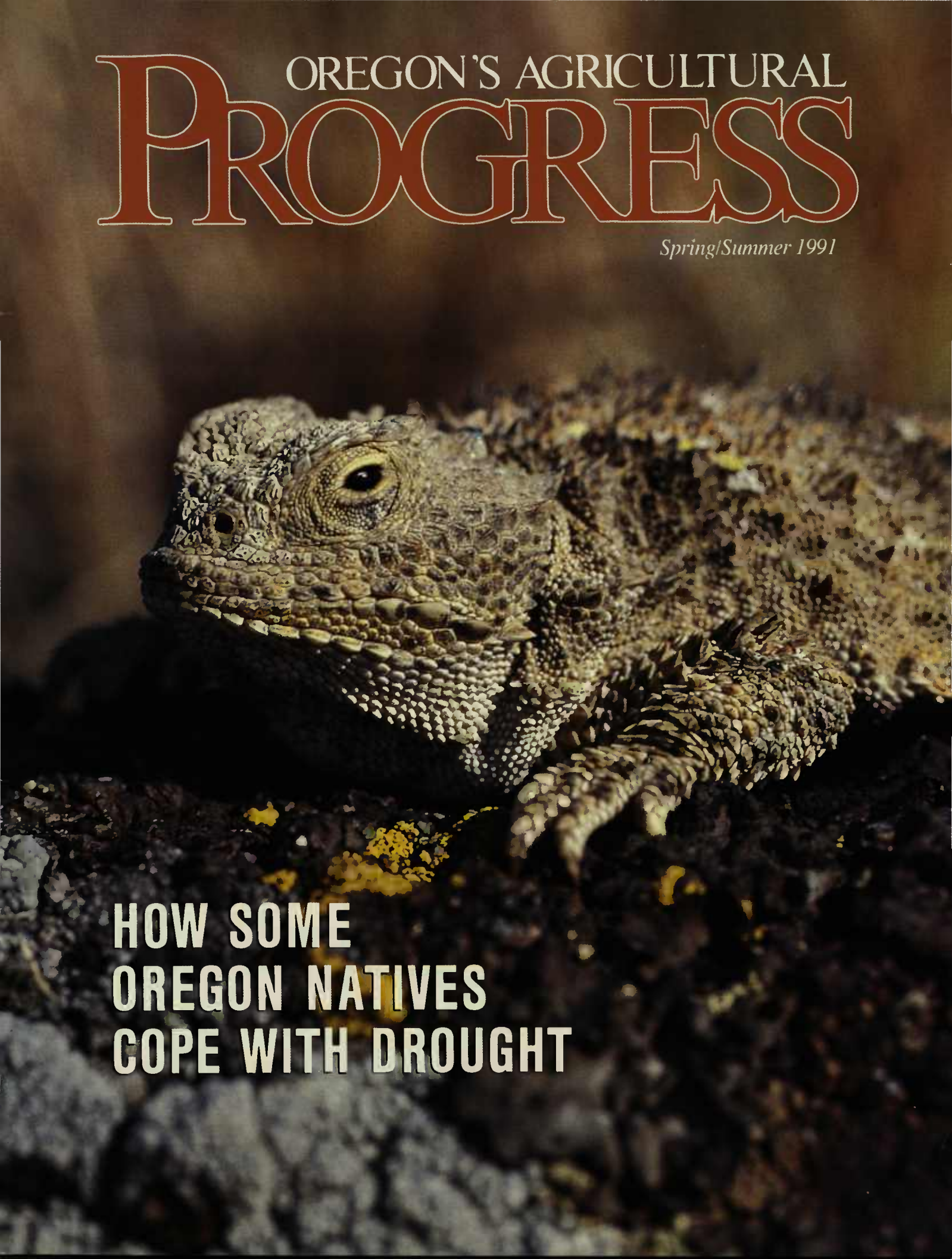
OREGON'S AGRICULTURAL

PROGRESS

Spring/Summer 1991



HOW SOME OREGON NATIVES COPE WITH DROUGHT

THE EDITOR'S NOTE

There weren't empty chairs. New people had filled them. But a while back, at a meeting in Corvallis, I started thinking of some loyal supporters of natural resources research in Oregon who've died in the last year or so.

One is G. Burton Wood, former director of the Agricultural Experiment Station. Another is Arlington wheat farmer Marion Weatherford. Also, there's my former boss, longtime Experiment Station editor Dick Floyd.

I started thinking of these three at a meeting of the Agricultural Research Foundation (ARF for short), an organization that helps guide and fund Experiment Station research. Dr. Wood and Marion were members of the foundation's board of directors and Dick was its trusted communications adviser.

I'll never forget Dr. Wood's financial reports as ARF treasurer. An economist of far-reaching reputation, his reports often were, as much as anything, analyses of the international economy. Listening to him was like listening to a favorite uncle with a knack for explaining the ways of the world.

Marion Weatherford often shocked me. He was an agricultural leader in Oregon before I was born. When I first met him I expected all old school conservatism. Again and again he told me, in essence, we needed to be "with-it" and be tireless communicating about research. I came to see him as a likely supporter of bold ideas.

"Sit down and tell me everything."

My memories of Dick Floyd, a former editor of this magazine, go past ARF meetings. First thing in the morning, usually on Mondays, he'd greet me and my office co-workers with the command to: "Sit down and tell me everything you know." We usually did. Dick's to-the-point ways, forged as a newspaper reporter, masked a gentleness that would have lured his staff over the Himalayas.

The diverse research covered in this issue shows Agricultural Experiment Station scientists and supporters moving forward. But it's nice sometimes to look back at a few of the shoulders they're riding on.

Andy Duncan

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Andy Duncan
Editor

Tom Weeks
Designer

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Cover: During dry cycles the insect food supply shrinks for the three-inch pigmy lizard, which lives in the sagebrush of southeastern Oregon. The lizard can hibernate to cut its need for food and water. See page 20 for more on how creatures adapt. (Photo: Tom and Pat Leeson)

UPDATE

BOVINE GAS

Turning Tillamook County's dairy cow manure into marketable natural gas and fertilizer is technically and economically feasible, an OSU study shows.

The dairy industry and the environment would be better off if someone built a waste treatment and methane generation plant to do just that, says Andy

Hashimoto, the Agricultural Experiment Station scientist who directed the research.

The need for milk increased a while back when the Tillamook County Creamery Association doubled its cheese-making capacity. But surplus dairy waste has nailed a lid on dairy herd expansion in the area. "Pastures in the county are nearly saturated with manure" from the 26,000 cows, explained Hashimoto.

Most dairy farmers store the manure in large tanks or sheds and apply it to fields as fertilizer during dry weather when stream contamination is least likely. Despite precautions, some of the nitrogen-rich byproduct pollutes local ground and surface water and occasionally causes the closure of shellfish harvesting in Tillamook Bay.

The Tillamook Methane Energy and Agricultural Development (MEAD) project, made up of the Tillamook County Creamery Association, the Tillamook People's Utility District, the Port of Tillamook, the Oregon Department of Economic Development, the state Department of Energy and other groups, commissioned Hashimoto's feasibility study. Hashimoto, the head of OSU's bioresources engineering department, is an expert on biogas generation.

The waste management system could cost farmers less than $100 a year per animal. They might be able to break even on waste treatment costs if enough farmers participated and sales on by-products of the plants were good enough, said Hashimoto.

The plant would work much like a municipal sewage treatment plant, with bacteria digesting dairy wastes in heat-controlled, airtight tanks. The odorless process would give off methane gas, carbon dioxide, traces of other gases, bacteria and sludge. Most disease-causing organisms would be killed.

Salable products from the cow-based plant would be methane and sludge. Methane, a combustible natural gas, could be burned to generate electricity or even to fuel the trucks that collect manure from farmers, said Hashimoto. The Tillamook People's Utility District is willing to buy power generated from such a plant, he said. Sludge could be marketed as a slow-release fertilizer or spread on pastures, crops or younger tree plantations in measured amounts, he added.

But "the real incentive is the increased potential for the dairy industry in Tillamook County to make a profit," said Hashimoto.

Several plants in the Midwest and overseas generate electricity with methane from animal wastes. The City of Salem and some other Oregon communities generate electricity with methane from sewage, Hashimoto noted.

The OSU researcher said a Seattle company is studying the possibility of constructing a plant in Tillamook and probably will announce its decision this fall.

THE PULSING CREEK

More than 30 scientists set up a tent camp beside Bridge Creek in central Oregon for three days earlier in the summer for an unusual study.

Near the researchers' tent camp, biologists in chest waders used electrical devices to temporarily stun fish so they could examine them. Downstream, entomologists placed traps in the water to find out what kind of aquatic insects were there. Further downstream, hydrologists poured small bottles of bright purple dye into Bridge Creek's swift-but-murky water to study channel patterns.

In the area near the stream that scientists call the riparian zone, and in the drainage's dry uplands, botanists surveyed plants, including many non-native grass and weed invaders. Soil scientists looked at erosion.

Range scientists eyed juniper trees expanding their territory, crowding out grasses. Wildlife researchers, starting before daylight, walked predetermined routes to catalog birds and other creatures. Interdisciplinary groups of researchers visited local ranchers to discuss the area.

The three days of research may have been Oregon's first environmental "pulse" study, where researchers from many disciplines move into an area for a short time to assess problems and identify research needs.

"The main reason for the Bridge Creek pulse was to find common ground for research needs among environmentalists and cattle people. In many ways, those groups want the same things and we want to help them work together by identifying research both think will be worthwhile," said Thayne Dutson, director of the Agricultural Experiment Station.

The Experiment Station sponsored the experiment on 45,000 acres of public land in the Bridge Creek drainage. The federal Bureau of Land Management's Prineville district office (BLM) manages the land, recently acquired in a swap with private owners. The area is about 40 miles east of Prineville and five miles northwest of Mitchell, where Bridge Creek slices into the Painted Hills section of the John Day Fossil Beds National Park.

ANDY DUNCAN

OSU and BLM researchers study Bridge Creek's fish.

Historically Bridge Creek, which feeds into the John Day River and is the home of native red-band trout and other fish, has been a spawning area for ocean-going steelhead.

But human-related activities including mining, livestock grazing, irrigation, wildfire suppression and road construction in this century, and beaver trapping long before that, damaged the ecosystem, according to Brad Keller, a wildlife biologist for the BLM who took part in the pulse study.

"Much of the damage in the Bridge Creek drainage was done a long time ago. We'd like to find a way to heal the entire watershed," said Keller.

After dinner each day the entire group gathered for "rap" sessions. The discussions, sometimes debates, were of things like nutrient recycling, soil profiles, habitat for cavity-nesting birds, and how much water thirsty juniper trees use.

The last day Rick Miller, an OSU range scientist, instructed participants to send him summaries of their observations and identify "knowledge gaps." That likely will lead to funding proposals, he said.

"These ecosystems are more complex than any of us can handle alone," Bob Beschta, a professor of forest hydrology at OSU, told the group. "What we need is a research site on the east side [of Oregon] where we can do long-term studies and start to get at basic questions over time."

"For years we've been telling ranchers and others over here what they've been doing wrong," observed Marty Vavra, superintendent of OSU's Eastern Oregon Agricultural Research Center, headquartered at Burns. "We're about to have the ball dropped back in our court. They're listening, and they're going to say, 'Okay scientists, now tell us what we're supposed to do? How we can fix things?' We better be ready."

BIOTECH POTATOES

Agricultural Experiment Station scientists at Hermiston remain optimistic about their field test with potato plants "bioengineered" so they can fight their own battles with a pest.

"So far, the data and visual observations in the plots appear to verify strongly" that the plants

LYNN KETCHUM

Researchers at the Hermiston experiment station hope genetically enhanced plants can resist the Colorado potato beetle.

are defeating Colorado potato beetles, said Gary Reed, superintendent of OSU's Hermiston Agricultural Research and Extension Center.

The Russet Burbank variety potato plants, developed by the Monsanto Company of St. Louis, contain a bacterial gene inserted to give them resistance to the beetle.

"The withdrawal of aldicarb insecticide from use on the potato crop in the Pacific Northwest in 1990 created far-reaching consequences," explained Reed. "Potato growers had not observed Colorado potato beetles since applications of aldicarb began in 1974. In the first season without aldicarb, Colorado potato beetles reappeared.

"Currently growers can kill the beetle with almost any approved insecticide," added Reed. "Soon, however, Colorado potato beetles could become resistant to almost all of the insecticides we have available. This has happened in all potato production areas where aldicarb is no longer used."

Researchers hope the genetically altered potato plants can reduce the need to apply pesticides. The strategy involves a crystal-like protein, produced by bacteria called *Bacillus thuringiensis* or B.t., that literally slices up cells in the stomachs of some insects if the insects eat it.

The bacterial protein has been used as a biological insecticide for about 25 years in commercial agriculture and home gardens. In Oregon, it's also been used to combat a forest pest called the gypsy moth.

Reed explained that one strain of B.t. bacteria produces a protein that is "fairly effective" when sprayed on the foliage of potato plants to kill the Colorado potato beetle. But there's a problem.

"B.t. insecticides have a history of losing effectiveness rapidly when they're exposed to sunlight," Reed said. "The potato production areas of the Northwest are blessed with some of the most intense solar radiation in North America."

Monsanto scientists placed the gene for B.t. production into the tissue of potato plants to overcome B.t.'s short period of effectiveness in sunlight.

"It converts the mode of action from that of a foliar insecticide to one that mimics a systemic insecticide," said Reed.

The Hermiston experiment, approved by OSU's Biosafety Committee and the federal Animal and Plant Health Inspection Service, is the state's first test in the field with a genetically engineered crop. Reed will harvest the potatoes and collect the plant materials around the first of October. Monsanto commissioned similar field tests in other states.

PUZZLING DEATHS

Each year, thousands of apparently healthy broilers on Oregon poultry farms drop dead, and Harry Nakaue is trying to find out why.

Researchers call the problem sudden death syndrome (SDS). "Some growers call SDS 'heart attack' because the birds die instantly, as if their hearts suddenly stopped beating," said Nakaue.

"Others refer to SDS as 'flip-over' because stricken birds are standing or walking normally when suddenly they squawk, jump up, gasp for air and flip over on their backs. That's the characteristic way you find birds killed by SDS, dead on their backs. They appear to have suffocated."

SDS is particularly puzzling because it usually strikes the biggest and best birds in the flock, mostly males, said Nakaue.

A study the researcher conducted on one farm showed that 1.24 percent of 604,690 broilers reared in six batches died from SDS—7,500 birds worth up to $9,000.

According to Nakaue, suspected causes include fish-meal feeds, pelleted feeds, a lack of vitamin B in feeds, or the presence of polyunsaturated fats in feeds. Some have even claimed SDS is brought on by sudden loud noises.

He and his colleagues and graduate students think the problem could be linked to the production of prostaglandins, hormones that affect the heart and other organs.

"Scientists and growers made tremendous strides in broiler genetics and nutrition as they developed a bird that's ready for market quickly," said Nakaue. "SDS may be an unanticipated characteristic of today's fast-growing commercial broiler."

WILL RICE BE NICE?

Researchers and farmers are eyeing a new crop for the Willamette Valley

When Pat Hayes moved from Minnesota to Oregon, he threw a handful of Minnesota wild rice seed into the fish pond in his Corvallis backyard, thinking nothing would happen.

But it did. Since 1986, wild rice has grown and set seed each year in his tiny pond. This gave Hayes, an OSU Agricultural Experiment Station barley breeder, an idea. Maybe wild rice could be grown in some of the wetter valley soils in western Oregon.

Though wild rice is only in its second season of "official" agricultural testing, things are looking good for the grain as a new, high-value specialty crop for western Oregon's seasonally flooded valley lands. Experimental yields and quality are high. A major northern California processor says there is a market for Oregon wild rice and is ready to buy all Oregon can produce.

A California processor says there is a market.

Wild rice is the only truly American grain, said Hayes, who did his doctoral work on wild rice genetics at the University of Minnesota. It is native to the Great Lakes region where it once grew only along lake and pond shores. Each rice grain is a seed from an aquatic grass botanists call *Zizania palustrus*. Native Americans harvested the rice

BY CAROL SAVONEN

Left: OSU Extension crop science specialist Russ Karow checks experimental wild rice growing near Tangent. Photo: Bob Rost.

for thousands of years by flailing the seeds off the rangy grass plants into their canoes.

Wild rice was not domesticated, planted in paddies and harvested by machine until the 1960s. Since then, commercial production has increased steadily each year, with more than 14 million pounds produced in 1990. Northern California now grows about half the world's supply, with Minnesota, Canada and Idaho producing the rest. Chewy with a full-bodied flavor, wild rice is most popular on its home continent, where most of it is consumed in rice-blend mixes. But it is rapidly gaining popularity among gourmets in Europe, New Zealand and Australia. There is also considerable potential to expand markets in the more prosperous sectors of Pacific Rim countries, said Hayes.

The thick clay soils of the winter-flooded Willamette Valley seem particularly suited for wild rice, he said.

"Wild rice grows best on fertile, poorly drained soils," said Hayes, "River backwaters and diked, low-lying farmland are ideal production sites. Our winter flooding is perfect—we seem to spend a lot of time trying to get rid of water here in the Willamette Valley in the rainy season."

They launched a canoe into the icy waters.

In the winter of 1989, a cereal production student of Hayes' approached him after hearing his praise of wild rice's potential in western Oregon. The student also happened to be a grower. Would Hayes be interested in planting wild rice on a swampy quarter acre near Halsey?

Hayes and Russ Karow, an OSU Extension Service cereals specialist, jumped at the opportunity. They applied for a small grant from the New Crops Board of the Oregon Department of Agriculture to study wild rice production in the southern Willamette Valley. In January 1990, donning their warmest clothes, they launched a canoe into the icy waters of the Halsey field. They flung into the muddy water two types of early-maturing Minnesota wild rice seed, air-freighted from Hayes' alma mater, the University of Minnesota.

Through the winter of 1990, the first official trial planting of wild rice seed lay on the bottom of the flooded Halsey field, getting the cold, wet overwintering period it needed to break seed dormancy.

BOB HOST

In the spring, verdant ribbons of its early floating leaves appeared at the water's surface. By May, stems poked though the water like graceful wands. Flowers soon formed. The wild rice set seed in July.

Hayes and Karow hand-harvested small sample plots in mid-July. They were pleasantly surprised. The rice was large grained and of high quality, and production matched high yields in California—an equivalent of 1,500 to 2,000 pounds of the green grain per acre.

"I had a reasonable expectation it would grow, but I didn't know how well

Left: Crop scientist Pat Hayes collects wild rice for planting the next year. Right: Farmers look over OSU's 1991 experimental wild rice crop at a field day on Brownsville grass seed grower Dave Roger's land.

BOB ROST

BOB ROST

it would do here in the Willamette Valley," said Hayes.

That trial in Linn County indicated another promising characteristic—early maturity.

"Our grain matured almost a month earlier in Oregon than in northeastern California wild rice fields," said Hayes. "There is a processing plant in Fall River Mills, California, that is eager to buy wild rice harvests from Oregon growers because of the timing difference. With Oregon grain, they could get their plant up and running earlier each year."

Hayes, Karow and local growers are cautiously hopeful about wild rice as an alternative crop in Oregon. But there are many unanswered questions.

Can the market bear more wild rice? How can Oregon compete with a major grower like California? How will Oregon wild rice be marketed? What pests will be a problem with wild rice in this region? Diseases? Will the new crop require large quantities of pesticides, soil fumigation or fertilizers? Is it best planted in the spring or the fall?

Students will help monitor the ongoing trials.

"One small trial is not enough," said Karow. "It looks promising, but we don't know what will happen with birds, weeds or water quality until we get some larger test plots."

Word about wild rice has spread around the region. Several growers contacted Hayes and Karow to offer use of farm land for more trials in 1991. Another has donated money towards research. As a result, wild rice is growing on farms in Independence, Brownsville and Junction City. Hayes, Karow and the growers plan to evaluate the success of Minnesota versus California varieties, and the effects of fall and spring planting on yield, quality and maturity dates.

"If this is a success, I'm ready to start on 25 acres next fall,"said Dave Rogers, a Brownsville grower who put two trial wild rice paddies on his Linn County

Left: Grower Dave Rogers, left, and Pat Hayes in a wild rice field. "Our winter flooding is perfect," says Hayes.

property in the fall of 1990 and plans to harvest the trial this summer.

Hayes decided wild rice research would be an exciting way to give OSU crop science students hands-on experience in cereals production. Students will help monitor the on-going trials and may develop a proposal to continue and expand research.

"We want to expose students to the pleasures and pains of public sector research," said Hayes. "The classroom setting simply can't do justice to the complexity and dynamic nature of Oregon cereals production. Wild rice research is a voyage of discovery. "

Unlike many new crops, said Hayes, the market for wild rice already exists.

"Many other new crops require oil extraction facilities or development of an entirely new market," he said. "People already know what wild rice is. You're not having to create a market for a product. And world consumption is growing every year."

"Oregon has the potential to be a strong competitor."

Todd Brown, manager of Fall River Wild Rice, a grower-owned cooperative, and owner of the Fall River Wild Rice Company, both in Fall River Mills, California, agrees. He says he is eager to buy and custom-process any wild rice Oregon produces. Processing includes curing the green grain in bins to give it a nutty aroma, parching to remove moisture, roasting for flavor and hulling.

"We are very, very, very interested in Oregon wild rice," said Brown, whose northeastern California mill processed 1.5 million pounds of wild rice last year and now has a capacity for 2.5 million more pounds. "Things are looking up for wild rice right now. I wish I had another 2 million pounds I could sell.

"I'm even a little frightened," Brown added. "Oregon has the potential to be a strong competitor with us [California]."

But Brown says he isn't too worried about being run out of business.

"The only way you would be a force against us was if your yields were

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Russ Karow and Jeanine DeNoma, student worker, use a homemade screen to protect wild rice from birds, a problem in California's industry.

BOB ROST

Right: Wild rice from OSU's 1990 experimental crop, the first in Oregon. The grain is hulled and roasted.

considerably higher, but since we have the same stock, I think you may be equal to us someday, but you won't jeopardize our product."

They use shotguns, propane guns, remote control airplanes ....

Potential returns from wild rice are attractive. Consumers are paying anywhere from about $3 to $6 retail per pound, said Brown. Northeastern California farmers are getting about $1.20 per pound for the finished, processed grain, or about 62 cents a pound for green unprocessed grain. Yields in northeastern California run as high as 2,000 pounds of uncleaned seed per acre, with average yields running around 1,400 pounds per acre. When prices for equipment, land, seed, fertilizers, processing and pest control are accounted for, growers net an average about $500 per acre in northeastern California, he said.

In contrast, Willamette Valley grass seed growers, who grow grass on heavy-soiled bottomlands that might be suitable for wild rice, sold annual ryegrass seed for 14 cents a pound most recently, down from 20 to 21 cents a pound a year or two ago, according to Frank Conklin, an OSU Agricultural Experiment Station economist.

"The result is a negative net revenue," explained Conklin. "While the margin has always been low on annual ryegrass, on 14 cents they don't come close to covering their overhead or fixed costs. Depletion of their capital costs cannot continue indefinitely."

Both Brown and Hayes see potential in marketing Oregon's wild rice as the high quality, large-grained gourmet grade with a "grown in Oregon" approach.

"There's a tremendous untapped demand out there for wild rice, especially if you establish a niche with a premium product," said Hayes.

The biggest pest of California wild rice is the marauding red-winged blackbird. According to Brown, "Northeastern California growers lose from 30 to 100 percent of their crop to the birds each year." They use shotguns, propane guns, remote control airplanes, full-sized airplanes, kites, balloons and loud music to scare the blackbirds away.

Wild rice requires relatively few chemical fertilizers or pesticides, nor do fields have to be burned for sanitation, said Brown. California growers apply nitrogen, in the form of urea, from airplanes. Midges, tiny aquatic larvae of gnats, are a pest during the early floating leaf stage and are controlled with a pesticide. Diseases, at least in California, are minimal.

Another difficulty with wild rice is proper seed handling, explained Hayes. It has to be kept moist at all times, making transport and storage difficult. And it must be kept wet in the field.

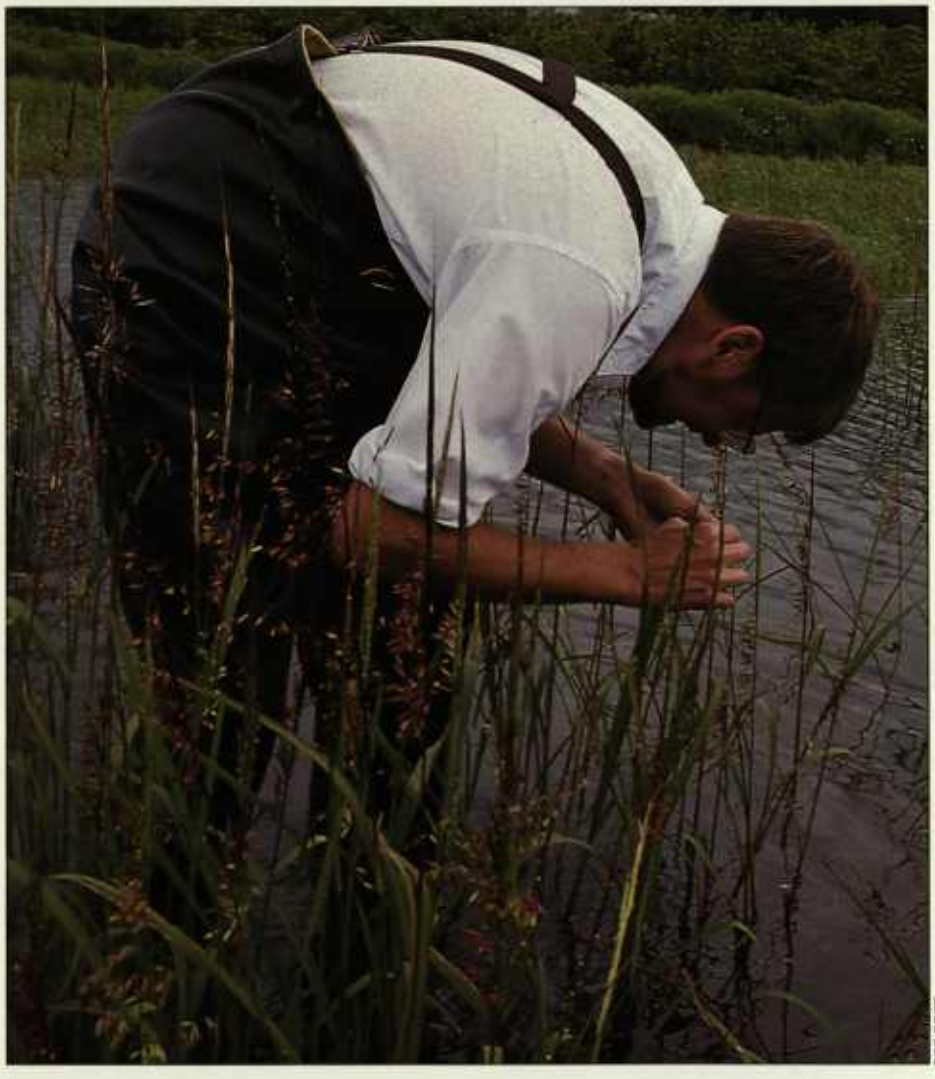
"For a successful seeding, you have to have at least a foot of standing water," he said. "Wild rice seeds are bearded, and when they are dropped into the water, they will make their own way down into the soil. Or, you can seed a dry field in the normal way and then immediately flood the area."

And seed is difficult to get.

"I know of only one company on the West Coast that sells it, near Sacramento, and it only deals in large lots of seed," said Hayes.

Despite unknowns and challenges, Hayes, Karow, Brown and interested Willamette Valley growers hope to plant larger trials in 1992.

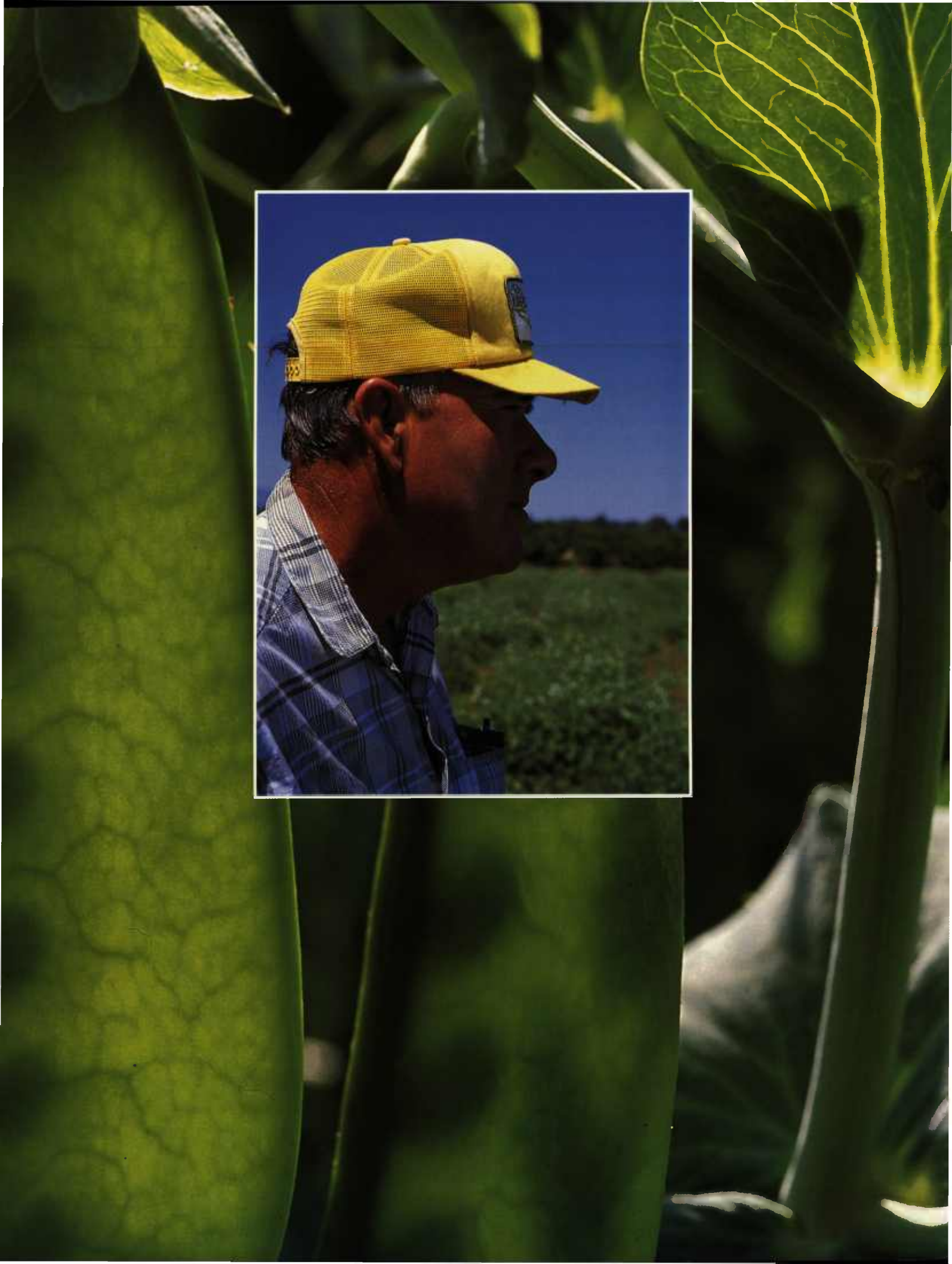
"Besides being a crop that will grow on marginal land with little chemical inputs, it requires a small initial investment, has a ready market with good prices and makes good waterfowl habitat," said Hayes. "What more could you want?"



BOB ROST

There's still a lot to be learned about growing wild rice in the Willamette Valley, says Russ Karow, here examining seed development. More trials are planned for 1992.

Carol Savonen is a science writer in OSU's agricultural communications office.



It's a new age in science, but Jim Baggett keeps giving us vegetables the old-fashioned-way

PEAS THAT PLEASE

BY BOB ROST

If pea plants were people they'd stand up and applaud Jim Baggett. Through many years of field research, he has developed pea varieties with strong resistance to a virus that's the pea plant's equivalent of cancer.

Enation mosaic virus (EMV) severely stunts pea plantings and causes tissue outgrowths on plant leaves and pods. There is no control except resistance to the disease. Of course, plants severely infected with EMV are useless for pea production.

The new EMV-resistant pea varieties—"Oregon Trail," a late season pea, "Oregon Pioneer," an early maturing pea, and "Oregon Giant," an edible pod pea—will probably be most popular with home gardeners initially. Home gardeners, Baggett explained, are important to the vegetable breeding program because they are often the first to try new vegetable varieties released by OSU.

Baggett, a vegetable breeder in the OSU horticulture department, has spent three and a half decades, a period spanning his entire career, working on peas. He started the pea breeding program at the OSU vegetable research farm in 1956. Since then he's grown hundreds of pea varieties, making cross-pollinations (or crosses, in breeder jargon) of those varieties and selecting from subsequent generations of plants to get the most desirable pea characteristics.

Why devote so much time to a bunch of tiny, green edible spheres? Baggett's reasons are simple.

Home gardeners are important.

"In vegetable breeding you look for ways to make improvements in vegetable varieties people can use," Baggett said. "We [Baggett and his predecessor William Frazier] started the pea breeding project back in the early 1950s because commercial vegetable producers and vegetable seed companies that supply seed to home gardeners needed virus-resistant pea varieties.

"With peas we saw a good opportunity to develop processing, garden and edible pod pea varieties adapted to Oregon's

Left: An early-maturing pea developed by OSU's Jim Baggett (inset). Photo: Bob Rost

climate that would have good resistance to enation mosaic virus, which is the major disease problem with peas," Baggett said. "No enation mosaic resistant pea varieties were available for use in the Pacific Northwest when this project began."

Baggett is quick to emphasize that peas are just one of his many projects.

As project leader of OSU's vegetable breeding program, the Experiment Station scientist's primary responsibility is to develop and evaluate vegetable varieties adapted to Oregon's varied climates.

"Most new vegetable varieties available to Oregon growers are developed outside the state in climates far different from Oregon's," he said. "Evaluation of those varieties is a necessity, along with breeding varieties adapted to the needs of the state's expanding vegetable industry."

In addition to peas, Baggett currently is working with green beans, broccoli and tomatoes. He says he'll release a new green bean variety to commercial growers sometime in the next two years, along with new tomato and pea varieties, and possibly new broccoli varieties. Baggett also field tests many new sweet corn varieties, including the relatively new super-sweet corns.

BOB ROST

Horticulturist Jim Baggett collects samples from pea plots at the OSU Vegetable Farm just outside Corvallis, where he does most of his field research.

Elvis Presley was driving trucks ....

A look at the imposing bank of file cabinets in his Cordley Hall office suggests that an essential of vegetable-breeding work is detailed record keeping. As part of that record keeping Baggett has sketched a pea family tree for each of his recently released varieties.

The sketches trace the ancestry of the three new pea varieties, with lines connecting the parents, aunts, uncles and cousins—pea varieties with names like "Wando," "PI 140295," "Early Frosty," "Eureka," 'Small Sieve Freezer" and "Dwarf Gray Sugar." Baggett created each new generation of peas from successive crosses at the rate of one or two generations per year.

By itself, the pea family tree gives no hint of the vast amounts of time vegetable

Right: Corvallis home gardener Deborah Kean picks new "Oregon Giant" variety peas in her backyard.

breeding consumes. For example, when the first cross of Wando and PI 140295 (which eventually produced the edible pod variety Oregon Giant) was made in 1953, Elvis Presley was driving trucks in Tennessee, Dwight Eisenhower had just been elected president of the United States, and the OSU football Beavers played their first game in Parker Stadium.

"It may take five or six generations [five or six years] to develop a pure line [variety that consistently expresses selected characteristics] and then many more years to evaluate it," Baggett noted.

In 1976, after selecting the lines which became Oregon Trail and Oregon Pioneer pea varieties, Baggett evaluated each in field trials for another 14 years. By comparison, the variety Oregon Giant breezed through the evaluation stage with a scant five years of field tests.

The release of the three disease-resistant pea varieties is just the latest in Baggett's long list of vegetable breeding successes. In the past decade alone he's released two green bean varieties, "Oregon 91" for commercial growers and "Oregon Trail" for home gardeners. He released two squash varieties, "Sugar Loaf" and "Honey Boat," three tomato varieties, "Oregon Cherry," "Oregon Spring" and "Santiam," and a new lettuce variety, "Summertime."

"They won't plant themselves."

"I've tended to have a lot of different things going on," Baggett understated. "But, if I don't see much opportunity to improve a particular vegetable, I don't spend a lot of time trying.

"Oregon growers have told me at times that the area needs new beet varieties, but I didn't get into beet breeding because I never had any confidence that I could develop a beet that's better than the varieties the seed companies are providing," he said. "I've continued to work with tomatoes over the years because they are so important to fresh market gardeners and home gardeners, and I saw opportunities for improvement."

As a scientist, Baggett seems an anomaly in these days of giant, cooperative research efforts. Instead of being part of a team of scientists working on several components of a project simultaneously, Baggett usually works alone, or with the help of one research assistant. He makes most of his own decisions about what projects he'll take on, and he spends most of his time at the OSU vegetable research farm or in his office.

He maintains close ties with Oregon seed companies and the vegetable industry, but he also maintains his independence as a researcher.

"I try to fit in as well as possible with their needs [seed companies and industry], but I do things I'm interested in and that I think I can improve," he said. "What you can accomplish is related to needs and availability of germplasm [reproductive tissue], including the material already developed in the breeding program.

"It's certainly helpful to stay in one place a long time, otherwise you'll never finish anything," he said. "It's not my nature to move around a lot. I've never gone on sabbatical leave. It's hard to breed vegetables if you're off somewhere else. They won't plant and select themselves."

What would keep a horticultural researcher like Baggett going for 35 years? He says his greatest drive and satisfaction in vegetable breeding is the appeal of creating something.

"In plant breeding you create living things," he said. "In that respect it may be different from other kinds of research where scientists are creating information. A measurement of success is how well a new variety is received by both commercial and non-commercial growers. That's a very great reward. You hope that at least part of what you release will survive and be used by somebody."


BOB ROST


BOB ROST

In addition to pea varieties, Baggett has also worked on developing new varieties of tomatoes, green beans, squash, lettuce and other vegetables for Oregon.

Bob Rost is an information representative in OSU's agricultural communications office.

STEVE TERRILL

HOMESTEADERS ON STEENS MOUNTAIN

Some relative newcomers are swarming one of eastern Oregon's wonders, and that's not the only place

BY ANDY DUNCAN

From the flats of the nearby Alvord Desert, Steens Mountain in southeastern Oregon looks like a ridge that got out of hand, one built for giants. Its crest, often capped with snow, is 50 miles long and rises almost 10,000 feet above sea level. But some stubby, gnarled creatures have managed to build homes more than halfway up.

The dark green creatures flank the mountain these days in numbers that would astound the cattle ranchers, sheepherders, Native Americans and others who lived in the area at the turn of the century. They are mostly in a belt between about 5,000 and 7,000 feet up. In some spots, they're dark flecks against a pale celery-colored sea of grasses, sagebrush and other shrubs. In other areas, they stand against the browns and reds of bare soil and rocks. Elsewhere, they surround swatches of lighter green or yellow, depending on the season, that are shrinking stands of aspen trees. It's solid dark green on some of the mountain's flanks.

The homesteaders are western juniper trees. Research suggests that since the 1870s the number on Steens Mountain has increased steadily, but slowly. Now the junipers have exploded, crowding out other lifeforms at a pace Agricultural Experiment Station range scientist Rick Miller compares to "the way weed colonies spread when they've built up a good seed source. The curve is pretty flat for a long time, then it shoots almost straight up."

A lot of us think they're pretty ....

The questions on Miller's mind are why is this process underway on Steens Mountain, and why are junipers also expanding their range in many other parts of central and eastern Oregon?

There's nothing inherently wrong with junipers. A lot of us think they're pretty attractive. They color the landscape. They provide shelter for some big game, food for some birds, habitat for some small animals and insects and microbes, and fire and fence wood for humans. In

LYNN KETCHUM

Far left: Uplifting at a crack in the earth created Steens Mountain. The west side slopes gently up to the steep east face, shown here. Geologists say it's the country's largest "fault block." Left: OSU range scientist Rick Miller is studying the mountain's vegetation.

certain harsh ecological niches, they do a better-than-nothing job of stabilizing the soil. In other parts of the world, the evergreen trees' fragrant berries are used to flavor a liquor, gin.

But Miller, who works out of the Eastern Oregon Agricultural Research Center, headquartered at Burns, and other OSU scientists say it's worrisome when junipers spread in mass from their traditional niches, as they're doing now. The trees kill grasses, shrubs and other plants that are valuable as wildlife and livestock food. The plants the junipers kill provide shelter to an even wider variety of animals, insects and microbes than do junipers, and the plants do a much more effective job than junipers of preventing soil erosion in upland areas like the slopes of Steens Mountain.


LYNN KETCHUM

Glaciers carved spectacular Steens gorges. Junipers are creeping up most of them.

Junipers also disrupt the flow of precious water ....

A juniper's seeds are in its berries. Birds eat the berries and spread the seeds. Water is another important transportation vehicle. It's not much of a contest between junipers and surrounding plants if a juniper seed gets a toehold. Seedlings often get their start in life under the sheltering "microclimate" of a sagebrush brush. Junipers have shallow, wide roots, and deep roots that can go down 30 feet or more. They also have a canopy of large, thick leaves that catch and absorb rain and snow. As they grow, they outcompete the sagebrush and surrounding plants for nutrients and water.

Under the canopy, a mat largely made up of juniper needles replaces a much more diverse web of plant, insect and microbial life. In the space between trees, there's mostly bare soil. Overall, there's less litter and foliage on the ground. There are fewer fibrous roots. Moisture tends to run off above ground rather than sinking in. That can damage streams and the creatures that live in them.

Miller and other researchers say junipers also disrupt the flow of precious water under the often-parched earth of central and eastern Oregon, and not just by reducing the water that sinks in. Lee Eddleman, an OSU range scientist, tells of a fairly dense juniper forest near Bend estimated to be using 7.6 inches of precipitation a year. "This particular site only gets about 10.5 inches a year," Eddleman said. "I think their impact on the water in an area is much greater than we've implied to this point."

Miller estimates on a warm spring day a juniper with a trunk base only 12 inches in diameter can use 15 gallons of water. "On a hot June day, that figure can rise to 30 gallons," he said. Persuading hydrologists to study how junipers affect the waterflows of various kinds of landscapes is a high priority, he adds.

Back to Miller's basic questions: why are junipers suddenly expanding in an unprecedented way on Steens Mountain and in other parts of central and eastern Oregon? Part of the answer is that it isn't unprecedented. Some of us tend to think of the ecosystem being in a state of equilibrium prior to European settlement, beginning roughly in the 1870s. But evidence like pollen gathered by paleobotanists suggests that over the last 50,000 years there have been numerous shifts in dominance and distribution among western juniper, sagebrush, perennial grasses and other plants.


LYNN KETCHUM

Hearty junipers crowd an aspen grove.

"Although juniper has more than doubled its range since the turn of the century, it's thought to have been more widely distributed 2,000 to 4,000 years ago," said Miller.

Fingers sometimes point at poor livestock grazing practices, and the farming of land later abandoned, when talk turns to why the current juniper expansion started in the 1870s. It's true poor grazing and farming can increase the rate of expansion, Miller says, but the key factor is fire. "Junipers will increase in number and density regardless of the presence or absence of grazing and farming if fire is no longer a part of the environment," he said. "Our research shows there's no relationship between the ecological condition of a site and juniper expansion."

The way overgrazing and poor farming fit in, Miller and others believe, is that those practices reduced the amount of "fine fuels," or plant matter, that built up in the environment. That reduced the frequency of fires that killed junipers and other woody plants like sagebrush. The fires helped grasses and other plants that grow quickly by removing competitors for water and nutrients and by actually

releasing nitrogen and other nutrients into the soil. The fires also helped aspen groves. The trees burned above ground but regenerated from root tissue into a nutrient-rich world free of some nasty competitors.

The key factor is fire.

Native Americans around Steens Mountain and in other parts of Oregon used to set fires knowing they encouraged the growth of plants they liked to eat, or of plants favored by animals they wanted to hunt. But lightning was the most frequent igniter. The settlers who came after the Civil War tried to put the fires out. Their descendants became very good at it.

"Today, much of the high desert country [of central and eastern Oregon] bears little resemblance to the landscape that the early trappers and settlers observed," said Boone Kauffman, a fire ecologist in OSU's rangeland resources department.

"If society demands that we: 1) maintain or restore the quaking aspen stands of the high desert; 2) improve upon the current composition and productivity of bunchgrass prairies; and 3) maintain the wildlife and other values that arise from intact high desert ecosystems, then our goal as land managers and researchers must be to improve our understanding of how fire functions in these ecosystems," wrote Kauffman in an Agricultural Experiment Station report on high desert research.

But even if stopping juniper expansion in an area is judged the right thing, fire may not be able to do the whole job, notes Kauffman. Long periods without fires discourage the growth of the fine fuels mentioned earlier that keep fires going. In some places it may be necessary to cut down junipers and leave them for several years before the areas will burn effectively.

BOONE KAUFFMAN

Left: Fires help grasses and other non-woody plants, increasing diversity.

LYNN KETCHUM

OSU's Rick Miller eyes the mountain's oldest juniper, perhaps a seedling when Columbus arrived.

"You used to be able to look clear out across the landscape. Now you can't even see the hillside. I can remember aspen groves the juniper pushed out," he said. Last year, Otley burned 1,400 acres of his land. It was expensive. It cost him from 25 to 60 cents an acre for labor and equipment, he says. But the land, in its second growing season, has less sagebrush and juniper. It has more grasses and wildflowers he says are good for his cattle, and for wildlife.

"You need to figure out the biological situation, then act on that," said Otley. "I think we need to re-establish fire as part of the system. We need to stop the juniper succession and optimize the watershed condition. Everything else out here depends on watershed management."

Miller agrees. His plans include continuing to study the juniper expansion on Steens Mountain so he and other researchers, including graduate student John Bates, who's studying juniper invasions of aspen groves, can project the future rate of expansion and summarize management alternatives.

ANDY DUNCAN

Rangeland resources graduate student John Bates examines Steens junipers burned on purpose. He's studying the aspen tree-juniper relationship.

Of course, fires can cause problems, sometimes, and that goes beyond charring a house or barn. In certain areas, unless properly managed after fire, hearty, undesirable weeds like cheatgrass can move in instead of more desirable vegetation. Also, controlling humanmade and wild fires is expensive. But an increasing number of public and private land managers are giving it a try as a way of combatting juniper expansion. Rancher Fred Otley understands why. Today, Otley sees a rapidly changing scene near his home on a northwestern slope of Steens Mountain.

One late afternoon, standing on a flank of Steens Mountain heavily sprinkled with dark green, he observed that "if you were here 150 years ago you wouldn't see any of this juniper. It was all grassland and sagebrush steppe. Before we do things, we need to try and understand how it will affect the system. Biological decisions for management need to be based on 50- and 100-year and longer periods. Not the short run. Nobody—ranchers, snowmobilers, hunters, skiers, hikers, nobody—should do something to the detriment of a resource like this."

THE DRY YEARS

BY ANDY DUNCAN

To the red country and part of the gray country of Oklahoma, the last rains came gently, and they did not cut the scarred earth. The plows crossed and recrossed the rivulet marks. The last rains lifted the corn quickly and scattered weed colonies and grass along the sides of the roads so that the gray country and the dark red country began to disappear under a green cover. In the last part of May the sky grew pale and the clouds that had hung in high puffs for so long in the spring dissipated. The sun flared down on the growing corn day after day until a line of brown spread along the edge of each green bayonet. The clouds appeared, and went away, and in a while they did not try any more. The weeds grew darker green to protect themselves and they did not spread any more. The surface of the earth crusted over, a thin hard crust, and as the sky became pale, so the earth became pale, pink in the red country and white in the gray country.

That's a classic passage in American literature. It's the first paragraph of "The Grapes of Wrath." Author John Steinbeck is introducing us to the Great Plains in the 1930s, the Dust Bowl. Eight dry years in a row and the agriculture practices of that time drove hundreds of real families like the Joads in Steinbeck's novel off their farms into migratory lives some found as cruel as the weather.

The Dust Bowl is a good example of why we humans tend to put droughts out of our minds and seem amazed when they come, as they inevitably do: They're like killer earthquakes, uncontrollable when they strike the little worlds we construct.

There's a drought now in California. It's been publicized nationally because it's sort of unusual, at least in traditionally wetter parts, and because a lot of people live in the state. In San Francisco

and Los Angeles, folks can't flush their toilets as much as they'd like. Can't water their lawns when they want. The drought is threatening food production, the environment, rich people, poor people. There's fighting over water rights.

Water often comes ... in spurts.

Oregon, east of the Cascades, has been in a drought, too. And although the news about that one hasn't traveled as far, there's suffering and people throughout the state are concerned. But there's one thing Oregonians shouldn't be: surprised. From Nature's standpoint there's nothing amazing about a string of drier-than-normal years on the sunnier, less populated side of the mountains. Much of the area fits the definition of a semi-desert. The precipitation is less than 15 inches a year. A few spots are true desert, with less than 6 inches.

ANTHONY MILLER

Droughts are hard on shallow-rooted forbs like Indian paintbrush.

But those are averages. Scientists studying natural records such as tree rings and fossils are finding water often comes to central and eastern Oregon in spurts. Through large spans of history, short-term dry cycles, and wet cycles too, were probably more typical than years of average precipitation.

A drought like the current one, which started in 1985, is tough on people, especially ranchers and farmers. But livestock and crops are relative newcomers. The settlers didn't appear in significant numbers until after the Civil War, and a lot's been written about their struggles. What about the animals and plants native to the region, or ones that arrived in the distant past? How do they cope with a drought like the current one?

No big surprises. Life goes on. Sunrise and sunset are still prime eating and drinking times for many creatures. During a summer day hawks and eagles still soar high above fields of crops and forested mountains and grass and sagebrush lands looking for food. Sage grouse take dirt baths to get some relief from the mites that torture them. Lizards skitter across the parched ground conducting their business, deer and antelope graze, kit foxes and bobcats slink through the bushes, songbirds chirp in cottonwoods along streams where fish swim in whatever water is left. Come evening, often on rocky outcroppings, coyotes raise their voices in song, signalling the emergence of a partially new cast—the strictly night creatures.

TOM AND PAT LEESON

Antelope need water and good spring forage to provide milk for their young. Photo pages 20,21: Tom and Pat Leeson.

Sage grouse take dirt baths ....

Of course, plant life goes on, too. With their leaves and roots, the native bunchgrasses like bluebunch wheatgrass and Idaho fescue spend their days collecting sunlight, moisture and soil nutrients. They convert them into materials they can use to grow more leaves and roots and to make shoots and finally a stem that will bear a seed stalk. Shrubs, trees and other plants do much the same, although their equipment for getting the job done is different.

Right: Larger predators like coyotes can alter their ranges somewhat during dry times to include new food and water sources.

TOM AND PAT LEESON

But at various times during the dry years, animals and plants in central and eastern Oregon take advantage of special adaptations that help them live where drought is a regular visitor.

"Wildlife basically have three water resources," says Dan Edge, an OSU Extension Service wildlife specialist and Agricultural Experiment Station researcher. "Those are free water they drink, what's called 'preformed' water in plants and animals they eat, and moisture they can extract from some fats and carbohydrates they eat."

Many animals rarely take a drink in dry times. How do they manage that? Small mammals like central and eastern Oregon's kangaroo rats eat grass seeds and convert moisture in them into preformed water. Then predators like

WHEN MARCO MET THE KHAN

Like in most high, dry areas, farming and ranching in central and eastern Oregon can be tough. Short-term weather extremes are pretty common.

Studies of tree rings show in the late 1200s, roughly when a young Italian named Marco Polo was in Asia exploring the Mongol court of Kublai Khan and France's Louis IX was leading an ill-fated crusade into Carthage, a fierce drought—like a 10 on the Richter earthquake scale—gripped central and eastern Oregon.

The tree rings say another whopper hit in the 1840s. That was about the time Friedrich Engels and Karl Marx were in London penning a little treatise called *The Communist Manifesto.* Americans were moving to the Oregon Territory in mass over a trail mapped by Army lieutenant John Charles Fremont and his guide Christopher "Kit" Carson. There'd been countless droughts in the five-plus centuries in between. Scientists believe a major one hit every 80 years or so. Plain old dry years were common.

Jump to the 1930s, when drought turned the Great Plains into the so-called Dust Bowl. That wasn't the only area hurting. Oregonians east of the Cascades suffered through what some think was the worst drought since the late 1200s. Many settlers had arrived in wetter times, after reading advertisements about fertile farmland, and wanted to believe that was pretty much the way things would stay. The weather stole their hopes and their homes. Lights sparkle across the Milican Basin east of Bend in an old night photograph taken from the top of Newberry Crater. Most of those blinked out during the Dust Bowl years, never to shine again.

The first half of the 1980s, when Malheur Lake south of Burns left its banks and claimed surrounding lands, is an example of recurring wet cycles scientists discover studying the tree rings. And that brings us to 1985, seven years ago, when the current drought started. It's been a fairly strong one, but not like the 30s. Last year much of central and eastern Oregon had the lowest precipitation since the 1930s, less than 6 inches in many areas.

The impact of a drought on farming and ranching depends on the area, and when moisture arrives. For example, in the dryland wheat country of the Columbia Basin, potential drought damage to summer wheat yields seemed high in each of the last three years. But late spring rains arrived every year to help growers avoid disaster.

In central and southern Oregon, on the other hand, lower-than-normal mountain snowpacks over the last several years reduced water in reservoirs. The result was spotty availability of water for irrigation. In that situation, some farmers see their crops burn up in the summer heat. Others get only enough water to keep crops, like mint in central Oregon, alive until the next year. Others receive sufficient water to produce a minimal to average crop yield.

This year livestock producers faced dry range and pasture conditions and nearly empty stock ponds. But badly needed rain and snow fell in May and June, giving hope the drought is ending. It wasn't enough to replenish deep soil moisture in many areas, but it turned brown grass green and gave producers operating on the economic edge a boost.

bobcats and badgers and coyotes obtain the preformed water when they eat the rats. Grazing animals, like antelope and deer, extract moisture directly from forbs, grasses and other plants.

The heartiest survived to breed ....

Poor plant growth during a drought can send ripples through the food chain, says Edge. "Say a poor grass seed crop affects a community of small mammals, who don't get enough to eat and enough moisture. A collapse of the small mammals can affect a population of predators, maybe raptors like red-tailed hawks or rough-legged hawks."

In particular, reduced water and food resources hurts animal reproduction, notes Bob Kindschy, for 33 years a wildlife biologist with the federal Bureau of Land Management. "Pronghorns [antelopes] need green forage in late August and early September to ovulate," says Kindschy, who's stationed at Vale. "In a drought you see a low fawning rate the next spring." Also, female antelope need good spring forage and water to provide milk to their offspring, and their young need forage and water as they develop.

Some animals, for instance ground squirrels and some other small mammals, and some reptiles, have the ability to hibernate underground in the summer, or estivate, so they'll need less water. During extreme droughts of the past, the heartiest, or the smart or lucky ones who

TOM AND PAT LEESON

Droughts can shift Nature's balances. BLM wildlife biologist Bob Kindchy sees a recent upswing in Oregon's dwindling sage grouse (top, page 25) population as part of a triangle: dry weather caused a boom in brushy plants and black-tailed jackrabbits (bottom, page 25) that need the plants. The rabbits provided more food for predators like golden eagles (above) that usually feed on the grouse. However, OSU bird researcher John Crawford doubts the theory and says the grouse are still in trouble.

DINOSAURS IN OREGON

Unless you're a real stickler, you can think of Oregon east of the Cascades as basically three kinds of country:

1. Northeastern and central Oregon: high, semi-arid grassland that is the southern tip of a geologic formation called the Columbia Plateau, which curves west as it dips down from British Columbia and Washington state.
2. Southeastern Oregon: a high, even drier region that's the northwestern corner of the huge, roughly circular Great Basin that covers much of Nevada and Utah and parts of Idaho and California.
3. The mountainous parts of central and eastern Oregon that rise up within the Columbia Plateau and Great Basin; they have pronounced characteristics linked to their geologic origin and altitude.

Besides central Oregon's and eastern Oregon's periods of relatively stable climate like the last 10,000 years, filled with short-term drought and wet cycles, there have been dramatic shifts in climate and in accompanying plant and animals life.

An example is the Mesozoic Era, the age of dinosaurs that ended about 70 million years ago, when much of central and eastern Oregon was a shallow, tropical sea. Another example is the Cenozoic Era, the age of mammals that ended about 10,000 years ago. At one point in that period, saber-toothed tigers roamed the John Day country and much of central and eastern Oregon were covered with coniferous forests. There were "ice ages" during the later Cenozoic Era.

TOM AND PAT LEESON

made the right choice at the right time, survived to breed and pass their genes forward.

Edge points out that interactions during a drought among animal and plant communities are complex. Some types of animals and plants may compete better during a drought than in wetter times. The health of their populations may depend on droughts.

The BLM's Kindschy offers an example. Black-tailed jackrabbits need brushy habitat to hide from predators and protect their young. Shrubs like sagebrush and greasewood grow better than grasses during dry weather. "So during the droughts the rabbits have more habitat," says Kindschy. "I really saw an upswing in black-tailed jackrabbits last year."

Kindschy contends that's helping eastern Oregon's sage grouse, whose numbers have been dropping dangerously low in this century but have been up a bit the last couple of years. Eagles and other predators, he theorizes, are feeding on the rabbits and killing fewer sage grouse.

But John Crawford, an OSU wildlife professor and Agricultural Experiment Station researcher who studies sage grouse, is skeptical about the rabbit theory. "Statewide the sage grouse

TOM AND PAT LEESON

population is up from the mid-1980s when there was record low productivity," he says. "Something's going on out there. We believe it may be a delayed positive response to weather patterns in the mid-80s.

"Anyway, the one reality is this: Between 1900 and 1940, sage ground range in Oregon declined 50 percent. Between 1940 and 1990 sage grouse abundance within that reduced range declined 50 to 60 percent. We see peaks and valleys. But when it goes down it goes way down. We believe the overall decline is related to quality and quantity of habitat.

"The grouse just don't have enough hiding cover, the chicks don't have habitat when they hatch, and the diet isn't good. In early summer, they should be eating succulent forbs like dandelions, hawksbeard and desert parsley, but I've found them in mid-June eating sagebrush. They don't starve but it makes them susceptible to other mortality factors.

Crawford is skeptical about the rabbit theory.

"There are some hard realities we may have to face," adds Crawford. "When conditions get severe, like during a drought, the livestock in some areas consume a great deal of the grass and forb cover. It's not just predators affecting grouse survival and productivity. Grazing can disrupt the system. Please don't paint me as anti-cow. I'm a farm boy. But our observations are defendable."

However, Marty Vavra, superintendent of OSU's Eastern Oregon Agricultural Research Center, feels Crawford's view is over-simplified. Vavra contends that a pattern of drier weather, and long-term suppression of natural fires, are helping sagebrush and juniper expand and forcing out foods like grasses and forbs in areas where sage grouse live.

"That's happening in places where livestock have been pulled off during this drought, where they aren't grazing," Vavra says.

Crawford notes that migratory waterfowl, and many other birds east of the Cascades, can fly to other areas to live during droughts. But the disturbance

TOM AND PAT LEESON

Perennial bunchgrasses stop growing to save themselves during a drought.

of their routines often means they don't breed productively.

Grazing wildlife, predators and even some small mammals can shift or expand their ranges somewhat to adapt to a drought; for example, to include temporary waterholes sometimes created by afternoon thunderstorms. "I noticed an amazing number of tracks around a waterhole down in the White Horse Desert [in southeastern Oregon]," says Kindschy. "Bobcats, coyotes, kit foxes, wild horses, birds."

It's different for fish, researchers point out. Their habitat usually shrinks. According to Hiram Li, a fisheries researcher at OSU, they can end up in small pools where snakes, birds and other predators can get at them.

"I noticed an amazing number of tracks ...."

"Many people think the problem with fish is that things overheat and dry out in the summer. But freezing is a problem, too," adds Dennis Lassuy, a biologist with the U.S. Fish and Wildlife Service in Portland. Lassuy, who specializes in saving scarce species of fish, says "the water can get so low during a drought it can freeze to the bottom in winter."

Fish like eastern Oregon's redband trout have adapted to the area's warmer stream temperatures. But Lassuy and others are worried about populations of several kinds of fish native to eastern Oregon. They've been collecting some and putting them in special holding facilities, in case their relatives don't make it through the drought.

TOM AND PAT LEESON

More east-of-the-Cascades residents: green-tailed towhees (a type of finch) in their typical brushy habitat. Many birds have salt glands that let them use alkalai water humans couldn't.

"A lot of these fish have survived in eastern Oregon a long time," says Lassuy. "But now dams and irrigation projects and introduced predators [fish] can make it more complicated for them to complete their life cycles."

Like animals, plants have special ways of adjusting to droughts, and special problems.

The term bunchgrass, mentioned earlier, applies to a number of grass varieties native to the West. Their stems stand erect with roots together, rather than forming dense mats of stems and roots like many grasses on the Great Plains. All bunchgrasses are perennial plants, meaning they regenerate year after year from roots instead of seeds. Many are nutritious foods for wildlife and livestock.

"The bunchgrasses usually come out of their winter dormancy in early April," says Paul Doescher, an OSU range scientist. "The really active growth phase is mid-May to mid-June, depending on the weather. By mid-July most bunchgrasses are through growing for the year." That's an adaptation to the moisture pattern. Normally, most moisture comes in the fall and winter.

In severe drought years, Doescher explains, bunchgrasses can stop growing earlier and move valuable proteins and other compounds into their roots for storage, as they'd do later anyway. Being perennials, they don't need to produce seeds each year to regenerate.

Annual grass plants must grow and try to produce seeds each year. Central and eastern Oregon have native grasses that are annuals, like annual fescues. But many annuals aren't natives. For example, humans introduced bulbous bluegrass as livestock forage. Cheatgrass, a less nutritious but hearty invader, moved to grasslands mostly from wheat fields, where it was considered a weed.

Plants have special ways of adjusting ....

Generally, perennials do better during a short-term drought because of their ability to protect themselves by going dormant and not producing seeds. But annuals do better during extended droughts, when the perennials' lack of seed production catches up with them. Annuals are more likely to have seed reserves in the soil that help them come out of an extended drought with a new crop of seedlings.

Forbs, broadleafed, flowering plants also popular with grazing animals, have shallow, relatively small roots systems and don't do well during droughts, explains Lee Eddleman, an OSU range scientist who's studied east-side plants for many years.

Shrubs like sagebrush are another matter. Most of eastern Oregon's sagebrush has two kinds of root systems, Eddleman points out. "They have a horizontal, spreading net of roots 3 to 6 inches deep and several feet wide. The other system is a vertical, or tap, root. It functions as a water pump more than anything else. It can go 10 or 12 feet deep, but 2 or 3 feet is average.

"In a drought year, the horizontal root system uses the small amount of snowmelt and rainfall we get, and later the plant relies more on the tap root. It may get water two or three years old."

Another strategy sagebrush and some other shrubs use is similar to the bunchgrass strategy: they go partially dormant above ground.

Sagebrush has two kinds of leaves—ephemeral, or early spring leaves, which are long, thin leaves that collect lots of sunlight, and small, thick perennial leaves that are less efficient for energy collection but use less water, according to Rick Miller, an OSU range scientist at the Eastern Oregon Agricultural Research Center, headquartered at Burns. "When the moisture runs low the plant can partially shut down by dropping the ephemeral leaves," explains Miller.

The year immediately following a drought can be exceptionally productive for plants east of the Cascades, especially grasses, researchers have found. It's the combination of moisture and nutrients that have built up in the soil during the lean, dry times when plants weren't working at full speed to extract them. That, in turn, can make the animals especially productive.

"That's the desert," says the BLM's Kindschy. "It's a country of extremes. The unusual is usual. But animals and plants have adapted. They have losses. But the recovery can be rapid. Everything is hooked together."

TOM AND PAT LEESON

Easter Oregon predators, like this badger with an unlucky ground squirrel, can go for long periods without a drink. They get moisture from their victims.

THE TURKEY MAN FROM TILLER

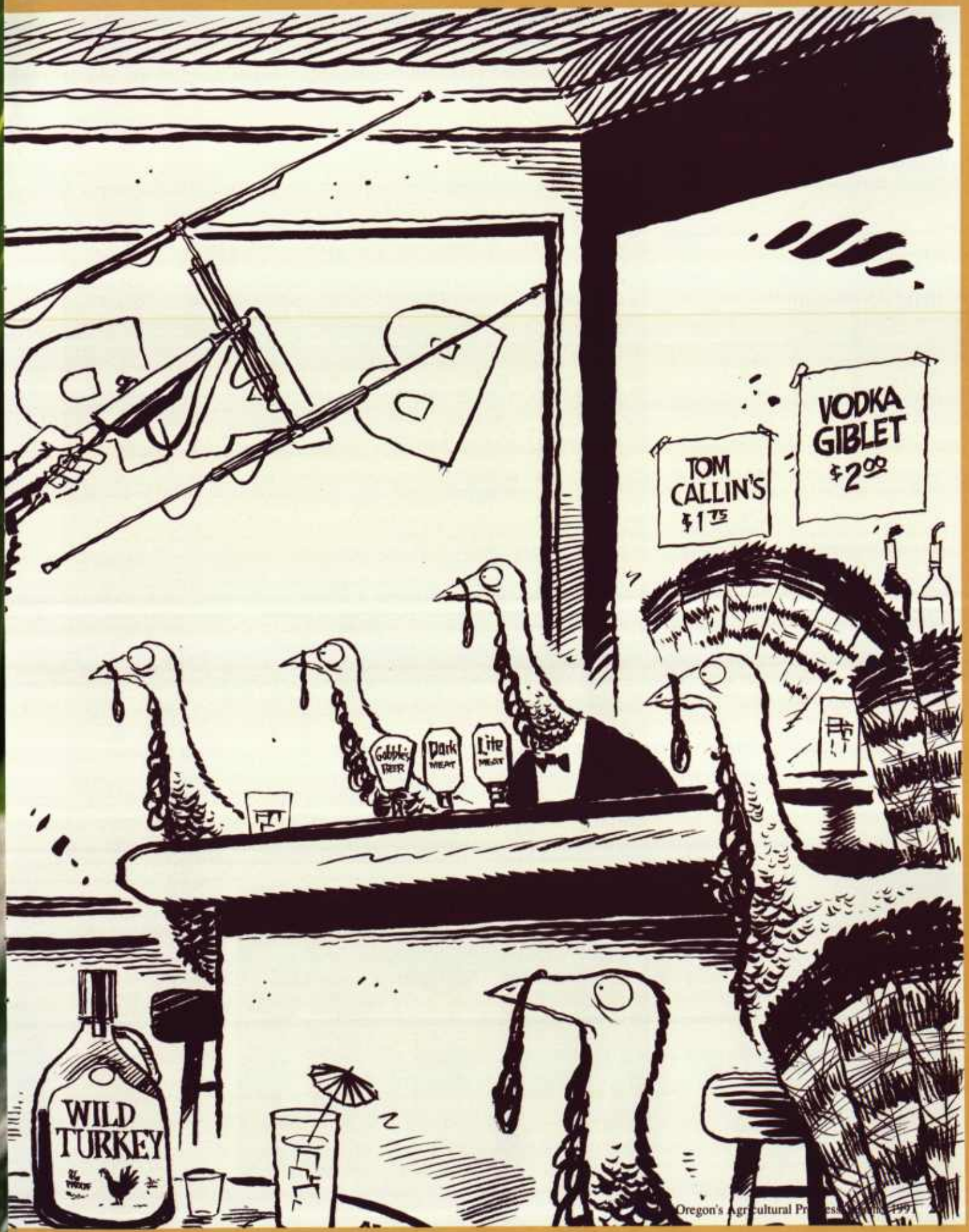
While we catch Johnny Carson, he's helping write a wildlife success story

In the dead of winter, with a relentless snow storm pounding the hills of southern Oregon, the patrons of Tiller's lone tavern were thanking their lucky stars to be inside. Suddenly the door opened and the howling wind blew in a wave of frigid air and a rather disheveled man wearing dirty jeans, well-worn boots and about an inch of snow clinging stubbornly to the brim of his hat. His haggard face seemed to be fighting a losing battle with frostbite. As he stumbled exhaustedly to a nearby table, the patrons turned back to their beers shaking their heads. It was just the turkey man.

■

Since October of 1988, Tom Keegan has spent most of his waking hours pounding through clearcuts, mixed forests, meadows and farmlands spying on Rio Grande wild turkeys. The birds are one of Oregon's most phenomenal wildlife success stories. Wildlife managers introduced the Rios a few years back, though they had their

BY MARK FLOYD


VODKA
GIBLET
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TOM
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Gobbler
BEER
Dark
MEAT
Lite
MEAT
WILD
TURKEY

highest hopes for turkey success in Oregon pinned on the introduction of another subspecies, the Merriam's. Merriam's, after all, are native to mountain areas and biologists were convinced they were a perfect bird for the eastern side of Oregon's Cascades. On the other hand, Rios were brought into Douglas County from the scrublands of Texas—hardly a match for moisture-laden western Oregon.

"It got to be a little depressing."

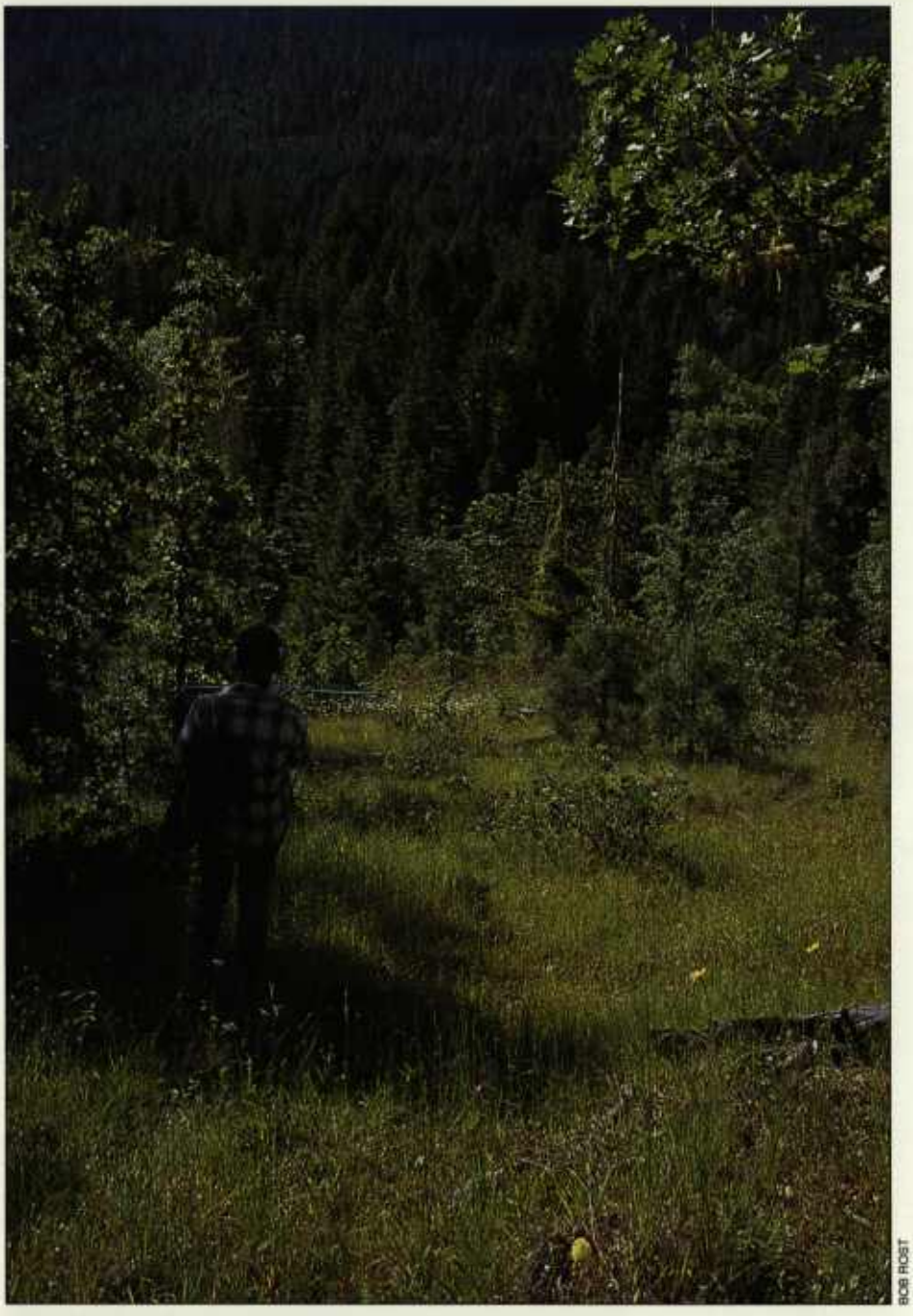
But the Merriam's have foundered ever since while populations of Rio Grande turkeys have skyrocketed. The question is, why?

Enter the turkey man from Tiller. Three years ago, Keegan was finishing a master's degree at Louisiana State University when he learned that John Crawford from OSU's Department of Fisheries and Wildlife was looking for a doctoral candidate to study wild turkeys in Oregon. Though he knew little about turkeys, Oregon sounded like a nice place to work and live. Besides, studying turkeys couldn't be too difficult, could it? Six months later, Keegan still hadn't seen his first Rio Grande. It wasn't for lack of trying. Every morning, Keegan would be up well before the sun, driving 15 miles from his cabin on Day's Creek to a study site near Tiller in southern Oregon. He would hike through the woods for 5, 10, even 15 miles, searching for the elusive Rios, to no avail.

"It got to be a little depressing," Keegan recalled with a laugh. "Here all the locals kept telling me the place was crawling with turkeys and I couldn't even find one. I probably went out into the field a hundred times before I finally saw some."

Once Keegan zeroed in on some flocks, he was able to bait sites and capture the birds with rocket-launched nets. Suddenly, the project began to show potential. Working with the National Wild Turkey Federation and other agencies, Keegan attached radio collars to the birds to track their movements, nesting habits and habitat use.

Then Keegan really got serious. He began venturing into the brush at mid-night to see where the Rios roosted. While normal folks were catching



BOB ROST

BOB ROST

Above and left: OSU graduate student researcher Tom Keegan uses radio collars and an antenna to monitor the lives of wild turkeys on his study area in southern Oregon.

MIKE DIGGS

Rio Grande turkeys like this male are expanding their range in Oregon. Officials estimate there are 8,000 in Douglas County alone.

WILD TURKEY ECONOMICS

Ten years ago, OSU graduate student Scott Lutz began stalking, trapping and tracking Merriam's turkeys in Wasco County in a project for John Crawford, an OSU wildlife professor in the College of Agricultural Sciences.

As *Oregon's Agricultural Progress* reported in a spring 1983 article, Merriam's were considered to be the most numerous wild turkey resource in Oregon.

A lot can change in a decade.

Today, another OSU graduate student working for Crawford is finishing a multi-year study of wild turkeys. This time, however, Ph.D. candidate Tom Keegan is looking into the population boom of Rio Grande wild turkeys, introduced to Oregon a few years ago from the drylands of Texas.

"A surprise? Very much so," says Crawford. "The most obvious effect has been the major increase in hunter interest and the recreational opportunities the birds provide. There is also more and more landowner interest from people who just like having them on their land. There are a lot of economic ramifications from the Rio Grandes."

The Rios, in fact, have soundly supplanted Merriam's as the most populous and widespread wild turkey in Oregon. Biologists hesitate to guess at numbers, but a conservative estimate shows 8,000 birds in Douglas County alone. Rios are now located in about two-thirds of the state's counties and their range is growing.

Hunters have "fallen in love" with the Rio Grandes, said Steve Denney, of the Oregon Department of Fish and Wildlife, which is using data from Keegan's study to plan further expansion of the turkeys.

"Our primary goal is to introduce turkeys into all primary turkey habitat in the state, both east and west," Denney said.

The economic impact of the Rio Grandes on Oregon isn't known yet, but studies from other states indicated that costs per gobbler harvested range from $350 to $2,200. In 1990, more than 3,700 hunters purchased tags in Oregon and bagged 751 birds, an 18 percent success rate.

Despite the low odds, turkey hunting is here to stay, Denney said.

"It's unique because it's a springtime hunt," Denney pointed out. "The weather is different and you can call the birds in, much the same as you would an elk. People get hooked on it and hooked in a hurry. The number of hunters will continue to increase."

Whether they have any success or not remains to be seen, though. Keegan said hunters and wildlife photographers should be intimidated by the turkey's reputation as a mysterious, wily phantom of the woods.

"Turkeys aren't really wily, or even overly intelligent," Keegan said. "But they can be extremely elusive. They have very good senses—extremely good eyesight and excellent hearing. They're out there trying to survive and they're good at it.'

Carson's monologue, Keegan would often as not be racing madly down some logging road in his old pickup truck trying to pinpoint a radio signal from a turkey on a nearby ridge.

By daylight, he tracked down as many nests as he could, counting eggs, studying habitats and looking for signs of predators.

For two years, he daily spent 10 or 12 hours in the field, with time off for Christmas, a visit with his parents, and an occasional elk hunting trip. He went through three pairs of boots, one set of tires, and a semi-serious relationship. Blame it on Rios.

"A 3- or 4-pound owl can take a 20-pound gobbler."

"Basically, they're why my girlfriend became my ex-girlfriend," Keegan said. His determination paid off. Not only was he able to obtain the most detailed data yet on the Rio Grandes' habitat and nesting traits, he may have solved the mystery behind the success of the birds.

"Actually, there are a few reasons," Keegan said. "First, Rios tend to nest just about anywhere, in any kind of habitat. The only place they do not nest is meadows. And about 90 percent of the Rios try to nest as yearlings, as opposed to about 35 percent for the Merriam's." Perhaps the most important difference between the two subspecies, however, is the Rios' greater tendency to renest after predators destroy their eggs. Keegan discovered a hen that had lost her young and almost immediately produced another brood. It was the first time such a trait had been documented in wild turkeys and Keegan found six other hens that did likewise.

"The post-brood loss renesting is pretty unusual, and it's important because wild turkeys are subject to a variety of predators," Keegan said. Opposums, raccoons and skunks can ravage a nest of 10 to 12 eggs, and such diverse predators as crows, ground squirrels and snakes will take an egg or two. Keegan said he has even had nests destroyed by bears.

Right: The less flamboyant individuals at each end of this group of Rios are females.

Once hatched, young turkeys become prey for a host of new hunters.

"The most common are probably coyotes, bobcats and great-horned owls," Keegan pointed out. "A 3- or 4-pound owl can take a 20-pound gobbler. I know both species of foxes take poults and I've even seen a golden eagle swoop down on a flock."

When Tom Keegan was eight years old, he used to trap grey squirrels in the New England woods behind his home. He would carefully weigh and measure each squirrel, and smear a bit of paint on its fur for identification. Then he would walk for miles and miles into the woods before releasing the squirrels.

CORNELL LABORATORY OF ORNITHOLOGY

Great-horned owls, bobcats and coyotes are common predators of Oregon's wild turkeys. Opposums, skunks and other critters steal their eggs.

MIKE BIGGS

Rio Grande males clash over mating rights. To the surprise of wildlife officials, the Texas transplants have supplanted the Merriam's subspecies as the state's most populus and widespread wild turkey.

MIKE BIGGS

BOB ROST

Brian Quick, OSU fisheries and wildlife department undergraduate, and summer employee, records vegetation surrounding a wild turkey nesting site.

"My Mom used to kid me, saying the squirrels would make it home before I did," Keegan said, laughing. "I guess I've been interested in wildlife ever since I was a kid."

The fascination with wild animals has never abated, though Keegan admits his turkey study has resulted in a scary moment or two. There was the time he was walking down an old logging road when a large black bear charged by, less than 40 yards away. Or the time he was tiptoeing across a hillside looking for an elusive turkey hen when he heard a buzzing sound, looked down, and saw two rattlers just a stride away—one snake already coiled and ready to strike. That changed his devil-may-care attitude somewhat.

He heard a buzzing sound ... and saw two rattlers ....

In the town of Tiller, he had a reputation as an eccentric. After nearly three years, the locals had seen Keegan wandering through the woods with headphones, claiming to be listening for turkeys; they had heard tales of him driving madly down logging roads at two in the morning, trying to catch up to a fading radio signal; they had seen him go out in zero degree temperatures to check on roosts. They had seen him many a morning, sound asleep in his truck after a night of stalking birds.

"Most of the folks in Tiller were kind of amused," Keegan said. "They never could figure out why I was interested in turkeys in the first place."

His friends, on the other hand, thought Keegan had the life of Riley—fresh air, plenty of exercise, and no dull office routine.

"A lot of people get scared off when they look at how much work is involved in wildlife research," Keegan said. "It's not just backpacking and camping and looking at dickie birds. And it's not just doing what other people do on their vacations. When I get a free weekend, I like to relax at home and have a beer or two. Everyone else can go out and do what I do for a living all year long."

Mark Floyd is a writer in OSU's news and communication services office.

OREGON'S OYSTER?

Holy mollusk, the state's eyeing a foreign bivalve!

"O Oysters, come and walk with us!"
The Walrus did beseech.
"A pleasant walk, a pleasant talk,
Along the briny beach."
The Walrus and The Carpenter —Lewis Carroll

If Lewis Carroll's classic was set on the West Coast today, the walrus would be issuing his invitation to oysters transplanted from Japan.

So what happened to our good old native oyster, the Olympia? By the turn of the century, populations of the Olympia oyster, which at one time ranged from Los Angeles to Alaska, had fallen victim to unregulated harvest and water pollution. For commercial purposes, it had all but given up its oyster ghost.

After World War I, the West Coast oyster industry experimented with a Japanese oyster as a replacement for the Olympia. That import, the Pacific oyster, has since become the mainstay of the industry. Other varieties subsequently imported from Japan include the Kumamoto, grown only in a few coastal bays of Oregon and Washington, primarily for the restaurant trade.

"The Suminoe has a lot going for it."

Now another Japanese import, the Suminoe, may also become an important aquaculture species.

"The Suminoe has a lot going for it," said Chris Langdon, a shellfish aquaculture researcher at OSU's Coastal Oregon

BY TOM GENTLE

TOM GENTLE

Left: The Suminoe oyster can grow quickly, says an Agricultural Experiment Station researcher.

Marine Experiment Station in Newport, a branch of the Oregon Agricultural Experiment Station. "In some growing areas, the Suminoe reaches market size faster than the Pacific oyster. In addition, it may grow in places not suitable for the Pacific oyster, so it won't have to compete for limited growing space."

The Suminoe has another trait that distinguishes it from the Pacific oyster. It tends to become sexually mature, or "ripen," later in the summer, lengthening the time in which its eating quality is high.

"When oysters ripen, their flesh becomes watery and infirm. They're still edible, but don't match the quality they have when unripe," said John Faudskar, OSU Extension agent in Tillamook County who works closely with the oyster industry. "The Suminoe should retain its table quality during the summer when the Pacific oyster is ripe. It's often referred to as a 'summer oyster' for this reason."

"The United States imports considerable quantities of oysters to meet domestic demand. The gap between domestic production and demand is even greater now that Chesapeake Bay produces only 10 percent of what it did in 1980," Langdon said. He believes the prospect of adding a fast growing oyster while continuing to produce the traditional Pacific oyster should appeal to West Coast oyster growers.

The diversity gained by growing the Suminoe is another argument in its favor, Langdon pointed out. There is a danger in relying on only one oyster species for production because a disease could then wipe out an entire industry. This has happened on Chesapeake Bay, where a parasitic disease called MSX has decimated populations of the American oyster and wreaked havoc with the oyster industry.

TOM GENTLE

Shellfish researcher Chris Langdon with algae Suminoe oyster larvae eat. OSU techniques for growing the algae help make commercial culture of the oysters feasible.

It showed up in ... the 1950's ....

The Suminoe isn't a recent arrival on U.S. shores. It showed up in Oregon during the 1950s in a shipment of Kumamoto seed oysters from Japan. In the 1970s, Langdon's predecessor at the Hatfield Marine Science Center, Willy Breese, demonstrated that the Suminoe could be successfully cultured, or grown, in the laboratory. But then the Suminoe

languished, except for quantities grown by the Oregon Oyster Company operation on Yaquina Bay.

Much about the Suminoe remained unknown. Just how fast did it grow? Where did it grow best? There were concerns about its flavor and eating quality. And how could growers be assured of a dependable source of seed oysters?

A native of England, Langdon conducted research on oysters while studying for his doctorate at the University of Wales. He came to OSU in 1986 and immediately noticed the Suminoe's potential. He successfully applied for a $127,000, three-year grant from the National Coastal Resources Research and Development Institute (NCRI), a federal agency that funds research to develop coastal economies.

The grant called for research in three areas: development of hatchery techniques to provide a foundation for a dependable supply of seed oysters; comparison of the growth rates of Suminoe and Pacific oysters in various West Coast locations; and determination of consumer acceptability through taste tests.

TOM GENTLE

The Pacific oyster, left, is the major type of oyster grown on the West Coast. The Suminoe, right, has a broader, platelike shell and different requirements for growth.

Female oysters spawn by releasing millions of microscopic eggs into the water. Those that collide with sperm from a male develop into oyster larvae no bigger than a speck of dust. Following a free swimming period of two to three weeks, the larvae sink to the bottom and seek a solid surface on which to cement themselves for the rest of their lives.

In hatcheries, pieces of oyster shell are placed in the spawning tanks for the larvae to attach to. Once cemented to the shell, juveniles are called spat. Oyster spat, in turn, are planted in bays and estuaries and allowed to grow to market size over a period of one to three years.

Langdon and his research assistant, Anja Robinson, set about unlocking the secrets of the Suminoe. They discovered that Suminoe larvae require seawater of a lower salinity than larvae of the Pacific oyster—20 parts per 1,000, or 2/3 the strength of sea water.

During its larval stage, it turns out, the Suminoe is a finicky eater. Its diet must include one-celled algae that are members of the *Chaetocerous* group. The tiny oyster larvae feed on algal cells less than 1/2,000 inch in diameter. For oyster hatcheries to produce seed oysters, algae must be grown at high densities and in large quantities. An algal food culture may contain about 2 million cells per cubic centimeter—a volume about equal to a sugar cube. Oyster larvae in a 180-gallon rearing tank eat nearly 7 billion of these cells every day.

TOM GENTLE

Left: The heavy basket on this dredge harvests oysters from the bay bottom.

Several oyster hatcheries ... have expressed interest ....

Langdon and Robinson obtained different varieties of *Chaetocerous* algae from Britain, Maine, Delaware and Japan. Robinson, who was primarily responsible for growing the algae and raising the oyster larvae, discovered that, while the *Chaetocerous* variety is more difficult to grow than other types of algae, it can be successfully cultured in quantities that make hatchery production of Suminoe seed oysters possible.

Suitable oyster growing sites must meet certain standards of salinity, water temperature, current patterns and tide level. Water quality is also important—pollution levels, oxygen concentrations and turbidity can significantly affect the growth of oysters. Another major part of Langdon's research involved planting Suminoe oysters at test sites in Oregon, Washington and Califomia. Monitoring of oyster growth at these test sites is in progress and preliminary results are encouraging, Langdon said.

"The increase in shell length for both the Suminoe and Pacific occurs at roughly the same rate at the various sites," Langdon said. "The increase in tissue, or meat, weight is the key measurement for the oyster industry, and at some sites, such as Tomales Bay, California, the tissue growth rate of the Suminoe is significantly greater than that of the Pacific oyster."

"You either love oysters or you don't."

The fast food industry has raised the standardization of taste to an art. A hamburger at McDonalds in Portland, Oregon, is indistinguishable from one cooked at its counterpart in Portland, Maine. In nature, however, things don't work that way. Oysters grown in one area can differ decidedly in flavor from the same type of oyster grown elsewhere. That's where oysters such as Chincoteagues, Quilcenes and Blue Points get their names. These aren't species of oysters, but oysters that possess a distinctive taste—favored by oyster lovers—attributed to where they are grown.

On the other hand, oysters from a particular area can have an unappealing flavor. This perception may have hindered the Suminoe's acceptance, according to John Faudskar.

"There has been some concern in the industry about the flavor and eating quality of the Suminoe," Faudskar said. "Some Washington growers have contended that the Suminoe has a bad taste. But the same growers tasted the ones grown in Yaquina Bay and concluded that they were very good."

TOM GENTLE

Floating oyster racks on Yaquina Bay hold Suminoe and other species of oysters. Oysters are also grown on the estuary bottom.

Langdon turned to the Sensory Evaluation Lab in the OSU Department of Food Science and Technology to help resolve the controversy over the Suminoe's taste. With funding from the oyster industry, 40 volunteers participated in a blind taste test of Suminoe and Pacific oysters. "You either love oysters or you don't," said Nancy Micheals, manager of the Sensory Evaluation Lab, when recalling the efforts to recruit oyster tasters. To get an indication of the oysters' visual appeal, the volunteers looked at a display of oysters in the half-shell on a bed of ice. For the taste test, the oysters were served two ways, in a stew recipe and broiled.

The results were encouraging. "The participants preferred the appearance of the Suminoe over the Pacific," Langdon said. "The Suminoe looks much like the European oyster, which is considered very attractive," he said. The finding confirmed his belief that the major potential for the Suminoe is in the half-shell trade.

Langdon's research project recently gained a two-year extension. During that time, he expects to resolve questions about flavor and quality differences of oysters harvested from the various growing sites. "We'll have market-sized oysters from our experimental growing sites to test for taste," he said.

But the major thrust of the next two years will be to transfer Langdon's findings to the oyster industry. Several oyster hatcheries in Washington have expressed interest in producing Suminoe seed oysters. Langdon will help them apply the hatchery techniques he and Robinson developed and monitor the growth of the juvenile oysters.

It's difficult to predict how long it will take the Suminoe to establish itself as a significant part of the West Coast oyster industry. It's not likely to displace the Pacific oyster, a proven producer and consumer favorite. But it could find a hearty welcome in areas where Pacifics are difficult to grow. And its reputation as a "summer oyster" may give it an instant niche in the marketplace.

However, it's a good bet that the Suminoe will eventually be as Americanized as its two transplanted oyster cousins, the Pacific and Kumamoto.

TOM GENTLE

During his research, Langdon often visited the nearby Oregon Oyster Company where Suminoe oysters have been grown successfully for many years.

Tom Gentle is a communications specialist for OSU's agricultural communications office.

A FOWL JOURNEY

Phil Whanger knew it would be an interesting flight as soon as he climbed aboard the little propeller-driven, Russian-built airplane. The other passengers stared at him with their beady eyes.

Then they started clucking.

"It was the first time in my life I'd flown with live chickens," says Whanger, a professor in OSU's agricultural chemistry department. "There were 12 of them with their legs tied together. I kinda shrugged and said, 'Gee.' The stewardess grinned and nodded. Then I remembered what I'd said—gee is the Chinese word for chicken."

That flight a few summers ago, which did get the scientist to his destination, illustrates how it's been for him during several research efforts in China: productive and fascinating.

"It's been one of the most rewarding experiences of my life," said Whanger, who grew up on a small farm in West Virginia and began a march toward a Ph.D. in biochemistry after a college biology teacher encouraged him.

The Agricultural Experiment Station researcher studies selenium, a trace element important to animals and humans. The mineral is scarce in the soils of Oregon and several other parts of the country, and other U.S. areas have a high level. Whanger went halfway around the world to study selenium because China is the only place it's known to cause significant human health problems.

"We don't know of any other country with an area as deficient in selenium as parts of China," said Whanger, referring to a long, narrow swath that stretches from southwestern China all the way to Harbin in the northeast of the huge country.

Unlike here, many Chinese eat food grown locally, often in their backyards. Where Whanger went, some suffer from a potentially fatal illness called Keshan disease, caused by selenium deficiency. The heart overworks trying to compensate.

Collecting and analyzing blood and urine samples, with the help of Chinese collaborators, gave Whanger an unusual opportunity to study how selenium behaves in the human body, especially a body that doesn't get enough.

That's not all. There's an area in southcentral China with a much higher than normal level of selenium. Villagers burn soft coal filled with the mineral. The smoke covers their food, and selenium poisoning can be a serious health problem.

Whanger compared blood and urine samples from the areas with low and high levels of selenium with samples from an area in China with an average selenium level. The research has applications here, as well as in China.

"A lot of people in this country think they aren't getting enough selenium, and selling selenium supplements is getting to be a big business," said Whanger. "Others are afraid we get too much selenium. Really, our knowledge of selenium needs is very spotty.

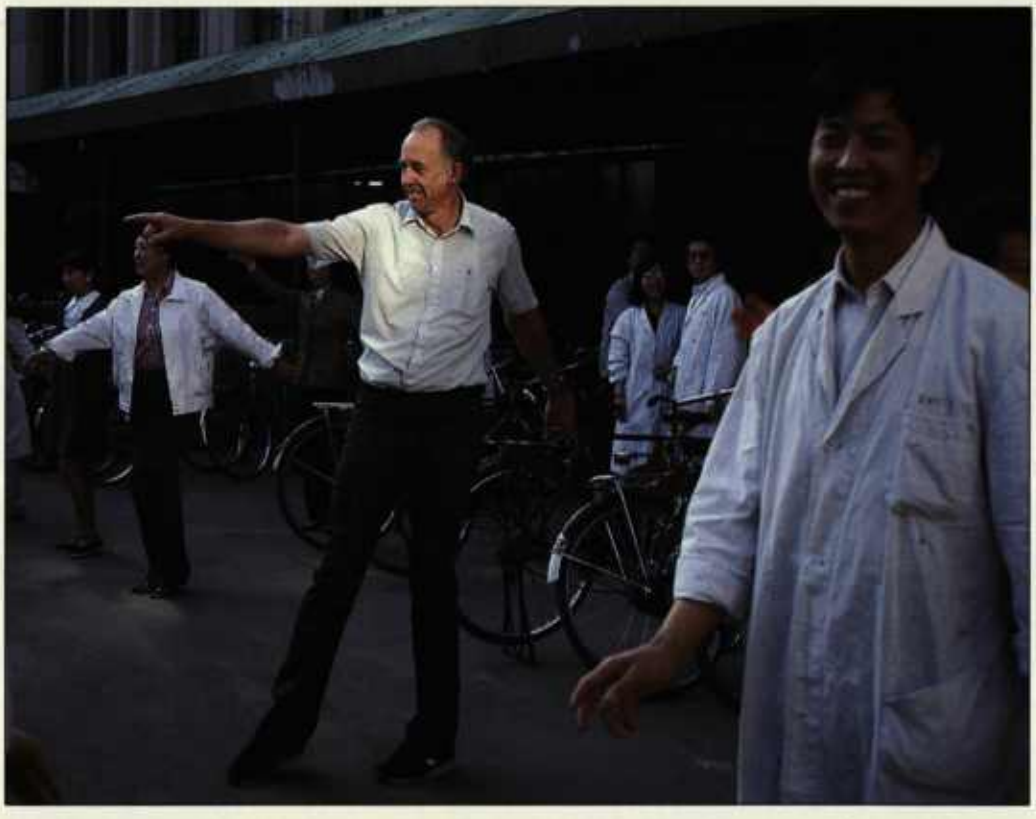
"The work in China is helping us fill in the picture of how selenium affects the body. That picture exists for iron and vitamin C and other familiar substances. Also, we've developed some diagnostic tools that will be helpful," he added.

A bonus, in the view of Agricultural Experiment Station director Thayne Dutson, is that grants from agencies such as the National Institutes of Health pay for Whanger's foreign work. Dutson points out that Whanger brings dollars into the state that support graduate student research and buy equipment used for many purposes. That includes Whanger research focused directly on Oregonians, such as a study he did of selenium needs of pregnant women.

Next?

"We want to go back to China and use stable isotopes (nonradioactive tracing materials) to study selenium metabolism in people in the same areas," he said. "The NIH is reviewing our grant proposal."

—Andy Duncan



Phil Whanger joins morning exercisers outside the Chinese Academy of Preventive Medicine in Beijing.

Agricultural Experiment Station
OREGON STATE UNIVERSITY
Corvallis, Oregon 97331
Thayne R. Dutson, Director
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OREGON'S NEW CROP?

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