

## Undergraduate Research Symposium May 16, 2014 Mary Gates Hall

### Online Proceedings

1F

#### EVOLUTION, ECOLOGY, AND ENVIRONMENT

Session Moderator: Caroline Stromberg, Biology

238 MGH

12:30 PM to 2:15 PM

\* Note: Titles in order of presentation.

##### **Comparative Bone Histology of *Lagomorpha* and *Sciuridae* Femora across an Elevation Gradient**

*Jacqueline Kinsey (Jackie) Lungmus, Senior, Anthropology  
UW Honors Program*

*Mentor: Patricia Kramer, Anthropology*

The influence of environmental oxygen level on the development and histological characteristics of mammalian bones has only recently begun to be explored by the biological sciences. By utilizing bone histology as the methodology, this research works to identify and analyze the influence of environmental atmospheric hypoxia on the characteristics of the microstructure of mammalian femora. This study focuses on wild caught animals of the order *Lagomorpha* and the family *Sciuridae*, provided by the Burke Museum of Natural History. Data was collected on bone wall thickness and a wide variety of mechanical properties in order observe any possible patterns and trends as the amount of oxygen in the environment decreases. The comparison is intra-species, and each animal is collected from a discrete elevational point and compared to animals from higher or lower discrete elevations. By using paleontological preparation methods we can strengthen our ability to make assumptions through evolutionary history and into the fossil record. The implications of this research are possible inferences about the universal effects of elevation, and as a proxy, oxygen level, on the growth and mechanical properties of mammalian bone. Because oxygen is believed to be a macroevolutionary pressure, identifying the physical manifestations of oxygen's influence within bones would further our broad level understanding of how an organism's habitat and environment influences the mammalian body.

##### ***Chenopodium* spp. Seed Use at North Creek Shelter, Utah**

*Kayla Worthey, Senior, Anthropology: Archaeological Sciences*

*Mary Gates Scholar, UW Honors Program,*

*Undergraduate Research Conference Travel Awardee*

*Mentor: Donald Grayson, Anthropology*

*Mentor: Lisbeth Louderback, Anthropology*

Cultivation of annual species of goosefoot (*Chenopodium/Amaranthus* spp.) for food was practiced by the ethnographic Southern Paiute groups in southern Utah (Kelly 1932-1934, Fowler 1995). Yet our understanding of the archaeological use of these plants in the northern Colorado Plateau is limited. This study documents use of these important species over time and examines evidence for *Chenopodium berlandieri* management at North Creek Shelter (NCS), an archaeological site in the Escalante river valley of southern Utah. NCS contains a rich macrobotanical sequence spanning the early Holocene to Proto-historic times, of which *Chenopodium* spp. fruits and seeds form the largest dietary component. Here preliminary results are presented on the use of *Chenopodium* spp. by examining 1) change in *Chenopodium* spp. abundance throughout the Holocene archaeological record and 2) concurrent morphological changes in the fruit margins and/or seed coats of *C. berlandieri*. To my knowledge, this is the first attempt to evaluate archaeological evidence for management of *Chenopodium* spp. in the northern Colorado Plateau. Findings of this study provide a local history of *Chenopodium* spp. use and an archaeological context for ethnographic data on wild plant horticulture in the region.

##### **What Describes A Successful Urban Ecological Restoration Project?**

*Yiyan Ge, Senior, Economics, Environmental Studies*

*Mary Gates Scholar, UW Honors Program*

*Mentor: Gordon Bradley, Environmental and Forest Sciences*

*Mentor: P. Sean McDonald, Program on the Environment*

*Mentor: Martha Moritz, SEFS, UW Grounds Management*

Urban restoration is a burgeoning movement in our increasingly urbanized but ecologically degraded living places. The success of an urban restoration project is usually measured against only ecological principles, such as complex vegetation structure, increasing biodiversity, and improved ecosystem services. The narrow set of performance criteria ignores social factors contributing to successful urban restora-

tion practice, which potentially hinders further improvements on urban restoration projects. The study aims to examine impacts of participants' cultural awareness and availability of long-term stewardship resources, as two examples of social factors on the outcome of urban restoration projects and also to create representative social indicators that can be adopted in urban restoration evaluations. To understand these two social variables, I conducted surveys on restoration volunteers and interviews with project managers/volunteer coordinators of local restoration groups, as well as extensive literature reviews. My internship as the volunteer coordinator for the Kincaid Ravine restoration project also provided first-hand experience working with volunteers on urban forest restoration. Findings suggest that two factors of urban ecological restoration projects selected can affect the outcome of restoration projects through various means therefore need to be incorporated into restoration evaluations. My research serves as a case study of two specific social factors; further research on the impacts of other social variables on the outcome of urban restoration projects is required. Moreover, it lays the ground for further efforts in developing social indicators to evaluate urban restoration practice, which is a necessary step towards promoting comprehensive urban ecological restoration.

#### **Purpose in Preservation: Management of a Forest Service Historic Property**

*Alana Rey Vidmar, Senior, Community, Environment, & Planning*

*Mentor: Jill Sterrett, UW Dept. of Urban Design and Planning*

Historic structures and sites on public, federally owned USDA Forest Service lands are reaching a pivotal point in time where preserving the structures becomes an integral part of preserving the legacy of the agency itself. The goal of the Forest Service is to conserve natural resources and the historic integrity of their properties. One of the most popular dilemmas for the Forest Service Heritage Program is how to maintain historic sites to meet the needs of contemporary uses. One such site is Koma Kulshan Ranger Station, located on the Mount Baker-Snoqualmie National Forest. By researching the site history and significance, and by conducting site visits, this project will evaluate the site in terms of historic integrity to determine what to preserve and maintain, and why. I have conducted research on how to prepare an Historic Properties Management Plan (HPMP) for the Koma Kulshan Ranger Station. I will coordinate with Forest Service staff in order to combine research from the site and report research into an HPMP. This plan will create an outline for contemporary use of the site and existing historic buildings, with the goal of maintaining the historic integrity of the site. This plan will be submitted to the Heritage Program of the Mount Baker-Snoqualmie National Forest in order to guide future maintenance and use of the site, and assist the Forest Service

in their goal to be proactive in their mission to maintain the use and history of their sites.

#### **Stormwater, Stewardship, and Service Learning: Tracking Contaminants as a Community Outreach Project**

*Austin Jennings, Senior, Environmental Science, UW Tacoma*  
*Mentor: Joyce Dinglasan-Panlilio, Interdisciplinary Arts & Sciences - Science and Mathematics*

Since 2009, students in First Creek Middle School's Environmental Science Club have been collecting water samples from a local creek running behind their campus as a part of an ongoing service learning partnership with the University of Washington Tacoma. These monthly samples, along with samples taken at two other locations along the stream, have been analyzed for several potential contaminants: select metals, nutrients, and emerging environmental contaminants known as perfluorinated organic acids. Analysis was conducted using various laboratory-grade analytical techniques and equipment including Graphite Furnace Atomic Absorption Spectroscopy (GF-AAS), SmartChem Discrete Nutrient Analyzer, and Liquid Chromatography-Tandem Mass Spectrometry (LCMS). The results were compared with data spanning back to the beginning of the service learning project and correlated with rain events in order to track contaminant levels over time and identify the effects of stormwater on pollutant levels. These results are also being used to help Science Club students better understand environmental processes and challenges associated with ecological restoration, while encouraging advanced learning through classroom based analyses which they have conducted themselves. Through improved understanding of pollutant transport and stormwater contamination, results may also be useful in identifying and quantifying the need for further community-based stewardship programs designed to help improve Tacoma's green spaces.

#### **Applications of RADAR and Object-based Image Analysis for Yellowstone National Park's Multitemporal Wetland Dynamics**

*Max Nathaniel Sugarman, Senior, Environmental Science & Resource Management, International Studies*

*UW Honors Program*

*Mentor: L. Monika Moskal, College of the Environment*

*Mentor: Meghan Halabisky, Environmental and forest sciences*

Wetlands provide critical habitat and ecosystem services in high-elevation semiarid environments such as Yellowstone National Park. Climate change is shifting patterns of precipitation and consequently the hydrological regimes of wetlands. To better understand the influence of precipitation on wetland hydrology, I used high-resolution remote sensing data to compare changes in wetland area to local precipitation patterns.

Wetlands are expected to shrink in drought years relative to normal precipitation years. Initially, wetland areas were delineated with RADAR (Radio Detection And Ranging) and aerial photographs through object-based image analysis – using spatial and spectral information to analyze images. Then, wetland pixels were extracted from Landsat satellite imagery over several years of normal and drought conditions. Finally, wetland area was matched against local precipitation data. Based on previous methods and similar analyses, the wetlands were expected to have variable and local hydrological patterns. By identifying wetlands that are vulnerable to climatic change, park managers can best identify wetlands that need attention for conservation. RADAR, as a widely available dataset, can also be used across a broader scope than other actively sensed data. Expanding the applications of RADAR-based wetland delineation across a wider area will reveal further nuances of RADAR’s potential for ecological research and management.

### **The Chengdu Plain and Water Quality: A Comparative Study of the Effects of Settlement Patterns**

*Jenna Kristin (Jenna) Pang, Junior, Mechanical Engineering  
Mary Gates Scholar*

*Mentor: Stevan Harrell, Anthropology*

For thousands of years, the Chengdu Plain in Sichuan, China has been characterized by the *linpan* settlement pattern, a system where the family compound is located amongst the lands they farm as well as thickets of bamboo and trees, creating a patchwork of farmland and human life across the Plain. A recent Chinese government program entitled “A New Socialist Countryside” threatens this unique pattern through nationwide reconsolidation of rural households into concentrated villages. This style of living undoubtedly places a new ecological strain on the Chengdu Plain, an effect believed to be more serious due to the concentration of environmental pollutants compared to the former dispersed pattern of waste flows. I sampled water in an area with both new and old settlement patterns, measuring the levels of nitrates, phosphates, ammonia and chemical oxygen demand. Through a comparative study of the results, initial findings point towards supporting the hypothesis that consolidated housing is more ecologically harmful than the *linpan*. The consolidation of the Chengdu Plain presents the exciting opportunity to capture and record the effects of modernization within rural farmland.

### **Finding the Center of Local Food**

*Emily Noyd, Senior, Environmental Studies*

*Mentor: P. Sean McDonald, Program on the Environment*

The U.S. food system has been de-localized from decades of industrialization and globalization. There have been many environmental and social repercussions, including loss of farmland, devaluing of farmers, loss of food sovereignty, and a consumer disconnect. How can we support a strong local

food economy and shorten the distance from farm to table? Organizations and agencies play a key role in facilitating the increasingly popular local food movement in the Puget Sound region. The purpose of this project was to analyze the capacity and affinity of each group, and investigate how a communication network could lead to greater success. My internship with American Farmland Trust researched these groups and organized them based on focal area. This served as a preliminary effort to map the overarching shared goals of the movement. Supplemental research was conducted through an extensive review of published literature and interviews. The results suggest that defining the “center” of the movement through a formal communication network and regional planning will increase overall success. Additionally, there are severe gaps in the local food supply chain and excessive emphasis in other areas that could be reallocated to better serve the broader community. A local food system with strong coverage from farm to table is imperative for the future of sustainability and food security in the region, and similar efforts elsewhere could serve to strengthen food systems nationwide.