Earth, Wind—and Food
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22 : A Fine Thin Skin—wind, water, volcanoes, and ice
Different as they seem, the soils of Eastern and Western Washington have one thing in common. They come—either by water, wind, or ice—generally from elsewhere. And what takes years to form can be covered over or wipped away in a geological heartbeat. By Tim Stukey

30 : Above and Beyond
In the spring of 1792, George Vancouver praised “the delightful serenity of the weather.” A few years later, William Clark complained of a dour winter that was “cloudy, dark and disagreeable.” How right they both were. Weather patterns determined by mountains and ocean grant the Pacific Northwest a temperate climate that also has a dark and unpredictable side. By Hannesor Saterman

38 : Billions Served
Seven billion people will soon become nine billion before the global population levels off. Can so many people be fed from a finite Earth? Yes, they can, say WSU researchers. But the solutions will necessarily be many. By Eric Sorensen

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Cover photo: “Small Forest in the Palouse Hills” by Chip Phillips

CONGRATULATIONS, 2011 WINNERS!

Challenge Awards

Behavioral Challenge
1st Place
Covington High School, Covington
2nd Place
Pullman High School, Pullman
3rd Place
Ferndale High School, Ferndale

Design Challenge
1st Place
Ballard High School, Seattle
2nd Place
Ferndale High School, Seattle
3rd Place
Heritage High School, Vancouver

Design for Sustainable Urban Development
1st Place
Pullman High School, Pullman
2nd Place
Redmond High School, Redmond
3rd Place
Tahoma High School, Covington

Design for Sustainable Engineering
1st Place
Ferndale High School, Ferndale
2nd Place
Redmond High School, Redmond
3rd Place
Heritage High School, Vancouver

Design for Sustainable Agriculture
1st Place
Pullman High School, Pullman
2nd Place
Redmond High School, Redmond
3rd Place
Heritage High School, Vancouver

Design for Sustainable Urban and Rural Areas
1st Place
Pullman High School, Pullman
2nd Place
Redmond High School, Redmond
3rd Place
Heritage High School, Vancouver

Billions Served
1st Place
Pullman High School, Pullman
2nd Place
Redmond High School, Redmond
3rd Place
Bellingham High School, Bellingham

Global Impact Award
1st Place
Ballard High School, Seattle
2nd Place
Heritage High School, Vancouver
3rd Place
Ferndale High School, Ferndale

Most Inspirational
1st Place
Lake Roosevelt High School, Coulee Dam
2nd Place
Creswell High School, Creswell

Most Likely to Succeed
1st Place
Pullman High School, Pullman
2nd Place
Redmond High School, Redmond
3rd Place
Ferndale High School, Ferndale

Most Innovative
1st Place
Pullman High School, Pullman
2nd Place
Redmond High School, Redmond
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Bellingham High School, Bellingham

Most New Participant
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Pullman High School, Pullman
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Advisors’ Favorite
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Westward Ho! There was a time, not so long ago, in our great Northwest when boundaries were not a great concern. When the first non-Indian settlers reached the Palouse and the Columbia Plateau, they could look to the distant horizon and see nothing but blue sky and virgin prairie and shrub-steppe, potential farmland as far as they could imagine. And as they learned to know the land, they reveled in what the college scientists told them, of seemingly endless topsoil, of windblown loess 200 feet deep. But even as that soil washed and blew away at an unsettling rate, they also learned to ignore the worries of those same scientists and wiped the dirt from their foreheads with studied denial.

Nevertheless, a providential climate, fertile soil, and, in the drier regions, massive irrigation projects helped create the agricultural paradise the pioneers had dreamed of as they loaded their wagons, turned their backs on an exhausted East, and pointed their oxen West. But that golden period of conquest and opportunity was soon expired. The endless land filled up, an agricultural empire finally bounded by ocean and desert and international border. And now, slowly, we’re starting to understand that the geographical sorts are not the only boundaries that hem us in.

In a recent paper in Nature, Johan Rockström and colleagues urge that a “safe operating space for humanity” be defined by scientifically determined, quantifiable planetary boundaries. Our home is not as boundless as we’d hoped, and feeding a burgeoning population is unfortunately not entirely consistent with the health of the planet itself. Just as our westward expansion was finally bounded by the Pacific Ocean, our earthly continuation will depend on recognizing the boundaries of climate change, of biodiversity loss, of the nitrogen and phosphorus cycles, of ozone depletion, and other factors.

In an even more recent policy paper in Science, WSU soil scientist John Reganold and colleagues argue that if we are to meet these considerable challenges, we must start thinking bigger. Although incremental approaches have established a robust modern agriculture, meeting the demands of both planetary health and a growing population will require a transformative approach that “builds on an understanding of agriculture as a complex socioecological whole.”

Anticipating that transformative challenge, the WSU Center for Sustaining Agriculture’s Climate Friendly Farming project has explored our impending dilemmas from the perspective of an intriguing observation: “While all economic sectors emit carbon dioxide to the atmosphere, only agriculture and forestry also absorb it.”

Over the last several years, the project has identified promising management strategies and technologies that could mitigate agriculture’s contributions to the greenhouse gases that are changing our global climate. Among them are reducing the emissions, restoring carbon to soil, and replacing fossil-fuel derived products with biomass-derived products. Through their aspiration and research, these scientists are leading the way in molding the mission of the land grant university toward the husbandry of a planet that is at once bounded and bountiful.
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It’s a big job. So the world needs big ideas.

When wildfire comes to town

Flames ripped through the pines and brush in the Dishman Hills west of Spokane in July 2008, just as they’ve done for thousands of years. A dry wind pushed the fire up a hill, hotter and faster, and straight into a new development of expensive homes, destroying 13 of them and burning 1,200 acres.

The wildfire’s destruction was not surprising or unexpected. But the number of homes and residents who survived the blaze serves as a testament to smart planning, an awareness of inevitable fires, and research into the interactions of fire-prone wildlands and the growing number of people who live near them.

Although the Valley View fire in 2008 caused $50 million in property damage, it could have been worse. Several residents had implemented principles of Firewise Communities, a national program to educate landowners and communities on mitigating damage from wildfires. By thinning trees around homes and reducing fuels, a number of homeowners saved their homes. When the escape route was cut off, people knew to head to a protected ball field.

In the Spokane Valley, not far from the scene of that fire, community volunteers, firefighers, and emergency management professionals learned about the Firewise program at a workshop in May led by Guy Gifford, a forester and educator with the Washington Department of Natural Resources, WSU Extension forester Eric Sjoquist, and others.

Firewise Communities began in Washington state in 2001 after the extremely destructive fire season in 2000. It emphasizes local, easily implemented fire prevention and awareness. Firewise ‘is not a cookbook. It doesn’t say ‘thou shalt do this.’ It provides a framework that shows there are many ways to get to your solution and make our communities more resilient to wildfire,” says Gifford.

To illustrate the program’s success, Gifford points past the buildings. “If we just look south of here on the hillside there’s a bunch of homes that survived that wildfire three years ago,” he says. “There’s a direct correlation to home survivability with people who did this type of work.”

Encouraging homeowners and communities to think about wildfire couldn’t happen at a better time. The number and intensity of fires has increased steadily in the last decade. Millions of acres and thousands of homes have burned each year, including record-breaking blazes in 2006. The cost of wildfires runs into billions of dollars.

The Big Burn and other great fires of 1910 led to a century of fire suppression that emphasized stopping all wildfires, and consequently a hazardous amount of fuel accumulation in forests. In the dry interior west, like northeastern and central Washington, those fuels increase the intensity and frequency of fires.

Climate change contributes to the problem. The number of acres that could burn annually in the West could increase 400 to 600 percent if the average global temperature rises one degree Celsius, according to a study by the University of Washington and the U.S. Forest Service. Warmer
temperatures also speed infestation of bark beetles and other tree-destroying pests that create higher risk for fire and disease, he says. Kant’s woods were logged in the 1990s. What came back were two new plantings—white pines, madronas, hemlocks, and Douglas firs. She and Zobrist wade into the timber, inspect the site. As they step through an understory of ferns and salal, Zobrist stops to point out a red huckleberry, a good sign. They look at the trees for disease and the plants on the ground disappear. “You have lost some habitat in here because it’s so dense,” he tells her. Thinning this area will come later in her plan. Further uphill they find several acres where she has removed some trees to support a more diverse habitat and provide the big trees space to get bigger. Zobrist looks pleased. “As a forester, I come out and then I just look for progress,” he says.

We see a variety of plants. Zobrist stops to check a young spruce that has blisters: “It’s more about stewarding and being proactive to prevent something that breaks down the bark and ultimately can kill a tree. The best way to check the disease is to pick up a small twig and examine the underside of the bark. With this disease, you see necrotic tissue and the bark is usually split.”

In the meantime, Zobrist explains, summer means thinning of unwanted species and preparing for the fire season. “Fire is development. Sometimes it’s just too expensive for owners to maintain their forests when they are taxed for land at its development rate. But there are alternatives. The Current Use Taxation program allows for the property to be assessed at its use for forestry. But many people don’t know about the program, or they don’t think they have the ability to create the forest management plans required,” says Zobrist.

“Fire is a natural part of forest management. Open, dense, more complex, and old growth. It is these older stages that support the greatest wildlsife,” says Zobrist. “We’re diverse, robust, and resilient.”

“Looking for the next five years, I think we can push our program forward,” says Zobrist. “Applying fire to our forests is the key to reducing the risk of fire and disease.”

Watching a video about small forest management and water efficient landscaping in the Pacific Northwest, Zobrist says, “That’s the future. We need to think about these things that we can do to mitigate the impacts of climate change.”

“Small forests are an area of land where we can really make a difference,” says Zobrist. “They’re conscientious, kind, and knowledgeable.”

“The biggest threat to small-forest ownership is development. Sometimes it’s just too expensive for owners to maintain their forests when they are taxed for land at its development rate. But there are alternatives. The Current Use Taxation program allows for the property to be assessed at its use for forestry. But many people don’t know about the program, or they don’t think they have the ability to create the forest management plans required,” says Zobrist.

“I really liked everyone who is connected with this. They’re conscientious, kind, and knowledgeable. And the fact that they were freshening up their understanding of their forest and bring her stewardship plan up to date so that she can continue equally for both tax cuts and Forest Stewardship Council certification.”

“I think owning forested land has made me a happier person,” says Kast. “I’m looking forward to sharing it with my grandchildren.”
Running with the PAC-12

A conversation with Bill Moos

:: by Larry Clark ’94 ::

I think it illustrates the importance we place on the academic component of being a student-athlete at Washington State. Our young people are here to get an education, obtain a degree, and compete on what is believed to be the finest conference in the country. When we see the results in any of our academic areas, such as the APR, it’s a source of pride not just for me, but should be for Cougars everywhere.

How will the conference’s new television contract help WSU athletics?

I’m very pleased that my peers and I were able to hammer out a revenue-sharing formula that provides equal shares of television money to all 12 institutions. That’s extremely important for us here at Washington State as we’ll be able to see our budget grow and hopefully we can continue to invest in our facilities.

Larry Clark of Washington State Magazine sat down with Moos for a discussion on what it means for WSU to be part of the PAC-12 conference, the television deal, and his vision for WSU’s athletic programs and facilities.
Ginger-pumpkin muffins

This is a recipe that editor Tim Steury cooked up recently for a WSM staff meeting. The richness of pumpkin, ginger, and molasses is balanced by the delicate texture of the muffin. The walnuts, pumpkin, ginger, and molasses are balanced for theWRSW.

**Ingredients:**
- 3/4 cup flour
- 1 cup pumpkin
- 1/2 cup brown sugar
- 1/4 cup molasses
- 1 egg
- Salt
- 1 tsp. baking soda
- 1/2 cup butter melted and cooled
- 2/3 cup finely chopped candied ginger
- 1 tsp. powdered ginger
- 1/2 cup chopped walnuts

**Directions:**
1. Preheat oven to 400°F. Grease or line a 12-cup muffin pan.
2. Whisk together dry ingredients in a bowl.
3. In another bowl beat egg lightly and then mix in melted butter and pumpkin.
4. Stir dry ingredients into wet ingredients until just blended. Fold in ginger and walnuts.
5. Spoon into muffin pan and bake for 15 minutes. Test with toothpick.

**How to process a pie pumpkin**

Cut a medium-sized (four-pound) pie pumpkin in half and scrape out the strings and seeds. Remove the stem. Place the pumpkin pieces face down on a coarse sheet, sprinkle with about a quarter cup of water, and cover tightly with foil. Bake in a preheated 400 degree oven for about an hour or until a paring knife slides easily into the skin. Cool slightly. Scoop cooled pumpkin out of the skin and puree in a blender. Makes 1-1/2 cups.
Some of the most important things your science teacher taught you are wrong

by Eric Sorensen

There’s the science most of us learned as kids. Then there’s the science that scientists actually do.

The K-12 variety is more like a cooking class, but with chemicals, griddles, an occasional flamerock, the unforgettable smell of formaldehyde, and nothing you would want to eat. There is science, too, taught to honor the formula of a lab report: hypothesize, test, observe, conclude, generally along the lines the teacher told you to expect.

Outside the classroom, science has over the centuries spawned revolutionary advances in knowledge and understanding. But inside the classroom, science is actually practiced.

Since the K-12 variety is more like a cooking class, some chemistry teachers have bemoaned the disconnect between what they teach and what science is really done. Judy Morrison is standing at the front of a classroom, teaching science, and emphasizing creativity and imagination can come into play at any moment.

Morrison hands out a few of the tubes and Erlenmeyer flasks she has brought with her. They are black marks. Everything else—like the notion of a lab report: hypothesize, test, observe, conclude—is not how science is actually practiced.

The misunderstanding starts with our popular notion that science is a way of knowing and the complications. There’s the science Morrison and all the other teachers think of as science, and the scientific method is reduced to the formula of a lab report: hypothesize, test, observe, conclude, generally along the lines the teacher told you to expect.

Outside the classroom, science has over the centuries spawned revolutionary advances in knowledge and understanding. But inside the classroom, science is actually practiced.

One of the things that science teachers need to recognize is that school science really needs to reflect the scientific endeavor, she says. “There has been a disconnect between those two things. School science is not often how science is actually practiced.”

Wild hair. Glasses. Lab coat. Standing next to a university professor in the Department of Electrical Engineering and Computer Science, Morrison looks more like a real scientist than most school teachers. Indeed, she says, that’s the thing she loves most about her job as director of a science-education program at Washington State University. Morrison says the students she works with are often surprised to learn that science is often not about memorization. It’s about creativity and imagination can come into play at any moment.

She says, “It can’t be one piece of rope with four ends. Morrison’s work grows out of a recognized need to help students better understand the concept of aging.

Morrison and her colleagues have been trying to deal with the problem of aging by having older people share their knowledge with students. They call it a “grandparenting” program and it’s one of several initiatives that have been started in recent years. The idea is to connect older people with younger people to help them understand the issue of aging.

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Using technology to address the challenges of aging

by Tanya Hilding

An increasing number of families know the stress of trying to deal with an elderly parent or spouse who is losing their ability to live independently. How can we maintain dignity for those who are having trouble completing daily tasks? How can we make sure our elders are safe, and who takes care of them?

A WSU research team, led by Diane Cook, has been working on a study to see if technology can help make it easier for older people to live independently. The project, called STEM (Science, Technology, Engineering, and Math), involves using a variety of sensors and devices to collect data on how older people are doing.

The data will be collected in the homes of older people in the greater Pullman area, and researchers will be looking at how this information can be used to help older people live independently.

The researchers are hoping that the initial pilot project at Horizon House leads to a more comprehensive study, which would follow a larger number of elderly residents for a longer period of time.

Residents are eager to participate in research that will support their desire to age in place, says Laurie Bushfield Larson, health services officer at Horizon House.

“As care providers, we need to understand what technology can offer as we serve our consumers who will expect to remain in their homes even with decline,” she says.

Currently, there are a few technologies that can help with the challenges of aging, such as wearable buttons that people can activate if they fall. Regarding clinical treatments for people with mild cognitive problems, there are no gold standards of care out there,” says Schmitter-Edgcomb.

As part of the study, researchers will install between 30 and 40 sensors in each apartment, including motion, door, power metering, and temperature sensors. Motion detectors will make up the majority of the sensors, and will monitor residents’ activities as they move from room to room in their apartments. Data will be collected continuously. Half of the study participants have mild cognitive problems and the other half are healthy.

Unlike some home-monitoring systems, the research project does not include any cameras or microphones. “Respecting privacy is a primary tenet of the project,” says Crandall. “We want to monitor, not watch, residents.”

The researchers expect to find patterns in the data that will help them discern and quantify changes in residents’ health or possible decline. The sensors will be collecting vast amounts of data throughout the day on each resident, collecting data on a wide variety of activities, such as brushing their teeth or cooking dinner. By having good information on these important activities that make it possible for people to live independently, the researchers intend to help caregivers better quantify and discern any changes that might indicate that people are losing their ability to function on their own. They will be comparing the information collected from the sensors with the typical medical assessments that are done to assess declines. The researchers also plan to develop computerized prompts for residents, reminding them of important activities that could help them live in their homes longer.

“We hope to automatically detect signs of decline very early in the process that caregivers will better be able to know the capabilities of their patients,” said Crandall.

The researchers are hoping that the initial pilot project at Horizon House leads to a larger, more comprehensive study, which would follow a larger number of elderly residents for a longer period of time.

Cross-cultural pen pals

by Angela Sams

One morning this spring, a group of WSU students from Jeff Petree’s Communication Studies 221 class fills half a small lecture hall at a Spokane riverfront campus. They have traveled here from Pullman to meet their pen pals, 5th through 8th graders from the Nez Perce Elementary School on the Colville Reservation in north-central Washington. Though they have been communicating with the grade-schoolers by letters throughout the semester, they are meeting for the first time to visit, “play” with science, and talk about going to college.

The Center for Civic Engagement at WSU started the pen pal project last fall. As a part of its mission, the Center’s goal is to help Washington State students realize the value of serving others, to extend themselves beyond campus and engage with the community. The Nez Perce students, who have a statistically high drop-out rate of about 50 percent for eighth-graders, might benefit from having one-to-one contact with college students, says Veneta Doty, academic programs coordinator in the CCE at WSU.

Nationwide, the fields of science, technology, engineering, and math have a small percentage of minorities. By making math, science, and technology more appealing to students, the Center hopes to attract more students to STEM careers.

The project is a potential model for how STEM education can be delivered to underrepresented students. Unlike some home-monitoring systems, the research project does not include any cameras or microphones. “Respecting privacy is a primary tenet of the project,” says Crandall. “We want to monitor, not watch, residents.”

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“...and we had to learn how to transmit it overhead, and also how to transmit it underground.”

**DAM MODELING**

One of the best areas to view the frenzied pace of WSC engineering in the 1950s was in the Lakebrock Hydraulic Laboratory. Demand for electricity was growing rapidly, and power companies and private utilities were looking to dams as power generators.

Washington Water Power came to WSC researchers in 1953 with a problem. They were looking to construct a spillway for a proposed $85 million dam on the Clark Fork River in Montana. Professor Paul Ruff had experience as a dam designer, and the WWP engineers asked him to construct a miniature flume in the hydraulic lab. At the time, the closest facility for dam modeling was in Minnesota. By December 1954, a miniature of the dam was built in an old WWII-era Quonset hut but behind Dana Hall. A few months later came another request—this time for a model of the dam on the Middle Snake River at Pleasant Valley. The researchers built a model, one-fifth the size of a real dam. It stood twelve feet high and 25 feet across.

While rock hunting across Antarctica last winter, WSU geoscientist Jeff Vervoort was captivated by how the landscapes revealed dramatic stories of melting glaciers, tortured ice, wind-sculpted snow, and glacial debris. But where he saw a language of science, Kathleen Ryan, an assistant professor of interior design, saw a language of aesthetic elements and principles, of curved lines, shapes, rhythm, and movement. The result was their interdisciplinary, husband-wife exhibit in the spring Academic Showcase: Visual Language of Ice and Rock on the Frozen Continent. They discuss highlights of the presentation in a web exclusive at wsm.wsu.edu/extra/antarctica. Photo courtesy Jeff Vervoort.
conducted. A frenzied pace continued in the lab through the 1970s as dams around the West and throughout the world were built. Among the dams modeled at Alburnett were the Rocky Reach Dam, built for Chelan County Public Utility District (PUD) around 1961, at a scale of 1:7.5; Priest Rapids, for Grant County PUD; Wells Dam for Douglas County PUD; and Wanapum, built for Grant County PUD on a scale of 1:20. The lab also did models of Snake River dams, including Pleasant Valley, Bremner, and Oswego.

The dam models were not only useful to industry, but became one of Pullman’s largest tourist attractions, drawing numerous visitors. At one time, there were two models side-by-side, one for a dam in Pakistan and the other on the Snake River.

POWER PROFESSORSHIP

As the 1970s arrived, power engineering and dam building were no longer the most popular field on the block. The electronics industry was taking off, and there were increasing concerns about environmental issues tied to the dams and energy usage. With less student interest in power engineering, universities began changing their focus to the newest field of microelectronics.

WSU’s power engineering program was almost dead, says Stephen Muchinsky (79 BS, EE), smart grid manager with Tacoma Public Utilities.

However, a group of industry people and WSU faculty decided to fund WSU’s Power Professorship program with the intent of continuing to train students in electric power.

Along with A.L. Betts, chairman of WSU’s School of Electrical Engineering and Computer Science, one of the leaders of the efforts was Wendell Satre, who was chair of Washington Water Power at the time. Glen Howr, emeritus professor in the School of Electrical Engineering and Computer Science, remembers driving around the entire state with Axel Strom to drum up support for the effort. Strom, who was with Grant County PUD and had been a prime mover on building dams on the Columbia, was a great supporter of the power professorship idea, which was unusual in including support from both public and private utilities.

The Power Professorship program led to an endowed chair in power engineering, currently held by Anjan Bose in the School of Electrical Engineering and Computer Science.

As part of the program, an industrial advisory committee works with faculty on curricula and research. Companies support many senior design projects and provide internships for students. The support of the program also allowed the school to establish two annual conferences on protective relays.

“The Power Professorship program is very important to our business,” says Paul Wagenaard ’79, senior vice president of energy operations at Puget Sound Energy. “We’ve attract industry to a gas utility. It’s one of our primary sources of new, young talent in the electrical engineering area.”

When Tacoma Public Utilities director and CEO Gaines graduated with his electrical engineering degree in 1978, the supply of power engineers was barely keeping up with demand. He received nine job offers when he graduated.

After having participated in an internship with Puget Sound Energy and finding that so many job offers, he decided to return to the power utility industry. Schweitzer’s company, Schweitzer Engineering Laboratories (SEL), started in 1982 with two employees.

When the company started, says Dave Whiteman ’39, CEO and president of research and development at SEL, utilities would buy Schweitzer’s new digital relay simply because it helped them determine quickly where on a transmission line they had a problem. They still kept their old electro-mechanical relays—until they figured out that the digital relay was better.

Today, the company employs 2,500 people. They have offices in 60 countries and their products are in 140 countries. Every utility in North America uses SEL products.

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* The acronym “STEM” stands for science, technology, engineering, and mathematics.
Soil scientist John Reganold contemplates soil layers revealed in a road cut near St. John. Photo Jim Richardson

**SOMETIMES IN LATE SPRING** and late summer, when the fields of eastern Washington have been tilled for spring planting or recently harvested, a wind will build out of the west, gathering the loose loess soil of the dry fields, lifting thousands of tons of it into an ominous cloud that shrouds the region in a murk. The dust that grates in the eyes and leaves a dirty skiff on everything is a lesson in both geology and agronomy.

**THE BIG PICTURE**

The soils of eastern and western Washington, different as they seem and are, have one thing in common, as do most. They come, either by water or wind, primarily from elsewhere. Within the geologic timescale, most soils are very young. Within a human timescale, they are ancient. They also form a minute part of the earth in general, a fine thin skin.

University of Washington geologist David Montgomery, in his recent book *Dirt: The Erosion of Civilizations*, describes soil as the “frontier between geology and biology.” Stressing how thin that frontier is, he compares it to human skin. Whereas human skin, at less than a tenth of an inch thick, represents a little less than a thousandth of the height of a person, soil accounts for barely one ten-millionth of Earth’s 6,380 kilometer radius.

East of the Cascades, the loess soils of the Columbia Plateau and the Palouse, some of the deepest soils of Washington, are the result of the return of windblown silts, says Bruce Frazier, recounting the major geological events that created Washington’s diverse soils. Frazier, a soil scientist, recently retired from WSU where he spent much of his career mapping Washington soils.

Southwest Washington is quite different, Frazier continues. Sedimentary materials interspersed with old basalt flows support mountain forests. Chehalis has a coal mine, he notes, highlighting the region’s much different geology.

**A FINE THIN SKIN**

wind, water, volcanoes, and ice

:: by Tim Steury ::

“To be a successful farmer, one must first know the nature of the soil.” —Xenophon, *Oeconomicus*. (The Economist), 400 B.C.

:: by Tim Steury ::

WSM Fall 2011
Soil scientist Craig Cogger, a scientist at Puyallup, continues the West-side narrative. Glaciers extended as far south as the middle of Thurston County, he says. When they retreated, they left behind a variety of soils. The glacial till soils are okay for agriculture, he says. But they have limitations. Their texture is coarse, so they won’t hold water.

Whereas glaciers played a dominant role in the nature of Puget Sound area soils, there is also a marvelous diversity. Past exceptions of Mount St. Helens and Mount Rainier, loosed huge mudflows, says Cogger, resulting in heavy wet soil interspersed with rocks—not suitable for row crops, but great for pasture and dairy. To the north, in Whatcom County, windblown silts, similar to the eastern loess, create fertile farmland. To the south of Olympia are older clay soils.

The best agricultural soils of the Puget Sound region are in the alluvial river valleys, which collect the sediments from the erosion of the surrounding landscape and the Cascades. “When you combine the soil with the climate,” says Cogger, “you have some of the best farmland in the world.”

Craig Cogger and Doug Collins present the result of their experiments with organic no-till at Puyallup Research and Extension Center, soil rich in organic matter and microbial life. Opposite: Alan Busacca has taken his fascination with terroir to its logical and delicious conclusion, joining winemaker Robert Smasne ’99 to produce wines from Syrah grapes with identical techniques from three different vineyards.

Busacca started out in geology, giving him a very fundamental understanding of soil formation, which comes from a combination of five rudimentary factors: parent material, climate, topography, time, and microorganisms.

Parent material, the beginning of soil, is created from organic material or from bedrock through weathering, which happens through various physical and chemical reactions. The rate of soil formation over time is determined by climate.

Busacca started working with grape growers in the mid-1990s, drawing on his understanding of soil formation and climate, which together determine what is understood as a site’s terroir, the personality of the site, if you will, the effect on the grapes determined by the same factors as soil formation: parent material, climate, time, topography, and microorganisms.

Since leaving WSU to devote himself full-time to consulting and viticulture, Busacca has taken his fascination with terroir to its conclusion. He and winemaker Robert Smasne ’99 have developed a label of syrah grapes from three very different vineyards to make three wines that express the terroirs of their respective sites.

The soils of the Minick Vineyard in the Battle Grounds north of Puyallup comprise a little loess over shattered basalt. The resulting wine yields red fruit flavors, a little cedar and spice.

The soils of Coyote Canyon in the Horse Heaven Hills are 4–5 feet of loess over hardpan and basalt. Syrah from this site yields a blueberry flavor with a medium body.

The soils of the Card du Cheval Vineyard on Red Mountain are windblown sand. Combined with its heat, wind, and drought stress, the site yields tiny berries with thick skins, an inky black juice with pleasing tannins and a blackberry taste.

Terroir might not be as pronounced in wheat or peas as it is in wine grapes, but geography and the resulting soil types work together to give Washington an extraordinarily diverse agriculture and landscape.

For Busacca, soil—geography determines a region’s story of settlement and agricultural development. Washington, its agricultural diversity second only to the much larger California, is still discovering the potential and beauty of its geographic diversity, not only for wine grapes, but for the more than 200 other crops it grows.

The sandy plateau of Horse Heaven Hills grows some of the best wine grapes in the country, but also carrots and a wide variety of other crops (see “In Season.” WSM Summer 2011). The alluvial soils and silt of the Wenatchee Valley and Yakima Valley have established Washington as the apple capital of the world. Cherries, pears, and other tree fruits love those same soils.

West of the Cascades, the rich alluvial soils that Cogger celebrates have established the region not only for its berries and vegetable crops, but also for its huge seed industry.

And then there’s the rich loess, blown in from elsewhere and just as apt to blow away.

Despite its rich soils, the state’s agricultural history is one of crop failures. king County “got fairly aggressive about farmland preservation.” But Snoqualmie Valley farmland seems to be fairly well protected. It floods every winter, so that keeps development out.

Within the soil cognoscenti, Busacca is perhaps best known for continuing E. Hendon Breiten’s solution to the channeled scablands puzzle. It was Breitz who first understood that the strange Eastern Washington landscape known as the scablands was the result of an unfathomably enormous flood, or series of floods, toward the end of the last ice age. Building on the work of Breitz and others, Busacca gradually established that the upper layer of loess that forms the Palouse hills is the indistinct result of those floods. After the floods scoured the existing basins that once layed the scablands, the silt settled out to the south, then was blown back up by the prevailing winds. And beneath that surface layer, more ancient soil (‘paleosols’ in the nomenclature), the results of two million years of prevailing winds.

Considering that European settlement came a mere geological yesterday, we’ve taken only a brief agricultural advantage of this resource. Skagit Valley is an exception. Much rich farmland remains, and farmers determined to keep it. After it lost the Kent valley to development, says Cogger, King County “got fairly aggressive about farmland preservation. So Snoqualmie Valley farmland seems to be fairly well protected. It floods every winter, so that keeps development out.” Pierce County, unfortunately, has made little attempt to preserve its farmland, says Cogger: “In the 27 years I’ve been here, I have seen the valley paved over. There’s no will to preserve farmland.”

**TERROIR: NOT JUST FOR WINE**

Alan Busacca grew up in his academic career as a soil scientist several years ago to help people grow wine grapes, one of the latest and most lucrative manifestations of Washington’s agricultural geography. Within the soil cognoscenti, Busacca is perhaps best known for continuing E. Hendon Breitz’s solution to the channeled scablands puzzle. It was Breitz who first understood that the strange Eastern Washington landscape known as the scablands was the result of an unfathomably enormous flood, or series of floods, toward the end of the last ice age. Building on the work of Breitz and others, Busacca gradually established that the upper layer of loess that forms the Palouse hills is the indistinct result of those floods. After the floods scoured the existing basins that once laid the scablands, the silt settled out to the south, then was blown back up by the prevailing winds. And beneath that surface layer, more ancient soil (“paleosols” in the nomenclature), the results of two million years of prevailing winds.

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Highly fertile soils are sustained by mild temperatures and adequate rainfall and are ideal for annual crops. High-risk fertile soils are vulnerable to mismanagement leading to compaction, erosion, and desertification. Marginal soils require pristine intervention; otherwise, they may suffer from further degradation.

It’s not even fair,” he says. Whereas the orders reflect soil quality to an extent—al eclis, for example, from hot desert areas—the matter of soil health is not that simple. A good definition of “soil health,” or “soil health,” is tough to pin down. But all definitions include certain things, says USDA soil microbiologist Ann Kennedy. pH, soil structure, perishability, the nutrients, all the chemicals, cation exchange capacity, and then all the things growing in it, the microbes, spigotax, and nematodes. Even with awareness of the wild diversity of soils, however, one might understandably assume soils on a small scale would generally be homogeneous.

Tillage is a hard habit to break. Any farmer will tell you, whether you’re tilling a vineyard or a field in a controlled setting, there’s a great satisfaction in looking behind you and seeing the furrowed soil. It’s a great satisfaction in looking behind you and seeing the furrowed soil. It’s a very precious resource.”

Ann Kennedy has been thinking for much of her career about soil microorganisms, about the extraordinary diversity of microscopic critters that make up a soil ecosystem. But lately, her thoughts have turned more to humus, to carbon, to organic matter. We’re not seeing the microbes, ’ says Kennedy. “We’re not seeing the nutrients stuck on the carbon chains to support plant growth.”

Whereas Collins, who is an extension educator for the WSU Small Farms Program, is encouraging small farmers to pay closer attention to residues, leaving soil as intact as possible so the roots can act as a slow-release fertilizer.

Explore an interactive map of Washington soils at wsm.wsu.edu/extra/soils.

account when you feel the need to plow. To get a cleanly tilled field requires many hours, much fuel, equipment.” On the other hand, tilled soil solves a lot of problems, which vary from site to site.

Words are just one of those. The easiest way to get rid of a weed problem is to plow it under. Another advantage of tilled soil is washing the soil more quickly, allowing root and shoot germination and growth. Soil scientists and direct-seeder farmers alike are frustrated with the slow acceptance region-wide of direct seeding. But all will admit it’s not an easy process. The long-established approach to tillage remains the norm for a reason.

But tillage also destroys the soil structure that attuned farmers and other soil aficionados extol like a wine connoisseur talks about a wine’s body and structure. “Not to cast asperion,” says Stubbs, “but the more tillage you perform, the more you break down that microbial community.”

More dramatically, once disrupted, the soil more easily washes or blows away.

In a paper titled “Erosion Impacts on the Palouse Misunderstood,” the late University of Idaho soil scientist Roger Veseth reported that since the Palouse was first cultivated in the late 1800s, all of the topsoil has been lost from about 30 percent of the prairie. Another one-quarter to one-third of the topsoil has been lost from another 60 percent of the cropland. Erosion rates of up to 200 tons per acre, or more than an inch of topsoil, have been measured on steep slopes, with a total of up to three feet of topsoil gone from hillslopes and ridges.

“When you walk on the Palouse and you see the Palouse River,” says Stubbs, “you know how brown it is, you question sustainability . . . that soil we’ll never get back. It’s a very precious resource.”
or the degree, however, their aim is to keep the soil as intact as possible—
and build organic matter.

Unfortunately, it isn’t easy. Even after 15 years of direct seeding, Stubbs continues to “refine, build, change on that system. The learning curve is pretty steep. Especially under such dry conditions.” Stubbs’s land gets about 15 inches of rain a year.

“Most years it’s closer to 13 or 14 than a low 16. That extra one or two inches makes a tremendous difference.”

“With this limited moisture, it is a bratty ride,” he continues. “But we’re able to see changes in soil structure, to see porosity increase, the ability to get soil structure, the top six inches to have it regain what was lost during the tillage period—that’s very rewarding.”

IT’S COMPLICATED

You don’t have to get very far into farming in its broadest sense to start noticing some contradictions. A particularly interesting one in the organic contradiction.

There’s a lot to like about raising food organically, no synthetic fertilizers and pesticides, generally a friendlier approach to the soil. Some of the most interesting research, including that by John Reganold and Preston Andrews in horticulture, is showing high nutrient values in organic crops and in some cases yields equivalent to those with herbicides and pesticides, generally a friendlier approach to the soil. Some of the most interesting research, including that by John Reganold and Preston Andrews in horticulture, is showing high nutrient values in organic crops and in some cases yields equivalent to conventional methods.

But attractive as it is, one of organic ag’s unfortunate little secrets is that it requires a lot of tillage, at least in field crops. Unless you’ve sired a dozen kids who love to spend their time pulling weeds, it’s hard to control weeds without herbicides or tillage.

One-third of a cup of soil will contain between 2,000 and 12,000 nematodes. Some nematodes are bacteria feeders, some are fungal feeders, some are predators. Some nematodes eat other nematodes or protozoa, some are omnivores, and some are pathogens.

“If you have all bacteria-feeding nematodes,” says Collins, “it tells you there’s been a recent disturbance or a lot of fertility.”

C. elegans, a bacterial feeder, can go from egg to egg laying female in four days.

The presence of predator nematodes, on the other hand, will indicate a more stable soil, as they take 14 months to go from egg to egg laying. Larger bodied nematodes, which correlate with earthworms, also reflect the degree of disturbance, as it takes a long time for them to complete their life cycle.

A disturbed system can still be fertile, says Collins. “From a farmer’s point of view… ultimately it’s the soil’s function that is important, not necessarily diversity.”

As diverse as they are, nematodes make up only a fraction of the microbial life of a healthy soil. In a fascinating paper in Annals of Soil Science, Ann Kennedy and Tam Stubbis ’80 (who is married to direct-seeder Michael Stubbis) review what is known and unknown about soil ecology.

“The functions of these diverse communities range from nutrient cycling and residue decomposition, to soil structural component, to plant growth effects,” they write. “Soil microorganisms provide a source of added carbon and nutrients in acid soils as well as protecting the soil from wind and water erosion.”

One of the more interesting things about nematodes, says Collins, “you can look at them under a microscope and tell what they do by the shape of their face.” For example, pathogens have a proboscis that they inject in the root or the epidermal cells of the plant.

Much of this diverse realm, however, is still beyond our comprehension, simply because of the vast numbers. Kennedy and Stubbis cite one analysis of soil bacterial DNA that indicated the presence of 4,000 genomic types—reflecting a possible 40,000 species.

SOIL AND CIVILIZATION

Nematodes and bacteria, of course, are not the only indicators of soil health. The ultimate expression of soil health: our survival. From ancient Greece to Easter Island, as the soil goes, so goes the civilization. Washington’s immediate share of rich soil and land area, combined with its rich agricultural diversity and favorable climate, offer a relative guarantee of survival. However, the continuing erosion of the rich loess soils of eastern Washington and the locking away of equally rich alluvial soils of the west side beneath an impermeable shell should stir unease in anyone interested in the future of eating. Also, a growing dependence by the rest of the world on those relatively few rich agricultural pockets around the world and factors such as political upheaval and climate change preclude complacency.

With Washington’s diverse geography, matched by awareness, appropriate agricultural research by a responsive university, and innovative agricultural practices, we can look forward not only to survival, but to continuing to eat and live very well indeed.
PERCHED ON THE EDGE of the ocean and cradled by mountain ranges, Washington is an excellent place for watching the weather. But while meteorologists and weather reporters are peering out to the Pacific and looking back over our historical patterns to help us prepare for this week, a whole cadre of scientists, including climatologists, hydrologists, engineers, and ecologists, are using data from the past and peering decades into the future to see if we will be warmer, wetter, or worse.

March 1, 1910 Stevens Pass avalanche. The deadliest avalanche in U.S. history was triggered by a thunder clap. It swept a passenger train and mail train down the mountainside. Ninety-six people were killed.

Winter 1949/1950 Seattle’s coldest winter on record had more than 20 inches of snow and temperatures below freezing for several weeks. Eastern Washington was paralyzed by up to 50 inches of snow.
ON DECEMBER 14, 2006, meteorologist Nick Allard ’03 wrapped up his morning shift at the Northwest Cable News station in Seattle. Since a major wind storm was headed for the coast, he checked into a nearby hotel, rested for a few hours, and then headed right back to work.

The severe weather had been building over the Pacific Ocean for a few days. As it closed in on Washington it was growing more intense. A long front reaching all the way up to Vancouver Island ran up against the coast and the Olympic Mountains. Every person has experienced a weather event that sticks with him for the rest of his life. For Allard and thousands of other Washingtonians, this storm would be it.

The previous month had soaked the region with 16 inches of rain and delivered plenty to report about thanks to a series of Pineapple Express storms carrying moisture from near Hawaii. That November had already broken precipitation records, flooded rivers, and caused dangerous mudslides.

Typically, when storms hit our coast they are weakening and falling apart. Some come from the southwest, then suddenly turn north and head for the Gulf of Alaska, danger diverted. But when the December 2006 storm hit land, it came in almost due west. Low, cold, unstable air moved over Vancouver Island, and around midnight something the experts poetically call “the potomac tail of the bent-back oocnus” wrapped a tail of high pressure and strong winds down and west over Washington.

Winds ranging from 50 mph on the coast to 70 around Seattle raked over the region, plucking trees and power poles from the sound’s ground. More than a million residents lost electricity, several lost their lives, and caused dangerous mudslides.

Washington has some of the harshest snowfalls, most catastrophic flooding, and the most intense non-tropical storms in the country. Adding to the unpredictability are the microclimates and surprising weather contrasts. For example, while the Olympic Coast is doused with rain up to 130 inches a year, just a few miles away the town of Sequim averages a mere 15 inches.

The other hand, everyone knows the Northwest for its temperate climate. The soft rain, the cool summers, the gentle winters. Even Eastern Washington, which shares its share of freezes and snows, is still quite sheltered from the coolest Canadian arctic air by the Rocky Mountains. Montana and the Dakotas aren’t so lucky. But in all this mildness, there lurks a dark, unpredictable side, says Allard. “A tree fell on my house,” he says.

The early explorers were the first to note the good and the bad. Captain George Vancouver’s gentle spring of 1792 with “the delightful serenity of the weather,” contrasts with William Clark’s dose winters that was often, “cloudy, dark and disagreeable with some rain all day.”

While the Pacific Ocean is really the star force in our weather, the mountain ranges are active in creating a number of other microclimates, including the Puget Sound convergence zone, where air flow from the Pacific Ocean is divided around the Olympics but then corralled by the Cascades. When the two fronts of the same flow meet over Puget Sound, air rises and forms a band of clouds and precipitation, usually in an area between Seattle and Everett. While it could be sunny in Seattle and Mount Vernon, it may be pouring in Bill Miller.

And while our mountains often protect us from the deepest cold, we have some major vulnerabilities including the Fraser Gap, which channels arctic air down the Fraser River and into Bellingham, and the Columbia River Gorge, which shoots cold air west from Eastern Washington. And sometimes the Canadian Rockies can’t hold back the cold arctic surges, which can drop our winter temperatures well below freezing.

It’s Brad Colman’s job as meteorologist-in-charge of the National Weather Service’s Seattle Weather Forecast Office to keep track of all of the weather. He found the Hannukah Eve Storm of 2006 particularly memorable. “A tree fell on my house,” he says.

When Colman came to Seattle to work for the National Weather Service 20 years ago, much of the weather data was provided by air traffic radar. It wasn’t that helpful, he says, since it was designed to see through clouds and precipitation. Back then it was even more difficult to watch the storms coming in off the Pacific, or to predict the cold fronts issuing from British Columbia.

Since then more than 120 Doppler stations, as well as other weather measuring equipment, have gone in around Washington and the rest of the country. “It was an amazing improvement,” says Colman. Now there are more than hits than misses, thanks to a number of tools including satellite images and numerical models that help the scientists look up to 15 days into the future. “That’s when we first see a storm,” says Colman. “At that point it doesn’t exist on the earth. It only exists in our models.”

The beginnings of our storms can happen on the other side of the Pacific Ocean. “Observations made in China will provide information long before it shows up on our radar,” he says.

This September, a new coastal Doppler radar station will be up and running near Copal Beach. It solves a key problem, that of the existing Camano Island station’s limited view over the Olympics. It will let us see below 25,000 feet and better look into approaching storms to determine their intensity.

The new station won’t necessarily help predict the storms, since it can only see out a few hundred miles. “But we will use a lot more of what’s going on,” says Colman. It also provides some lead time with flooding because the station will be able to capture more details about the type and amount of precipitation. “It will improve the quality of our rainfall estimates a great deal,” says Colman. That in turn will give the Weather Service, depending on which river systems get the rain, six to 18 hours to prepare and provide flood warnings, helping forecasters like Allard do their jobs. “I’m often more amazed about what we do know than what we don’t know,” says Colman.

But forecasting in the Northwest has its own set of challenges. “The ocean is a big ocean, and there’s not quite as much information available as there is over the continent,” says Colman. The jet stream is close to us. And the mountains make things much more complicated. A weather system could come in a broad shield, but when “the terrain just totally breaks it up into bits and pieces,” you get pockets of calm.
amazing accelerations, and gap winds where airflow is accelerated through mountain passes and places like the Strait of Juan de Fuca. There’s something for every season, says Colman. “In our office, we just don’t have very many down days.”

THE NEW DOPPLER RADAR, which will help us look 250 nautical miles out to sea, is one thing. But for more immediate information, the meteorologists make use of WSU’s AgWeatherNet, a tool that gives raw data about wind, temperature, and rainfall from 130 sites around the state. The measurements are made from tiny weather stations set up in every county, from Austin to Whitman, with many of the sites along the Columbia and Yakima river basins. For good measure. The first stations were installed in 1988 in places like Touchet, Quincy, and Basin City to provide support for tree fruit growers, says Gerrit Hoogenboom, an agronomist and director of AgWeatherNet.

While we’re talking, Hoogenboom pulls up the AgWeatherNet website. “There are 60 people looking at it right now,” he says. “It’s fairly early in the morning and the fruit trees are blooming. The users are likely checking for frost and wind information,” he says.

The stations are networked through radio telemetry to a WSU server and the data are updated every 15 minutes. With so many high value crops like apples, cherries, and pears, a few minutes of warning can offer enough time to turn on irrigation systems or wind machines to protect the fragile buds from frost. In some areas along the Columbia Basin, the number of weather stations is quite concentrated—it’s because of the variation in the landscape, says Hoogenboom. Ideally, he adds, there would be one every square mile.

Providing the high quality data has its challenges. WSU must maintain and recalibrate the stations. With so many throughout the state, that takes a lot of work. But the system is useful beyond tree fruit needs, notes Hoogenboom. The data can be used by researchers and natural resource workers, it can help farmers make decisions about managing their fields, and teachers can access it for their classes.

“Not only for agriculture,” Hoogenboom says. “It has a whole range of different applications—science in the classroom, water management, energy management. ‘The National Weather Service, particularly the Spokane office, makes frequent use of the stations’ data.”

WHILE OUR WEATHER FORECASTERS watch the sky and the sea to help us prepare for the coming week, a whole cadre of experts, including more than a dozen at WSU, including engineers, agronomists, and environmental scientists, are parsing ahead up to 100 years to see how the climate in Washington may be changing.

Brian Lamb’s expertise in air quality makes it no surprise that his most memorable weather event in Washington was the 1980 eruption of Mount St. Helens. “It’s not quite a weather event,” admits the director of the WSU Center for Environmental Research, Education, and Outreach. But weather played a part. Winds blowing east carried ash 300 miles to the Palouse where it grew to 30 feet. “The street lights went on in Pullman at 1 p.m.” While most people remember the blackout and falling ash, that layer of ash cloud prevented the areas it covered from warming during the days and cooling at night.

Because of his expertise with measuring air particulates, Lamb works closely with hydrologists, meteorologists, and atmospheric scientists including Cliff Mass, author of The Weather of the Pacific Northwest and professor at the University of Washington, on a wide range of studies involving the weather, climate, and global warming due to human activities. When it comes to expertise in Northwest weather, “he’s the guy,” says Lamb. According to Mass, with climate change “things are going to vary a lot around the world.” But warming in the Pacific Northwest will probably be down and slow. “Our weather is dominated by the Pacific,” he recently told a crowd in Port Townsend. “We are downstream of an area that is warming up more slowly than most places.” Between the 1990s and the 2020s, Mass sees no great difference. By the 2050s, he expects average temperatures to rise three to four degrees. By the 2090s, it should be up 8 to 10 degrees in places like central Washington. “This is a different world,” he said.

The scariest change in Man’s forecasts is in snowpack. “We’re not going to have less precipitation,” he says. “We’re going to have less snow,” which means less snow melt for hydropower, consumption, and irrigation. Not only does Lamb work with Mass and others to look at what the weather is doing (Is there rainfall? Which way and how forcefully is the wind blowing?) he is concerned with the particulates carried or not carried around on Northwest air currents. “You not only have to get the weather right, you have to deal with the sources of pollution,” he says.

Those include traffic, the oil refineries north of Seattle, and agriculture in Eastern Washington, to name a few. “All these have to be captured at some level of detail in order to get things right,” he says.

Lamb is concerned with extreme events and the lack of weather—these still periods when air contaminants, particularly ozone, can build up. The study of air quality in the United States really started back in the 1950s and 1960s, when Ohio was asked to compare air quality, Lamb linked the Los Angeles smog problem to automobile emissions. It was at Caltech in the 1970s that Lamb developed his expertise in measuring air quality. “When I came to WSU, there was already a very active air pollution group,” he says. It had started in the late 1940s and early 1950s in response to air pollution associated with aluminum smelters in the Northwest. By the time Lamb arrived, though, the program was focused on field studies in the southern and eastern United States, areas with higher populations and major air quality issues.

“Then the Puget Sound region developed a ground-level ozone problem of its own. High levels of the volatile gas are a danger for animals, plants, and humans. The Washington State Department of Ecology asked Lamb and his colleagues to make measurements and later create a modeling study. ‘The weather here has a huge effect for ozone,’” says Lamb. “Although things have improved (thanks to air quality standards and improved automobile emissions requirements),” it’s still a concern. “We still have ozone-encrusted days,” he says, especially “when it’s hot, with pretty light wind, and lots of sunshine.”

But ozone isn’t the only issue in the state. Eastern Washington has concerns with particulates from dust and pollutants, and Tacoma is running into problems with very fine particulates from both industry and wood-burning in the atmosphere. “They get very stable inversions in the winter time,” says Lamb. That limited air movement, the cold, and the burning of wood stoves make for a high level of these small particles that can aggravate heart and lung diseases.

Lamb is also looking at bigger questions. As part of an EPA-supported project he’s one of a team studying how climate will change and how global change affects air quality. “Global change, not just climate, but vegetation change, urbanization, all the development in China and Asia. Land use changes. When you start thinking about global change, it really gets complicated in a hurry.”

**December 14-15, 2006:** Hanukkah

Hanukkah Hanukkah in Connecticut was accompanied by heavy rain, blew down trees and knocked out power to 3.8 million customers in the Puget Sound region.

**November 1966:** Spokane’s ice storm

Spokane’s ice storm, the worst since 1911, produced up to an inch of ice on homes, streets, trees, and cars. Some homes and businesses were without power for two weeks.

**January 1993:** Inauguration Day

A snowstorm hit Washington since 1962. The powerful gale knocked down trees, destroyed 79 homes, and knocked out power to 750,000 in the Puget Sound region.
As part of a multi-university effort, Lamb; Claudio Stöckle, chair of WSU Department of Biological Systems Engineering; Chad Kruger, director of the WSU Center for Sustaining Agriculture and Natural Resources; and several other WSU scientists are members of BEACHC (Regional Approaches to Climate Change). The $20 million USDA-funded project involves scientists from the University of Idaho, Oregon State, and WSU. Together, they are trying to help farmers adapt their agricultural practices to the changing climate and to perhaps practice farming in ways that can reduce greenhouse gas emissions and make more efficient use of fertilizer and fuel.

But first they must understand how the climate is going to change. "Climate change is going to be superimposed on the wide range of changes we normally experience. If you just look back over the last several years, we've had really hard winters three of the last four years," says Lamb. Further back, they were not so bad. That's not climate change, says Lamb. "That kind of variability is natural."

**But over the long term** we will see warmer temperatures, changes in precipitation patterns, shorter snow seasons, and earlier spring melts. "It will have an impact on ski resorts, ag producers, power generation, and stormwater runoff in urban areas," Lamb says. "The sea level of air quality, the modeling we've done so far doesn't show a really large climate effect on air quality in the Northwest." It does in other parts of the country, though. In places with big snow problems, including the eastern half of the country, there will be more stagnant air episodes. But since our weather is driven by the Pacific Ocean, "here in the Northwest, we should be concerned with what happens in Asia," he says.

As difficult and demanding as it is to peer out over the ocean and "in the clouds," Lamb says," "but if we've understood something so basic as the relationship between the weather and the ocean currents, of climate, the modeling we've done so far doesn't show a really large climate effect on air quality in the Northwest.

A multitude of climate change projects are now in the hands of WSU scientists. One afternoon this spring Chad Kruger stepped out of a room on the Pullman campus where he had spent the day discussing climate modeling efforts with more than a dozen other scientists. The BioEarth project is mostly about models that will help us look into the next few decades. Led by Jennifer Cadillo, an assistant professor in WSU's Department of Civil Engineering, the team is using the Pacific Northwest to study how nitrogen, carbon, and water interact to make regional aquatic, terrestrial, and atmospheric models that will help governments and decision makers better manage our agricultural and natural resources.

Because the Northwest is a complex place with extensive agricultural lands, pristine wildlands, and heavily populated urban areas, it is good location for developing a state-of-science regional modeling system. "We're trying to incorporate human management into the modeling," says Kruger. Projecting 20, 30, even 50 years into the future, the group is defining agro-ecological zones and projecting what these zones might need. In some cases, when the climate gets two to three degrees warmer, seasons will start earlier and water will become scarcer. Issues of diseases, pests, and weeds will change. The modeling will help the scientists and the farmers understand what's coming and how they might adapt their behaviors, says Kruger.

Robert Lamb; Jim Moore and a group of 40 scientists have tried to make the climate change process clear. "It will have an impact on ski resorts, ag producers, power generation, and stormwater runoff in urban areas," Lamb says. "In terms of precipitation in the next 20 to 40 years. Moore says the winters now are much milder than when he was a child. Back then they fumed in a way that captured moisture from the heavy snows. Moore knows that major weather events can stick with you for your life. He remembers the winter of 1949-1950 when it dropped to 20 below and stayed that way for several weeks. The Palouse Falls froze. For the Moore family, the big challenge was getting water from the well to the cistern. The butane pipe froze solid, leaving the family and livestock without water until a neighbor used a big electric water heater to heat the pipe with an electric current. But the cold wasn't the end of it. When a warm spring Chamook wind blew up from the south, it suddenly melted all the snow. With the ground still frozen, there was no place for the water to go. "On the road to Kahlotus, the water was knee-deep," he says. "We couldn't even see our car if we opened the door; the water would pour in."

For Moore, then, a time, the flooding was more fascinating than frightening. "We had a lot of fun with it as kids. Washed it away in a matter of hours in the running water. "Still, he'd be happy never to see another season like it. "That's the worst winter I can remember," he says.

Though he thinks about the weather every day, Nick Allard carries with him the times he was really awed by Northwest weather. He was a reporter in the Tri-Cities and a severe storm was building. He stopped outside of TV station in coups dust rolling above him. They were working up to what might have become a tornado, he says. He was hedged as long as he could and got into his car. Outside to view the rest through a video feed from a camera atop of the building. Suddenly there was a microburst, he says. Rain fell, the pressure changed, and the storm just fell apart. "It was like it never happened."

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INGENIETY AND TECHNOLOGY have repeatedly saved the day as the world’s growing population has come perilously close to famine. But agricultural productivity is now leveling off, and another two billion people should be here by 2050.

by Eric Sorensen
You may know the tale, but it doesn’t get old. In the middle of the last century, Vogel developed a short wheat plant that could produce twice the grain of its taller, conventional brethren. Fifteen years later, the Indian government, peering over the brink of a mass famine, ordered 10,000 tons of wheat seed that Norman Borlaug had bred from Vogel’s discovery. Combined with irrigation and fertilizers, the dwarf wheat tripled India’s production inside a decade. The country, which had been living “ship-to-mouth” on U.S. aid, was feeding itself.

Iterations of the story can include Vogel’s humble roots as a Nebraska farm lad. Or Borlaug winning the Nobel Prize for the “Green Revolution” and repeatedly crediting Vogel for his contribution, which Borlaug said, “changed our entire concept of wheat yield potentials.” Vogel himself chalked it up to a good mix of luck, hard work, and zeal. “To plant things and make it grow full fast,” he said near the end of his years, when I visited him in Lincoln, Washington, for the Spokesman-Review.

Like a full belly, the story is straightforward, satisfying, and true. It’s the sequel that grows complicated. Fertilizers and other farm chemicals central to the Green Revolution are now blamed for a variety of public health and environmental problems. India still has plenty of food, but not everyone gets it. One-third of its people are hungry; half its children are malnourished.

Meanwhile, India’s population—and the world’s—has more than doubled. By the middle of this century, it is expected to reach 9 billion.

Then, having doubled ten times in 10,000 years, the world’s population may actually start to drop. The human population boom will end.

But for the next four decades, we need to grow more food, and as things stand now, agricultural productivity has leveled off and in some cases is declining. We need to grow it with more limited resources like land and fossil fuels, and in more environmentally conscious ways, preserving water, public health, and an atmosphere that farm inputs are helping warm.

“The challenge is also in just production,” says Oamaru Badru (24 M.S. ’30 Ph.D., a native of Bharatpur and associate director for West and Central Africa in WSU’s International Research and Development office). “It is how you can produce smartly so that you don’t deteriorate things that you have today and then jeopardize what you have next month. We need to get food to those who need it, or at least help them get it or grow it.”

And we need to get food to those who need it, or at least help them get it or grow it.

“Right now, there are 7 billion people in the world,” says Ralph Coolman, International Research and Development’s associate director for community collaborations. “One billion of these are undernourished or malnourished in some way that has nothing to do with food production. The world produces enough food. But they don’t have access to it or a way to get it.”

Badru and Coolman are among scores of WSU staff, faculty, and students—directly or indirectly—are addressing the new millennium’s food challenge. The range of their expertise is fitting for such a massive, thorny problem and its many prisons of economic development, education, environmental sustainability, equal rights, technology, philanthropy, culture, and politics.

“In 1968, Stanford University biologist Paul Ehrlich published his book, The Population Bomb, and famously proclaimed, “the battle to feed all of humanity is over.” Civilization had lost; widespread famine was imminent.

Four years later, the book was joined by The Limits to Growth, which took a similarly dim but more systemic view by weighing not only population but declining resources and the effects of environmental pollution and degradation. It was already time for environmentalism. Andrew Ford, a WSU professor of environmental sciences, had a close ear out, running a PhD under then-Dartmouth College professor and Limits co-author Dennis L. Meadows. To this day, says Ford, the book is the best study of how the exponential growth of people and resources can overload the planet’s carrying capacity, leading to a collapse.

As he sees it, “the food problem is embedded in a system that also has resources problems, and an environmental problem.

“Here’s how the limits shade out. The globe, he explains, has only a certain amount of potentially arable land. Indeed, in the past five decades, usable land has grown by less than one-tenth.

“Plant yields, says Ford, are ultimately fixed, as are non-renewable resources like oil and gas. So too is the ability of the environment to absorb, dissipate, or otherwise render harmless things like reactive nitrogen from heavy fertilizer and carbon dioxide from fossil fuel burning.

Combined with a growing population, he says, “we’re on a path toward an overshoot of our limits and a difficult collapse that we wouldn’t like.”

Ford compares the situation to the French story of a pond with a single little lily that doubles in size each day. Unchecked, it would cover the pond in 30 days, choking off the pond’s other life forms. For a long time, the plant seems small; people decide not to take action until it covers half the pond. But that moment doesn’t come until the 20th day, leaving only one day to save the pond. And if the pond watchers decide to double the size of the pond, that only gives them one more day to solve the problem.

“The lesson of exponential growth,” says Ford, “is it appears like it takes a long time to get there, but it is very, very fast.”

The solution, he says, is “don’t keep trying to grow. It’s too slow. And the answers are not on the production side—how to produce more food, or how to produce more oil. It’s too be more efficient in how we use energy or resources.”

But Ford’s concern has been voiced before, to where we might be suffering a sort of limits fatigue. Thomas Robert Malhotra back in 1798 proclaims that our “ambition is to grow as extensively and luxuriously as possible.”

The world has certainly seen its share of famines since, but humanity has managed to grow and prosper; the population limit higher, if only temporarily. New farmlands opened up in America, Australia, and elsewhere. Europe embraced New World crops like corn and the potato. Tractors replaced horses; land once used for animal feed could now be used for human food.

Then came fertilizers and new varieties.

“The next thing you know,” says Gill, “the yields were so high that we grew the migration anywhere.”

At the time, Gill and his two brothers would cut half an acre in a day. The yields were high. “The heat would approach 100º F. Gill had found his calling.

“Thanks to the automobile, he’s trying to improve on a shortcoming of the Vgel wheat, a lack of the horsemilk gibelichon. As co-author, says Gill, “everything shrunk.” The reduced height kept the plant from falling over, but it also had smaller roots.

“I think there is a lot of potential with all the research we’re doing in genomics to deliver,” he says. “And then we may see yet another Green Revolution, free of all the old problems.”
Glover is an agroecologist, adapting broader ecological principles to crop production and focusing on techniques that stand to save and restore degraded and marginal landscapes. The product of a Colorado farm, he came to his three WSU degrees by way of Skagit Valley Community College, where he studied landscape design and plant science while living in a ’54 Chevy camper. There he read a paper by WSU soil scientist and organic farming pioneer John Reganold, who became his doctoral advisor.

“Agroecology integrates so many of the different elements of being a human: the social, political, economic, our interactions with the natural world; and so on,” he says. “It was a fairly short, fast trip from discovering soil science to becoming devoted to agriculture and the implications for humanity.”

While at WSU, Glover had a fellowship at The Land Institute, a Salina, Kansas, nonprofit working on perennial crops that could marry stable prairie ecology with the grain yields of annual crops. Glover studied a tall grass prairie that had been mowed for hay for nearly a century. It had no inputs like nitrogen fertilizer. As might be expected, the harvested grassland’s soil was healthier than either conventional or organic ground. Moreover, the mowed acre was harvesting more nitrogen in the grass hay than he was from the high-input wheat field where he applied high levels of nitrogen fertilizer to maintain adequate yields. In the grassland, Glover saw “a model for a truly sustainable type of agriculture” and a reaffirmation of The Land Institute’s vision.

Glover is now on leave from the institute as an international agricultural research advisor working with USAID. The journal Nature has called him one of the “five crop researchers who could change the world.” National Geographic has called him a visionary “emerging explorer.” Writing last year in the journal Science, Glover and Reganold called for a focus on perennial grain research similar to that underway on biofuels. Unlike conventional grains, which have been planted annually for most of agriculture’s 10,000 years, perennial grains could be planted every few years, using less fertilizer, herbicide, and fuel, and causing far less erosion. With roots as long as 12 feet, they could build soil, sequester carbon from the atmosphere, find more water, and use none of the nitrogen that can pollute drinking water and create marine “dead zones.”

The grains, which he hopes predicted could be a reality in 20 years, would be particularly helpful in the world’s marginal soils that support half the world’s population.

IF THERE WILL TRULY be a second Green Revolution, it will be in the face of pressure to make it green in an environmental sense.

“It’s widely acknowledged that there were too many social and environmental problems resulting from the intensive high-input ag approaches often promoted during the Green Revolution,” says Jerry Glover (’97 BS Soil Science, ’98 BA Philosophy, ’01 PhD Soil Science). “USAID and the international research centers now focus much more on soil and water resources and social impacts of agricultural development.”

“USAID is focused on the post-2015 agenda of sustainable development and agriculture is key to achieving the Sustainable Development Goals (SDGs). While the first Green Revolution focused on the development of high-yielding crops and the extension of smallholder agriculture, the second Green Revolution is focused on the development of crop and livestock products that can be grown sustainably and that provide nutrition and other benefits to farmers worldwide,” said USAID’s Director of Agriculture and Natural Resources, John Herrick.

But he did take to heart the engineer’s concept of the “rate-limiting step,” the slowest part of a reaction that in turn determines the reaction’s overall speed. As he turned his attention to ecology and the challenge of feeding the world, he realized a lot more than food was involved in food security.

“The constriction point is not technical solutions,” says Chappell, an assistant professor of environmental science and justice at WSU Vancouver. “It’s political feasibility and political will. That’s quickly obvious when you look right now. A couple people have responded to the question of, ‘How do we feed 9 billion people?’ with, ‘How do we feed 6 billion people?’ Because we have enough food now but we have around a billion people who are malnourished right now. That clearly is not just a problem of supply.”

To be sure, he says, food production in some cases will be important, even paramount.

“But in the majority of cases,” he says, “there are a lot of other factors, like how much of the food dollar farmers recover, which would help a lot of farmers in terms of their own food security. And actually a slight majority of the people who are malnourished are farmers or rural inhabitants.”

“Most of the people in rural sub-Saharan Africa are smallholder farmers. Many lack adequate roads and access to markets.”

“How do you production but don’t have infrastructure,” says Chappell, “that’s not going to help farmers very much, even in a very economic-market-driven way.”

“Raising the status of women has also been shown to have a huge impact on malnutrition. As their incomes rise, they’re more likely to spend it on their family than themselves, says Chappell. “When women have education, have better nutrition, have better political power, they tend to take care of the family better,” he says. “So women’s education and health is very strongly tied to infant health, and not surprisingly.”

Food challenges vary from place to place, and WSU International Research and Development workers have visited many to help the world’s poorest farmers. Clockwise, from top left: Ralph Coolman, Oumarou Badini, Colleen Taugher, and IRD director Chris Pannkuk. Photos courtesy of individuals, except Pamunuk by Robert Hubner. Opposite: For Jerry Glew (TSI PhD tail gallons), agriculture’s brightest future is below ground in the saved soil and powerful root systems of perennial grains he is helping develop.

As a Peace Corps worker in Sierra Leone, Pannkuk saw women threshing rice with their feet. So when he saw a bicycle-powered threshing at a Food and Agriculture Organization conference, he got one and brought it to the village.

“Probably should have talked to the women,” he was told. He then went to understand that the rice harvest was a communal event, for them, and while they were threshing, they were also talking with each other while the men looked after the children.

Food production is a human right, but in the poorest nations of the world, food is too often a luxury. In 2008, the United Nations estimated that 1 in 6 people didn’t have enough to eat. In many places, food security is a basic human right. Nationally, the United States uses 9% of its land to produce food; in many nations, it’s 70%. Pannkuk’s office is working to make sure food security is a right for all.

**Limits can be just as important a consideration as assets. A subsistence farmer making $2 a day—the norm for the farmers the office works with—can suddenly invest in expensive seed or a suite of inputs. “They have very little that they can lose,” says Pannkuk, associate director for community collaborations. “So getting them to try and make new changes, getting them to adapt new technologies, is challenging, because they’re living on the edge. They know that what they do provides at least some minimum standard for their family. A change, while it could provide return, also has more risk than with changing what I do in my garden at home.”**

**Taugher has seen similar small-scale, appropriate technologies help farmers. For Jerry Glover (01 PhD Soil Science), agriculture’s brightest future is below ground in the saved soil and powerful root systems of perennial grains he is helping develop.**

**The first billion was the hardest. But starting in the 1990s, enough farmers and billions more people arrived. As fertility rates decline, the world population could peak at 9 billion or so. That’s billion or so more people to feed.**
Rick Small ’69

Founder, Winemaker, and Owner (with his wife Darcey) of Woodward Canyon Winery.


Credited with helping establish Washington state as one of the most celebrated wine-producing areas in the world.

 Loves to cycle, 4,000 vertical feet on his mountain bike.

Life Member of the WSU Alumni Association.

“I commend the WSUAA’s Life Member of the WSU Friends under, Winemaker, and Owner (with his wife Darcey) of Woodward Canyon Winery, who recently had a show displaying his nature photography. His images portray the landscapes of central California and the Sierra Nevada.

In Ann Whishan (’71 M), was recently inducted into the Pacific Northwest Grapes Association Hall of Fame. Whishan played on the LPGA Tour from 1979 to 1990, where she won three individual tour titles and two team titles. She currently lives in Olympia and is an LPGA teaching pro at the Home Course in DuPont.

Dick Brown (’74 MA Child & Family Studies, ’75 MA Counseling Ed.) is the executive director of the Northwest Wine Gmail Commission, and was chosen as the 2011 Sacred Heart Children’s Hospital Advocate of the Year.

Lindsey Fiker (’77, ’79 MEd) has been appointed to the San Francisco Valley Board of Supervisors. She is the Burlington-Eaton School District’s work-based learning coordinator and has served as the Burlington-Eaton career center specialist for the past 15 years.

Bertha Lynn (’77 Comm.) and Ana Cabrera (’04 Comm. and Spanish) work as news anchors for the Denver ABC, where Ms. Cabrera graduated in 1984. Bertha has worked in Denver news for nearly 30 years and currently serves as a producer at KMGH, and is a member of the Denver Art Women’s African Outreach Task Force.

Roger Woodworth (’78 Wildlife Biology) is in the position of executive director, as the chief biologist of the DNR (Division of Wildlife), state of Washington, since 2003. Woodworth worked for the DNR for 12 years before moving to the DNR as director of wildlife management, and has served as the department’s wildlife management director since 1999.

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Kathleen J. Anderson (’79 Arch.) has been appointed head of the Department of Interior Architecture and Product Design at Kansas State University. She was the associate dean and professor of interior design in the College of Architecture and the University of Nebraska-Lincoln, where she taught from 1992 through 2001. She founded The Anderson Design Group in 1995.

Paul Mills (’58 MA Eng., ’61 PhD Eng.) was the technical director of the Board of Directors of the Santa Barbara, California, Office of the Water Resources Commission, and served as chancellor of the UC Santa Barbara Center for Water Resources from 1980 to 1989. He has also been a member of the Board of Directors of the California Department of Water Resources since 1998. He has been a member of the Board of Directors of the California Department of Water Resources since 1998.

Dr. Yaaban Suh (’80 Industrial Ed., ’87 MA Ed. Admin.) is superintendent of schools for the Creek

Members of the Girl Power Hour team:

Corrie Westmoreland ’02, Darcy Cendron-Worden, Darnell Sue ’02, and Danna Westmoreland ’03.

The evening’s themes are “Fit and Fabulous,” honor the location at a women’s gym where the workout includes a ballet barre and dance and Pilates techniques. The sponsors are a protein bar that creates just for women, and a plastic surgeon. Sue, née Westmoreland, graduated in busi-

ness and went to work at media jobs including at a record company, a television station, and most recently with a communications group that produces WHERE Magazine for Seattle. In 2007, in the middle of a very corporate annual meeting, she realized she’d rather be doing just about anything else.

It was one of the classic business events with bad coffee and fluorescent lights, she says. “I just wanted to hide until it was over.” Fortunately, she met Samantha Lawton who was having the same experience. The two agreed
The idea was to provide women a social event and setting to network and discuss women’s issues. Sue says, “Really, it’s about building community.”

That first Girl Power Hour party was easy, says Sue, “That’s because we didn’t know what we were doing.” But with each new event, they added depth and interest, finding new themes and focusing on women’s needs and charities, including breast cancer awareness and clothing drives. The themes evolved to include eco-friendly fashion, how to survive and stay (stylish) during a recession, and how to market your brand and your business.

They also turned Girl Power Hour into a club with memberships. GPIW members can attend events in Seattle, attend events in Bellevue, or attend events in a city near you. They have now become a movement.

That networking skill helped Sue find Candy Cameron-Weidner, founder and chief stylist of StyleX Seattle, a few years ago at the Seattle Fashion Week event. They both quickly realized how well their two businesses complemented each other. “This is a great opportunity to see what other women are doing in the networking service with our mutual goal of success,” says Sue. “We’re old and we’re not anymore!”

Sue knows that women are natural networkers, “sue says Cameron-Weidner. “And with men out of the equation, it’s so much easier.”

She is excited about the new opportunities that women’s networking efforts in the Seattle area, says Cameron-Weidner, hope to achieve with Sue. “It is a little differently,” she says. “It’s not hots and bollers,” she says. She does the core work of planning and coordinating the events and offerings, but builds off the ideas of her team as far as location, themes, and sponsors. Other members of Sue’s GPIW team include her sister Connie Westoverland, her cousin Danica Leeming (of Westminster TV), and other local business women with marketing, advertising, sales, and business backgrounds.

This September, Girl Power Hour celebrates its fourth year of events. The clients have changed, says Sue. Initially women only were employed. Now 75 percent have jobs with an employer. And while initially most of the participants were in their 20s, it now seems to have a broad appeal, says Sue. The majority of the members are between 25 and 35, and 20 percent are 40 and older, says Sue.

Last October, Sue left her magazine sales job and devoted herself full-time to developing Girl Power Hour. Now that she’s having success in Bellevue and Seattle, she’s planning on reaching out to Tacoma for an event or two the coming year. And as she continues to refine the formula, Sue hopes to take Girl Power Hour to other states.

“I’m proud we’ve been able to keep our interest for this long,” she says. “It’s a lot of what they offer that are everyday people, cocktails, and swag, says Sue. “But if we can find a deeper purpose in them, all the better.”

A Leonard legacy

By larry Clark ‘94

Elmer O. Leonard was born in Seattle on July 21, 1915. When the call came in 1918, he headed for Europe and the Great War as a soldier. Like a number of other young men, he was killed in combat and never returned to Pullman and the college. His nephew and namesake Elmer F. Leonard (‘87 MS Voc. Tech. Ed., ‘91 PhD Hist.) plays the part of Blake in the recently released film Water for Elephants. He has directed television and films since the late 1980s, and has been in many commercials, TV episodes, and movies, including Star Trek and the movie Jutland.

Elmer O. Leonard has been an assistant coach for the men’s basketball team at Eastern Washington University. After 14 years as a player on the HBS team and 11 years as my brother and I both had a job and we were working with BHP Skills development doing interviews for USG, Gettyota, and the Seattle SuperSonics.

Sam Regaldo (‘83 MA His., ‘97 PhD Hist.) has been the California State University Humboldt State University’s Outstanding Researcher, Scholarship, and Creative Arts Professor Award for 2010-2011. He has been working at California State University since 1998 and has recently written a book called “The Big Stick: The United States in World War II from 1942 to 1946, and eventually graduating from WSC in 1946.

Ever since the first two Elmer Leonards there has been a part of the Leonard family and a source of many memories, including Elmer F.’s decision to follow his father into a career as a firefighter and never returned to Pullman and the college.

Elmer O. Leonard was born a year later. He followed in his uncle’s footsteps to Pullman, enrolling as a student at WSU in 1919, joined the Army and serving in World War I from 1918 to 1919, and eventually graduating from WSU in 1924.

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sent to the Instrucional AIDS department at the Command and General Staff School at Fort Leavenworth. Johnson led a staff of photographers, interpreters, artists, terrain model-builders, and so forth. Their job was to provide training aids and other information for nursing briefings for the colonels attending the school training to be generals.

While in the military, Johnson was surprised and pleased to see his cougar head painted on a Corsair fighter and an A-20 Havoc bomber.

"Of course there was no way I could find out who had chosen those titles, though I wished I could. I still believe I might have known those guys."

When Washington State College became a university in 1959, Johnson's design suddenly required a re-design. President French called him to talk it over. Johnson came up with a sketch and presented it, neatly shifting the C of him to talk it over. Johnson died in 2007. His cougar head logo was retired in 2011.

\[\text{wsm.wsu.edu} \]
Sharpesteen, in effect, interviewed the various blind men holding on to various parts of the elephant, from rank-and-file union members to the president of the company, and seemingly scripted executive director. The technique deprivates the book of an overarching narrative, but it does take us into a lot of places we might never go.

Here’s a pilot parking a 688-foot container ship: there’s a tag captain on deck the same with a 4,000-ton crane and an 8-ton rudder. But on shore things get mean as the forces of capital, collective bargaining, public health, global economics, and women’s rights collide. We see Noel Park, a resident of nearby San Pedro, struggle for years to improve the “Death Valley zone,” as ships put out the exhaust of 1,200 cars, a from well over 1,000 the same as that used by a modern truck. His efforts are repeatedly stymied in a pattern of battles and defeats that will be familiar to many an activist. At last, he spits. The value also seems stacked against Gorshin Williams, one of the first female longshoremen. Men see at how they unload new Toyotas. When she tells the supervisor that men have tried to assault her, he says, “Don’t worry about it, little lady.”

At last a private law firm takes up her case with the complaints of a half a dozen other women, and a federal judge imposes hiring quotas for women on the union local. Williams calls the case “the most successful affirmative action program in the country. First.” But in an ironic footnote, the job openings her organization arranged and the unions, her community of song and dance and protest and wrangling and whatnot, has also happened.

Sharpesteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a Sharpsteen spent about a decade pondering what turned out to be a 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The Docks by Bill Sharpesteen ’80

University of California Press, 2011

by Bill Sharpsteen ’80

In my sailing days on Puget Sound, I got used to watching for U.S. Marines...
To the lighthouse

FOR MORE THAN A CENTURY one of Washington’s earliest man-made landmarks has perched 120 feet above the sea on the Bluff at Admiralty Head on Whidbey Island. In its early years, the lighthouse beacon guided the sailing ships that helped settle Puget Sound. Today, the white stucco structure with its 30-foot tower charms visitors exploring the island.

The first lighthouse was built on Admiralty Head (also called Red Bluff) in 1861. At the time, the building was made of wood and the lamp was fueled by whale oil. It had to go, though, to make room for Fort Casey, a U.S. military post. In 1903, a replacement lighthouse was built a few hundred feet to the north. The building, which stands today, was made of brick and covered with stucco in the California Spanish-style design of architect Carl Leick. It was quite fancy, with an indoor bathroom and spacious living quarters that during its years of operation suited several different lighthouse keepers and their families.

At night when ships sailed through the strait, they would use this lighthouse and the one at Point Wilson on the other side of Admiralty Inlet to know when and where to turn south and into Puget Sound. “It wasn’t here to warn sailors of harm. It was here to guide them,” says Julie Pigott, program coordinator for WSU’s lighthouse docent program, which staffs the lighthouse for visitors. But when there was fog, the house did have a horn.

The lighthouse was decommissioned in 1922 because steamships with more sophisticated equipment could more easily navigate along the west shore of the inlet, and because the lights from Fort Casey provided a bright enough landmark for the nighttime traffic.

With the exception of World War II, when it was painted green and made into living quarters for soldiers stationed at the fort, the structure was forgotten. In the 1950s, the Washington State Parks department and the Island County Historical Society made repairs and opened it to the public. But 40 years later the state parks department lost money for managing the lighthouse and had to cease both restorations and public visits. That’s when WSU’s Island County Extension office stepped in, offering to staff the historical site with local volunteers in exchange for office space on the second floor for its Beach Watchers and other programs.

The main floor, which comprises the entry, living room, dining room, and kitchen of the lighthouse keepers’ residence, is now a museum and gift shop. Visitors can learn the history of the landmark and see up close the large fourth order Fresnel lenses that could beam enough light to be seen 16 miles away.

To learn more, visit www.selinc.com/possibilities.

Explore an interactive lighthouse and read about the volunteer docent program at www.wsu.edu/extra/lighthouse.

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- Life-Stage Planner to find the estate and gift planning information that fits you
- eBrochures in easy-to-browse formats that illustrate estate and gift-planning topics

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