



Photo taken along Forest Road 99, just miles from Windy Ridge

Luke Wakefield

Issue 5 - July / August 2014

Summer at Windy Ridge

By Ray Yurkewycz

Just a few days ago, I drove up to Windy Ridge for the first time this year. After 8 seasons of working at Windy Ridge, I'm still in awe of this spectacular place! I have set up a field camp in the Windy Ridge area every summer since 2007. In 2007 through 2009, it was with John Bishop of Washington State University-Vancouver, where we used camp as a base of operations for field work on the Pumice Plain. In 2010, with Charlie Crisafulli, we hosted visiting scientists and worked all over the northeast side of Mount St. Helens. Most recently, I've been able to create the field camp of my dreams for the Mount St. Helens Institute near Windy Ridge. We built it...and people have come. More about our camp and programs later.

Let's talk a little about why this area northeast of Mount St. Helens is so unique. First of all, the scenery is spectacular. The drive up to Windy Ridge takes you along winding Forest Roads 25 and 99 through spectacular old-growth forests of Douglas Fir, Pacific Silver Fir and Mountain Hemlock. Evidence of the 1980 eruption is hinted at by the loose pumice obvious in road cuts. After rounding a corner soon after the Bear Meadows interpretive site, you enter the blast zone and the views seem endless. Sharp peaks and deep valleys prevail, with numerous overlooks of Spirit Lake. The road ends with a looming view of Mount St. Helens, a mere 5 miles away, and with the Pumice Plain, Mount Margaret Backcountry, Spirit Lake, Johnston Ridge, and the North Fork Toutle Valley laid out before you.

Besides the outstanding scenic beauty, this drive takes you through an awe-inspiring cross-section of the disturbance of the 1980 eruption. Forests that survived despite deep deposits of pumice. Standing dead trees that succumbed to the intense heat of the eruption. Blown-down forest where old-growth logs continue to appear as matchsticks on the landscape. And the Pumice Plain, where the land was ravaged by the debris

avalanche, blown away by the lateral blast and blanketed in many meters thick of pumice deposited while glowing hot. It's enough to make you question your sense of scale.

Perhaps the most enticing aspect of the Windy Ridge-area is the varied hiking opportunities. From short jaunts, to multi-day backpacking trips, the options are endless. A few of my favorite hikes are:

- "Plains to Plains" hike - This loop hike follows the Truman, Willow Springs, Loowit and other trails and takes you across both the Pumice Plain and the Plains of Abraham in one fell swoop (15 miles). The wildflower displays in July are stupendous, and the elk in September are up-close and personal.
- Norway Pass - Many different hike options radiate from this trail head. No matter which direction you choose, glaciated valleys with lake-filled cirques and mountain goats are on the bill.
- Harmony Falls - Besides winding through bushes thick with berries, this short hike (2 miles round trip) is the only way to access the shores of Spirit Lake...enough said.



Stream crossing on the Pumice Plain

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Mission

Mount St. Helens Institute is a non-profit 501(c)(3) organization that advances understanding and stewardship of the earth through science, education and exploration of volcanic landscapes.

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The *Rumblings* newsletter is produced by the Mount St. Helens Institute. Please submit articles by the 8th of the month to Luke Wakefield - lwakefield@mshinstitute.org

We depend on your contributions.

Species Spotlight!

Mountain Goat (*Oreamnos americanus*) is an icon of alpine and subalpine environments and is a frequent sight near the Mount St. Helens crater and the Mount Margaret Backcountry. This native species' feet have adaptations for climbing steep slopes including traction pads, hooves that spread apart and sharp dewclaws. Mountain Goats are grazers and feed on grasses, herbs, mosses and lichens. They migrate to lower elevations during the winter. Mountain Goats molt in the spring and observant hikers find their soft white hairs stuck to rocks and shrubs.



**2014 MOUNT ST HELENS
MUSIC ON THE MOUNTAIN**
 SUMMER CONCERT SERIES AT JOHNSTON RIDGE OBSERVATORY

6:30 - 8:30pm FREE CONCERT!
 RAIN CANCELS. TO CHECK WEATHER CONDITIONS CALL (360) 449-7804 [FACEBOOK.COM/MUSICONTHEMTN](https://www.facebook.com/MusicOnTheMtn)

JUNE 28TH - SCIENCE! "Science! is riveting acoustic music - a perfectly simple, universal and truthful roots band." WXPN Philadelphia Quyen Shanahan	JULY 26TH - CODY DEEBE AND THE CROOKS "A hybrid of Santana and Alice in Chains." Examiner.com Derek Tobias	AUGUST 30TH - DANIEL KIRKPATRICK AND THE BAYONETS "Tom Petty meets Bruce Springsteen with a little Clapton influence on the guitar." KISM FM 92.9
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THANK YOU TO OUR SPONSORS:

Poetry Corner

The Way to Windy Ridge

By Tim McNulty

*"I'm grateful to the mountain
because it gives me the opportunity to pray."*

- Ursula Le Guin

1.
We follow a high ridge
from Smith Creek headwaters
through crimson paintbrush
and healing stalks of fireweed,
bright and tossing in the summer wind.

The white cymes of *Anaphalis*:
"pearly everlasting"
flit and swirl pollyannish
over this momentary landscape.

The first to come flocking back.

2.
The trail is cut through a blowdown fir,
wide rings of growth at its heart
sprung from an earlier disturbance
—tephra fall or wildfire—
and dense rings of the outer edge
marking centuries of quiet growth.

Then--
one day.

Juncos say, "Same world, Tim."

3.
Below us, Spirit Lake is roofed
with a forest of drift logs.

Continents assemble
and disassemble in wind,
collide and rift apart
as restless as the larger continents

afloat
on that warmer sea
just beneath us.

4.
We skirt a palisade of lava cliffs,
remnant of an earlier flow.

Snags rise like Doric columns.
Loose rocks rumble and clack
to lakeshore;
puffs of ash float back up.

From a shallow ledge on the cliff face,
a delicate columbine blossom
and wind-shook sprays of saxifrage
show us the way:

quiet exuberance
as the ground slips and rises beneath us.

5.
Around a final shoulder of ridge
the sloped expanse of Pumice Plain
(drift of the mountain that stood before)
spreads into uneasy mesas
incised
by shifting streams.

From a distance, the pale scrim of plant life
scrabbles wildly
over the newly born ground,
claiming every niche and corner.

6.
From the mile-wide bowl of the crater,
where dust and ash billow
from collapsing walls,
and an incipient glacier gathers itself,
the blessing of earthwarm water
spills through the blasted breach
to a nascent greening earth
opaque with promise.

7.
We stand at a windy altar.
The volcano is washed in morning light.

Just out of sight,
a new lava dome heaves and falls,
swells at a pace that staggers.

The mountain is a window
open
on the moment of creation.
From its ragged skirts
a fresh and hungry world unfurls.

Sinuous canyons, brushy slopes
and high windy ridges—
where we
for the moment
enter into its story.

The view from here is more powerful,
daunting, yet flush with hope
for this damaged earth

than anyone dared imagine.

This poem was taken from *In The Blast Zone: Catastrophe and Renewal on Mount St. Helens -- Oregon State University Press*.

Tim McNulty is a poet, essayist, and nature writer based on Washington's Olympic Peninsula. He is the author of ten poetry books and eleven books of natural history. Tim has received the Washington State Book Award and the National Outdoor Book award among other honors. View Tim's works at his website:

timmcnultypoet.com/

Mount St. Helens Fun Fact

Blue flames of burning sulfur gas were observed coming out of Mount St. Helens on March 29, 1980 and during the 1831 eruption.

Mount St. Helens Fun Fact

Despite the seemingly harsh environment in the crater, the American Dipper nests and feeds in the swiftly-moving, cold streams of glacial meltwater in the crater of Mount St. Helens.

Mount St. Helens Fun Fact

The May 18, 1980 lateral blast moved at speeds up to 730 miles per hour. At this speed, you could drive from the Pacific Ocean to the eastern border of Washington State in 30 minutes.

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Recollections of YMCA Camp Meehan

By Joe Balden

I was not yet 13 years old when I went to Camp Meehan in the summer of 1955. It was the first time for me camping in the majestic Cascade Mountains. I had been to Boy Scout camp on the Oregon coast and to a church camp in the Columbia River Gorge when I was a year younger, but this was the big adventure. I had a boyhood friend who had been to Camp Meehan with his older brother and he told me about the fun they had as campers. He talked about the beauty of the area, snow-capped Mount St. Helens and the big trees. I brought the idea up with my parents and they thought it would be OK for me to go. I didn't have any siblings so it was probably an easy decision to send me. This was a real coming of age experience for many kids who were away from home for the first time. I went to a two-week session the first year and to 2 consecutive sessions (4 weeks) the second and third years. Parents probably thought the longer the kid was away the better.



Swimming area at Spirit Lake

The camp was run by the southeast Portland YMCA (Y). The camp director was a staffer at that Y. I think his name was Mr. Taylor and one of his sons was a camp counselor. There were about 45 kids going to camp, 12-15 years old. I believe we were all from the greater Portland area. We boarded a charter Greyhound bus in front of the Y with our backpacks stored in the baggage compartment. The bus ride took us to the end of the Toutle River highway near the Spirit Lake Ranger Station where we were met by camp staff. First year campers were loaded into an old bright red steel lifeboat along with our gear for the trip up to the north end of the lake and camp. While waiting to load up, I discovered rocks that float, something that most of us had never seen before. We were told it was pumice from Mount St. Helens. I was amazed at how clear the lake was. I could look down what seemed like 100 feet and see the bottom. There were trees down there that

Mount St. Helens Fun Fact

2500 years ago, the sediment damming Spirit Lake failed, sending lahars with higher flow rate than the Amazon when it's flooding. Today Spirit Lake is drained to prevent this from happening again.

were standing up. Looking back towards the dock I could see Mount St. Helens and it stood out bigger than life. Just like a big white ice-cream cone. I wondered if we would be hiking up there some day. (Wasn't until my third year that I became a part of a climbing group on the mountain).

The older kids hiked to camp, taking the 3-mile trail around the east side of the lake past Donnybrook and Cedar Creek campgrounds and Harmony Falls Lodge. They thought they were really big, tough guys.

The first 2-week session started mid-June when the weather was great in the Willamette Valley but not so good at over 3000 feet in the mountains, as we soon discovered.

The camp had an impressive lodge where we took all of our meals, and had evening sing-alongs when the weather was crummy. We were surprised to see snow on the ground in shady areas, which was most of the camp under towering fir trees. Living quarters for us campers were 3-sided open shelters with 6 bunks, 2 high. Now think about cold nights, rainy days, and it's summer, right? That took some getting used to. The weather improved after a while, so we had evening campfires down by the creek where we learned songs like "Allouette", "John Jacob Jingleheimer Smit", "Green Grow the Rushes Ho", and "Swing Low, Sweet Chariot".

As this was a YMCA organization, there was a chapel service on Sunday on a bluff overlooking Spirit Lake. Taps was played every evening.

I can't recall much about our meals, except that we always had cold cereal or scrambled eggs for breakfast, milk or "kool aid" was served in big metal pitchers, and we all ate together at boarding house style tables. Mealtime was also announcement time where we signed up for various activities and hikes.

After each meal we all pitched into washing the dishes and pots and pans in an assembly line series of troughs outside the hall.

Hikes were the big deal at camp. We started out with day hikes and progressed to overnight, 3-day, and eventually 5-day trips. The 3 and 5-day trips were for the older kids. Parents were sent an equipment list of what the kids needed to bring so we were ready for anything. Our pack was the Trapper Nelson style wood pack board with web shoulder straps and no waist belt. I remember how those straps rubbed into my shoulders. Packs seemed heavy with the load we carried. No freeze-dried food back then—Spam, peaches, chili, Chef Boyardee spaghetti, peanut butter, jelly—all in cans or jars. The light stuff was a loaf of white bread and crackers. Add in the old military style mess kit, a skillet or grill, canteen, sleeping bag, canvas tarp, and clothes. A serious load for a 12 year-old boy.

Continues on page 5

Familiar hikes were overnight to Meta Lake where there was a raft that we could pole out to the middle of the lake, or Grizzly Lake. Day hikes took us to Sweden mine, and Commonwealth mine where there was an old miner's cabin. I remember seeing a 1930's calendar on the wall. One of the old mines in the area was an ice cave. Longer hikes were to the Clearwater Valley and Paradise Falls, St. Helens Lake, and Coldwater Lookout which was usually manned by mid-summer. The Coldwater lookout trail took us past St. Helens Lodge and that was the first time I saw Harry Truman. Old Harry had been up there at his lodge for a long time, even back then, and was well known among the Spirit Lake regulars who often stayed at his lodge and rented his fishing boats. He wasn't too happy to see a group of boys hanging about, looking for a coke, and making too much noise. The hike leader probably told us that Mr. Truman was a grump.

The camp and Spirit Lake lies in a basin, with Camp Meehan at the north end, which means you had to go over one pass or another if you were going any direction other than south. Bear Pass, Norway Pass, and Independence Pass all led to the backcountry. Trails led through the giant trees of old growth forest, as logging hadn't come into the area yet. The quiet of moving through the dark forest was almost eerie. The wind blew through the treetops, causing them to sway like giant sentinels. The trails were steep without a lot of switchbacks. All of us hikers were pretty much valley kids and had little experience in mountainous terrain. The hikes were the most memorable part of the whole camp experience, probably because they were hard at first. Some kids were overweight and really struggled until they figured out how to pace themselves. Rarely did we see bears, but they were out there. There was a garbage dump somewhere near Harmony falls, and I had the opportunity to accompany camp staff a couple of times when we took our garbage over there on the boat. The fun part was to wait around until dark and spotlight the bears as they foraged through the trash.

Swimming wasn't very popular given the cold lake temperature, but if you wanted to go out in a canoe you had to pass a swim test first. A canoe hike was added to the schedule one year. This was a 3-day trip that followed the shoreline all around Spirit Lake, about 10 miles. Wind and rain out of the south made for a tough paddling experience. Waves seemed big and scary as we paddled as hard as we could seemingly making little progress. We used our canoes for shelter from the rain one night. It was not one of my

favorite adventures. I don't know if that trip was ever tried again.

Campfire evenings were always fun. Watching the flames dance in the darkness, the songs, stories, some of which were scary stories about the ghosts of miners or the apes that lived near Ape Cave surely kept some kids awake—especially after having to find their way several hundred yards back to the shelter in pitch-black darkness with a dim flashlight. There

were a few times when we heard the scream of a cougar out there in the darkness. That had some campers' eyes wide open and shaking in their sleeping bags.

Part of the social aspect of camp life was the initiation into the YMCA fold where a kerchief was awarded, known as becoming a "ragger". This always came near the end of the session, and staff and older boys voted in new campers. I know that I didn't get elected in that first year—must have done some bad deed.

There was a parent's day on the Saturday mid-session. Not too many parents made the long drive up to Spirit Lake. Those who did were shuttled across Spirit Lake on the old motor lifeboat. This was a chance to show the folks what the place was like; crafts you

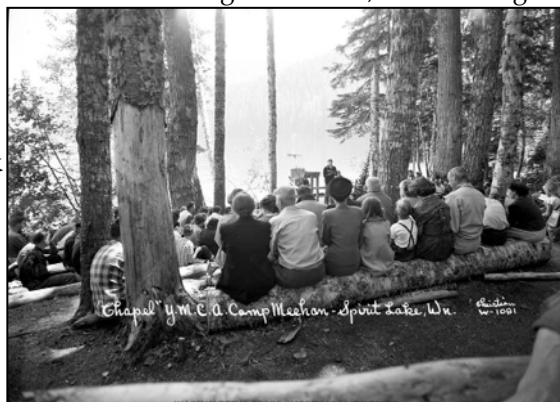
were working on (like belt-making or rope braiding) and we treated the parents to lunch.

The weeks went by in a hurry. Those of us who were staying for another session greeted the new guys as if we were experienced veteran campers. We had the responsibility of taking them around the camp, showing them where all of the facilities were located and answering their many questions. Eventually, the camp was closed down for the winter after all of the campers returned home. Stories were told to family and friends about the adventures we had. Having to pass a swim test in icy Spirit Lake, struggling up the mountain trails, scaring the new kids with ghost stories, and cooking meals over a campfire on overnight hikes. Would we come back again?

You bet!



View from Scout's Camp, 1955



July 19 | Lawetlat'la- Exploring the Cultural Significance of Mount St. Helens with a Hike Above Tree-line

\$50 - \$20 is tax-deductible

Details: Lawetlat'la (the Cowlitz name for Mount St. Helens) was recently designated as a Traditional Cultural Property in the National Register of Historic Places. This field seminar will explore the cultural significance and significant spiritual power of Mount St. Helens by hiking up to that "thin place" at tree-line near Butte Camp on the southwest side of Mount St. Helens with Nathan Reynolds, Ecologist for the Cowlitz Indian Tribe, and Rick McClure, Heritage and Tribal Programs Manager for the Gifford Pinchot National Forest.

Hike Level: Difficult

Requirements: This is a 7-8 mile hike with 1,500 feet of elevation gain. Participants should be able to hike up steep and fairly rough terrain for long distances.



Butte Camp Trail on the south side of Mount St. Helens

July 26-27 | From Old-Growth to Spirit Lake - the Changing Face of the Blast Zone

\$110 - \$70 is tax-deductible

Details: Explore natural history in the blast zone alongside Mount St. Helens, scientist Charlie Crisafulli and MSHI Science Manager, Ray Yurkewycz. This seminar begins Saturday morning at Cedar Flats Natural area with a brief hike through the old-growth forest. We then drive closer to Mount St. Helens, stopping at tephra fall, standing dead, and blowdown disturbance zones from the 1980 eruption. The day ends with spectacular views of Spirit Lake and Mount St. Helens at Windy Ridge field camp for dinner (included) and a campfire. The next morning during a 6 mile hike, learn how life has reestablished and evolved over the last 30+ years in the most highly impacted landscape on Mount St. Helens, the Pumice Plain. Enjoy spectacular wildflower displays and learn what factors determine who lives and dies in one of the Pacific Northwest's most extreme natural environments.

Hike Level: Difficult

Requirements: Sunday includes a 5 mile hike involving a 1,000 foot ascent to Loowit Falls. Participants should be able to hike over rough terrain over long distances.



The spectacular wildflowers you will encounter

Foraging for Edible Mushrooms

October 11 | With Reinhard Böhme and Kate Hobbie

October 18 | With Joe Boldensmith and Ray Yurkewycz

\$50 - \$20 is tax-deductible

Details: Explore the magical kingdom of fungi! Learn how to identify common characteristics of wild edible mushrooms. Then learn how to harvest different types of edible mushrooms and cook them into delicious dishes. Plan to get your shoes and hands dirty as you discover the forest's most striking and sometimes delectable offerings.

Hike Level: Easy

Requirements: Participants should be prepared to walk off-trail on uneven terrain.



Participants enjoying the harvest of wild edible mushrooms

The Awesome Hike

By Amy Tanska

I had only taken 10 steps onto the trail. I could see the halfway point – a tiny patch of blue sky in the middle of what should be a solid basalt ridge – a keyhole arch that I often point out to visitors at Johnston Ridge Observatory. I wondered how many visitors really see it when I point it out to them.

It was late June 2013; my co-worker Grace, a British volunteer named Hannah and I headed out to scout three trails the Mount St. Helens has linked together to create the “Awesome Hike.” We were hopeful that the majority of the route would be clear of snow by now.

The first two miles were dry and easy, although the traverse across a steep slope hundreds of feet above the Pumice Plain as I neared ‘Devil’s Elbow’ could cause someone with a fear of heights to slow their pace a bit. Rounding the ridge, I was thrilled with the day’s first view of Spirit Lake. The logjam was at the other end and the water sparkled in the early morning sun.

We decided not to take the short side trail to hike up Harry’s Ridge, instead we tackled the 1000’ elevation gain over the next 1.5 miles with dedication and vigor before the sun hit its peak. A mile later, we are resting on a switchback on the back of a ridge when we are nearly run over by a young male elk, his eyes wide and snorting foam out his nose. Concerned about the cause of his flight, we scrambled to get moving up and around the ridge and were relieved to see it was ‘only’ a large bull elk standing guard over his harem of nine females.

Moving on, we crossed over the highest point of the ridge and two diverse but equally exciting views stopped me in my tracks: the rock arch looming in front of me and the dazzling blue color of St. Helens



Amy Tanska

Lake. We took plenty of time to enjoy both as we snapped dozens of photographs and then ate our lunch on the rocks situated under the arch.

Invigorated by our caloric intake and the fact that we are halfway through our adventure, we started hiking across the ridge that parallels the crater breach of Mount St. Helens, snapping dozens more images before the trail intersected with the South Coldwater trail and

then the Mt. Margaret backcountry commanded our attention: steep, craggy points of Minnie Peaks that glowed bright silver against the cloudless blue sky as the sun reached its peak. We kept moving at a quick pace; there was no shade on this trail until the last mile.



Amy Tanska

We reached the first of three pieces of rusted logging equipment on Coldwater Ridge: a stark reminder there was once an old growth forest in this exact location where the tallest foliage now are alder shrubs stunted by the continual foraging of elk. Shortly thereafter, we entered a stand of these young trees and enjoyed relief from the sun for the remainder of our hike.

In retrospect, the 11 miles went quickly as the landscape continually offered new views, varying terrain and evidence of the May 1980 eruption. We spent the rest of the day at Johnston Ridge Observatory with a greater understanding of nature’s processes and its resilience in the wake of destruction.



Amy Tanska

Amazing opportunity for your group! Save \$25 on our August 9th Awesome Hike when you register a group of 5 participants or more.

Simply send us an email: climb@mshinstitute.org with the email addresses of your group and we’ll send them the discount code for your group. All participants must be registered by July 31st.

Across

2. The Pacific Northwest _____ is at home in the hummocks ponds! This amphibian is able to change its life cycle in order to survive in these ponds that sometimes dry up.
5. A steam eruption. These occurred frequently in the months preceding the 1980 eruption.
8. A hot, turbulent, type of volcanic flow made of hot gas, ash, and rocks.
9. This furry critter lives underground. This critter was probably surprised by the new landscape it saw after heroically digging itself out of its hole following the 1980 eruption.
11. The device used for measuring earthquakes.
13. Another name for Mount St. Helens, derived from the names given by Native American tribes.
15. Concrete-like mudflows of ash, water, and other debris.
18. This kind of lava formed the 1980 bulge, and is the stickiest of the three kinds of lava at Mount St. Helens.
19. Scotch broom is an _____ species. It is a non-native plant that adversely affects the biodiversity of plant life around Mount St. Helens.
20. Elk munches on plants, which means it is a _____.
21. The chemical element that bacteria on the roots of alder and lupine fix and put into the soil.
23. Lumpy landforms made of the old summit of Mount St. Helens which formed in the 1980 eruption.
24. The name for liquid rock when it's underground.

Down

1. Small bits of volcanic rock the size of flour to about the size of a pencil tip.
3. A symbiotic relationship between a fungus and the roots of a vascular plant.
4. This large mammal tilled the ash-covered ground after the eruption, bringing up buried soil that helped plants return.
6. The type of extremely explosive volcanic eruption that sends a column of ash greater than 11 km into the sky, named for a Roman lawyer that documented the 79 AD Vesuvius eruption.
7. A sideways volcanic eruption. In 1980 it moved up to 730 miles per hour!
10. This kind of nitrogen-fixing tree is especially happy in the wet environment of the hummocks ponds.
12. The building block of lava, this chemical element is also the main ingredient of most glass.
14. The syndrome killing little brown bats in the US.
15. A purple-flowered plant which was the first to be found on the Pumice Plain after the eruption.
16. A light-colored frothy volcanic rock consisting of glass filled with lots of small holes. It can sometimes float on water!
17. The name for liquid rock once it has reached the surface of the Earth.
22. The general name for fragmented materials ejected in a volcanic explosion.

Answers provided on page 12

iMUSH - Imaging Magma Under St. Helens

By Ryan Cole, Geologist - M&GM / Gifford Pinchot National Forest

Mount St. Helens is once again the subject of a large-scale scientific study. A group of scientists from Oregon State University, Rice University, Columbia University, the University of Washington, and the US Geological Survey's Cascade Volcano Observatory (CVO) in Vancouver and Crustal Geophysics and Geochemistry Science Center in Denver were awarded a grant from the National Science Foundation to image magma beneath the volcano. The project, officially named "Imaging Magma Under St. Helens" or iMUSH, will attempt to produce a three-dimensional, high-resolution model of the Earth's subsurface from the subducting Juan de Fuca plate to the top of the crust.

Mount St. Helens was chosen for the project because frequent (in geologic timescales) and recent eruptions ensure the presence of magma; the chemical composition of which allows for a broader understanding of continental crust generation as well as the mantle derived root system (or volcanic plumbing). The project has the potential to allow for a better understanding of the dynamics of magmatic systems and to advance the science of volcanic hazards assessment. The study, scheduled to begin in the summer of 2014 and last until the fall of 2016, has three components: magnetotelluric imaging, passive-source seismic imaging, and active-source seismic imaging, and encompasses federal, state and private lands.



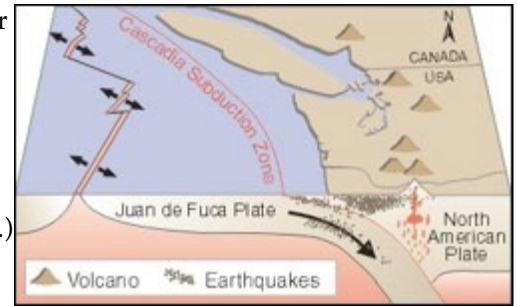
Researchers preparing an MT site.

The first component of the iMUSH project is Magnetotelluric imaging (MT) and will be led by Oregon State University. The MT technique measures natural variations of electrical and magnetic fields at the Earth's surface. It relies on

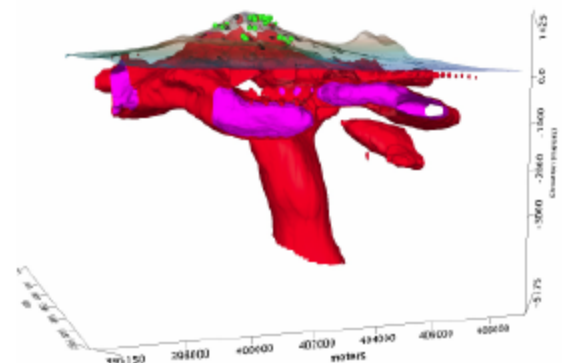
lightning and solar energy to induce electrical currents in materials in the subsurface. Earth materials (rocks, magma, water, etc.) have varying electrical conductivities, and thus impede more or less electrical energy than other

materials. By imaging the resistivity contrasts of materials at depth, scientists can create a three-dimensional subsurface model of material in the subsurface. This portion of the project will be completed over the summer of 2014, researchers from OSU plan to implement a large number of instruments around the mountain, including 86 sites on the Gifford Pinchot National Forest and 2 within the Mount St. Helens National Volcanic Monument.

To collect MT data, scientists hike in equipment and bury one magnetometer and four electrodes, which are connected to a data recorder that is powered by a 12-volt car battery and solar panel. The MT stations remain in place for 1-21 days per location until a sufficient amount of data are collected. After the data have been collected, the instruments are removed and the ground is returned to its pre-disturbed condition.



Cross-sectional view subduction zone created between the Juan de Fuca and North American plates; the intended imaging area of the project. Image courtesy of National Oceanic and Atmospheric Administration (NOAA).



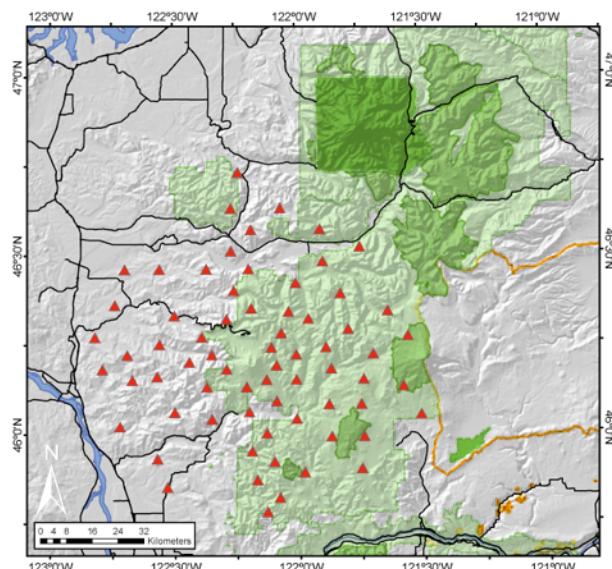
Example of three-dimensional model made from MT data. Image from Quantec Geoscience.

Continues on page 10

The second component of the iMUSH project, led by the University of Washington and the US Geological Survey, is passive-source seismic imaging. Passive-source seismic imaging utilizes an array of seismometers that rely on the low-frequency, natural seismicity in the earth (earthquakes) to reveal information about the Earth's structure. By recording the seismicity at three or more locations, scientists can pinpoint the hypocenter (subsurface origin) of the seismic source. Once the hypocentral location of the source is known, scientists minimize the difference between theoretical and observed travel times between the source and the seismometer that receives the seismic energy. Scientists can then generate a three-dimensional model of wave velocity through the subsurface. Since seismic energy passes through different materials at varying speeds, researchers can then infer subsurface material properties based on the velocity differences (e.g.: hard rock, sediment, magma). Researchers from the University of Washington plan to install 45 seismometers across the volcano, including 32 sites on the Gifford Pinchot National Forest.

To collect the passive-seismic data, researchers hike in equipment and bury the seismometer in a 3-foot deep by 2-foot diameter hole, which is connected to a data recorder that is also powered by a 12-volt car battery and solar panel. The instruments will remain in place through the summer of 2016, and instrument sites will be returned to pre-disturbed condition at the conclusion of the project.

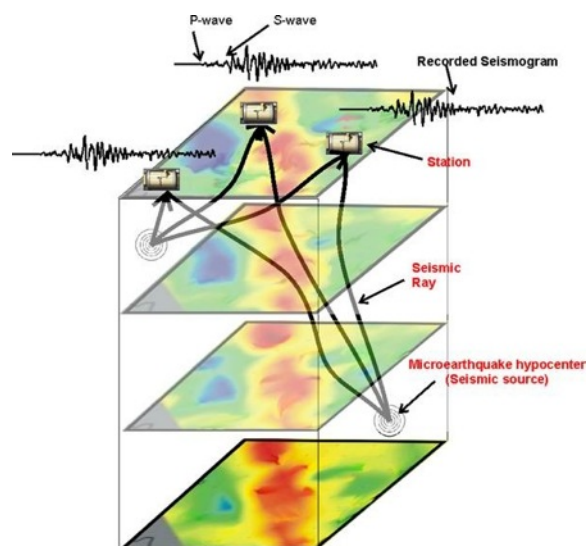
The third and final component of the iMUSH project is active-source seismic imaging, and will be led by Rice University. This technique, somewhat similar to passive-source seismic imaging, also relies on seismic energy to image the subsurface. The seismic energy for this technique, however, is generated in the near-surface of the Earth and is man-made as opposed to natural. Researchers hike in and place numerous small seismometers, called geophones, across the area they wish to image. They then drill shallow holes, and place charges at the bottom of the hole. Once all equipment is in place, the charges are detonated, and the resultant seismic energy is recorded at each geophone. Scientists then measure the difference in arrival time of seismic energy to each geophone. Because seismic energy travels at different speeds through different materials, seismic energy is reflected and refracted along boundaries between different materials (like hard volcanic rock overlain by soil). By back-calculating using the travel time of the seismic waves, researchers can determine the depths to subsurface boundaries. This allows the researchers to develop a three-dimensional model of subsurface structure (folds, faults, and stratigraphy).



Map showing locations of seismometers to be used in the iMUSH project. Image courtesy of the University of Washington.



Equipment used in an iMUSH passive-source seismic station. On the left is the seismometer, data recorder and battery housing in the center and the solar panel on the right. Image courtesy of the University of Washington.



Schematic of a passive-source seismic array and the type of data that can be generated. Image courtesy of www.landtechsa.com

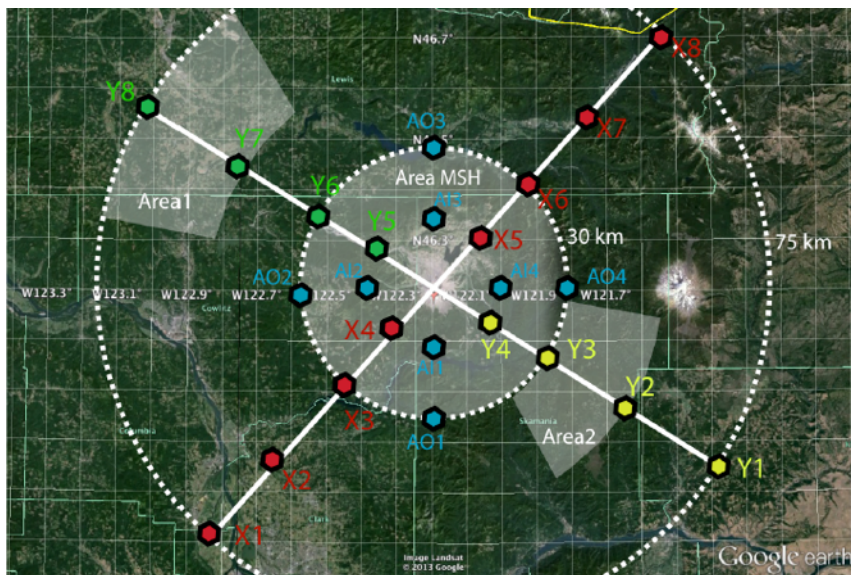
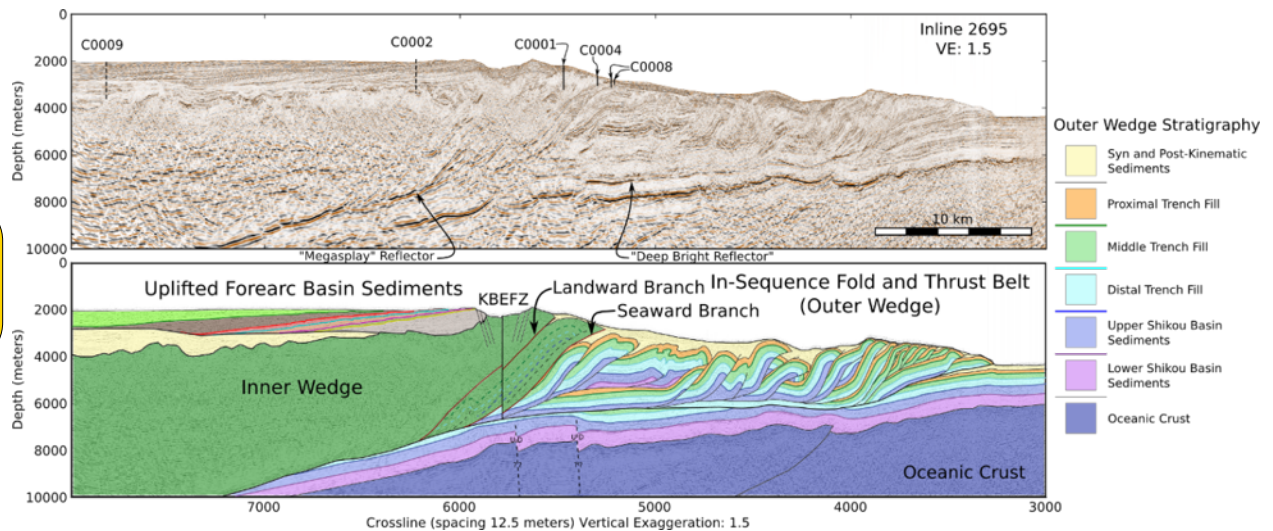
Researchers intend to place an extensive geophone and shothole network in the vicinity of the volcano, including 13 shothole locations on the Gifford Pinchot National Forest. They plan to implement and complete the project in the summer of 2014.

The Gifford Pinchot National Forest has begun the National Environmental Policy Act (NEPA) process and has already issued two special use permits for the majority of the MT and passive-seismic portions of the project. An Environmental Analysis has been completed for the remainder of the project and it is anticipated that a third special use permit will be issued. More information related to the permitting effort can be found on the Gifford Pinchot Schedule of Proposed Actions (SOPA) project page at <http://www.fs.usda.gov/projects/giffordpinchot/landmanagement/projects>.



Geophone that will be used in iMUSH.

Example of active-source seismic data and model that could be derived from the iMUSH project. Image courtesy of www.conference.scipy.org



Deployment plan for the active-source seismic imaging component of iMUSH. Colored points indicate shothole locations and solid white lines and shaded areas indicate geophone placement. Image courtesy of Rice University.

Summer at Windy Ridge continued...

Really, though, there's no better way to experience the northeast side of Mount St. Helens than on a Mount St. Helens Institute trip. You'll get the scenery and hiking while accompanied by walking encyclopedias full of Mount St. Helens knowledge. In a few short weeks, Charlie Crisafulli and I will be leading a weekend-long field seminar (*From Old Growth to Spirit Lake – the Changing Face of the Blast Zone*; July 26th and 27th) that explores all of the disturbance zones of the 1980 eruption and includes multiple hikes. Plus, you get to stay at our camp and yours truly will cook dinner for you!

You can't forget our "Into the Crater" and "Crater View Climb" trips (various dates). These also include a stay at our camp, plus all meals. Finally, our good friends Bob and Katherine Appling will be leading a Volcano Discovery Hike weekend on August 22nd and 23rd out of our camp.

Summer is short in the high country. Before you know it, Labor Day will have passed, the rains will start and chanterelles will be on your mind. Take advantage of the brief but spectacular summer by spending some time at Windy Ridge with us!

Crossword answers from page 8

Across:

2. salamander
5. phreatic
8. pyroclastic
9. pocket gopher
11. seismometer
13. Loowit
15. lahar
18. dacite
19. invasive
20. herbivore
21. nitrogen
23. hummocks
24. magma

Down:

1. ash
3. mycorrhizal
4. elk
6. Plinian
7. lateral blast
10. alder
12. silica
14. White Nose
15. lupine
16. pumice
17. lava
22. tephra

Volcano Outdoor School

Help inspire the next generation of scientists! Volcano Outdoor School focuses on developing inquiry and observation skills, guiding positive communication, promoting leadership skills, encouraging self-development, and initiating team building with science-educator led instruction at the Mount St. Helens Science & Learning Center. Programs include a two-hour interactive field trip, an overnight education experience, and overnight youth summer camp. Lessons are aligned with National Science Standards, and customized program options are available to meet your education goals.



Daniel Highkin