The Sharpshooter

Oregon Society of Soil Scientists
Quarterly Newsletter
Winter, 2020

OSSS President's Message

Hello soil enthusiasts! 2019 was a heck of a year for OSSS and hopefully you were a part of it. I'd like to take a moment to recap some of the things we've accomplished since our last Winter Meeting in Lincoln City before we have our 2020 Winter Meeting at Silver Falls State Park and I pass on the metaphorical presidency torch to our current VP, Bruce Moffatt.

Before doing that, I think it is important for you all to know just how much time and energy the OSSS Board has put into keeping this society current and exciting. I have to personally thank the entire board for their commitment to making sure we have member engagement, new opportunities to reach out to the public, and a continued set of events to expand our soil knowledge and networking. More thanks to come at the winter meeting February 28 – March 1st.

After last year's Winter Meeting, where I took the reins as OSSS President, one of my visions for the society was to host a hands-on soil workshop to provide education and training to working professionals. You likely heard about this event, but I'm still proud of the workshop's huge success and

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excellent feedback that was received. For those that missed it, the one-day workshop was held this past spring at the South Slough National Estuarine Research Reserve outside of Coos Bay where we had a morning filled with excellent speakers followed by an afternoon in the field looking at soil. I hope that OSSS is able to continue hosting professional soil workshops like this going forward.

Our other major event of the year was the Chetco Effect: 2019 Summer Tour held along the Southern Oregon Coast. This turned out to be an excellent event in collaboration with the US Forest Service where we were able to visit many different burned area sites and learn about some of the effects these varying intensity fires have on the surrounding soils and habitat. A special thanks goes out to Sarah Hash for coordinating with the local Forest Service folks to provide a fantastic summer tour experience.

There certainly isn't enough room in this Sharpshooter article to mention all we have accomplished and all the praise that is deserved for this past year, so hopefully you will join us at the upcoming Winter Meeting at Silver Falls State Park (see our website for event information and registration). I hope to see you all there. It has been a pleasure serving as the OSSS President this last year and the future looks bright for this organization! Keep thinking SOIL!

Sean Rochette

OSSS President

Editors note

By Vance Almquist

Welcome to 2020 and another edition of the Sharpshooter! We have several important society updates in this issue, not least of which is our winter meeting announcement (Page 4). We have a great meeting lined up which will be taking place at Silver Falls in Silverton. This meeting will feature 5-10 minute lightning talks presented by any and all who wish to provide the society with updates on their work or interesting ideas. Don't forget that we hold elections during the winter meeting and now is a great time to consider running for a position. Students don't forget that we will be having a poster session with a cash prize for best poster!

In addition to the winter meeting, this issue has a brief story about soil water sensors sponsored by Stevens Water monitoring, and update of the summer tour planning, a brief article about soil survey updates in SE Oregon, and information about the newly published Envirothon soil judging manual and an update regarding the activities of Past-president, Shannon Cappellazzi.

Thank you to all who submitted content to this edition of the Sharpshooter! - V.W. A

Featured Recipe

Submitted by A.N.Nymous

Flan Coco

In a large bowl, whisk together:

1 can Sweetened and Condensed Milk ~400g
1 can coconut milk
1 can whole milk
4 eggs
1 tsp vanilla
zest of 1 lime
1tsp cinnamon
1 tsp cardamom (freshly ground)
50g unsweetened grated coconut

Caramel topping :
3/4 cup sugar
1/4 cup water
Gently simmer until a dark brown liquid forms

Instructions: Pour the caramel into a 1.5 qt, deep glass baking dish (~5x4x11). Let the caramel cool for a minute or so then pour the flan mixture in the dish. Next, fill a 9x13 baking dish half full of boiling water. Place two chop sticks in the bottom to isolate the flan from the bottom of the water bath. Bake at 375 deg.f just until an inserted butter knife comes out clean. ~45min. Be sure not to over cook! Allow the flan to cool fully*. Before serving, release the flan from the baking dish by placing it into a bath of very hot water until a thin film of liquid forms at the edge of the flan and the pan. Then carefully invert onto serving platter. * preferably refrigerate overnight before serving


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2020 Winter Meeting

Friday, February 28th through Sunday, March 1st

Silver Falls Conference Center in Sublimity!
(*20022 Silver Falls HWY SE Sublimity, Oregon 97385*)
A Local/Forest Soils Perspective featuring the geology, indigenous, and recreational history of the area

Registration is currently live on the website
(https://www.oregonsoils.org/upcoming-meetings/event-registration/)

Friday February 28th, 2020 – Evening
Check in Starting after 3pm

4:00pm – 5:00pm Public talk at Silver Falls Brewery Ale House 207 Jersey St, Silverton, OR 97381 (19 min drive, open 11:30am – 10:00pm); Happy hour is 2 -5pm
7**:00pm+** meet & greet social in lodge

Saturday February 29th, 2020 – All Day

7:30am – 8:30am *Breakfast in Big Leaf Dining Hall*
8:30am – 8:40am – Welcome and overview in Smith Creek Meeting Hall – Sean Rochette, OSSS President
8:40am – 9:40am – Geologic History of Silver Falls in Smith Creek Meeting Hall **–** Dr. Scott Burns
9:40am -9:50am – *Break*
9:50am – 10:15am – History of Silver Falls Park in Smith Creek Meeting Hall – Silver Falls Staff
10:20am -11:20am – Indigenous Soils and Land Use in Smith Creek Meeting Hall– Dr. David Lewis
11:20am -11:30am – *Break*
11:30am -12:00pm – O horizon/ Forest Soils/ Soil mapping update in Smith Creek Meeting Hall –David Rand/ Cory Owens
12:00pm – 1:00pm- *Lunch in Big Leaf Dining Hall*
1:00pm – 2:00pm – Networking and Research Breakout Sessions *(choose one)*

- Networking group in Smith Creek Meeting Hall
- Yoga for Soil Scientists (and other human beings) in Smith Creek Meeting Hall- Marissa Theve, OSSS Westside Director. Enjoy some movements to relieve and respect low back, shoulder, hip, and knee injuries. Whether you sit at a desk or hike steep slopes and dig pits, this class can offer stretches to feel good. *Signed waiver required.*
- Guided networking hike option

2:00pm – 2:45pm –Poster Session in Smith Creek Meeting Hall
2:45pm – 3:45pm – Member Share: Lightning Talks in Smith Creek Meeting Hall **–** 5-10 min talks from members and friends presenting their work or ideas. Up to 1 slide allowed, though one is not necessary either. Presentations welcome!
4:00pm – 5:30pm – Business meeting in Smith Creek Meeting Hall– Sean Rochette, OSSS President & Bruce Moffat, OSSS Incoming/ Vice President
5:30pm – 6:00pm *Break*
6:00pm – 7:00pm - *Dinner in Big Leaf Dining Hall, cash bar*
7:00pm+ Social gathering in lodge
8:00pm - 9:37pm -*Leaning into the Wind* showing in Smith Creek Meeting Hall

Sunday March 1st, 2020 – Breakfast and Field Trip

7:30am – 8:30am Breakfast in Big Leaf Dining Hall
9:00am – Gather at trailhead – Field Tour until around 1pm (lunch Included)

For directions or information regarding the lodge silver falls lodge, visit :Silver Falls Conference Center website

Registration fees include lodging and meals unless otherwise stated.
Full Registration; Member: $275.00
Partial Registration; Member; **No Lodging** : $175.00
Full Registration; Non-Member: $375.00
Partial Registration; Non-Member; **No Lodging**: $225.00
Full Registration; Student: 100.00

2020 Summer Tour: A preview

By Sarah Hash, Eastside Director

This August, we hope you'll plan to join OSSS and our collaborators from Central Oregon Geoscience Society (COGS) for our 2020 Summer Field Tour in the Newberry Caldera! We're planning two full field days of exploring the landscapes on and around Newberry, the largest volcano by volume in the Cascades arc.

We'll explore the local geologic and geomorphic landscape and investigate soils influenced by, or formed directly from, Newberry's recent volcanic processes. Geologic interpretation will be provided by Dr. Daniele McKay, University of Oregon Geosciences Department instructor, volcanologist, and central Oregon geology expert. Expect additional support from other local COGS members, current and retired U.S. Forest Service geologists, and of course, your local soil scientists! We will see distinctly different soils in four or five different tephra deposits, geomorphic evidence of cataclysmic events, and unique perspectives on some iconic geologic features.

We are tentatively planning for mid-August dates (likely mid-week). Camping at East Lake Campground and some shared meals will be provided. We'll get a message out to our membership with more details and registration information once final dates are set.

We look forward to seeing you all in central Oregon this summer!

- Sarah Hash, Eastside Director

Down to Earth

Soil moisture data is helping enhance meteorological and hydrological models

by Keith Bellingham, Stevens Water Monitoring Systems

The relationship between soil water content and the yield of crops has long been known. But only in recent decades has science quantified the specifics of these relationships. This research has expanded to develop a relationship between soil moisture levels and the impact on meteorological and hydrological models and forecasts.

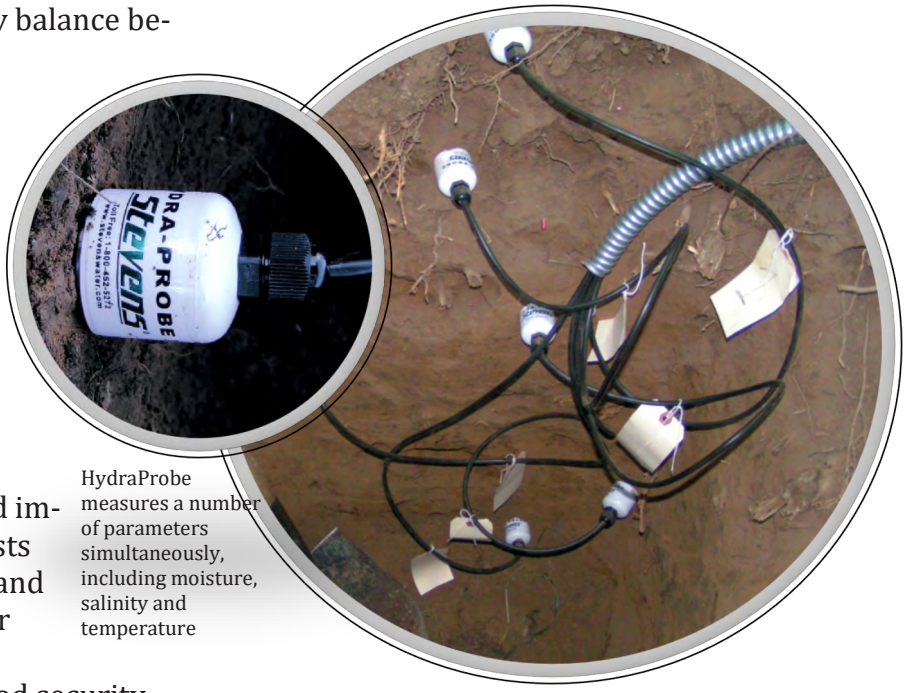
THE RELATIONSHIP EVOLVES

In the late 1970s, the met community became interested in soil moisture after studies were published addressing thermal fluxes between the atmosphere and the ground. The studies suggested that the water content in the soil played a major role in the water/energy balance between Earth's surface and the atmosphere, which has an influence on regional weather.

Water supply forecasts in streams for hydropower generation traditionally used snow water equivalent (SWE) and rainfall for their predictions. In the 1960s, soil moisture under the snow pack was recognized as a potential input parameter for watershed hydrology models, which could improve the water supply forecasts for hydropower management and all the other demands on water resources.

Agriculture management, food security, and the need to better understand drought drove a need for regional soil moisture and vegetation index maps, which led to the development of the remote sensing of soil moisture from satellites in the 1980s. Remote sensing of soil moisture then increased the need for soil sensor monitoring stations to 'ground truth' the data from satellites. This growing interest in the way soil moisture impacts weather, regional and local watershed hydrology, and agriculture, led to development of new analytics, formulas and equations to better quantify these relationships.

The Topp Equation in 1980 quantified an analytical relationship between soil moisture and a measurable parameter characterizing the storage and distribution of the energy in soil using radio frequencies called the dielectric permittivity, in which soil is the dielectric. Soil moisture sensor technologies were then developed using the fundamentals of the Topp Equation and an electromagnet wave propagation through the soil.



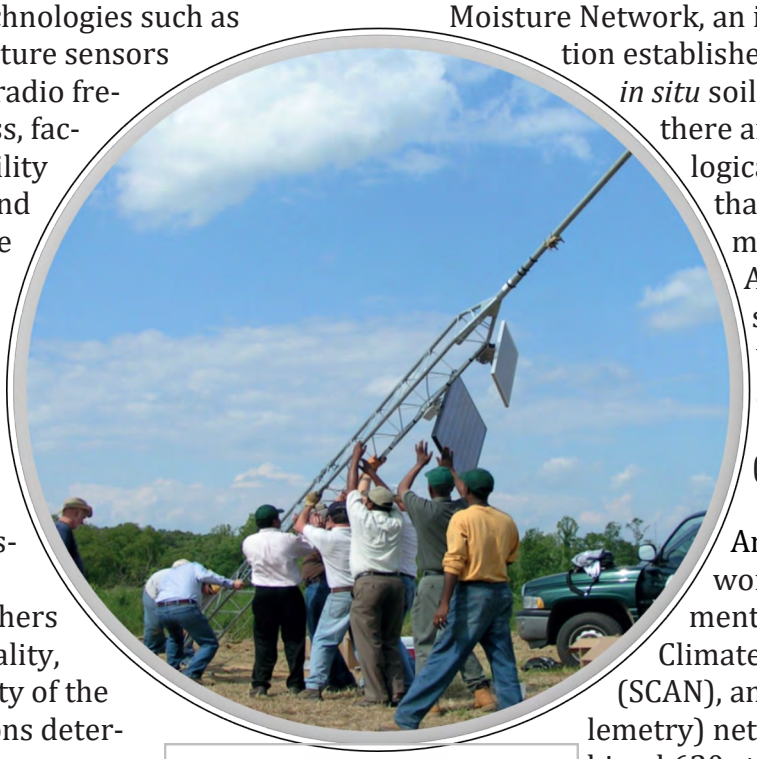
HydraProbe measures a number of parameters simultaneously, including moisture, salinity and temperature

THE TECHNOLOGY

Such sensor technology includes time domain reflectometry (TDR), which sends an electromagnetic wave down two parallel guides and measures the time the energy reflects back from the end of the wave guide. Time domain transmission (TDT) sensors measure the time the elec-

trometric wave travels around a wave guide. Frequency domain reflectometry (FDR) sensors derive soil moisture from changes in an electromagnet wave's frequency after a reflection of the signal through soil. However, these sensors make certain assumptions in determining the dielectric permittivity that could wrongly influence the measurements.

Dielectric permittivity is a complex number containing both energy storage and energy loss terms. Because technologies such as TDR and FDR soil moisture sensors make assumptions on radio frequency (RF) energy loss, factors such as the variability of soil morphologies, and changes in temperature and salinity, introduce instability in the determination of soil water content. Since soil conditions and soil types vary from region to region, the expanding interest of soil moisture monitoring on a large scale had researchers concerned over the quality, consistency and stability of the soil moisture estimations determined by a dielectric measurement. Large regional and continental scale soil moisture networks require a suite of sensors including soil moisture sensors that have a high level of consistency, accuracy and long-term stability. The quality of the sensors is important in providing the high level of confidence in the data sets required by the end users.



Raising a meteorological tower for a remote soil monitoring station

Responding to the need for a consistent, accurate and uniformly comparable soil sensor, physicists at Dartmouth College, New Hampshire, developed technology to fully characterize the dielectric spectrum from a single frequency based on a series of reflected RF signals. This research brought major improvements in the stability of soil moisture measurements by eliminating many of the measurement errors associated with soil morphology and salinity. The HydraProbe soil sensor (a complex coaxial impedance soil sensor) evolved out of this research.

THE RISE OF NETWORKS

Over the past 10 years, new soil moisture networks have emerged and soil moisture sensors have been added to existing weather station networks. According to the International Soil Moisture Network, an international cooperation established to maintain a global *in situ* soil moisture database, there are 50 to 100 meteorological networks with more than five soil moisture monitoring stations. About 60% of the soil sensors in these networks are HydraProbe soil sensors at various depths down to 1m (3.3ft).

Among the largest networks is the US Department of Agriculture's Soil Climate Analysis Network (SCAN), and SNOTEL (snow telemetry) networks, with a combined 620 stations that account for 3,000 soil sensors installed throughout the country. Another large network in the USA is NOAA's Climate Reference Network (CRN), which maintains 125 sites with 600+ soil sensors.
Mesonets and other expanding international soil monitoring networks have deployed around 6,400 soil sensors in more than 1,800 stations globally. The majority of these stations include the HydraProbe because of its research-quality features, which include a more complete characterization of the dielectric permittivity that helps eliminate uncertainties associated with soil types, soil morphology and salinity.

Cont'd on next page.

The interest in soil moisture and its impact on weather, hydrology and agriculture continues to grow, and is driving growth in the soil sensor market. According to MarketsAndMarkets' independent research, the combined global market size for soil sensors in 2016 was US$99.3m, and this is expected to rise to US$288.3m by the end of 2025. While agriculture is the main application for soil sensors, particularly economy qualitative sensors that track relative changes in soil moisture conditions, there is a demand for more quantitative soil moisture data enabling water mass balance calculations for satellite active passive remote sensing outputs.

THE USE OF SATELLITES

While there are about a dozen satellites in space collecting soil data, the Soil Moisture Active Passive (SMAP) satellite is one of the most important. SMAP is a low Earth orbiting satellite launched by NASA in 2013 that has a revisit time of 1-2 days and uses a microwave L-band providing soil moisture data with a resolution of 10-40km (6-25 miles). Typically measurement depths are 2-6cm (0.8-2.4in). The SMAP Mission offers considerable data critical for many studies and international scientific collaborations benefitting society. SMAP observation of soil moisture from outer space allows for improved estimates of water energy and carbon transfer between the land and the atmosphere. The better accuracy of these models from SMAP improves weather predictions, as well as flood, draught and climate assessments.

Soil moisture data collected by large satellite and ground-based networks such as SMAP, SCAN and CRN is critical to the development and functionality of enhanced meteorological and hydrological models and forecasts. Research-grade quality sensors that are accurate, consistent and durable with long-term stability continue to advance in performance, providing experts with a high level of confidence in data sets. In addition to hundreds of smaller studies conducted by universities and research institutions worldwide, the HydraProbe soil sensor has largely been chosen for most climate reference networks in North America.

Envirothon Manual Published

By Marissa Theve, Westside Director

For the first time, Oregon Envirothon will have its own dedicated soil manual for participants to study from. Previously, the program relied on Oregon State University's Manual for Judging Soil. While it is still a great reference, the soil judging manual is 200 pages long, contains outdated terms like 'mottles' (replaced with redoximorphic features) and 'permeability' (replaced with K_{sat}), and is just plain too technical for 13 to 18 year olds. The new manual is around 30 pages including images and references and will be hosted on the Envirothon website: https://www.oregonenvirothon.org/

Authors Marissa Theve (BLM) and Garrett Duyck (NRCS) are excited to have something specifically tailored to high schoolers. Special thanks to reviewers from around the state: Amy Meredith (BLM), Taylor Cullum-Muyres (NRCS), Pam Keller, Mark Keller (retired BLM and NRCS), Sarah Hash (Forest Service), and Emily Parent (Salem-Keiser School District).

As always, the Envirothon team is looking for volunteers to help the May 1st exam at Oregon Gardens run smoothly. Please email mtheve@blm.gov for more information.

Ever Expanding Networks

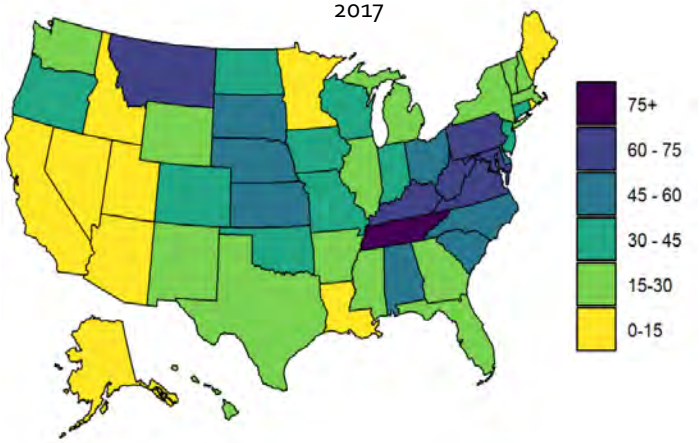
By Shannon Cappellazzi, Soil Health Institute

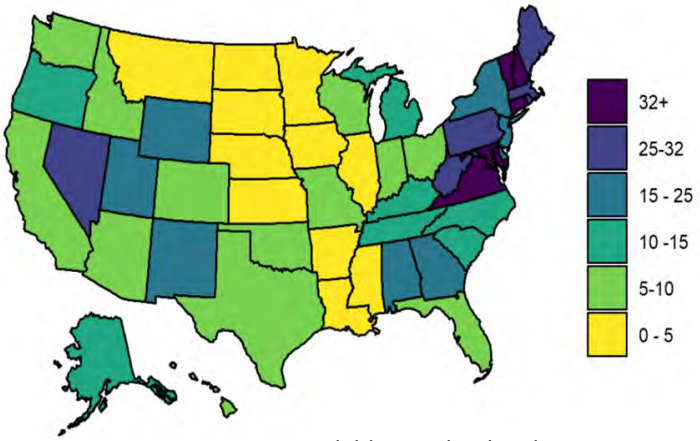
Hey Oregon Soil Scientists. First, I want to say that I miss you all. I have missed too many meetings and I look forward to catching up at the 2020 Winter Meeting at Silver Falls. The new job with the Soil Health Institute (SHI) has kept me on the road. After a solid three months living out of my truck and camper (the new gold standard for sampling habitation), I finished my spring sampling campaign and got right to work disseminating information.

I was invited to talk about soil health at the WSU Lind dryland field day where I had the opportunity to be on a podcast called "Wheat all about it." (check out episode 133 if you have a chance). Then I was invited to go to the American Society of Agronomy's Sustainability meeting to discuss the current state of soil health. I shared data from the US Ag census (SHI report linked here) indicating that the number of acres in cover crops has gone up by 50% in the last 5 years and the total reported "no-till" acres has now reach 37% of arable acres. We are making progress in changing the way farmers manage their land!

At the Soil Health Institute's 4th Annual meeting, I was given the opportunity to give a PEDTalk, it's like a TEDTalk but all about soil! It was produced with the Conservation Technology Information Center along with NRCS, SWCS, SHI, and Soil Health Partnership. They now have a whole YouTube channel dedicated to this series of talks. I encourage folks to check it out, if for no other reason than to hear me talk about snot in front of all my soil science idols.

US Ag Census: Percent Available Cropland with "No-Till" in 2017





US Ag Census: Percent Available Cropland with Cover Crops in 2017

This fall I also presented at the Pacific Northwest National Laboratories EMSL meeting, at SSSA, and at American Geophysical Union (29,000 people!). It was my first time at AGU and the first time AGU has had a Soil Health session, organized by our very own Markus Kleber, Claire Phillips. It was well received and after the talks we were able to have a good OSSS-style beverage-induced soil science nerd-out night on the town among an international consortium of soil health enthusiast. It was the highlight of the whole meeting for me.

It has been a busy year, and the opportunities I

have had to share the information, meet my heros, and learn from so many along the way has pushed me to want more data and more discussions. Our SHI team is now starting to get the data back from our 2025 samples collected from across North America in spring 2019 and our team feels like kids at Christmas with each new data dump. I hope the next time I see you to be able to share more about the soil health interpretation framework that our team is putting together. To quantify how well a tested soil is performing specific functions, we are building a framework that incorporates the interactions between the intrinsic characteristics of the soil developed in place with the dynamic characteristics measured using each of the currently available soil health assessments. We hope that our unique dataset will help folks to make soil health assessments a useful management decision tool.

Look forward to more chats soon.

Shannon Cappellazzi

Soil Science Stories in Southeastern Oregon

By: Vance Almquist

Under clear blue skies lying beneath the sagebrush and greasewood, there are soils waiting yield their secrets to those determined enough to seek them out.

BLM soil scientist Meghan Krueger in pursuit of a soil profile among the alluvial flats and bajadas of Mcdermit.

While most of us won't experience the unfolding drama firsthand, with the aid of online platforms such as ESRI's StoryMaps, we can at least vicariously participate in the experience of the discoveries told by the discoverers themselves.

I recently encountered one such story written by Meghan Krueger, a BLM soil scientist working on an initial soil survey of the southern half of Oregon's Malheur county. The brief story, *Digging into soils with high pH*, focuses on Krueger's pursuit of the unknown, which in this case is the correct classification and genesis of an enigmatic soil. Her quest is set against the backdrop of historic and recent volcanism, basin and range extension, and the genesis of arid land soils all deftly told alongside pictures, maps, diagrams of saline and sodic soils, and even soil description sheets! This glimpse into Meghan's world will remind many among us of their days working for soil survey. For others, it provides a great synopsis of just what it takes to get a soil series established and you can sense the satisfaction that comes with getting to know a new soil.

The profile along with its tentative classification. Photo by Meghan Krueger

For those of you who have never experienced a StoryMap, take a minute to read Meghan's story in it's entirety, who knows, perhaps you will find that you want to create one of your own.

The complete telling of the events described in this article, and in the author's own words can be found @:

https://www.arcgis.com/apps/Cascade/index.html?appid=8343ec1061e748d5bcb9d29f363a42a2

The Sharpshooter is the official quarterly newsletter distributed to the members of the Oregon Society of Soil Scientists. Send address changes or inquiries about membership to:

pres.osss@gmail.com or

OSSS | P.O. Box 391 | Corvallis, OR 97339

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Whole page—$50, 1/2 page—$25, 1/4/ page—$15, or 1/6 page—$10.

Provide a jpg file copy to the Sharpshooter editor by the deadline (first of the month—January, March, June, and November).

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Membership Rates:

$50.00	Regular Member
$30.00	Student Member
$500.00	Lifetime Member

OSSS Webpage: **www.oregonsoils.org**

Please feel free to submit an article. We welcome input from soil scientists near and far.

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