Fourteenth Annual

AEG Student Poster Night

Portland State UNIVERSITY

Western Oregon UNIVERSITY

Tuesday, May 17th, 2016
5:30 – 9:00 pm

Book of Abstracts

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Kirstin A. Hargie, Alexa R. Van Eaton, John W. Ewert, Robert H. Holzworth

Abstracts

Urban Erosion Rates from TLS Scans and Point Cloud Differencing

Max Bordal, Department of Geology, Portland State University, email: mbordal@pdx.edu

Quantitatively exploring the nature of rapid and intense erosion on human time scales is critical to understanding its present and future consequences. This investigation focuses on the physical controls on the size and retreat rates of knickpoints, defined as localized near-vertical reaches of a fluvial channel, and the role they play, in a contextual urban landscape dominated by loess and land use issues. The Bull Mountain area, in Washington County, southwest of Portland, Oregon, is an ideal study area, offering accessible and measurable knickpoints that translate the response of the rapid erosion throughout this transient system. Rapid urbanization there has increased peak flows in streams, potentially initiating rapid channel incision and associated slope stability and sediment pollution issues, affecting real property and infrastructure. Despite the documented increase in discharge, other metrics like upstream migration rates of knickpoints, as well as the overall channel erosion rate, were still unknown. Terrestrial laser scanning (TLS) and point cloud analysis software provides a way to capture the changes of the landscape, in three dimensions, throughout time. Here multi-interval scans of two sites, experiencing rapid erosion, are differenced, and a high resolution estimate of the volume of material eroded, was resolved. These detectable changes to the landscape, on the order of decimeters, reveal the style and rate of erosion. This analysis is part of a larger project and will include: soil density analysis, to determine controls on knickpoint height, and a GIS based channel profile evaluation.

Abstracts

Estimating reservoir temperature and alteration mineralogy from surface water chemistry in Cascade geothermal aquifers.

Don Malkemus, Department of Geology, Portland State University, email: malkemus@pdx.edu

Geothermometry in geothermal systems describes the application of near surface indicators to estimate deep subsurface temperature. Classical geothermometers are empirical based relationships between observed water chemistry and measured reservoir temperature. Multi-component geothermometers use thermodynamic relationships between water and host rock to quantitatively estimate equilibrium conditions between thermal fluid and hydrothermally-derived secondary mineralogy. In this study, both classical and multi-component geothermometers are applied to the Breitenbush Hot Springs and Wind River Valley geothermal systems to aid in estimation of the geothermal energy potential in the Oregon and Washington Cascades.

Abstracts

Seismic Preparedness in Western Oregon

Paul Rostad, Earth and Physical Science Dept., Western Oregon University, email: prostad15@wou.edu

Earthquakes are a powerful force of nature capable of causing millions of dollars worth of damage, displacing populations, and carrying the risk of endangerment to human life. They are deceptive in that the damage caused by ancillary co-seismic processes (e.g. liquefaction, tsunami, falls, slides) can sometimes outweigh the damage caused by the ground shaking itself, which is why preparation is a key aspect of mitigation planning. Co-seismic processes are responsible for shaking foundations of poorly-supported buildings, weakening and toppling un-reinforced masonry structures, the destruction of public road systems vital to post-event aid, and are even capable of damage thousands of miles away. The destruction caused by earthquakes and related processes can never be truly avoided, but it is within our scope of ability to reduce the amount of damage and risk associated with them. By evaluating structures based on their construction, regional geologic analysis, and promoting a partnership between planners and the public to establish safe havens, the costs of earthquake-related damage can be minimized. This paper focuses on current efforts to increase seismic awareness and preparedness in western Oregon.

Abstracts

Regional Hydrology and Water Resource Issues in the Umatilla Basin

Cesar Cardenas, Integrated Science Education, Western Oregon University, email: ccardenas13@wou.edu

Groundwater nitrate levels in the lower Umatilla Basin commonly exceed 10 to 20 mg/L and present a notable public health hazard. Regional land-use activities that contribute to the high nitrate concentrations include agriculture, food processing, livestock production, domestic sewage, and military operations. This project provides an overview of a 550-square-mile study area located in northern Morrow and Umatilla Counties. Water-bearing hydrostratigraphic units are primarily associated with the Miocene Columbia River Flood-Basalts (CRBs) and related sedimentary interbeds. The upper part of the CRBs forms an unconfined aquifer that is in hydraulic communication with overlying alluvial zones. This paper examines the occurrence of high nitrate concentrations in the ground water and explores remediation options. The Umatilla Basin comprises an important component of the greater Columbia River region, and is an area of groundwater concern in the state of Oregon.

Abstracts

Seismic Hazards in Willamette Valley

Kyle Warren, Earth Science and Business, Western Oregon University, email: kwarren13@mail.wou.edu

Subduction zone earthquakes are notorious for being among the most powerful events in nature, with examples including the 2011 magnitude 9.0 in Japan, the 2005 magnitude 8.6 in Indonesia, and the 1964 magnitude 9.2 in Alaska. Some of those areas that experienced the more recent earthquakes are still recovering from the consequences. Western Oregon is positioned on the leading edge of the Cascadia subduction zone with a documented 300-500 year recurrence interval that is coming due soon. Seismic hazards in the Willamette Valley include ground shaking, liquefaction and co-seismic landslides. Advancements in building codes, seismic retrofitting and investment in hazard reduction strategies are much needed. This paper examines the seismic hazards associated with living in the Willamette Valley and the types of strategies used to mitigate potentially disastrous effects to life and property.

Abstracts

Tsunami Hazards in Coastal Oregon

Joey Rodgers, Integrated Science Education, Western Oregon University, email: jrodgers13@wou.edu

This paper focuses on tsunami hazards associated with the Cascadia Subduction zone in western Oregon. The Oregon coastline is characterized by low-lying estuaries, beaches and floodplains that fall within the hazard zone associated with potential surges of water that come with a tsunami. Mitigation efforts include public education, inundation mapping, and relocation of sensitive buildings to higher ground. Given the history of high magnitude, low-frequency seismic events associated with coastal Oregon, advancement of tsunami mitigation plans to preserve life and essential infrastructure is of the utmost importance with respect to implementing emergency management strategies.

Abstracts

Radon-Related Health Issues in Oregon

Kolby Childers, Earth and Physical Science Dept., Western Oregon University, email: kchilders13@wou.edu

Radon is a natural but hazardous gas that results from the decay of uranium and is common in most soils. Geology is the most important factor in controlling the source and distribution of radon. Radon hazard mapping has been used to decrease the risk and identify potentially more dangerous areas as the gas is highly mobile in the environment, entering buildings and contaminating water supplies. There is uncertainty about all of the possible health risks associated with radon exposure, but it is the second leading cause of lung cancer and affects the health of humans if not properly contained. Radon causes over 21,000 lung cancer deaths and comprises approximately 13% of all lung cancer deaths. Being able to map and control a safe level of radon is the only way to contain exposure. This paper explores the distribution and health hazards associated with radon exposure in Oregon.

Abstracts

Medical Geology and Public Health

Hannah Smith, Dept. of Biology, Western Oregon University, email: hsmith12@wou.edu

Medical Geology is a developing field that requires collaboration of many scientific disciplines, including geologists, chemists, biologists, and medical anthropologists. This paper explores the relationship between the geologic environment and public health. Several case studies are discussed to identify influencing factors that affect human health, including air, water, and soil quality. One of these studies includes the recently publicized Portland Moss and Air Quality Report. This emerging technique is being used by scientists to measure air pollutants in urban areas. Mosses act as sponges in the environment, absorbing airborne contaminants and pollutants. By collecting, examining, and testing the types of contaminants within samples of moss, we are able to better understand urban air quality and minimize potential public health risks. Recognizing the important linkage between humans and the geologic environment allows policy makers to improve mitigation of public health hazards and encourages society to maintain healthy ecosystems.

Abstracts

Hydrogeomorphic Response to Forestry Practice in Mountainous Watersheds of Western Oregon

Spencer Welter, Environmental Studies Program, Western Oregon University, email: swelter14@wou.edu

Forestry practices in western Oregon, especially clear cutting and road construction, have had significant, dynamic and occasionally detrimental impacts on watersheds. Increased soil erosion in the form of landslides have been shown to occur far more frequently in heavily logged areas and cause dramatic changes in sediment yields and water quality. Additionally, in the instances of clear cutting, slash-burning, and road construction, the extensive removal of vegetation has caused significant impacts to stream water temperatures, oxygen levels and peak flows. As longer and supplementary studies are conducted on these diverse relationships, the collected reports point toward an increasingly complicated series of influences. Short term studies often come to vastly different conclusions as compared to long term analyses, regardless if the subject is stream flow discharge or sediment transport. At risk are the ecosystem services that are provided to aquatic species, salmonids and related old-growth habitats. If Oregon forests are to be conserved and utilized efficiently, further studies and collaborative efforts are needed so as to quantify the impacts of logging methods in various environments. Ongoing review of forestry practice standards and adaptive management methods form an important part of a statewide forest plan. This paper reviews the relevant literature and provides a framework for understanding complex landscape response to forestry practice in western Oregon.

Abstracts

Debris Flow Hazards in the Central Oregon Coast Range

Nicole Inman, Earth and Physical Science Dept., Western Oregon University, email: ninman15@wou.edu

Debris flows represent a potentially dangerous mass wasting process that is often difficult to predict. They are complicated events with many factors influencing their size and power, and every year they affect thousands of Oregonians. The importance of creating accurate prediction models and educating the public as to their risk cannot be understated. This is especially imperative in western Oregon where climate and geology result in a higher rate of debris flow occurrence compared to other regions of the U.S. Understanding the debris flow process, controlling factors and their triggers are essential for developing regional mitigation and emergency management plans. This paper provides a review of the literature and status of debris flow hazard research in the Central Oregon Coast Range.

Abstracts

Hydrogeomorphic Response to Forestry Practice in Mountainous Watersheds of Western Oregon

Spencer Welter, Environmental Studies Program, Western Oregon University, email: swelter14@wou.edu

Forestry practices in western Oregon, especially clear cutting and road construction, have had significant, dynamic and occasionally detrimental impacts on watersheds. Increased soil erosion in the form of landslides have been shown to occur far more frequently in heavily logged areas and cause dramatic changes in sediment yields and water quality. Additionally, in the instances of clear cutting, slash-burning, and road construction, the extensive removal of vegetation has caused significant impacts to stream water temperatures, oxygen levels and peak flows. As longer and supplementary studies are conducted on these diverse relationships, the collected reports point toward an increasingly complicated series of influences. Short term studies often come to vastly different conclusions as compared to long term analyses, regardless if the subject is stream flow discharge or sediment transport. At risk are the ecosystem services that are provided to aquatic species, salmonids and related old-growth habitats. If Oregon forests are to be conserved and utilized efficiently, further studies and collaborative efforts are needed so as to quantify the impacts of logging methods in various environments. Ongoing review of forestry practice standards and adaptive management methods form an important part of a statewide forest plan. This paper reviews the relevant literature and provides a framework for understanding complex landscape response to forestry practice in western Oregon.

Abstracts

The Influence of Timber Harvest on Sediment Transport in the Western Cascades

Jacob Higgins, Dept. of Biology, Western Oregon University, email: jhiggins13@wou.edu

As timber harvest continues to be one of our primary land uses in the Pacific Northwest, it is important to understand the potential affects it can have on the environment. One important way that timber harvest can affect the environment is by increasing runoff and sediment load in headwater landscapes. Increased sediment transport can have serious effects on water quality, channel stability, and riparian ecosystems. Previous studies have shown that sediment yields are much higher in areas that have experienced recent clear cutting events and that have access roads associated with them. If timber harvest does cause increased sediment transport and degrade water quality, it is imperative to find new methods of timber production that will minimize these effects and enhance ecosystem services. This paper provides an overview of forest practice and its effect on sediment transport in the Western Cascades.

Abstracts

The Occurrence of Arsenic in Groundwater Systems of Western Oregon

David Solvedt, Chemistry Dept., Western Oregon University, email: dsolvedt13@wou.edu

Globally, millions of people are exposed to hazardous and potentially deadly concentrations of arsenic in groundwater on a daily basis. Arsenic (As) is a naturally occurring element found in bedrock and regolith that nearly all humans are exposed to via food, air, water, and soil. Although exposure is inevitable, the highest potential for health effects has been identified as arsenic associated with drinking water. Arsenic has been widely recognized as highly toxic and carcinogenic to humans when consumed in an inorganic form. In the Willamette Basin of Western Oregon, there are several localities that possess levels of arsenic in groundwater many times higher than maximum allowable concentrations recognized by the U.S. Environmental Protection Agency. This study provides an overview of the toxic effects associated with arsenic and examines the geologic factors that contribute to its presence in local aquifer systems.

Abstracts

The Effects of Forest Roads on Hillslope Hydrology and Sedimentation in the Western Cascades

Connor Pomeroy, Earth and Physical Science Dept., Western Oregon University, email: cpomeroy13@wou.edu

Improper construction and maintenance of roads on both public and private timberland contribute to clogging river channels with sediments, thus impeding migration of local fish species, as well as making the hillslopes unstable. In western Oregon, legacy forest roads were constructed in ways that over-steepened slopes and removed nearly all of the natural barriers protecting against these hazards. Misplaced road alignments in steep forested terrain disrupt the natural flow of groundwater and render hillslopes unstable during wet weather conditions. If ditches and culverts are not properly constructed, they concentrate a majority of the surface flow into narrow channels which dramatically increases erosion and sedimentation into valleys below. Improper maintenance of the logged land and ditches can also contribute to this problem when the supporting groundcover is completely removed, which decreases root strength, allowing loose sediment to runoff directly into eroding channels. These matters can pose a serious threat to local communities and native fish species, however, through applying erosion-control techniques, many of these concerns can be mitigated. This study examines the effects of forest road construction on hillslope hydrology and sedimentation in forested timberlands of the Western Cascades, Oregon.

Abstracts

Geomorphic Effects of Dams on River Systems

Alicia Hubbard, Earth and Physical Science Dept., Western Oregon University, email: ahubbard13@wou.edu

There are an estimated 75,000 dams in the U.S. and they form an important economic driver for our nation because they provide water resources for drinking supplies, irrigation, industrial processing, recreation, and hydroelectric power. Dams however come with an environmental cost and significantly alter geomorphic processes in river systems. Large dams commonly alter natural hydrologic processes and sediment transport mechanisms that are critical for ecosystem services and often affect landscapes for hundreds of kilometers downstream. Dam-related changes in channel width, water discharges, channel bed elevation, bed material sizes and vegetation commonly cause the rivers to respond with incision and development of a course grained surface layer. Pre-dam concentration of sediment and suspended loads downstream are not equal to the post-dam conditions, as they vary through time. Upstream from the dam, a sequence of geomorphic processes may ultimately lead to a new equilibrium channel depending on the mass and grain size of the sediment. This paper focuses on the geomorphic effects that dams have on river systems and their ecological repercussions, with case studies from the western U.S.

Abstracts

Dam Removal and River Restoration in the Klamath Basin

Joshua Lucas, Integrated Science Education, Western Oregon University, email: jlucas14@wou.edu

There is ongoing conflict in the Klamath River basin with diverse stakeholders and disparate interests competing for usage of vital water resources. In addition, there are several dams along the Klamath that have significantly altered the hydrologic regime of the river system. Pacific Power, and companies like them, view dams as beneficial sources of clean and renewable energy. The farmers that cultivate the area view the dams as irrigation controls for their fields. Fish ecologists view the dams as disrupting the fragile ecosystem of salmon and blocking fish passage. The Native Americans call the basin their home and view the river as a sacred being that benefits their way of life. A coalition of stakeholders have joined forces to remove some of the dams in order to restore the river to its natural state, while power companies and irrigators are trying to sustain an economic foothold in the region. Water usage in the Klamath basin has a complicated history, with many perspectives and no easy answers. The fight for an equalized and healthy river system continues. This paper provides an overview of the issues and strategies involved therein.

Abstracts

The Role of Beaver Dams in Riparian Habitat of the Pacific Northwest

Hunter Collins, Earth and Physical Science Dept., Western Oregon University, email: hcollins14@wou.edu

This paper discusses the historic geomorphic impacts of beaver populations in the Pacific Northwest and resulting influence on riparian habitat. Trapping and landscape alteration following post-European settlement resulted in an order of magnitude reduction in beaver population, with dramatic alteration of hydrology and sediment distribution in river systems. Population reduction diminished wetland acreage, altered channel complexity and reduced salmonid production potential by as much as 60%. Recent studies suggest that the ecological significance of beaver dams in the Pacific Northwest is far greater than originally believed, hence replenishing beaver populations is a key component of salmonid recovery strategies.

Abstracts

Hydraulic Connectivity of Floodplains and Channels as Restoration Strategy in the Willamette Valley

Will Edwards, Earth and Physical Science Dept., Western Oregon University, email: wedwards13@wou.edu

This study examines historic floodplain function and related restoration actions in the Willamette Valley of Oregon. In the last 100 years, the Willamette River's sediment load has been reduced substantially; peak flows are now confined to the river's main channel by dams, roads, levees, and railroads which have hydraulically disconnected floodplains. Lateral migration has been restricted, sediment load reduced, wetlands minimized and ecosystem services compromised. This reduction in coarse sediment load, floodplain area, and channel migration has drastically changed the available terrain for indigenous vegetation and, subsequently, reduction in fish breeding grounds. Restoration actions are aimed at improving hydraulic connectivity between the river channel and floodplain. Methods include excavation to reconnect floodplains, removing dams, adding riparian vegetation, and gravel recruitment. Increasing floodplain connectivity, wetland acreage and side-channel areas are critical for restoring salmonid habitat in the Willamette Valley.

Abstracts

Melting in the mantle wedge: Quantifying the effects of crustal thickening and viscous decoupling on melt production with application to the Cascadia subduction zone

Jiaming Yang, Department of Geology, Portland State University, email: jiaming@pdx.edu

Subduction zones are often characterized by a narrow chain of active arc volcanoes at the surface. This magmatism is sustained by the complex interactions between the subducting slab and the overlying mantle. Partial melting of mantle peridotite is achieved by fluid induced flux melting and decompression melting due to corner flow. Crustal evolution and changes in temperature, flow, and pressure fields in the mantle wedge have a strong effect on the generation of melt. This study incorporates modern constraints from the Cascadia subduction zone and investigates the effects on melt production of crustal thickening and viscous decoupling of the shallow slab-mantle interface. I modified a 2-D finite volume mantle convection code to numerically simulate melt generation based on the parameterization of hydrous, adiabatic melting from Katz et al. (2003). Testable hypotheses are: crustal thickening beneath the arc causes melting to migrate trenchward, while decoupling shifts the location of melt production landward.

Abstracts

Approaches to River Restoration and Salmonid Habitat Improvement in the Pacific Northwest

David Takano, Integrated Science Education, Western Oregon University, email: dtakano12@wou.edu

For years, Pacific Northwest salmonids have faced endangerment and have had their population size threatened. As a result, millions of dollars have been invested annually to restore their natural habitat, however completed projects have had little evaluation on effectiveness of treatment. Along with varied results from restoration techniques, there is a dispute within the scientific community over success and effectiveness. Consequently stream rehabilitation experts have created a hierarchical strategy for site specific restoration assessment, which include: (1) assessment of watershed processes, (2) protecting already existing high-quality habitats, and (3) understanding effectiveness of current techniques for habitat rehabilitation. After assessing the habitat site, there are a number of options. First and foremost, the most important task is protecting current high-quality habitats; then reopening or repairing high quality habitats that were cut-off through means of artificial blockages (e.g. roads, bridges, culverts). Once habitat has been repaired, monitoring of the resulting geomorphic (e.g. movement of sediment), hydrologic, and riparian processes (e.g .side-bank maintenance, alteration) is required. It is essential that one evaluates the effectiveness of the alterations for the biological and physical processes of the watershed following restoration. This paper provides an overview of the river restoration techniques and methodologies applied in the Pacific Northwest.

Abstracts

Lightning Stroke Rate, Distribution and Energy Release During Volcanic Eruptions at Kelud, Indonesia, and Calbuco Chile

Kirstin A. Hargie, Alexa R. Van Eaton, John W. Ewert, Robert H. Holzworth, Portland State University, USGS Cascades Volcano Observatory, and University of Washington, email: Portland State University, USGS Cascades Volcano Observatory, and University of Washington

Timely detection and reporting of volcanic ash cloud dispersal is an ongoing challenge in volcanic hazards monitoring. Lighting data collected by the World Wide Lightning Location Network (WWLLN) has recently been used to complement data such as weather radar, satellite, and seismic data to improve timeliness of eruption alerts and characterization of eruption style. A current challenge with using WWLLN lightning is that meteorological lightning around volcanic vents creates false alerts. This is the first study to examine the stroke energy of WWLLN volcanic lightning in order to characterize it and examine if it differs from meteorological lightning for two eruptions Kelud, Indonesia (2014), and Calbuco, Chile (2015). Observations of volcanic lightning energies in space and time indicate that stroke energy and distribution can be used to interpret eruption style of multi-phase eruptions, and evaluate regional differences in volcanic and meteorological lightning at high latitude or temperate-climate volcanoes. However, delayed onset of high-energy strokes may hinder early alerting, except at volcanoes without much meteorological lightning.