

Volcanic Ash-cap Forest Soils of the Inland Northwest Properties and Implications for Management and Restoration

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Good Morning and Welcome. My task today is to set the stage for a productive conference by providing an historical context, an overview of the subject matter to be covered, and a challenge for next steps by interested scientists and practitioners.

An Historical Perspective

Volcanoes have been part of the Earth's history ever since it has had a solid surface. And, volcanoes have been a part of human culture for thousands of years. In some ways, our reactions to the magnitude of a volcanic explosion haven't evolved as much as one might think. Ranging from ancient cultures who believed that victims should be sacrificed in response to volcanic eruption, to Harry Truman who stubbornly sacrificed himself during the most recent eruption in the continental United States, volcanoes have impacted our lives in many ways and will continue to do so in the future.

But disaster sometimes brings fortune. Here on the West Coast where some volcanoes erupt violently every 20-30 years or so, we live in one of the grandest ash-cap locations in the world. Soils throughout the Inland Northwest region of the United States extending from the Cascade Mountains of Oregon and Washington to Northern Idaho and Western Montana have been influenced and overlain by tephra from cataclysmic eruptions of Mount Mazama.

About 6,850 years ago Mount Mazama, a strato-volcano, collapsed to produce Crater Lake, one of the world's best known calderas. The caldera is about 6 miles (10 km) wide. The catastrophic pyroclastic eruption released about 12 cubic miles (50 cubic km) of magma to the surface. It was one of the largest eruptions in the last 10,000 years.

The Mazama eruption was followed by the May 18, 1980 eruption of Mount St. Helens in west-central Washington. This eruption spread less than 1/100th of the Mazama ash volume over areas of eastern Washington and Northern Idaho. The St. Helens ash plume carried by the jet stream took 2 weeks to circle the globe! Though considerably smaller in volume output than the Mazama eruption, the Mount St. Helens eruption and deposition had effects on soils and productivity in our region that are still visible and proudly measurable.

On a personal note, these volcanoes and the consequence of their eruptions have had a direct impact on my life and career in three ways. As an Oregonian by birth I was a visitor to Crater Lake learning about local geology and forests. As a resident of Moscow, Idaho during the May 1980 eruption of St. Helens (and the nearly 1-year aftermath) I had the experience of being blanketed with ash and having life's pace slow to a walk with a mask and goggles in a snowy white haze. And, as a student of the Habitat Type at UI and a researcher developing stand growth simulation models in the Grand fir, Douglas-fir and cedar hemlock systems of the Inland Northwest, I learned first hand about the impact of ash on soil properties and chemistry and site productivity and potential vegetation. So, I have for some time been awed by the power of these profound phenomena—the volcanoes that produce the ash, and the ash caps that add value to the region's soils.

My experience with the aftermath of volcanic eruption was expanded and deepened this past year, when I had the opportunity to tour Las Valles Caldera in northern New Mexico. This is a 50 mile wide caldera that blew its top 1.2 million years ago, leaving behind an inspiring landscape of biological diversity. I went there to meet up with scientists from three New Mexico universities conducting research on watershed dynamics and carbon-water relations. This is a remarkable place at 10,000 feet in the Southern Rocky Mountains. Don't miss your opportunity to visit and learn about the past and present conditions of Las Valles Caldera.

These major volcanic eruptions and depositions all created the same wondrous outcome; ash-cap soils. As a result of frequent volcanic activity, the soils of the Northwest are unique and behave differently than anywhere else in the United States. As you'll hear from a dozen researchers and land managers over the next 2 days, we now know much about the properties and characteristics of these deposited soils and the effects of our activity on them.

An Overview of Our State of Knowledge— Preview of the Conference

We know the distribution of Andic soils, and Mark will tell you more. We know about the chemical and physical properties of Andisols. They are light and fluffy, low density and have remarkable water-holding capacity. Paul will tell us more about all of this, drawing from his 2005 treatise on Andisols. We know something about Andic soil quality and will hear more about that from Steve later this afternoon.

We know that the most significant glass accumulations are found in forested areas. It has been suggested that outside a forest structure like the Douglas-fir, or the more mesic Grand fir and cedar hemlock ecosystems, volcanic ash is not retained against erosion, certainly not under extreme conditions of management that exacerbate erosion.

We also know there is a strong link between Andisol distribution and forest productivity; reference my earlier comments about habitat type as a predictor variable in stand growth simulation models. In the 1970s, Habitat Type was explaining much variation in our tree growth and forest stand simulation models, acting as an effective integrator of slope, aspect, elevation, moisture and temperature in the prediction of species occurrence and abundance as well as tree and shrub growth rate. At that time, many scientists and managers were beginning

to believe that the one factor not adequately stratified in Daubenmire's Habitat Type scheme was soil type.

Ash-cap soils play a critical role in water relations and nutritional ecology, and thus, plant diversity in forested ecosystems. Later attempts at habitat typing in the United States have taken soil type much more seriously.

In more recent science on forest nutrition, soil parent material has taken on celebrity status as a predictor variable in site productivity. Researchers and land managers now speak of *good and bad rocks* (parent material) and acknowledge through empirical and laboratory science the characteristics of ash soils and their direct impact on nutritional ecology. Through cooperative research and outreach, this has had a direct influence on management prescriptions on both public and private forest ownerships.

From this body of research and practice, we know that properly managed Andic soils can be some of the most productive on earth. Dennis and Larry will share their knowledge on management regimes on forested systems with ash-cap soils. Marianne will share ways to improve tree performance through nutritional augmentation and site decisions. Pete will tell you about the effects of different fire regimes on Andic soil types.

We know these soils are susceptible to compaction, and decrease in value and volume under intense and frequent fire and erosion following irresponsible forest management practices. Han and Leonard will review the effects of machine traffic, plans for a lighter footprint during forest operations, and the overall economics of timber operations with an eye to ecological and economic sustainability. Chuck will introduce us to restoration schemes for degraded soils. And, Mike will share best management practices relating to insect and disease populations and harvest operations.

The Challenge to Scientists and Practitioners— Where We Go From Here

We know much, and you've gathered an impressive crew of scientists and practitioners to share the current knowledge base. But, the conference is about more than just dumping all the current knowledge on the table. It's about synthesizing current knowledge into a more coherent perspective on these soils and the management they can tolerate. And, just as important, it's about framing the next set of questions...laying out your science road map for the future, and doing it together.

In interviewing soils folks and managers in preparation for this presentation, I was told by more than one person that most of the studies on Andisols have occurred in the Midwest and overseas—in Japan, Iceland, and New Zealand for example, and that the body of information available in the U.S. is fleeting and incomplete. It would be good to organize a list of highest priority research to be conducted on Andic soils in this region.

Most also agree that around the edges of this spotting science base, there are mental volumes of endemic, practitioner knowledge about Andic soils stored in the expert systems that are our experienced local forest managers. It would be useful to all of you to organize this endemic knowledge and subject it to scientific scrutiny, invalidation and confirmation. That's why you're here—to match the insights and experience of forest managers with the curiosity of forest researchers...to develop a coherent research agenda that will lead to best practices for protection and sustainability of this important Andic soil resource.

That's the real reason I accepted the invitation to be with you today. Obviously, I can't stand toe to toe with you on the science of soils or the intricacies and art-form of management. But, I have spent my career straddling the research and outreach worlds of academia, striving to bring the researcher and practitioner together around a coherent and integrated science and management agenda. The best outcomes of science are achieved when the scientist and practitioner conceptualize a problem and research question together and I'm passionate about making this type of connection a reality. The rewards are profound for all who subscribe.

So, my closing statement is an admonition in that spirit of collaboration and coordination.

Soils are taken for granted and underrated by the average person. Just dirt, you know—uncorruptable and forever static in the average mind's eye. But, you and I know this isn't true. They are in fact the substrate on which most life and biodiversity resides, they are the physical base on which the water system self-regulates, they are often the defining factor in what you can and cannot do well on a particular site. And they are fragile, corruptible and degradable. In many cases, if you screw them up once, you don't get a second chance. In extreme cases of erodibility, when they're gone, they're gone.

The Andic soil is particularly erodible. Studies of Andic soils can give clues to other highly erodible soils in even more critical regions of biodiversity, like the topics.

As we continue to grow our understanding of the working processes and functions of ecosystems, and as a society, we recognize and attempt to quantify, and even trade, the values of natural capital, soil and it's relationship to water and carbon will be key areas of inquiry, value, credit and trade.

Most climate modelers and carbon scientists now agree that the Inland Northwest, in fact the Grand fir and cedar hemlock ecosystems with moist, relatively warm temperature regimes and at low to mid elevations, may be one of North America's biggest carbon sponges. Andic soils definitely play a role in this equation. In the marketplace that characterizes our economy and society, our valuing of these soils will follow on our understanding of these soils.

Scientists and managers in western North America have in their backyard a living laboratory in which to study the Andic soil. You're in the driver's seat for advancing the world's knowledge on these soils, their properties and characteristics, their additions to ecological potential and production, and their responses to the regimes of human activity. And, you're gathered here to ponder this.

So, listen well to what you and your colleagues know and chart a course together that will fill in the blanks. Identify the key management questions and issues relating to ash cap soils. Identify the categories of inquiry that are important to pursue. Identify areas where you need to go beyond anecdote to science and make some plans to test and invalidate your mental models. Let the practitioners influence the research agenda, and hold the scientists accountable for getting the science out in usable form to managers on the ground.

The University of Idaho is a land grant institution with a mission to advance both science and practice in natural resource management. We will be looking for ways to partner in your noble pursuit.

Good luck with your meeting and thanks again for the invitation to participate.