

Masthead Logo

Western Washington University
Western CEDAR

The Planet

Western Student Publications

Fall 2010

The Planet, 2010, Fall

Mitch Olsen

Western Washington University

Huxley College of the Environment, Western Washington University

Follow this and additional works at: <https://cedar.wvu.edu/planet>

Part of the [Environmental Sciences Commons](#), [Higher Education Commons](#), and the [Journalism Studies Commons](#)

Recommended Citation

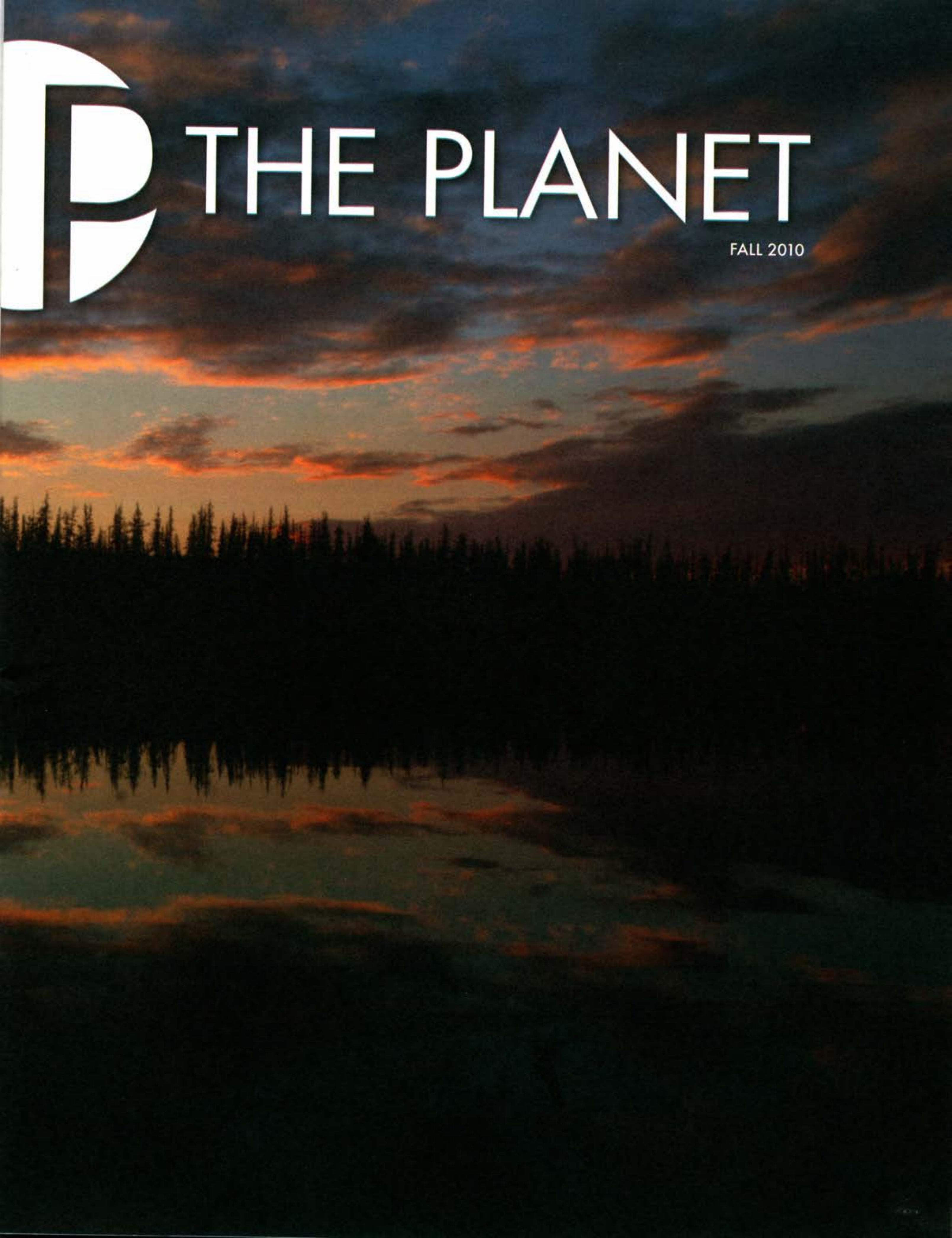
Olsen, Mitch and Huxley College of the Environment, Western Washington University, "The Planet, 2010, Fall" (2010). *The Planet*. 58. <https://cedar.wvu.edu/planet/58>

This Issue is brought to you for free and open access by the Western Student Publications at Western CEDAR. It has been accepted for inclusion in The Planet by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wwu.edu.



THE PLANET

FALL 2010



DEAR READER,

To say we have reached a pivotal juncture in our history is a bit of an understatement. From technology and the environment to our everyday lives, the way of the world is rapidly changing without respite. At times, faster than many of us can or care to keep up with. Given the current wavering nature of our society, it is important to step back and think critically about the changes we see every day.

This fall, *The Planet* offers a smorgasbord of issues with an undercurrent of change. Some good, some bad and some that are just plain fascinating.

In some articles, change is obvious. One writer's personal essay takes us on a journey to Siberia, where the effects of climate change are simply irrefutable. In Portland, Ore. a volunteer based organization, appropriately named Depave, is changing the way we view derelict pavement. As the season fades to winter and the bounty of fresh local fruits and veggies disappear, locavores creatively adapt their diets with mouthwatering culinary adventures.

Other changes are subtle. Amongst the moss on the floor of the Hoh Rain Forest is a red rock, symbolizing one man's determination to change the way people perceive noise pollution and natural soundscapes. In Olympia, Wash., we meet a woman who changed her life by seriously downsizing her home.

In many changes we see potential. Despite the stigma of salmon farming, it is still a solution to overfishing, but the industry needs work. With a bit of refining, it could be a viable option to keep salmon on the dinner table while avoiding extinction. If you haven't noticed the solar panels popping up on rooftops all around Washington, then you may not have fully realized how lucrative all the incentives are. Turns out, solar works in the Northwest and we've only begun to tap into a practically infinite resource. In Skykomish, Wash. BNSF Railway Co. is on the verge of completing a cleanup that literally uprooted the entire downtown. Although the company has enacted measures to prevent such contaminations, the legacy of older, irresponsible practices is turning up in other parts of the country.

Change, adaptation, evolution...whatever you want to call it, as humans we are naturally good at it. Our successes and failures can attest to that. Depending on your perspective, change can be the dark and dangerous beast threatening everything we know to be stable, or it can be the luminous bastion of future righteousness. To deny or refuse change is to deny part of human nature. Although change is nothing new to our species, it is good to step back and appreciate our flexibility once in a while.

We appreciate your readership and welcome comments, suggestions and questions in the form of email, letters, conversation and high-fives.

Thanks for reading,



Mitch Olsen
Editor-in-Chief

ADDRESS

The Planet
c/o Huxley College
Western Washington University
516 High Street, CF 220
Bellingham, WA 98225

CONTACT

(360) 650-3543
planet@wwu.edu

WEBSITE

<http://planet.wwu.edu>

BLOG

<http://www.theplanetmag.blogspot.com>

The Planet Magazine is the quarterly student publication of Western Washington University's Huxley College of the Environment. We are dedicated to environmental advocacy and awareness through responsible journalism.

This issue of The Planet is printed on Mohawk Options #80 percent PC Cool White Smooth paper. It is made from 100 percent postconsumer waste fiber.

Special thanks to Bill Dietrich (Captain Planet).

EDITOR-IN-CHIEF

Mitch Olsen

EDITORS

Chelsea Crump
Andrea Farrell
Alex Marquard

SCIENCE EDITORS

Stephanie Eckard
Matt Moroney

PHOTO EDITOR

Hailey MacKay

DESIGNERS

Laura Beggs
Susan Good

WRITERS

Raymond Flores
Louise Foster
Brianna Gibbs
Joy-Elise Harrington
Lea Kaahaaina
Alison Lo
Jessica Peterson
Rebecca Tachihara
Wiley Volker
Max Wilbert

PHOTOGRAPHERS

Jacob Crabill
Crista Dougherty
Reiko Endo
Raymond Flores
Wiley Volker
Max Wilbert

COVER

Lake Shuchi, Siberia
Photo by Max Wilbert



4



16

4
SOUNDS OF SILENCE

16
SIBERIAN SUMMER

28
DOWNSIZED DWELLINGS



28

8
PEELING OFF THE PAVEMENT

12
FISH FOOD FOR THOUGHT

21
RAILROAD REMEDIES

24
SEASON'S EATINGS

26
SUNNY RAYS FOR CLOUDY DAYS



12



8



23



21



25

SOUNDS OF *Silence*

STORY **BRIANNA GIBBS** | PHOTOS **CRISTA DOGHERTY**



Late in the morning in the Hoh Rainforest of Olympic National Park, dense fog from the previous night is beginning to burn off, allowing streaks of sunlight to speckle the mossy earth. Nearly 100 feet from the Hoh River Trail, nestled at the edge of an ancient log, lies a single red stone.

While the small stone may seem insignificant, it represents a century-long battle over America's national parks and one man's fight to preserve their natural silence.

Gordon Hempton is not your average war-hungry general. An acoustic ecologist from Joyce, Wash., he leads an army of one. His red stone represents one square inch of silence, and Hempton has sworn to protect it from all man-made noise intrusions.

The Hoh Rain Forest is far from silent. Elk bugle in the distance as the faint rumble of a waterfall thunders down a far away hillside. The forest is alive with sounds that Hempton believes represent a symphony worth protecting from man-made noise pollution.

Natural silence is defined as the absence of man-made noise, Hempton said. When we seek it, we often do so in the wilderness. But silence is hard to find. Noise pollution has become a fixture of society. While this was once only a worry for city dwellers, the problem has spread into America's most protected wilderness areas.

There is nothing particularly intimidating about Hempton, but fly an aircraft over his prized square inch of silence and you may think otherwise.

What is your favorite sound? Is it the dull roar of an interstate highway? Or do you enjoy the graceful silence of a spider web in an autumn breeze? Do you smile up at the thundering airline jet? Or do you find comfort in the symphony of a mountain stream? Maybe, you simply find peace in quiet.



The stone at One Square Inch of Silence was placed by Gordon Hempton on Earth Day 2005. This small stone represents the small area Hempton defends from noise intrusion, in hopes of spreading natural silence throughout Olympic National Forest.

"Anyone can fly over one square inch," Hempton said. "But if they do, they shouldn't be surprised if they get a letter from me informing them that it is a protected natural resource."

Since placing the little red stone on Earth Day of 2005, Hempton has frequently visited his quiet sanctuary with his favorite toy: a decibel meter to record sound levels.

When he visits the Hoh Rain Forest, Hempton keeps an ear open for overhead flights. If he hears one, he jots down the time, the decibel level and the direction. Then, back at home, Hempton uses an online flight tracker to figure out which airline was the culprit. Once the noise intruder is identified, he sends a letter to the airline asking them to not fly over the Hoh Rain Forest. When he

is feeling especially feisty, he sends a sample recording of their noise intrusion.

Hempton chose the one square inch after traveling the U.S. in search of the quietest places. In parts of the Hoh Rain Forest, there are areas free from man-made noise intrusions for almost an hour at a time.

"That just doesn't exist anywhere else," Hempton said.

Hempton said he believes that for commercial airline flights, the solution is a simple re-routing of their flight plans to avoid national parks. Not everyone agrees.

"Instituting such a concept would have serious and detrimental effects on the air traffic control system," said Ian Gregor, a communications manager for the Federal Aviation Administration (FAA) Western Pacific Region.

"This would at times create a ripple effect across a significant portion of the country and would put a cost on aircraft operators," Gregor said.

For wilderness lovers, Hempton said he thinks that paying extra is worthwhile.

Hempton said a plane flying overhead could affect the natural soundscape of roughly 1,000 square miles. He believes by defending one small inch of land on the ground and protecting it from man-made noise, he can keep the soundscape intact.

Hempton would rather not be known as the sound guy bugging the airline industry. He said he only does it because he knows the park service will not take their mandated responsibility.

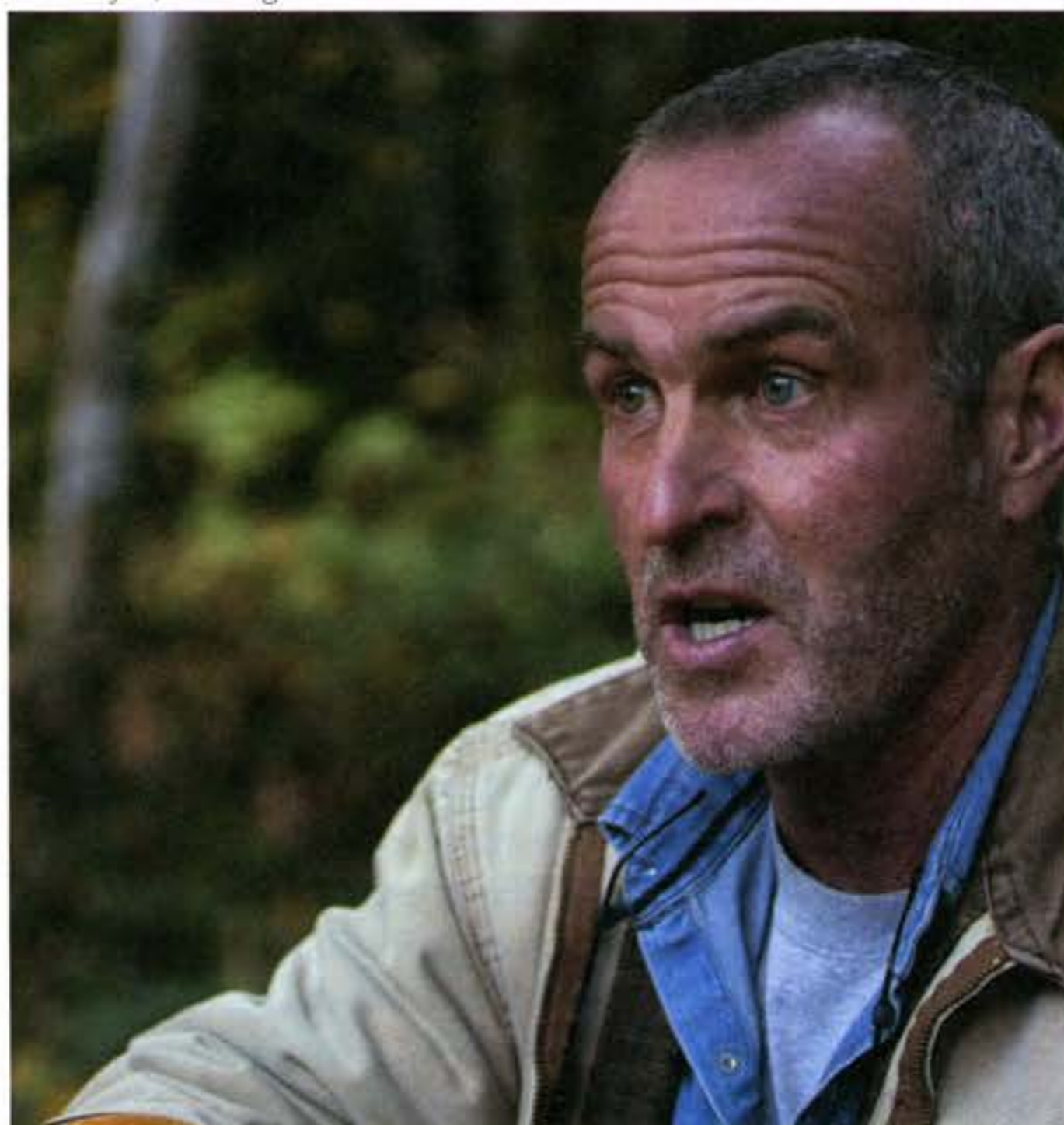
Barb Maynes, a public information officer at Olympic National Park, said she respects Hempton's initiative, but the Park does not always agree with his views.

For instance, when Hempton first created his one square inch of silence, he left a jar below the stone for visitors to share their silent thoughts. The park service removed the jar, because it did not qualify as research and could cause ecological harm.

"These are wonderful, inspiring, deeply informative thoughts that people have written in the complete presence of natural quiet," said Hempton. "This is not just research data that describes the significance of natural quiet in cultural terms, but really reaches deeply into the value of natural quiet for human nature."

"This country is 24/7 now.
24/7 commercialism
and noise."

Gordon Hempton explains the story of his quest to preserve silence at his home in Joyce, Washington.



Maynes said that while the jar itself would not cause an impact, it draws visitors away from established trails, which is not allowed.

"I know what happens to quiet places when we don't share them," Hempton said. "They go unnoticed, unprotected, unappreciated."

The National Park Service was founded in 1916 to protect the natural atmosphere of the parks to be enjoyed by generations to come, but a century later, parks remain unprotected from noise pollution.

In Grand Canyon National Park, 90,000 flights are permitted to fly over the park each year. These include commercial airlines, military jets, helicopters and flightseeing planes, which give tourists a bird's-eye view of the park.

Dick Hingson, an aviation and noise specialist for Sierra Club, said although Grand Canyon National Park is 90 percent wilderness, it is not protected from aircraft noise. Hingson said planes are the primary noise heard in wilderness.

"This country is 24/7 now," Hingson said, "24/7 commercialism and noise."

The trail marker lists the many popular destinations along the way. The One Square Inch of Silence goes widely unadvertised, as the parks services encourages visitors to stay on designated trails.





▲ Just before the 3.3 mile marker along the Hoh River trail grows the portal to One Square Inch of Silence. Walking through the stilted tree, guides visitors to an elk trail leading to the stone.

Congress has taken measures to protect the natural soundscape of the parks. In 1987, they enacted the National Parks Overflight Act, which paired the National Park Service and the FAA to develop soundscape management plans.

Twenty years later, the act has fallen on deaf ears. Part of the problem is the National Park Service has thousands of square miles to maintain and other ecological factors to consider. Maintaining the ground these parks reside on is hard enough, let alone the sky above.

The FAA, transporting millions of people each day, has far greater concerns with safety and scheduling than the noise planes generate from 30,000 feet.

Gregor said that both organizations have recently begun funding research efforts to try to determine the human and wildlife response to aircraft noise in naturally quiet areas.

The National Park Service website lists more than six-dozen studies exploring the impact of airplane and other man-made noise on animals.

Songbirds using their acoustic environments to communicate, find mates and listen for prey are severely affected, Hempton said. Other studies include the noise effects on reproduction in caribou and foraging efficiency among bighorn sheep.

In December 2010, Grand Canyon National Park will release a 1,000-page environmental impact statement, possibly leading to a final ruling on aircraft noise in the park.

The statement will be available for public comment

It is hard to maintain the ground these parks reside on, let alone the sky above.

until March 2011, and Hingson said that anyone who cares about national parks should write in and ask for the most restrictive noise solutions.

"This statement is for the Grand Canyon," Hingson said, "but it will be precedent-setting, so it has implications for other parks."

Washington state Senator Maria Cantwell introduced a piece of legislation in March 2010 called the Silence Helps Us Hear Act. The act sheds light on the degradation of America's natural soundscapes and directs the Secretary of the Interior to conduct studies on preservation within National Park land.

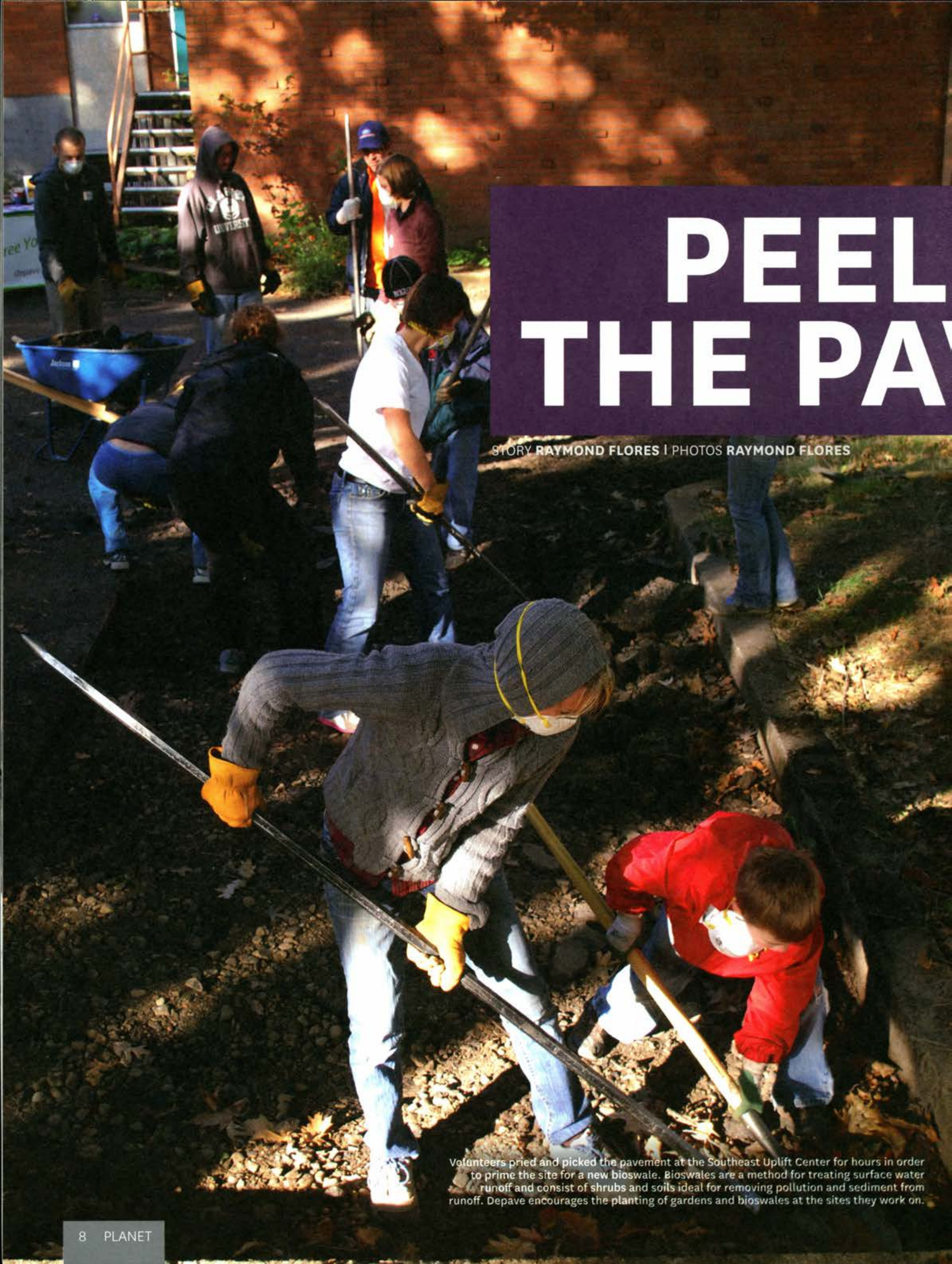
Hempton has high hopes that by 2016, the 100th anniversary of our National Park System, Congress will pass a law declaring one, if not more, of the national parks no-flight zones.

"That will deliver to the National Park Service the sky above the parks that they should have been able to manage from day one," Hempton said.

Today, the little red stone in the Hoh Rain Forest does not sit alone. Dozens of new stones have been left by visitors to the site over the last five years. Each stone tells a different story and an individual desire to protect the Hoh Rain Forest. In the fight for silence, an army is speaking up. 🗣️

BRIANNA GIBBS is a junior majoring in Environmental Journalism and minoring in Spanish. This is her second time writing for Planet Magazine.

CRISTA DOGHERTY is a junior majoring in studio art with a photography emphasis. Once called "some kind of nature girl" by a rapper from Cincinnati on a greyhound bus, she cares about the environment. She despises tomatoes and writing the letter S.



PEEL THE PAV

STORY RAYMOND FLORES | PHOTOS RAYMOND FLORES

Volunteers pried and picked the pavement at the Southeast Uplift Center for hours in order to prime the site for a new bioswale. Bioswales are a method for treating surface water runoff and consist of shrubs and soils ideal for removing pollution and sediment from runoff. Depave encourages the planting of gardens and bioswales at the sites they work on.

NG OFF VEMENT

A giant puddle forms in a crosswalk during the first rain of the season, forcing pedestrians to jump and skip around the area. They attempt to avoid the sheen of oil dumping into the nearly overflowing storm drain a few feet away. This storm water runoff is only one implication of excessive pavement in cities across the country.

On a frigid fall morning, nearly 25 volunteers set to work pulling up slabs of unused pavement from a parking lot in southeast Portland.

Rowan McIntosh, 11, and his brother Collin, 7, were the youngest volunteers removing pavement at the event.

When asked why he came to the event Rowan replied, "Because I like to smash things."

Formed in 2007, Depave is an organization in Portland, Ore., that works to remove unused pavement from urban environments. They depend on volunteer workforces comprised of local community members who become more educated and reconnected with their environment.

In U.S. residential areas up to 60 percent of the ground can be covered in pavement, some of which is abandoned. Urban and industrial areas can reach more than 90 percent pavement coverage, according to Depave. The excessive amount of pavement contributes to water pollution.

Jennifer Devlin from the Bureau of Environmental Services in Portland said surface water run-off is a major environmental problem. Run-off from pavement carries petroleum products and other chemicals into streams in greater concentrations than if filtered through soil, according to the U.S. Environmental Protection Agency.

Instead of being filtered through the ground, pollution is rushed into water bodies during a rainstorm.

"In a city that is trying to preserve fish and wildlife, it's a pretty big deal," Devlin said.

In Portland, this is an issue because storm water drains are attached to the sewer. During and after heavy rains, the sewer can become overloaded and spill into the Willamette River, which runs through the city.

Another problem associated with pavement is the urban heat island effect. The urban heat island effect is blamed for increasing the temperature in densely populated areas, such

as big cities, contributing to global climate change. The collection of paved surfaces, tall buildings and greenhouse emissions from cars results in each city having a unique climate, one that is often hotter than surrounding countryside, according to the U.S. EPA. Depave is hoping to reduce the urban heat island effect and make a cooler environment, one that is easier to look at and live in.

The group consists of about 10 core volunteers who coordinate projects with the city of Portland. They rely on a wide volunteer base to smash and remove the pavement. Depave chooses sites that will have the most impact on the community. Their goal is to replace unused parking lots and blacktops with community gardens and greenspaces.

The majority of sites are schools and community institutions where educational and recreational gardens can serve the public for years to come. Occasionally, private landowners contribute spaces for depaving to improve the aesthetic or environmental friendliness of a site. The process starts when an interested party comes to the group requesting its services. Once the group decides to tackle a project, volunteer grant writers draft proposals.

Permits from the city are necessary before any depaving can begin. The group requires a plan from landowners for

what will go into a site after the depaving. Once the permit process is complete, the fun work begins.

Days before the volunteers come in and take the pavement out with steel pry bars, a pavement cutter is rented and the area is cut into large slabs. The day of the event, volunteers haul asphalt and concrete chunks into battered wheelbarrows and transport the material to a recycling drop box. A second layer of gravel must be raked up and removed before the final stages.

Replacing paved areas with gardens, storm water filters and parks improves the livability of an area for people and wildlife. The group is working towards depaving their first section of street and hopes to do more work in riparian zones, core group volunteer Ted Labbe said.

The area closest to the banks of streams and rivers is called a riparian zone, and is for regulating water temperature and quality. They are sensitive areas crucial to filtering run-off before it enters the water.

Vestal Elementary School in Northeast Portland is one of the group's biggest achievements. Volunteers depaved an area the size of more than five tennis courts for community and educational gardens. The area totaled 15,000 square feet, according to the Depave website.

Over 100 volunteers from the community, including Portland Mayor Sam Adams, helped at the event. Several other city officials have attended Depave events, which shows the successful relationship the group has fostered with the city. Commissioners Amanda Fritz and Nick Fish have gotten their hands dirty helping free the land of unnecessary pavement.

*Any life in that soil is gone.
It's been baking under hot
pavement for decades.*

✓ Vestal Elementary School in northeast Portland is one of Depave's biggest success stories. They utilized over 100 community members and depaved 15,000 square feet.





▲ The Vestal site incorporates community gardens as well as educational gardens for the nearby school.

Project Site Coordinator Drew Swayne said one of the problems Depave faces is dealing with the damaged soil they find under the pavement.

"The soil we uncover is practically an impervious surface itself when we get to it," Swayne said.

After breaking up the soil to allow roots to grow, remedial soil and compost is added to bring life back to the area.

"Any life that was in that soil is pretty much gone," Labbe said, "it's been baking under hot pavement for decades."

Depave is supported by grants from the City of Portland and the Multnomah Soil and Water Conservation District. This year they received the EPA's Environmental Justice Small Grant, which will enable the group to focus on more underprivileged areas. Urban Conservationist Mary Logalbo, for the West Multnomah Soil and Water Conservation District, said Depave's work is crucial.

"We need less impervious areas to keep our waters clean and get them cleaner," she said, "and the education component is huge."

Depave relies completely on volunteers to organize and execute their events. By bringing volunteers from neighborhoods, they create a sense of community and place in the locations they depave. Swayne said using community mem-



▲ About 25 volunteers showed up at the Southeast Uplift Center on October 16th to help remove unnecessary pavement from part of the center's parking lot.

"The soil we uncover is practically an impervious surface itself when we get to it."

bers increases the likelihood of citizens returning to a spot because they feel a sense of ownership. Depave wants people to take full advantage of the reclaimed land.

As the idea for depaving has spread, so has the demand for the group's services. They have posted guides on their website for citizens to start depaving their own neighborhoods. Labbe said Depave is designing educational workshops that will begin next spring. The group is also thinking about hiring their first paid coordinator.

"I think we are ready to grow," Labbe said.

Since 2007, Depave has uncovered over 50,000 square feet, or roughly the size of a football field. They are hoping Depave catches on in other cities.

With its collection of unused pavement flushing contaminants directly into Bellingham Bay, it is surprising Bellingham has not seen its own Depave chapter. Considering its environmentally-conscious attitude and the amount of community-oriented citizens, depave could find a niche in the city of subdued excitement. 🌱

Go to www.depave.org to learn what it takes to depave your city.

RAYMOND FLORES is a senior from Portland, majoring in environmental journalism. He has been published in The Western Front. This is his first time writing for The Planet.



FIS FOR TH

STORY WILEY VOLKER | PHOTOS WILEY VOLKER

The five native species of salmon (from the top): pink, silver, sockeye, chum, and king.

H FOOD HOUGHT

For centuries, coastal communities of the Pacific and Atlantic Oceans have worshipped salmon as an integral piece of their beloved habitat, but these wild stocks are now threatened by overfishing.

For families seeking salmon, two options are present in the marketplace: wild or farmed salmon. The farming of salmon, an industry known as aquaculture, came as a response to overfishing in Norway in the early 1960s.

Aquaculture displaces the issue of overfishing because it is entirely dependent upon the wild capture of feed fish. With research and reform, these farms could become places of sustainable practice. As it stands now, aquaculture presents too many risks to the environment for it to be considered a viable option.

Species within the oceans are in constant flux, and many factors need consideration in determining the sustainability of fisheries. Humans will be unable to feed our rapidly growing population with commercial fishing fleets without decimating wild populations.

"It is almost as though we use our military to fight the animals in the ocean," said marine biologist Daniel Pauly, who specializes in human impacts on global fisheries. "We are gradually winning the war to exterminate them."

According to Greenpeace, more than 70 percent of global fisheries are over-exploited or significantly depleted. These numbers illustrate the consequences of feeding an increasingly populous society with capture fisheries alone.

"Projections of a 50 percent increase in the human population within the next three or four decades, coupled with finite food production systems, create scenarios that will bring domestic food security to the forefront of our national interest," said Kevin Bright, Environmental Permit Coordinator at American Gold Seafoods.



▲ Open net pens at a chum salmon hatchery located in Kendrick Bay, Alaska.

The environmental issues surrounding farmed fish can be simplified to a few categories: pollution, disease and fishmeal production.

Bright, a Western Washington University alumnus with a degree in biology, has worked for nearly 20 years at the Cypress Island salmon farm in the San Juan Islands, cultivating Atlantic salmon. Since entering the industry, he said he has witnessed its boom, with farms now contributing more than 60 percent of the world's fish supply.

Aquaculture has become the fastest growing industry in the world, said Jennifer Jacquet, a fisheries and oceanography professor at Western Washington University and the University of British Columbia. Aquaculture proponents boast year-round availability of salmon for human consumption with standardized prices regardless of season. Their aim is to supplement the global supply of seafood.

The environmental issues surrounding farmed fish are convoluted and multifaceted, but can be simplified to a few categories: pollution, disease and fishmeal production.



▲ The crew of Fishing Vessel *Heavy Duty* at work hauling in wild Alaskan salmon.

Salmon are farmed in open net pens, approximately 7,000 cubic meters in size and containing up to 25,000 fully grown fish, Bright said. Open net pen farming can be detrimental to the surrounding seabed when massive amounts of excrement fall from the pens onto the sea floor. Oxygen is then depleted when bacteria use it to decompose the raw waste. Low oxygen levels make it difficult for other organisms, often invertebrates, to survive.

Plaguing certain populations of both wild and farmed salmon is the spread of bacteria, viruses and parasites.

Some of the most dangerous parasites are sea lice. Sea lice pose a threat to juvenile salmon as they exit river systems. Young pink and chum salmon, or smolts, are at high risk because they are smaller than other species when it comes time for the out-migration. Salmon smolts can contract infestations as they swim past open net pens where the lice are free to multiply amongst densely farmed salmon. Young salmon can die if they acquire a few lice while adult salmon can tolerate a higher number, but it is different for each fish.

Sea lice are commonly found offshore and are unable to survive in fresh water. Sea lice thrive in coastal regions where the salinity levels are high. Farms, such as Cypress Island, have never had problems with sea lice because of Puget Sound's lower salinity levels. In the spring and summer, many surrounding mountains provide snowmelt, flushing Puget Sound with freshwater and breaking the life cycle of sea lice.

Aquaculture's primary concern is the amount of feed fish required to raise farmed salmon. Atlantic salmon are the most commonly farmed salmon, selectively bred for their docility. Atlantic salmon currently constitute more than 90 percent of the farmed salmon market and more than 50 percent of the global salmon market, according to the United Nations' Fisheries and Aquaculture Department.

Atlantic salmon are near the top of the food chain and considered apex predators, feeding predominantly on animal proteins. The fishmeal fed to farmed Atlantic salmon

at the Cypress Island site contains approximately 25 percent fish. The fish used are mostly anchovies caught off the coast of Peru and Chile. Bright said the ratio is 1.3 pounds of dry feed to produce 1 pound of wet salmon. This is misleading, because it only accounts for the weight of the dry feed and not the wet fish used in the feed production. After calculating the ratio of wet fish in to wet fish out, Jacquet said the revised figure is closer to 7 pounds of feed, wet and dry, to produce 1 pound of salmon.

As aquaculture booms, livestock ranches continue to produce and compete for fishmeal. In the 1960s, 98 percent of fishmeal was sent to chicken and pig farms. Since the 1980s, 60 percent of fishmeal has gone into aquaculture, Bright said.

"There's only so much fishmeal out there," he said. "Demand has gone up."

Although fish farmers claim to increase the overall food supply and help alleviate world hunger, the issue is more complex. The three largest consumers of salmon are Japan, the European Union and North America, according to the Department of Environmental and Natural Resources at the University of Rhode Island. Fresh and frozen salmon is abundant in the first world, where it is preferred to anchovies or sardines. Aquaculture provides delicacies for those who can afford them, but robs developing countries of anchovies and smaller fish that would be a welcome sight for a family in need.

"These fish could provide humans with large quantities of protein but we waste them by using them as raw material for fishmeal," Pauly said.

✓ A sea louse on a wild pink salmon



Aquaculture provides delicacies for those who can afford them, but robs developing countries of anchovies and smaller fish that would be a welcome sight for a family in need.

Peru, with a 25 percent infantile malnourishment rate, exports between eight and 10 million tonnes of anchovies annually. In the Peruvian economy, canned anchovy fillets sell for five times the price of fishmeal while using only half as much fish. Fishmeal replaced soy and grain-meal as animal feed due to a competitive price resulting from the exploitation of cheap Chilean anchovy, according to Jacquet.

"Each year, we turn one-third of all ocean-caught fish into fishmeal for pigs, chickens and farmed fish," Jacquet said.

Research and development is going into vegetable-based feed products for salmon. Most fish farms currently use soy, corn gluten, or rapeseed oil in their fishmeal, Bright said.

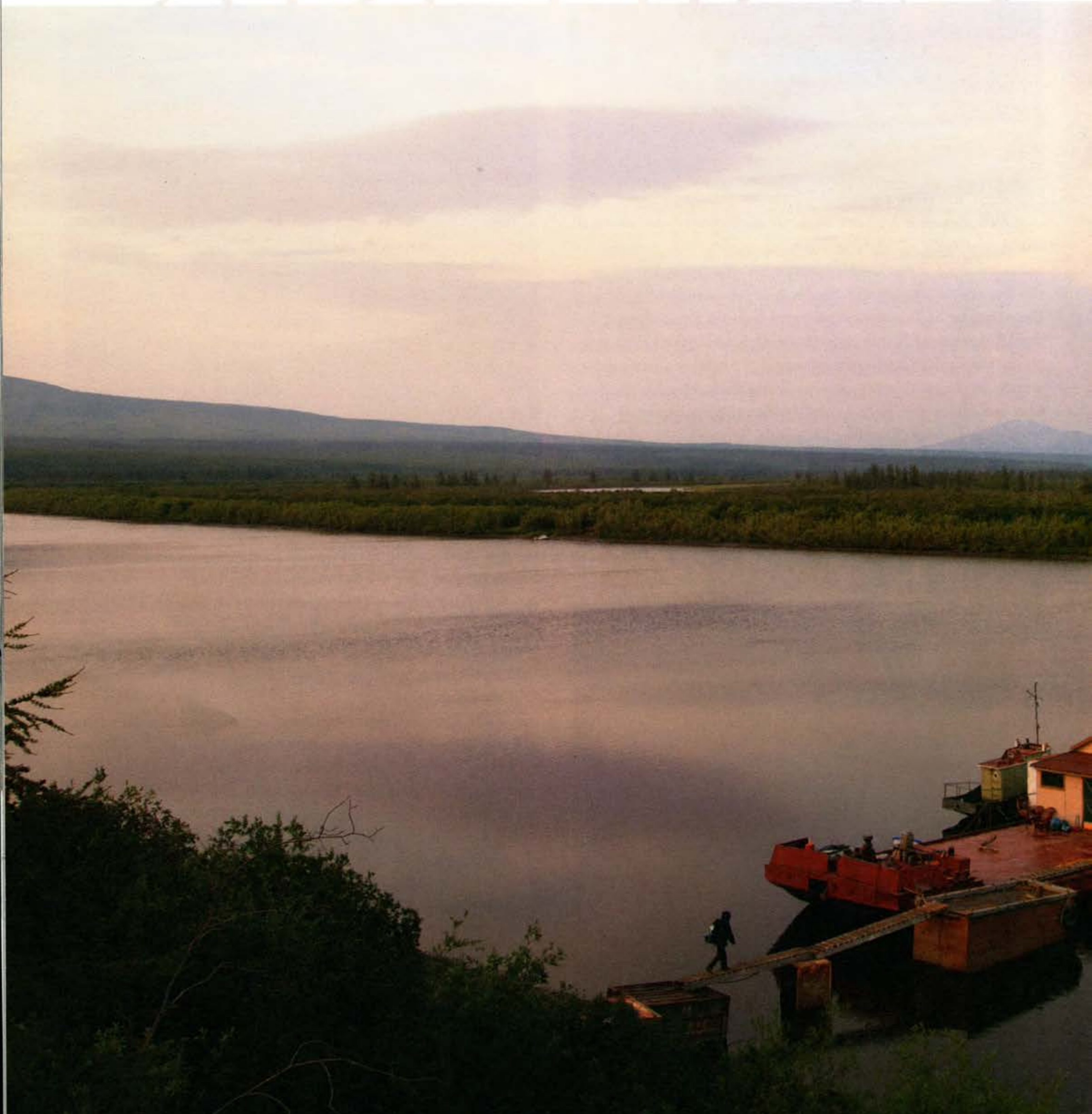
An alternative proposal is the use of hop byproducts from breweries. However, advancements in the vegetarian direction may not be the ultimate solution because salmon are not herbivores. Atlantic salmon need animal proteins to survive. Some pollock canneries recycle their scraps, offering heads and guts for fishmeal production.

Aquaculture may have slowed overfishing of wild salmon, but commercial fleets are still exploiting the global fish supply. Boatloads of anchovies from South American waters are traded for a few hundred pounds of fresh salmon to be sold in affluent nations.

Until the environmental implications and the amount of feed it takes to produce a salmon are balanced, aquaculture is still questionable. Next time you are considering that 3-pound farmed salmon fillet, imagine all the mouths you could feed with 21 pounds of anchovies. 🌱

WILEY VOLKER is a sophomore majoring in good karma and seeking a career in fun. You can find him at the mountain, worshipping la niña.

SIBERIAN



The long Arctic twilight paints pink hues on the barge that houses the researchers of The Polaris Project, as one researcher finally arrives home after a long night in the lab.

SUMMER

STORY MAX WILBERT | PHOTOS MAX WILBERT



SIBERIA— IT CONJURES IMAGES OF THE DEEPEST WINTERS, of Soviet gulags and featureless tundra that stretches to the horizon. It is a land frozen in time. If Siberia were its own country, it would be the second largest in the world. Cold is what defines this place. Soil that remains below freezing for many years, known as permafrost, underlies the vast majority of Siberia. This permafrost contains the remains of an ancient grassland - billions of tons of carbon, safely locked up in a freezer thousands of miles across. It's been called a "climate bomb" that is poised to go off. And as the climate warms, it is beginning to thaw.

That is why I am here, peering out the window of a small propeller plane, looking down on a strange landscape. Small lakes streak by beneath us, then a deep blue expanse - the Kolyma River. The airport, if it can be called that, sits on the far side of the river; we seem to be plunging into its depths. We touch down, and the plane shakes violently. The wheels screech and shoot tongues of dirt into the air.

I get ready for my first breaths of crisp, cool Arctic air. The flight attendant's voice chimes through the speaker, first Russian, then English. "On behalf of Air Yakutia, I want to welcome you to Cherskii." She opens the hatch, and hot, stagnant air creeps under my collar, along with the first of the mosquitoes.

The heat is sadly ironic. I'm here with a dozen climate scientists as part of The Polaris Project, a \$1.6 million, three-year project funded by the National Science Foundation. Professor Andy Bunn, who teaches climate change at Huxley College, is a lead researcher and permits two students from Western Washington University to apply each year.

We are in the lower reaches of the Kolyma River, in far northeast Russia. I'm serving as the expedition journalist, working with Chris Linder, a professional science journalist, and serving as a representative of the Huxley College Environmental Journalism program.

SIBERIA HAS BEEN CALLED A CLIMATE BOMB POISED TO GO OFF.

For the next three weeks of the Siberian summer, we will be studying the ecosystems and their relationship to climate change. The main lab sits beneath an enormous Soviet-era satellite dish. Our quarters are narrow bunks on a barge floating on the river - three to a room. We have porridge for breakfast, moose for lunch and fish soup for dinner. For the first week, the temperature hovers around 90 degrees.

The scientists are split into teams, each studying a different part of the landscape. Research is being conducted on everything from nitrogen in soils to insect populations in local lakes and streams. Travis Drake, a recent graduate



1



4



7

(1) Trees slump as part of what locals call a 'drunken forest.' The trees lean as the permafrost melts. (2) A scientist uses a measuring tape to measure permafrost depth. (3) A scientist uses a measuring tape to measure permafrost depth. (4) Polaris research includes measurements of soil temperature. (5) The Russian Academy of Sciences in Yakutsk, Siberia, displays a piece of ice hacked out of an ice shelf. (6) A scientist uses a measuring tape to measure permafrost depth. (7) 'Orbita' is the Russian name for the main lab where equipment runs analysis of soil samples. (8) A scientist uses a measuring tape to measure permafrost depth. (9) A methane bubble silently bursts on the surface of a lake.



underneath their roots thaws and the soil shifts. (2) Chris Linder peers over the edge of an eroding escarpment at Duvanni-Yar, on the Kolyma River. (3) Melissa Robbins, from the University of Reno, Nevada, caps permafrost depth, temperature, and composition. Here a researcher gathers a sample of the frozen, carbon-rich soil that underlies the region. (5) Valentin Spektor, a researcher at the Melnikov Permafrost Institute of the Russian Academy of Sciences, examines a sample of soil. (6) Small lakes and tributaries crisscross the floodplain of the Kolyma River near the town of Cherski. Some lakes are draining as the permafrost beneath them thaws, leaving empty lakebeds behind. (7) A researcher examines samples gathered in the field underneath a Soviet-era satellite dish. (8) Sergei Zimov, the head scientist at the Northwest Science Station, and Polaris participant Lydia Russell-Roy use this 8-wheeled amphibious all-terrain vehicle to traverse the surface of Shuchl Lake, near the Northeast Science Station. During the short Arctic summer, the sun does not set at all but traverses the horizon for hours on end. This photo was taken one minute before midnight.

from Carleton College, is looking at how gases dissolved in small streams are escaping directly to the atmosphere. Drake has spent two summers on the Polaris Project, and said his experience has been challenging.

"This place is truly scary to me," Drake said. "Seeing slumping trees and thawing permafrost is exciting scientifically, but nerve-racking as a human."

Drake and the rest of the scientists agree - this landscape will play a vital role in the next hundred years of climate change.

"Warming in the Arctic is two to three times greater than the global average," says Dr. R. Max Holmes, senior scientist at Woods Hole Research Center in Massachusetts and leader of The Polaris Project.

The effects of this rapid warming are immediately visible in the landscape. Permafrost in the area is thawing more than ever before. Erosion is accelerating. Some lakes are disappearing, draining into the soil as the underlying permafrost thaws. Others are migrating, as the shorelines thaw and the prevailing winds cause one side of the lake to slump and erode. Some roads have dropped more than 10 feet as the land beneath them subsides. "Drunken forests" are visible everywhere, as trees lose their grip on the thawing, shifting soil and keel over.

The vegetation and soils that erode into the lakes are decomposed by bacteria that release methane, a potent greenhouse gas. Shuchi Lake, near the station, is where much of the research on this phenomenon has been conducted. As I trudge through the mud, wearing tall boots and struggling to hold my balance, owls swoop overhead and bubbles of methane erupt around my feet.

Something even more frightening is happening on the coast. Jorien Vonk, a Polaris participant from the University of Stockholm, said rapidly thawing soil along the Arctic coast is losing its strength. As the coastal erosion increases, methane trapped under the seabed is venting into the atmosphere and carbon locked in the soil begins to reach the atmosphere. The National Science Foundation has warned that even if a small fraction of the methane trapped under the sea is released, we risk "abrupt climate warming."

This is an example of what scientists call a positive feedback loop: as greenhouse gases accumulate, the planet warms and accelerates permafrost thaw. This triggers the release of more greenhouse gases, which amplify warming and strengthens the loop.

Another feedback loop is affecting the oceans. As carbon dioxide builds up in the atmosphere, it dissolves into the oceans, acidifying them and contributing to a 40 percent decline in phytoplankton since 1950, according to recent research published in the journal *Nature*. These tiny creatures are the basis of ocean ecosystems and take carbon

dioxide out of the atmosphere. With less phytoplankton more carbon stays in the atmosphere and oceans.

Climate is driven by heat, so as the planet warms, weather patterns are shifting. These shifting patterns result in what meteorologists refer to as climate destabilization: stronger and more frequent storms, droughts, floods, and forest fires. This contributes to glaciers melting around the world and rising sea levels.

These stresses are taking their toll on ecosystems around the world that are already affected by mining, logging, overfishing, agriculture, industry and overpopulation.

Even remote Siberia is not immune to these problems. Flying over the endless landscape, vast clear-cuts of the boreal forest assailed my eyes. Railways and pipelines cut across long empty stretches of land, and bulldozers scraped and burrowed in vast open-pit mines. All over the world, ecosystems are bearing the brunt of industry, or simply collapsing.

Greenhouse gas emissions are tracking near the high end of the scenarios used by climate modelers. James Hansen, the NASA scientist who helped create the first climate models, and who first brought climate change to the attention of Congress in the 1980s, has said he believes that we need drastic cuts in emissions to protect our planet and all of its inhabitants.

"This is analogous to the issue of slavery faced by Abraham Lincoln or the issue of Nazism faced by Winston Churchill," Hansen wrote in his recent book, *Storms of My Grandchildren*.

"On those kind of issues you cannot compromise. You can't say let's reduce slavery, let's find a compromise and reduce it 50 percent or reduce it 40 percent," he wrote.

Hansen has joined many who are frustrated with the lack of government leadership in calling for direct action to halt the flow of fossil fuels. He was arrested in 2009 for attempting to shut down a mountaintop-removal coal mine in West Virginia.

His words ring in my ears as we begin the long journey home. We spot dozens of wildfires from the plane. In Moscow, thick smoke clogs our lungs and makes us light-headed; simply breathing outside for one hour is the equivalent of smoking two packs of cigarettes, according to the city health department.

A few days later, Moscow surpasses 100°F for the first time in recorded history; then again... and again, as part of a global trend of rising temperatures. Obviously, this is not just weather fluctuations anymore.

Russia was one of 18 countries to set all-time high temperatures in 2010. 🌍

WARMING IN THE ARCTIC IS TWO TO THREE TIMES GREATER THAN THE GLOBAL AVERAGE.

MAX WILBERT is a senior majoring in Environmental Advocacy and Communication. He works with the local environmental organization Fertile Ground, and spends his free time cooking and enjoying the natural world.

STORY JESSICA PETERSON
PHOTOS REIKO ENDO

RAILROAD REMEDIES

A westbound BNSF train comes into town in Skykomish, Wash. ▾



The soil, dark and rich in color, resembles healthy manure ready to be spread in a garden. However, this dirt has a secret: it's polluted. Dug up from underneath homes, stores and rail ties, the contaminated soil has been the source of one of Washington's largest railroad-related environmental cleanups.

"It was ignorance of environmental concern and carelessness. When they were refueling, there was carelessness."

Mayor Fred Black, of Skykomish, Wash., surveys his town and sees potential. Dilapidated historic buildings, once flourishing, have a second chance. When the fences and building material are removed, Black said he knows his quaint town in the Cascades will bring visitors once again. The railroad, responsible for the devastation imposed on Skykomish, can become a welcomed industry in an environmentally conscious future.

The Great Northern Railway, now part of the Burlington Northern Sante Fe railroad (BNSF), historically used Bunker C fuel in locomotives. While refueling on the flat span of tracks in the small Stevens Pass town of Skykomish, Bunker C was often spilled. Bunker C fuel, made of heavy residual petroleum oils, poses life-threatening risks to the animals living in or near contaminated water, according to the National Oceanic and Atmospheric Administration website.

Although Bunker C fuel has since been replaced by diesel fuel, and is no longer used in locomotives, its legacy left a dark mark under the town of Skykomish.

In 1996, after more than 100 years, Bunker C fuel was discovered to be seeping into salmon habitat of the Skykomish River and pooling underneath the town's buildings.

Houses, historical buildings and other existing structures had to be relocated to remove the contaminated soil and replace it with clean fill. The contaminated soil, still being excavated today, is piled into train cars and hauled to a facility in southern Washington. The excess oil is then burned out of the soil to make it safe for reuse.

While the cleanup is nearing completion, the incident has left a lasting impression on the residents of Skykomish.

▼ Mayor Fred Black of Skykomish looks westbound, toward a distant railway signal in Skykomish, Wash. Skykomish is one of the largest railroad related cleanup sites.



"It's affected a lot of people. Actually, everybody if you look at the whole project," Black said. "Even people whose houses weren't moved have had to deal with noise, construction and dust."

However, there is a silver lining in the oil-stained soil of Skykomish. BNSF is not only paying for the cleanup, but also for the town to be upgraded. New additions include construction of street lamps, a wastewater treatment facility and a community center. The town of 209 residents will not be billed by BNSF.

"I am very pleased with the Department of Ecology and BNSF," Black said. "I am pleased with the way this is going."

Former BNSF Locomotive Engineer Jerry Apt said that the industry has changed in the past 50 years. He said when he began working on the railroad in 1965, there were few environmental regulations to control hazardous spills. A gallon of diesel spilled every once in a while was not a problem, Apt said.

"When fueling locomotives, they would fuel on open track," he said. "Eventually they made concrete catch basins and have since done so extensively to recoup the oil."

Katie Skipper, Washington State Department of Ecology media relations, said there have been changes in the way fueling, maintenance and construction are approached.

Skipper, who works with San Juan, Skagit and Whatcom counties, said although trains are constantly moving through these regions, railroad spills are rare. Since she has worked in the area, she could not recall a single railroad related cleanup in Bellingham.

Bellingham has its own environmental cleanups, Skipper said. However, she said these are not associated with the railroad, even though some occur near tracks. Boulevard Park and other cleanup sites in Bellingham stem primarily from the



▲ A stationary, east-facing BNSF train waits in Goldbar, Wash.

former Georgia-Pacific pulp and paper mill. Despite the tracks running through Boulevard Park, the pollution on the site was caused from a facility that converted coal to gas used in cooking and heating homes.

In 2005, the seven major freight railroad companies in the U.S., including BNSF, joined SmartWay Transport Partnership. SmartWay, part of the United States Environmental Protection Agency (EPA), helped lead a combined effort between these companies to lower their impact on the environment. Together, these seven companies account for more than 90 percent of all domestic rail freight in the United States.

One of the joint efforts of the partnership was to reduce train idling with engines that have automatic start and stop mechanisms. With improved engines, there is greater control over horsepower and revolutions per minute. Another effort was retrofitting switcher engines that switch train cars around the rail yard because they are often older and have higher emissions.

Along with this move, the EPA adopted standards to reduce emissions of airborne contaminants. Contaminants included particulate matter, which are airborne particles that penetrate deep in the lungs, as well as nitrogen oxides that contribute to smog and acid rain. These standards are expected to reduce particulate matter by 90 percent and reduce nitrogen oxide emissions by 80 percent.

As the world becomes more environmentally conscious, Gus Melonas, regional director of BNSF Public Affairs, said that railways are set to play a major role.

"The future is certainly bright, and certainly green," Melonas said.

He said BNSF is investing more than \$2 billion to improve the industry, which includes new locomotives and new rail to allow efficient traffic flow.

Melonas said a ton of freight moved on a rail car can move more than 450 miles on a single gallon of diesel, equivalent to



▲ The Skykomish River, with the bridge that crosses it into the town of Skykomish, Wash. Bunker C fuel was discovered to be seeping into the salmon habitat of the Skykomish River in 1996. The oil had been pooling underneath the buildings of the town, accumulating in the soil.

driving from Bellingham to the Idaho-Montana border. On the rail, a single railcar can carry more than 100 tons of freight. Each train, sometimes carrying two containers per railcar, may span a mile long.

Melonas said the design of metal on metal drastically reduces friction, allowing high fuel efficiency while carrying large loads.

Dale Tabat, truck freight program and policy manager with the Washington State Department of Transportation, said that heavy haul freight trucks can carry 80,000 pounds and average six miles per gallon of gas. One truck may carry one ton of freight 218 miles, which is less than half of what a train could haul.

As we enter a new era, with better technology and environmentally-centered methods of transportation, freight rail companies are looking at ways they can make positive changes. Although they cannot undo the damage of the past, they are working to minimize their impact on future. However, Skykomish is not the only place where this contamination has happened.

In November 2010, the Missoulian newspaper revealed a new lawsuit brought forth by 152 Livingston, Mont. residents. Similar to Skykomish, BNSF spilled diesel fuel and other contaminants into the soil during refueling. Will BNSF commit to as thorough a cleanup for Livingston as they did for Skykomish? What about any others that may emerge in the future? 🗣️

JESSICA PETERSON is a Public Relations major with double minors in Anthropology and Environmental Studies. She works at the Whatcom Humane Society and after graduation plans on working with non-profit organizations.

REIKO ENDO is a senior and an international student from Japan majoring in Visual Journalism with a linguistics concentration.



SEASON'S EATINGS

STORY LOUISE FOSTER | PHOTOS CRISTA DOUGHERTY

(lōc·ə·vohr)

A group committed to promoting local sustainable agriculture and raising consumer awareness of the impact of food choices. They advocate eating food grown within a 100 mile radius.

A pot of soup sits simmering on the stove, filled with tender beef, caramelized onions, beets, potatoes, carrots, and topped with fresh herbs. For desert, a crisp apple stuffed with honey, butter and hazelnut, bakes in the oven until the apple bursts and a pool of butter covers the pan. Who says locavores cannot eat well in the winter? All this can be made in the middle of winter from ingredients all grown on Washington's farms.

Eating locally is becoming an increasingly popular pursuit. In 2005 the term "locavore" was defined to mean someone who strives to eat seasonally and within a certain region.

In a country where most foods travels 1500 miles on average to get to the consumer, it is nice to be able to point to something on a plate and say, "I know where this was grown." Spending money at local farms keeps money in a community and allows consumers to develop relationships with the people who grow their food.

Locavores have it easy in the summer. Gardens, grocery stores and farmer's markets are stocked full of local foods, like fresh corn, juicy tomatoes, brightly colored salad greens and the sweetest fruits imaginable.

But in the dead of winter when only a few hardy vegetables can survive in the freezing temperatures, it is still possible to eat locally. With some creativity and planning, a local winter diet can be fulfilling and delicious.

Bellingham, Wash. is an ideal place to eat seasonally because even in the winter there are many sources of local foods. For beginners, the

downtown Bellingham farmer's market stays open until mid December and is a great place to learn what foods are available in the winter.

Checking labels is an easy way to figure out what is grown in Washington. Dark, leafy greens and hardy vegetables, like kale, beets, and cabbage, are available fresh throughout the winter. Many foods harvested in the fall can keep their freshness through the winter like squash, potatoes and apples.

"A lot of eating local is just adapting what you're used to eating," said Nick Spring a Fairhaven student and coordinator for the Outback

Farm at Western Washington University.

Most of Spring's diet comes from foods he grows himself. He said eating locally in the winter, especially on a budget, starts with planting a garden in the spring to harvest and preserve foods for the winter. Spring recommends low-maintenance vegetables that do well in Washington's climate such as peppers, onions, and cucumbers.

An option for students without space for a garden is getting a plot at the Outback. The Outback offers plots free of charge to students and volunteers are happy to help get first timers started. Bellingham residents can get a plot at a community garden though

Bellingham Parks and Recreation or Bellingham Urban Garden. Plots are located in various neighborhoods including Happy Valley, Lakeway, Lettered Streets and Fairhaven.

Once the garden is ready for harvest, there are several ways to preserve foods for the winter. Freezing, pickling, canning or dehydrating

In a country where most foods travels 1500 miles to get to the consumer, it is nice to be able to point to something on a plate and say, "I know where this was grown."



▲ Romanesco broccoli, an aesthetically appealing winter vegetable, is made up of a self-similar pattern that composes a natural fractal. Relative to the common broccoli and cauliflower, romanesco broccoli can be put to the same uses in the kitchen as its cousins.

✦ Pumpkins and squash are some local winter vegetables available at the Bellingham Farmers Market. These seasonal vegetables are wonderful for soups, breads and baked dishes.

parts of your harvest while they are fresh ensures more variety of food to eat during the winter. Preservation methods may seem intimidating at first, but with some improvisation and substitution, saving foods becomes less of a challenge. One idea is to dry foods in an oven instead of investing in a dehydrator, or freezing a fresh tomato sauce instead of worrying about canning it.

Heather Jefferys, an AS environmental coordinator at Western Washington University, strives to eat locally throughout the year. During the school year Jefferys organizes informal classes about cooking and preserving local foods. Her idea is to bring students together to make eating locally feasible for those on a low budget.

In her last class, Jefferys taught students how to make and can caramelized onion jam, sweet pepper relish, and cayenne pepper apple sauce. Most of the ingredients were harvested from the Outback. Jefferys explains that canning is easier and less scary than one might assume. She encourages students to check out books from the library and start experimenting.

Jefferys said in the winter she gets creative with her waffle maker, making sweet potato waffles topped with local honey and butter. Spring said his typical winter meal might be an omelet with local cheese and fresh herbs from his windowsill, or a stew made with dried stinging nettles and winter squash.

Many locavores allow themselves a few exceptions to their diets to include products that are not local, but greatly improve the flavors of local dishes.

"Eating local makes me appreciate the things I get that aren't local," Jefferys said.

Some of these imported staples include, salt, pepper, coffee, chocolate, olive oil, and coconut milk.

Seasonal eating in Washington winters can be equally as tasty as it is in the summers. It just requires a little knowledge about what is available and how to cook it. Feel free to experiment or to substitute in the kitchen.

"I don't really believe in absolutism, find out what works for you," Spring said "It's a lifestyle, not a short-term fad." 🌱

LOUISE FOSTER is a senior majoring in environmental education. She likes experimenting in the kitchen and eating seasonal foods.

CRISTA DOUGHERTY is a junior majoring in studio art with a photography emphasis. Once called "some kind of nature girl" by a rapper from Cincinnati on a greyhound bus, she cares about the environment. She despises tomatoes and writing the letter S.

Local Recipe

Winter Baked Apples

Ingredients:

- 1 Apple (use tart variety like Jonagolds or ask your local farmer which variety is best for cooking with)
- 1 Dollop of butter
- 1 Handful of hazelnuts
- 2-3 Spoonfuls honey

Cooking Instructions:

Preheat oven to 350 degrees. Cut the top off the apple and carve out the inside. In a small bowl mix hazelnuts, honey and butter together. Fill apple with hazelnut mixture and put the top back on the apple. Bake until apple is soft. Serve warm.

🌱 The Planet Magazine

Local Recipe

Kabocha Squash Soup

Ingredients:

- 1 lb of Kabocha squash
- ½ Onion, chopped
- 4 Cloves garlic, minced
- 2 tbsp Ginger, minced or grated
- Salt & Pepper
- Paprika
- A handful of hazelnuts

Cooking Instructions:

Cut squash into rough pieces. Place squash, onion, garlic and ginger in a pot and fill with water until it covers all the ingredients. Cook covered on low heat until squash is soft. Mash or blend ingredients together. Salt and pepper to taste, and garnish with a dash of paprika and hazelnuts.

🌱 The Planet Magazine

Local Recipe - Adapted from *Simply in Season*

Nutty Sweet Potato Waffles

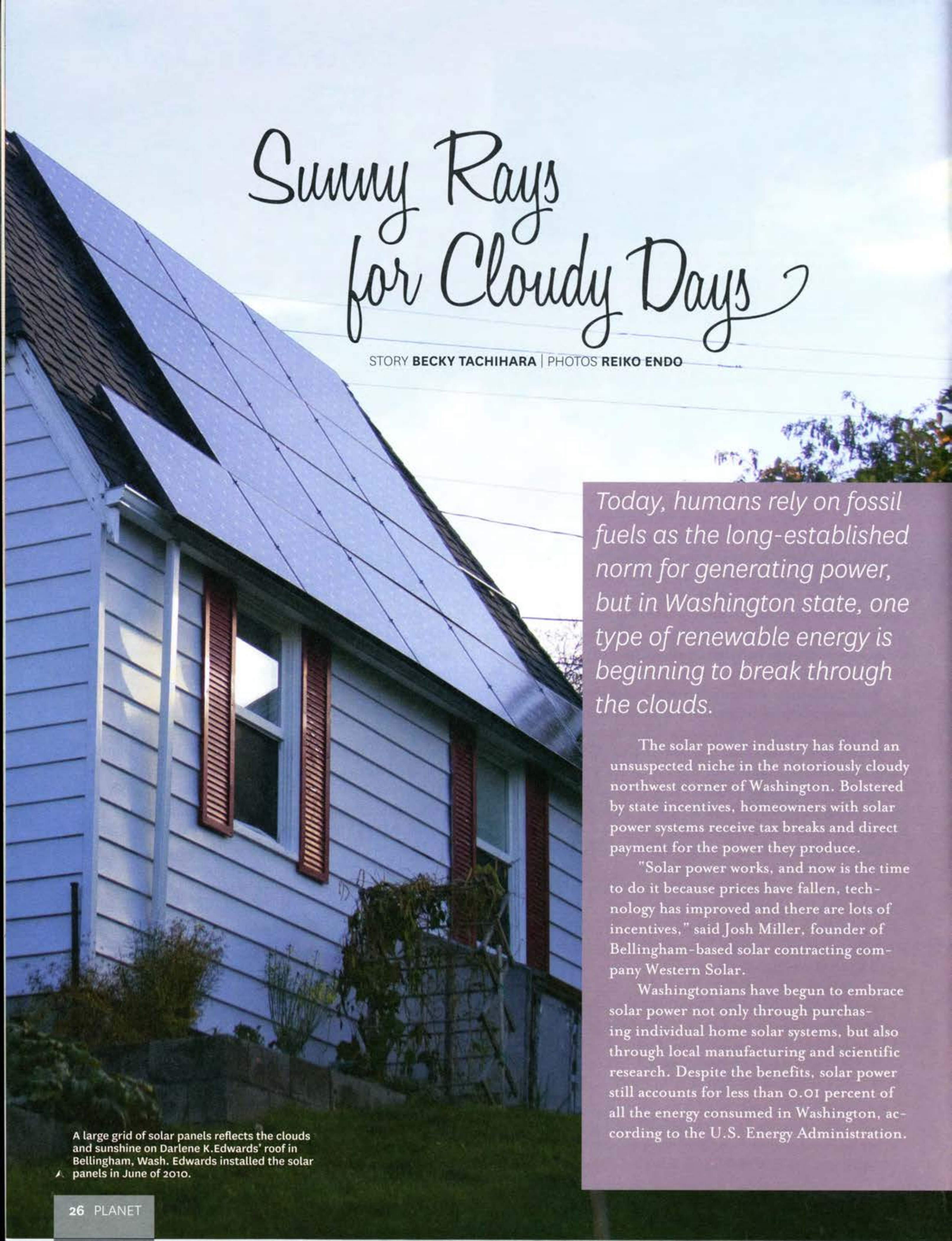
Ingredients:

- 1/2 cup Butter
- 2 cups Sweet potatoes (cooked and mashed)
- 6 Eggs (beaten)
- 2 cups Milk
- 1 cup whole wheat flour
- 1 cup rolled oats (finely ground in blender)
- 1 cup walnuts, pecans, or hazelnuts (finely ground)
- 2 tablespoons baking powder
- 2 teaspoons salt

Cooking Instructions:

Melt butter. Set aside and allow to cool. Stir potatoes, eggs and milk into the cooled butter. Sift flour, oats, nuts, baking powder and salt into the sweet potato mixture. Mix until combined. Bake in a hot waffle iron.

🌱 The Planet Magazine



Sunny Rays for Cloudy Days

STORY BECKY TACHIHARA | PHOTOS REIKO ENDO

Today, humans rely on fossil fuels as the long-established norm for generating power, but in Washington state, one type of renewable energy is beginning to break through the clouds.

The solar power industry has found an unsuspected niche in the notoriously cloudy northwest corner of Washington. Bolstered by state incentives, homeowners with solar power systems receive tax breaks and direct payment for the power they produce.

"Solar power works, and now is the time to do it because prices have fallen, technology has improved and there are lots of incentives," said Josh Miller, founder of Bellingham-based solar contracting company Western Solar.

Washingtonians have begun to embrace solar power not only through purchasing individual home solar systems, but also through local manufacturing and scientific research. Despite the benefits, solar power still accounts for less than 0.01 percent of all the energy consumed in Washington, according to the U.S. Energy Administration.

A large grid of solar panels reflects the clouds and sunshine on Darlene K. Edwards' roof in Bellingham, Wash. Edwards installed the solar panels in June of 2010.

If a solar house is still connected to a utility company's power grid, the owner can be paid up to \$2,000 per year for the solar power they produce, whether they use it or not, according to Washington state legislation passed in 2005.

This complements a program called net metering that gives homeowners credits with their utility company for energy they produce, but do not use, according to Washington's Puget Sound Energy (PSE), which offers this program.

Credits earned from excess generation during long summer days are redeemed during the darker winter months when solar panels do not meet the household's energy demands.

Since net metering and the payments for power produced are two separate programs, homeowners are actually getting paid twice for their power, Miller said.

Former Washington state Sen. Harriet Spanel, said she received approximately \$1,000 from PSE last year for the power she generated with solar modules on her Bellingham, Wash. home. She also accumulated 5,076 kilowatt-hours of net metering credits from PSE, enough to offset approximately eight months of her peak electricity use.

"I've only paid maybe two full electricity bills since last July," she said.

Miller said people who are skeptical of solar's effectiveness in western Washington should consider how well it works in Germany.

"I like to remind people that Germany is the largest consumer of solar in the world and they get 25 percent less sun than we do," he said.

Right now, the biggest obstacle solar power has to overcome is the initial high cost of installing a system.

Miller said the problem is not that solar power systems cost too much, but that Americans have a hard time paying for things up-front.

"It's easier to pay \$100 a month now than to take out a \$15,000 loan," he said.

But a project is in the works at Western Washington University's Advanced Materials and Science Engineering Center (AMSEC) that could make solar modules more affordable.

John Gilbertson, a Western chemistry professor on the project's research team, said they are developing a new type of solar module called a luminescent solar concentrator. The concentrator differs from traditional solar modules because sunlight is not absorbed directly by the cells that transform it into electricity, he said. Instead, a sheet of special dyes absorbs the light and redirects it to solar cells around the edges.

Janelle Leger, an assistant professor in AMSEC, said the project will reduce solar module costs by reducing the number of solar cells needed to generate electricity.

Last summer, the research team received a three-year grant of approximately \$970,000 from the National Science Foundation to fund the project, Leger said.

Leger said current technology is efficient at converting solar energy into electricity, but the average low-to-middle-class homeowner cannot afford it.

Although the project is still in its infancy, the team hopes to have a finished product for the solar industry when the grant expires, Gilbertson said.

Dana Brandt, founder of Ecotech Energy Systems in Bellingham, said the current economic downturn could be helpful to the solar industry if people begin thinking of solar as an investment.

"What I find is that people want to invest in something real," he said.

"They can take money out of stocks and put it into a solar [power] system that will generate clean electricity for 20 years."

Brandt said another barrier keeping solar from becoming a major energy source is the expense of constructing a utility-scale plant. It is cheaper for utility companies to generate mass quantities of power using wind and hydroelectric plants, he said.

These two renewable sources combined make 73 percent of Washington's total renewable power generation, according to the Energy Information Administration.

Sara Julin, a physics professor at Whatcom Community College, installed a \$28,800 solar electric system in her home and said it was worth the investment. She said that between the tax credits, power payments and electricity bill savings, the system will pay for itself in 11 years.

"I like to remind people that Germany is the largest consumer of solar in the world and they get 25 percent less sun than we do."

A power meter attached to Darlene K. Edwards' house on State Street in Bellingham, Wash. Edwards says, "There are days when I can just watch the meter going backward."



Darlene K. Edwards, who installed solar modules in her home in June, said even people who cannot install solar themselves are excited about its spread.

"People going by were cheering the installers while they were putting panels on my roof," she said.

Tim and Alana Nelson, founders of Fire Mountain Solar in Mount Vernon, installed solar when they built their rural Skagit County home. The Nelson's property is not connected to a power grid and their house and business office are powered entirely by solar modules and a small wind turbine.

On the cloudy October morning when the Nelsons opened their home for the Skagit Valley Solar Tour, Tim Nelson said their modules would generate approximately 4,000 watts at their peak on overcast days, about one-fourth of the power their home uses on an average day.

"People going by were cheering the installers while they were putting panels on my roof."

Tim Nelson said one common misconception about solar, especially off-grid solar, is that it cannot support modern electric conveniences.

"People say, 'I can't live without my hair-dryer, but you don't have to,'" he said.

Nelson said that the only things his home cannot run on electricity is their stove and water heater, which are fueled by propane. However, they do have a full-size electric refrigerator and run three computers for the business.

Approximately 30 miles south of the Nelsons' solar home is Washington's first solar module manufacturer, Marysville-based Silicon Energy.

Erin Jenkins, Silicon Energy's operations manager, said the company does not use any toxic substances in their solar modules, except a miniscule amount of lead from soldering the silicon solar cells—the parts of the module that converts sunlight into electricity.

Jenkins said the company plans to install their own solar modules on their plant. The company also recycles everything possible from the production process, as well as composting food scraps and re-using packaging materials.

"We're going to suck up everything and not leave anything for anybody except a big fat mess."

Gary Shaver, president of Silicon Energy, said they use inert materials and renewable energy because they want their panels to not only produce clean energy, but also be sustainable themselves.



▲ A stack of fully-assembled solar panels at Silicon Energy in Marysville, Wash.

Tim Nelson said modules manufactured in Washington are approximately 50 percent more expensive than modules from out of state.

Miller said homeowners could be paid nearly four times as much for the power generated by solar components made in Washington.

Looking into a future where solar is more cost efficient, Miller said solar has the potential to go beyond just home electricity. Electric cars could reduce gasoline consumption and help alleviate the world's oil crisis, especially if charged by a solar power system, he said.

Leger said energy conservation needs to be addressed while solar technology is developed, but even with reduced consumption, Shaver, Gilbertson and Brandt all said cheap fossil fuels will not always be available.

With the scarcity of fossil fuels looming and strong state incentive programs beckoning, Washingtonians have more reasons than ever to make the switch to solar.

"Studies show that in 100 year's time, the only sources large enough to meet the world's energy needs are nuclear and solar," Brandt said. "And I'd rather have solar." ☺

BECKY TACHIARA is a junior majoring in environmental journalism and minoring in environmental planning and policy. She aspires to someday be the Victor Hugo of science journalism.

REIKO ENDO is a senior and an international student from Japan majoring in Visual Journalism with a linguistics concentration.

Downsized Dwellings

STORY LEA KAAHAAINA | PHOTOS CRISTA DOUGHERTY

Living in a dorm has become a quintessential part of the college experience, and students find ways to deal with the challenges of living in a small space. But Dee Williams of Olympia, Wash., actually enjoys living in a tiny house.

➤ Dee Williams has lived in her tiny house in Olympia, Wash. for six years. Parked in a friend's backyard, the wheels on her home and the dollhouse-like appearance help her avoid tricky legal issues for a non-mobile tiny home.



▲ Dee Williams' home has a footprint the size of an elevator. The tall living room ceiling and windows on every wall illuminate the area, creating an open and comfortable space.

Dee Williams lives in a tiny house in Olympia, Wash. with a total area of 84 square feet and a living room the size of an elevator.

When Williams moved into her dollhouse-like home six years ago, she downsized the rest of her lifestyle as well. There was simply no room for excess possessions.

"I'm locked into being mindful about what I consume. I own 325 personal items, so if I buy something, something else goes out," Williams said.

Her home, which she built with her own hands, is a possession she takes pride in. The warm tones of naturally-finished wood create a beautiful, cozy escape from the often dreary gray Washington weather. Soft light filters in from the skylights overhead, making the one-room house glow.

Small homes are being built all over the country as alternatives to big houses. For some, living in a small dwelling means leaving behind unchecked consumerism for a more sustainable and satisfying lifestyle. A small home has fewer direct environmental impacts and fosters a sense of community, interdependence and resource stewardship.

Williams is happy in her tiny home, but some argue that bigger is better. Today, the average size of a single-family house in the U.S. is 2,349 square feet, while in the 1950s it was only 983 square feet, according to the National Association of Home Builders.

The vast amount of resources needed to support this bigger-is-better lifestyle means Americans are eating more than their fair share of the planetary pie.

By 2030, humanity will need the equivalent of two Earths to support increasing population and consumption trends, according to the Global Footprint Network website.

For Americans, the consumption of resources starts at home. A typical dream house has three to four bedrooms, 2.5 baths and a two-car garage. This large-scale structure requires enormous amounts of land, energy and materials for construction and heating.

Before moving into her tiny house, Williams felt disconnected from the natural environment and the people important to her. When a close friend was diagnosed with cancer, she found herself spending all her time and money fixing up her house rather than helping her

friend. So she ditched the house and changed her lifestyle. She no longer wanted to be defined by her house or the other things she owned.

"I wanted to honor my relationships to nature and to community," Williams said. "That's who I am."

Williams won Washington State's Governor's Award for Sustainable Practices in 2008 and calculated the amount of resources she saved by living in a tiny house. She reduced material use by approximately 1,700 percent when she downsized from her 1,500-square-foot house. She now uses 100 percent renewable energy from solar panels and has reduced her water use by 13,000 gallons per year. She carries water from her neighbor's house and uses a composting toilet.

Williams said relying on neighbors for showers and other resources has made her value the community around her. She said she loves being able to carry a hot bowl of soup to her neighbors without it getting cold.

One issue for Williams is the zoning challenge of living in a friend's backyard on a trailer with no hookups. Zoning laws are common obstacles to building and living in a smaller home because many lots are zoned for one single-family unit. While Williams had a government inspector look at her home to get it approved, many people

struggle with how to legally live in a tiny house.

Williams has downsized her home considerably, and some Bellingham, Wash. residents are experimenting with small, but not so tiny, homes as well. Bellingham Cohousing and Matthei Place are two examples of communities with smaller homes in Whatcom County.

The Kulshan Community Land Trust (CLT) was able to construct Matthei Place, a development of small, affordable homes, despite current zoning laws.

Fourteen homes are clustered on one acre, a higher density of homes than in an average residential neighborhood, said Paul Schissler, former executive director of Kulshan CLT.

The clustered homes are well sealed, which increases heating efficiency, Schissler said.

"When I think of a large house, I picture a huge cathedral ceiling,

"I'm locked into being mindful about what I consume. I own 325 personal items, so if I buy something, something else goes out."

▶ The skylight above Dee Williams' lofted bed allows her to admire the sky while cotton insulation keeps noise out and the temperature regulated. Experienced in construction, Williams built the house herself from many recycled and found materials.



the hot air rising, and me sitting on the couch freezing,” Schissler said.

Along with a tiny heating bill, tiny homes can cost less to build. In Washington, the average cost per square foot of a new home is \$116, according to Home-Cost, a construction estimate company. At that rate, the average total construction cost of a 2,400-square-foot home would be nearly \$300,000. In comparison, the Tumbleweed Tiny House Company offers a fully-constructed 65-square-foot house for less than \$39,000.

John Gower, a residential architect based in Victoria, B.C., has found many clients asking for small home design plans.

“People are looking for simplification of life. It’s a part of down-sizing, and they want less stuff,” Gower said. “Some people just think it’s the right thing to do, that materialism is a dead-end trap.” With small home design, everything is scaled back, automatically reducing the amount you consume, Gower said.

Building sustainably requires more than simply using renewable energy and green building technology, Gower said.

“People who think that solar-powered houses are the answer are completely wrong. Another integral part is reducing a home’s footprint,” Gower said.

But some people want to live in a large fortress-like house that has it all: fitness room, home theater, even library. There is no reason to leave, no opportunity to interact or be in public spaces. The sense of community is lost, Gower said.

“There’s an attitude in today’s culture, especially in the U.S., that if you’ve got the money, you deserve [a big house],” Gower said.

Designed to support an intentional community, Bellingham Cohousing is a built environment where residents consciously commit to living as a community. Oriented around pedestrian paths, smaller private units have all the features of a standard home, but larger shared spaces, such as a common house, courtyards and play areas, allow residents to interact. The cohousing architectural model has been used in 150 communities across the country, according to



Williams has become a spectacle of her neighborhood, with many curious visitors. Williams also travels with her house – which is mobile – to many home shows to inspire and inform others.

the Cohousing Association of the United States.

At Bellingham Cohousing, the smallest units are 780 square feet. Although the homes are smaller in size than an average house, residents passionately embrace the challenges and advantages of living small.

Kathleen Nolan has lived in Bellingham Cohousing since it was built 10 years ago. She said a smaller home pushes her to expand her life outward into the community. She said she does not spend a lot of time inside her own home; instead she goes outside or to the common house.

Nolan said cohousing is like living with her best friends at her doorstep.

“Life is a struggle,” Nolan said. “This place just gives me more resources to deal with it.”

The intentional community supports residents in living a sustainable lifestyle as well.

“This isn’t going counter to American culture,” Nolan said. “This really gets at the core of our culture without the added layer of explosive consumerism. There is a strong support for living with limits.”

Living in a tiny house nurtures community and resource stewardship. Leading a satisfying and sustainable lifestyle really does start at home. 🏡

Square Footage of Common Buildings

Average U.S. Home (2010)
2,349 ft²

Average U.S. Home (1950)
930 ft²

Two Bedroom Cohousing
780 ft²

Nash Dorm Room (Double)
210 ft²

Dee’s House
84 ft²

Statistics taken from local and nationally reported averages.

LEA KAAHAAINA is a junior majoring in environmental education.

CRISTA DOUGHERTY is a junior majoring in studio art with a photography emphasis. Once called “some kind of nature girl” by a rapper from Cincinnati on a greyhound bus, she cares about the environment. She despises tomatoes and writing the letter S.



Here we face a critical branch point in history.
What we do with our world right now will
propagate down through the centuries and
powerfully affect the destiny of our descendents.

-Carl Sagan