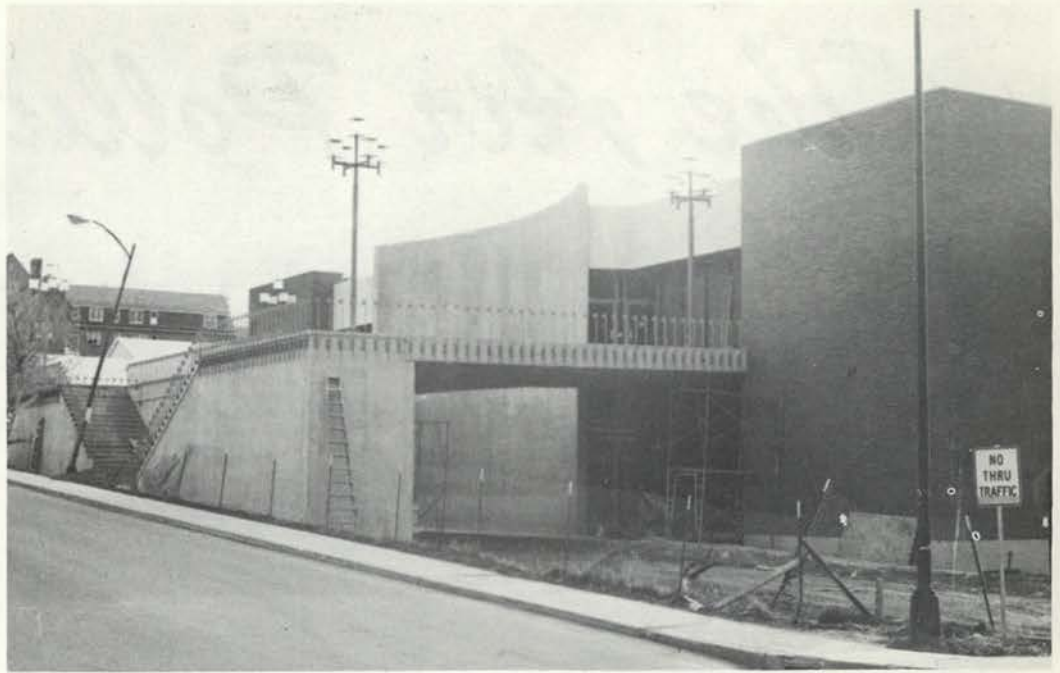
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—Photos by Scrivner

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Dream
Come
True**



*Through These Portals We Will Pass
(or Fail?)*

The New Forestry Building (open for classes next fall)



Photos
by
Scrivner

*The Air Pollution
Problem
In
Lewiston*

 **THREE VIEWS** 

1.
Potlatch
Forests,
Inc.

2.
Idaho
Health
Department

3.
A
Lewiston
Citizen

Our Continuing Commitment To Pollution Control

Potlatch Forests, Inc.

In recent months, much of American industry has come under attack as harmful polluters of our air and water. Certain individual companies have been singled out for particular attention by well-meaning but generally uninformed groups.

The belief is widespread in many segments of our society that damage to the environment must accompany industrial growth, and that much of industry exhibits a callous disregard for the environment. Certainly at Potlatch nothing can be further from the truth. But we must all recognize that the criteria for plant location, equipment, and design were quite different 20 or more years ago than they are today. Now the task of bringing old plants up to standards desired by all of us in this period of our history is a difficult and time-consuming one. With the best of good will and effort there is no way in which it can be completed immediately.

Given intelligent and objective cooperation and understanding by the public in the areas in which we operate and by state and federal governments, we believe that we can, within a reasonable period of time, bring our plants up to acceptable standards of environmental quality. This certainly is our goal.

The preceding three paragraphs were taken from the foreword of a pamphlet entitled **Our Continuing Commitment to Pollution Control** which was prepared this year by Potlatch Forests, Inc. The foreword was signed by Benton R. Cancell, President.

Following are those portions of the report specifically dealing with air pollution related to the Lewiston, Idaho pulp and paperboard mill. Excluded are those portions dealing with water pollution at Lewiston as well as air and water pollution — problems, accomplishments, and goals — at our Cloquet, Minnesota plant. The complete report is available from the Public Affairs Department, Potlatch Forests, Inc., Lewiston, Idaho 83501.

Pollutants, basically, are by-products created in the processes that convert energy or matter from one form to another. In fact, nature itself creates pollutants. Changes of energy in the earth's crust, resulting in volcanoes, create catastrophic pollution. Natural forces at work on the earth's surface continually convert rock structures into fine materials that cloud streams and rivers. Decay of organic matter creates pollutants in swamps and streams. Seepage of mineral-laden water from the earth can adversely affect water quality. Many natural ecological processes create pollutants.

Industrial facilities, including those that convert natural resources into manufactured processes, unavoidably create waste materials in the manufacturing process. In excessive amounts, these wastes, unless collected or properly disposed of, can create pollution as they escape into the air, water, or ground. To protect the environment, industry must control these effluents and emissions within the allowable limits of the environment.

Potlatch Forests is no exception. The major pollution abatement challenges facing us arise from the processes used to produce pulp and paper. The conversion of wood chips into paper and paperboard requires the use of air, water, and chemicals. The challenge is to use these ingredients with as

little waste as possible and to collect and render harmless the waste that cannot be prevented.

Potlatch's air and water pollution abatement programs are designed to meet or exceed state and federal standards. And as standards are established and programs are approved, we are moving ahead with major construction projects to install highly effective pollution abatement equipment and processes.

Air Quality

The production of wood pulp also produces atmospheric emissions of small solid particles, visible water vapor, and various odorous gases in great part measured as total reduced sulfur.

The question of exhaust quality primarily arises in the chemical recovery operation, in which the liquor (pulp cooking chemicals) is recovered for reuse. After the wood is digested into pulp, the black (spent) liquor containing inorganic cooking chemicals and dissolved organic matter is removed from the pulp. In the first phase of liquor recovery, the black liquor passes through a series of evaporators to increase the concentration of solids.

When solids are concentrated to a certain level, sodium sulfate is added, and the solution is sprayed into the recovery furnace. In the furnace, the organic materials are burned to carbon dioxide and water vapor. The inorganic chemicals are recovered as a molten smelt.

The molten smelt flows into tanks and is dissolved in water to become green liquor. The green liquor is treated with lime to renew the solution as white liquor ready for the digesters. The lime mud residue produced in this process is collected, washed, and burned in a kiln to recover lime for reuse in treating further batches of green liquor.

Atmospheric emissions of particulate matter and gases develop from the many complex processes involved in the recovery cycle.

Particulate Control

The most effective equipment now available for particulate control is the electrostatic precipitator. An electrostatic precipitator is a chamber containing electrically charged wires. As exhaust gases pass through the chamber, soot and ash particles receive an electrical charge and adhere to the wires. The action is somewhat like metal filings clinging to a magnet. Periodically the wires are vibrated, permitting the particulate matter to fall to the bottom of the chamber for collection.

The three recovery boilers at the Lewiston pulp mill employ electrostatic precipitators in their exhaust-stack gas stream. A fourth recovery boiler with a precipitator rated at 99.7% efficiency has been ordered and should be in operation in 1972. When this project is completed in 1972, particulate emission from the Lewiston recovery stacks will drop from the current 6,000 lbs. a day to 2,600 lbs. a day.

Odor Control

The most difficult aspect of pollution abatement facing sulfate pulp mills is odor. In the processes of pulp digesting and chem-

continued on page 11

The State Of Idaho's Position On Air Pollution In The Lewiston-Clarkston Area

Arthur W. Van't Hul

Regional Public Health Engineer

Idaho Health Department

The valley formed by the Snake and Clearwater Rivers with its very deep canyon and its poor ventilation is a natural trap for smoke, gases and other forms of air pollutants. The valley has a high rate of air inversions — well over 200 per year. Inversions are due to a cold air mass aloft and lack of air movement in the valley. If an inversion persists, a buildup of pollutants occurs, visibility is impaired, disagreeable odors assail the nostrils. The resulting buildup of gases and particulates can become physically irritating, especially to those whose respiratory tracts are sensitive to gases and particulates.

The Sources of the Problem

Lewiston has several industries which pollute the atmosphere. The largest single source of industrial air pollution is the mill operation of Potlatch Forests, Incorporated which provides the city's largest payroll. Many businesses and homes in the older portion of Lewiston frequently emit large quantities of heavy smoke through the use of low grade fuels or improper operation of obsolete heating systems. Most of the interstate auto traffic passes over two streets in the bottom of the valley through downtown Lewiston causing a noticeable concentration of exhaust gases at times.

The History of Air Pollution Control Activity

As created by the State legislature in 1959, the first Air Pollution Control Commission was an opinion-seeking body. It did not have funds to carry on studies nor to take action. In 1967, the present Air Pollution Control Commission, composed of 5 members, was established by the legislature. The 1967 law established the Air Pollution Control Commission as an independent administrative body and gave it duties and functions. These functions are coordinated within the State Department of Health. The Commission is independently financed and has equipment and staffing to do basic air pollution monitoring. Its main function is the establishment of regulations for the control of air pollution in Idaho. The Director of the Commission coordinates activities with the Federal Government.

Prior to 1967, the Federal Government was assumed to be responsible for establishing air pollution control regulations in inter-state problem areas such as Lewiston-Clarkston. During the period 1961-1967, several studies of the problem were made by Potlatch Forests and by the U. S. Public Health Service. The Federal Government recommended that the states of

Idaho and Washington, the communities of Lewiston-Clarkston and the county commissions of the four counties involved should work together in establishing air pollution controls. But outside of a few meetings of a Tri-County Air and Water Quality Control Committee, nothing was done on an area-wide basis. The city of Lewiston developed and adopted a no-burning ordinance which was the only control in the entire valley. In 1967, Potlatch Forests, which had been working on the air pollution problem for many years, presented an acceptable proposal to the U. S. Public Health Service for continuing construction of emission control devices and for a monitoring program.

In Nov. 1970, the state of Idaho was informed by the National Air Pollution Control Administration that the Federal Government was relinquishing its responsibility in the inter-state area to the states of Washington and Idaho and that an air shed was being established for the Lewiston-Clarkston region. By this action, the problem became the responsibility of the states of Idaho and Washington to control air pollution in the area. The Idaho Air Pollution Control Commission will take over responsibility for all future studies involving Idaho air pollution sources in the valley.

What is Being Done?

Air pollution standards for Kraft Mills were developed and adopted by the Idaho Air Pollution Control Commission in March, 1971. These standards are almost identical to those in Washington and Oregon. Continuous monitoring by the Commission staff will be conducted to insure that the newly adopted standards are met.

New furnaces to be installed at the Potlatch mill should greatly reduce many of the pollutants from that source. There is no intent at this time to reduce the large quantities of steam which occasionally create visibility problems in the valley. Some odorous sources have been isolated recently and the smell could conceivably be reduced, but it will not be eliminated completely.

In the final analysis, pollution control is everyone's business — not just industry nor the state and Federal agencies — each citizen must do his part, however small. It is only by working together that we will achieve an environment relatively free of air contamination.

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The Smell of Money?

Jack O'Connor, Citizen
Lewiston, Idaho

In 1948, I decided I could no longer live in my native Arizona without developing an ulcer. I was born in Arizona. I grew up there. I had worked and had gone to college in the South and the Middle West, but I was never happy in any place except my native state. I returned to Arizona in 1931. From 1934 until 1945, I was a professor of journalism at the University of Arizona.

In 1934, Tucson had been a charming city of about 40,000 with good shops, good doctors, good restaurants, little crime, clean air. By 1948, the population was probably around 100,000-150,000. Pleasant stretches of desert land where I had picnicked with my family were filled with sub-divisions with Jerry-built houses and fancy names in bad Spanish. Now Tucson has a population of over 300,000 and has riots and rackets.

I had resigned my position at the University of Arizona in 1945 to take a much more remunerative job as a staff writer for a national magazine, one that would enable me to live anywhere. I had wanted to leave Tucson at the time I left the University, but my wife was reluctant. We had a pleasant home and young children to worry about. However, in 1948 she agreed to go wherever I wanted to go.

Actually I didn't know just where I wanted to land. All I knew was that I wanted to find a place where there was some bird shooting, some country to wander around in, some hills and trees and clean air and water. I thought of various places, but two friends focused my attention in Idaho. One was a colonel in the air corps who had been stationed near Boise during the war. Another was a famous motion picture star, who had shot pheasants and had been skiing in Idaho.

In the early spring of 1948 before my wife could change her mind, I sold our Tucson house for delivery on July 1 and left to look over Idaho. I found real estate prices in Boise high and the town had the look of a place that was going the way of Tucson. I remembered that one of my friends had favorably mentioned a place called Lewiston. I left Boise in the afternoon, spent the night in McCall. I slept poorly, got up at the crack of dawn, ate breakfast, and took off.

It was still early when I reached the top of the Winchester grade and began the winding descent to Lapwai. The hills and the fields were green, the sky brilliantly blue, the air scented with the fragrance of pines. I saw dozens of pheasants near the road around Lapwai, some Huns, and some quail. When I got to Lewiston I fell in love with it. This was the place I was looking for. I bought our present house and have lived in Lewiston ever since.

There are a lot of things in this life besides money, and actually I have valued money only because having some of it gave me security, enabled me to have some freedom of choice and movement, and to buy a few things I have wanted — a fine Italian sidelock double in an oak and leather trunk case, for example, an occasional big-game hunt with my wife along, and so on.

Those first few years in Lewiston I used to tell my friends in the East about all the things anyone who lived in Lewiston got for little or nothing. The bird shooting around Lewiston and across the line in Washington was good. Many times my wife and I would get the kids off to school, drive 8 or 10 miles and be back home two hours after we left with a couple of limits of quail. On the first weekend of the pheasant season, the big bright cocks flew around in the Lapwai area like sparrows.

But in the 23 years since I moved to Lewiston the valley has

become a much less desirable place to live. The worst blow the Lewiston-Clarkston area has ever got was the Potlatch pulp mill. This monster pollutes the air and the water. It robs the residents of the valley of their sunshine, undermines their health. Many times I have awakened in my Lewiston home to a grey, dirty, stinking day; and after having driven up the Lewiston hill toward Moscow I have discovered that the weather was purely local. On the top of the hill, the air would be clean and the sun bright. Below it was grey, stinking, too thick to breathe, too thin to swim in. Since the pulp mill was installed, I, along with hundreds of other people in the valley, have developed chronic bronchitis. As I write these lines, the wind has changed and I feel better. But for the three days before, the stench from the pulp mill was in every crevice and cranny in the valley, blackening the silver, searing lungs, causing sinus trouble and emphysema.

At first, the reaction around Lewiston was about that of a former major of this fair city. He was quoted as saying that the mill's stench "smelled like money." To me it has always smelled like a common substance, the name of which is spelled in four letters the first being "S." Those who expressed some dissatisfaction with Potlatch's invasion of their homes, the fouling of their air, and the polluting of their water were told that if they didn't like it they could move. They were looked upon as screwballs and soreheads.

One poor guy in Clarkston woke up one morning and found his house had been blackened by the lethal fumes of the pulp mill. He sued Potlatch for the price of a new paint job, but that great firm brought out a high-powered battery of attorneys and beat the case. If he had won, his victory might have given the peasants ideas. Until comparatively recently, Potlatch has maintained with a straight face that it had little or nothing to do with the air pollution in the valley — that it was caused by automobile exhausts, cigar smokers, people burning autumn leaves, and what-not.

The Army Engineers have been laboring like little beavers to finish off the Snake and Clearwater Rivers. They have sold the chambers of commerce on slack water navigation from Lewiston to the sea. Exactly what the series of dams will cost when completed I cannot say, but probably in the neighborhood of a billion dollars. All the jolly little businessmen are sitting around, rubbing their palms together, and thinking the dams will make them rich. There is about as much economic justification for those dams as there was for the flight to the moon. Farmers could ship their wheat out by water for a thousand years and never recover the dams' cost. In the meantime it looks as if the dams will mean the end of the salmon and steelhead runs. Dworshak dam on the North Fork will flood out some of the winter range of North Idaho's biggest elk herd. Dworshak dam was sold as a flood control measure, but since I have been here, the worst thing the flood of the Clearwater has done has been to tip over a couple of unoccupied out-houses. Building the dam has resulted in some profit by merchants and real estate speculators, but that is about the only tangible result.

One of the most terrifying things to me is what the farmers are doing to the environment. It is enough to boggle the imagination! I know one farmer, who (So help me God!) is a bird hunter. On his place there were some willows along the creeks, some brush on the rocky hillsides, a little brush in the draws that ran up into his wheat fields. It was once good bird country. Now he has bulldozed the brush out of the draws and

from along the creek. Maybe he has enough more grass to feed one cow each year for one week. The willows that protected the stream banks are gone and the banks have eroded down to bare rock. There are no pheasants, no Huns, no quail. A year or two ago the farmer told me "I don't know what the hell has happened to the birds. They may have got some disease or those bastards from town probably sneaked in here and shot them all off."

In years past, I spent many happy autumn days wandering around with a dog and a shotgun near Lewiston. I used to shoot some Huns and a pheasant now and then. The last several times I have gone out with a good dog into once productive haunts I have not seen ONE BIRD. Most of the brush has been bulldozed out. Almost all hillsides are so heavily grazed that if there is any brush it affords no cover because cattle have eaten off all grass and weeds under it. Most of the topsoil is gone. Every spring the country is drenched with chemical poisons like DDT and parathion. I ran into a famrer on whose place I used to hunt. "Were there any pheasants last year?" I asked. "Hell," he said, "I haven't seen a pheasant on the place for five or six years. There are a few chukars on the hillsides but that is all." "You poison them off," I said. "We have to farm like that to make money," he told me.

For several miles upstream from its confluence with the Clearwater, Lapwai Creek used to be a cool haven for game birds and small game. On each side was a narrow belt of willows that protected the birds — and also the stream banks from erosion. Lapwai creek was once a famous salmon and steelhead stream and thousands of fish came up to spawn. Now the stream has been "improved" by the Idaho State Highway Department, the Army Engineers, and the Camas Prairie Railroad. The creek now runs over a barren ugly bed of sterile rocks. The pheasants, the quail, the cottontail, the coons that the willows once protected are gone. I am told that a few steelhead still run up the creek and spawn. How they do it I cannot say.

I am not one to sell short the incredible greed and shortsightedness of the average Homo americanus. We have the ugliest cities in the civilized world, with the possible exception of Tokyo, which I have not seen since 1919. We are using our resources at a breathtaking rate. We probably cannot do much about individual greed. We were born that way. I think, though, that we can curb the short-sighted, poorly educated, barbarous specialists that we support with tax funds and who are raping this fair land — the Army Engineers with their high-powered and cynical public relations department and their wasteful dams, the brainless and barbarous highway engineers who destroy the streams and whose ambition it is to put the country under asphalt, the ignorant and short sighted agricultural experts like the county agent who encourages the farmer to poison the land, to cut the trees, bulldoze the brush, and devastate countryside for short term gains; the foresters, who believe that nothing has a right to grow in the woods that cannot be con-

verted cheaply and easily into pulp or lumber.

I hope that the pioneer era of short-sighted and greedy exploitation of our rich land and resources is coming to an end. I believe it is. A few years ago anyone who didn't think the stench of the Potlatch pulp mill smelled like Chanel No. 5 was considered a nut. Anyone who opposed the construction of dams was considered an enemy of progress and practically a Communist. Anyone who thought it a bit odd to destroy our fragile topsoil to raise wheat at government expense and then give it to India to raise more Indians to hate our guts was considered subversive.

Today, the majority of the people in Lewiston-Clarkston area are weary of the stench of the pulp mill, disgusted with the mill's pollution of the Snake and Clearwater rivers, hostile to more destructive dams.



The indescribable innocence
and beneficence of Nature,
—of sun and wind and rain,
of summer and winter,
such health, such cheer, they afford forever!
Shall I not have intelligence with the earth?
Am I not partly leaves and vegetable mould myself?

Henry David Thoreau

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AIR POLLUTION-P.F.I.

continued from page 7

ical recovery, various odorous gases are formed. These gases are measured in great part as total reduced sulfur.

The difficulty in satisfactorily controlling odorous gases is that one part of gas in one billion parts of air can be detected by a sensitive nose. Potlatch is working hard, as is the industry, to abate the emission of total reduced sulfur. Much has been done, and much more is planned.

Currently at Lewiston, the lime kiln is equipped to accept and burn various odorous gases from the pulp making process. In addition to reducing the odor, the lime kiln is also equipped with a scrubber to remove the particulate matter from the kiln exhaust stack. A vaporsphere is being considered in the engineering for Lewiston. This is a holding tank to collect and meter odorous gases to the lime kiln at a rate that will not exceed the kiln's capacity to burn the gases effectively.

The most significant odor abatement technique in place at the Lewiston pulp mill is the oxidation system for weak black liquor. This system is designed to stabilize the formation of compounds that liberate odorous gases during evaporation and burning of spent cooking liquor in the recovery boilers.

Concentrated black liquor oxidation will be added to the process at Lewiston to reduce odorous gases exhausting in recovery furnace operations.

Potlatch is also attacking the odor problem at a different point in the chemical recovery system. This is the point of final evaporation when the black liquor is exposed to hot combustion gases from the recovery furnaces. The contact of the hot gases with the liquor liberates odorous compounds. This has been a major source of odors confronting sulfate pulp mills.

Recently, recovery boiler systems have been developed to avoid exhaust gas contact with the liquor. The new recovery unit ordered for the Lewiston pulp mill will incorporate this feature.

In 1972, the total reduced sulfur emitted from the Lewiston recovery boilers is expected to drop from the current 7,000 to 9,000 lbs. a day to less than 420 lbs. a day. This marked reduction of total reduced sulfur emission will result in less odor from the pulp mill. But as long as some odorous compounds may be detected in ratios as small as one part in one billion parts of air, some odors might still be detected from mill operations.

Air Emission Improvement

Lewiston Pulp Mill	1970	1972
Particulate - Recovery Boilers (lbs. per day)	6,000	2,600
Total Reduced Sulfur + Recovery Boilers (lbs. per day)	7,000-9,000	245-420

Commitment

Potlatch's commitment to environmental improvement is a continuing one within the limits of technology and our economic ability. The plans and objectives for the period 1971-1974 will lead to measurably significant results.

In 1972, the emission of particulate matter and odorous gases will be cut dramatically in Lewiston.

Potlatch does not expect these programs to complete its work in environmental improvement. The commitment will continue, and additional sums will be spent in the fight against pollution.

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Fire For Elk In Northern Idaho

Thomas A. Leege
Senior Game Research Biologist
Idaho Fish and Game Department

Many people are complaining that elk aren't as numerous as they used to be in much of northern Idaho. This concern is justified only if they don't look too far back in history. Past records indicate that elk were rare when Lewis and Clark traveled through Idaho in the 1805-06 period. Elk remained scarce throughout the region until the early 1900's when their numbers started to increase in the Selway River drainage. Elk populations continued to expand and spread during the 1920's, 30's, and 40's. Numbers peaked between 1935 and 1955, depending upon the particular area. Since then, however, elk numbers have been slowly dwindling on most of our northern Idaho ranges.

Reasons for Large Elk Herds

Elk, like other animals, are products of their environment. There is a direct relationship between changes in elk habitat and changes in elk numbers. Prior to 1910, habitat conditions were poor for elk throughout northern Idaho because timber covered most of the low elevations where elk concentrate during the winter to avoid deep snow. Timber stands provide very little browse in their understory. The 1910 wildfire burned millions of acres in northern Idaho. As a result, brushfields replaced coniferous forests on much of this acreage. Many of the shrub species that followed the fire were ideal elk forage and occurred in large quantities. Elk herds flourished. Additional elk range was created by big wildfires in 1919 and 1934. However, plant communities are continually changing. As they change from the early shrub stages that occur immediately after burning to the climax coniferous stage, conditions for elk deteriorate. In some areas, the crowns of young conifers have completely crowded out the shrubby species. In situations where conifer regeneration has been delayed, (frequently where two or more wildfires have occurred in recent years), the browse supply has held up the longest. However, even on these areas, many of the palatable shrubs have grown too tall for elk to reach. At the same time these tall shrubs have shaded out the low growing forage beneath them. Even on our best elk ranges, the quantity of browse is now less than one-third of the peak production that occurred five or ten years after the wildfires. Browse quality has also declined because of the depressive effect that shading has on nutritive value. Elk numbers decreased in direct response to this forage reduction. This downward trend is destined to continue until habitat improvements occur.

The chances of significant amounts of elk habitat improvement by wildfire have been minimized due to technological advances in fire location and suppression techniques. Logging will increase the browse supply in areas where timber was missed by the early fires, but it will be many years before the young trees on recently burned areas are ready for harvesting. Herbicides have been used with only limited success for improving overgrown browse ranges. Coppicing, the cutting down of tall shrubs to promote sprouting, has proven somewhat successful, but costs are much too high for the limited wildlife funds that are available. In order for a range rehabilitation program to be successful, the technique must be economical as well as effective.

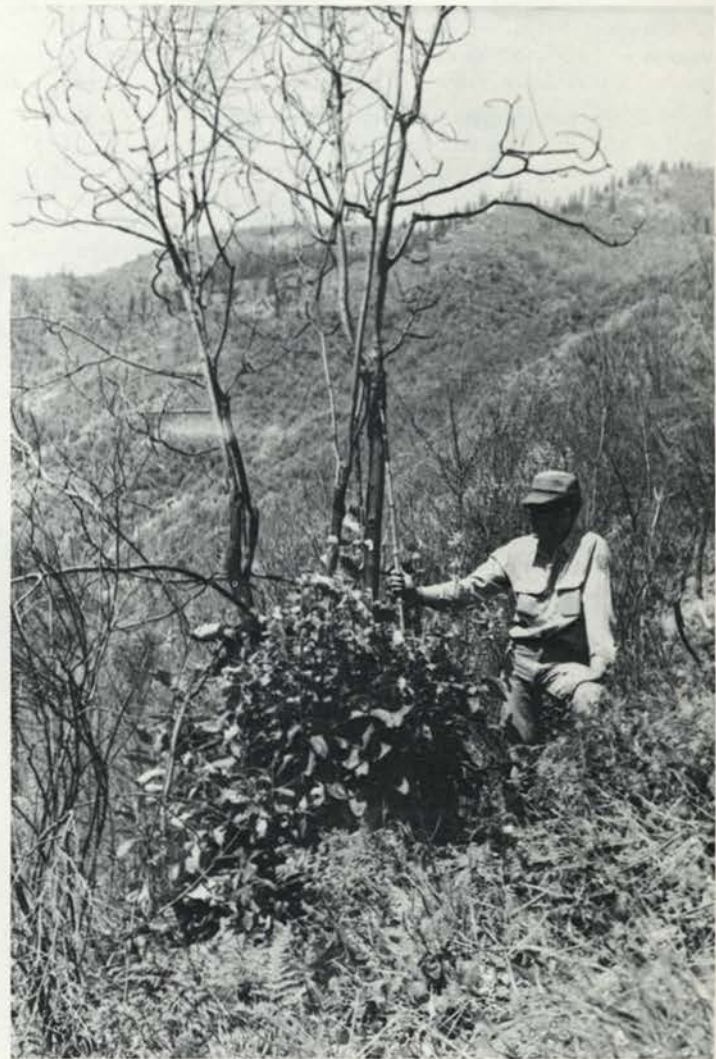
Prescribed Burning Studies

In 1965 the Idaho Fish and Game Department and the

U.S. Forest Service initiated a study to evaluate the use of prescribed burning to improve elk ranges. We recognized that fire control would be easiest during the spring shortly after snow melt, and in the fall after the summer dry period ended. Our studies were designed to compare the results that were obtained from burning during these two seasons. We chose study areas in the Lochsa River drainage because of the good access afforded by U. S. Highway 12. Vegetation on the Lochsa is similar to other burned-over drainages to the north and south.

Sprouting Response

About 400 shrubs, representing most of the main forage species on elk ranges in northern Idaho, were measured before and after burning and on control areas. The shrubs most im-



This typical willow had its aerial portions killed by a spring fire just four months before this photo was taken. Available browse has been increased because of prolific sprouting.

portant to elk, because of their palatability and abundance were redstem, willow, mountain maple, and serviceberry. These species, as well as the less desirable ones, sprouted abundantly from the root crown following both spring and fall burning. A few redstem and bitter cherry plants failed to sprout. Others of the same species also died on the unburned control areas; so death was not necessarily caused by burning. Redstem and bitter cherry are intolerant of shading and they are among the first shrubs to disappear as the canopy closes with advancing plant succession.

Willow was the most vigorous sprouter; it produced shoots averaging four to five feet long after one growing season. Individual willow sprouts were as long as 12 feet. Most of the other species grew sprouts that were two or three feet high. Average sprout numbers ranged from a low of ten for cascara to a high of 120 for mountain maple. All species together averaged 40 to 50 sprouts per plant. Fall burning produced fewer sprouts for most species than spring burning, but as a rule the sprouts were longer.

Immediate Browse Increase

Burning effectively reduced the height of shrub crowns and increased browse availability of the tall-growing species like mountain maple, willow, and serviceberry. On one study area where we measured changes in browse production, there was a 300 percent increase of available browse during the first growing season following spring burning. However, these tall shrubs have tremendous root reserves and gain their height back very rapidly after burning. Just four growing seasons after both spring and fall burns, maple, willow, and serviceberry averaged nearly 10.5 feet high. Only 80 percent of their production was considered to be low enough for elk to use. It appears that repeated burns will be necessary to keep these tall-growing shrubs at a usable height.

Long-Term Benefits

The long-term benefits of prescribed burning depend upon the germination of redstem ceanothus seeds and survival of the seedlings. One of the main reasons for the decline of browse on elk ranges is the reduction of redstem plants in recent years. Redstem is very intolerant and some indications are that it is naturally short-lived. Whatever the reasons, it is evident that many redstem plants have disappeared from seral shrub communities. Redstem has adapted to fire. The seeds have extremely durable seed coats that enable them to lay dormant, but viable, in the soil and duff for many years. Only when the seeds are heated by fire or the dormancy is broken in some other fashion does germination occur. Both spring and fall burns cause germination. Fall burning apparently favors redstem establishment by causing more seeds to germinate than spring burning. Also, survival is better after fall burning because seedling growth begins will all other vegetal growth the spring following burning. In contrast, after spring burning, redstem seedlings do not start growth until the following spring; they have to compete against other plants which are beginning their second growing season.

Other Burning Benefits

Other benefits that result from burning include increases in browse palatability and nutrients. Our findings indicate that four years after burning the elk still made greater use of the browse on burned areas, eating stems to larger diameters and even browsing on some species that they rarely touch in unburned areas. Browse protein increased following burning and remained higher for two growing seasons. But by the third year, nutrient content has returned to pre-burn levels.

Soil Erosion

Soil erosion has not been noticeably accelerated by the prescribed burns. Fall burning consumed the litter more completely than spring burning and exposed additional bare soil. For these reasons and because the soil remained unprotected by vegetation over the winter, fall burning caused a greater erosion potential. However, the soil and humus were moist during both spring and fall burns in contrast to the dry conditions found during summer wildfires. The high moisture levels prevented the heat from penetrating and destroying the soil holding properties.

Problems of Application

After it was established that prescribed burning improved elk range, it became evident that several problems would need to be resolved before enough range could be improved to significantly benefit the elk. These problems are: (1) insufficient financing, (2) inadequate manpower and techniques, and (3) multiple use conflict.

Most of the elk range in need of prescribed burning in northern Idaho is found on the Coeur d'Alene, St. Joe, Clearwater, and Nez Perce National Forests. The Multiple Use Act, under which the U. S. Forest Service functions, authorizes these Forests to manage specific areas for elk. It must be established, however, that these areas are more important for elk than other forest uses. Unfortunately, very meager funding is provided to the Forest Service for managing these elk ranges even after their importance is recognized. However, Forest Service personnel initiated a burning program for habitat improvement in 1965 and expanded the program annually until almost 4,000 acres were rejuvenated in 1968. Poor burning weather limited the burning to about 1,600 acres in 1969. Costs were reported at \$0.75 per acre because considerable manpower and money were donated from other functions. Almost all of the burning was done in the spring, because it was much less expensive than fall burning. With about 250,000 acres of elk range in need of rehabilitation in northern Idaho, it became clear that more financing was needed to establish a burning program sufficiently large to register reasonable progress. The Idaho Fish and Game Department contributed \$7,500 to the Forest Service burning budget in 1970; and about 9,000 acres were treated. The Forest Service is planning to spend \$30,000 of Department money in the spring of 1971 to burn almost 14,000 acres. Larger sums of money will be needed to establish a program of desirable size, about 25,000 acres annually.

Money Will Not Solve All Problems

Lack of funds is not the only obstacle slowing progress toward a larger burning program. Many of the areas in need of burning are extremely inaccessible. This problem, coupled with the lack of adequately trained manpower and the occurrence of only a few good burning days each spring, makes it very difficult to get large acreages treated. We are experimenting with a technique whereby ignitor devices can be dropped from a helicopter. This will enable a very few people to ignite many inaccessible areas during the normally short periods of time when burning weather is adequate. If this aerial ignition technique can be perfected, an expanded burning program will be more feasible.

The third problem, that of conflicts with other national forest uses, is a very real one at times. For instance, it is difficult to grow timber on an area that is being burned for elk

continued on page 25

1970 Summer Employment Survey

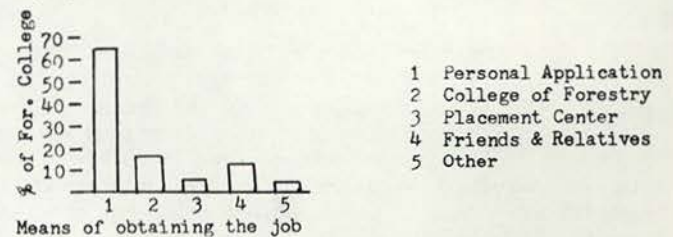
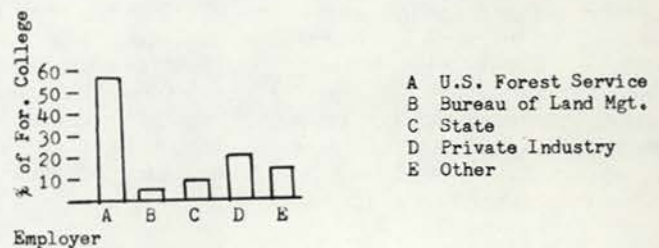
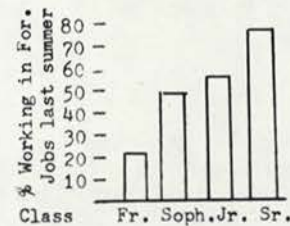
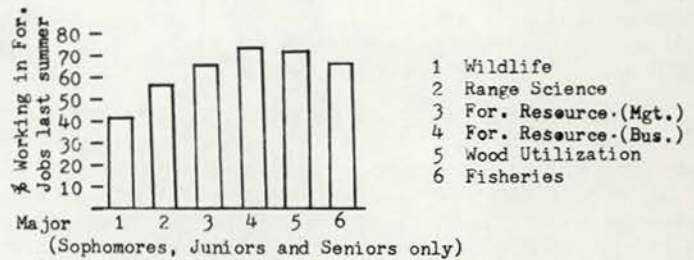
William L. Scrivner
Student

During registration for the spring semester 263 students filled out questionnaires regarding employment last summer. The purpose of the survey was to determine how many students worked in forestry related jobs, how they got the jobs, for whom they worked, where they worked, and how much they were paid. Other questions were included to explain why some students did not have forestry related work. The information from individual questionnaires was punched onto data cards. Frequency distributions were obtained by processing the data through the IBM 360 computer at the University Computer Center. The information gained through this survey will be used by the College of Forestry, Wildlife and Range Sciences to help place students in the best jobs available.

While looking over this report, one should keep in mind that the summer of 1970 was an unusually slow one for forest industries. Due to federal spending cutbacks and a slow-down in the lumber and wood product industries, forestry jobs for students were significantly decreased.

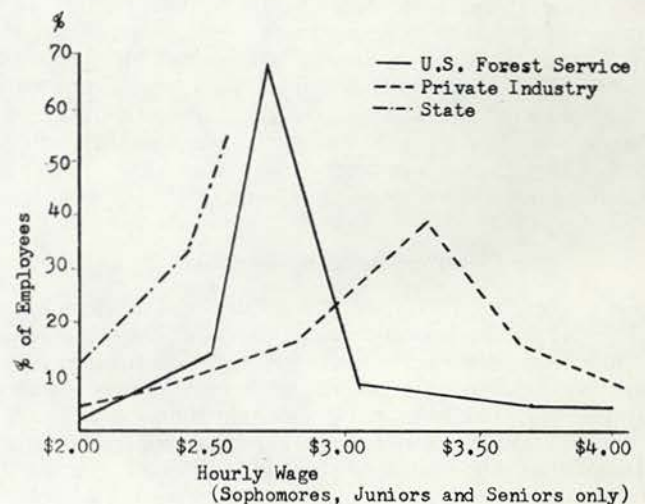
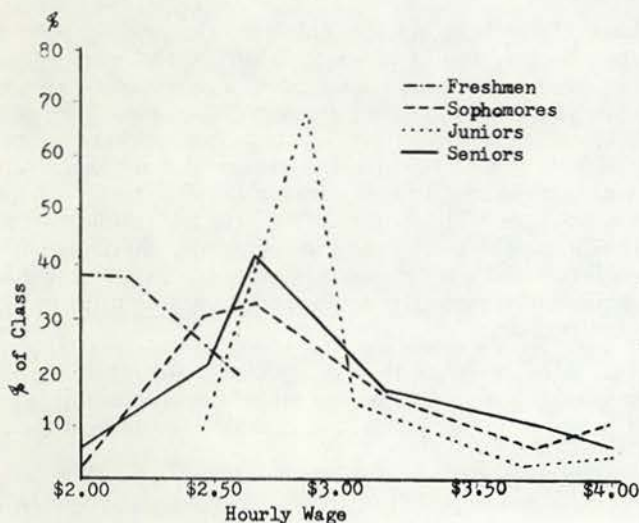
In addition to the frequencies shown graphically, the survey showed that 72.2% of the students employed worked in Idaho. The survey also showed that of those not working in forestry related summer jobs, 83% worked at another type of job. 72.6% of those not working in forestry related jobs did not attempt to find such a job.*

Freshman students were not included in some of the frequencies. This was done to avoid bias caused by large numbers of unemployed freshmen in some groups. At the time of this survey, these students had just graduated from high school; they had not yet affiliated with the University of Idaho nor the College of Forestry, Wildlife and Range Sciences.



* Sophomores, Juniors and Seniors only

*Percent of entire College (66% of Soph., Jr., and Sr. not working did not attempt to find forestry work).



Forestry in Chile

Charles G. Johnson
Graduate Student

Mr. Johnson spent 2½ years in Chile with the Peace Corps. He worked with the Chilean Division of Forestry in its reforestation program, taught forestry to pretechnical school students and constructed a development plan for one of the national parks.



Monkey Puzzle Tree in Tolhuaca National Park, Chile
Photo by Author

Visualize a country 2600 miles long but only 110 miles wide. This would be equivalent to a measuring rule 24" long and 1" wide. Now consider a few physiographic features. The western side is bounded by the Pacific Ocean and the eastern boundary is the rugged backbone of the Andes cordillera. From north to south, climatic extremes include the driest desert in the world, the Atacama Desert, and a region of dense forested wilderness in the extreme southern third of the country which receives as much as 200 inches of rainfall per year. Thus, Chile is a highly variable country with complex problems owing to its many social and political differences and its relative isolation from the rest of the world.

The Division of Forestry is responsible for the management of Chile's forests which are located primarily in the southern half of the country and comprise 27% of the total land area. Since the government is highly centralized, with transportation and communications difficult between the various zonal and regional offices, the implementation of policies developed in Santiago, the capital city, is extremely difficult. There have

been several attempts to decentralize the division and place more policy-making decisions in the hands of the zonal directors, but with little success.

To understand the situation in Chile today, we must look at the past. As Chile was colonized, the native forests fell to the landowners' axes and were burned ruthlessly in an attempt to create needed agricultural lands. Colonization is continuing today, but those lands being cleared of native forest are not suited to agricultural activities. This brings into focus the number one problem faced by Chile's foresters today, — namely the continual erosion of prime forest land induced by ill-advised agricultural practices on slopes too steep to handle the high winter precipitation. Directly related to this problem are the wildfires caused by clearing the forested lands.

One fifth of the accessible forest land or 2.6 million acres has been destroyed by fire and erosion. To combat this tremendous resource loss, the government has undertaken an ambitious reforestation program which (it hopes) will not only restore denuded lands to production, but will foster new wood utilization industries and employment. To promote this program, low interest loans and materials are extended to landowners by governmental agencies working closely with the Division of Forestry. As a further incentive to the landowner, reforested lands are exempted from taxation.

The major species used is Monterey pine (*Pinus radiata*). It is provided at minimal cost to the landowner through local government nurseries. It survives well on diverse sites and has a very rapid growth rate. This species is ideal grist for the pulp and paper mills. Its common annual increment is 1.0-1.5 inches and you have a pulpable tree at 18 to 20 years. At 28 to 30 years, this species is normally harvested for sawtimber. Other species used are coast Douglas fir, redwood, ponderosa pine, eucalypti, and Himalayan and Monterey cypress.

One of the major deterrents to reforestation is the large percentage of denuded lands under small ownership. These land holdings are generally from 25 to 250 acres in size and are held by poor owners who must utilize the acreage for agricultural ends in order to survive. The difficulties in promoting the program among these numerous owners is a very real problem not yet fully solved. In the region I covered, over 80 percent of the lands classified as having a forest capability were held by these small landowners.

An intensive forest fire campaign was initiated in 1967 which has had a very profound influence among the populace. Fire fighting crews have been trained and deployed to combat the raging fires which are frequent in the plantations and native chaparral in the coast range of central Chile. Lightning is a rare occurrence. The fires all start as a result of man's activity, usually from clearing fires which have gone out of control. To remedy the situation, stiffer fines will have to be leveled against landowners who fail to secure burning permits or who do not take the proper precautions when burning.

Another problem which has received little attention is the yearly encroachment of coastal dunes upon the forested

coastal range. Today 328,000 acres are covered by growing, shifting dunes. Some efforts have been made in widely scattered areas to stabilize the dunes through plantings of acacias, (*Acacia dealbatae* A. *melanoxyton*) followed by maritime pine (*Pinus maritima*). These experimental plantings have proven the feasibility of dune control, but the limited budget of the Division of Forestry cannot undertake full scale operational plantings.

Chile's wood utilization industry is just getting under way. There are three pulp and paper mills and one tissue mill which produce enough for national consumption, but high grade paper must still be imported. Plans call for a total of eight such mills to handle the projected volume of raw material from the infant pine plantations. There are many small lumber mills which produce poor quality lumber due to antiquated equipment and a general lack of technological training. The product is too far from population centers. Poor transportation between forest and market will not allow a prosperous industry to exist. When transportation and product quality cease to be problems, the lumber industry should grow. The two large efficient mills in the country are operated by U.S. interests and they export most of their lumber.

The Department of National Parks and Forest Reserves, which should have divisional status, is just another department of the Division of Forestry. It is in charge of 36 national parks and 39 forest reserves comprising 11.6 million acres. Many of the parks have failed to meet the criteria adopted by the Latin American Conference of National Parks in 1968 and will soon be re-designated or placed under other administering agencies. Emphasis should be placed on a few of the total number of parks to serve as models for the rest of the parks in the system. Five major parks are currently being studied and developmental designs prepared. However, there is a shortage of personnel to effectively administer and carry out the work needed to build the park lands into a unified system of properly developed parks accessible to the visitor. A more autonomous administrative structure is needed in order to give greater status and funding to the system.

Chile has some very interesting land forms and vegetation protected within the national park system. Two insular possessions in the Pacific, Juan Fernandez Island and Easter Island, contain large areas designated as national parks. Two national parks preserve large stands of monkey puzzle tree (*Araucaria araucana*). This prehistoric relic has its last stronghold along a narrow ribbon high in the southern Andes. Several semi-active volcanoes and the famous Torres de Paine are also included in the system.

There is a difference between the Chilean forester and his North American counterpart. After five years of college education, much like that received by a forest resource manager here, the Chilean forester is usually placed in a top administrative position with the Division of Forestry or a closely related governmental agency or private industry. He assumes no subordinate role prior to his administrative post and receives no real field experience. This creates a gap between the administrator and untrained worker. Realizing this, the educational system has developed two year technical forestry schools which operate similar to those in our country. The reason the professional forester jumps from classroom into a top administrative position is because of the lack of foresters in Chile. The first Chilean forester graduated in 1955. Since that date two universities, the University of Chile and Austral University, have been graduating about fifteen foresters yearly.

This small contingent formed the Association of Chilean Foresters in 1965 to provide an interchange in ideas, advances through research and administration and to discuss matters common to the profession. Regional and national meetings are

held with technical papers presented and analyses made concerning the aims and goals of forestry in the country. It has been a particularly good organization which has done much to unify and coordinate Chilean forestry efforts between all individuals and organizations engaged in forestry endeavors.

There are many changes evolving. Chile has discovered that a free enterprise system is not necessarily the best means to rid itself of its economic problems. The road to socialism has resulted in part from pressure by a growing number of university-trained people and in part, by a growing awareness of Chile's high dependency on foreign governments and foreign industry. The bold new reforms may give Chileans the industrial independence and stable economy they seek. Although socialism per se will not be the answer, neither is the U.S. style of free enterprise. Chileans believe that when the rich copper industry is theirs and large estates are broken down for distribution among the have-nots via agrarian reform, the goals of industrialization and non-dependence on other governments will be in sight. The forest industry will be able to develop without deficit spending or large international loans. Needed equipment and funds should become available through a resulting import-export market more favorable to Chile than that which now exists. With this better economic situation, jobs will be available for large numbers of unemployed workers and educational opportunities more widely distributed than now. Though the current political situation in Chile may not be favorable for U.S. industries currently operating there, Chileans believe it is good for Chile. Perhaps that is what is most important after all!

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Bobcats

Theodore N. Bailey
Graduate Assistant
Idaho Cooperative Wildlife Research Unit
University of Idaho

The old lava tube was an ideal den for the female bobcat to raise her two kittens. The tube once transported hot lava from a nearby crater, but some time in the distant past the top had collapsed allowing entrance underground. The den was cool during the hot summer months, and rabbits, the bobcat's main prey, were plentiful nearby. The female still wore the aluminum tags I placed on her ears in February. She weighed 21 pounds then, about average for an adult female bobcat. She probably mated with one of the two adult male bobcats I captured and released in the same vicinity — either the 29 pound "tom" taken near the den, or a 24 pound "tom" I captured two miles away.

It was August when I first saw the scattered remains of rabbits near the lava tube. The tell-tale kitten tracks in the dust advertised it as a bobcat den. That evening as I lay concealed behind some sagebrush, I saw the tag-wearing female

leave the den. She scanned the surroundings for about 30 seconds before swiftly climbing the rocks to ground level and disappeared into the darkening sagebrush. She could provide me with valuable information about family relationships if I could place a radio transmitter on her. I also knew she would be difficult to capture. She, like other female bobcats with kittens, would probably use different routes to enter and leave the den. She would move the kittens to another area at the slightest hint of danger. But I managed to recapture her a few days later. After carefully measuring a dosage of immobilizing drug, I place the drug in a syringe mounted on the end of a pole and injected the drug into the female's hip. Five minutes later, after the female was unable to move, I examined her and fitted her with a radio transmitter collar. The drug would wear off in 2 to 3 hours. This female bobcat and her two kittens would now provide me with much information about the life of a bobcat.

Tagging and tracking bobcats with radio transmitters are part of a bobcat population study I began in 1969. The study is conducted through the Idaho Cooperative Wildlife Research Unit. The Unit Leader, Dr. Maurice Hornocker, is my graduate advisor on the project. In addition to my personal interest in the bobcat, several other reasons prompted the study. First, the bobcat is a predator. In animal communities, predators often help reduce violent fluctuations in the numbers of prey, and they operate as a selective force eliminating diseased and unfit individuals. A factor influencing the efficiency of predation is the size of the predator population. One objective of my study is to learn how the size of a bobcat population can be determined. Second, bobcats are solitary, but

even solitary mammals exhibit some form of social behavior. Territoriality, as a form of social behavior, could limit the number of bobcats living on a given area. Understanding how territoriality functions with the bobcat might benefit other species of wild cats that are endangered.

Current demand for bobcat fur has made the bobcat an important furbearing species. In Idaho, as in many other states, the bobcat is not considered a game animal and is therefore not protected by law. This situation makes it difficult to find a study area where bobcats are abundant but undisturbed. The Atomic Energy Commission's National Reactor Testing Station, a large area of rugged lavas and ancient craters in southeastern Idaho, was chosen because hunting and trapping were prohibited within its boundaries. I would capture, tag, and release the bobcats living on a selected area of the Station. Recapturing, snow-tracking, and radio-tracking would



Juvenile male bobcat with ear markers.

— Photo by Author

give an estimate of population size, composition, and distribution. Bobcat carcasses would be collected from trappers near the study area to give additional information on bobcat ages, reproductive rates, and food habits.

Bobcats breed throughout the year, but the peak breeding period on my study area occurs from January through March. After a gestation period of about 60 days, the kittens, varying from 2 to 5 per litter, are born in protected locations such as caves and rock piles. Most kittens are reddish-brown in color with many black spots, but a dark

gray color phase can occur in the same litter. When mature, these dark gray bobcats are sometimes called "lynx cats" and are mistakenly believed to be different from the "bobcat". The female weans the kittens by bringing prey to the den. Blacktailed jackrabbits and cottontail rabbits are the major foods of the bobcat on the study area. Prey taken in lesser numbers are kangaroo rats, chipmunks, pack rats and mice.

As the kittens mature, or if the den is disturbed, the female moves them to other locations. Later, the kittens accompany her on hunting trips. If threatened, she will signal her kittens to take protective cover in the rocks. If no protective cover is available, she may hide her kittens under sagebrush and later return for them after the danger has passed. Females may even bring prey to captured kittens. Because of their dependence on her, the female's death probably means death for the kittens. Kittens may remain with the female for at least six months. But as they grow older, they begin spending more time alone. The female may meet and stay with a kitten as it moves within her range, but eventually she may escort it away and return alone.

continued on page 25

Western Red Cedar Bark — A Pollutant Or A Product?

Roy Adams
Research Assistant in Wood Utilization

For many years wood and bark residues have created one of the most serious problems for the wood based industries. But in the past two decades our concept of wood waste has changed drastically. We now consider former waste residues as valuable raw materials. Improved technology has made it possible to use sawdust in pulping operations. Sawmill edgings and slabs now provide chips for pulping or board products. These uses absorb a sizable quantity of the wood resources; but large volumes remain and **bark** is the main unused residue.

Pole producing companies are an important wood industry in northern Idaho. These companies use western red cedar exclusively. Removal of the bark allows preservative to enter the wood. Cedar bark degrades so slowly that it constitutes a fire hazard if left in the forest, so the debarking operation occurs at the mill. Until recent implementation of air pollution regulations, pole producing companies disposed of the bark by burning it in the infamous teepee burners.

Fuel

Many teepee burners can operate within existing air pollution regulations, but may require some modification to do this. If one keeps the temperature within the burner sufficiently high, a significant reduction in smoke and particulate matter occurs; and the burner only smokes extensively when first ignited. Dry bark forms a good fuel with $\frac{3}{4}$ the heating value of coal. However, it becomes an increasingly marginal fuel as moisture content increases, due to the use of much of the heat produced to evaporate its own moisture. Even bark peeled in the summer contains considerable moisture. Thus, in order to keep the temperature up when burning, the burners require underfire heating using natural gas or oil. Most pole companies find this cost prohibitive.

Faced with the accumulation of excessive amounts of cedar bark, the Rocky Mountain Pole and Treating Association requested that the University of Idaho's Wood Utilization staff help in solving the problems of cedar bark utilization. In 1968, the five companies cooperating with us in this project produced some 2.5 million cubic feet of cedar bark.

Uses of Bark — Past and Present

Since the birch-bark canoes of the Indians, bark has found many varied uses. Exotic species provide such products as cinnamon flavoring; the cocktail ingredient, angostura biters; the antimalarial drug, quinine; and an aphrodisiac, yohimbine. Some products derived from West Coast species consist of cork, waxes, tannins, dyes and pharmaceutical chemicals. Other methods of utilization include **fuel, land fill, soil amendments, chemical production, and board products**. Let us examine each of these uses in relation to western red cedar bark.

Fuel for Power?

A committee set up recently by the Governor of Idaho will determine the feasibility of utilizing municipal and wood industries' solid wastes (including bark) in a steam-electric gen-



Red Cedar pole yard in Northern Idaho. This Burner is no longer used to burn Cedar bark. (Photo by Scrivner)

erating plant in northern Idaho. Members of the University of Idaho faculty from Business and Wood Utilization will assist the committee in its work.

Landfilling — Poor Method of Disposal

Companies which cannot meet the air pollution standards for burning, utilize landfill sites for disposal of their bark. When suitably located, these fills do not result in air or water pollution. Landfilling offers the only immediate solution to the problem of bark disposal without pollution. However, landfilling has several serious drawbacks. High land costs and Department of Public Health regulations make acquisition of suitable sites difficult. Transportation costs are high. Cedar bark compacts poorly. It can constitute a fire hazard; and because of the stringy nature of cedar bark, the debarker often produces pieces of bark several feet long which are extremely difficult to handle mechanically.

Use As a Soil Amendment

Bark and other wood wastes have found extensive use as mulches or soil conditioners. Larger pieces of bark make good ornamental material, while the small particles make good soil conditioners. Bark provides physical benefits to the soil, e.g., improvement of soil porosity, water retention, weed control, and temperature regulation. However, bark has no intrinsic value as a fertilizer. In fact, the decay producing micro-organisms associated with the bark consume nitrogen from the soil causing a nitrogen deficiency unless corrected by addition of fertilizer.

Several factors would appear to limit the utilization of western red cedar bark as an ornamental material or mulch or as a soil conditioner. The stringy nature of the bark would prevent its use as chunks for ornamental purposes. Workers have found that pure cedar sawdust depresses the growth of young pea plants, probably because the extractives interfere

with nitrogen fixation by bacteria in the soil; the same effect may apply to cedar bark. High transportation costs limit this form of utilization to a reasonable radius from the mill. Since such large quantities of bark from other species exist; and since other species can do a better job, competition would appear too keen for cedar bark to make successful inroads in this field.

Chemical Utilization of Bark

Barks have a more complex chemical structure than their corresponding woods. We can divide the components of bark into extractives and residues. The extractives constitute that part which dissolves in solvents such as water, alcohol, benzene, and ether. These extractives could furnish valuable chemicals. For example, Douglas fir bark yields such products as insecticide carriers, resin extenders, and dihydroquercetin, used for medicinal purposes. The Chemistry Department at the University of Idaho has started isolating various fractions of cedar bark extracts in an effort to determine if these could provide potentially useful chemicals. Due to the many different compounds present, this study takes a great deal of time.

Destructive distillation of wood, i.e., heating in the absence of air, produces such products as charcoal, turpentine, acetic acid, and pitch. Charcoal, the end product of destructive distillation, has a potential market in briquets for recreational use. The present market demand for chemicals and charcoal from destructive distillation is not strong enough to make much of a dent in the large quantities of bark available.

Board Products Research

Board products can provide an outlet for large quantities of bark. Previous work has shown that cedar bark and wood residues make reasonably good insulation board and hardboard. We can class these as fiber boards formed using a wet process. Professor Kenneth Sowles, Assistant Professor of Wood Utilization and I decided to study the use of cedar bark in making particle board. We define particle board as wood particles bonded by synthetic resin adhesives under heat and pressure.

Using facilities at Washington State University, we first passed the cedar bark through a tumble drier, then through a hammer mill to reduce the particle size. We determined the particle size distribution by passing a sample through screens of different sizes. This showed a large percentage of fines or dust which we felt would be detrimental to the properties of the board, so this was removed. After redrying the particles, we sprayed them with phenolic resin in a rotating drum. We then spread the particles into a mat 12-by-15 inches in size

and pressed this mat into a board 3/8-inch thick, using temperatures over 270 degrees F. to cure the resin.

After leaving the board for several days to allow moisture content to equilibrate and the resin to finish curing, we determined bending strengths and internal bond strength (tensile strength perpendicular to the surface) of samples taken from the board. The bending strengths exceeded those required by standards for wood particle board, but the internal bond did not. We feel that the low strength of the individual particles impart an overall low strength to the total board. As the next step, we plan to form boards from bark reduced down to individual fibers.

We have shown the feasibility of producing boards with reasonable strength from western red cedar bark in the laboratory. The capital investment necessary to set up a new mill or a new production line in an existing mill for production of these boards requires more study before the process can be regarded as commercially feasible.

However, we are sure that all of the research into bark utilization will eventually provide the breakthrough necessary for us to think of bark as a valuable raw material rather than a waste product.



It is something to be able to paint a particular picture,
or to carve a statue,
and so to make a few objects beautiful;
but it is far more glorious to carve and paint
the very atmosphere and medium through which we look,
which morally we can do.
To affect the quality of the day,
that is the highest of arts.

Henry David Thoreau



The morning wind forever blows,
the poem of creation is uninterrupted,
but few are the ears that hear it.

Henry David Thoreau

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Water Quality and Steelhead Migration Studies

on the

Lower Snake River

C. M. Falter
Assistant Professor of Fisheries
University of Idaho

The Lower Snake River extends from Lewiston, Idaho to its confluence with the Columbia River at Pasco, Washington. Throughout this stretch, it is an immature stream, with short gradual rapids alternating with ½ mile long deep pools. Development of this region of the Snake River has been swift in the last decade. Three low head dams have been constructed and a fourth one is about 20% completed. When the fourth dam is completed, 140 miles of free-flowing river will have been transformed to 4 placid pools. We are only now becoming concerned as to the effects of these impoundments on water quality.

There are two main reasons for our concern:

1) The historical and recreational interest in the Snake River runs of salmon and steelhead. Over 200,000 salmon and steelhead pass through the Lower Snake River each year, swimming upstream to spawn in upper reaches of the Snake River and its tributaries. The recent demise of these runs has prompted sudden interest in the long term effects of river developments, i.e., a re-evaluation of the prevailing notion that any development represents an increased net gain to society from the "zero" worth before development.

2) Then of course, there has been a sudden strengthening of state and federal water quality standards as well as stepped up enforcement of existing standards . . . all in the interest of environmental quality.

Impoundment of a free flowing stream has several adverse effects on the water:

— Plankton populations of algae increase in the slow moving or still water.

— Oxygen levels will show more extreme diel fluctuations, with lower nightly lows and higher daytime highs. This is because of planktonic algal production, a decrease of the surface area to volume ratios, decreased surface turbulence recharging oxygen, and reduced water velocity thereby concentrating decomposition over a smaller area.

— The river has a much reduced natural aeration capability.

— Reservoir water tends to have higher mean temperatures than the previously free-flowing stream.

— Beds of submerged aquatic vegetation develop over shallowly-submerged agricultural lands.

— Toxic gases might occur from biological decomposition in deep water layers. We must keep in mind the nature of these Lower Snake River reservoirs. They are "run of the river" impoundments as opposed to storage impoundments. In these Lower Snake reservoirs we can expect little or only localized vertical stratification of water layers; most of the water masses are freely circulating and intermixing. Thus, there is little opportunity for widespread occurrence of reducing conditions which produce toxic gases.

Water quality in the three existing reservoirs below Lewiston is passable . . . at least whatever problems might be there are not glaringly evident. But then, there really is no reason to suspect major problems. The only unnatural inputs to this section of the Lower Snake are:

1. Increased silt from agricultural lands.
2. High nutrients from these cultivated lands.
3. Slight amounts of organic matter from cattle feeding operations along tributaries to these pools. Various pollutional inputs at Lewiston are reduced somewhat by partial decomposition, or algal utilization by the time the water enters the first existing impoundment, Little Goose. These inputs are presently being assimilated by the river with no severe effects. They will, however, be flowing directly into the Lower Granite pool at Lewiston.

We must consider the following sources of pollution loading into the Lower Granite pool:

1. Lewiston and Clarkston sewage effluent - high in organic matter and plant nutrients.
2. Potlatch Forests Inc. Kraft process pulp and paper mill wood fibers, sugars, plant nutrients, bacterial load, and components toxic to aquatic life.
3. Leached plant nutrients and dissolved organics from log ponding.
4. Cattle feed lot drainage - high in plant nutrients (especially nitrates) and bacterial load.
5. Food processing wastes - organic materials especially resistant celluloses.

The Water Quality Section of the Environmental Protection Administration is supporting our water quality-steelhead migration research in this section of the river to explore effects of water quality change and impoundment on adult summer steelhead. Concurrently, a second goal in this study is to document the present water quality in the Lower Granite area and to predict resulting water quality after impoundment. This latter goal (a joint WSU-Idaho effort) is part of a larger work plan currently in progress. It is funded by the Army Corps of Engineers, which is documenting water quality in the entire Lower Snake, from the Columbia into Hell's Canyon.

If water quality problems are predicted in Lower Granite, the overall study will identify causes and make recommendations to improve the situation. For example, if discrete density currents high in industrial or domestic wastes flowing through the impoundment are predicted by this study, design modifications of the dam could be made to allow for various layers to be drawn off, preventing buildup of stagnant water masses. Or perhaps the pool could be drawn down at times of fish passage to maintain free-flowing conditions at that critical Snake-Clearwater Rivers confluence.

Specific parameters being assessed on a year-round basis are:

Water temperature
Light penetration
Hydrogen ion concentration
Alkalinity
Total Hardness
Total Dissolved Solids
Oxygen
Organic matter (Total and dissolved)
Chemical oxygen demand
Biological oxygen demand
Bacterial occurrence
Algal composition and production
Total iron
Ortho phosphates
Nitrates
Sulphates
Chlorides
Hydrogen sulphide
Carbon dioxide
Ammonia
Mixing patterns of the Snake and Clearwater River waters below their confluence
Tannins and Lignins

We have selected eight sampling points on the Lower Snake and Clearwater Rivers to obtain this information. In addition, the Corps of Engineers is conducting basic physical and chemical measurements at 4 additional points on Little Goose and Ice Harbor reservoirs.

This physical and chemical information will be used in the 3-dimensional modeling of the hydrodynamics of the pool, after which the total known limnology of the free flowing river can be fitted to this model for estimates of water quality and biological production of this strategic impoundment. Algal production is the aspect with which we're most concerned.

The Snake coming out of Hell's Canyon is no mountain stream. It carries a stout load of organics and essential macro- and micro algal nutrients. Our chief worry with impoundment is that increased algal production due to impoundment alone will be "spiked" by addition of nutrients in the Lewiston-Clarkston area. Most dissolved nutrients will still be left after the proposed secondary sewage treatment. We have some indication of this possibility. Oxygen sag curves from the Snake-Clearwater confluence (pollution loading point downstream) show an atypical peak several miles below the confluence, suggesting increased production by the existing planktonic and periphytic (attached) algae. The increased algal populations with the advent of slack water will cause an even higher oxygen peak with subsequent lower nighttime oxygen levels as algal production increases in the stilled river.

How far can oxygen levels drop before we can label it as a significant deterioration of water quality? In the mid-summer to fall period, oxygen levels presently drop to less than 6 mgm/liter in the free-flowing river. Migrating adult salmon and steelhead will not pass upstream through water of less than 5 mgm/liter oxygen. Post impoundment oxygen levels could drop below 5 mgm/liter at times during runs of summer steelhead and summer chinook.

Low oxygen levels are but one aspect of our concern for post-impoundment water quality in Lower Granite pool. Another major point is the fate of the toxic components of future wastes dumped into the pool. The pulping effluent from PFI, for example is high in biochemical oxygen demand, suspended solids, and a very complex organic mixture of compounds significantly toxic or confusing to the olfactory senses of fish. Some of these toxic components are mercaptans, sulphides, low pH or acid wastes, and quinones.

Faced with this pending change in water quality, we have set out to describe migrational patterns and behavior of adult summer steelhead in this section of the river before impoundment by Lower Granite Dam. We can then recognize post-impoundment changes in these patterns and, perhaps, even correlate observed changes with specific changes in water quality. Beginning in 1969, we have tagged and tracked 25 adult steelhead per year in the Snake River above and below Lewiston, Idaho. We then map and summarize their travel paths. We have posed the following hypothesis:

Altered limnological conditions will have no effect on steelhead migration patterns.

Before we can accept this, we must have explored all possible avenues which may show it not to be true, i.e.: there is some effect. Some considerations we are looking at

1. Steelhead travel time through the area.
2. A change in general migration pathways.
3. General pathways may be similar, but we may find specific avoidance by steelhead at certain areas due to high concentrations of Kraft Mill effluent, low dissolved oxygen, high carbon dioxide, low or high pH, or even concentrations of hydrogen sulphide.
4. Total numbers passing through the area may change.
5. There may be an increase of wandering or indecision of fish to pass up either river at the confluence.

Our tracking efforts are concentrated in July, August, and September since water quality is at a yearly low point due to low flow and high temperatures.

To date in the pre-impoundment phase, we have seen no consistent patterns of fish avoiding existing pollution sources, but analyses have not been completed. Eventually, fish behavior and water quality interactions will be exposed with multiple correlation techniques.

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Range Sheep Production and Nutrition

Wally Butler
Graduate Student

The Intermountain Region of the Western United States is an important range sheep producing area. Idaho is a major sheep producing state, ranking eighth in total sheep production in the United States. Of the sheep produced in Idaho, vast numbers are produced on range forages.

The Study Area

The area in which I am working is in southeastern Idaho, predominantly on state-owned land. The entire study area is owned or leased by the Idaho Citizen's Grazing Association. Some additional work is being done in cooperation with the Eastern Idaho Grazing Association, also predominantly on state-owned land.

The area is characterized by mountain ranges and intervening valleys, varying in elevation from 7,729 feet above sea level to a low of 5,925 feet. Most of the slopes are moderate to gentle and the valley bottoms are relatively flat or low rolling hills. All of the watershed is within the Blackfoot River drainage. Blackfoot River Reservoir divides the area into a west half and an east half.

Vegetation zones vary from a marshland type around parts of Blackfoot River Reservoir through vegetation zones of sagebrush-grass, mountain brush, and forest types. The sagebrush-grass zone is the most extensive vegetation type; it extends from the lower valley bottoms up the slopes to relatively high elevations.

Land Use

Past use of the area has been primarily for grazing with mining, cropland agriculture, and recreation becoming more important. This sector of Idaho was, at one time, one of the largest shipping points for lambs in the United States. Up until World War I extensive flocks of sheep from Utah and



In a range situation, sheep are watered every other day. These sheep have just taken their water and are beginning to move away in a loose grazing pattern.

—Photo by Wally Butler

Nevada grazed there during the spring, summer, and fall months. In 1919, Governor Alexander forced the formation of the Association. The main purpose for his action was to keep the out-of-state sheep off Idaho's state-owned lands, thus the name Idaho Citizen's Grazing Association.

How the Sheep Operations Work

The sheep operations that use these lands are typical ewe-lamb operations except for one yearling operator. Five of the ewe-lamb operations lamb on the range beginning in May, the remainder lamb in February and March under shed conditions.

The average ewe-lamb operation consists of about 3,400 head of ewes. The range in size of operation is from 800 to 7,000 head.

The sheep men move their animals to Association-controlled land about May 1, when range-lambing begins. In early July the sheep are moved to the Cache and Caribou National Forests. About one-half of the operators truck their sheep to the National Forests; the others trail their sheep. Lambs are weaned and sold in mid-September as the sheep are moved from national forest land back to Association range where they remain until about November 1. Most of the sheep are then trailed across the Fort Hall Indian Reservation on their way to public land administered by the Bureau of Land Management. Privately owned and leased lands provide forage for the sheep beginning in late December, but one operator winters on desert lands in Utah and Nevada. Shed lambing operations move to the lambing sheds in late January or early February. In late March or early April the sheep move from wintering areas to public lands of the Bureau of Land Management. They cross Fort Hall Indian Reservation lands in late April and arrive back on Association range by mid-May.

In range lambing the bucks are placed with the ewes in early December at a ratio of about one buck per 50 ewes. The rams stay with the ewes for about 40 days. Bucks of the black-faced breeds are used for commercial lamb production and bucks of the white-faced breeds are used for replacement ewe production.

Ewes are culled in the fall of the year. Some operators cull at the time the lambs are weaned, others wait until later in the fall. Culling is done on the basis of the condition of the teeth, age, soundness of udder and producing ability.

The range-lambing operations have an average lamb crop of about 105 percent at weaning time. Of the lambs weaned, 44 percent were fat lambs, weighing about 92 pounds, and 56 percent were feeder lambs, weighing about 80 pounds.

Shed-lambing weans a larger percentage of lambs than range-lambing and the percentage and weight of fat lambs from shed-lambing is also greater. Increased production occurs under shed-lambing because the ewes receive more individual attention; more lambs are saved. There is of course a larger labor cost with shed-lambing.

Objectives of the Study

The objectives of the study are (1) to ascertain the nutritional value of the forage available to the sheep, and (2)

to characterize the botanical and chemical composition of the diet of the sheep in relation to the nutritive requirements for optimum production.

These objectives are being accomplished by ascertaining the forage quantity and quality in the area, and by collection and analyses of the diet of normally grazing sheep. Forage work is done by use of production and phenology plots. Production samples are analyzed for available nutrients. The sheep diets are collected using esophageal fistulated wethers. Botanical composition of the diet is ascertained using a modified version of the point-centered quadrat method of vegetation analyses.

Nutritional value of the diet actually consumed and the value of the forage available will be compared to sheep nutritional requirements as set down by the National Research Council. The adequacy or inadequacy of the diet will be evaluated and a system of grazing can then be developed.

The recommended system will be aimed at securing optimal sheep and lamb output based on nutritional value of the various range types.



Time is but the stream I go fishing in.
I drink at it; but while I drink I see the sandy bottom and detect how shallow it is.
Its thin current slides away but eternity remains.
Henry David Thoreau

THE START OF SOMETHING GOOD

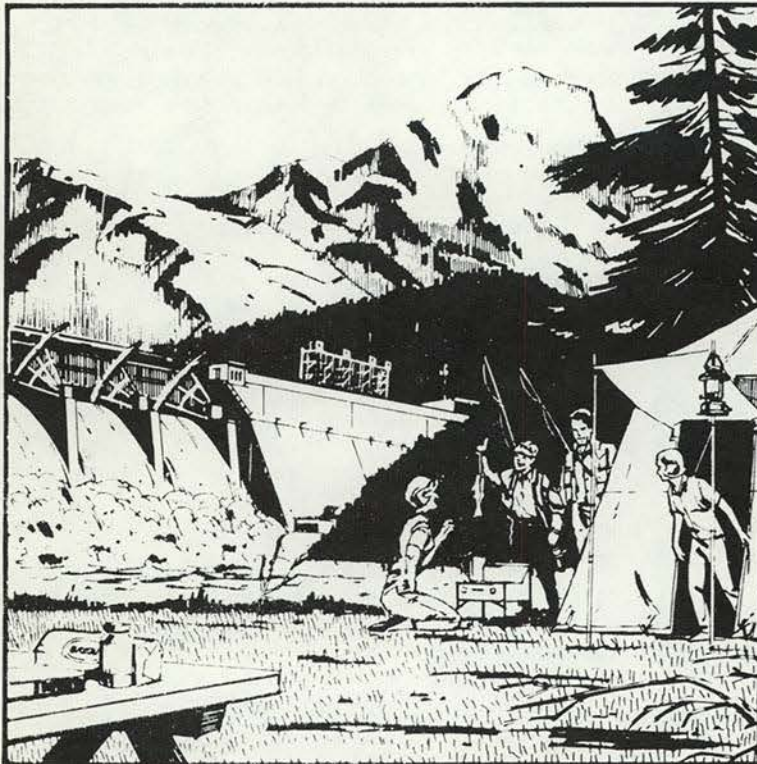
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ELK-LEEGE

continued from page 13

range. The forest supervisor must make the decision that the area is going to be dedicated to elk range in the same manner that other areas are dedicated to timber production or campsites for recreation. The decision is made only after the proposal has been studied and recommendations have been made by forest service personnel specializing in the uses that will be affected by burning. Conflicts have been minimal because areas proposed for burning are normally poorly stocked with trees. Originally, prescribed burning was not done along highways for aesthetic reasons, but experience has shown that the burning evidence is only present for two or three months. Therefore, no attempt is now being made in most cases to hide these burns from the public. This is fortunate as some important

winter ranges are on canyon walls adjacent to highways.

Additional Research is Needed

A great deal has been accomplished toward the goal of restoring the productivity of elk ranges in northern Idaho, but much work remains. Continued research is necessary to document long-term effects of burning and reburning on soil and vegetation. New burning techniques must be worked out along with devising better criteria for determining proper burning conditions and satisfactory areas for burning. We will continue to keep a close watch on the elk for indications that they are responding to our efforts in terms of increased calf crops and stabilized or expanding populations. Only when this occurs can we say that the burning program has been a success.

HIRE A FORESTRY STUDENT *this summer*



BOBCATS-BAILEY

continued from page 17

A bobcat population on a given area is composed of adults, immatures or nonbreeding individuals, and kittens. Only the adults remain year after year; the immatures are temporary residents; and the kittens disperse to other areas. When an adult dies, its place is taken by one of the immatures passing through the area. Apparently bobcats are able to detect each other's presence in an area. Although the manner in which this is accomplished is unclear, bobcats may use their droppings, or scats, to signal their presence. Scats are left in conspicuous locations such as near cave entrances, rock outcrops, and along the rims of craters — places where other bobcats would pass by. The scats in these "marking areas" could function as follows: fresh mark — bobcat nearby, area occupied,

going on involves the danger of an encounter; a less fresh mark — proceed with caution; an old mark — go ahead. A bobcat, before passing such a mark, would deposit its own scat, thus advertising its presence. The age and sex of bobcats using these marking areas and the time of year they are used varies. Thus the "marking" function is complex.

As one delves into the lives of bobcats, one discovers how little we really know about them. Regardless of how long we study he will always retain much of his mystery — silent, curious, stealthy and seldom seen — a truly wild creature in a wild environment.

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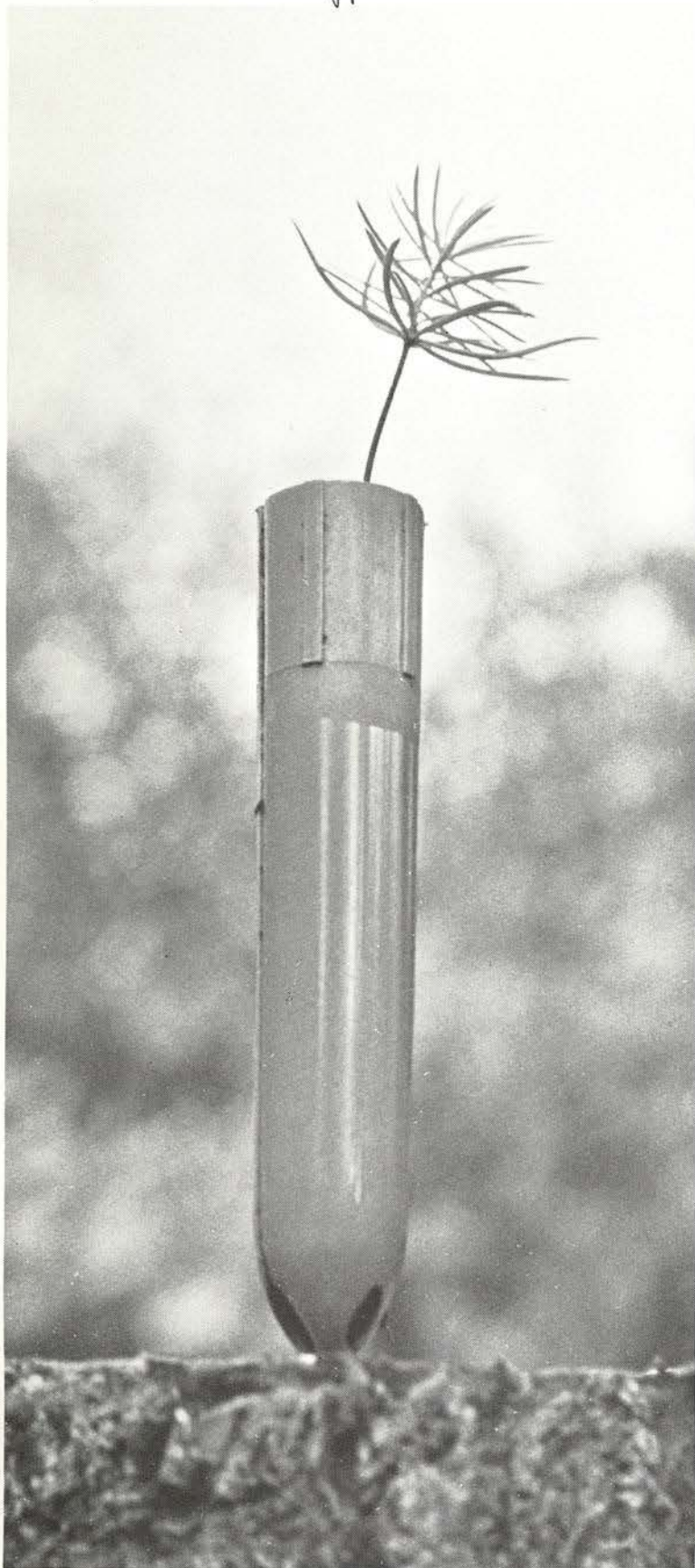
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BOOKER EDWARD C	DRISSEN JOHN P	GUSTAFSON CARL A	MCKEEVER DONALD G	RUTLEDGE R H	WIGGINS EDWARD
BOY GLENN L	EASTMAN VIRGIL H	HALLETT NOEL L	MICHELL WILLIAM W	RYAN CECIL C	WILSON ALLAN S
BRANDT JOHN C	EPPELSON PAUL L	HEPHER WILLIAM S	MOODY VIRGIL C	SAASTAD HAROLD L	WILSON DONALD W
BREON EUGENE E	ERICKSON EDWARD JR	HERMAN CHARLES H	PUNSON OSCAR	SCHUMAKER OREN F	WOODWARD DORAN E
BROCK JOHN E	EVANS JEROME	HOPKINS JESSE K	NETTLETON HARRY I	SHANK PAUL J	YOUNGS HOMER
CALL ELWOOD C	EVERSON AXEL C	HUNTINGTON COLLIS H	NITZ GEORGE C	SIENERT GEORGE W	
CALLENDER WILLIAM	FAYRE CLARENCE E	KELLY JAMES J	OLSEN CLARENCE C	SLIPP ALBERT W	
CARLSON ROBERT A	FENN LLOYD A		PARSONS RUSSELL M	SNYDER ERNEST P	

Howard Hoffman



Helping Mother Nature Meet Man's Needs

Through their scientific management of more than four million acres of timberlands, Georgia-Pacific foresters are helping "Mother Nature" provide the wood and wood fiber that are needed in ever-increasing quantities to meet the expanding needs of people.

Constant research is helping to unlock more and more of "Mother Nature's" secrets. One tangible result is the marked reduction in the time it takes to grow a crop of timber. Take Douglas fir, for instance. It wasn't too long ago that it required more—much more—than a normal lifetime for one crop to grow. Now, due to a combination of faster growth and better utilization, two crops are possible within one lifetime.

"Seed orchards," started more than a decade ago, are "paying off" for G-P with superior seeds that give promise of faster-growing and more disease-resistant trees. Currently, our planting and seeding techniques are being given serious study. One new process is the plastic container or "bullet" developed in Canada. We're trying to improve on it. Meanwhile, we're using this procedure in several areas with excellent results.

Good forestry and good foresters are important to G-P, now and as far as we can see into the future.


GEORGIA-PACIFIC
GROWING FORESTS FOREVER

A black and white photograph of a forest. In the foreground, a large, textured tree trunk stands vertically, its bark deeply furrowed. Behind it, a dense forest of smaller trees rises, their leaves creating a dappled light effect. The sky is visible through the canopy, appearing bright and slightly overcast. The overall mood is serene and contemplative.

THE LAW OF LIFE

*The tree that never had to fight
For sun and sky and air and light,
That stood out in the open plain
And always got its share of rain
Never became a forest king,
But lived and died a scrubby thing.*

*The man who never had to toil
Who never had to win his share
Of sun and sky and light and air
Never became a manly man,
But lived and died as he began.*

*Good timber does not grow in ease
The stronger wind, the tougher trees
The farther sky, the greater length
The more the storm the more the strength
By sun and cold, by rains and snows
In tree and man good timber grows.*

LARGEST MOUNTAIN

PUDENOVIA PAUL

MADE IN THE U.S.A.