terra

A world of research & creativity at Oregon State University • Spring 2006

Will the Ocean Light Our Future?

Boot Camp for Vets
Monitoring Animal Health

20/20 Vision
Spring Creek Project

Sexual Health
Asking the Tough Questions

Why *Terra*?

As a land-grant university, OSU has long focused on the Earth and its resources — oceans, forests, farm fields, watersheds and ecosystems. These are the stages for the evolving human story. On them, we play out the full range of endeavors, from engineering and science to the arts, professions and humanities. Today, OSU researchers are writing new chapters, expanding their explorations with new technologies, creating benefits for society and life-changing opportunities for students. *Terra* — Latin for Earth — will be a window on their activities. *Terra* will take readers well beyond the Corvallis campus. In this inaugural issue, we travel to the coastal community of Reedsport, Oregon. Timber and fisheries have been its bread and butter since this Douglas County town was established at the mouth of the Umpqua River in 1852. In the past few years, declining fish populations and a mill closure have hit the Reedsport area hard, resulting in empty schools and storefronts. Now, thanks to the work of two OSU engineers, opportunity comes in with the regularity of ocean waves. In her cover story in this issue, Lee Sherman describes a new wave energy technology and the ripples of hope it is bringing to the Reedsport area — and to other coastal towns like it.

Welcome to the world of OSU research.

terra

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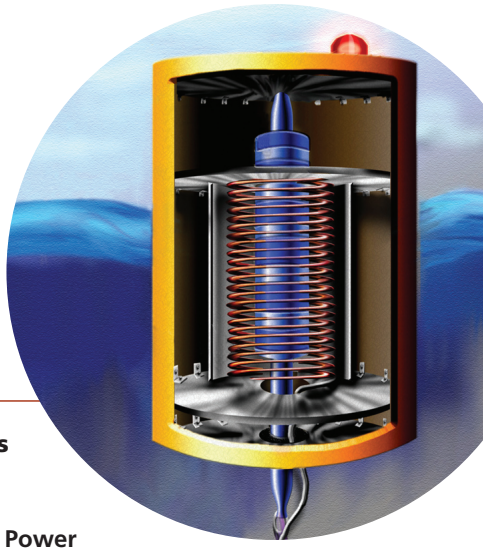

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OSU electrical engineers Annette von Jouanne and Alan Wallace and their students are developing innovative wave energy devices. Their plan to create a wave energy research park near Reedsport, Oregon, brings hope to a community hit hard by economic decline.

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Chuck Estill knows that taking care of large animals can be tough. That's why he takes OSU veterinary medicine students out to Willamette Valley farms where they can confront their fears — and see wonders.

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The Spring Creek Project takes us into the wild through writing workshops, overland treks and public programs. The goal: to explore our relationship to nature.

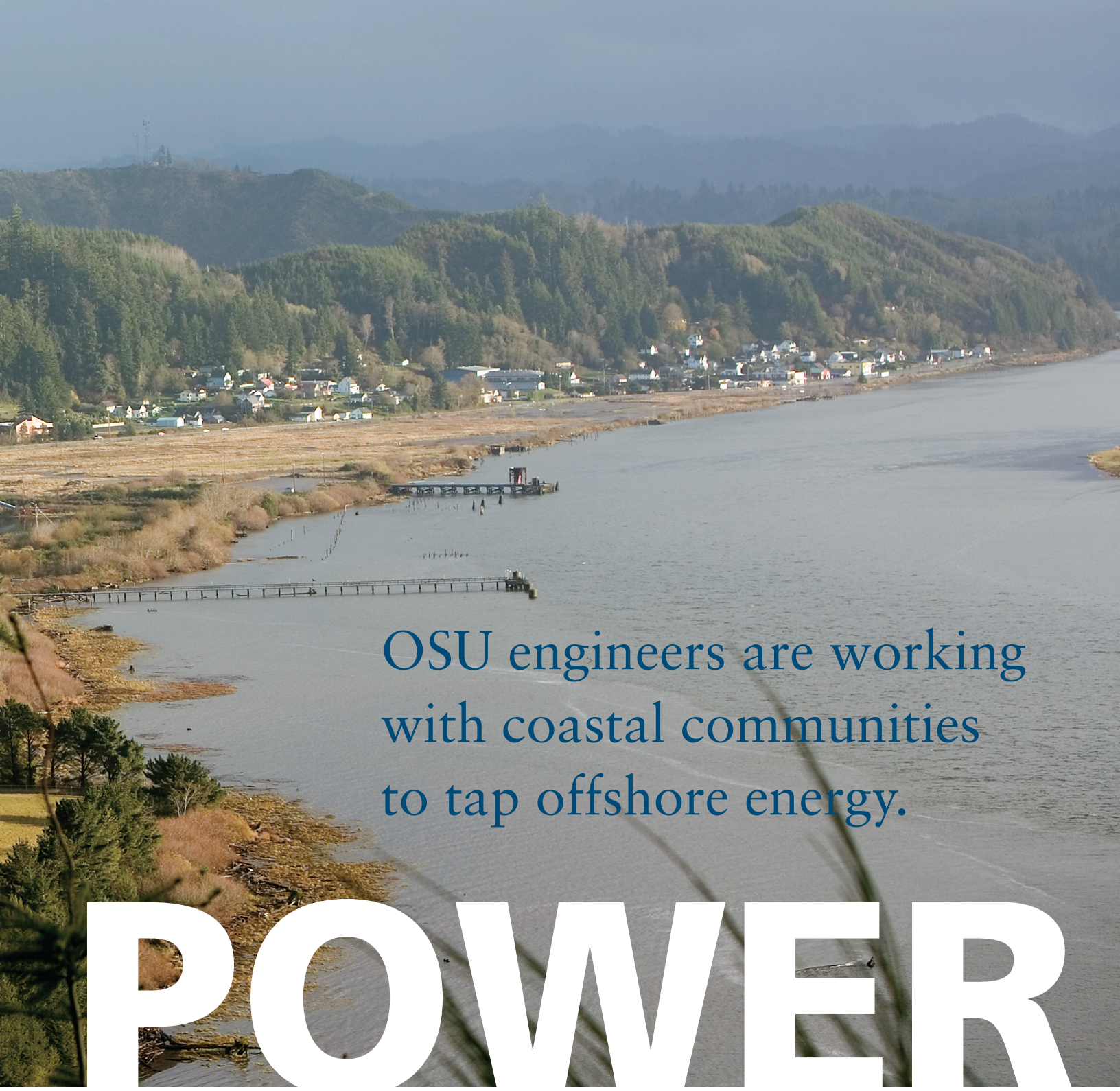
Terra is on the Web at oregonstate.edu/terra
Watch a slideshow, *Down on the Farm*; see video and listen to audio files; and find related stories on wave energy, veterinary medicine and the Spring Creek Project

Sea

The mill is silent now, and still.

When International Paper succumbed to the slump in logging a few years ago and shut the doors on a plant that had once employed 650 in Gardiner and neighboring Reedsport, commerce in the coastal Oregon communities took a body blow.

By Lee Sherman



OSU engineers are working with coastal communities to tap offshore energy.

POWER

The pain of the mill closure was compounded by catches of coho salmon that had been dwindling for a decade. As loggers knocked the mud off their caulk boots for the last time and fishermen let their commercial licenses lapse, families drifted away. Schools lost students. Today, Reedsport's many boarded-up storefronts signal a community in distress.

The town sits back from the open ocean, snug against the sheltering hills of the Coast Range and wrapped inside the arc of sand that forms Winchester Bay. But out beyond the bay, past the bar, churns the constant, unceasing movement of what could someday stanch the decline of this place: Pacific Ocean waves. That's because a team of Oregon State University researchers has been inventing devices for creating electricity — clean, renewable, low-impact energy — from the motion of the ocean. And they've zeroed in on Reedsport as the "sweet spot" for testing and demonstrating new technologies — in part because the old mill's power substation, now sitting idle, could quickly be reengaged and once again buzz with electricity.

Wave Power Prototypes

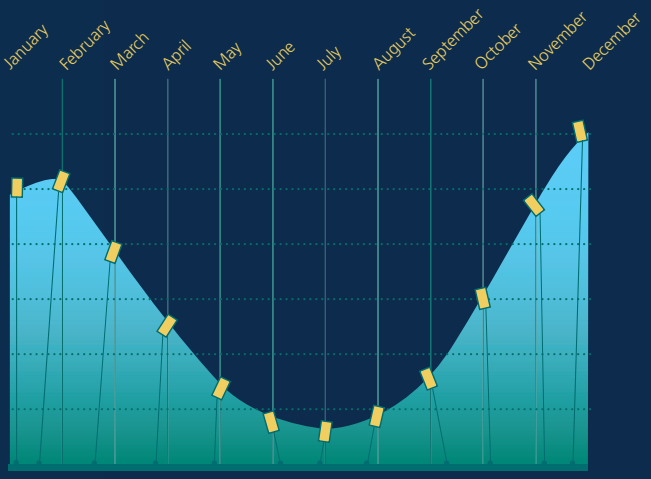
OSU's "direct-drive" buoy approaches allow electrical generators to respond directly to ocean waves. Inside the Permanent Magnet Linear Generator Buoy (shown below), wave motion causes specially designed electrical coils to move through a magnetic field, inducing voltages and generating electricity. The Contact-less Force Transmission Generator Buoy uses large, high-strength permanent magnets configured as a "piston." It transforms linear motion to rotation with a ball screw that drives a permanent magnet rotary generator. In the Permanent Magnet Rack and Pinion Generator Buoy, linear to rotary conversion is developed with permanent magnet gears. Advanced designs will achieve higher efficiencies and power output. To further optimize these technologies, the OSU wave energy team is designing linear testbeds for their laboratory to cover power ranges from 100 watts to 250 kilowatts. If approved for funding, the facility will have the largest power capacity of any linear testbed in the world.

Working in the Motor Systems Resource Facility with Annette von Jouanne and Alan Wallace is undergraduate student Andrew Metzcus, of Lowell, Indiana.

Permanent Magnet Linear Generator Buoy

Powering the Planet

OSU is not alone in ocean-energy research and development. Projects are underway around the world, led by Europe and backed by strong government support and funding. Great Britain is several years ahead of the U.S. on wave research, with a test facility — the European Marine Energy Center — generating power on an experimental basis on Orkney Island off Scotland, using a device called Pelamis (Greek for "wave snake"). A Swedish team has developed a related system, one that drives turbines with pumps and high-pressure jets of water. A device designed by Danish experts has been dubbed the "Wave Dragon." Not to be outdone in dramatic nomenclature, the Japanese call their model the "Mighty Whale."



Seasonal variation in available wave energy is a good match for Northwest energy demand. (Source: National Data Buoy Center)

The energy potential of the world's oceans is astounding. Just a tiny fraction of the energy contained in the Earth's seas — their currents, tides, waves, and heat — could power the entire planet. Tom Tymchuk is awe-struck by the statistic. "If you could harness even 1 percent of ocean energy, you could light up the world," says the Central Lincoln Public Utility District board member, struggling to take in the enormity of that idea. "Light up the world!"

Compared to wind — the current frontrunner in renewables — waves are a lot more efficient. That's because of what OSU electrical engineer Annette von Jouanne calls "energy density." "Water is about 1,000 times more dense than air," she points out. "That means you can extract more power from a smaller volume, which in turn means lower cost." Besides, waves roll in with a lot more regularity than wind blows. Energy is available from waves upward of 80 percent of the time, compared to 45 percent or less from wind, leading to more efficient scheduling for other energy sources on the grid.

More than 20 agencies, including the Oregon and U.S. departments of energy, are backing OSU's initiative to launch a U.S. Ocean Wave Energy Research, Development and Demonstration Center to create and test wave-power technologies. With members of Oregon's congressional delegation strongly behind the initiative, it's quite possible that the roar of the surf and the tang of salt spray could someday replace the *kthunk-kthunk* of the mill and the acrid smell of pulp as the sounds and smells of prosperity in Reedsport and other sagging economies up and down the coast.

Surviving the Tempest

The notion of extracting energy from waves is not new. When von Jouanne and her colleague, OSU electrical engineering professor Alan Wallace, began exploring the potential of wave power, their search for prior scientific writings and inventions took them into records two centuries old. As they pored over thousands of patents for turning wave energy into electricity, they pinpointed the big flaw in those earlier designs: too many moving parts. In an environment as tempestuous as the sea, moving parts require frequent maintenance and are vulnerable to breakdowns.

"To capture energy from waves, the device must be survivable, reliable, and maintainable," says von Jouanne, a principal investigator in OSU's wave energy research project. "In the past, there have been some failures because of the survivability issue."

Prevailing technologies generate power by compression of a liquid (such as water) or a gas (such as air). Pumps and pistons, valves and filters, hoses and tubes, fittings and couplings and all sorts of switches, gauges, meters and sensors go into operating these systems. In contrast, with $270,000 from the National Science Foundation and $60,000 from Oregon Sea Grant, von Jouanne and Wallace are developing technologies that work with just a handful of basic components, including an electric coil, a buoy and a magnetic shaft secured by a steel cable.

One of the OSU devices on the drawing board — which the engineers describe as a "permanent magnet linear generator" — works like this: A spiral of copper wire is secured inside a 12-by 15-foot long buoy made of an impervious composite of plastic and fiberglass. The coil surrounds a magnetic shaft, which is stationary and tethered to the ocean floor by a steel cable. As the buoy rises and falls on the waves, the coil moves up and down relative to the shaft, inducing voltage as it passes through the magnetic field. A power take-off cable carries the resulting electric current about 100 feet down to the seafloor where another cable takes the power generated by many buoys to an onshore substation.

> *"I can promise you one thing. Whatever we build out there for wave-action generation is gonna have to be one tough dude."*
>
> ***— Terry Thompson,** Fisherman*

One buoy is projected to generate 100 kilowatts of power, on average. A network of about 500 such buoys could power downtown Portland. Moreover, wave parks could address the state's energy imbalance. West of the Cascades, Oregon consumes about 1,000 megawatts more than it generates. By tapping about 5 percent of the coastline, wave energy could make up the difference, and no new transmission lines would be needed.

The engineers' goal is to produce a device that is lean and streamlined, designed to withstand gale-force winds, monster storms and the vagaries of sea life, from rafts of floating bull kelp to colonies of seals looking for a place to haul out. The engineers are now working on their fourth and fifth prototypes. They call their simplified approach to energy conversion "direct drive." The fishermen just call it common sense. As one lifelong Oregon fisherman, Terry Thompson, puts it, "There's a rule of working in the ocean that fishermen use that goes, 'Keep it simple, stupid.'"

Wallace and von Jouanne agree. "Simplicity is the essence of it," Wallace says. However, embedded in their design is a great deal of engineered precision. The magnetic shafts are made of a steel alloy that creates an exceptionally strong force field. The highly conductive "air-gap" coils are made of solid copper instead of the more common combination of copper and steel used in generator armatures. Thus, the conversion of mechanical motion (waves) into electrical energy can take place with great efficiency and efficacy.

The engineers develop their prototypes in OSU's Motor Systems Resource Facility, the highest-power motor and drives testing lab at any U.S. university, and test them across campus in the O.H. Hinsdale Wave Research Laboratory, which boasts a 342-foot flume. But it will be in Reedsport that the wave-energy buoys meet their real test: the Pacific Ocean.

Of all the waves washing across the planet, Oregon's are optimal for extracting energy, according to a study by the Palo Alto, California-based Electric Power Research Institute (EPRI). That's because on the West Coast, the trade winds blow strong and steady, and the seafloor is a long, gentle slope, a configuration that lends itself to good wave action. And then there's the old mill just north of Reedsport. In addition to its 50-megawatt electrical substation, it has an outflow pipe stretching 3,000 feet into the ocean — a ready-made conduit for the subsea power cable bringing electricity back to shore.

Von Jouanne and Wallace have been working closely with Justin Klure of the Oregon Department of Energy to promote the Reedsport/Gardiner area as an optimal location for the nation's first commercial wave park. Several developers have stepped forward with the first planned phases in the 20- to 30-megawatt range. Manufactur-

Water as Destiny

Annette von Jouanne

There's something serendipitous, almost poetic, about Annette von Jouanne's work in wave energy. She was raised in Seattle, a metropolis laced with lakes and bedeviled by drizzle. Growing up, she never went anywhere without first tossing a Speedo in her backpack, just in case a chance for a swim presented itself.

When she wasn't swimming, Annette was tinkering. As a girl she would borrow her engineer father's screwdrivers, taking apart the family TV, and would study her college-age brothers' engineering texts.

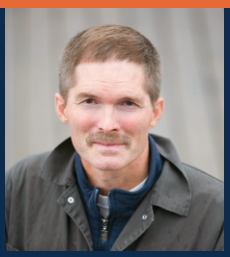
A competitive swimmer in college, von Jouanne married a member of the Portuguese Olympic swim team — Alex Yokochi, who is also an engineering professor at OSU. They swim daily in their dual-flume workout pool at home. They named their oldest daughter Sydney for the 2000 Olympics and their younger daughter Naiya, Hawaiian for the wild dolphins the couple has swum with in Key Largo and Kauai.

Alan Wallace, like von Jouanne, was the child of an engineer and grew up taking apart household appliances. Although his hometown of Sheffield is landlocked, Wallace notes that "no place in England is very far from the sea." Every year, his family summered on the coast in an old boat that had been converted to a vacation cottage. At night, lying in his room in the prow of the grounded vessel, young Alan would fall asleep to the *lap, lap, lap* of North Atlantic waves.

It was the North Atlantic that first piqued Wallace's interest in ocean-generated power. As a graduate student at the University of Sheffield in the 1960s, he attended a seminar about capturing the enormous energy of the tides that surge through Bristol Channel. "It stuck with me," he says, "all these years."

After a 25-year career designing innovative linear motors for transit systems — in places as far-flung as Detroit, Toronto, and Turkey — Wallace was, in a sense, circling back when he teamed up with von Jouanne to puzzle out the problem of wave energy.

Alan Wallace



SCOTT HARTZELL

Fisherman

Taking an annual harvest of a quarter-million pounds of Dungeness from his 85-foot craft Ossian, this crabber brings a lifetime of ocean experience to his role as an "industry cooperator" with OSU. "I'm interested in the location of the wave park, how it's going to be anchored, how invasive it's going to be for the environment and how intrusive it might be to the Dungeness crab industry."

ing and fabrication would be performed locally, meaning job opportunities for coastal Oregonians. At about one to three miles offshore, the park will be invisible from the beach, thus preserving views, but close enough to make anchoring and transmission feasible.

Activists for Wave Action

Tapping the vast energy massing off Reedsport's shores has become the dream of local leaders who have joined forces with the engineers to revolutionize power generation in the Northwest. Tom Tymchuk is one of the most avid. At 77, this former Reedsport mayor, one-time logger and retired storekeeper is right at the heart of this local movement to rethink nature's bounty and retool for a new millennium. "Since the proposed site was in our district," says Tymchuk, "I thought I'd better jump aboard and see where we can go with this."

The minute he heard about the wave project, Tymchuk encouraged his fellow utility board members to kick in $20,000 of seed money for the EPRI study. Then there's the younger Tymchuk, Keith, a schoolteacher who earned his master's at OSU and holds the post of Port of Umpqua president. Ever since getting wind of OSU's idea, he has been bumping the limits of his cell-phone contract, piling up minutes in conversations with state and national officeholders to promote the project.

Physician Ron Vail recently had the sad task, along with other members of the school board, of closing the middle school after enrollments plunged. He was "blown away" when he first heard about wave energy, which he sees not only as a way to bring family-wage jobs back to Reedsport but, in the bigger picture, as an "engine" to power hydrogen fuel production for America's future. And there's PUD executive Matt Boshaw, a self-confessed "electricity geek" who is "jazzed" about the immediate practicality of wave power for beefing up the electricity grid for coastal Oregon.

The enthusiasm of these hardcore Reedsportians doesn't mean, however, that there's no skepticism among local stakeholders. Oregon's crab fleet has broken harvest records in recent years and plies the same ocean real estate that OSU's engineers are eyeing for "wave parks." Crabbers are nursing some worries. They are intensely interested in making sure that an upturn in energy resources doesn't cause a downturn in crab harvest. But for now they're backing the project, at least in principle. As third-generation crab fisherman Scott Hartzell puts it, "Clean, renewable energy — how can you argue with that?"

Going from lab to open ocean is where the researchers will need to draw on the experience of Hartzell and other fishermen who've spent a lifetime reading waves and reacting to them, getting to know them in all their ferocity and variability from the deck of a trawler. As OSU sociology professor Flaxen Conway notes, "When you start talking about understanding the sheer power of the ocean — the winds, the currents — fishermen *live* out there. So when researchers say, 'We've used a model to test this device, and we know how waves work,' the fishermen will look at them and say, "*I'll* tell you how waves work.'"

OSU's engineers are listening. Conway coordinates the Oregon Sea Grant Extension Port Liaison Project, which links von Jouanne and Wallace with a pool of "industry cooperators" — expert fishermen who get paid to bring their practical knowledge to the program. Terry Thompson is one. He says fishermen are essential for making the leap from lab to a "real-world scenario" in the ocean. "Man-oh-man," he says, "it's a nasty, hard environment to work in."

A world-class runner at the University of Missouri and then at OSU, Thompson gave up a berth on the 1968 Olympic track team to, quite simply, "go fishin'." Although he has retired from commercial fishing, he is a Lincoln County commissioner

Coastal Views

Four residents of Oregon's shore — a fisherman, a former mayor, a teacher and a doctor — weigh in on wave energy

TOM TYMCHUK

Board member, Central Lincoln Public Utility District

At 77, this former mayor could be forgiven if he whiled away his afternoons down at the local taqueria, waxing bitter with the town elders about the way things are going. But instead, he has become a leading booster for wave energy. "I intend to stay involved, no matter how old I get."

KEITH TYMCHUK

President, Port of Umpqua

A lifelong Reedsport mover and shaker, this schoolteacher sees tapping waves for electricity as a 21st century use for an ancient resource. "Its great advantage is that you don't have to deplete the resource as you go."

RON VAIL

Board member, Reedsport School District

Since the mill closed, school enrollments have dropped sharply, forcing this physician and his fellow board members to make Draconian cuts in faculty and programs. "Every year it's a crisis. I see the wave park as a unique opportunity to bring family-wage jobs back to the area and help stabilize student enrollment."

and remains right in the thick of coastal commerce and politics. A couple of years ago, he donated his half-million-dollar trawler to the university for ocean research — research that he thinks is sorely needed to better inform environmental policies and fisheries management. OSU's wave energy project is another of his burning interests. The idea of grabbing onto the power of the ocean and putting it to practical use has intrigued him for decades.

"When you sit out in the ocean, you get slammed by big waves every day," Thompson says, leaning back in his Newport office in a pair of gently worn Wranglers and tooled-leather cowboy boots. "You go, 'God, dang, that wave hit me so hard! How can I get the power out of it? How can I turn that wave, which is beatin' the tar out of me, into something positive?'"

That's why he got excited in the spring of 2005 when OSU convened the first of several public meetings to introduce local people to wave energy and get their input. More than 100 community members jammed into a cramped conference room to listen. The fishermen put all kinds of concerns on the table: optimal depth, strongest tethers, best anchors, conflicts with river outflow, impact of magnetic fields on sea life and migration patterns, water temperature changes, durability in a 20- or 30-foot swell.

Recreational fishermen like Nicholas Poon, 11, also tap Oregon's rich Dungeness crab fishing grounds at Winchester Bay, near Reedsport.

"I can promise you one thing," Thompson says. "Whatever we build out there for wave-action generation is gonna have to be one tough dude."

Topping the list of fishermen's worries is the potential impact on the Dungeness crab industry, currently Oregon's most lucrative fishery. Last season's harvest obliterated all previous records, with the state's 430 permit holders hauling in almost 34 million pounds of the prized shellfish — and injecting $50 million into local economies.

With that much money — and that many livelihoods — at stake, the potential for conflict between crabbers and wave parks is very real. That's because the same conditions that make for good crabbing also make for good wave action. For now, though, the fishing community is cooperating, encouraged by the way OSU has reached out to them.

"The university did the right thing by bringing the industry into the project on the ground floor," says Nick Furman, executive director of the Oregon Dungeness Crab Commission. "They could have sent out an e-mail or a fax that said, 'We've got this wave project out there and here's the GPS — the latitude and longitude coordinates. We want you to notify the crab fleet to stay out of that area.' That would have been the quickest way to alienate the fleet."

Furman, whose job is to be the "eyes and ears" of Oregon's crabbers, thinks OSU is going about it in the right way. "They're saying, 'We want to share this area of the ocean. How can we do it to minimize the impacts and be good neighbors?'"

Nudge to the Future

Reedsport faces the same hard reality confronting rural communities everywhere. It's what Furman calls the "biopolitics" of resource management, the eternal tension between consumption and conservation. But just as farmers have found new possibilities in the wind that once blew unnoticed across the land — now leasing easements to utilities for wind-powered turbines — so, too, residents in coastal communities are discovering unimagined potentials in their oceans. Beach towns like Reedsport are being nudged toward the cutting edge of energy technology. The residents who have stayed on here — tough, rooted, doggedly optimistic people like Tom Tymchuk — are tapping into the resilience and the ingenuity that sustain communities through tough times. *Those* resources, anyway, are not in short supply around here.

Meanwhile, von Jouanne, Wallace and their team of enthusiastic undergraduate and graduate students are immersed in computer models and wave tanks, teasing out the mysteries of wave energy in their labs. OSU's College of Engineering is seeking $3 million from the U.S. Department of Energy to build the national wave energy research center, where the engineers hope to test not only their own designs but those of other researchers and commercial developers. In just a few years, the nation's first large commercial wave park could be generating ocean-based power and science in the offshore swells of Reedsport, Oregon. t

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Biomass harvesting could generate economic and environmental benefits.

Out of the Woods

A meeting of the minds on forest issues is rare. Yet an innovative energy project underway in Oregon's Fremont National Forest has won near-unanimous support from stakeholders who are often at odds. That's because, in the words of OSU's Hal Salwasser, dean of the OSU College of Forestry, "It's an integrated solution to a multifaceted problem."

Broadly, the facets of the problem are unthinned forests (posing fire risks), unemployed woods workers (hurting rural communities) and unsustainable energy sources (too costly in dollars and environmental damage). Like many Northwest woodlands, federal forests near Lakeview are primed for summer wildfires, full of tinder-dry underbrush, and stressed and diseased trees. Local economies are smarting from declining logging operations and sawmills. Soaring petroleum prices and worrisome greenhouse gasses are spurring demand for clean, affordable power.

Enter, the Lakeview Biomass Project — a sweeping collaborative of local community leaders, university scientists, an energy company, a timber company (The Collins Companies' Fremont Sawmill), conservationists and experts in forestry, fisheries and wildlife from federal and state agencies. The partners are cooperating to develop a state-of-the-art power plant designed to burn "biomass" — the excess wood that can otherwise fuel forest fires and choke off productive habitats. The electricity generated will supply the Fremont mill and enter the grid serving local power customers. Residents will find new jobs in harvesting and hauling the once-unwanted biomass. And the salvaged materials that are suitable for solid wood products will be milled, another boon to jobs.

The partners hope the new plant will be up and running within a year. So promising is the concept that Governor Ted Kulongoski has designated it as an Oregon Solutions project, appointing Salwasser to head up the Solutions Team along with Lake County Commissioner J.R. Stewart.

OSU faculty and students will assist with field studies on ecological impacts of forest thinning and design computer models to account for the project's "total carbon budget." Calculations will reflect where carbon is stored and released and include offsets against other forms of electricity generation.

"The project has the potential for being a net benefit to the carbon balance and a model for other places," Salwasser says. "The biological logic is very straightforward. It's the social and economic parts that are the sticklers."

Today's Forecast
Windy and Toxic

Heceta Bank off the central Oregon Coast may act as an "incubator" for generating blooms of Pseudonitzschia, a phytoplankton species that produces toxic domoic acid.

Diggers target Oregon Coast razor clams.

Heading out to dig clams at your favorite beach? Someday you may be able to check the red tide forecast in addition to the tide tables. Using local sampling data and satellite measurements of ocean color, two Oregon researchers are developing a method to predict the likelihood that red tides will contaminate razor clams, mussels and other filter-feeding shellfish.

Their project could lead to an early warning system for coastal managers, health officials and commercial and recreational fishers. At present, shellfish closures are based on regular testing by the Oregon Department of Agriculture.

Peter Strutton of the Oregon State University College of Oceanic and Atmospheric Sciences and Michelle Wood of the University of Oregon Department of Biology are leading the project with funding from the National Oceanic and Atmospheric Administration's Oceans and Human Health Initiative.

They believe that certain areas, including the Heceta Bank off the central Oregon Coast, may act as "incubators" for generating the blooms of *Pseudonitzschia*, a phytoplankton species that produces toxic domoic acid. Shellfish that feed on the plankton accumulate the toxin in their tissues.

"Every spring there is an algal bloom in the Pacific from San Diego, California, to Vancouver, B.C., that is a result of warming spring temperatures, upwelling and the general ocean-atmosphere interaction," Strutton says. "Often one species of phytoplankton will dominate, and we need to identify when it is *Pseudonitzschia* so we can create an early warning system."

Key to the project is understanding how *Pseudonitzschia* responds to changing ocean conditions and how those conditions can be detected by satellites. The researchers have combed through data over the last 10 years from the Oregon shellfish monitoring program. They are comparing recorded levels of toxicity in razor clams, mussels and other shellfish with archival satellite data showing sea surface temperatures and "ocean color" — chlorophyll levels and rates of fluorescence.

They hope to find a combination of physical and optical signatures for potential blooms. During the next two years they will sample those areas at peak times to measure phytoplankton abundance and toxicity levels.

It is possible that a symbiotic interaction between the diatoms and certain species of marine bacteria enable, or enhance, the production of toxins, adds Wood, who is affiliated with the OSU Cooperative Institute for Oceanographic Satellite Studies.

Open Source
"Hot and Cool"

Alex Polvi may work and study at OSU, but he gets paid by Mozilla, an Internet software company in Mountain View, California. The rail-thin, curly-haired junior in computer science from McMinnville, Oregon, works in OSU's Open Source Lab (OSL) where he maintains Mozilla's Web site server infrastructure, the source of its popular Firefox Web browser.

During a summer job in 2005, Polvi helped to design the Mozilla system. In computer-speak, he says he was a "dedicated sysadmin monkey."

To Polvi and the other nine students at the OSL, open source has become as much a part of their days as cell phones and e-mail. At the lab, they contribute to software projects, solve network problems and interact with organizations that could provide future career opportunities.

One of Polvi's co-workers, Eric Searcy, a sophomore in computer science from Medford, Oregon, manages a Web site for participatoryculture.org, the Participatory Culture Foundation. PCF software powers a free Internet-based TV system. As open source programmers around the globe modify the software, Searcy works behind the scenes to maintain PCF's repository and track changes.

Another OSL student, Brandon Philips, a junior from Sherwood, Oregon, has helped to run OSU's own computer network. Philips modified and coordinated updates to an open source program known as Maintain, first developed by OSL Associate Director Scott Kveton. Maintain helps manage OSU's wired and wireless network. In addition to computer science, Philips is working on a minor in English literature.

"Open source" refers to the free sharing of software, but this is not the Wild West of computer programming. There are rules. If you use someone else's software and change it, you must also share your own work openly. Modifications are reviewed by other programmers before they are adopted. Author and Portland radio talk-show host Thom Hartmann calls it "power-to-the-people software."

The OSL hosts about 100 open source projects, including some of the most popular names, at least in high-tech households — the Linux operating system (known as the "Linux kernel") and the Apache Web server. The movement has attracted attention in education, industry, government and even the military. "We're going to start to see these tools mature and get easier for average people to use," says Kveton, who was named by *Information Week* in December, 2005, as a "change agent," someone likely to change the information technology industry in the coming year.

The OSL had a banner year in 2005. Among highlights were a national conference on open source software in government, a $2 million donation of bandwidth from TDS Telecom and a $350,000 donation by Google for open source development at OSU and Portland State University.

In Beaverton, Kveton's hometown, the nonprofit Open Source Development Laboratory focuses on Linux. Also active in the movement are three of Oregon's high-tech giants: IBM, HP and Intel.

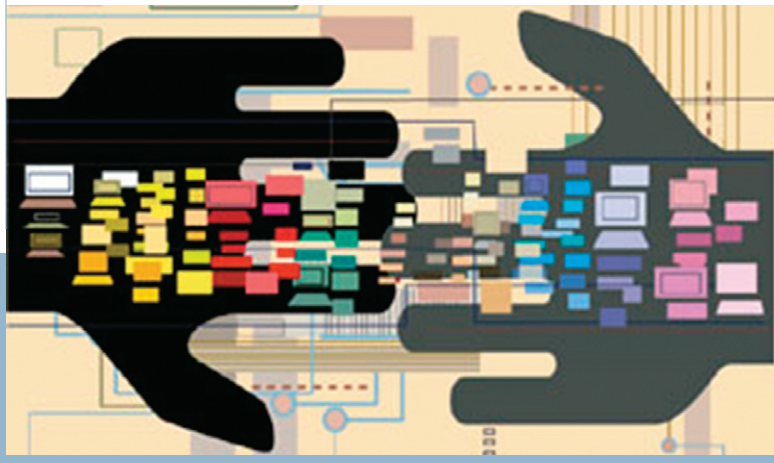
"Our students have extraordinary opportunities to be directly involved in some of the largest and most significant open source projects in the world," says Curt Pederson, vice provost for information services. "Their experience, combined with their degree, should make them very sought after in the IT marketplace."

In its first 18 months, the OSL leveraged a $450,000 investment into about $2 million worth of software, says Jason McKerr, the lab's operations manager. With OSU Research Office support, OSL is working with Indiana University, Cornell and other universities to develop software to manage academic research programs.

"Indiana has already written the budget management piece for grants and proposals, and we wanted to add conflict of interest, our financial system integration and other things. We get the features we want, on a system we want, for less than we would have spent. And we end up with a lot more than we would have gotten because we get all of the features someone else wrote," McKerr explains.

"In the computer world, open source is hot and cool right now," says Polvi. "To have that in-house is like being a rock star, a nerdy rock star."

See the OSL online:
OSUOSL.org



Solutions for Business

Developing new software? Testing the latest in hardware? The Business Solutions Group in the College of Business has performed those services for Fortune 500 companies, start-ups and public agencies such as the Oregon Department of Transportation. Last year, BSG had $830,000 in revenues.

The BSG consists of full-time software and testing engineers, MBA and MIS (Management Information Systems) students and more than 50 student interns.

"The industry standard platform for most businesses is based on Microsoft," says Mark Van Patten, BSG operations manager. "We develop that expertise in our students to meet market demand. At the same time, we do include open source components into our systems and instruction when beneficial."

The group creates custom, multi-tiered Microsoft.NET applications for workflow processing, content management, business intelligence and large enterprise resource planning systems. In product testing, BSG identifies defects and performance issues per manufacturer specifications.

Dean Ilene Kleinsorge says: "Companies have often looked to universities for research collaboration. Now, they are realizing the win-win by contributing to the experiential learning of our students."

See a list of BSG services online:
bus.oregonstate.edu/programs/bsg.htm

Wheat field near Pendleton, Oregon.

Amber Waves of *"SuperSoft"* Wheat

> *"The future success of many of Oregon's agricultural industries is likely to lie in identity-preserved markets, providing high-quality products that have real added value to end users."*
>
> ***Russ Karow***
> *Chair, OSU Department of Crop and Soil Science*

Wheat fields may have inspired Katherine Lee Bates to write a song about America's beautiful "amber waves of grain," but not all wheat is created equal. Mid Columbia Producers, Inc. (MCP), a farmer-owned cooperative based in Sherman County, Oregon, is banking that a new type of soft winter wheat developed by Oregon State University scientists will earn a premium in the marketplace.

Last fall, MCP signed an exclusive licensing agreement with OSU to plant and market a wheat variety that had been in development since 1992. According to Russ Karow, chair of the OSU Department of Crop and Soil Science, the agreement "opens new doors and creates important marketing opportunities for Oregon wheat producers."

OSU has a long tradition of wheat research in Corvallis and at agricultural experiment stations in Pendleton and Hermiston. Varieties developed under the leadership of the late Warren E. Kronstad have nearly doubled wheat yields in the Pacific Northwest since 1960. Jim Peterson currently holds the Warren Kronstad Wheat Research Chair in Crop and Soil Science and leads OSU's wheat research endeavors.

Historically, public wheat varieties are released openly and marketed as a commodity, leading to a loss of brand identity for varieties with novel attributes.

The future of the OSU "SuperSoft" wheat variety will be different. It has superior end-use qualities — low protein content, high flour yields, large cookie diameters and high sponge cake volumes — that are prized by millers and manufacturers of baked goods such as cakes, cookies, pastries and snack foods. By granting an exclusive license, OSU will enable wheat producers to capture value by segregating and delivering a product with superior and more consistent quality, says Karow.

"The future success of many of Oregon's agricultural industries is likely to lie in identity-preserved markets, providing high-quality products that have real added value to end users," he adds.

MCP Manager Raleigh Curtis says the cooperative is excited about the new opportunity. "This will be the first soft white wheat variety identity-preserved (IP) program of this type in the United States and perhaps in the world," he says. Cooperative members planted 3,500 acres last fall and may increase that to about 80,000 acres in 2006. MCP plans to begin marketing "SuperSoft" wheat this summer.

It takes over 10 years of research and breeding to develop a new wheat variety. OSU researchers evaluate tens of thousands of experimental lines each year to identify a handful of selections that have potential for commercial production. In addition to soft white wheat, OSU researchers are developing hard wheat varieties to better meet the needs of the Asian noodle market. OSU breeding and genetics research is conducted in partnership with growers and the Oregon Wheat Commission.

Today, the legacy established by Kronstad and his colleagues continues with support through an endowment from the wheat industry, managed by the OSU Foundation.

Online, discover how OSU researchers are adding value to Oregon's agricultural crops, at Oregon Invests!
oregoninvests.oregonstate.edu

BOOT CAMP FO

OR VETS

MONITORING ANIMAL HEALTH TAKES GRIT AND SHOULDER-LENGTH GLOVES

Jaime Ueda braces herself against the 1,500-pound tranquillized cow as it shifts nervously from side to side. She hesitates, looking from the cantaloupe-sized swelling on the Holstein's chest to the seven-inch knife she grips in her hand. "Are you kidding?" says the 4-foot-11, 100-pound veterinary student. "Ohmygod." And then, taking a deep breath, she drives the knife into the abscess, sending a spray of white fluid across the hospital pen at Van Beek's Dairy."You did it!" Professor Charles Estill says, proudly. "You didn't wimp out!"

By Lee Sherman

Treating a frightened calf at Van Beek's Dairy, Professor Charles Estill and students Jaime Ueda (center) and Dana Hoyt team up with physical strength and a gentle touch.

Jaime Ueda collects milk samples to test for mastitis (an udder infection) and ketosis (a metabolic condition caused by low glucose levels).

Students keep tools of the trade close at hand.

Hospital on wheels: meds, vials, and syringes on Oregon's back roads

Lancing abscesses is just one of the practical skills Estill passes on to the fourth-year students enrolled in Rural Veterinary Practice I, a required course in OSU's College of Veterinary Medicine. Even students planning to practice on canaries or ferrets need experience working on farm animals, Estill says. That's because biological agents such as anthrax and plague, and infectious diseases like avian flu and hog cholera, originate among livestock. A bioterrorist attack or a deadly pandemic would require veterinarians to step into the breach — to be, in Estill's words, the "first line of defense." In such a crisis, even a suburban cat-and-dog doctor could be recruited to work with infected herds or flocks. "Their license qualifies them to work on all species — every living, breathing thing on this planet, except people," notes the 55-year-old specialist in bovine reproduction.

So on this chilly November morning Ueda, who aspires to a clean, white-coated career with lab animals, finds herself traveling the back roads of Benton County clad in canvas coveralls and rubber Muck boots. Unmindful of the passing landscape — of the leafless oaks etched in fog and the frost lingering beside the road — the 25-year-old from Oahu and fellow student Dana Hoyt, a 34-year-old Oregonian from Klamath Falls, chat about trans-tracheal washes and sheep scald, primary uterine inertia and dystocia as they ride along with Estill and resident vet Bronwyn Crane, 27, a native of Canada's Prince Edward Island.

The "farm-visit" program, launched in 1981, serves a dozen commercial farms and hundreds of what Estill terms "backyard pets and hobby animals" such as llamas, alpacas, pigs and goats within a 30-mile radius of campus. He and his students do pregnancy checks, disease surveillance and routine vaccinations for dairy cows, beef cattle and horses on a weekly or monthly basis. With referrals from local vets, they also handle emergencies and difficult cases throughout Oregon and, occasionally, in Washington and Northern California. The farm-visit teams conduct research, too, collecting specimens for studies on nutrition, reproduction and disease among the herds.

Today, their Ford F350XL mobile clinic — stocked with antibiotics and diagnostic compounds, syringes, blood-collection tubes capped in a rainbow of colors, portable ultrasound and X-ray machines and boxes and boxes of latex gloves — stops first at the OSU Research Dairy. Over the past four decades, scientific breeding of dairy cows through genetic selection at OSU has doubled annual per-cow milk production, from 10,000 pounds in the 1960s to 20,000 pounds today. A healthy animal can pump out 100 pounds of milk every 24 hours.

In an industry that depends on slim profit margins for economic viability, any drop-off causes concern. So when one of OSU's research cows suddenly started coming up short at milking time, Estill got a phone call.

The university's high-tech milking barn hums with the rhythmic *swish-swish* of vacuum pumps as a New Zealander nicknamed "Kiwi" works a row of plump udders with practiced efficiency. The milk is measured as it streams through a jumble of transparent tubes, the quantity recorded instantly on electronic panels. The glowing numbers confirm the problem: The recalcitrant cow has given only 21.5 pounds so far that day — less than half that of her barn mates.

"Her name is No. 710," Estill tells the students as he leads them to the "loafing barn" with the just-milked cow in tow. "OK, ladies, check her out. There's room for lots of stethoscopes."

The three women press their stainless-steel instruments against the Holstein's white-and-black hide. Lifting her tail, they insert their digital thermometer and draw blood from her "tail vein." After getting normal readings on heartbeat and body temperature, they perform "simultaneous percussion and auscultation" (thumping and listening) and "palpation" (feeling around inside the reproductive and intestinal tracts). No hint of disease. Tests for udder infection and ketosis again turn up nothing. Cow No. 710, they decide, is suffering from indigestion (no small problem for an animal that processes 50 pounds of feed a day).

"Lots of gas," Crane concludes. Back at the lab, the blood sample shows low magnesium — a common finding associated with bowel trouble in cows. The Rx? Oral Epsom salts.

Not every vet-med mystery is so easily solved. Sometimes it takes extensive lab tests or even a full-blown study. In the winter of 2003-2004, many Willamette Valley dairies saw a decline in birth rates among their herds. After analyzing the animals' feed — a mix that typically includes alfalfa, corn, grasses such as fescue and ryegrass, cottonseed and soybean meal, beet pulp, barley, canola and a "mineral pack" — Estill and fellow OSU researchers discovered an unknown compound, which they traced to mold. They're now searching for ways to prevent harmful mold growth through silage inoculants, as well as proper harvesting and storage of hay and silage.

With support from the Agriculture Funding Consortium, Estill and a team of Canadian researchers are also investigating the effects on dairy-herd fertility of omega-3 fatty acids in flaxseed. He conducts field tests at Van Beek's Dairy in the hamlet of Bellfountain, where the mobile clinic travels every Monday. Today, the farm's 1,350-head herd has Estill, Ueda, Hoyt and Crane up to their armpits in work. After vaccinating five-month-old calves for brucellosis, and then tagging and tattooing the animals' ears to meet federal regulations, they each slip a shoulder-length Ag-Tek Poly-Sleeve onto their arm. Working methodically from barn to barn, they take turns reaching deep inside dozens of pregnant (or possibly pregnant) cows to gauge the growth of the fetuses. Standing on her toes, Ueda leans in and then calls out: "Oh! This is very cool! I can feel the tip of the fetus." Estill tells her that sometimes, the unborn calf will suck on the examining vet's finger.

At the end of the day, as they head for the muck hose and the warm truck, the team pauses beside a heifer in labor. Two tiny hooves have emerged, portending a new member of the Van Beek herd. When Estill talks about this part of his profession, he sheds some of the clinical matter-of-factness he typically exhibits. "Who could walk by an animal giving birth and not stop to watch?" he asks. "Who wouldn't be awed by the wonder of the whole process?" t

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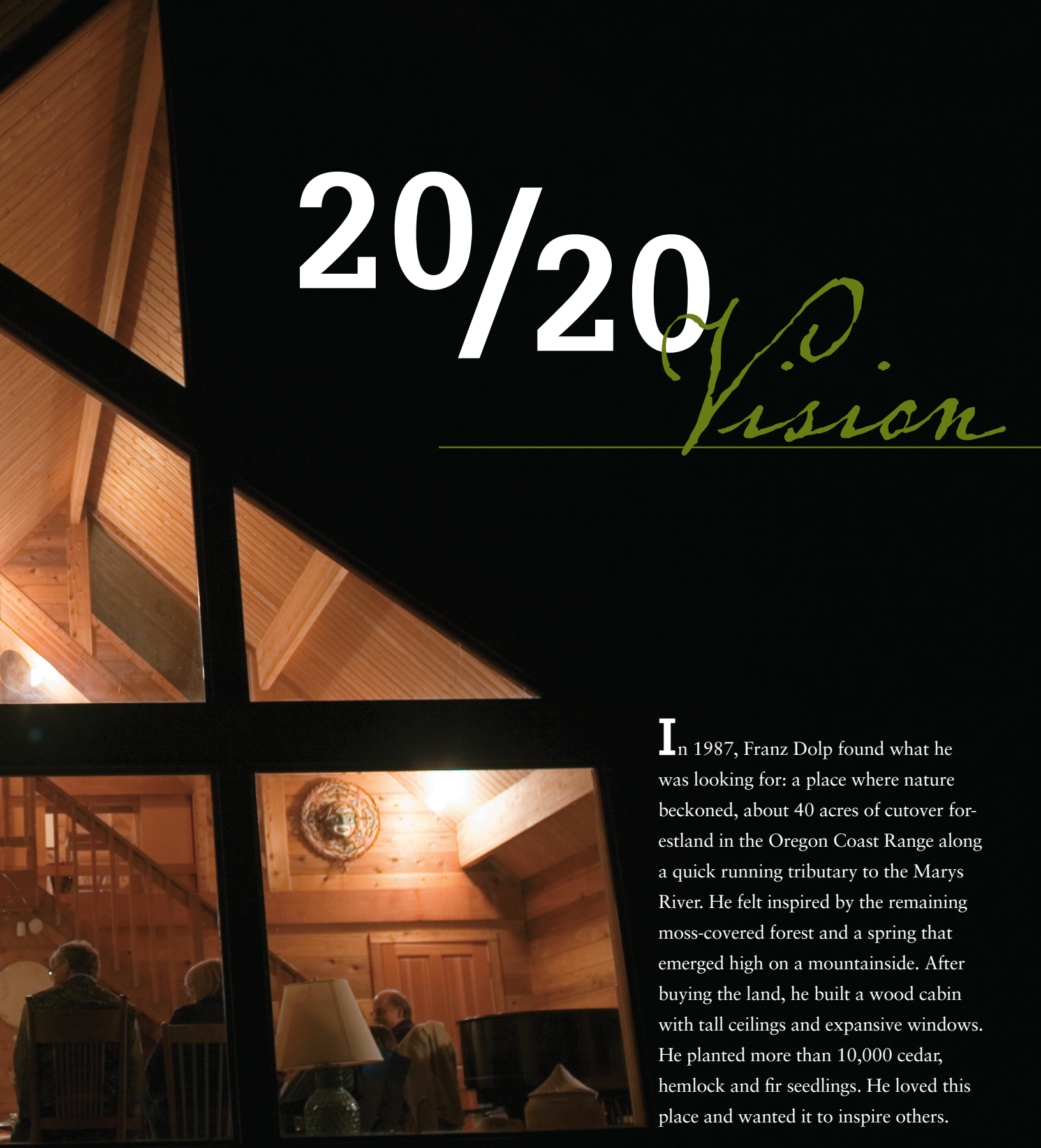
Learn about opportunities in veterinary medicine:
www.vet.oregonstate.edu/

From a cabin deep in the Oregon Coast Range to the Spring Creek Project asks a difficult question: relationship to nature?"



20/20 Vision

In 1987, Franz Dolp found what he was looking for: a place where nature beckoned, about 40 acres of cutover forestland in the Oregon Coast Range along a quick running tributary to the Marys River. He felt inspired by the remaining moss-covered forest and a spring that emerged high on a mountainside. After buying the land, he built a wood cabin with tall ceilings and expansive windows. He planted more than 10,000 cedar, hemlock and fir seedlings. He loved this place and wanted it to inspire others.

By Nick Houtman

the shoulders of a Cascade volcano,

"How should we understand our

"Maybe I should have asked not how we can bring wildness into our lives, but how we can remember to notice the wildness in every sweating pore, every stewed carrot, every solid step; in the morning air noisy with rain; in the reeling stars."

***— Kathleen Dean Moore,** The Pine Island Paradox, 2004*

Running water has long held meaning for Kathleen Dean Moore, director of the Spring Creek Project. Her book Riverwalking: Reflections on Moving Water *(Lyons and Burford, 1996), received the Pacific Northwest Booksellers Association Book Award.*

"He said he was planting an old-growth forest," says Kathleen Dean Moore, a friend and philosophy professor at Oregon State University. "He was investing in a future that he would never see, but he felt nourished by this land, and he felt a responsibility to nourish the trees. Every spring, he went out with a hoe to release the trees from the fallen leaves and encroaching brush."

Dolp, an economist and poet, died in 2004. Before his death, he worked with Moore to create a program that carries out his vision for the cabin to serve as a retreat for writers and naturalists. Today, operating out of the Department of Philosophy under Moore's direction, OSU's Spring Creek Project for Ideas, Nature and the Written Word brings poets, writers and scientists together to explore our relationship with the natural world. The cabin on Shotpouch Creek hosts retreats, meetings and other Spring Creek events.

Moore and her colleagues have taken their mission well beyond these mountains. Financed by a private donor, they have held gatherings and academic conferences in Corvallis and a public presentation attended by more than 1,800 people in Portland. With the U.S. Forest Service, they sponsor an annual poet's retreat at the H.J. Andrews Experimental Forest east of Eugene. Moore and Associate Director Charles Goodrich regularly lecture or give readings in the Northwest and throughout the country.

Their goal: philosophical clarity in our relationship to nature. "As a philosopher, I believe that ideas matter, that what people believe shapes the decisions they make," says Moore. "The more cogent and clear-thinking their ideas, the wiser their decisions will be. On the other hand, confusion or disagreement about the fundamental ideas of a practice lead to incoherent policies or stalemate.

"For example, what is a forest? Is it a commodity like a seam of copper? Is it a cathedral, a sacred grove? Politicians and forest managers are accustomed to consulting scientists for information that will help them make good decisions. But they less often consult artists and humanists who can help them understand what forests mean in the human experience — important information for those who would design forest policies in a complex and changing social context."

Science blends with art and writing in Spring Creek's Long-Term Ecological Reflections (LTER) project at the H.J. Andrews Experimental Forest. In 2004, nature writer and scientist Robert Michael Pyle served as the first LTER writer-in-residence. He focused on a 200-year-long log decomposition study. Its purpose: to understand growth and decay cycles in the forest. Other participating writers have included Robin Kimmerer, author of Gathering Moss *(OSU Press, 2005); Scott Slovic, writer, critic and educator; and poet Pattiann Rogers. The U.S. Forest Service co-sponsors the project.*

Mount St. Helens Foray

Few places provide as dramatic a focus for Spring Creek as Mount St. Helens. On a warm July evening in 2005, Moore, Goodrich and two-dozen poets, writers, scientists and artists circle around a campfire dug into loose pumice on a windswept ridge near the mountain. The deep carpet of popcorn-sized rock makes for uncertain footing. The mountain's 1980 eruption had reshaped the landscape with no regard for trees, wildlife, people or even well-honed scientific theories.

One member of the group, author Ursula LeGuin, asks if they are in any danger. "Some shaking is possible, but no ballistics are expected in the next few days," replies Lynn Burditt, U.S. Forest Service official. Fred Swanson, a Forest Service geologist and co-organizer of the event, notes that knowledge of the mountain's underground environment is "crude."

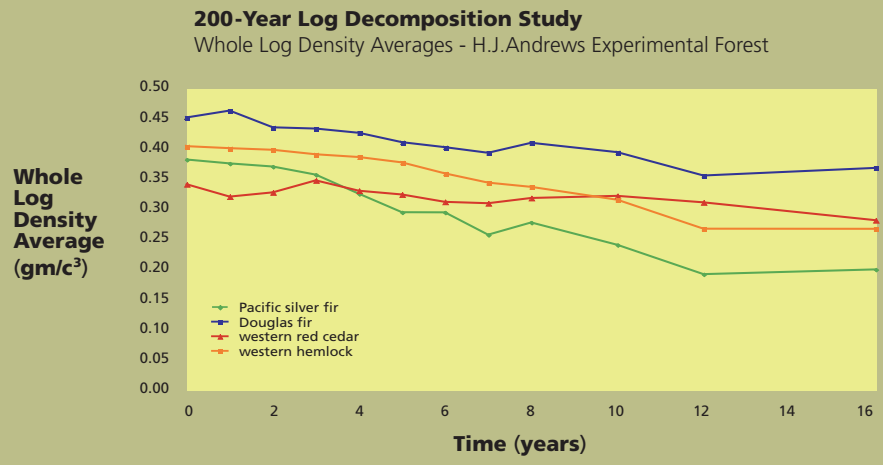
Research at the national monument has overturned theories of how nature responds to upheaval, and the Spring Creek group's conversation often turns to scientific surprises. Ecologists describe biological diversity that blossomed unexpectedly after the eruption. They point to populations of western toads that are flourishing here while they are declining elsewhere. They tell of hot gases and rocks that turned Spirit Lake into a microbial stew resembling a pulp mill lagoon and how fish eventually returned. Geologists talk about the plumbing under the mountain and how often it has cracked and heaved in cycles of cataclysm.

In the face of such power, there is also poetry and song. Folksinger Libby Roderick sings "Thinking Like a Mountain" and "If the World Were My Lover." Goodrich reads a Denise Levertov poem, "Open Secret," evoking

"The moss grows, the raven barks, the trees go to soil — first hemlocks, then firs, finally cedar. All the while the decomp team is there, watching how the cookies crumble. Maybe looking to the future is a way of hoping there will still be something to see when we get there. Maybe it's the only way to make sure of it."

— ***Robert Michael Pyle***

"The Long Haul," ***Orion magazine****, September/October 2004*



Tree species lose mass (through density) at varying rates. Above are data for Pacific silver fir (Abies amabilis), Douglas fir (Pseudotsuga menziesii), western red cedar (Thuja plicata) and, western hemlock (Tsuga heterophylla). (Unpublished data, Mark Harmon, the Richardson Chair in the OSU Department of Forest Science)

Shotpouch Creek flows out of the Coast Range into the Marys River.

the power of mountains as metaphors for human aspiration. They watch the full moon rise and roll up a neighboring slope. As moonlight strikes the valley floor behind them, a chorus of coyotes yips and howls. Nighthawks dip and climb overhead.

Beautiful as the scene is, this is no sentimental journey. They are here to work. They trek through the "blast zone" where dark forests, once destroyed, have given way to a carnival of new life. They find pockets of sphagnum moss, Indian paintbrush and penstamen, some of the "biological legacies" that survived the blast, paving the way for diversity by seeding the new landscape. They visit forests that had been left standing after layers of volcanic ash had covered every leaf and branch.

They discuss the differences between human-caused and natural catastrophe — and the meaning of recovery. The point is to think hard and deep about nature's resilience in the face of destruction and to reconsider the ideas that define the role of humans in these natural processes.

At the end of three days, they give a public presentation at the Windy Ridge Visitor's Center. Mount St. Helens' steaming crater, which geologists say could rebuild the collapsed mountain in as little as nine years, broods over the deliberations.

Left Brain, Right Brain

OSU biologist Mark Hixon has participated in several of Spring Creek's gatherings. The project "offers a remarkable opportunity for environmental scientists to integrate their intellectual, left-brained worldview with the spiritual, right-brained perspective of environmental writers, poets, and artists," he says. These exercises are "essential for successful conservation and sustainability efforts."

Moore, Goodrich and their colleagues bring diverse academic and literary expertise to the task. Moore has a Ph.D. in the philosophy of law. She has written seven books, including three compilations of essays exploring the cultural values of wet, wild places. That has not always been her focus. Her first book, published in 1989, explores the moral justification for presidential pardons. Since then, she has won a Pacific Northwest Bookseller's Award for *Riverwalking* (1995) and the Sigurd Olson Nature Writing Award for *Holdfast* (1999). In 2005, she won the Oregon Book Award for *The Pine Island Paradox*.

In addition to several volumes of poetry, Goodrich has written a book of essays (*The Practice of Home*) and edited two anthologies of poems.

The Spring Creek Project has inspired students such as OSU marine biology graduate Roly Russell. "Places like Shotpouch are necessary," says Russell, now a post-doctoral researcher at Columbia University's Earth Institute. "The overwhelming ecological issues that face our society won't be fixed by a better understanding of the underlying science alone. We need to have places that foster interactions and discussions between people who understand various facets of the issues involved."

In 2004, Russell spent two days at the Shotpouch cabin with a small group of OSU students and faculty. Their topic: science and art as sources of knowledge and ways to communicate in a sustainable society. "This didn't fall into the typical training of scientists like myself. Yet truly cross-disciplinary discussions about what leads people to care and pay attention to their environment are fundamental if we hope to move toward a more sustainable future," he says.

Toward that end, Spring Creek fosters storytelling. Told through poetry, song or scientific report, stories evoke common human values that link people across barriers of culture, politics or religion, say Moore and Goodrich. "On a practical level, it is the most powerful way to bridge different viewpoints, to meet people face-to-face and hear their stories. You can't abstract people into a single position," says Goodrich. "Stories reveal the whole of a life.

"Some scientists are looking to people who specialize in storytelling. And many writers find the stories of science to be very compelling and add a precision that can be missing in lyrical and metaphorical language."

In addition to eliciting stories, Spring Creek programs create an atmosphere that inspires listening, sharing and creative thinking, a kind of leadership training for Spring Creek's mission to "re-imagine the place of humans in the natural world."

"We're just getting started," says Moore. Future Spring Creek programs will focus on ideas related to land ownership, the commons and watershed health.

With the Forest Service, Spring Creek sponsors the Long-Term Ecological Reflections project at the H.J. Andrews Experimental Forest (see sidebar, page 19). The plan is to bring writers and poets to the forest annually for a week at a time for the next 200 years. The resulting record of creative responses to the forest will help us to understand what forests mean in the human experience.

"Imagine if we had started this project 200 years ago, with Lewis and Clark, what we would know about the changing human response to the land?" Moore says. t

Read more about the cabin on Shotpouch Creek and Spring Creek programs at ***springcreek.oregonstate.edu/***

Common Ground

Gardens and Scholarship

"All my hurts
My garden spade can heal."

— Ralph Waldo Emerson, Musketaquid

Ralph Waldo Emerson was a cultivator and connoisseur of pears. His protégé Henry David Thoreau grew beans on the shores of Walden Pond. In the unfolding and fruition of plant life, these great 19th century Transcendentalists saw a metaphor for human life — and a glimpse of God. "Husbandry," Thoreau wrote in 1846, "is universally a sacred art…."

So when David Robinson kneels, trowel in hand, to tend his hillside garden, the experience is not merely horticultural. It's spiritual, too. And it links him to those eminent American philosophers and social reformers he has spent his career researching. "For me, as a gardener, one of the great moments in Walden is hearing Thoreau talk about protecting his beans from the woodchuck," says Robinson, who holds the endowed Oregon Professor of English position at OSU.

His trenchant scholarship — which won him the prestigious Distinguished Achievement Award from the Emerson Society in 2005 — reveals not only the poetic and mystical sides of the Transcendentalists. In his most recent book, *Natural Life: Thoreau's Worldly Transcendentalism*, Robinson makes clear the Transcendentalists' bent toward the scientific, as well — their meticulous observations of the physical world, their detailed recordings of nature's processes. The place where the inner and the outer worlds unite, Emerson and Thoreau argued, is where the greatest truths exist.

"Both of them had a foot in each of these worlds," Robinson says. "They were keen to show how that which science was discovering and proving confirmed that which they believed on philosophical grounds about ethical and spiritual questions."

That unity of philosophy and science is what OSU's Spring Creek project is all about, says Robinson, who directs the university's Center for the Humanities. "Spring Creek is trying to reconnect people who are interested in the natural world and the environment — people who, because of the way modern life is structured, the way universities are compartmentalized, work inside their own disciplines," Robinson says. "The project gets philosophers and biologists and poets and geologists talking together and finding common ground." *(See "20/20 Vision," page 16.)*

Mind Your Math

It just adds up — math education is about more than learning to add and subtract. It takes reasoning and creativity, skills that students learn by sharing ideas. It takes what educators call developing "mathematical habits of mind."

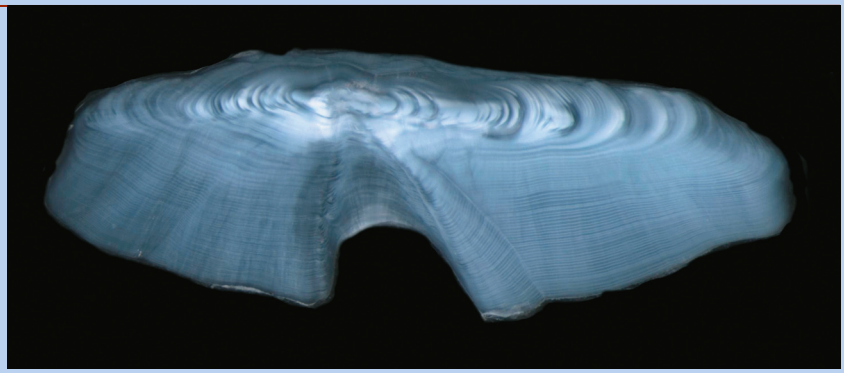
With a five-year $5 million grant from the National Science Foundation, OSU researchers are working with classroom teachers, school administrators and college students in education to improve mathematical discourse in the classroom.

Collaborators include researchers at Portland State University, the nonprofit Teachers Development Group in West Linn, Oregon, the Woodburn School District and RMC Research Corporation. They are creating a cadre of math education leaders in school districts across the state.

The grant supports participation by about 100 teachers from 50 schools in 10 Oregon school districts in grades kindergarten through 12. Another 80 teachers are supported through funding from the Oregon Department of Education and school districts.

The project focuses on all content areas of math, says Karen Higgins, director of teacher education in the OSU College of Education. "Writing and talking about math increases conceptual understanding," she adds. The challenge for classroom teachers is to find worthwhile tasks that engage students in teamwork, debate and discussion.

How students approach their solutions contributes to their mathematical habits of mind. And ultimately, says Tom Dick, OSU mathematics professor and project leader, it's about raising student achievement.



A thin section from a 53-year-old splitnose rockfish (Sebastes diploproa) otolith. Annual growth rings are clearly visible on the right.

Tree Rings and Fish Bones

Fish bones smaller than a fingernail have a big story to tell. Known as otoliths, they grow slowly, adding a new layer year by year. Scientists at OSU's Hatfield Marine Science Center are analyzing rockfish otoliths in combination with tree rings from the Cascade Mountains to shed light on how climate changes in tandem on shore and at sea.

"Tree rings have been widely used to generate growth chronologies that reflect forest history and climate change," says Bryan Black, senior research scientist at the Cooperative Institute for Marine Resources Studies at the center. "The key to our research was discovering that the same procedures could be applied to build chronologies from growth increments of long-lived rockfish otoliths."

Black is working with George Boehlert, center director, to examine the effects of ocean conditions on fish growth. Their analysis of the climate-growth relationship clearly shows that rockfish grow best in cool ocean conditions with plenty of upwelling, especially in winter and spring.

The tie between ocean variability and fish growth is as strong as the relationship between temperature or precipitation and tree growth in many tree-ring studies, Black points out. "The strength of the correlation is surprising — and encouraging," he says.

The story gets even more interesting for scientists when they compare the rockfish chronology with tree-ring chronologies from the Cascades. "We see a strong inverse relationship between rockfish growth and tree growth," says Black.

When ocean conditions are warm, the winter is less severe, and the growing season for trees in the Cascades starts earlier and lasts longer. Tree rings become wider, not narrower — just the opposite signature from the rockfish.

"The inverse connection between tree growth at 5,000 feet in the Cascades and rockfish living hundreds of feet below the ocean's surface shows the enormous influence of climate in both the marine and terrestrial ecosystems," adds Black.

"Our next goal is to expand our analysis to include long-lived marine clams and freshwater mussels to better explore linkages between marine and terrestrial ecosystems."

Sounding an Arctic Retreat

The Arctic doesn't give up its secrets without a fight. A science team led by OSU oceanographer Kelly Falkner learned that the hard way last year when a sudden wind storm off the northern Greenland coast destroyed their tents and scattered debris for miles. No one was injured, but the incident underscored the dangers of working in a harsh environment.

Falkner is no stranger to such risks. Over the last 10 years, she has helped to establish Arctic monitoring stations and flown to remote areas to collect water samples. As a professor in the College of Ocean and Atmospheric Sciences, she traces the origins and changing circulation of Arctic waters by analyzing water chemistry.

"Ten percent of the world's river water drains into the Arctic, which represents just 1 percent of the world's ocean volumes," Falkner says. "The water flowing out of the Arctic can have impacts on ocean circulation, and thus climate, throughout the world.

"During our 2003 cruise to Nares Strait (between Greenland and Ellesmere Island), we were able to get our ship further into the Petermann Gletscher Fjord than any ship has ever gone before. This is because the floating tongues of the continental ice sheet are retreating all around Greenland more than they ever have in recorded human history."

Since 1978, when satellite measurements of Arctic ice first became available, the overall ice cap has shrunk more than 8 percent each decade.

Falkner's camp on Arctic sea ice in April 2005.

Sexual Health

Asking the Tough Questions

Using the research tools of social science — questionnaires, focus groups, interviews and data analysis — Marie Harvey, chair of OSU's Department of Public Health, delves into the most private of human behaviors and the attitudes that shape them.

From her viewpoint, the stakes are far too high to avoid asking the tough questions. Studying the reproductive health of vulnerable women is, she argues, one of our era's most urgent tasks — a lynchpin in the quest for social justice. Minority women can't hope to achieve economic parity when they are disproportionately affected by HIV, other sexually transmitted diseases (STDs) and unintended pregnancy.

Helping Latina and African-American women stay healthy and plan their pregnancies will take nothing less than a paradigm shift — a revolution in contraception and disease prevention that gives women wider choices and greater control over their reproductive lives, Harvey says. The first step is to identify factors that put women at increased risk for HIV and STDs. They are complex and not entirely clear — a Gordian knot of social conditions and contextual issues including relationship dynamics, culture, poor housing and access to health care. To tease out the strands, the scientific methods must be as rigorous as the subject matter is delicate.

> ***"We need more data on men's influence on women's attitudes, motivations, decisions and behavior related to the prevention of HIV and STDs."***
>
> ***Marie Harvey***
> ***Chair, OSU Department of Public Health***

So Harvey and her team of OSU researchers devote countless hours to designing their instruments. Crafting a questionnaire for a $1.3 million Centers for Disease Control and Prevention study on rural Latinos, for example, they hashed over every linguistic fine point in excruciating detail. Working shoulder-to-shoulder with members of underserved racial and ethnic minority populations has attuned Harvey to the nuances of words — those shades of meaning that can carry powerful subtexts. "Being respectful of cultural issues and differences," she says, "is absolutely essential in undertaking this kind of research."

Harvey's work also takes her into the trenches of the culture wars. The book she co-edited with Linda Beckman in 1998, *The New Civil War: The Psychology, Culture and Politics of Abortion*, is a case in point. As Professor Carole Joffe of UC Davis says of the collected writings: "This exhaustive analysis of the way Americans feel about abortion reveals that, at core, abortion continues to be defined primarily as a moral issue, often at the expense of women's health and well-being."

Harvey's groundbreaking studies have earned her a national reputation — one that extends beyond her scores of scholarly articles to include wide citations in the popular press, ranging from the intellectually weighty (the *Los Angeles Times* and National Public Radio's "All Things Considered") to the supermarket mainstay (*USA Today* and *Glamour* magazine).

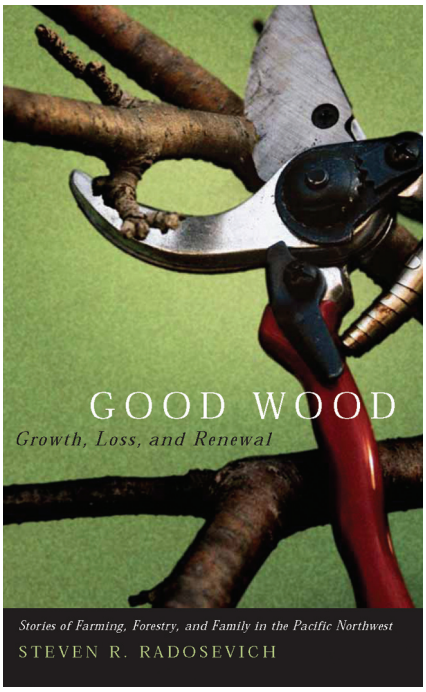
Her reformer's spirit took hold 35 years ago. As a history grad in need of a job, she fell back on her minor in psychology to land a social work position in Los Angeles. The teen moms she worked with sealed her future, inspiring her to earn a doctorate in public health at UCLA with a plan to go "upstream" to find the sources of the poverty defeating her clients.

The barrios of Southern California were light years from her early-childhood home in the high desert of Eastern Oregon, where diversity meant a mix of Lutherans, Catholics and Baptists. Maybe it was the hardscrabble life on a ranch, helping to herd cattle and bale hay in a one-horse town called Twickenham, that girded her for the challenges of social work. Maybe it was attending a one-room schoolhouse without indoor plumbing or central heating. Or rising at dawn to pick sugar beets, bush beans, and strawberries when her family moved west to a Willamette Valley truck farm.

The CDC study has brought her back to those agricultural roots. After years of studying sexual health in urban populations, she has broadened her research to include the rapidly growing Hispanic communities of rural Oregon. The bigger barriers that block protective behaviors among rural populations are under Harvey's scrutiny. "We're interested in how broader issues such as racism, medical mistrust, poverty, health literacy and culture interact and how they impact access to and use of reproductive health services."

With a $2 million grant from the National Institutes of Health, she is also investigating the skyrocketing rate of HIV infections among primarily African-American and Hispanic men and women in Los Angeles. Unlike the typical reproductive health study, which focuses on women or on men separately, Harvey's work looks at the interplay between women and men. How, for example, do gender-based power and control issues affect decision-making about contraception and disease prevention? After all, sex is what Harvey calls a "dyadic" behavior — that is, "It takes two to tango." How that tango unfolds is still a big unknown.

"Research in this area is in its infancy," Harvey notes. "A thorough understanding of how relationship dynamics influence sexual behavior is needed."



Finding Today

By Steven R. Radosevich

Excerpted from
Good Wood: *Growth, Loss, and Renewal*
Oregon State University Press, 2005
On the Web at http://oregonstate.edu/dept/press/.

Steven Radosevich *is a professor and graduate program coordinator in the Department of Forest Science at OSU. His research interests focus on plant ecology, sustainable forestry and agriculture, and the impacts and ethics of human land uses. He grew up on a farm in Tieton, Washington, in the upper Yakima Valley. Pruning an orchard, he writes, means making choices. "Good wood" refers to tree limbs laid on the ground, a result of choices that lead to a productive orchard.*

"I hope he remembers this time when he's fifty, no matter where he is, because I want him to grow up feeling the land – this land."

A subtle change in light outside the 747 must have awakened me. Is it dawn or dusk, I wonder, peering through the porthole into near darkness at 34,000 feet up? It could be either. I left Sydney that evening while it was still daylight and fell asleep during takeoff, heading back to Oregon. I am flying east into yesterday, toward a distant orange horizon that separates the obsidian sea below from its dome of stars. Is this a sunrise or a sunset; is it tomorrow or yesterday? Then, where is today?

I often work in my vineyard alone, but lately, since the weather has gotten better in Oregon, Tyler likes to "help" me prune. He's my grandson, three years old. I park the John Deere between the grape rows when we work there together. I don't need the tractor to prune vines but it gives him something to climb on. We're good company. I hope he remembers this time when he's fifty, no matter where he is, because I want him to grow up feeling the land — this land. To know the good smell of moist dirt, the wonders of worms and weeds, vines, silence, and songs sung only to ourselves. This is what we do, lost among the trellises. I hope he'll remember. I think he might, because I do. Dad taught me to drive a tractor when I was eight, how to thin fruit when I was ten and to prune trees at thirteen. Before that, I knew the way to every tree in his orchard, and how to find the creek on the homeplace, its paths among the thistle, willow, and cottonwood. I first fished that creek for rainbows with Uncle Al when I was four. They say that early experiences are imprinted indelibly. That you are who you'll become by the time you're three. Today — yesterday — tomorrow.

It is still the same evening as when I left Sydney by the time I arrive at the hospital in Yakima. Dad had gone outside the night before for some reason. Confused in the dark, he'd fallen. He'd awakened a neighbor at dawn, disoriented, bruised, and scared, banging at his door. He's unconscious by the time I arrive, propped up in bed with a tube in each nostril and arm. His chest labors beneath a bleached sheet. His mouth is open, a hollow toothless cavern that craves more air, more air. Leaning close, I smell the organisms on his breath that are killing him, carious, pneumonic. Ashen fingers move ceaselessly across the open collar of his gown. Searching for what? The last sensations of life? I stay with him until midnight. Susan, my daughter, goes back with me in the morning. He's still asleep. We sit together, watching him, holding hands. What is she thinking? I see me lying there in thirty years — same nose, hairline, forehead, gray stubble around the toothless cave. Does she see me too? We learn so much from our parents. Is this the final lesson? Am I teaching or learning now? My brother and sisters come into the room. When did they leave? That night, I turn on a Mariners game with the sound off and sit alone in the dark with him. When do I ask the unaskable question? Not yet.

By the next weekend, Dad is better. Maybe it's the change in medication, or maybe it is his stout old heart. Still my brother, Joe, and I board up the windows and doors of the old house. Otherwise, he will want to live on the farm again, alone. Why? Is that land so imprinted into him that it's who he is? It will be the first time in seventy-five years that one of us hasn't lived on the homeplace. He'll live with my sister Babi in town. Just for the winter, we'll say. I'll take the dog.

When we are done, Joe and I walk together through our newest planting of black walnut trees on the farm. It is nearly dark and the air is desert crisp. The yellowed leaves fall from our saplings and we crush the skeletons of last summer's weeds as we brush through them. The ever-present smell of dry earth and sagebrush from the butte nearby hangs stiffly in the air like old incense, surrounding the farm and us. Is this an end or just another beginning, I wonder. I wish I had Tyler with me — on my shoulders, straddle-legged, fingers wrapped tight in his Grandpa's hair, for support. We sometimes walk like that through the vineyard.

Finally, Joe and I stand somberly and silent among the new trees that we planted the spring before, the forest we may never live to harvest, and make plans to plant another.

LPI Researchers Take Aim at Lou Gehrig's Disease

How did Oregon State University's Linus Pauling Institute become home to groundbreaking research on nerve cell degeneration? It all started with a letter from a small town New England attorney.

In the early 1980s, Orlo Williams, a lawyer in Springvale, Maine, sent a note to the institute asking about research on vitamin C and other micronutrients. Staff members answered and continued to send him the annual newsletter.

In subsequent years, Williams sent back small contributions, but the big surprise came in 1998. Williams' estate included a $1.2 million unrestricted gift to LPI. His generosity spurred an additional $500,000 in contributions. With the Oregon State University Foundation, the institute created the Ava Helen Pauling Endowment, dedicated to the memory of the peace activist and inspiration for Linus Pauling, her husband and winner of the Nobel Peace Prize.

The fund enabled LPI to hire Joseph Beckman whose expertise complements the institute's ongoing research on micronutrients and health. Beckman focuses on oxidative stress, neurodegeneration and dietary factors in disease prevention. In addition to holding LPI's Ava Helen Pauling Chair, he directs OSU's Environmental Health Sciences Center and is a professor in the Department of Biochemistry and Biophysics.

LPI Director Balz Frei (holder of the Linus Pauling Institute Endowed Chair) notes that Beckman is one of the most frequently cited scientists in the world, in the top 250 in biology and biochemistry, according to the ISI Web of Science (a science information service).

One of Beckman's goals is to understand ALS, or Lou Gehrig's disease, a condition in which nerve cells die, slowly robbing the body of the ability to move and breathe. About 5,600 Americans are diagnosed with it annually. Average life expectancy after diagnosis is three to five years. The cause is unknown, but Beckman's research shows that oxidative stress and micronutrients play crucial roles. "There are five or six things going wrong all at once. And we don't understand all the players," he says.

While no cure exists, treatments can improve quality of life and extend survival. Beckman and his colleagues are developing new therapeutic agents, but clinical trials can take 10 years or more. "Our interest is in testing alternative therapies, and micronutrients are one way that potential benefits, even if small, could be achieved more rapidly," he says.

Beckman shares his knowledge with patients and their families through the ALS Association of Oregon. At LPI, he works with Frei, Maret Traber and other scientists to understand the roles of vitamins, zinc and other dietary constituents in reducing the risks of ALS, dementia and cardiovascular disease.

Beckman has received numerous grants from the National Institutes of Health to study oxidative stress and ALS. However, those funds are subject to annual federal appropriations. The endowment provides crucial "seed money," he explains. "It's important for letting us have flexibility, trying new approaches that cannot yet be funded by traditional grants."

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A day on the pier at Winchester Bay near Reedsport, Oregon. OSU's wave energy project may bring new opportunities to the coastal community. *See the "Sea Power" story on page 2.*

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