

Rumblings

Luke Wakefield

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Field Notes: Crater Glacier - Past, Present, and Future

By David R. Sherrod and Steve P. Schilling — *U.S. Geological Survey, Cascades Volcano Observatory*

"It's very different from the last time I saw it." That comment would top the list of understatement if describing a before-and-after comparison of Mount St. Helens today relative to May 18, 1980. In the past few years we've heard similar comments many times from those who visit the snout of Crater Glacier, on the floor of the Mount St. Helens crater.

Indeed, the glacier looks different across short spans of time for at least three reasons: (1) it is still advancing and covering a larger part of the crater floor, (2) it has calved into the head of Loowit and Step creeks, and (3) small tributary canyons are being carved deeper as meltwater pours from its face (fig. 1). Discussed here are some of the basic facts about Crater Glacier, why Mount St. Helens can even host a glacier, and a prognosis for the glacier's fate.

Background

Rockfall and snow avalanches began mantling the crater floor following the

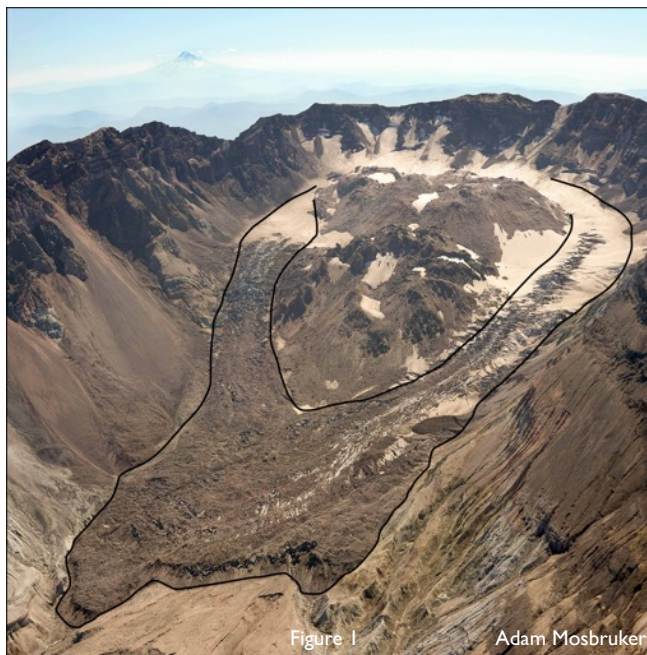


Figure 1

Adam Mosbrucker

Aerial oblique view of Crater Glacier

1980 landslide and eruption. The deposits were rock rich in the first few years, but snow has become the predominant component in the past two decades. By 1988 the frigid accumulation became a permanent snowfield 200–260 ft (60–80 m) thick, as measured by comparing topographic maps.

Permanent snowfields don't move, but glaciers do. The first clear indication of flowage—of a crater glacier—came with the recognition of crevasses in the crater-floor ice, seen on photos of September 1996. The icy mantle had thickened to 660 ft (200 m) by year 2000, comprising one-third rock debris and two-thirds snow and ice, layered repetitively like a frozen andesite parfait (fig. 2 - page 2). The glacier spread into two lobes around the east and west sides of the 1980s lava dome, taking on a horseshoe outline (in map view). The lobes would become known as the east and west arms of the Crater Glacier as they lengthened and advanced downslope.

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Melt or move? In 2004 the volcano erupted anew to build yet another lava dome, this one pinched between the 1980s dome and the south crater wall—the head of the glacier. For the glacier, having hot lava as newest neighbor proved rough in the years 2004–08. But surprisingly, the lava dome shouldered the glacier aside instead of melting it much, shoving ice over ice until the glacial thickness had doubled. Net effect was this: greater potential energy, which translated into faster downslope movement. The glacier’s two arms were on their way to a handshake; they joined on the slope north of the 1980s dome in February 2008.

How fast does the glacier move? GPS receivers on the glacier recorded rates as high as 80–100 inches (2.0–2.5 m) per day in 2005, a time when the spines of the new dome were growing and pressing on the glacier. The other measurement of glacier advance comes from mapping the position of the downslope snout. When at their peak, snout-advance rates ranged from 8 to 24 inches per day in the years 2006–09, when the lava dome was bullying the glacier. That furious advance has slowed to less than 5 inches per day since then (fig. 3).

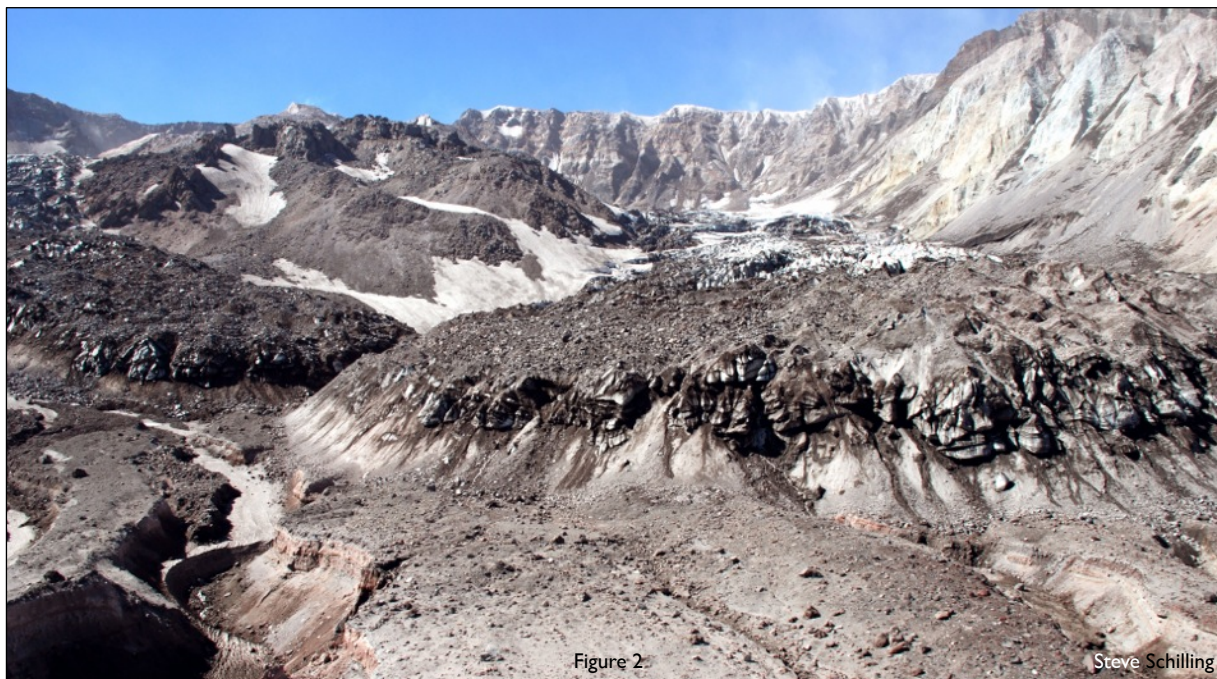
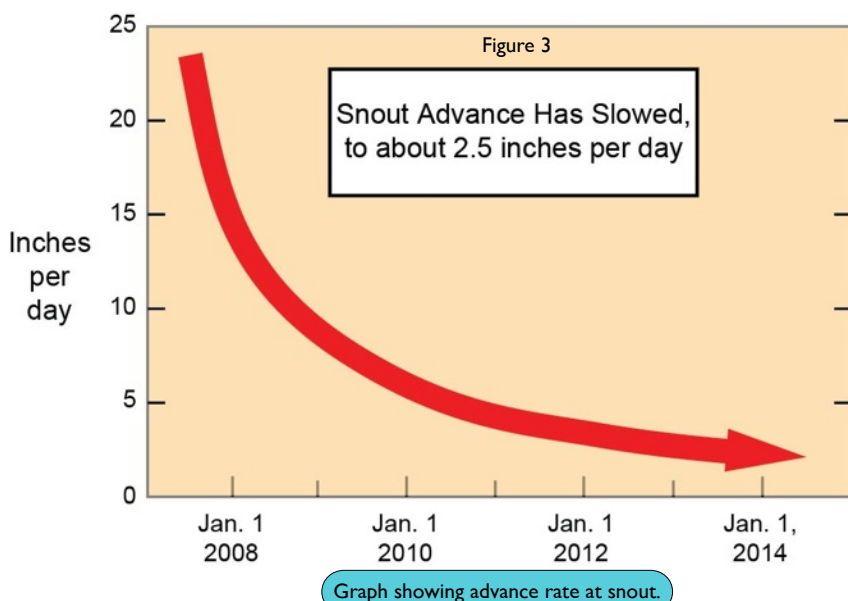


Figure 2: Parfait layering (ice and rock debris) visible in the glacier’s steep snout, July 31, 2008, soon after the east and west arms joined. Steve Schilling

Why a glacier? - Location

Why should a new glacier form at a time when existing glaciers in the Pacific Northwest are wasting away? The answer lies in the exceptional 1980 event that formed a moderately high-altitude, north-facing, steep-walled, high-relief amphitheater—the feature commonly called the Mount St. Helens crater. Avalanching from the crater walls funnels much more snow into a small accumulation area than could be amassed simply by the dumping from snowstorms. The interlayering of rock debris from the crater walls has added to the mass; and the rock, at times, protects the snow from melting. The high crater walls provide shade much of the year. It’s the real-estate trinity: location, location, location.



Fools and Newcomers Predict the Weather

If the past is the key to the future—a hallmark expression from Geology 101 to describe the inexorable workings of the Earth—then the forecast for Crater Glacier is more of the same, for a while. The glacier gains snow each winter by the same process that started its growth in the first place. So we should expect glacial advance rates of inches per day for another few years. In the years from 2010 to 2013 the snout advanced about 4 inches per day, based on yearly measurements (fig. 3 - page 3).

But the path ahead is increasingly rugged, both for the glacier and for fools who predict its progress. Indeed, our May 2014 snout mapping suggests the advance may have slowed by 50 percent, to only 2 inches per day. Whether that slowing is a short-term aberration or marks the beginning of the end remains to be seen.

The glacier took advantage of a steep slope to descend 800 feet from the crater-floor area of lava domes (6,300 ft) to the current position of the glacier's snout (5,500 ft). From there, however, the slope is flatter, perhaps proving too much for the glacier to overcome. If so, then the glacier will reach an equilibrium length, neither gaining nor retreating over the long term. Once that happens, the rock rubble that rolls off the snout will build a wall-like terminal moraine. Also working against the glacier is the loss of shade as it advances

northward beyond the shadowing by crater walls. Increased solar radiation on the northward-moving snout will increase melting there, a contributor to the equilibrium position of the snout.

Cyclic weather variations over tens of years will affect the abundance of snowfall in the glacier's accumulation zone. Successive years of lessened snowfall may halt glacial advance, or even more damaging, lead to retreat by wasting at the snout.

Glacier Fun Fact

Surface area of glaciers in the Olympic Mountains of Washington has decreased 30% over the last 35 years.

boots & bow ties

By Kate Richardson, Office Manager

We invite you and your friends to join us in celebrating over 18 years of education, research and stewardship at the Mount St. Helens Institute (MSHI).

Who: Friends and businesses who share MSHI's enthusiasm for the Pacific Northwest's youngest and most active volcano.

What: At MSHI we like to do things differently, and it starts with your attire for the evening ~ a combination of cocktail attire and outdoor gear! Ideas include: mud boots with dresses, suits with snorkels, gowns with gaiters...still stumped? Consider adding harnesses, helmets, hiking boots, headlamps and running apparel to spice up any outfit. One of the highlights of the evening is the silent and live auction of fantastic local goods and services. Our guests share a passion for outdoor recreation, environmental stewardship, and overall health and well-being, so we are carefully selecting items that will appeal and intrigue.

Where: Hilton Vancouver Washington | 301 W 6th Street

When: Saturday, November 15th, 2014 | 5:30pm – 9:00pm

We will be hosting a Silent Auction and Cocktail hour from 5:30pm to 7:00pm, followed by Dinner and the Event Program. The Live Auction, starting at 7:30pm, will wrap-up the evening.

Why: MSHI serves over 100,000 children and adults annually through our youth education programs, hiking and climbing adventures, and volunteer/stewardship efforts. We need your help to continue to provide programing that continues to enrich people's experiences at Mount St. Helens.

How: Join us! Event tickets are \$75.00 per guest. To register for the event visit: [Registration Page](#)

Donate an auction item! To make an item donation visit: [Item Donation Page](#)

Serve as an event Sponsor! Contact MSHI by calling (360) 449-7883

For More Event Information: Call (360) 449-7883 or email info@mshinstitute.org

Our success is your success

By Tod Thayer, Executive Director

With our summer programs concluding and the holidays approaching, I want to take this opportunity to acknowledge the great work the Mount St. Helens Institute (MSHI) has done in 2014. I am delighted to report that we saw a 246% increase in youth educated in the field, classroom and online! We had 15 children attend our very first Volcano Camp! MSHI experienced a 15% increase in participation in our guided programs. What is equally amazing is the 52% increase in volunteer hours provided by our Mountain Stewards.

As you can see, the volunteers, board and staff have given a significant amount of their efforts to providing exceptional scientific, educational and recreational programming, ensuring a one of a kind experience on Mount St. Helens. We continue to uphold the mission of MSHI, to advance understanding and stewardship of the earth through science, education and exploration of volcanic landscapes. You are a critical and integral piece of our success. Here are several ways you can help in 2015 and beyond.

Get Involved. Become a **Volcano Volunteer** and provide information, direction and enthusiasm at one of three visitor centers. Join **Conservation Corps** and help keep Mount St. Helens safe, clean and enjoyable for all as we take on trail maintenance and repair, invasive species removal and trail structure restoration. Become a **Mountain Steward** and assist visitors along the Mount St. Helens climbing route, support our guided climbs, field seminars and assist on trail reports and

surveys. Sign up to assist our **Office, Special Events and Outreach Events** throughout the year.

Donate. You can also consider a financial gift to the Mount St. Helens Institute. There are many ways to give. Your support makes it possible for us to provide hands on education to students, deliver interpretive talks to visitors, inspire stewardship among outdoor enthusiasts and cultivate a strong sense of community and partnership around Mount St. Helens.



Students work with experts to set up their study plots

Become a Member. Help us advance the understanding and stewardship of the earth with your membership contribution. Become a Sustaining Steward. An easy and effective way for you to support our efforts through secure, automatic monthly payments from your credit card, debit card or bank account.

Sponsor a Program. Is your company looking for a community-based organization to partner with? There are sponsorship opportunities available that highlight your company while allowing the Mount St. Helens Institute to continue offering a large array of programs at no or low cost to those we serve.

Link. Shop. Support. Finally, as you begin your holiday shopping consider SmileAmazon (smile.amazon.com). AmazonSmile is the same Amazon you know. amazon.com donates 0.5% of the price of your eligible AmazonSmile purchases to Mount St. Helens Institute. Please, support us with your online shopping. You can also link your Fred Meyer Rewards card to MSHI and make a donation every time you use it.

Thank you for your continued support. Happy Holidays!

Important Partners in Mission

Mount St. Helens Institute owes its success to ongoing partnership with the following outstanding organizations:

Cowlitz County Economic Development Council - Ecotrust - Chevron - Gifford Pinchot National Forest - Mount St. Helens National Volcanic Monument - Pacificorp - Weyerhaeuser - U.S. Geological Survey Cascade Volcano Observatory - Pacific Northwest Research Station - Discover Your Northwest - City of Longview - City of Kelso - Vancouver Summer Adventures - Washington STEM - Clark County - Skamania County - City of Vancouver - City of Portland - Washington State University - Oregon State University - U.S. Fish and Wildlife Service - Cowlitz Indian Tribe

Fields of Experiences: High school field study at Mount St. Helens

By Abi Groskopf, Science Education Director

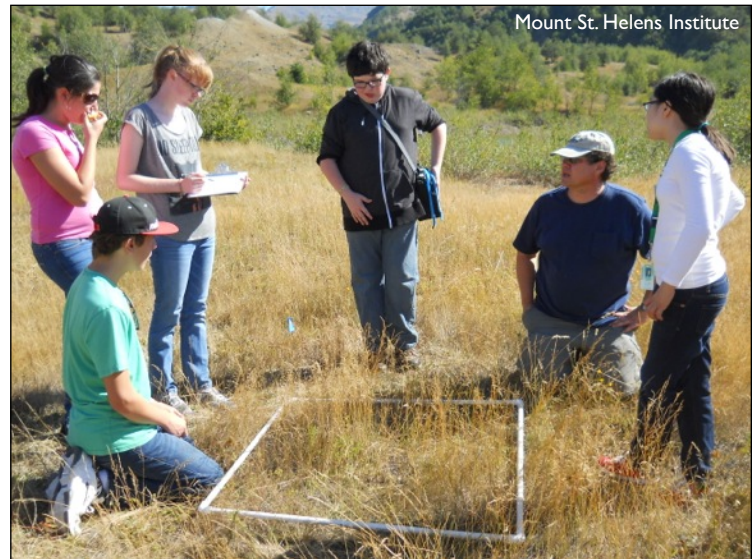
From sweltering September heat and perfect autumn days, to sheets of rain and dozens of rainbows, 175 high school biology students from around the region received an once-in-a-lifetime experience conducting research at Mount St. Helens.

The Mount St. Helens Institute's STEM Field Study program is in its fourth year. Since Ray Yurkewycz and Tom Wolverton developed the STEM Field Study Program four years ago, we've reached 530 number of students and of those, 392 visited the mountain! The central goals of the program are to 1) introduce high school students to the process of a field study and 2) expose students to a wide-variety of career fields that are fundamental to science.

The scientists and professionals we invite come from the US Forest Service, non-profits, universities, the business sector and state agencies. They may not all conduct research on a day-to-day basis, but they rely on research and the inquiry process in their careers. They are landscape architects, media specialist, natural resource managers, outreach and education specialists, graduate students, field technicians, scientific researchers and educators.

The program begins with an introduction to the 1980 eruption of Mount St. Helens and how it dramatically altered the surrounding ecosystems. They then travel to Mount St. Helens for an overnight field trip. The first day is spent becoming familiar with data collection protocols, using the technology (GPS, hypstometers, data loggers) and reflecting on their experience in the heart of the blast zone. The second day, they work in small teams side-by-side professionals to collect data at two different sites - one terrestrial and one aquatic. During this process, they have to be organized, follow directions, and keep track of their data, all the while working in extreme conditions.

It's hard work, but like most hard work, at the end of the day, it feels good to have accomplished so much and to be so tired.



Students work with scientist to systematically estimate plant cover

In one instance, a 10th grade student complained, "I don't want to go back to school tomorrow". After being reminded, "But this is school right now," he replied, "Not really, this is different."

This *is* school but it sure doesn't feel like it!

How is it different? In a classroom students conduct experiments and complete worksheets from text books that are tried and true and ultimately predictable. While students are accountable for learning in a classroom it is largely to themselves and to their teachers and parents.



Students with their research equipment :)

But on Mount St. Helens the variables are dynamic and less controllable, the process is messy, the data is rich and there is a lot of it, the weather is a challenge, the teamwork is fundamental, the guest scientists are the real-thing, the stars or camp fire at night are unbelievable. Students participating in this program are accountable not just to the peers in their school but to all the students and with that comes a sense of community and purpose.

When the students return to the classroom they enter the data in Excel. They develop a good research question. Questions are diverse ranging from the difference in shrub abundance in replanted and naturally regenerated sites to macroinvertebrate abundance at ponds with high canopy cover and low canopy cover. You can imagine that for a teacher this diversity of questions requires individualized teaching. Our amazing set of teachers from CASEE (Battle Ground), Castle Rock, Centralia, iTech Preparatory (Vancouver), Toutle and Wahluke (Mattawa) love the challenge!

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Students then learn to use Excel to sort and filter, summarize and analyze their data. Then they prepare a poster presentation on their own unique question which they will present at a student research conference held at WSU-Vancouver. It is at "the conference when all the pieces come together that there is a tremendous sense of achievement and pride. Many of the students are elated!" says Charlie Crisafulli, Mount St. Helens Research Ecologist with the USFS Pacific Northwest.

The lessons learned are as simple as teamwork and as weighty as choosing a career in ecological research or forestry. One parent at iTech Preparatory who chaperoned the trip said, "In 20 years, my daughter and I will still be talking about this trip. In the future, these students will pass this information onto the next generation and isn't that where the benefits of this trip truly start to show their strong roots?"

Check out The Columbian's great article on the CASEE school's participation in the 2014 MSH Field Study program: <http://www.columbian.com/news/2014/oct/25/living-lab-at-st-helens/>

See the WA STEM's article on the 2012 Field Study here: <http://www.washingtonstem.org/Our-Impact/Stem-in-Action/Mount-St-Helens-Institute#.VFEczPnF-uk>

This program is made possible by a Weyerhaeuser Giving Fund award and the Gifford Pinchot National Forest Mount St. Helens Children's Forest program and from members like you.

Strong partnerships with the Gifford Pinchot National Forest, Mount St. Helens National Volcanic Monument, World Forestry Institute, PNW Research Station, WA Department of Natural Resources, ALS Global, WSU-Vancouver also make this program possible.

Do you want to be involved? [Contact Abi.](#)

2015 Volcano Naturalist Program!

By Amy Tanska, Volunteer Programs Director

We will begin accepting applications for the 2015 Volcano Naturalist Program (VNP) on Monday December 1st. This program will provide in-depth education about Mount St. Helens' ever-changing landscape, her history, ongoing research, and the inclusion of high-quality interpretation skills will aid graduates in telling her intriguing story. The 2015 program consists of 13 classes on Wednesdays, 6:00 – 9:00pm at the Gifford Pinchot National Forest Headquarters in Vancouver, WA from February 11 through May 13, 2015 with one week off in April. The course also includes three weekend field trips - one of which is overnight – at no additional cost. A course fee of \$225 covers all instructional materials and refreshments. For more information, contact Amy Tanska, MSHI Volunteer Programs Director at 360.449.7826, atanska@mshinstitute.org. Details will be available at mshinstitute.org soon.



2014 Volcano Naturalist Graduates

Species Spotlight

Northwestern Salamander (Ambystoma gracile)

The Northwestern Salamander is a large brown salamander that has two different life history strategies. Adults breed in ponds in the early spring. Larvae have large gills and a high tail fin. After approximately one year, larvae metamorphose into adults and leave the water for shelter under the ground.

However, some larvae become adults but do not metamorphose. The debris avalanche on May 18, 1980 and subsequent events resulted in dozens of new ponds, which are perfect for a salamander. But the surrounding environment with little shade and poorly developed soils did not offer adults protection. Northwestern salamanders at Mount St. Helens are often neotenes or aquatic gilled adults. These tough species are also mildly poisonous which helps them survive alongside predators.



Aquatic neotene of a Northwestern Salamander



Adult terrestrial form of Northwestern Salamander

Students far and wide connect with MSHI and scientists through Volcano Explorers

By Ray Yurkewycz, Operations Director

Thousands of students visit Mount St. Helens every year. They spend time at Johnston Ridge Observatory, explore Ape Cave or receive an even more in-depth experience at MSHI's [Volcano Outdoor School](#) at the [Science and Learning Center](#). Mount St. Helens provides one of the most unique opportunities for students to engage in science, nature and culture. But what about those innumerable other students in Washington, Oregon and across the country who will never get the chance to visit the volcano? Volcano Explorers is working to address that need.

The [Volcano Explorers](#) program brings our region's volcanologists directly to students in the classroom through webinar technology. Since 2008, we've worked closely with the U.S. Geological Survey Cascades Volcano Observatory (CVO), Mount St. Helens National Volcanic Monument and Education School District 112 to bring these live and interactive presentations to students across the country. The presentations don't just focus on earth science topics, but also allow students to interact with a scientist and learn about their career path and inspiration. All a class needs is a computer, projector and a decent internet connection. All classes are welcome, but the programs are geared toward 5th – 8th grade classes that study earth history, landforms or geologic processes.

This year's Volcano Explorers series commemorates the anniversary of the 2004 eruption of Mount St. Helens. Cynthia Gardner, research geologist at USGS CVO and the scientist-in-charge during the exciting times of the 2004-2008 eruption, spoke in September about how volcanoes reawaken as well as how the eruptions of Mount St. Helens over the past 34 years have advanced our understanding of volcanoes worldwide. In October, Seth Moran, a seismologist at USGS CVO and veteran of the 2004-2008 eruption, gave a great presentation on how scientists can diagnose volcanic activity. Over 1000 students and teachers have participated in the past two programs alone!

Besides the exciting topics, Volcano Explorers engages

students through interactive components of the presentations. The "Anymeeting" webinar software offers polling capabilities, which allow us to insert multiple choice questions into the presentations. Classes can then discuss the question, answer as a group and then view how other classes answered as well. In the last program, Seth Moran had classes predict the outcome of certain seismic activity, essentially making the students scientists as well. Additionally, there's a question and answer session at the end where classes are able to ask questions using the "Chat" feature in the webinar program. This interaction between

students and scientists draws students in and makes them a part of the presentation too.

While we've offered these programs sporadically in the past, generous funding from Chevron has allowed this program to continue and grow into a regularly offered and sustainable program! As we expand we will highlight biological and cultural Volcano Explorers as well. The next program is on **Friday, November 21 at 11:00am** and features Dan Dzurisin, geologist at USGS CVO. Dan Dzurisin will talk about how and why volcanoes change

shape, and what these changes tell us about what's going on deep inside the earth. Please visit [Our Website](#) to sign up and for more information about Volcano Explorers.



Beaming science education to classrooms everywhere.

Ray's Book Picks

"The River Why" by David James Duncan

Mountains, rivers, trout, crazy parents, bait-fishing vs. fly fishing, a savant brother named Bill Bob, a Portland on the edge of becoming a modern city complete with strip malls and suburbs... this novel is a Northwest fiction classic and one of my favorite all time reads. A fishing theme certainly runs through this book, but much like "A River Runs Through It", fishing is a metaphor for life's up and downs and discoveries. The back and forth between Gus's parents makes me laugh out loud, while his salvation through his yearning for a beautiful fisherwoman pulls at the old, sappy heartstrings. Fall and winter are a good time to get some reading done and this book ought to be on your list.

