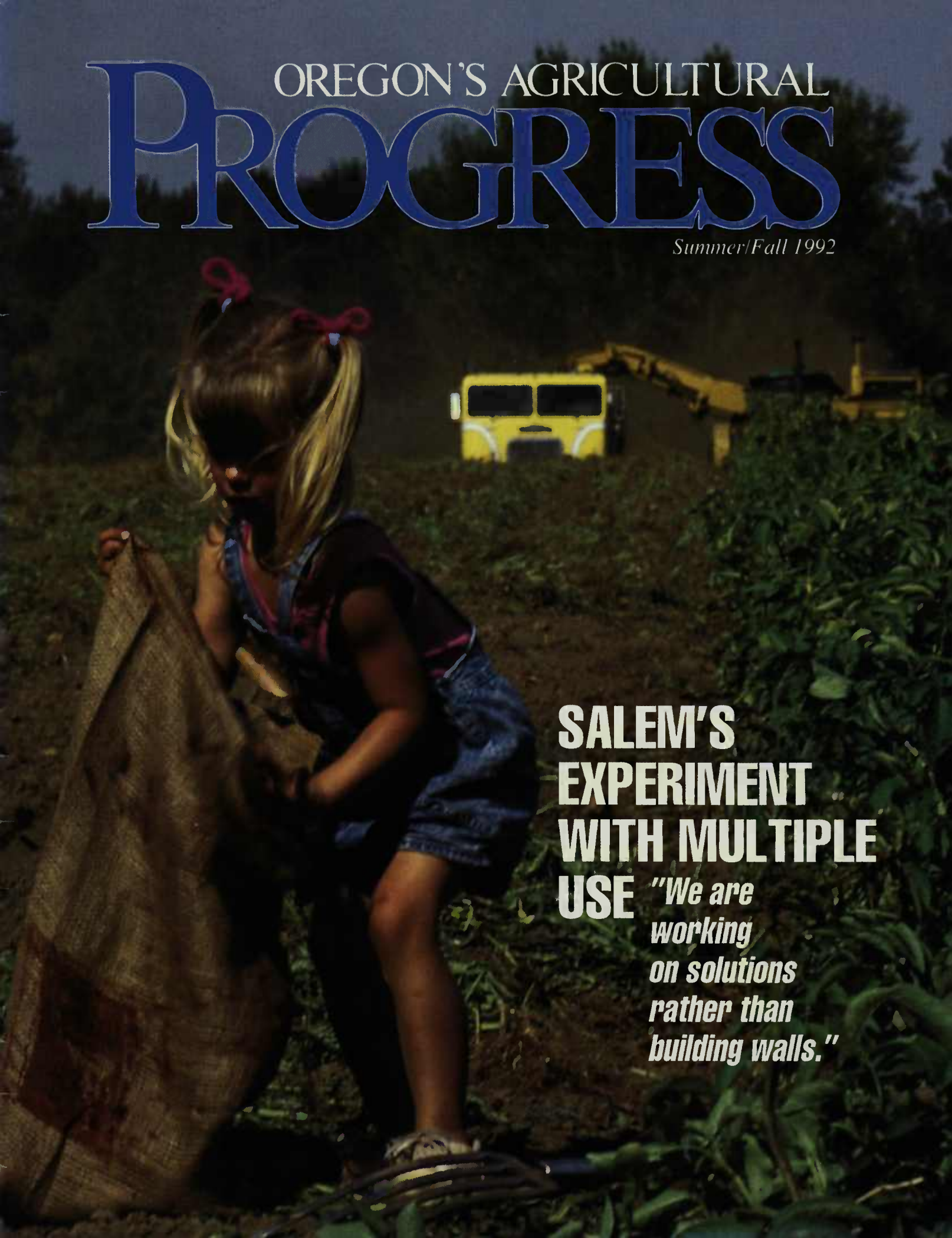
OREGON'S AGRICULTURAL
PROGRESS
Summer/Fall 1992



SALEM'S EXPERIMENT WITH MULTIPLE USE

"We are working on solutions rather than building walls."

THE EDITOR'S NOTE

When I was young my grandparents had a weeping willow in the backyard near their garden. They always said it was my tree. That made me proud. It was one of the reasons I loved to visit them.

One day, when we completed our adventure along the miles of two-lane blacktop and pulled into the familar driveway at 311 West Elm Street, I hopped out of our green Plymouth and ran around to the back of their house. The willow was gone.

I don't remember why they cut it down. I think it had to do with the garden. What sticks in my mind is how dark the world suddenly seemed.

I was nuts about my grandparents. They spoiled me, my sister and my brothers, and I know they would never have hurt me intentionally. But I wish they had talked to me about their plans for that tree.

The garden probably would have won. I think I would have felt better, understanding their reasoning and having my say.

Sometimes, that experience comes to mind when I think of the conflicts we're having here in Oregon. I try to imagine the feelings of people who don't even know each other and are at odds over what's going to happen to a natural resource important to each of them.

I don't remember why they cut it.

I hope you take a look at the article on page 24. You'll read about a park on the edge of Salem. People with diverse viewpoints are working together there to solve a natural resource conflict. Their effort may make *you* proud, or at least hopeful.

Andy Duncan

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Cover: Miranda Yarbarough fills her harvest sack during an educational event at Salem's Minto-Brown Island Park, an unusual blend of agricultural, wildlife and recreational lands. See story, page 24. (Photo: Lynn Ketchum)

Andy Duncan
Editor

Tom Weeks
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MELON BUSINESS

OSU researchers have the components for a new food processing industry in Oregon, including plans for a mechanized melon baller invented by bioresource engineer Ezra Tice. The only problem is, no company has taken the next step.

"This is an opportunity that should be taken advantage of by someone in Oregon," said Gary Reed, superintendent of OSU's Hermiston Agricultural Research and Extension Center. "The research was mostly paid for by the people of Oregon, but if no one takes advantage of it here, the patent on Tice's machine will probably be purchased by one of the two California firms that already wholesale melon balls."

All the melon balls made today are produced by hand and the mechanized melon baller is a significant improvement, said Reed. In addition, he asserted, conditions for producing sweet, firm melons are as good in the Hermiston area as any place in the world, including Japan, where there's a lucrative market for melon balls.

Beginning in 1987-88, Reed, Hermiston-area farmers and researchers on the OSU campus began putting together a plan of action for bringing the melon ball industry to Oregon. Funding sources included the State Regional Strategies Development Program. Reed and Hermiston growers approached Tice, who then developed the idea for the mechanized melon baller.

"I would expect that this machine would cut the balls at least as fast as someone scooping by hand, and maybe up to twice as fast. It's capable of being fully automated. I'm in the process of applying for a patent," said Tice.

ANDY DUNCAN

Hermiston growing conditions are excellent, says Gary Reed.

He added that "wages are extremely low at the facilities in Mexico and Guatemala where melon balls are processed. I've also heard that carpal tunnel syndrome from repetitive scooping all day causes a high turnover in labor."

Tice said several Oregon firms are looking at the machine, and a representative of the Oregon Economic Development Department is trying to support for development of a prototype melon baller that can be tested.

"He's [Tice] done a beautiful job," Reed said. "The machine is something that could fairly quickly be integrated into a roboticized system. It would be a real shame if the patent went to a California firm that is not capable of making the product we are."

WELCOME BACK

Jeff Snyder hopes history repeats itself in Wallowa County.

No one had seen the Columbia sharp-tailed grouse in Oregon in about 25 years until the spring of 1991, when biologists reintroduced the native bird into a piece of its original Oregon home range.

Only a few of the 33 birds released are thought to have survived, said Snyder, a graduate research assistant in OSU's fisheries and wildlife department. Researchers think the high death rate might have been because the grouse didn't know the area and were easy prey for hawks, eagles and coyotes.

Last spring, Synder captured more sharp-tailed grouse in southeastern Idaho for release at the Wallowa County grassland site. He fitted some with lightweight transmitters and, with the help of Nature Conservancy volunteers, monitored them day and night through early fall.

"The survival was much better this year," said Experiment Station wildlife biologist John Crawford, Synder's major professor. "Last spring and again this fall some of the males formed a 'lek' [a display group related to mating]. That's the first sign we've got a population that's starting to function normally.

"We also have an unconfirmed siting of three immature birds, which would indicate reproduction," added Crawford.

Little is known about reintroduction. Some research shows if the process is carried out a minimum of three years, and more than 100 birds are put into fairly good habitat, there's about a 50-50 change of success.

At one time the sharp-tailed grouse was common over most of the Pacific Northwest east of the Cascades. Scientific literature attributes a reduction in habitat to farming, ranching and other human activities, according to Crawford. Today, the bird's distribution is only 10 percent of what it used to be, and there have been no native populations in Oregon since the late 1960s, he said.

Crawford noted that the attempt to reintroduce the bird into eastern Oregon is a cooperative effort of the Oregon Department of Fish and Wildlife, the Oregon chapter of the Nature Conservancy, the Bureau of Land Management, the U.S. Forest Service and OSU.

"I was going along a ridge in Wallowa County this fall and flushed some of the birds," Crawford said. "They got up and really boogied. Wild behavior like that is a wonderful sign. It was pretty neat."

WILLIAM BURKETT

One of Oregon's new Columbia sharp-tailed grouse (a male).

DARK FARMING

Farmers who start working when the roosters crow might be better off listening to night owls.

OSU studies have demonstrated that cultivating the soil during the night can dramatically reduce the germination of certain undesirable weed seeds.

Researchers in the Department of Forest Science found that buried weed seeds may be able to detect a split-second exposure to sunlight during the cultivation process, triggering their germination and growth.

Cultivating the soil at night resulted in a reduction of up to 70 percent in seedling emergence in different grass and broadleaf weeds.

"This approach isn't going to be a panacea for farmers or gardeners who are trying to control weeds," said Ana Scopel, who presented the findings at the annual meeting of the Ecological Society of America. "But it might give them an alternative tool to work with, one that can be combined with other weed controls. It would cost virtually nothing and wouldn't require the use of herbicides."

According to Scopel, seeds from many weeds undergo a period of dormancy after they are released by the plant, as they wait for the proper combination of temperature, moisture, nutrients and light.

In recent experiments, it's been demonstrated that a short period of burial may produce a 10,000-fold increase in the light sensitivity or "very low fluence response" of the seeds. Then, if the seeds are exposed to light even for a millisecond during the cultivation process, a photoreceptor called "phytochrome" promotes seed germination and growth.

This ability to wait for optimum growth conditions—water, light, cultivated soil—apparently evolved over more than 30 million years, she said, and is a key to weed survival.

BOB ROST

A midnight plowing experiment at OSU's vegetable farm.

Field experiments near Corvallis tested the emergence of grass and weed seedlings one month after cultivation in three conditions: cultivation during the day; during the night with some artificial light; and during the night with no light at all.

The artificial lights used in one night experiment compared to those that might be used on the headlights of a tractor, Scopel said, and did not cause any greater weed growth than near total darkness.

When a more bright light was placed directly upon the soil furrows at night while they were being cultivated, weed emergence was about 50 percent of daytime levels.

In another test, researchers draped a plow with covers to keep out as much sunlight as possible during just the cultivation process itself. That daytime experiment produced little reduction in the emergence of grasses but a 40 percent cutback in broadleaf weeds.

"It's clear that not all weed species will respond exactly the same way, and we need to do many more field tests," Scopel said. "However, this could provide a significant new approach to agricultural weed control."

WHEAT FINDINGS

Researchers at the Columbia Basin Agricultural Research Center at Pendleton, operated by OSU and USDA's Agricultural Research Service, have released the results of two studies that may affect Oregon's multi-million dollar wheat industry.

The results concern the cereal cyst nematode and physiologic leaf spot. Each can severely reduce spring and winter wheat yields.

The cereal cyst nematode is a barely visible, worm-like creature that lives in the soil and attacks plant roots.

"Under certain crop or rotational sequences the cereal cyst nematode presents a potentially high risk for cereals in annual-crop regions of the Pacific Northwest," said Dick Smiley, superintendent of the Pendleton branch station. "We measured as much as a 50 percent reduction in yield whenever wheat was grown for a second or third consecutive year. By contrast, optimum wheat yields averaging 100 bushels per acre were maintained whenever an effective rotational sequence was in place."

Smiley's trials involving the pest took place over five years, culminating in August. More details on crop rotations that were effective in controlling the pest are available by contacting Extension Service offices in Columbia Basin counties.

Smiley said chemicals are available to combat the pest, but they aren't an acceptable way of addressing the problem because groundwater in the area is near the surface and there is a risk of contamination.

The OSU plant pathologist also has released research findings about the wheat disease known as physiologic leaf spot.

"Winter wheat in many parts of the world, including the Pacific Northwest, have brown leaf spots of unknown cause," said Smiley. "The disease is called physiologic leaf spot because it is possibly caused by a genetic abnormality in the plant. But that's never been proven."

Studies of other possible causes, such as fungi, bacteria or viruses, have been inconclusive, said Smiley. Yet many Columbia Basin growers attempt to control the problem with fungicides, because the disease appears similar to Septoria leaf spot and tan spot. Those diseases attack wheat in more humid regions like the Willamette Valley and the central and eastern United States.

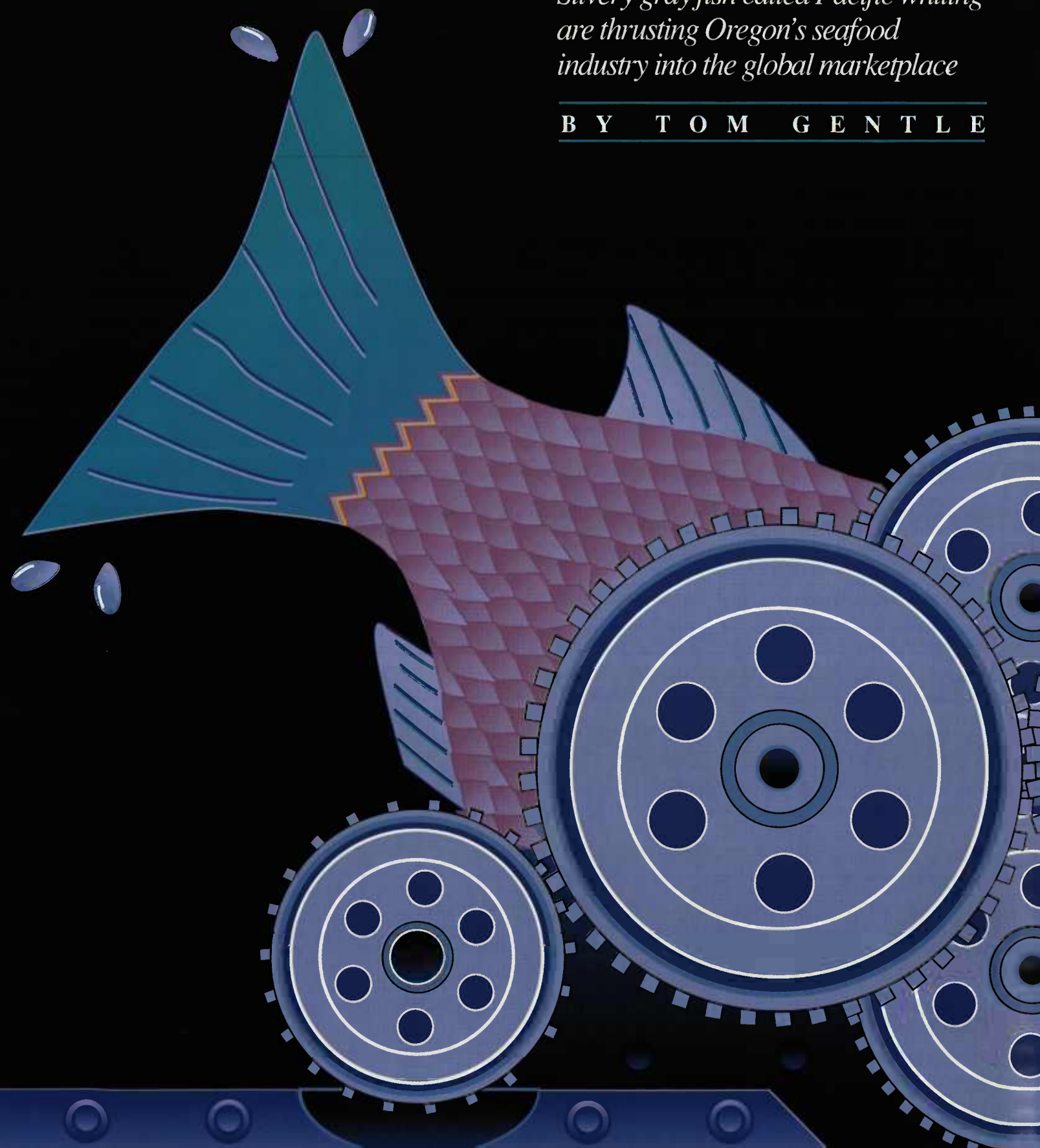
Results from Smiley's research show that the wheat variety most susceptible to physiologic leaf spot is Stephens, followed by Batum, Hoff, Kmor and MacVicar. Resistant varieties include Buchanan, Dusty, Moro and Tres.

"Crop loss from physiologic leaf spot can be reduced by applying urea plus calcium chloride to susceptible varieties, or by growing wheat varieties with low to moderate susceptibility," he said. "Crop rotations should be used to manage this and other diseases."

A GROWTH INDUSTRY

Silvery gray fish called Pacific whiting are thrusting Oregon's seafood industry into the global marketplace

BY TOM GENTLE



Pacific whiting: the most abundant fish off the West Coast; spawns in early spring; huge schools swarm off the Pacific Coast from California to the Gulf of Alaska from spring to early autumn. Most whiting are harvested off Oregon. Formerly known as Pacific hake.

On a sunny morning in late September, two crew members of the trawler docked at the Point Adams Packing Company in Warrenton unloaded a catch of Pacific whiting. While a strong ebb tide swirled around the vessel and seabirds hovered nearby, a large vacuum hose pumped 80,000 pounds of whiting from the trawler and carried it through a connecting pipe to the processing plant a quarter mile away.

Inside the plant, filleting machines sliced the flesh from each fish and whisked the resulting fillets by conveyor belt to machines that removed the skin. From there, the fillets journeyed through a series of shiny, stainless steel machines that ground up, washed, pressed and refined the flesh into surimi, a bland paste-like substance that could be mistaken for mashed potatoes if you were anywhere but in a fish plant.

"Welcome to Oregon's new Pacific whiting fishery," said Michael Morrissey, a food scientist and director of OSU's Coastal Oregon Marine Experiment Station Seafood Laboratory in Astoria.

TOM WEEKS

Morrissey and his colleague Gil Sylvia, an Experiment Station economist at the OSU Hatfield Marine Science Center in Newport, have become experts on whiting and surimi made from whiting as part of a cooperative effort by industry, government and the university. Their research and the work of others from the Oregon Sea Grant Program, the Oregon Department of Agriculture, the Oregon Department of Economic Development, the Oregon Coastal Zone Management Association, and private consultants have made Pacific whiting this year's wonder fish on the Oregon coast.

A new $4 million plant opened in Newport.

Consider what happened in 1992. Two fish processors in Newport—in addition to the Point Adams plant near the mouth of the Columbia River—invested millions in surimi manufacturing equipment. A new $4 million plant opened in Newport to turn whiting and other seafood waste into fish meal.

Just a year before, these developments would have been unimaginable. Then, no seafood plant in Oregon was capable of making surimi. Processors and coastal officials were trying to figure out what to do with the seafood waste that would be generated *if whiting processing actually became a reality.*

Investment in 1992 wasn't limited to the processing sector. More than 30 trawlers were modified—at a cost up to $250,000 each—to bring whiting to port.

Economic benefits to the coastal economy from the fledgling whiting industry are estimated at $30–$50 million a year.

"Because it's harvested in such large volumes and can be sold in so many different product forms, whiting has thrust the Oregon seafood industry into the global marketplace. By historical standards, the quantity of fish coming ashore is much larger than Oregon has ever experienced and more than the regional market can absorb," said Sylvia, whose comprehensive study of whiting markets provided information about the economic potential of this silvery gray groundfish.

GINNY GOBLIRSCH

Until recently, whiting were considered trash fish because their flesh turned mushy so quickly.

TOM GENTLE

A trawler unloads whiting at the Point Adams Packing Company dock at Warrenton on Oregon's northern coast. OSU researchers have identified after-catch practices that combat the mushiness problem.

Most U.S. consumers remain unfamiliar with whiting products, even though they may have consumed them as breaded fish sticks or imitation crab. Whiting marketed under its own name has not had widespread acceptance in the American marketplace until recently. On the other hand, whiting is a popular seafood item in eastern and western Europe, Russia and the Third World.

Whiting product forms include headed-and-gutted whiting and whiting fillets sold on the fresh retail market, frozen blocks of fillets that go to restaurant chains and other institutional users, and surimi, the minced fish flesh used to manufacture imitation seafood items such as crab and shrimp.

Although the fishing industry has had its eye on the vast whiting resource for a long time, it wasn't until the late 1980s that the industry, headed by Barry Fisher of Newport, convinced the Oregon legislature to fund a study that would lead to a shore-based whiting fishery.

"Leaders in Oregon's fishing industry knew they had a narrow window of opportunity. If shore-based vessels and processing plants failed to take advantage of it, catcher-processors from Seattle and Alaska would harvest the resource, and any possibility of onshore processing and its economic benefits would be lost," Sylvia said.

The loss would have involved more than jobs on fishing boats and in seafood plants. The frozen blocks of whiting as well as surimi are used as raw materials by secondary manufacturers who turn them into a variety of seafood-based products.

"The long-term goal is to attract these secondary processors to locate on the Oregon coast where they will have access to a large, stable supply of whiting," said Sylvia.

But before any of these whiting dreams could come about, some serious problems with the quality of whiting had to be solved.

"When [Pacific whiting] die, their flesh turns to mush unless the fish are chilled to near-freezing and processed within a few hours." John Bragg, fishing industry writer.

While writers often refer to it as the mush problem, food scientists tend to talk in less dramatic terms of "soft texture." It's not a problem of food safety, according to Morrissey, but rather one of food quality.

"The Pacific whiting is different than any other fish. Pollock or rockfish can be kept on ice for several days and still retain their quality. But after three days on ice, more than 50 percent of whiting develop soft texture defects," Morrissey said.

TOM GENTLE

OSU lab technician Lewis Richardson puts whiting mince through a refiner to remove small particles and fat globules.

The culprit that causes the flesh to soften is an enzyme, known as protease (pro-tee-ace), in the flesh of the whiting. The enzyme does not present the same problem for at-sea processing because the delay between catching and processing is minimized. In order for a shore-based whiting industry to succeed, some way had to be found to resolve the soft texture problem.

"We knew it was connected with temperature and time. Whiting has to be cooled to near freezing and kept there or the flesh will go bad. And the longer the fish sit around, even on ice, the worse they get," Morrissey said.

He and Sylvia received a $100,000 grant from the Oregon Department of Agriculture's Center for Applied Agricultural Research and the Oregon Trawl Commission to investigate quality guidelines that would allow trawlers to land whiting onshore. The staff at the Seafood Laboratory began testing whiting that had been caught and landed under various time and temperature conditions.

Based on their findings, they recommended a number of practices to ensure the quality of the whiting brought to shore plants. First, they advised day trips so whiting could be delivered to the processing plant within 6–18 hours after bringing the fish aboard. They also stressed the importance of cooling the fish immediately to near freezing and constantly monitoring the temperature.

TOM GENTLE

Right: Michael Morrissey, left, director of the Seafoods Laboratory at Astoria, chats with a commercial trawler captain. The lab is part of OSU's Coastal Oregon Marine Experiment Station.

"The time limitations give trawlers time to make two separate tows with their trawl net, bringing in from 40,000 to 60,000 pounds with each tow. That's less than trawlers are capable of bringing to port in one trip, but they make it up by making several trips a week," said Morrissey.

Benefits to the coastal economy are estimated to be $30–$50 million a year.

The handling and care required to bring quality whiting to shore also involved a new way of doing business for fishermen and processors. "They had to cooperate to a greater degree than ever before. Boats have to catch, refrigerate, and deliver within strict time limits. Processors have to offload and process quickly. And the fish temperature has to be carefully maintained the entire time. Boats can't come in at the same time. Everything has to be scheduled," Sylvia said.

Surimi: a deboned, washed, refined mince resembling fish paste; normally made from a whitefish such as Alaskan pollock. It has no odor or taste, but is high in protein. By adding different flavors and ingredients, it can be made into a variety of food products.

Surimi, or rather the price of it, helped hasten the establishment of Oregon's shoreside whiting industry. In 1991, the price jumped from 80¢ to $2 a pound. Until then, most observers, including Sylvia and Morrissey, assumed whiting processed on shore would be sold in various frozen forms and the transition into surimi, because it involved considerable investment, would be more gradual.

"The price of surimi caused shore-based whiting to occur much faster than we thought," said Morrissey. He and Sylvia realized that their research on time and temperature limitations on post-catch handling of whiting would have to be extended to surimi.

Morrissey strengthened the Laboratory's surimi research capability by bringing in two new food scientists, Haejung An, who specializes in seafood biotechnology, and Jae Park, who spent several years with the largest North American producer of surimi seafood.

Research on surimi and whiting was not new to the Seafood Laboratory. Dave Crawford, Morrissey's predecessor as director, was one of the first researchers in the United States to apply food grade inhibitors at the final stage of the surimi process to stop the action of the protease enzyme.

"Without the discovery of protease inhibitors, it would have been impossible to make acceptable market quality surimi from whiting," Morrissey said.

TOM GENTLE

Morrissey and Dongdong Lin, an OSU graduate student in food science, discuss a test of surimi texture.

TOM GENTLE

Quality is determined by texture and cohesiveness. This cooked surimi is undergoing a torsion test.

Several different materials derived from animal or plant sources are used as inhibitors, including beef plasma protein, egg whites and potato starch extract.

The Laboratory investigators began making batches of surimi from whiting that had undergone a variety of post-catch time and temperature conditions. Their aim was to determine how long whiting could be out of the water and the flesh temperature that had to be maintained in order to make quality surimi.

Their findings reinforced their earlier conclusions about post-catch handling of whiting intended for fresh or frozen products. The greater the care and attention given to post-catch time and temperature recommendations, the higher the quality of surimi that resulted.

"We recommended to fishermen and processors that they should start the surimi process within 24 hours from the time the fish are first brought out of the water in order to produce a quality product," Morrissey said. "And the temperature of the fish must be constantly kept close to 32 degrees without allowing it to freeze." Freezing destroys the muscle proteins that must be intact in order to make surimi.

The recommendation, while appearing simple, puts considerable pressure on the fishing endeavor because of the huge amount of fish—40 to 50 tons—each vessel catches on a one-day trip. A delay at any point in the process raises the risk that the final product, whether fresh,

frozen or surimi, may not meet market quality standards.

In addition to time and temperature considerations, the researchers wanted to determine the effect the enzyme inhibitor would have on what is called the "gel strength" of the surimi. When surimi is heated, it forms a gel that is elastic and has a texture similar to cooked crab. The strength of this gel is measured by a torsion test in which a small piece of the gel is twisted until it breaks.

There are several grades of surimi based on gel strength, according to Morrissey. Their findings indicated that protease inhibitors not only allowed the production of higher grades of surimi, but actually improved the gel strength.

"We also found a close correlation between careful post-catch handling and gel strength. The more care that is taken and the sooner the whiting is processed, the better the chance of producing quality surimi," said Morrissey.

Research on whiting and surimi is far from over at the Seafood Laboratory. Investigations are continuing into the effects of different vessel refrigeration systems on whiting quality and whether the amount of fish caught in each sweep of the trawl net causes undesirable bruising. They also want to find out if there are seasonal variations in whiting quality.

Perhaps most significant, they have begun research that represents the next step in the economic development of the whiting industry. In July 1992, the Seafood Laboratory researchers received a grant of $115,000 in state lottery funds to develop value-added products made from Pacific whiting.

TOM GENTLE

OSU food scientist Haejung An uses a process involving ultraviolet light and an electric field to learn more about how enzymes affect surimi.

TOM GENTLE

Gil Silvia, OSU marine economist, provided market information that demonstrated the potential for a shore-based whiting industry.

Whiting Allocation: Preferred option for long-term allocation of Pacific whiting provides priority for vessels delivering to shore-based plants. — Pacific Fishery Management Council newsletter, September 1992.

Early in the development of the West Coast whiting fishery, the question of who would get to harvest it, at-sea or shore-based interests, was viewed as an either-or proposition. There was some basis for that viewpoint in the use-it-or-lose-it provisions of federal law, which require that preference be given to U.S. fishing interests who can demonstrate a capacity to use the fish.

Investments in research are paying off.

As recently as 1990, shore-based interests couldn't show such a capability, and no doubt the weight of the law supplied the motivation for them to catch up with the offshore proponents with utmost speed. But as the whiting industry has evolved, it is obvious that in the future, the two sides will share the catch.

For Gil Sylvia, the important thing is that the shore-based fishermen have a guaranteed opportunity to catch whiting. "We need a secure supply of whiting over a long period, otherwise processors and secondary manufacturers won't risk the investment in new plants and equipment," he said.

For the local ports, the shore-based whiting fishery means there will be regular fish landings from April through November, providing steady employment. And for the trawl fleet, a guaranteed share of the whiting harvest will provide a much needed alternative to catching other species that have already suffered from being heavily fished.

For the university, some long-term investments in research combined with more immediate applied research are paying off, said Sylvia. And for the private sector, state government and the research community, the vision of a whiting industry on the Oregon coast is becoming a reality.

Tom Gentle is a communications specialist in OSU's agricultural communications department.

THE SMELL OF DEATH

Frogs and other amphibians are mysteriously disappearing in the Northwest, the Rockies, Australia, Great Britain and elsewhere. Oregon has become a nerve center for the scientists studying why

By Dave Stauth

In the flatland of the Willamette Valley, it was a sweaty-hot day with no nonsense about morning clouds or a cooling breeze. Just a dry, bright heat that started early and stayed late.

It was typical weather for a western Oregon day in early August. But this wasn't August. It was the first week of May and temperature records that had stood for a hundred years were falling all over the state.

The weather person, of course, had some simple explanation about a "high pressure system," and cheery advice to break out the bathing suits.

But this day also came on the heels of the balmy non-winter of 1991-92. And that winter came on the heels of years of drought. You begin to wonder, "What's going on here?"

On that same, sweaty-hot May day near Santiam Pass in the central Oregon Cascade Range, Lost Lake sat doing a slow bake in the noon sunshine.

Despite the 3,000-foot elevation, the snow had long since melted, and the sun seemed to burn through the thin air with a special intensity. A couple of tourists stopped to look around before prudently retreating to their air-conditioned car.

The lake does help cool things off somewhat, and it's pretty. In the early morning elk come down to the shore to drink. Osprey swoop over the water and fish for rainbow trout. A campground takes advantage of the solitude and scenery.

Right: The Cascade frog lives mostly in mountain ponds and marshes. The Northwest native is doing poorly in some areas and has disappeared from others. (Photo: Dan Lamont)

But then, there's this massive black puddle on the far side of the lake.

On closer inspection, the first thing you noticed was the noise, a loud-but-dull droning, the kind of ominous buzzing noise you might hear in a Hollywood movie like "Revenge of the Killer Bees." It was from swarming flies, big flies, hundreds of them. They were feasting.

On still closer inspection, you noticed the smell.

It was coming from nearly 3 million rotting eggs of the western toad. This wasn't some theoretical health threat posed by a computer model, or something that might happen 50 years from now. It was a big, black puddle of death. It stank. It was nauseating. The flies, of course, were in a state of bliss.

Again you wonder, "What's going on here?"

A lot of people are wondering things like that, all around the world. Among the curious are scientists at Oregon State University, including Agricultural Experiment Station researchers.

Frogs and toads and other amphibians are dying, all around the world. No one is certain why. There's probably no single answer, but some of the suspects are ominous. Those same forces might affect sea life in the oceans, they might affect crop agriculture or forest health. They might ultimately affect you.

DAN LAMONT

OSU zoologist Andrew Blaustein studies amphibian survival in his campus laboratory, as well as in the field.

"This is the fourth year we've had a massive die-off."

Whatever it is, it's sure as hell affecting the frogs. Right here, right now.

"We probably lost 90 percent of the toad eggs in this year's hatch," said Andrew Blaustein, an OSU professor of zoology, as he gingerly stepped around the puddle of death at Lost Lake.

"A normal mortality rate for toad eggs would be about 5 percent or less," Blaustein said. "And this is the fourth year in a row we've had a massive die-off like this. Every year we're seeing fewer and fewer amphibians here. If the babies keep dying, eventually the populations will go extinct."

A fungal infection on the toad eggs at Lost Lake appears to be at least part of the problem, but Blaustein doesn't think the problem is nearly that simple. It's just as likely that something else is weaken-

ing the eggs and making them vulnerable to a fungus, he said. Eggs that were brought into a laboratory, living in exactly the same lake water, have had a 100 percent survival rate and turned into a happy swirl of tadpoles.

And a particular fungus in a particular lake of the Oregon Cascade Range doesn't explain the hundreds of thousands of tadpoles that have died in another mountain lake five miles to the north. Or the western spotted frog, once the most abundant frog in the Willamette Valley, that has become extremely rare within the past 20 years.

Or the amphibians that have died or gone extinct in the Rocky Mountains of Wyoming, the rain forests of Costa Rica, the mountains of Australia, the plains of Great Britain, the valleys of California.

The search for some answers is now picking up speed fast, for a fairly obvious reason. If the amphibians are going now, what will be next? And why? Is this an early indicator of something seriously wrong in the global environment?

A researcher at the University of California at Berkeley put it this way.

DAN LAMONT

DAVE STAUTH

Frog eggs rotting in Lost Lake.

"Amphibians were here when the dinosaurs were here, and they survived the age of mammals," said zoologist David Wake. "They are tough survivors. If they're checking out now, I think it is significant."

Corvallis, Oregon, has in one way become the nerve center of the whole operation. Last year, it became home to the "Task Force on Declining Amphibian Populations," a collaborative effort of OSU's Center for the Analysis of Environmental Change, the U.S. Environmental Protection Agency, and the International Union for the Conservation of Nature.

Different researchers are looking at a lot of different, possible causes. It might be acid rain in some places, but clearly not in all of them. It might be habitat destruction, pesticide pollution, an increase in natural predators, higher temperatures due to global warming, natural periodic fluctuations, droughts. And one possibility–one that has everyone involved more than a little concerned–is that this phenomenon could be linked to rising levels of ultraviolet blue radiation, or UV-B light, a natural component of sunshine.

It's tough these days to keep track of your environmental threats without a scorecard. There's global warming, also known as the greenhouse effect. There's air pollution, water pollution, heavy metals, PCBs, nuclear waste, soil erosion. There's the concern about biodiversity and spotted owls.

Left: Blaustein, second from right, and associates search for frogs in Lost Lake near Santiam Pass. The others, left to right, are Susan Walls, a postdoctoral student; Dede Olsen, a Forest Service biologist; and Beth Livermore, a free-lance writer.

But a rising star among these players is stratospheric ozone depletion. You've probably heard of it before. In the next few years you'll be hearing about it a whole lot more.

Researchers figured out, at least in the laboratory, that some of the chemicals we've routinely used in the past few decades, especially chlorofluorocarbons released from devices like refrigerators and automobile air conditioners, can deplete the Earth's protective ozone layer. For elaborate chemical reasons they eat up the ozone molecules that tend to shield us from UV-B radiation.

An ozone "hole" has already been documented over the Arctic, and there's mounting evidence that ozone is also being depleted at mid-latitudes, meaning where you live. Some measurements in Switzerland—almost exactly the same latitude as Oregon—found a 1 percent per year increase in UV-B radiation each year between 1981-89.

The implications? Without qualifying things more than necessary, it appears high levels of UV-B can have a direct impact on phytoplankton, the minute animal and plant life that is the nutrientional base for practically all higher marine life in the oceans. It can reduce crop yields. It can reduce tree growth.

"Amphibians were here when the dinosaurs were."

It can suppress the human immune system. It can cause cataracts. And it can cause cancer.

The United States right now is in the midst of an epidemic of the most deadly form of skin cancer, melanoma. Last year it killed 6,500 people. If you want a simple answer for the cause, just look up in the sky.

That's what Andy Blaustein was doing on that bright, sweaty-hot day in May. Squinting against the hot sun, going over some field experiments and trying to figure out what was killing all those toad eggs.

"This is one of the first field experiments to ever test the effects of amphibian exposure to UV-B light," Blaustein said. "We use different filtering screens and several control plots to see how natural sunshine, with and without its UV-B component, affects these toads."

The toad populations at Lost Lake have been studied for many years. Only about 2 to 5 percent of the eggs usually

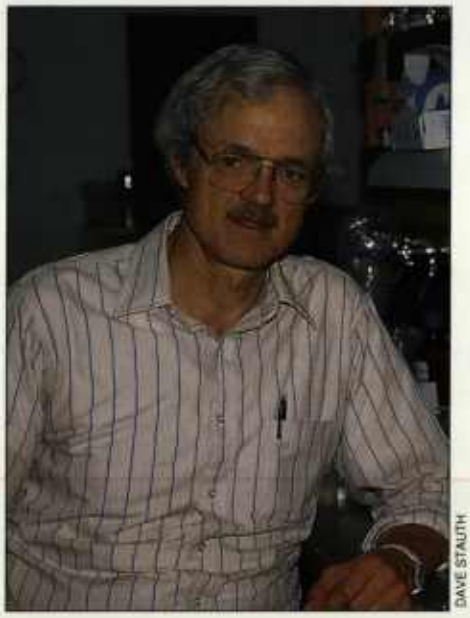
die. It's routine, after the toad eggs hatch, for 99 percent or more of the tadpoles and juvenile toads to die by predation or other causes. The few toads that survive can live 20 or 30 years, and those adults are about all that's currently sustaining this population.

"This year is the worst it's ever been," Blaustein said. "More eggs were laid, but more than ever are also dead. If this keeps up, eventually this species is going to be in trouble. And eventually is coming up fast."

"Just look at this," he said. "It really stinks, doesn't it?"

Blaustein is working on this project with zoologist Frank Moore, who studies reproductive endocrinology, and Agricultural Experiment Station molecular biologist John Hays. Hays studies the way in which organisms can tolerate and repair damage to their DNA, the very genetic basis of their life processes.

"It's not new news that UV-B light can damage DNA, whether it's in plants, animals or humans," Hays said in his Corvallis laboratory. "For quite some time we, along with many other laboratories, have been studying the mechanisms by which organisms can tolerate and repair damage to their DNA."



DAVE STAUTH

OSU molecular biologist John Hays theorizes that vanishing frog species have less capacity to repair damage from UV-B light.

One enzyme has been identified, Hays said, that recognizes a "photo-product" in DNA caused by UV-B exposure. This enzyme, photolyase, recognizes the photoproduct in order to remove it, since it can interfere with the DNA's ability to replicate itself or express its genetic information, and in at least some animals has been shown to be carcinogenic.

"This is a classic example of plant and animal evolution to combat a threat," Hays said. "Some humans suffer from a hereditary disease in which DNA repair mechanisms don't work. They have a 100 percent incidence of skin cancer by the age of 20."

Less is known—and Hays is trying to fill that gap—about the extent to which frogs and other amphibians have these

A GLOBAL GLANCE

Here's a brief look at some of the world's frog problems. The information came from researchers at several U.S. universities and federal agencies.

- The western spotted frog, abundant in Oregon as recently as the early 1970s, has become extinct in western Oregon and Washington.
- Up to 40 species of amphibians in Costa Rica are now endangered, and the golden toad has almost disappeared from a protected national park in that country.
- The red-legged frog, once among the most common frogs in California, has disappeared or is in rapid decline across the state.
- In the mountains of Australia, the gastric-brooding frog has apparently become extinct.
- In Oregon's Willamette Valley, breeding populations of the red-legged frog have become extinct.
- Boreal toads that used to clog hiking trails in the Rocky Mountains of Wyoming are now scarce.
- Frogs and toads have disappeared from relatively undisturbed ponds and lakes in Colorado, Arizona and New Mexico.
- In the Sierra Nevada mountains of California, yellow-legged frogs have disappeared from 98 percent of the lakes in which they were found in the mid-1970s.
- In Great Britain, the natterjack toad is now virtually extinct from lowland heaths that formerly supported half of its populations.
- Salamanders have been reported as declining in Mexico, toads in Peru and several species of frogs in Brazil.
- Rapid amphibian declines have been reported in central and northern Europe.
- Disappearances of frogs, toads and salamanders have been cited in areas of North America, Central America, South America, Europe, Asia, Africa and Australia.

—D.S.

DAN LAMONT

Left: Some think the bullfrog, an introduced predator, reduced the Willamette Valley's population of red-legged frogs

DAVE STAUTH

Blaustein with trays of frog eggs used in a study of the effects of solar radiation.

DAN LAMONT

Grant Hokit, a zoology graduate student at OSU, conducts a frog census at Scott Lake. He'll compare his finding with historical records.

DAVE STAUTH

In reproduction, a male toad latches on until the female drops her eggs. Then he releases sperm.

mechanisms to tolerate UV-B exposure and repair damage from it.

"It appears a frog's ability to repair UV-B damage is fairly high," Hays said. "So we're measuring the repair capabilities of different species, some that are apparently declining and others that aren't. Our hypothesis is that vanishing species will have less repair capacity than those that are doing okay."

UV-B is a serious issue, Hays said, and not just because of frogs.

"Atmospheric scientists predict that we'll ultimately face a 20 to 50 percent increase in DNA damaging radiation, just from the ozone damage the atmosphere has already incurred," Hays said. "That will be pretty hard to avoid."

Clearly this could affect humans. It could affect many other animal species. And the U.S. Department of Agriculture has been funding most of Hays' work because it would also affect crops.

"One study has shown a 20 percent decrease in soybean yields under anticipated levels of UV-B exposure that are pretty realistic," Hays said. "And plants can't very well wear a sunscreen."

Are existing levels of UV-B light affecting the frogs? Hays is far less certain.

This could be linked to ultraviolet radiation.

"The current levels of UV-B increase have been very low so far," Hays said. "Let's say they've gone up 1 or 2 percent. I have a hard time believing that 1 or 2 percent would be enough to cause a major problem to organisms with a healthy UV-B repair mechanism."

Because of those uncertainties, researchers all around the world are hedging their bets. That's partly where the new "Task Force on Declining Amphibian Populations" comes into play.

"One of our primary goals is a data base to scientifically quantify amphibian populations and changes in them, both from now on and with a historical perspective," said James Vial, director of the new task force in his office at the Corvallis EPA laboratory. "The problem is serious, but it's important to determine whether it's a natural phenomenon or an indicator of some other environmental impact."

Dozens of "study groups" around the world are becoming involved in this research and monitoring, Vial said. Suspected causes of the frog decline range from UV-B radiation to pollutants called organophosphates in products like laundry soap, predators like bullfrogs introduced into areas where they aren't native, and natural fluctuations in frog populations. The potential avenues of vulnerability are many, Vial noted, because amphibians live on both water and land, have permeable skin and are sensitive to contaminants.

The mystery, so far, remains unanswered. So the work continued on that sweaty-hot May day at Lost Lake, where the bell had already tolled for the toad eggs in the puddle of death.

What killed them? How? Why?

Who's next?

Dave Stauth is a writer in OSU's news and communications services office.

BY ANDY DUNCAN

GUNS AND HOSES

Welcome to the offbeat world of federal excess equipment, where the Experiment Station is almost literally beating swords into plowshares

On a day in early fall, wake-up calls shatter the 4:30 a.m. quiet in four rooms at the Pony Soldier in Kent, Washington, just south of Seattle. Four figures rise, dress quickly and meet in the motel's lobby. By 5:45, though it's still dark, they've had coffee and doughnuts and driven a few miles north on Interstate 5 to the headquarters of one of this country's largest defense contractors, Boeing. Like eager beavers at a garage sale, the four early risers enter a huge warehouse, as long as a football field, and begin looking over an odd assortment of goods—plywood, electrical wire, computer printers, water distillers, sheet metal, steel and aluminum pipe, oscilloscopes, cars and trucks, bolts originally intended for the construction of B-2 bombers. By 7, when Boeing officially opens, the four have picked out what they want and are loading their trucks and trailers. Soon they're back on the freeway headed to Fort Lewis, a U.S. Army base near Tacoma, where they'll do it all again.

"When we work in the Seattle area, we usually go the night before so we can start early and get home the

TOM WEEKS

same day. You never know what's going to happen. On that particular trip, I didn't get back to Corvallis until about 1 a.m.," recalls Van Volk, associate director of OSU's Agricultural Experiment Station.

Volk chuckles (gallows humor, apparently), then continues. "Our trailers were really loaded. One of them blew a tire about 25 miles north of Kelso and there was no spare. I stayed with the vehicle. Gene [Mielke, superintendent of the Mid-Columbia Agricultural Research and Extension Center at Hood River] and Lowell [Fausett, an architect and drafter with the experiment station] went off to look for another tire."

There was a surprise waiting for them farther south.

"We went in an Exxon service station down at Castle Rock and ran into Ned [Chestnut, a technician at the Hood River branch station and driver of another truck and trailer]," says Mielke. "He'd gone on ahead of us and had blown a fan belt. I won't go into all the details, but Lowell and I finally ended up in Kelso at what looked like a burned-out gas station. It was closed, but we'd heard they had a bunch of used tires and we got in touch with the owner by phone and found out one of his employees was nearby at a restaurant. That's how we finally got a tire that would work."

"They're using torpedo shipping cases as cattle feeders."

Welcome to the slightly offbeat world of federal excess equipment procurement. You might consider this odd territory for university types—a place where "street smarts" are more important than "book learning." But some entrepreneurial Experiment Station administrators, technicians and scientists like it just fine.

"The bottom-line goal is to upgrade the quality of research our branch station and on-campus scientists can do for Oregon taxpayers," says Volk, who in 1988 got the experiment station involved in what's officially known as the Federal Excess Personal Property program.

"The chair I'm sitting in is excess property. That cabinet over there is excess property. There's no doubt in my mind," he adds, "that it's allowed us to upgrade facilities when there wasn't money to buy what was needed—the potato processing lab at Klamath Falls, the computer lab at Hermiston, the labs and conference room at the North Willamette station. It's hard to drop everything and go on one of these runs. But I'm convinced it's cost-effective."

Volk credits Kelvin Koong, a former Experiment Station administrator now head of OSU's Department of Animal Science, with helping get the Station involved.

TOM GENTLE

Cattle at OSU's branch agricultural experiment station at Burns munch on hay from what used to be a torpedo shipping case.

BOB ROST

Ned Chesnut, a technician at OSU's Hood River branch station, buries old fruit with a snow cat that came from the Bonneville Power Administration.

"Kelvin mentioned the program to me. I think that's where the idea first surfaced," says Volk. "The next thing I did was go to some training in Lexington, Kentucky."

Volk learned that when an agency or department of the federal government declares property as excess, there's a pecking order for who can get it. First dibs go to others in that unit. Then other federal units get their turn. Oregon's Agricultural Experiment Station qualifies because it is part of a national network affiliated with the U.S. Department of Agriculture's Cooperative State Research Service (CSRS). If no federal agency wants the property, it's made available to state agencies, which have to pay. Excess property goes to federal agencies at no charge (although paperwork, travel and shipping cost money, Volk stresses).

Betty Bolt, a property manager with CSRS, "has taught me a lot about how things operate," says Volk. One of the keys to success is figuring out where there's property in your region that you want. Volk zeroes in on military and other government facilities in the Seattle, San Francisco Bay and Boise areas, although he's obtained property in Utah and elsewhere. Another key is persistence.

"The GSA [General Services Administration] sends me screening sheets regularly—for example, lists of items turned in by Boeing contractors. A lot of times there's not enough description for me to have any idea what an item really is. We mark the ones we think someone here might be interested in. I go to Seattle to screen every couple of months or so. I like to take a team. Someone good in electronics. Someone who knows about maintenance shops and auto mechanics. Technicians—people like Ned Chestnut at the Mid-Columbia branch station and Joel Swindlehurst at the Burns station—tend to be better than scientists.

"Some of the branch station superintendents are good, too—Gene Mielke, for example. He's ingenious and super in electronics."

Another key to success is imagination, Volk contends.

"How can we use something the Army or Navy had made for another purpose?" he says. "Over at the Burns station they're using torpedo shipping cases as cattle feeders. Some people would just see a torpedo case. Say, 'I don't need that.' At Hermiston, they're using huge cabinets we got up at Boeing—about 20 feet long, eight feet wide and eight feet high—to raise insects for research. At Ontario they're using them for seed storage. At Hood River they're using them to house electronic instruments in the experimental orchards."

Calls to branch experiment stations turned up other thoughts about, and examples of, excess equipment use.

"The nice thing is, they're made of aluminum. All the producers who come here to the station on tours wonder where they can get them," says Tim Del Curto, an animal scientist at the Burns station.

BOB ROST

Van Volk coordinates the Experiment Station's excess property aquisitions.

He's talking about the torpedo cases Volk mentioned, the ones serving as cattle feeding troughs.

"We have forklifts from the USS *Nimitz*."

"The aircraft engine containers are really neat, too," he adds. "We throw hay in them for our cattle. They're really solid. We have a couple of forklifts [from the USS *Nimitz*, an aircraft carrier] we use to move feed around. We went over to Corvallis and loaded up a pick-up with glassware, beakers and stuff. I don't know where they got it, but it's wonderful. We were like kids in a candy store.

"We got a 5,000-gallon tanker truck that helps us get water to cattle. Also, before, with our smaller trucks, we didn't dare burn [start experimental range fires] without the help of the BLM and local fire departments. Now we can. They have a snowdrift problem up at Union [a research facility near La Grande]. They got a 6x6 military troop transport vehicle. They changed the truck bed and put in a pallet and use it to haul hay. That thing will go anywhere, anytime."

Joel Swindlehurst, a biological sciences research technician at Burns who says his title is "a fancy name for maintenance person," is as enthusiastic as Del Curto:

"Every time a list comes [from Volk in Corvallis], I glance through it. Once I

TOM GENTLE

Dick Smiley, a superintendent of the branch station at Pendleton, douses a fire with water from a truck obtained from an airport. "The truck has been of tremendous value," he says.

just happened to see this freeze dryer Tim needed. Another time I found a centrifuge that had never been out of the crate. Brand new. Picked it up at Fort Lewis. It had come from a VA hospital.

"Metal, my goodness. It's phenomenal. I actually got some titanium once. Found out I couldn't cut it with our tools. I've gotten a lot of strong, light-weight metal probably meant for submarine construction. We use it for things like rebuilding gates."

"You think of Ferrari as making fancy sports cars."

OSU's North Willamette branch station near Portland had a different kind of need.

"When you say equipment most people think of farm stuff," says horticulture researcher Del Hemphill. "But when we expanded here we didn't have any money to furnish the place. Everything in our new meeting room is federal excess, except for one slide projector and screen. Without the excess stuff, we would have had to have some kind of major fund-raising campaign."

Ken Rykbost, superintendent of the branch station at Klamath Falls, has made several excess equipment "runs" with Volk, acquiring vehicles and other gear.

"I've been to Fort Lewis and Boeing, and we've been to California several times," he says. "To me, that's an area that might be more fruitful in the long run. You think of Ferrari as making fancy sports cars. We got a Ferrari rototiller.

JOEL SWICKLEHURST

At the Union facility, they use this military personnel carrier to haul hay.

BOB ROST

Gene Mielke, superintendent of the Hood River branch station, in a military communications center he got at Fort Lewis, Washington. He'll use the device to house equipment for an experiment in a commercial orchard.

It's a big, tough machine. A monster. We use it for little experimental plot areas where we can't use a tractor.

"We got a humongous military heater. Propane. We'll use it in our potato storage facility when we have a severe cold spell. We almost completely outfitted our potato quality lab with excess property."

"My last run when we went across the scales at Cascade Locks we weighed 28,200 pounds," says Mielke, of the branch station at Hood River. "We had all kinds of stuff—steel and aluminum pipe, tubing, bolts, a military tent Fred Crowe over at the Central Oregon station is going to use as an equipment cover.

"We basically haven't bought any sheet metal or aluminum in four years. Our station was one of the poorest, and it's allowed us to repair things we couldn't have otherwise."

The Hood River station, which concentrates on tree fruit research, also has items such as a military ambulance serving as an all-purpose vehicle, conduit and wire used to build tree support systems, a snow cat with blade used for tree removal and pushing brush, and parachutes doubling as tree pollination cages.

The Malheur branch station near Ontario has surplus cars and trucks from the Army and a tractor from Mountain Home Air Force Base in Idaho. The tractor is being used in soil sampling that is part of a study of how to clean up groundwater contamination in the area.

"The excess equipment is useful, but it costs something to go after it. It's a shame we have to do this sort of thing, but budget shortages are pushing us hard," says Clint Shock, superintendent of the Malheur station.

Dick Smiley, superintendent of the branch experiment station at Pendleton, has a similar concern. Smiley says he's been reluctant to devote much time to looking for excess equipment that may not be exactly what his station needs for its grain and other research. But he notes that the station does have some valuable excess equipment, including items acquired years ago through its affiliation with the U.S. Department of Agriculture's Agricultural Research Service. At the top of his list is a fire truck that came from an airport.

"Lightning sparked a fire near one of my long-term experimental plots about 15 miles from the station," says Smiley. "It was going directly toward the plot. Farmers, the co-op and our staff fought the

fire most of the night. Our tanker was used as a nurse truck to refill smaller trucks that could get up the hills. The fire stopped a quarter mile from our plots, saving eight plot-years of data. The truck has been of tremendous value at our station and we also use it side by side with nearby farmers to help save their grain."

Some academic departments on the OSU campus, whose professors do research through the Agricultural Experiment Station, are using excess equipment, too.

"We managed to outfit our new chemical storage facility," says Sheldon Ladd, head of OSU's Department of Crop and Soil Science. "I think it's important to realize some of the stuff available is junk. But sometimes you get lucky. It's worked out well for us."

Van Volk doesn't disagree about the varying quality.

"Occasionally, I've made mistakes," he says. "I went up to Seattle once and froze 8 or 10 small refrigerators to be shipped later. What I saw was good. But someone else got the good ones and we got a bunch of junk. But I would say half of what we get is brand new. For example, it might be material the government was buying for a military project, but the project was cancelled, or cut back. Now they're closing military bases.

"I've seen bolts valued at $200 and really expensive gas chromatographs with exceptionally low prices. All the equipment remains under the title of the federal government and you can turn it in if it isn't working out. Also, I don't pressure anyone to be involved. I try to help if a unit wants to participate. It's not a top down kind of thing."

If a unit does participate, promptness is important, says Volk. "Get up there and get the property fast. You're competing with other agencies."

TOM GENTLE

At the branch station at Ontario, a technician moves potato crates with a military forklift.

TOM GENTLE

Camouflage paint jobs, like on this former military road grader at Burns, are common these days at the OSU Agricultural Experiment Station's branches around the state.

"I'm convinced this pays off for taxpayers."

There are politics, too. "Getting to know the people who run the programs can open doors. It pays off when they call me. I can't be there all the time. I know where there are a bunch of road graders in another state. I'd dearly love to get those for our people. So far I've been able to get two. We need two more. No luck so far. But I'm still trying."

Sometimes, getting a piece of equipment doesn't mean the work is over.

"When Marty [Vavra, superintendent of the Eastern Oregon Agricultural Research Center] got the 6x6 personnel carrier, they outfitted it to haul hay, took it up to Union and we forgot about it," says Volk. "But one day I got a call from some captain in Michigan. He said we got it illegally. I said we didn't. The Army took it up with Boeing and GSA lawyers. They all decided it wasn't worth fighting over."

A chart Volk keeps in his office demonstrates "the bottom line," as he sees it. It shows that since 1988 the Oregon Agricultural Experiment Station has obtained excess equipment worth more than $3.5 million. The next five years look bright, he notes—federal agencies probably will continue to cut back and release excess property. There's even a new national organization called the Users and Screeners Association.

"We don't want to be viewed as scavengers," says Volk. "But agricultural research is vital to Oregon and I'm convinced this pays off for taxpayers. I think a lot of people would agree with me, especially at the branch stations. At some of them you can find excess equipment in almost every room."

SUMMER IN THE CITY

Salem's Minto-Brown project has turned a natural resource confrontation into a demonstration of how agriculture can fit into an urban environment

BY CAROL SAVONEN

The situation was about as potentially explosive as a powder keg near a lit match. In the fall of 1989, the Salem chapter of the Audubon Society became concerned about pesticide spraying in Minto-Brown Island Park, Salem's 883-acre city park, a unique blend of agricultural, wildlife and recreational lands.

Since 1970, farmers, hikers, joggers, birdwatchers, bicyclers, fishing enthusiasts, picnickers and wildlife had coexisted in the park on the Willamette River. Joggers trotted on trails around cornfields. Bicycles and baby strollers rolled on bike paths through potato patches. Great blue herons, nesting in giant cottonwoods on the end of the island, graced the river's shallows. In the autumn, bird watchers enjoyed viewing hundreds of ducks and Canada geese feed on corn and wheat stubble and grain planted for them by the park farmer.

When Audubon submitted their pesticide report, park users, conservationists, farmers and city employees braced themselves for trouble. Agricultural-urban conflicts are often not pretty. Land-use debates usually drag on and on and end up in court, costing everyone involved heartache, time and money. Most thought the situation looked grim.

Page 24: Sonny Lee, Keizer, learns firsthand about potato harvesting, and where his food comes from. (Photo: Lynn Ketchum)

"This is a park, so everyone had an interest in it," explained John Burt, chair of the Marion County office of the Oregon State University (OSU) Extension Service. "The management of public land becomes a public issue. When we have natural resource issues, we have different values and perceptions. You get conflicts. It was like the spotted owl, only on a smaller scale."

"It was like the spotted owl, only on a smaller scale."

R.G. Andersen-Wyckoff, Salem's current mayor and president of the Salem Parks Advisory Board in 1989, realized that if the park-pesticide debate headed in the wrong direction, it could be a negative force within the community. He sensed it might irreparably damage the delicate balance between agriculture, natural resources and recreation in the park.

"As sometimes happens, concern grew about pesticide use in the park," explained Andersen-Wyckoff. "The direction it took was to eliminate pesticides entirely. That would have stopped agriculture altogether in the park."

Elimination of agriculture in the park would be bad news for wildlife habitat,

he said. The city could not afford to plant and maintain large fields of grain and crop stubble, vital to Pacific flyway ducks and geese, including rare dusky Canada geese, which winter in the park. Without farming, open areas would revert to bramble and blackberries, useless to waterfowl.

"Everybody did some internal eye rolling at the initial stages."

With his typical, open style of leadership, Andersen-Wyckoff decided to bring as diverse a group of people as possible together to find a solution that would serve everybody. He invited organic and mainstream farmers, the city parks board, the Audubon Society, Oregon State University (OSU) Agricultural Experiment Station researchers, the Northwest Food Processors Association, wildlife biologists, Oregon Department of Agriculture, the OSU Extension Service, Oregon Tilth, Oregon Agricultural Chemical Association, the local school district, a fertilizer manufacturer, Oregonians for Food and Shelter and Boise Cascade. And in time, they all became part of the Minto-Brown Task Force.

"It's been said that politics make strange bedfellows," said Andersen-Wyckoff. "Well, so do issues of this nature. We pulled together one of the most diverse groups of individuals yet assembled on any given issue in Salem."

For the first few months, Minto-Brown Task Force meetings were no picnic.

"Everybody did some internal eye rolling at the initial stages," said Helene Murray, project associate for the USDA's Sustainable Agriculture Research and Education program, administered through the OSU Agricultural Experiment Station. "I know I did."

"But after a while it was easier to talk," she said. "Once we got to know each other and understand others' perspectives, we came to appreciate other organizations' views and goals. And we realized we didn't have to agree all the time."

Instead of pounding on the table about the pesticide issue, in just two meetings, the group decided to find common ground. They turned the focus of their discussions to the question, "How can agriculture survive in the urban environment?"

A central dilemma emerged: The non-farming public would like farmers to protect the environment and conserve natural resources, without raising the cost of food production. What could the Task Force do to help make this happen? Through monthly meetings, good leadership and a strong consensus process, the group plowed ahead.

"We all realized there were many educational opportunities in Minto-Brown Island Park," said Terry Witt, a member of the Minto-Brown Task Force and director of Oregonians for Food and Shelter, a

LYNN KETCHUM

Minto-Brown Island Park provides Salem-area residents with opportunities for recreational activities such as jogging, hiking and bicycling.

LYNN KETCHUM

Ken Iverson, who farms on the island, joins children ages 4–11 and their teachers and parents in a summer educational activity sponsored by the Salem-Keizer school district.

statewide agricultural advocacy group based in Salem.

"We then focused on education and solving problems, rather than create a situation that would exaggerate our problems," continued Witt. "From that point on, we made real progress."

Ken Iverson, who farms on Minto Brown Island, is an enthusiastic member of the Task Force.

"It's been eye opening," said Iverson, who leases 240 acres on the island to grow corn, wheat and potatoes commercially, and cover crops for waterfowl.

"It's a good site for the public to learn that as farmers we're always looking for better ways to do things," he said. "The ag-urban boundary is a good place because it gives the public the chance to see what's going on. Plus, it's always great to have OSU come do test plots on your place. You can learn a lot from it."

The interchange with growers is also fruitful for agricultural scientists, explained Murray.

"OSU researchers gain a lot by having farmers help design and evaluate experiments," Murray said. "This is one of the big advantages of having research sites on farmers' fields."

LYNN KETCHUM

In this corn, explains OSU Extension agent Dan McGrath, a Minto-Brown farmer experimented with using less herbicide and planting a clover cover that reduces erosion and improves water quality.

In 1990, the Task Force gathered information about agricultural practices in the park. They broadened Audubon's initial report on pesticides to better reflect what pesticides were currently being used by park maintenance crews for weed and mosquito control and in the farming operation. They began to design an outdoor education program to inform the public about agriculture and wildlife on the island. And, under the direction of OSU Agricultural Experiment Station and Extension Service scientists, they planned research and educational projects to evaluate mainstream, low-input sustainable agriculture and organic agriculture.

"One of the most exciting twists that occur when you design a strategy for a project like this is that it can sometimes take on a life of its own," said Andersen-Wyckoff.

No sooner had the Task Force put these concepts together, when the OSU Extension Service determined that a couple of pest control studies would work nicely on the island. Then the Salem-Keizer School District decided that the outdoor education opportunities were exciting. The OSU Agricultural Experi-

THE FLOOD OF 1861

Minto and Brown Islands once were actual islands in the Willamette River. But during the great flood of 1861, the river changed course. Minto and Brown were left high, dry and connected to the southwest edge of Salem. Where the river once ran, sloughs and oxbow swamps formed perfect homes for aquatic wildlife. Rich floodplain soils and forests became more easily accessible to Salem-area settlers.

Some of Minto-Brown's 1,200-some acres have been farmed since 1867. Other areas have been used by the timber industry. And some of the wilder, wetter areas were home to rich wildlife populations. In 1970, the City of Salem and Marion County purchased 860 acres to create Minto-Brown Island Park, with a planned 240-acre agricultural inholding. The Boise-Cascade Company donated 22 acres at northern point of Minto-Brown, containing a great blue heron rookery, to the Salem Audubon Society.

LYNN KETCHUM

Minto-Brown Island is the home of great blue herons.

LYNN KETCHUM

"Minto-Brown is a microcosm of the agricultural-urban fringe," says Rick Craiger, a member of the Salem Parks Advisory Board. The work there may benefit other communities.

ment Station recognized that research opportunities both on the island and on their own farms could be useful.

Starting with a $1,000 seed grant from the City of Salem, financial support grew steadily. Oregon Department of Agriculture and the private sector contributed funds. The Marion County office of the OSU Extension Service submitted a groundwater research and education proposal to the U.S. Environmental Protection Agency (EPA). John Burt proposed that the Iverson farm-park would provide an exceptional chance to increase communication way about multiple use concepts, environmental protection, alternative agricultural systems, farming on the urban fringe and food production in general.

"All our urban communities are growing into agricultural land."

The EPA liked the idea. In late 1990, they granted Marion County $45,000 for a one-year groundwater education program in Minto-Brown Island Park. The Oregon Processed Vegetable Commission also funded research.

"Farmers near urban boundaries have to keep chemicals and fertilizers out of the water," said Burt, chair of Marion County Extension. "All our urban communities are growing into agricultural land. The agricultural community is being challenged. We need new information about farming with fewer impacts. I think OSU research like this has a role in providing the technical expertise in managing natural resources."

During 1991 and 1992, OSU Experiment Station and Extension Service researchers have been conducting low-input sustainable agriculture research in the park with the farmer, Ken Iverson. They are evaluating an old strategy, the use of fall-planted cover crops like clovers and annual ryegrass to catch nitrogen and recycle it for the following crop. That also keeps the nitrogen out of surface and groundwater, explained Daniel McGrath, Marion County Extension agent, who is spearheading many of Minto-Brown's agricultural research projects. Researchers are also luring corn-ear worm moths with natural insect attractants called pheromones. This is helping them learn more about how to

control pest outbreaks with fewer chemicals. They have also been studying flea beetle outbreaks in the Iverson's potato fields.

"By sweep netting to see where the beetles are first, instead of spraying a whole field, Ken Iverson has found that flea beetles first come in from the edges of a field," explained McGrath. "So sometimes Ken can just spray the edges instead of the whole field to control them."

LYNN KETCHUM

Crop stubble on Minto-Brown Island is vital for geese that winter there, according to Salem mayor R. G. Andersen-Wyckoff. Without farming, he says, open areas would revert to bramble.

LYNN KETCHUM

A Minto-Brown Task Force put interpretive signs around the island.

"We realized we didn't have to agree all the time."

Education has been another thrust of the EPA grant. Park users can read interpretive signs about crops and experiments as they stroll by certain fields. There have been field days, where growers and other interested people can come see and learn from the experiments. Together, the Task Force wrote a series of interpretive signs for permanent display explaining agricultural and natural resource issues on the island. The Salem-Keizer School District and Iverson have arranged a day where children can come dig up potatoes and learn where their food comes from. An OSU graduate student in General Science, Mette Hansen is developing an agricultural education curriculum for 5th and 6th graders based on Minto-Brown's programs.

The Minto-Brown situation might inspire other Oregon communities to work out their conflicts, suggested Rick Craiger, member of the Salem Parks Advisory Board and Minto-Brown Task Force.

"Minto-Brown is a microcosm of the agricultural-urban fringe in most places in Oregon," he said. "We have shown that agriculture can be compatible with the urban environment."

The Minto-Brown Task Force has even come to a consensus about their consensus.

"What started out as confrontational turned into an an educational effort by a diverse and in many cases, opposite interest groups," said Witt, of Oregonians for Food and Shelter. "But we all learned to understand each other. We are all human and care about the environment. We are working on solutions rather than building walls."

"There were no black hats, or white hats in the group," said Mark Wigg, president of the Salem Chapter of the Audubon Society. "It's just people."

Carol Savonen is a science communication specialist in OSU's agricultural communications department.

BORN TO BE VILE

Actually, mosquitos are just doing what it takes to get by. OSU entomologists are studying their feeding to learn more about malaria

BY MOLLIE MONDOUX

The rainy, temperate climate of Oregon seems an unlikely place for malaria—after all, we usually think of the malaria-carrying mosquito as living in the tropics. But more than 160 years ago Oregon had a malaria epidemic.

Between 1830 and 1833 the disease affected native and non-native peoples in the lower 100 miles of the Willamette Valley, the lower 200 miles along the Columbia River and along the coast for 100 miles south of the mouth of the Columbia. Few non-native people died, but the disease devastated Native Americans, killing almost 90 percent of those living in the affected areas. Historians believe the epidemic probably came from ships that visited the Columbia River after making stops in tropical areas where the parasite was prevalent.

Right: An *Aedes* mosquito, a type that transmits avian malaria. It is used as a model in research on human malaria.
(Photo: Philippe Hossignol)

While malaria isn't a worry in Oregon nowadays, the disease is still a problem in many parts of the world. The World Health Organization (WHO) estimates malaria is a threat in areas that support almost 40 percent of the world's population. An OSU Agricultural Experiment Station scientist's research may help people who make decisions about how to manage malaria-carrying mosquitoes in those areas.

The disease is a problem in many parts of the world.

OSU entomology professor Philippe Rossignol, and Xiaohong Li, a Ph.D. candidate working with him, are studying malaria transmission—how the malaria parasite gets from the mosquito vector into its human host and back. Understanding transmission may help people dealing with the disease know better when, or even if, they should intervene and use methods to eradicate the mosquito.

There are many types of malaria and all are caused by single-celled organisms, spread by mosquitos. Many vertebrates carry malaria parasites. Human malaria is spread by female *Anopheles* mosquitos (termed the "vector" or spreading agent by entomologists), who bite a malaria- infected person (termed "host").

When a female mosquito bites an infected host, she sucks up malaria organisms along with her blood meal. In a few days, malaria cells multiply into thousands of very small spindle-shaped cells in the mosquito's digestive tract. These malaria cells then migrate to the mosquito's salivary glands.

When the mosquito bites another human victim, malaria cells are transmitted to the new host. There, they enter the liver, multiply, then enter red blood cells, where they increase repeatedly again. They break out of the blood cells, destroying them at regular intervals and producing anemia and recurring fevers. If another mosquito comes along and bites the infected person, malaria cells are carried off and the cycle begins again.

In the 1950's DDT was used to launch a malaria-eradication campaign in Africa. In a little more than a decade, eradication efforts failed. The mosquito developed a resistance to DDT. Malaria has come back with a vengeance.

"What the campaign did do was suppress malaria for many years," explained Rossignol. "There's now a tremendous upsurge of malaria."

Rossignol's research has revealed new information about the relationships between the malaria parasite, the mosquito vector and human host. He and his colleagues have learned that in transmission, the parasite manipulates not only the mosquito vector, but also the host. And the parasite isn't the only one doing some manipulating. The malaria-carrying mosquito also manipulates the human host while feeding on blood.

BOB ROST

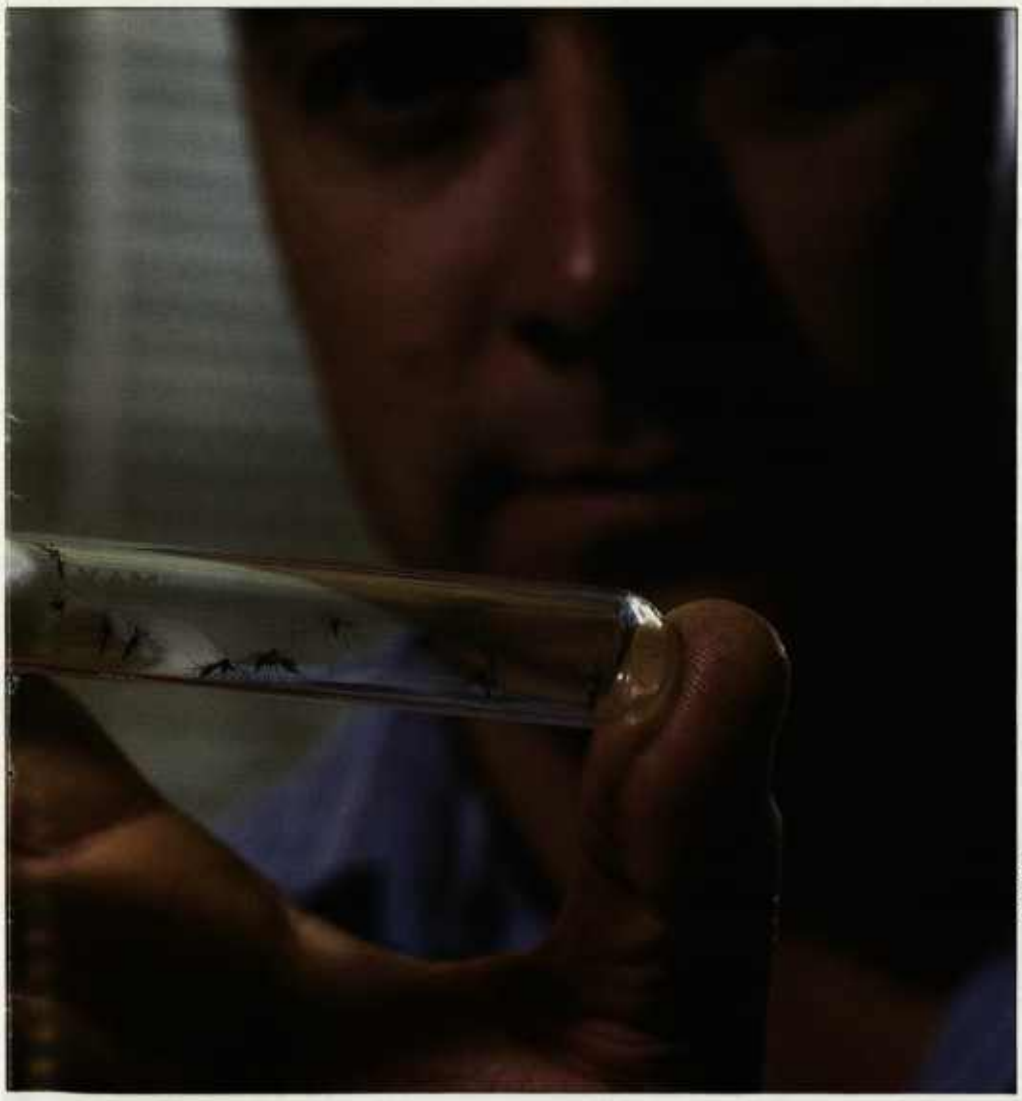
Female mosquitoes extract blood to get protein for egg development.

BOB ROST

Beaver ponds, now relatively rare, once were primary breeding areas in the Willamette Valley for malaria-carrying mosquitoes.

BOB ROST

Graduate student Xiaohong Li has found that, surprisingly, a large load of parasites in a mosquito can decrease the chance of malaria transmission: The parasites kill their host.



BOB ROST

For adult female mosquitoes, feeding on host blood provides protein for egg development. But finding a host's blood vessel to tap isn't easy. Vessels that are big enough for a mosquito are deep under the skin and rather scattered.

"A mosquito enhances its chances of locating a vessel by just causing damage, probing at random," Rossignol said. "If it happens to hit a vessel, a hematoma (an accumulation of blood) forms and this gives the mosquito a target."

But when a mosquito taps into a vessel, the body naturally wants to stop the blood loss. Platelets, minute granular discs in the blood, play a role in blood clotting, by aggregating to stop blood flow. They also release a substance that makes the blood vessel constrict, thereby further reducing bleeding. With clotting, there's no easy meal for the mosquito. But, as Rossignol discovered, the mosquito has a way around this problem.

Mosquito saliva contains an enzyme, apyrase, that stops platelets from aggregating. When the mosquito taps into a host's vessel, apyrase-laden saliva prevents normal clotting processes. Bleeding from the vessel doesn't stop as it normally would after injury. So the mosquito gets a meal of free-flowing blood.

Malaria has come back with a vengeance.

While the mosquito feeds, the malaria parasite is transmitted. The more slowly a mosquito feeds and the more hosts it feeds on, the better the chances are for malaria's success. But odds are, if a mosquito feeds slowly and visits many hosts, it would most certainly be killed by the slap of a hand. To survive, a mosquito attempts to get its meals quickly.

Rossignol discovered that malarial parasites have found a way to modify a mosquito's tendency feed rapidly. Inside the mosquito, the parasite destroys part of the mosquito's salivary glands, thus destroying the mosquito's ability to make apyrase. Without this enzyme, blood clots normally. So the mosquito has a harder time feeding, takes longer, and may move

Left: OSU entomologist Philippe Rossignol is trying to collect information that will help medical researchers fine-tune their understanding of malaria transmission.

on to more hosts to get enough to survive—the optimal situation for the malaria parasite.

Once the malaria parasite is living inside human host, its needs are different than when it is living inside the mosquito vector. Malaria needs to get passed from one host to the next, before its current host dies. To do this, it again needs the mosquito. Rossignol has found that malaria changes the feeding dynamics of the mosquito in yet another manner.

"We have shown that animals that have parasites like malaria lose their platelets," said Rossignol. "The parasite then makes it easier for the (mosquito) vector to feed on an infected host."

When a host has no platelets, the slightest wound causes a huge accumulation of blood and the mosquito finds blood much faster than normal.

"You try and make a guess about what will happen if you intervene."

After incubation in the host, malaria parasites invade the red blood cells, multiply and destroy the red blood cells, causing anemia in the host. Anemia may be also be blessing for the mosquito. One of Rossignol's students, Jong-Neng Shieh, has demonstrated that anemia causes the mosquito to feed faster. When a host has anemia, the blood is thinner and can be ingested faster. Again, the parasite seems to be manipulating the host to its advantage. And the mosquito also may be getting a better deal.

"We postulated that there is the possibility of mutualism between the malaria (parasite) and the mosquito," Rossignol said.

Infected hosts are often more lethargic and less defensive, so they provide a good target for the mosquito to feed on without getting swatted. As the mosquito feeds on an infected host, the parasite gets from the host into the mosquito.

The cost to the mosquito of feeding on an infected host is paid two weeks later when the parasite matures inside the mosquito and damages the mosquito's enzyme-producing glands, cutting off apyrase enzyme the mosquito needs to counteract the clotting action of a host.

At least it's a price the mosquito pays if it lives long enough. Two weeks is beyond the normal mosquito's life expectancy.

"The life expectancy of the mosquito is typically a week and it takes the parasite almost two weeks to develop in the mosquito," Rossignol said. "So the parasite needs to be very lucky to find a mosquito that lives a long time. The parasite needs a vector. It cannot be transmitted without a vector. So all it's doing is making it easier for the vector to feed on an infected host. By insuring that a mosquito benefits, the parasite benefits."

Xiaohong Li has also done research that dispels some traditional ideas conceming malaria transmission.

It was commonly thought that a mosquito carrying malaria parasites delivered all of them in the first few probes. But Li has shown that transmission can go on a long time past the first probes.

Another part of Li's work provides evidence that may dispel another traditionally held idea and provide an answer to the question "What if the malaria parasite causes mortality in the mosquito vector? Intuitively, it would seem that the more parasites a mosquito carries, the greater the number of parasites transmitted," Li said.

But he has found that sometimes when a mosquito has a lot of malaria parasites, the parasites kill the mosquito, preventing it from delivering any parasites at all. So, in the cases where there are a lot of parasites, transmission decreases.

Li gave an example to illustrate his point. If 100 mosquitoes have one parasite each, this probably won't cause the mosquito's death, so potentially 100 parasites will get transmitted. But if 10 mosquitoes have 10 parasites each, and because of the parasite load, five of the mosquitos die, then only 50 parasites would get transmitted. So, more parasites could mean fewer get transmitted.

Such discoveries may provide a truer picture of how the malaria parasite is transmitted and help researchers understand what to evaluate in the field in areas where malaria is prevalent. But to get a good picture of the dynamics of malaria in any one region is extremely difficult, explained Rossignol. There are many species of mosquitos, malaria parasites and vertebrate hosts.

"An area where malaria is occurring is thousands of square miles and it's very difficult to tell if people have malaria without taking a blood smear. Then you have to be very good to identify it (from the smear). Then you have to collect mosquitos to see if they're infected, and see what they're biting. Then you get all this data and you try and make a guess about the type of transmission and what will happen if you intervene."

BOB ROST

As Rossignol watches, research assistant Anthony Gordon dissects a mosquito to remove its salivary glands for further study.

Mollie Mondoux is a free-lance writer in Corvallis, Oregon.

GROWERS SENT HIM TO SCHOOL

Dale Coats doesn't think of himself as a fireman, but his research may cool the flames in central Oregon's grass fields.

He's spent the last four years investigating viable ways to grow bluegrass turf seed without open-field burning.

In 1989, Coats returned to OSU to begin a master's program and learn all he could about raising certified Kentucky bluegrass seed. And Jefferson County grass seed farmers paid for his tuition, books and research so he could become an expert on the subject.

Growers in Jefferson County sell their prized certified seed to turf managers all over the United States. In 1989, however, when the threat of a ban on open-field burning endangered their livelihood, the growers turned for assistance to Fred Crowe, the superintendent of the OSU Agricultural Research Station in Madras.

Crowe teamed up with campus-based Bill Young, the Extension Service's seed production specialist, who was excited about the possibility of creating a "bridge" between his Willamette Valley research project and the branch station. Together, they made an offer the Jefferson County growers couldn't refuse. Why not use the research money that they'd collected to send one of the station's research technicians to graduate school for training in bluegrass management?

All parties agreed and found a champion for their cause in Dale Coats. Coats had prior experience with the wheat and barley programs at Madras, and he'd also expressed interest in seeking an advanced degree.

"After the Jefferson County grass seed growers agreed to the offer," Coats said, recalling the situation, "Fred told me that if I was serious about grad school, here was my chance to 'take the ball and run with it.' And I have."

Over the last four years, funding for Coats' bluegrass research and experimental equipment purchases, totaling $111,000, has come from the Jefferson County grass seed growers, the Oregon Department of Agriculture (ODA) and the ODA's CAAR (Center for Applied Agricultural Research) program.

TOM GENTLE

Dale Coats

"We've developed a pretty good research program," Coats said. "This year I hope to finish my thesis, which is a report that describes the effects of post-harvest residue management on Kentucky bluegrass seed yield and seed quality in central Oregon."

According to Coats, returning to grad school was more than a test of his academic abilities. He was also tested by the six-hour round-trip commute between Madras and Corvallis.

"To get my master's degree in crop science, I had to complete two years of course work," Coats said. "For the first year and a half I lived in Corvallis in a travel trailer during the week, and then came home on weekends to take care of my family and conduct research at the station. I took my dog along just to keep me sane." Coats also did work related to the central Oregon station while he was in Corvallis.

"For two terms after that, I drove across the mountains a couple times a week to take night courses–all the while trying to maintain my job and family relations. Needless to say, I worked my tail off."

"But for the entire time, growers around here have been just super to work with," Coats said. "They have loaned me personnel, equipment and land and have been there personally to help me with my test plots."

Until Coats conducted his replicated trials, central Oregon bluegrass seed growers had no sound, economical alternatives to open-field burning for their certified crops. Coats has been able to discover several viable alternatives; but all are more expensive than current post-harvest management methods–which include either bailing and removing the straw or scattering the straw, then open-field burning, and, finally, burning the field a second time with a propane burner towed behind a tractor. This elaborate method is used because minimum standards for growing certified turf seed require a pure, disease- and weed-free stand.

"After harvest," Coats said, "growers burn the fields to clean them. By comparison, in our field trials we've gotten anywhere from 50 to 120 percent of the average seed yields by using methods that don't include open-field burning."

The most effective, but also most expensive, alternative Coats has found involves propane burning and the use of a machine known as a *Grass Vac* –a combine-sized lawn mower and grass catcher. Unfortunately, there is no economical way to dispose of dirt and straw gathered by this method.

He has also experimented with treatments using a combination of two other machines: a flail-chopper that trims the stubble, followed by a wheel-rake, which de-thatches the grass crowns by combing the field with teeth set an inch apart.

"The growers are really making an effort to find alternatives," Coats said. "But if open-field burning was banned today, the available alternatives would cut considerably into both the growers' and the seed company's profit margins.

"Field burning is not a whole lot of fun. You can have your barriers surrounding the field, but it's still scary when you set one of them off, and then a dust devil comes through and throws the flames up twenty feet. If the growers can find an economical alternative, they'll jump on it."

August Baunach

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