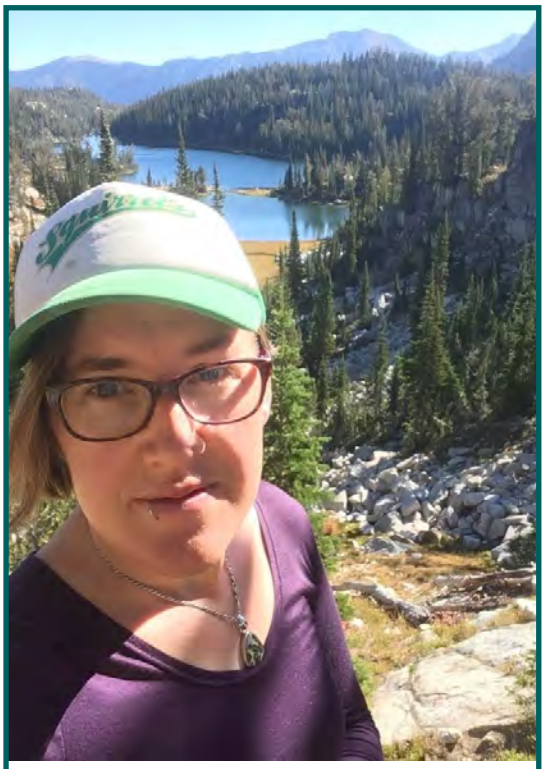
The Sharpshooter

Oregon Society of Soil Scientists Quarterly Newsletter Spring, 2022

Greetings to Oregon's most dedicated soil enthusiasts!

Wow! If you had told me five years ago that we would successfully hold a hybrid meeting during a surge in a global viral pandemic, I'm not sure I would believe you. Over the past several years we have had to find new ways to adapt to this ever changing situation, and I for one am proud of the things it has pushed our society to do. Last year's virtual meeting went over better than I could have imagined, and this year our annual meeting included some attendees and speakers who were virtual and lots of us gathered in person. We got to catch up over free beers (thanks Worthy!) and explore the soils that make central Oregon such a challenging place to farm. Thank you to all of you that made that a successful meeting, and if any of our members are interested in getting access to the recorded presentations and/or annual member meeting, please let me know.



Alicia Leytem during the optional backpacking trip that followed the 2018 OSSS Summer Tour to Wallowa Lake.

In case we haven't officially met, let me introduce myself. My name is Alicia Leytem, and I am about 2 months into my presidential term for this fine society. I have been involved with OSSS for about 12 years now, and have held several positions on the board including student liaison, secretary, and most recently Vice President. I think of myself as a dedicated soil enthusiast, although I do have a masters degree in Soil Science from OSU. Through my studies and experience I could describe myself as a botanist, a mycologist, a soil biologist, a pesticide expert, an amateur farmer, and an educator.

Currently I spend 9 months of the year as an instructor at OSU teaching

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an introductory environmental science and sustainability lab class to non-science majors. (Of course we spend one of the 9 labs talking entirely about soil!) The other 3 months of the year I spend catching up with all of the things I pushed off while teaching: house projects, my garden, friends, family, and traveling. Since becoming an instructor, the two summers I've had off have been during covid. I'm really hoping that this summer ends up being more "normal" so my daughters (ages 6 & 9) and I can fully take advantage of this time together to explore.

Speaking of summer - I hope you all have saved the date for our upcoming summer tour to Newberry Crater! Due to covid, this tour has been in the planning phase for a couple years now. We're really hopeful that we'll finally be able to gather again for a soil based summer adventure. The bulk of the action will be on September 8 & 9th, but we will have camping available September 7-10th.

Lastly, I want to encourage any of you to reach out to me or the other board members whenever you have questions about what we've been doing, ideas about what the society could do, or if you just want to get more involved. It is only through the dedicated actions of volunteers that we are able to sustain our mission: to facilitate communication, foster professionalism, encourage cooperation and fellowship, promote public appreciation of the profession, advance the field of soil science, stimulate scientific research and publication, and support high standards of education in soil science.

Thank you for reading, and I'm excited to see what we can achieve together this year!

-Alicia Leytem *(OSSS President)*

Save the Date

The Oregon Society of Soil Scientists will be hosting this year's summer field tour at Newberry Caldera!

Come join us for two full days (**September 8 and 9**) of field stops that include soil pit viewing opportunities and gain understanding of the Newberry Caldera's unique volcanic landscape. The tour will be based out of the **Hot Springs Administrative Campground** within the Deschutes National Forest. The campground accommodations include primitive tent or trailer camp sites, access to running water and rustic toilets (sorry, *no RV hookups, picnic table or fire rings are provided*). **Camping accommodations and dinner on the evening of September 7th is included with your registration fee.** For this event, the campground has been reserved through Sunday, September 11th. If you want to extend your stay, you are more than welcome to stay the entire weekend to continue exploring this fascinating location.

If you prefer hotel accommodations, make your own reservation at the suggested locations:

Best Western Newberry Station - ReservationDesk.com La Pine, Oregon is about a 25-30 minute drive to the Hot Springs Campground.

East Lake Resort:
RESERVATIONS | eastlakeresort. Cabins and RV sites with full hook-ups are available.

MAKE YOUR ARRANGEMENTS EARLY--central Oregon is a busy tourist destination and available rooms/RV spots go quickly. Also, we **highly recommend** arriving the evening of **September 7** – to entice you dinner is on us! We will start bright and early on September 8 and need to carefully arrange carpools/vanpools to minimize vehicles at some tight stops. Stay tuned for additional information that will be published on OSSS website and the Summer Sharpshooter issue.

A Worthy Winter Meeting of OSSS in Bend

This past Winter meeting was held in Bend, OR at Worthy Brewing from February 24th to the 26th. Attendance was objectively good and the meeting room was almost completely full. It was great to see faces that we have only seen on a screen for the past 2 years. I think it goes without saying that everyone was ready to put COVID restrictions behind them and look forward to a return to normal life. Thanks to our great (now former) President, Marissa Theve for making it all happen. We also thank our newly elected President, Alicia Leytem for taking up the mantle.

During the course of the meeting, OSSS hosted a variety of speakers including Alexis Biddle with 1,000 Friends of Oregon, John Meidema with Bio-Logical Carbon LLC, Peter S. Nico with Lawrence Berkeley National Laboratory, Andy Gallaher with Red Hills Soils and OSU Faculty Research Assistant and PhD student, Michale Fechir. The presentations covered a variety of topics, but John Meidema's presentation on the nature, properties, and production methods of bio-char stole the show (in my humble opinion). I'm always taken by presentations that contain already-established real world data and are readily applicable.

Also included in our Winter meeting was a screening of the film "Kiss the Ground" and the much anticipated field tour. Attendees visited 2 sites in the Central Oregon area, each with their own set of 2 test holes. The first, Fields Farm, is located only a few minutes from Worthy Brewing. Fields Farm has a history of organic farming and the soil amendment practices there are evident in the comparison between the two test holes dug in the native soil, and their active field. Jim has been able to create soils with greater water holding capacity, richer organic matter content, and more productivity with his soil amendments. Five Kingdoms Farm was the second destination and provided attendees the opportunity to observe soil conditions in 2 separate no-till fields; one with, and one without grazing. Jeremy Allen, owner of the farm, has a goal of promoting a more natural condition in his fields, while also restoring and potentially expanding the soil microbial community therein.

A special thank you to all current and new board members. We would like to welcome Todd Reinwald, our new Westside Director, and Website Manager Victoria Moreno, as well as our new Student Liaisons, Christian Lessey and Shijie Zhang.

-Kevin Hesson *(OSSS Eastside Director)*

After a long couple of years, the Oregon Society of Soil Scientists reunited for the annual winter meeting in Bend, Oregon. President (now Past President) Marissa Theve organized a fantastic meeting hosted by Bend's Worthy Brewing Company which was kicked off with a public lecture on Thursday evening by the one and only James Cassidy. James' expansive lecture deftly wove together philosophic insights and basic soil science in the noble pursuit of imbuing a profound appreciation of soils among the rapt attendees.

A rapt audience intently listening to a classic Cassidian exhortation.

The following day is when the meeting began in earnest. Our first presenter, Alexis Biddle from 1000 Friends of Oregon, presented an interesting overview of Oregon's land use system and how

its explicitly designed to protect our farmland from city encroachment. I found it particularly interesting to learn that Oregon's system is somewhat unique, with only a couple of other such codified systems having been established elsewhere in the world, and no others in the US of A. It's all the more impressive that our system of land conservation was began by the farmers themselves because they saw how their way of life and our fertile soils would disappear without regulation.

Following Alexis' presentation, we then heard from local entrepreneur John Miedema of Bio-Logical Carbon LLC about his vision of a biochar-based solution to carbon sequestration and energy generation. His presentation covered a lot of ground and focused on building a case for a decentralized system of energy co-production based on the capture of waste heat generated during biochar production, with the char being used in a variety of contexts. He presented the results several studies he has conducted evaluating the efficacy biochar the removal of contaminants from waterways, such as the removal of phosphorus and nitrogen from waters entering Klamath Lake.

The last talk before lunch was presented by Peter Nico of Lawrence Berkeley National Laboratory wherein, he articulated the potential for mineral weathering in soils as a means of carbon sequestration. The fundamental idea underlying the concept is that when carbonic acid, which is generated in soils due to respiration, reacts with silicate minerals, the result is a net reduction in CO2 due to the formation of reactant products. With that as their basis, Dr. Nico and colleagues developed a complex model to estimate the rates of CO2 capture in agricultural fields through the addition of highly weatherable minerals such as olivine. This research was interesting in part because it highlighted how there is no silver bullet solution to carbon capture and sequestration (except curbing emissions….) but it also presents a well-constrained prediction of mineral weathering rates which can now be tested!

An hour of heady talk around the lunchroom was followed by a tour of Worthy Brewing's new on-site farm/greenhouse operation and how it fits into their business model and worldview. We discussed their man-made soil which had to be brought in to augment what little soil they had (most likely belonging to the Gosney Series, a Lithic Torripsamment) and then they gave us the run of the place. There were soil scientists poking, prodding, and pontificating for the better part of an hour that brisk but sunny day.

Attendees touring Worthy Brewing's new onsite farmlet and greenhouse operation.

The final presentation of the day was a joint presentation by Andy Gallagher and Michael Fechir in which they discussed the elements of hop terroir! Andy began the talk with a crash course in hops, their use in beer, and the chemical pathways of terroir expression. Dr. Féchir then took the helm and began presenting some impressive findings from a comparative study that was conducted in Oregon and Washington looking at hop terroir. However, the presentation was not to be. I can only describe what transpired as an audio-visual disaster of unknown origin. Impressively, he persevered (though I am sure he was not at all happy about it) and managed to describe the findings and the implications of a detailed chemical and sensory analysis of two hop varieties grown on two different soils. I thought the most striking sentence of their presentation was that the effect of terroir on hop differences was sufficiently strong to be equivalent to differences among variety. So basically, comparing cascade hops grown in Oregon versus those in Washington is like comparing Cascade to

Centennial. Despite the painful presentation, we were in it together with Mr. Féchir and were impressed by his perseverance and appreciated his contribution to the meeting!

Following the scientific presentations we took a brief break and then began the membership meeting. Marissa provided a retrospective of the Board's activities in 2021 which was then followed by a membership update led by Shannon. The esteemed Pam Keller then provided the annual treasury update (we are in great financial shape) and the annual expense report of the organization. Janessa then gave an update/report on the OSSS scholarship committee. Board elections were then held during which time I (Vance Almquist) was elected as incoming Vice President, Todd Reinwald was elected to fill the position of Westside Director, Victoria Moreno was elected as incoming Website Manager and Shijie (Eric) Zhang was elected as incoming Student Liaison! We then held an open discussion during which we discussed several topics, notably the recent changes to Oregon State University's Soil Science program following a wave of retirements and the unexpected passing of Dr. Dave Myrold. Much support and enthusiasm for the program was expressed, and some very healthy critiques as well.

Winners of the Poster competition (Graduate students Pedro Martinez and Esther Kim and the undergraduate winner Otillia Schreuder) basking in the limelight.

The membership meeting concluded with a tribute to John Good and the outpouring of fond memories held by many among us. He is dearly missed. We then took a break for dinner and then began the poster session. There were many excellent posters and a lot of great research conveyed therein. The evening was capped off with a congratulatory recognition of this year's scholarship recipients (Fabian Curiel-Garcia and Hunter Calvert) and the winners of the poster competition (First place Pedro Martinez, second place Esther Kim); congratulations to you all!

-Vance Almquist *(OSSS Vice President)*

Whoopee, we are back live!

Thursday evening, James Cassidy our record-breaking 3-term OSSS president started things out with his rousing talk about all things Soil! What is the answer he asked?? "ADD MORE ORGANIC MATTER"! The students were a lively bunch and didn't realize there would be test questions throughout the session. What is the answer? "ADD MORE ORGANIC MATTER"! Our meeting was held at Worthy Brewing in Bend. They have a dedicated room for pub talks called the Hop Mahal with excellent sound and a big screen to help us old folks for viewing, and the beer was good!

Friday morning, our yoga master (now past OSSS President) Marissa Theve kicked things off with the lecture series. In the background, Alicia Leytem (current OSSS President) worked her magic getting things set up for online viewing for the folks not able to attend in person. She is a whiz at zoom technology and kept things running smoothly. Thanks, Alicia!

After a hearty lunch buffet catered by Worthey, we got a tour through Worthy Gardens' new hoop house farm. They are using high-tech off-grid solar technology to control temperature and extend the growing season for producing vegetables and produce for their restaurant. We also learned that central Oregon is one of the toughest places to grow a garden as the growing season is less than 3 months. Add on the extremes of heat, frost, drought, wind, hail, insect and animal pests all of which help to make successful growing difficult. For our afternoon session, Andy Gallagher and Michael Fechir talked about Hop Terroir in

the Willamette Valley, Oregon, and Yakima Valley, Washington. They are trying to develop Terroir with hops for beer as they have grapes for wine. They are finding that the same variety of hops develops different taste characteristics when grown in different climate and soil regimes.

Memorial recollections were held for John Good who recently passed away. John was a long-time OSSS member, past president, secretary, treasurer, and wonderful supporter of our organization. He was always fun to have on our summer tours and winter meetings. He was a big advocate of soil health which he incorporated into his tree business and was a wealth of information on many topics including bats and their importance in our environment. He will be sorely missed. After the business meeting, a poster session was set up for viewing current student projects and research, and the beer was good.

After dinner, we had a viewing of the film "Kiss the Ground" which showed the importance of regenerative practices that nourish the soil and protect ecosystems. Also, Worthey's hopservatory was opened for viewing close-ups of Orion's belt stars through their high-tech telescope, and, did I mention, the beer was good!

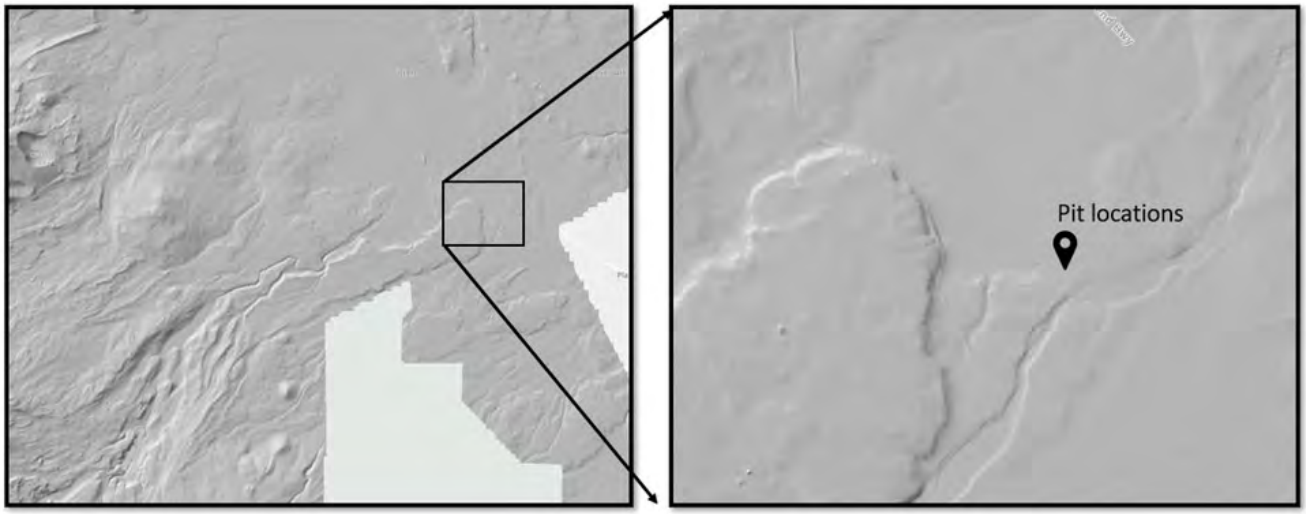
Saturday was field tour day. The tour was set up to view soil pits and farming practices in the Bend/Sisters area. Markus Kleber helped get this part of the tour organized. We met in the parking lot of Sleep Inn to put together lunches. Shannon Andrews did a great job organizing the lunch assembly line .

Our first stop was the Fields Farm in Bend. We looked at 2 soil pits one in an area that was organically farmed and another similar soil that had not been farmed. The soil mapped here was Deskamp (Ashy, glassy, mesic Vitritorrandic Haploxeroll). Deskamp is moderately deep (20 to 40) inches to basalt bedrock. It also has a sandy

textural family which is hidden by the Ashy designation. The "ashy, glassy, and Vitri" parts of the classification indicate the volcanic ash influence from various sources. The "torr" part of the family classification indicates an aridic (10 in precipitation) moisture regime which is why there is not enough weathering to kick it into the Andosol order. There was a noticeable difference in the topsoil thickness of the farmed soil as there were yearly additions of compost and mulch to make it more productive. This supports James Cassidy's mantra when in doubt, "Add More Organic Matter"!

Next was a lunch stop at the Sisters Park with another assembly line set up with extra side dishes and cookies for dessert. My dog Tig, got to run off some of her extra energy by catching pine cones that people tossed in her direction during our lunch break. It was also established here that Tom Clark was the most senior member attending our meeting!

At Five Kingdom Farms near Sisters, we looked at two more soil pits prepared with the help of Chris Burgess, Pedro Martinez, and Horia Dom-



Bare-earth LiDAR depicting the location of the Five Kingdoms Soil Pits just outside of Sisters.

nariu. These soils had not been mapped yet and were thought to have bedrock underlayment similar to the soils in Bend. The soil Wanoga (Ashy, glassy, frigid Humic Vitrixerands) would be a good guess as it was mapped in the surrounding area. Wanoga is deep with cemented properties over basalt bedrock. It has enough weathering with a "xeric" moisture regime and 15 inches of annual precipitation to place it in the Andosol order. It also has a cooler "frigid" temperature regime than the Deskamp soil. The "Ashy, glassy, Vitri" designations indicate the volcanic influence mostly from Mt Mazama, and the "Humic" designation indicates rich organic matter or mollic epipedon. The soil textures here were heavier being sandy loams vs the loamy sand textures of Deskamp. Again, this is covered up with the "Ashy" textural family designation. Back to our soil pits, Pam Keller noted that rock fragments in the profile were rounded indicating that they were deposited through alluvial processes and not the residual development typical of Wanoga. Andy Gallagher busted through the pan layer in one of the soils pits to confirm no bedrock under the pan. Finishing up, the shovels were broken out so everyone could get some down-to-earth exercise, filling in the soil pits. Thanks to Marissa, the board members, the informative speakers, and all the folks in the background that helped make this meeting a success!

-Ed Horn *(OSSS Lifetime Member)*

It was a joyous reunion for those who could attend in person after a fully remote meeting in 2021. OSSS is changing and growing with the times—we offered our first-ever blended meeting, with a virtual option for those who couldn't make the trip or weren't comfortable attending in person. James Cassidy kicked things off with a Thursday-night public talk (SOIL!!! – What it is and How it Works: What Every Human on Planet Earth Should Know!) in Worthy's Hop Mahal. While public attendance was a little thin—a barful of oblivious beer-swilling tourists lurked just outside the door, unaware they were missing out on essential life-changing information--James got all the long-time soil devotees reinvigorated and properly spooled up for two days of awesome talks and field explorations.

In keeping with the meeting theme, "Life in the Anthropocene", Saturday's field trip focused on local soils that have been meaningfully influenced by management practices over the past few decades. Our first stop was at Fields Farm, a family-run 10-acre parcel of agricultural land tucked in among the bustling subdivisions and businesses on Bend's east side. Jim and Debbie Fields have been farming organically here for 33 years and shared with us the trials and tribulations of learning the nuances of the varying soil types on their land and learning what grew best in which locations. We looked at shallow Gosney soils with traffic impacts and no farming history, and much

deeper Deskamp soils which have been continuously farmed for the last few decades. They've practiced no-till and other regenerative methods on these soils and have built an impressive reservoir of soil organic matter that is woefully lacking in most Mazama pumice-derived soils in central Oregon. We had some spirited discussions about central Oregon geologic history and origins of buried soils. Our second field stop was at Five Kingdoms Farm, a rotational grazing establishment near Sisters. We again saw soils whose carbon reserves have been enhanced by management activities (and perhaps shifts in vegetation composition) and where mindful practices have preserved this character. Some of these soils had two-foot-thick A horizons directly over bedrock or colluvial material. The short-range differences in buried geologic materials was quite perplexing, and reminded us of the fine-scale nuances of landscapes and soil systems that can only be understood by digging and observing. Perhaps the most memorable vision of our field day is that of a blue-suited Dr. Markus Kleber becoming increasingly agitated as he repeatedly pleaded with the large group to "PLEASE, STEP **AVAY** FROM ZEE **PIT FACE**!" Crowd control and following instructions is not our strong suit. Many thanks to Markus, Eastside Director Kevin Hesson, and Westside Director Shannon Andrews for coordinating with landowners, scouting, digging and describing our pits, and facilitating field discussions.

For me, as is the case for many of our members, the real value of the society is the once-or twice-yearly opportunities to gather with our diverse community bonded by a shared love of soils, connect with old (and new) friends and colleagues, and learn! I always leave these meetings with some invigorating ideas, a renewed appreciation for my work, a new friend or two, and a refreshed intent to be an engaged, informed, and inquisitive soil manager. I'm looking forward to sharing more of our fascinating central Oregon landscape with you in September, when we gather for our Summer Tour in the Newberry Caldera. See you there!

-Sarah Hash, *(OSSS Member and former Eastside Director)*

The brilliant sunshine streamed in my hotel room window. I knew immediately it would be a good day for a fieldtrip. We gathered together to pack our lunches and headed off to the first of four soil pits which Markus Kleber, Kevin Hesson, and Pedro Martinez had prepared for us. Our first two pits were located on Fields Farm in the heart of Bend. The entirety of the farm occurs on lava plains which are mantled in volcanic ash, the soils are mapped as a Deskamp-Gosney complex and that is more or less exactly what we found.

The Deskamp is the deeper of the two profiles and belongs to the Vitritorrandic Haploxerolls. Despite the pit face being frozen, we enthusiastically started poking and prodding and eventually found some nice durinodes beginning around 20 inches. The second pit fits the bill of the Gosney Series perfectly (a Lithic torripsamment). The wee-little profile was only about 20 inches deep but this didn't stop Markus from protecting the pit wall from being trodden upon by enthusiastic soil scientists. We filled in the pits and thanked the Fields for their hospitality and their interest in soil science; it helps when your niece took State at the Soil judging contest last year!

Markus protects the pit wall from disturbance and gives us a great introduction to each pit.

Our second half of the tour took place just outside of Sisters, on the Five Kingdoms Farm. The two pits we examined occurred at the interface between glacial outwash, over-riding lava flows and Holocene alluvium all mantled in volcanic ash (most of which is from the eruption of Mt. Mazama). Initial soil survey has not been compet-

Left: Andy Gallagher, clearly happy with himself and collecting material from below the indurated horizon at the bottom of the pit. Right: What the indurated material looks like. Note the abrupt contact evidenced by the fine-grained yellow volcanic ash.

ed for the area so no soils are mapped, though the Henkle, Fremkl, Laidlaw, and Lungren Series are mapped nearby. The first pit consisted of ~1 meter of volcanic ash with abundant lapilli and a few rounded cobbles scattered throughout the profile. Mollic colors to about 70cm. The ash lies directly atop cemented sands and gravels. I thought at first that we must be on the Deschutes formation and that the abrupt transition did not favor the interpretation that we had a duripan on our hands.

However, Andy Gallagher managed to punch a hole through the completely indurated layer which turned out to only be a couple of inches thick. Below the indurated layer was basically pristine sandy and gravelly alluvium, which given its abundance of large pores may have created a capillary barrier at the contact with the finer ash, thereby allowing a duripan to form at the interface; I don't think we came to a firm conclusion. The second pit was basically the same, though a bit deeper and with more coarse fragments (~30 -35% by volume).

Following our usual deliberation, the group then collectively filled in the pits, with a substantial majority being accomplished by some very eager and capable students. Many of us broke a sweat despite the near freezing temperatures. Good-byes and well-wishes were exchanged and thus conclude we yet another OSSS winter meeting. Kudos.

-Vance Almquist *(OSSS Vice President)*

Welcome New Westside OSSS Director : Todd Reinwald

Howdy OSSS membership,

I would like to introduce myself. My name is Todd Reinwald and I have recently been appointed to the west side director position in OSSS. I've been involved in OSSS off-and-on since I was a student at OSU in the early '90s. I'm an Oregon State and Central Oregon Community College alumni ('92 & '87 respectively) and have worked as a professional in natural resource management in both the public and private sectors in Oregon for the past 35 years. Most of my career has been focused on public land management. Currently, I am employed as the soil and water program manager on the Mt Hood Nat. Forest and reside in Zigzag, Oregon.

For my first contribution to the Sharpshooter, I'd like to share about the post-fire activity occurring on forested lands that were burned over by the cataclysmic wildfires of 2020 in western Oregon. Particularly in relation to soil and water resources. Most of you are probably aware that those incidents had profound effects on communities and cultural values, along with indigenous and natural resources. As could be expected, some of those effects continue to persist after the fires have ceased to burn.

One of the first things to occur is **assessment**. A potentially lengthy topic that I'll not delve into, the task is essential for planning post-fire recovery work. Within the first year following the fires a suite of analyses was initiated to evaluate conditions, identify hazards and risks, tally losses, and figure out what to do next and how to pay for it.

Relative to soils, one of the principle activities of course is **erosion control**. The greatest extent of which is occurring naturally. Fire effects to the below-ground soil biome was not near as amplified

and impactful as above ground. Within weeks new growth was beginning to sprout. Now two years later, forbs, grasses, new shoots, and detritus are providing an effective ground cover that in places exceeds 50 percent. Although on harsh or less productive sites regrowth is more delayed. The resilience of western Cascades ecosystems is impressive. Much of it owed to the inherent productivity below the surface that withstood the onslaught. For example, at one site where I had probed several inches below the heavily charred surface ants were very busy processing mycorrhizae less than a week after the fire.

There are of course lots of additional human attempts to oppose accelerated erosion. Typically, it is more focused and area specific. **Revegetation** efforts have been occurring and continue to ramp up. Reforestation with native conifer species is the largest of these efforts. Seedlings are at a premium because a lot of landowners have been replanting the large swaths of green forest they lost. But replanting and seeding with other native species is also a big deal, particularly on sensitive or important sites and select habitats such as along streams and riparian zones, administrative sites, campgrounds, hardwood ecotypes, wetlands, or in shallow rocky soils for example. Soil scientists play a role in helping to plan revegetation activities. Sometimes they merely walk randomly through the burned-out forest with a sack of native seed mix spreading it by hand as they go, which is one of my favorite things to do.

Noxious weed and invasive plant control are another considerable task. A never-ending endeavor, it continues with vigor repeatedly. Wildfire can offer an opportunity for potentially abating invasive plant populations successfully afterwards. But like all eradication efforts, it's very hard work. Methods entail chemical applications, but also the use of mulch, establishment of native vegetation, and providing shade where feasible. And then, as always, there's brute pulling it out of the ground. Even after wildfire scotch broom can be a mofo to pull! Trying to stay ahead of resprouting invasive plants to control them is a huge job but there's something really satisfying about it. The role this plays in enhancing forest soil quality is often understated.

One aspect of the post-fire environment that is sometimes underestimated is the massive amount of **wood residue** or slash to deal with. All the fire-killed trees that fall or that need to be cut down and removed, along with the profuse charred remnants of woody vegetation blown all over like a bomb went off has generated gargantuan volumes of slash. Tons of it are piled and burned just to get rid of it, which can create its own problems. But there's also a silver lining to capitalize upon.

A lot of slash is grinded or chipped, which generates material to be used as mulch or compost. A lot of it gets re-distributed to provide ground cover on select areas within the burn scar. Tons are hauled off to composting facilities in the valley. Then there is a proportion that can be converted into a specialty item such as biochar.

There is a lot of feedstock available after a fire. But the amount that goes in is far more than that which comes out and there are only a few contractors and licensed machines in the state that have large-scale processing capabilities. The capacity to deal with massive volume is constrained. It's an underdeveloped option currently. None the less, on the Mt Hood NF we have been able to generate

about 200 cubic yards of material thus far with intentions to produce more. Most of it will be repurposed to aid fire recovery or for other local restoration projects. The conversion of all that dead, burnt biomass into a final form for reuse or disposal necessitates a huge quantity of money.

On the more unpleasant side of soil concerns relative to wildfire is **hazmat**. A lot of structures and human-made substances that burned must be cleaned up. Hazmat costs are high. Preventing fur-

ther contamination of soil and water resources that could threaten health and safety is an unfortunate priority since so many structures were destroyed. One to highlight is the removal of waste from all the toilet vaults that were burned on public lands such as in campgrounds. The below-ground portion of those facilities were exposed when the above-ground structure was annihilated. Cleanup, testing, and monitoring continue.

The last item I'll mention has to do with **monitoring and research**. Science partnerships between research branches, academia, and various agencies have developed plans to investigate a myriad of post-fire related hypotheses. Amongst those associated with soils includes measuring erosion. Rates of soil loss and sedimentation, the proportion of ash content, altered frequency and magnitude of mass wasting, and effects to water quality and quantity are being investigated widely. A plethora of graduate students and researchers have been establishing sample sites, setting up instruments, and taking measurements. We are looking forward to their correlations and conclusions.

A lot of monitoring has been occurring in both systematic and random fashion in the burn scars. One notable version in the western Cascades is the acquisition of real-time water quality data for municipal water providers and water managers. The water supplies for Cities such as Portland, Salem, Albany, and Eugene were affected, as were many smaller burbs and towns.

There has been a large-scale, multi-agency effort to provide this service so that treatment operators can make alterations and adjustments as needed when the quality of the water from their burned over source areas becomes laden with turbidity, nutrients, or ash. The number of telemetered sampling sites has been expanded on a handful of rivers in the western Cascades to provide greater real-time monitoring capability. The data also serves reservoir managers where water contact recreation occurs during the summer when rising temperatures can prompt the formation of algal blooms.

These and other activities will continue to occur in the burned over areas of the 2020 wildfires for years. Soils scientists, particularly those working in the public sector will also continue to play a role in that work.

Todd Reinwald (OSSS *Westside Director*)

"Fire Season" Video Wins National Award

Fire Season" Video Wins National Award
A Klamath Falls, Oregon high school senior, Linnea Gebauer, produced a video about efforts to address wildfire through the National Cohesive Wildland Fire Management Strategy, focusing especially on the Bootleg Fire of 2021. Linnea Gebauer's video, "Fire Season," has won national recognition by earning a second-place award in StudentCam, C-SPANS's annual national video documentary competition. StudentCam encourages students in grades 6-12 to think critically about issues that affect our communities and our nation. The competition's theme this year was, "How does the federal government impact your life?" Linnea's video was one of over 3,000 videos submitted this year. The video is a clear, concise, and compelling depiction of the challenges we face in addressing and managing wildfire and is an example of how effective messaging and communication can raise awareness and give us the tools we need to work together to address community needs.

Linnea Gebauer, filming on location, in an area burned in the 2021 Bootleg Fire.

The full video is on YouTube:
https://www.youtube.com/watch?v=RXlyDcFTTbY
The video along with messages from the Governor of Oregon, the NPS Division Chief for Fire and Aviation Management, and a Klamath Falls City Councilman, are available on the StudentCam website:
http://www.studentcam.org/2022/2ndPrize-KlamathUnionHighSchool0406.htm

Chris Gebauer (*OSSS Member*)

Bootleg Fire 2021
Fremont-Winema National Forest

The Bootleg fire started on Fuego Mountain near the town of Sprague River on the Chiloquin Ranger District of the Fremont-Winema National Forest on July 6, 2021. The fire was initiated by lightning striking a landscape that has been effected by extreme drought combined with strong winds. An area of 426,700 acres was burned before it was fully contained on August 15, completely extinguished on November 23, and put out on January 14, 2022. The burned area was primarily located within the Upper, Middle, and Lower Sycan River and North and South Fork Sprague River watersheds on the Bly, Chiloquin, Paisley, and Silver Lake Ranger Districts. On July 13, the Bootleg fire had grown to be the nation's largest fire.

The fire had become so powerful it created its own weather causing wind directions to change and the development of pyrocumulonimbus clouds accompanied by lighting and fire whirls. On July 18, extreme fire behavior caused a tornado to touch down on the eastern perimeter of the fire . It was reported by Derek Williams (a meteorologist assigned to the federal strike team) that the fire tornado ripped massive trees out the of the ground and left them piled like used matchsticks. University of Nevada atmospheric science professor, Neil Lareau, speculated the Bootleg tornado's strength was equivalent to an EF2-type tornado (wind speeds between 11 and 135 miles per hour). On July 20, the Bootleg fire merged with the Log fire and grew to 140,196 acres within 4 days. The Bootleg fire complex was the 2nd largest wildfire in the United States for the year 2021.

After the Bootleg fire had been contained, members of the Burned Area Emergency Response (BAER) team surveyed the burned area's physical, biological, and ecological effects of the fire on soil and vegetation. Determining what happened to the soil during the fire is a critical indicator of recovery of the area and the potential risks post fire.

The BAER program is designed to identify and manage potential risks to resources on National Forest System lands and reduce these threats through appropriate emergency measures to protect human life and safety, property, and critical natural or cultural resources. The team generates a "Soil Burn" map by using satellite imagery which is then validated and adjusted by BAER team field surveys to assess watershed conditions and model potential watershed response from the wildfire. The Soil Scientists on the BAER team included Leslee Crawford, Soil, Malheur National Forest, Megan McGinnis, Soil Scientist, Northwest Oregon District - Bureau of Land Management and Lizeth Ochoa, Soil Scientist and Hydrologist, Rogue River-Siskiyou National Forest. Megan McGinnis and Lizeth Ochoa have provided a summary of their experience while working the Bootleg Fire BAER team on the following pages-thank you both for your contributions.

Bootleg Fire BAER Soil Scientists. Left to Right: Lizeth Ochoa, Leslee Crawford, and Megan McGinnis.

<u>Experiences on the Bootleg BAER Assessment</u> – Megan McGinnis (*OSSS Member*)

The Bootleg Fire was probably the 11th fire and 9th BAER assessment to which I'd been assigned; it was among my favorite assignments not only because of the many unique soil conditions and fire

behavior that existed across the burn, but also because of the stellar team I got to work with.

There were several qualities that made the Bootleg burn different from any other I had worked on so far:

Landscape characteristics: Despite the vast area of the burn, the landscape was among the most homogenous in dominant vegetation and soil characteristics due to the volcanic history. I had worked in numerous soils with volcanic ash caps of various depths and degree of weathering, but this was my first time working in the deep, loose, pumice soils that comprise much of central and eastern Oregon. Because of the light, insulating properties of these soils, heat penetration rarely penetrated beyond the first 1-2 cm of the soil, even in areas of extensive, intense above-ground consumption. In some instances, ant hill deposits protected pockets of forest floor material. The result was a dimpled soil surface that appeared completely bare and eroded, but where buried duff created micro-islands of unaltered or lightly scorched organic material. While most soils are naturally highly insulating, this was the first time I had seen how dramatically pumice soils resisted heat penetration and influenced soil burn severity determinations.

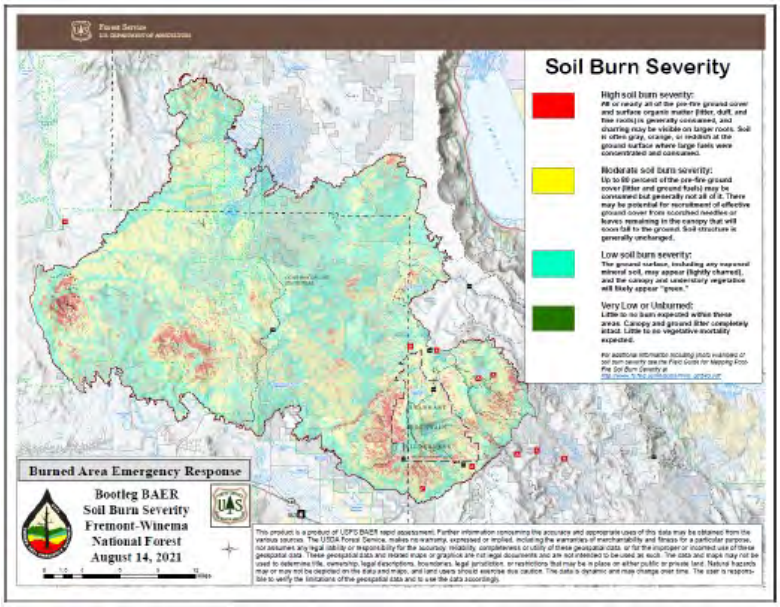
Local Climate and Fire behavior: Before I arrived on the Bootleg fire, I had seen news reports of how the fire was generating its own weather systems and had produced 'fire tornados'. I had seen strong fire-induced winds on other burns that resulted in swaths of snapped tree-tops, and I was somewhat dubious of whether I would find anything more than the typical fire-induced blowdown. My skepticism was misplaced! The tornados were real, and the path of destruction was dramatic. A path of flattened trees was visible from a rocky knob near Campbell lake. Every fire I have worked on has had some degree of climatic variation or topographic gradient within the burn area which drove fire behavior and burn impacts. I later learned that the east flank of the Bootleg fire had a history of generating locally unstable atmospheres and dramatic weather events. While soil impacts from the tornado were relatively unremarkable due to the short fire residence time, the sight remained a memorable lesson on how local topography, climate, and fire behavior can interact; local climatic history is invaluable in interpreting and predicting disturbance impacts.

Dialing in unburned site characteristics: The Bootleg fire reinforced the lesson that differentiating fire-induced impacts in dry site volcanic soils can be a subtle endeavor—the devil is in the details! Getting a strong understanding of soil structure, texture, color variation, organic matter impact and degree of native hydrophobicity in unburned soils was essential for correctly identifying fire impacts. The Bootleg pumice soils naturally had weak structure, ashy textures, low organic matter accumulation, dry, brittle roots, and strong hydrophobicity. Without taking the time to characterize soil properties in unburned soils, it would have been easy to misattribute volcanic and climatic properties to wildfire impacts. I often am eager to assess the hottest burned areas first, but on this assignment, I was reminded to spend equal time getting familiar in unburned areas up front.

Working with a great team: In the throes of the COVID-era, getting interaction with my coworkers can be challenging; it is even more challenging to find chances to interact with folks outside of my home unit, or other soil scientists in general. As an

introvert, it can be easy to settle into my silo. The Bootleg assignment was a great reminder of how valuable it is to collaborate with colleagues and how much can be learned from our peers. Interpreting a landscape as a team, working together with multiple sets of eyes each seeing the ground a little differently, is among the most enriching and rewarding parts of BAER. It was especially rewarding getting to problem-solve on such a unique fire and piece of ground with a team of rock-stars! My thanks to the team leads, Rob Tanner, Kyle Write, and Peggy Wilson; my fellow soils team, Lizeth Ochoa and Leslee Crawford; and hydrologist Leah Tai and the rest of the team for an awesome experience! What a great reminder that connection is at the heart of so much of what we do.

Interacting disturbances and site conditions: The impact of the severe and historic drought in the Klamath basin leading up to the fire had a big impact on fire behavior, soil conditions, BAER soil assessment, and potential site recovery. I think some of the nuance in differentiating burn impacts from native soil conditions was amplified because the prolonged dry spell; it resulted in really hydrophobic soils and dead surface roots, which sometimes made it challenging to separate the two disturbances: was the dead roots and vegetation we observed in unburned but fire-adjacent sites a result of wildfire radiant heat or months of extremely low moisture and record high temps? Probably both. I think it also contributed to the insulating properties of the pumice, since nearly all pore space at the surface was filled with air rather than water. Of course, the extremely dry fuels, high temperatures and low humidity contributed to the extreme fire behavior as well. I think sometimes antecedent conditions like drought can be overlooked when facing a dramatic incident like a megafire, but in reality, the two events interact with each other, affect the interpretation of the landscape, and may have compounding or complicating effects on long term recovery of the site.



<u>Experience on the Bootleg Fire as a BAER Soils Specialist</u> – Lizeth Ochoa

My experience on BAER assignments is always one of learning, excitement, stress, relationship building, and of accomplishment. The Bootleg Fire BAER assignment was no different! This assignment was on the Fremont-Winema National Forest, which is not my Forest. Therefore, I was excited to see a new Forest and meet new folks who I had not had a chance to work with.

BAER assessments are rapid assessments. Therefore, aerial reconnaissance for BAER assessments can be critical. However, in this assessment much of the topography was flat and accessible by vehicle, so there was not a need. During BAER assessments important mile markers to attain are completing field observations, the final Soil Burn Severity Map, erosion modeling, treatment recommendations, and Soil's report. Therefore, time management is also very important to keep in mind during BAER assessments. Field observations are focused on visiting sites with moderate to high soil burn severity to identify true ground conditions. This fire area was influenced by loose, coarse-textured loams derived from volcanic ash and pumice soils. Because these soils naturally had low ground cover, weak soil structure, high natural erosion hazards, and ashy textures, determining moderate and high soil burn severity was difficult at times. However, a deeper layer of loose, structureless soil at the surface, fine root scorching, and increased sub-surface hydrophobicity were observations readily seen in moderate and high soil burn severity.

Soil Scientist Interview: Dan Cressy
Part Two

Questions to Dan: Could you share with us about your thoughts on forest soil management? What are your observations over the years of the management of forest soils? Any advice for newer forest soil scientists?

I want to focus on a major concern of mine and that is: cumulative impacts to the soil resource that affect its long-term productivity. The residual impacts *(what still remains)* from timber harvests are extensive and significant, at least in the BLM Roseburg District area of the Coast Range, Klamath Mountains and the lower to mid slopes of the Cascades. My conclusion is based on my interpretation of aerial photos from 1959 to 2004, and lots of field observations, auguring, digging, and testing for compaction

(Note: This is anecdotal evidence collected over nineteen years. My assertions concerning cumulative impacts, their extent and possible long-term productivity implications must be taken as opinion. Substantial soil productivity loss on steep slopes is also my opinion. The negative effects of timber harvest compaction on forest-soil productivity in Western Oregon, however, have been well documented in studies which include those of former OSU professor Hank Froehlich. A good summation of the pre-1992 research can be found in the publication "Soil Compaction Research" by Peter Cafferata, who at the time was a forest hydrologist with the California Dept. of Forestry and Fire Protection).

Dan Cressy at Mount Saint Helens, 2000.
Photo credit: Ed Horn

The bulk of these impacts in the BLM Roseburg District occurred in the 1970s and earlier from practices quite different from those much lighter-touch ones more typically applied today (*There has been one big backsliding, unfortunately. Feller-Buncher, a method of harvesting on the more gentle ground that requires large landings, closely spaced skid trails and yarding of the whole tree or tree, minus the top, has made a big comeback this past decade*). The most concentrated residual impacts are typically on slopes of less than 40 percent. Exposed compacted subsoil is common in dense networks of old skid trails, landings and on other parts of the forest floor where tractor skidders laid down their blades and segregated topsoil into mounds mixed with subsoil. The compaction is persistent due to the low shrink-swell clays and possibly, the absence of deep freezing and thawing. Consequently, these subsoils have exhibited little healing thirty or more years later. They retain a high bulk density and have platy or massive soil structure. I had observed before retiring eleven years ago that some of these surfaces were developing embryonic A horizons that were typically two to three inches deep, had little bit of humus formation, and had platy, breaking to blocky structure.

On some of these skidded slopes, the slash was also pushed by tractors into large piles to be burned, increasing the compacted area to about 80 percent of the total harvested area. The surface soil beneath the piles were often highly altered by intense burning. There were additional isolated instances where low-order stream banks were collapsed into their channels and used as skid trails. Whole-tree yarding was a practice back then, but I do not have a handle on how common it was. It would have been limited to

the smaller-sized commercial trees. Removing trees without first cutting off their branches and tops increases the nutrient capital leaving harvested sites.

Soil productivity took substantial hits on many steep slopes due to the methods of road construction (locations on unstable slopes, side-cast of cut material, inadequate drainage) and of timber harvest (examples: clear cuts on very unstable slopes, down-hill cable yarding causing concentrated down-slope drainage, and inadequate suspension of up-hill and down-hill yarding cables causing slope gouging). One result was landslides and gullying at rates and magnitudes much higher than under natural regimes. Additionally, broadcast burns were consistently hotter on the steeper slopes, especially those greater than 70 percent. The results were higher consumption of A horizon organic matter and large woody debris and scattered alteration of the surface soil structure (Burning hotter on steeper slopes would also apply to wildfires that had occurred but the range of outcomes would differ from that of harvested sites where heavy slash loading was often present).

The bottom line is that a lot of nutrient capital was lost and the soil physical and organic properties negatively altered for the long-term over large acreages. The functioning of roots, the soil biota and the cycling of nutrients were in turn altered for the long-term. I view this as a problem, particularly for the soils with low and relatively low base saturation: the Ultisols, ultic Alfisols and dystric Inceptisols. One concern I have is that very deep Ultisols like the Honeygrove Series may not have enough weather-able minerals left in their profiles for adequate base replenishment. Data collected by OSU graduate student, Justin Hynicka, contained in his published work of his and in his Master Thesis seem to support my concern. He did total digests of deeply weathered soil like Honeygrove and often found, especially in soil derived from sedimentary parent material, that primary mineral nutrients could be largely depleted in the main rooting zone of some Coast Range soils. Dr. Stephen Perakis, Supervisory Research Ecologist at the USGS Forest and Range Ecosystem Science Center, who was Justin's Masters advisor, has the references for Justin's research for those who might want them.

I can conceive of a future not too many timber harvest rotations later when serious diminishing returns will be reached in tree growth and health and in the heath of ecosystems as a whole if we are not careful how we manage the forests going forward. My musing does not take into account the further layering of stresses to our forests being brought on by climate change and the need for carbon sequestration. Perhaps serious diminishing returns in forest maintenance, regeneration and carbon capture are here now or right around the corner.

All future timber harvests, salvage operations and other types of projects will leave some level of negative impacts to the soil upon completion, even after restorative mitigation is applied. In my opinion, we must incorporate protective design features that will allow the soil over a specified time to recover to a high degree the productivity that had been lost. For a timber harvest, perhaps that period could be the time it takes a replacement stand to reach the commercial thinning age (about 30 years). If the impacts are too great to reasonably heal over the specified period or, let's say, for example, a road spur is built that that management wants to be permanent, then onsite or offsite mitigation of old residual impacts would be required. If funding is available for extra mitigation of the old, all the better. The idea is to ultimately not add to, and, perhaps, even slightly diminish the large body of residual impacts spread across landscapes. Very slow natural healing will always be a large part of this process of recovery.

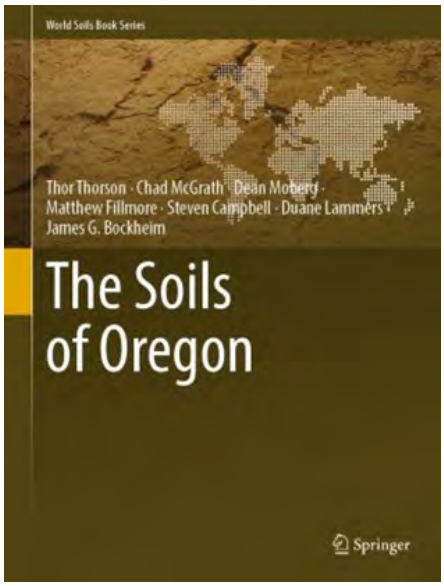
I would like to continue and discuss how well or not so well certain project design features I have used worked and what ones I would have liked to have tried. Unfortunately, there is not space for that now. Maybe that could be a future article. Let me throw in one quick piece of advice: Study those old aerial photos available to you, take copious field notes, when time allows, of the geology, vegetation present, slope characteristics and landslide scars, the shape of the conifer boles, man-made features, soil profile information from auger/sharpshooter holes, the strike & dip of rock

strata exposed in road cuts, etc. This information is helpful for analyzing the project at hand, but with cumulative observations in different locations over time, interesting patterns can emerge that builds confidence in your perceptions. You young soil scientists have begun your careers at an inflection point on how our forests are to be managed due to climate change. I think you will be challenged more than my generation of soil scientists dealing with the Spotted Owl controversy. I wish you success!

Dan Cressy *(OSSS Member)*

Release of "The Soils of Oregon" book

This is to let you know that a new book entitled THE SOILS OF OREGON has just been published. It is part of the World Soils Book Series. The authors are Thor Thorson, Chad McGrath, Dean Moberg, Matthew Fillmore, Steven Campbell, Duane Lammers, and James Bockheim. Many of you probably recognize most of the authors as people who have worked in Oregon and are now retired or are currently working In Oregon. James Bockheim is a retired professor from the University of Wisconsin.



This book discusses the nature, properties, genesis, classification, and use of the soils of Oregon and provides maps of dominant soil great groups in Oregon based on Soil Taxonomy. The study of soils in Oregon originated with a reconnaissance soil survey of Baker City in1903, shortly after the Bureau of Soils, a precursor to the Soil Conservation Service and the more encompassing Natural Resources Conservation Service (NRCS), was established. Portions of all but five of the 36 counties in Oregon have received an order 2 or 3 soil survey (scale 1:24,000). Oregon has a variety of physiographic provinces that have led to the mapping of more than 1,700 soil series in the state. This study was made easier by an abundance of natural resource maps (vegetation, geology, etc.) and other technical information. We were assisted in this endeavor by Cory Owens, Oregon Assistant State Conservationist – Partnerships; Jericho Winter, State soil scientist; and Whityn Owen, Oregon GIS specialist/coordinator.

This book is dedicated to the professional soil scientists from the Natural Resources Conservation Service, US Forest Service (US Department of Agriculture), Bureau of Land Management (US Department of Interior), Bureau of Indian Affairs, National Park Service, US Fish and Wildlife Service , soil and water conservation districts, and the Oregon Agricultural Experiment Station (Oregon State University), who contributed to the mapping of soils in Oregon. We would like to acknowledge the support of these agencies and other land management agencies that contributed to soil surveys. This book could not have been written without the support of NRCS database managers.

This book originated from data collected by the USDA-Natural Resources Conservation Service, including the Soils Data Mart and Web Soil Survey, and by approximately 100 research reports dealing with the soils, geology, and vegetation of Oregon. The interpretations were made solely by the authors. This book should be of interest to individuals in federal, state, county, and non-government organizations who are interested in and responsible for safeguarding Oregon's natural resources. The book will be of interest to students in soil science and allied disciplines.

This Book is the result of the work of the authors over approximately the past two years. We are glad to announce that the book is finally published and is available at the following web address: https://springer.com/book/10.1007/978-3-030-90091-5. The cost of the book is $129 for an eBook and $169.99 for a hard bound book. The book contains approximately 545 pages divided into 19 chapter and 4 appendices. There are 197 color illustrations and 32 black and white illustrations. It is part of the World Soils Book Series. The cost may seem high but is very much inline with other books in this series of publications. The last two chapters are a great addition to this book as they discuss how soils are imbedded in the Oregon land use laws and conservation practices. These two chapters set this book apart from others books in this series. This book will make a great reference for soil scientists, resource managers and planners, and for students and educators.

Chad McGrath (*OSSS Member)*

Department of Crop and Soil Science | Oregon State University

OREGON STATE UNIVERSITY PRESENTS

The 2022 Warkentin Lecture

Professor Margaret Torn.

Dr. Torn is an ecologist and biogeochemist who studies the natural carbon cycle and human impacts on the carbon cycle through land use, energy use, and climate change.

Her work spans topics ranging from the basic mechanisms of soil carbon cycling and ecosystem-climate feedbacks, to ecological aspects of bioenergy production, to strategies for climate-change mitigation.

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To attend online, register at: https://beav.es/ikD

Reception following | MU Main Lounge | 5:30 PM

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Oregon Society of Soil Scientists

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OSSS Scholarship: $500 to $1,000

Applicant Criteria and Required Materials

- Attending a college or university in Oregon in Fall 2022
- Pursuing studies in soil-related discipline
- Students studying related disciplines invited to apply if applicant relates studies to soil in essay.
- OSSS Scholarship application form (link below)
- Minimum 3.0 overall GPA
- Preference given to students who have not received an OSSS scholarship in the past 12 months.
- Unofficial transcripts (high school transcripts if high school student or 1st year college student, otherwise, college transcripts only)
- 500 – 1,000 word essay on soil
  - Significance and importance of soil
  - One or both of the following topics:
    a) Goals for career objectives relating to soil
    b) Personal interest in studying or enhancing soil

Application Deadline: 5PM PST June 24, 2022

https://www.oregonsoils.org/links/scholarships/

Send submissions and questions to:

osss.scholarships@gmail.com

Also seeking scholarship committee members, If interested, please send email to above address.

OREGON SOCIETY OF Soil Scientists

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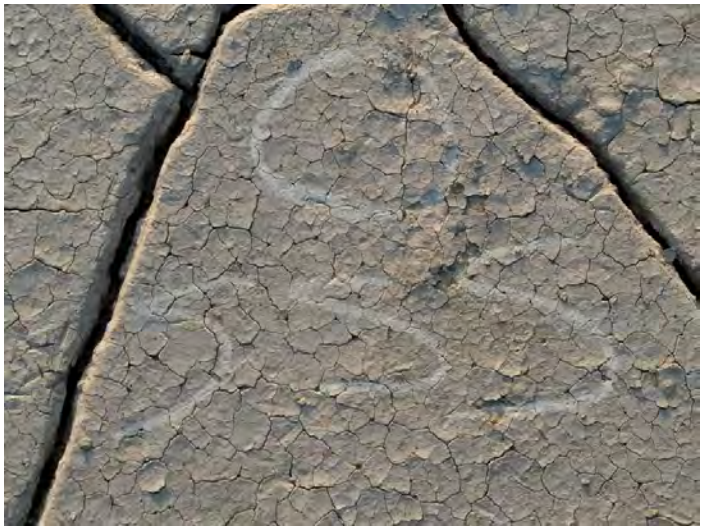

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