SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

Table of Contents

i  WHY UNDERGRADUATE RESEARCH?

ii  PARTICIPATING PROGRAMS

iv  PROGRAM SPONSORS

1  ABSTRACTS - POSTER PRESENTATIONS

POSTER SESSION SCHEDULE

Thursday, August 11, 2016

Joe Crowley Student Union, Ballroom C Lobby
2:00PM – 2:30PM  Registration and Poster Hanging

Joe Crowley Student Union, Ballroom C
2:30PM – 2:45PM  Welcome
Scott Mensing, Professor of Geography and Director, Undergraduate Research
Nicholas Winner and Anita Albanese Senior Co-Editors, Nevada State
Undergraduate Research Journal

2:45PM – 4:30PM  Poster Symposium and Reception
WHY UNDERGRADUATE RESEARCH?

Develop Skills to Conduct Research:

The job market is continuously evolving and the rate of change is fast because of the rapid development of new technologies. The job market is also highly competitive as employers try to be efficient and do more with less. An adaptable workforce gives employers an edge and hence the ability to adapt is a requirement and no longer a luxury. Furthermore, effective communication skills are now essential in nearly all fields of practice. Undergraduate research teaches students the process of developing creative ideas, formulating and executing research and presenting the outcome. The skills learned through undergraduate research enable the college graduate to develop and adapt to new ideas and pursue them in a systematic way. The ability to communicate, both in written and verbal form, enhances the overall effectiveness of the individual and helps to make her/him a success.

Develop and Produce New Knowledge:

One of the major roles of universities is to create and investigate new ideas. Undergraduate students can be an important part of teams that often involve graduate students and research associates, all operating under the guidance of a faculty mentor. Because of their fresh and unbiased look at new ideas, undergraduate students often strengthen the research team and can positively affect the direction of research.

To Motivate Talented Students and Recruit Them to Graduate School:

Many highly capable students do not pursue graduate degrees, frequently because of a lack of understanding about the possibilities that graduate education offer both during school and following graduation. The perception that graduate education is hard, costly and not rewarding is commonly overcome by becoming involved in research as an undergraduate student. The satisfaction that comes from solving a problem or attempting a creative endeavor that has not previously been attempted can create a new perspective and potentially encourage students to attend graduate school.

Improve a Sense of Community and Group Dynamic:

The exposure of many students to the university setting is often limited to attending classes and occasionally meeting with an advisor. Undergraduate research provides a mechanism for students to interact more closely and frequently with faculty mentors and other researchers on campus. The improved sense of belonging and accomplishment enriches the educational experience of the student and provides opportunities to explore potential career paths.

Visit our website for upcoming solicitations and more information:
www.unr.edu/ugresearch
The Honors Undergraduate Research Awards (HURA), administered by the Office of Undergraduate Research, is open to all senior Honors students at UNR. The awards are made in the fall of each year and provide research support for both the student and the faculty mentor, and are intended to support costs associated with completing the Honors thesis.

PARTICIPATING PROGRAMS

Experimental Program for the Stimulation of Competitive Research (NSF EPSCoR)

The Nevada System of Higher Education (NSHE) received a Research Infrastructure Improvement (RII) Award from the National Science Foundation’s Experimental Program to Stimulate Competitive Research (NSF EPSCoR). The Solar Energy-Water-Environment Nexus in Nevada project’s mission is to advance knowledge and discovery through research on solar energy generation, its environmental impacts and the associated water issues, and accelerate this research by developing new capabilities in cyberinfrastructure in Nevada. Academic year EPSCoR grant proposals are solicited annually in the fall semester. Successful proposals are funded up to $4,000 for the student and $750 for the faculty mentor.

Honors Undergraduate Research Award

The Honors Undergraduate Research Awards (HURA), administered by the Office of Undergraduate Research, is open to all senior Honors students at UNR. The awards are made in the fall of each year and provide research support for both the student and the faculty mentor, and are intended to support costs associated with completing the Honors thesis.

IDeA Network of Biomedical Research Excellence (Nevada INBRE)

Nevada INBRE, part of the IDeA Network of Biomedical Research Excellence, is a National Institutes of Health program designed to help traditionally underfunded states build biomedical infrastructure. Nevada INBRE also works with NSHE partner institutions to promote biomedical research knowledge and educational opportunities across the state of Nevada via biomedical and science pipeline programs.

McNair Scholars Program (McNair)

The McNair Scholars Program is a federal TRIO program funded at 194 institutions across the United States and Puerto Rico which is designed to prepare undergraduate students for doctoral studies through involvement in research and other scholarly activities. McNair participants are either first-generation college students with financial need, or members of a group that is traditionally underrepresented in graduate education.

Nevada Undergraduate Research Award

The most popular program administered by the Office of Undergraduate Research has been the Nevada Undergraduate Research Awards. These awards are co-funded by the Office of the Vice President for Research and Innovation and the ASUN and are granted every spring semester and last for one year. All UNR students are eligible and research, scholarship, and creative activity in any discipline are supported. Students who receive awards are able to pursue extracurricular research projects that they have developed with a faculty mentor. Approximately thirty awards are made annually on a competitive basis. The proposals are due in April with awards up to $1,500 made at the end of the spring term.
National Science Foundation Research Experiences for Undergraduates

NSF funds a large number of research opportunities for undergraduate students through its REU Sites program. An REU Site consists of a group of ten or so undergraduates who work in the research programs of the host institution. Each student is associated with a specific research project, where he/she works closely with the faculty and other researchers. Students are granted stipends and, in many cases, assistance with housing and travel. Undergraduate students supported with NSF funds must be citizens or permanent residents of the United States or its possessions. An REU Site may be at either a US or foreign location.

NVSCG Rise and HOP

Designed to support independently conceived research or hands-on-projects by NSHE undergraduate students in disciplines that will help advance the missions and goals of NASA. RISE and HOP projects should generate measurable results or advancements in Science, Technology, Engineering, or Math (STEM) research that are relevant to NASA’s science and technology goals.

International Research Experience for Undergraduates

University of Nevada, Reno Office of Undergraduate Research and the University Study Abroad Consortium (USAC) offers this new program aimed at providing undergraduate students an opportunity to do research abroad and earn credits towards their degree. Students selected for this program participate in an 8-10 week research experience with a mentor at a university in another country under the auspices of the USAC program and UNR Office for Undergraduate Research. Students work one-on-one with a selected mentor and their research team on an active research project in their field of interest. This program is designed to allow students to have an international research experience while still making progress towards completing their major and particularly supports students in STEM disciplines.
The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense. With an annual budget of about $6.06 billion, we are the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing."

The goal of the NSF EPSCoR and NSHE supported program for Nevada Infrastructure for Climate Change Science, Education and Outreach is to create a statewide interdisciplinary program that stimulates transformative research, education and outreach on the effects of regional climate change on ecosystem resources, and supports use of this knowledge by policy makers. The project will build capacity to model regional climate change, evaluate methods to downscale model output, understand and quantify key ecological and hydrological processes, translate climate change science into formats usable by decision-makers, integrate models and data, and transform how students learn about climate change. In addition, this program has enhanced graduate education, stimulated undergraduate student research, promoted the involvement of women and underrepresented groups in STEM, and improved the pipeline for science and engineering through support of innovative K-12 science and math programs.

The Office of Undergraduate Research works to foster an atmosphere of discovery and scholarship for all undergraduates, graduate students, and faculty. Undergraduate research provides unique opportunities for students and faculty to address complex research issues of critical importance to the state of Nevada.

The Associated Students of the University of Nevada (ASUN) is made up of every undergraduate student at the University of Nevada, Reno. We provide a means for students to voice concerns and address issues at the university, local, state, national, and international levels. We also provide information to students on upcoming events, student events, student services, clubs, and more. We are committed to enhancing our university and enriching students just as we have since our inception in 1898.

If you have any questions about ASUN, please visit the website at http://www.nevadaASUN.com, call 784-6589, or visit our offices on the 3rd floor of The Joe Crowley Student Union in the Center for Student Engagement.

Established in 1864, the University of Nevada, Reno is Nevada's land-grant institution. Within the University, ten colleges offer undergraduate and graduate majors. Graduate-level training and research, including a number of doctoral-level programs, further the University's mission to create scholarly activity. The university is an integral part of the thriving Reno-Sparks area.
Noah Amme

Title: Temporal and Spatial Patterns of Pinyon Expansion at Upper and Lower Tree Lines in the Shoshone Range of Central Nevada
Funding Source: NSF REU The Value of Snow
Mentor(s): Peter Weisberg
Department: Natural Resources and Environmental Science
Institution: UNR

The pinyon-juniper forest (PJ) is a major ecosystem that covers vast areas of land in the Great Basin of the American West. Many PJ forests are drastically changing in structure and range due to anthropogenic stressors such as land use and climate change and these changes have both human and ecological consequences. This research seeks to elucidate the variables that are constraining expansion of the pinyon pine, hypothesizing that pinyons are water limited at their lower tree line and temperature limited at their upper tree line. We used dendrochronology to investigate the temporal and spatial structure of the pinyon pine forests at their lower and upper ecotonal boundaries of expansion. Field sampling was conducted in Barrett Canyon in the Shoshone Range of Central Nevada (in a forest belt dominated by pinyon pine) at elevations ranging from ~2100~2700 meters. We established belt transects perpendicular to topographic contour lines at the upper and lower edges of the forests. Within each transect, the height and basal diameter of each individual pinyon were recorded and establishment dates were estimated from increment cores and stem sections. Preliminary results suggest that pinyon pine expansion at the lower tree line appears to be dominated by discrete patches of younger and smaller trees that surround larger parent trees. This supports a pattern of episodic advancement at the lower tree line in which parent trees facilitate the establishment of new seedlings. The upper tree line transects appears to have a more random assortment of heights and diameters, indicating no clear evidence that the tree line is expanding upwards. The measurements and age dates gathered in this project will allow for an exploration of correlation between climate signals and the differing patterns of establishment at each tree line.

Herah Ashraf

Title: Identifying Post-Translational Modification (PTM) in Human Ovarian Cancer Cells
Funding Source: IDeA Network of Biomedical Research Excellence (INBRE)
Mentor(s): So Young Ryu
Department: School of Community Health Sciences
Institution: UNR

Ovarian cancer is the fifth leading cause of cancer death among women in the United States. Studying the mechanism of ovarian cancer may provide valuable information to develop novel treatment option and/or drug targets. Recognizing that the perturbation of protein post-translational modifications (PTMs) plays an important role in cancer, our goal is to identify as many protein PTMs as possible in human ovarian cancer cells using mass spectrometry coupled with bioinformatics tools. There are many types of PTMs such as phosphorylation, glycosylation, and methylation. Among these, we are particularly interested in studying phosphorylation, the most common mechanism of regulating protein function and transmitting signals throughout the cells. To achieve our goal, ovarian cancer cells of six patients were analyzed by mass spectrometry with a phosphopeptide enrichment step. Then, data were processed by a bioinformatics tool called MaxQuant. In this summer research project, we summarized protein identification results using Microsoft excel. Among 2,207 identified proteins, we identified 1,547 proteins with phosphorylation. Among 2,987 identified phosphopeptides, 87.55% of them had one phosphorylation modification site, while the rest had two or three phosphorylation modification sites. We believe that cataloguing PTM identifications to lay a foundation for the future quantitative comparative study between different subtypes of ovarian cancer patients.
For forest trees growing in water-limited ecosystems similar to Nevada, the seedling establishment phase is particularly sensitive to drought. However, climate-induced water stress is challenging to quantify for tree seedlings under field conditions across large areas, although such data are needed to generate projecting models for drought effects on forests. Certain proxy measures of drought stress, including chlorophyll fluorescence and spectroscopy, have potential for landscape-level modeling of drought-related mortality risk but require exact calibration and validation. New satellite based innovations in fluorescence and spectroscopic readings are developing to allow ecosystem wide measurements. These measurements allow insight into what is happening at the molecular level before it affects mortality, which can be important in influencing management decisions. The overall goal of our project is to validate proxies of water stress in a controlled experimental setting and to evaluate the relationships between chlorophyll fluorescence and spectral signals in two water stressed coniferous species. By assessing the relationship between watering treatments and spectral signature temporally we will develop a functionally relevant spectral drought index related to our watering treatments, growth measurements, and chlorophyll fluorescence. Spectral results will also be used to validate and expand upon existing investigated indices such as NDVI, NDWI, WI, MSI, NDII, and red edge position.

Human immunodeficiency virus-1 (HIV-1) is the primary pathogen of a chronic and life-threatening disease called Acquired immunodeficiency syndrome (AIDS). Cyclotriazadisulfonamide or CADA has emerged as a promising CD4 attachment inhibitor as it was shown to down-modulate the expression of CD4, thus inhibiting viral replication of various strains of HIV and simian immunodeficiency virus (SIV). To date, a new pyridine-fused CADA analog, LAL001 was successfully synthesized and tested for CD4 down-modulation. My project will be centered on the synthesis of this CADA compound and exploring the drug like capabilities. I will investigate the hydrophobicity and the hydrophilicity of this compound. It is our goal that the pyridine CADA analogs will have better water solubilities and membrane permeabilities.
Cameron Berg

Title: A Potential Photo-Switching System  
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP  
Mentor(s): Robert Sheridan  
Department: Chemistry  
Institution: UNR

Carbene’s are a class of highly reactive carbon molecules observable only at extremely low temperatures. Due to their electronic structure, they are able to exist in multiple states, dependent on attached substituents. If an electron rich substituent, the carbene’s ground state will be that of a non-magnetic singlet state, opening up an empty P orbital to allow electron donation. Inversely an electron withdrawing will have an opposite affect, making the magnetic triplet the favored ground state. We plan to exploit this switch-ability by attaching a molecule to a carbene that can be induced to changing its electronic configuration. Through previous work we have become well acquainted with a molecule, called a chromene, that can change it’s electron configuration when exposed to UV light. Here we will show proposed synthesis methods and modeling on how the chromene works in switching its electron configuration when exposed to light and how this will affect the carbene. These so called photo-switchable systems have only been observed in a few molecules and are proposed to have potential in micro-scale memory storage and processing.

David Busby

Title: Modeling the Temperature Profile of Shasta Reservoir with CE-QUAL-W2 During 2015 Drought Conditions  
Funding Source: NSF REU The Value of Snow  
Mentor(s): Laurel Saito  
Department: Natural Resources and Environmental Science  
Institution: UNR

The drought conditions of 2015 in northern California presented challenges for Shasta Reservoir managers to meet downstream temperature requirements for Chinook salmon. Shasta managers utilize a temperature control device (TCD) to manage dam discharge temperatures by withdrawing water at selected elevations in the water column. A two-dimensional CE-QUAL-W2 (W2) model has been used to understand the impact of TCD operations on reservoir and discharge dynamics. The conditions of 2015 provide a valuable dataset for assessing the efficacy of modeling the temperature profile of the reservoir under very low inflow volumes. Previous studies have started the model on January 1 with an initial isothermal temperature profile of 9°C. Alternatively, we ran the model from August 1, 2015 when the reservoir was stratified and examined the sensitivity of modeled temperatures to the initial water temperature profile. We compared modeled temperature profiles on 9 days in 2015 between August 1 and November 21. The model was started with a 9°C isothermal profile, a 14°C isothermal profile (14°C was the measured vertical temperature profile average on August 1), and the measured vertically-varying temperature profile on August 1. Results indicate that the latter run produced the best temperature profile output. We then simulated how two future air temperature scenarios would impact the temperature profile of Shasta in 2015. We hypothesized that warmer air temperatures will cause greater temperature variation through the vertical profile, and a decrease in the volume of the cold water pool. This presentation will describe the effects of initial temperature profiles when running W2 simulations that start on a date with a stratified water column, as well as the effects that warmer air temperatures would have on the reservoir temperature profile throughout 2015. Project results will assist managers in preparing for the changes in reservoir hydrodynamics that accompany a changing climate.
Kirsten Casey

Title: In Search of Corrections to Newtonian Gravity  
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP  
Mentor(s): Andrew Geraci  
Department: Physics  
Institution: UNR

Gravity is perhaps the most familiar and yet least understood of all fundamental forces. In most circumstances it agrees with the principles described by Isaac Newton hundreds of years ago. However, some theories suggest that Newton’s laws could break down when the distance between objects becomes extremely small. If proven, these theories would represent groundbreaking new physics and our current understanding of gravity would be fundamentally transformed. For my research project, I worked with a postdoc to create an ultra-sensitive force detector in order to measure these theoretical forces. The force detector works by levitating a silica nanosphere in an optical cavity. The displacement of the nanosphere is then measured and the gravitational force is calculated from that displacement. I focused on keeping the temperature of the cavity stable using a PID (proportional-integral-derivative) circuit, and ensuring that the cavity stays locked to the frequency of the laser used to levitate the nanospheres. The ultimate goal is to keep the cavity stable enough to begin capturing nanospheres at high vacuum and to empirically determine the best method to control the nanosphere’s position within the optical cavity.

Barrie Chileen

Title: An Evaluation of Gridded Temperature Products and their Effectiveness in Modeling Small Scale Ambient Temperature  
Funding Source: NSF REU The Value of Snow  
Mentor(s): Thomas Albright  
Department: Geography  
Institution: UNR

The use of gridded temperature products is becoming increasingly prevalent in ecological research due to their accessibility, low cost, and spatial and temporal coverage. While a few studies have compared griddded products against each other and against weather station data, little research exists that attempts to verify the accuracy of these gridded products on finer spatial scales in field settings. In this study, we use two networks of temperature sensors to evaluate the effectiveness of these widely used gridded products in modeling ambient temperatures and compare tradeoffs between spatial and temporal resolution of gridded products. We deployed 65 temperature sensors in radiation shields (Holden 2013) at the Kofa wildlife refuge in Southwestern Arizona and 80 sensors on the Snake Range of Eastern Nevada. From 2014 to 2015, the sensors recorded hourly temperatures. We then compared the sensor-collected temperatures against three widely used gridded temperature products that have varying spatial and temporal resolutions: NLDAS 10 km at hourly intervals, PRISM 4 km at daily intervals and Daymet 1 km at daily intervals. In order to compare the daily products, it was necessary to interpolate hourly values from daily minima and maxima. To do this, two methods of hourly interpolation (a cosine fit with variable sunrise and the Chillr package in R) were compared against sensor readings. We find that gridded products provide strong overall fits with sampled datasets but have a tendency to underestimate maxima and overestimate minima. Studies involving processes that are sensitive extremes and threshold based indices may be negatively affected by these biases. Of the gridded products used, Daymet was the most accurate at capturing Tmax and hourly temperatures (average R2 > 0.90), while NLDAS was the least accurate (R2 = 0.70). While this suggests that the benefits of finer spatial resolution may outweigh the benefits of finer temporal resolution, other factors unrelated to resolution may have contributed to the differences among products.
James Condie

Title: Fluctuations of Solar Photovoltaic Electricity Generation Across Las Vegas
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Eric Wilcox
Department: Mechanical Engineering
Institution: UNR

We are interested in how solar productivity is affected by clouds and how it affects the power grid of a whole city. If households have drops in solar power, they’ll demand more electricity from the power company at that time. Power companies have a hard time dealing with rapid fluctuations in energy demand. The power company might need to turn a gas or coal generator to maintain power supply such as a combustion turbine (https://www.nvenergy.com/company/energytopics/where.cfm). Gas and coal production doesn’t just turn on or off on a dime, they take some time to get going. One other solution is that power companies distribute solar power from other parts of the grid to ease the places where solar production might be diminished. Which leads to our question: On cloudy days, will all rooftop solar PV arrays in a city decrease energy generation together or will they fluctuate independently and thus, be able to compensate for each other? This research will assist in answering a different practical question: Are solar forecasts of specific rooftop arrays valuable? If all PV arrays tend to go down together in a city, solar forecasts are valuable. For example, solar forecasts from specific sites could help the power company predict diminishes in solar energy more accurately and they could prepare early. But if the cumulative power from all the rooftop PV arrays can compensate for each other and provide a steady supply of electricity from across the city, then these precise solar forecasts would not be as necessary.

Presley Conrad

Title: Human Perception of Red-Tailed Hawks
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Scott Bassett
Department: Geography
Institution: UNR

This research focuses on human perception of Red-tailed hawks along the urban gradient from rural to densely populated areas of Reno. In order to understand human perception of Red-tailed hawks relative to urban density, a study will be conducted by visiting the five closest houses to a nest and the five closest houses to the 732 meter radius mark from a nest (half of the average distance between nests according to the Reno Hawk Projects nest map). The survey was distributed to 28 nest locations semi-randomly selected along the urban density gradient. A total of 280 residents partook in the survey. The questions included were designed to understand the public’s overall outlook on Red-tails. Residents were asked if they had any interaction with the hawks, had a preference towards them (like/dislike), felt that their pets had been threatened, had ever removed the hawks from their property, if they raised chickens and their age was also recorded. Red-tailed hawks have been known to cause problems with poultry although they have not been shown to eat poultry in Reno regularly. Analysis of the survey will demonstrate whether or not nesting Red-tails are viewed favorably by the public or if the local residents are frustrated with their prey selection and eating habits. If the public views Red-tails in a negative light, a correlation could arise between nest failures coinciding with the loss of a mate, or possibly a pair felt threatened from human interaction and abandoned their nest; which will allow for further investigation to ask more questions of human harassment.
Since 2011, Nevada has experienced five consecutive years of severe drought as a result of historically low precipitation rates and snowpack levels. Particularly susceptible to drought are Nevada farmers and ranchers, who comprise a vital component of the state economy and generate millions of dollars in crops and livestock annually. However, they are forced to limit their production subject to the availability of water for irrigation and grazing each year due to drought. This loss of production not only adversely affects the revenues of Nevada farms, but also affects workers’ wages and employment levels throughout the entire Nevada economy. Our research estimates the total economic losses suffered by the Nevada economy in 2014 as a result of diminished agricultural production due to lack of surface water. Using a social accounting matrix model, we estimated the state’s inter-industry losses in revenue, production, income, and jobs. Additionally, because of the inclusion of households in our model and their linkages to Nevada industries, we were able to examine the distributional impacts of drought on both farm and nonfarm employee compensation (wage) levels based on household income levels, skill levels, and industrial sectors. Our findings showed that reduced agricultural production across the state most heavily diminished wage levels in high-income, skilled service sectors, especially legal and healthcare professions; losses in farm production indirectly induced a lower demand for such services and thereby decreased their associated levels of compensation. Future research will disaggregate our model of the Nevada economy to the county level, revealing effects of drought given the unique economic structure of each Nevada county. Whereas Elko County and Churchill County are largely dependent on revenue from agricultural production, more metropolitan counties, such as Washoe County and Clark County, have diversified economies that derive large portions of revenue from gaming and tourism.

Foreign Aid is a contentious subject, experts disagree on whether or not aid helps or hinders a country with regard to development and its expected outcomes. This study aims to address the question of whether or not targeted health aid is effective in developing nations, as defined by the Organization for Economic Cooperation and Development. Through a statistical investigation of targeted health aid and the outcomes measured by World Development Indicators such as Life Expectancy, Infant Mortality rates and Maternal Mortality rates, this study will determine targeted health aid effectiveness.
Common sources of energy production, such as coal and petroleum, are known to cause pollution and contribute to climate change. Alternative energy sources such as wind and solar are therefore desirable, but they sometimes produce excess energy that cannot be met by current demand. It would be beneficial to store this energy by converting it into a useful chemical form. Extra electricity can generate H\textsubscript{2} through water electrolysis. CO\textsubscript{2} from carbon capture can be combined with H\textsubscript{2} in the Sabatier process to create methane, which can then be injected into the natural gas grid. The balanced reaction is: \[ 4\text{H}_2 + \text{CO}_2 \rightarrow \text{CH}_4 + 2\text{H}_2\text{O} \] According to Le Chatelier’s principle, it should be possible to increase methane yield by removing water from the reaction site. In order to function in-situ, the adsorbent must be capable of adsorbing water at temperatures greater than 300ºC. Charcoal and activated carbon are a promising category of adsorbents. The research conducted used a pilot plant and TGA to measure the adsorption capacity of Carbon impregnated with salts. The data suggests that salt impregnation does increase adsorption capacity, but there was not enough time to test many different salts. Future research could test other salts, as well as exploring the effects of differing temperature and pressure on conversion efficiency.

Populations of the Bi-State Sage Grouse, a distinct population segment of the Greater Sage Grouse (Centrocercus urophasianus) have been declining steadily since the 1950s, a trend largely attributed to habitat loss and fragmentation due in part to Pinyon-Juniper expansion in the Great Basin region. Due to this decline, the Nevada Department of Wildlife, in partnership with the U.S. Forest Service and the Bureau of Land Management has implemented several habitat restoration projects to remove Single-leaf Pinyon Pine (Pinus monophylla) and Utah Juniper (Juniperus osteosperma) from identified Sage Grouse habitat. The China Camp field site is one such area that received treatment using hand tree thinning techniques and intermittent burn piles in 2011, and has been monitored using vegetation survey techniques for five years following treatment. Using data taken in 2011, 2014, 2015 and 2016, I determine the success of these tree-removal restoration techniques using a number of metrics. These include investigating the changes in sagebrush, graminoid and forb cover as well as the changes in invasive grass abundance and plot-level biodiversity changes. With reference to temperature and precipitation data for this site, we explore how this treatment affected the vegetation structure of this area. Here we find that over the course of the 5-year monitoring period, there has been an increase in the abundance of forbs and graminoids in treatment sites, with a slight increase in the density of sagebrush. Biodiversity also appears to have increased in treatment sites. However, there are also trends pointing towards an increase in cheatgrass (Bromus tectorum), suggesting that the tree removal treatment and subsequent burn piles, while allowing for native forb and graminoid renewal, may have also, at least temporarily, resulted in an opportunity for cheatgrass invasion. This analysis illuminates several potential effects of these Pinyon-Juniper treatment techniques. However, long-term monitoring over a broader spectrum of climatic conditions will provide a more nuanced analysis of the success of these treatment techniques.
Michelle Fuhrman

Title: Expanding the Scope of the Pauson-Khand Reaction: Dichloroacetylene as a Substrate in the Intermolecular Pauson-Khand Reaction
Funding Source: McNair Scholars Program
Mentor(s): Laina Geary
Department: Chemistry
Institution: UNR

Five-membered rings are very common in biologically active molecules, with cyclopentenones, such as cyclopentenone prostaglandins, exhibiting characteristic biological activity. The Pauson-Khand reaction (PKR) is a powerful organocobalt-mediated reaction that can be used for the efficient, atom-economical synthesis of highly-functionalized cyclopentenones from a variety of simple alkene and alkyne starting materials. However, its synthetic utility has been limited mostly to intramolecular applications, with the intermolecular variety being plagued by problems with reactivity and regioselectivity and limited in its scope mostly to reactions between strained bicyclic alkenes, such as norbornadiene, and symmetrical or terminal alkenes, which are generally more expensive than the corresponding alkenes and produce exclusively -substituted cyclopentenones. Dichloroacetylene has not been explored in organometallic reactions. It is readily produced from trichloroethylene, typically in-situ because of the explosive nature of pure dichloroacetylene. There are several procedures which can be used to stabilize dichloroacetylene, including distillation in a 1:1 molar ratio with diethyl ether. This project explores the use of dichloroacetylene as the acetylenic substrate in the PKR; the \(\text{\_\_dichloro\_\_cyclopentenone}\) products that would result would be very difficult to synthesize otherwise. Subsequent, selective functionalization of the two C-Cl bonds at the \(_-\) and \(_-\) positions is well known to proceed via various palladium-catalyzed cross-coupling reactions, resulting in a wide variety of highly-functionalized cyclopentenones.

Kasey Hewson

Title: Investigating Diurnal Streamflow Response to Compare Ecohydrological Processes at Watersheds Across the Western U.S.
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Adrian Harpold
Department: Agriculture
Institution: UNR

Mountain watersheds are critical for sustaining water for ecosystems and economic growth in the Western U.S. The purpose of this study is to improve predictions in two dominant water fluxes in mountain watersheds, evapotranspiration (ET) and snowmelt, by investigating diurnal streamflow across a range of watersheds and climate conditions. Diurnal variations in streamflow occur over 24-hour cycles due to snowmelt in the Spring and ET in the Summer. During part of the year snowmelt- and ET-mediated diurnal cycles are directly out of phase. We propose to identify this no phase transition (NPT) where the ET and snowmelt diurnal signals are canceled to investigate the role of incoming solar radiation on the timing and magnitude of hydrologic partitioning. We investigate nineteen watersheds from four sites in the Western U.S.: Bull Creek, CA, Providence Creek, CA, Reynolds Creek, ID, and HJ Andrews, OR. Preliminary results suggest that there is significant spatial variation of the NPT in the Western United States. Comparison of the NPT timing to snow disappearance suggest that this process is strongly mediated by snowmelt dynamics. We also find that the slope of the daily relationship between discharge and solar radiation approaches unity during a large portion of the snowmelt and growing season, suggesting that solar radiation is efficiently converted to latent heat. Our findings suggest that diurnal streamflow information could be an under-utilized observation for gaining insight into the water and energy budgets at catchment-scales.
Leah Heydman

Title: Analysis of Signaling Pathways in Nerve Growth
Funding Source: IDeA Network of Biomedical Research Excellence (INBRE)
Mentor(s): Thomas Kidd
Department: Biotechnology
Institution: UNR

Slit is a large secreted molecule that normally repels growing nerves in the CNS. Slit is cleaved into two fragments in vivo, but the function of this cleavage is unknown. Our analysis suggests that Slit cleavage provides a means for nerve growth via alternative signaling pathways. Recently, we have identified the protease responsible for cleaving Slit in flies. We are testing the human homolog in cell culture to see if the protease activity is evolutionarily conserved. Using CRISPR, we are generating an uncleavable slit allele to see if nerve growth is disrupted in vivo. One of the cleaved Slit fragments interacts with the Dscam receptor facilitating nerve growth. Additionally, we serendipitously discovered a Dscam isoform that appears to be constitutively active in cultured cells leading to excess of filopodia and long branching cellular extensions. This has not been tested in flies. We have generated a transgene to test the Dscam isoform in vivo using the Drosophila GAL4/UAS system. Our results will provide insight into how nerves normally grow. Spatial and temporal application of our construct has implications for treatment of spinal cord injury and neurodegeneration. Moreover, understanding the functionality of Slit fragments can help us better understand how they impact metastasis, immune responses, and regulation of body temperature.

Riley Kellermeyer

Title: ORN Activity Patterns in Drosophila larvae Elicited by Ecologically Relevant Odorants
Funding Source: Honors Undergraduate Research Award
Mentor(s): Dennis Mathew
Department: Biology
Institution: UNR

Most insects locate their food source through olfaction. In Drosophila larvae, attraction and repulsion to environmental odorants are based on the activity of 21 olfactory receptor neurons (ORNs). While a considerable amount of information has been generated regarding the ORN responses of worms, flies, and mammals to odorants, less is known about their role in driving behavioral output. This gap in knowledge prevents development of odor coding models that can elucidate general principles of information processing and instruct effective solutions for insect control. In this study, we examined the hypothesis that ecologically relevant attractive or repulsive odorants elicit specific patterns of ORN activity in the Drosophila larva. To measure this, a two-choice behavioral paradigm was used to test the behavioral response of wild-type Drosophila melanogaster larvae to 54 odorants selected from its ecological habitat. Using this behavioral screen, a panel of 10 odorants that elicited the strongest attractive or repulsive responses in larvae was identified. This panel was used to assess the response patterns among the 21 larval ORNs. For this, we expressed each larval odorant receptor in an in vivo expression system, the "empty neuron" system, and measured neural responses using single-unit electrical recordings. The panel of strong behavioral determinants elicit both excitatory and inhibitory responses from a variety of larval odors. Many of these receptor-odorant combinations exhibit varying response dynamics. Preliminary evidence suggests that ecologically relevant odorants elicit specific patterns of ORN activity. Conserved patterns of sensory neuron activity may instruct downstream olfactory coding of behavioral valence. By comparing amplitude, temporal dynamics, and distribution of all ORN responses, we aim to identify conserved patterns among sensory neuron activity elicited by attractants and repellents. The results from this study have the potential to impact development of more reliable odor coding models and to transform existing methods of insect control.
Adam Kirosingh

Title: Probability Distributions of System Average Interruption Frequency Index: A Reliability Index for Power Grid Interruptions
Funding Source: NSF REU Mathematics
Mentor(s): Javier Rojo
Department: Mathematics and Statistics
Institution: UNR

System Average Interruption Frequency Index (SAIFI) is calculated by the number of total interruptions in an electrical grid divided by the total number of customers served. The SAIFI describes the dependability of electrical grids. The frequency of electrical interruptions can be modeled using Poisson processes. Calculating the distribution of the SAIFI assesses radial branching topology and can be beneficial in designing robust electrical networks. A probability generating function describing the complex networks was manipulated in Mathematica to calculate probability distributions, expected values, and variance. Changing the rates of interruptions in the Poisson processes and varying the number of customers provides insight about consistency in complex radial systems. The model will provide a template for heterogeneous Poisson processes, like accounting for seasonal changes, or extreme scenarios involving high traffic, like the Super Bowl.

Vaughn Lewis

Title: Emerald Bay / Desolation Wilderness: Redefining Wilderness Through Rephotography
Funding Source: NSF REU The Value of Snow
Mentor(s): Peter Goin
Department: Art
Institution: UNR

Emerald Bay and Desolation Wilderness serve as case studies for how visual interpretations of wilderness affects the concept of wild lands as defined in the 1964 Wilderness Act. Emerald Bay and Desolation Wilderness represent idealized natural landscapes that have been manipulated by humans to accommodate economic development, scenic preservation, and recreational activities. As early as 1881, Emerald Bay, situated on the western side of Lake Tahoe, became a destination for tourists. Lake Tahoe remains a significant recreational destination. However, the very qualities of beauty that attract visitors are being jeopardized as the enduring appeal of the lake and the surrounding landscape is at risk due to overuse. Desolation Wilderness is one of the most popular federally protected wilderness areas in the National Wilderness Preservation System because of accessibility, close proximity to major metropolitan areas, and its natural beauty. Emerald Bay and Desolation Wilderness are built according to different standards; one is a designated wilderness area while the other is within a State Park. Together they help provoke redefining the concept of wilderness. The objective of this project is to use historical photographs and rephotography, surveying landscape changes and providing evidence that the concept of wilderness can be effectively managed.
Brandon Lopez

Title: Life Cycle Energy and GHG Impacts of Utility-Scale Solar, Wind, and Geothermal Electricity in Nevada
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Kent Hoekman
Department: Chemical and Materials Engineering
Institution: UNR

State and federal governments aim to reduce greenhouse gas emissions by constructing renewable energy plants. Unlike fossil fuel resources, renewable energy plants produce little to no environmental impact while in operation. However, the creation and eventual dismantling of these renewable energy plants requires processes that do cause environmental impacts and must be accounted for in determining the impact of the plants over their entire life cycle. A complete life cycle analysis (LCA) of photovoltaic, concentrated solar (tower and parabolic trough), wind, and geothermal power production was completed to account for environmental impact associated with the entire life cycle of the plants, from acquisition of raw material to final disposal and accounts for the intermittent nature of solar and wind energy and the location constraints on geothermal. The results of this project provide a comprehensive look at the renewable electricity being produced in Nevada and provide a comparison with the performance of fossil fuels. The results of this LCA and others like it will provide a better understanding of the impact of transitioning the current electrical grid to a more sustainable mixture. Furthermore, policy makers and investors can make more informed decisions in the discussion of how to best reduce our impact on the environment.

Stephen Lukas

Title: Evaluating the Transferability of Collaborative Modeling-Participatory Research Methods Across Snow-fed Arid Land River Systems
Funding Source: NSF REU The Value of Snow
Mentor(s): Loretta Singletary
Department: Economics
Institution: UNR

Collaborative modeling and participatory research (CM-PR) methods are increasingly undertaken to address natural resource challenges stemming from climate-induced change and the subsequent need to devise effective adaptation strategies. Advantages of CM-PR methods include scientists and stakeholders working together to enhance mutual understanding of system function to identify the impacts of proposed solutions. In particular, snow-fed arid land river systems provide a unique opportunity to utilize CM-PR due to characteristically variable water supply impacted by decreasing snowpack and increasing drought periods in addition to diverse competing demands for scarce water resources. Assessing the transferability of CM-PR methods to other snow-fed systems merits the development of a typology to characterize key attributes of these methods. Subsequently, a typology was developed based on an analysis 14 CM-PR case studies conducted in systems across the globe. From this analysis, four key criteria were identified: comparable institutional frameworks, the presence of diverse stakeholders, availability of reliable data, and shared outcomes desired by stakeholders and scientists. These transferability criteria were tested against two snow-fed arid-land river systems: the Truckee-Carson River System (18,104 km2) in northern Nevada, US, where CM-PR methods are currently being developed and implemented; and, the Aksu-Tarim River Basin (32,000 km2) in Xinjiang Province, China, where parallel climate induced water supply challenges and stakeholder communities may merit implementation of similar CM-PR methods. Analysis suggests that transferring CM-PR methods, developed for the Truckee-Carson River System study, to the Aksu-Tarim River Basin is favorable given recent advances in data availability, shifts in national water policy, and improving relations with international collaborators. Further assessment of transferability requires direct engagement on site with scientists and local stakeholders.
Matthew Mahaffey

Title: O-GlcNAc Cycling and the Effect of Oxidative Metabolism
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Patricia Berninsone
Department: Biotechnology
Institution: UNR

O-linked-\(\beta\)-N-acetylglucosamine (O-GlcNAc) modified proteins are critical in myriad cellular processes and functions, such as stress response and the cell cycle. Glycosylation plays a similar role to phosphorylation in terms of stoichiometry, localization and cycling. Abnormal O-GlcNAcylation is associated with a spectrum of diseases, including Alzheimer's disease, cancer, cardiovascular disease, and diabetes. The enzymes responsible for O-GlcNAc cycling are O-GlcNAc transferase (OGT) and O-GlcNAcase (OGA). Some of the most recently discovered glycosylated proteins have function in the mitochondria. The purpose of this research is to determine if glycosylated proteins play a role in oxidative metabolism. Oxygen consumption rate (OCR) was measured by the Seahorse Biosciences XFe24 extracellular flux analyzer in the model organism Caenorhabditis elegans (C. elegans). The impacts caused by the loss of function of OGT resulted in a decrease in oxygen consumption, while a loss of function of OGA had no impact on oxygen consumption. Mitochondrial morphology was measured using mitotracker, and mitochondrial health was measured using trimethylrhodamine (TMRM).

Wheeler Musnicki

Title: Incorporating Shape Memory Alloy Bar Test Results in Seismic Response Analysis of Bridge Columns
Funding Source: National Science Foundation Partnership for Innovation
Mentor(s): Alireza Mohebbi
Department: Civil and Environmental Engineering
Institution: UNR

Attempts are being made to improve current seismic bridge design through the use of innovative materials, such as shape memory alloys (SMA). Shape memory alloys have the ability to regain their original geometric shape through applied heat or the unloading of stress (superelastic effect). The superelastic behavior of the SMA is most desired for structural engineering application because no heat needs to be applied for the SMA to recover its deformation. Since research on structural use of SMA is fairly new, designers have limited information on how the SMA bars performs in bridge columns under seismic loading. The current study focused on finding correlation between individual SMA bar test and the performance of SMA in the plastic hinge of bridge columns. This is being done by first modeling previous experiments incorporating SMA in plastic hinge of bridge columns conducted by the University of Nevada, Reno. The two bridge columns where studied consisted of square cross sections with circular cores. Both bridge columns where cast with engineered cementitious composite (ECC) throughout the entire length. Also, both bridge columns incorporated Nickel-Titanium SMA bars in the plastic hinge region. The main difference between the two bridge columns was the length of the SMA bars, which where 18 and 13.5 inches. After modeling the bridge columns using the open source structural analysis software OpenSees developed for nonlinear dynamic and seismic analysis, the next step was to find the corresponding calculated stress to the measured strain from the experiments. Then comparing this stress-strain relationship to the measured stress-strain relationship from the individual bar tests. Finally, identifying the correlation between the two stress-strain relationships and use the information in design of SMA-reinforced bridge columns.
In this work, we report on the mechanical behavior of a dense brush of small-diameter (1-3 nm) non-catalytic multiwall (2-4 walls) vertically aligned carbon nanotubes (VACNTs), measured using spherical nanoindentation and scanning electron microscopy (SEM) in-situ micro-pillar compression testing. These VACNT brushes were produced using high temperature vacuum decomposition of 6H SiC single crystals that results in a very small 0.35 nm inter-tube distance and high density close to 0.95 g/cm³, which is 10 or more times higher than carbon nanotubes (CNTs) produced by other techniques. At these small inter-tube distances, electron beam irradiation has been shown to introduce stable links between neighboring CNTs. The purpose of this current work is to study the mechanical behavior of VACNTs subjected to such inter-tube bridging. For in-situ SEM micro-compression experiments we utilize a focus ion beam (FIB) micromachining technique to fabricate VACNT micro-pillars of varying diameters. Micro-compression testing of VACNT pillars of varying diameters allows us to study the mechanical and viscoelastic response of the VACNT bundle as a function of the amount/degree of intertube bridging. The micro-compression results demonstrate a significantly higher buckling strength for pillars with smaller diameters, suggesting reinforcement from the outer rim containing crosslinked CNTs. Decreasing the pillar diameter is also seen to cause a more brittle failure in the VACNT pillars. Our results show that increasing the volume of the crosslinked region in VACNT pillars results in an increase of their mechanical properties under compression such as their elastic moduli (which increases from ~13 GPa to ~100 GPa) and yield strength (from ~ 0.5 GPa to 4 GPa), but decreases the viscoelastic response (as well as ability to withstand large strains) of the VACNTs. These results are explained in terms of VACNT inter-tube bridging and the lack of sliding between CNTs in their crosslinked state.

Since late 2015 there has been an outbreak of Zika virus disease in South and Central America. This is particularly worrisome because of its connection to microcephaly in infants born to mothers who were infected while pregnant. There are two mass gatherings happening in 2016 in Brazil: Carnival (6-10 February 2016) and the Olympics (5-21 August 2016). These events brought large groups of foreigners to Brazil who could have been exposed to the virus and transported it back to their home country. We created a mathematical model to analyze if a group of visitors to Rio de Janeiro for either of these events would cause an outbreak in Miami, Florida when they went home. Our model shows that if conditions are assumed the same for the populations in Miami and Rio de Janeiro, the visitors to Carnival could cause an outbreak in Miami in October that in three months infects roughly 75% of the population. If, however, the parameters for the model are modified to reflect different lifestyles and vector populations in Miami, the size of the outbreak there can be reduced. The model for Rio de Janeiro suggests that by August the majority of the population will already have been infected and there will be a low number of vectors. Therefore, our model predicts that due to reduced infection rates during the Olympics the chance of visitors bringing back the disease to Miami is very low.
Sasha Ortega

Title: The Quantitative Relationship Between Litter Moisture Content and CO2 Efflux
Funding Source: Nevada Undergraduate Research Award
Mentor(s): John “Jay” Arnone III
Department: Natural Resources and Environmental Science
Institution: TMCC

We know that the decay of dead plant litter and soil organic matter releases CO2, the most important greenhouse gas, from ecosystems back to the atmosphere. It is important to better understand how environmental factors control litter decomposition in arid ecosystems because they cover almost 40% of the world’s land area and are projected to respond strongly to climate change. The objectives of our research project were to investigate the relationship between water absorption capacity of main shrub species litter in the Great Basin of Nevada and to specifically quantify (1) the threshold litter water contents are when microbial decomposition (CO2 efflux) begins and (2) at what litter water contents CO2 efflux saturates. We hypothesized that water vapor absorption due to high relative humidity (RH) will significantly stimulate CO2 efflux from litter, that the CO2 efflux will most likely begin after a certain threshold of litter moisture is met, and that the minimum thresholds will differ between plant species. We collected litter from beneath each of the three shrub species at a site near DRI in Reno, NV and incubated them overnight in glass jars kept at 100% RH to moisten the litter. We then weighed the litter sample to calculate its water content, sealed the sample in the glass jar to measure its CO2 emission rate (using an infrared gas analyzer, for ~2 min), removed the sample from the jar to allow the litter to dry, and repeated this process every hour for each sample until the sample was air-dry. We then quantified the relationship between CO2 efflux rate and measured litter water content. With this data we hope to be able to more accurately predict what will happen to decomposition patterns of litter in the Great Basin under drier atmospheric conditioning occurring with climate change.

Dustin Parker

Title: Stanford Ridge Vent
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Winnie Kortemeier
Department: Geological Sciences and Engineering
Institution: WNC

Stanford Rock Ridge tuff cone on the northwest shore of Lake Tahoe, California. Northwest of Lake Tahoe, California, on the west end of Stanford Rock Ridge facing the lake are the remnants of a basaltic tuff cone. Tuff breccia stretches 1912 feet along the edge of the mountain between 6709’ and 7077’ elevations. The material was blown south from the vent, as there are no signs of material north of the vent area. The tuff breccia is above an area of small rounded gravels that formed on the shores of Proto Lake Tahoe. Above the tuff breccia are basalt flows and a scoria field. Mantling these volcanic rocks is till left behind from the Tahoe and Tioga age glaciers. Below the tuff cone is a fault that has contributed to uplift and erosion of the vent. The vent is composed of basaltic tuff breccia with sand to pebble sized lapilli. Blocks up to 3 feet are found at the source and up to 16 inches as far as 1150 feet away. Near the middle of the vent the tuff layers are chaotic with orientations ranging from N13E, 47NW to N70W, 15NE. 1150 feet south of the vent, tuff layer orientations are more uniform: N5W, 15NE to N3E, 17SE and represent the out-flow area of the tuff cone. Only a portion of the tuff cone is still visible after approximately 2 million years of erosion. Tuff is a soft, friable material that is very unstable. This area has been uplifted along a major fault that runs at the base, and parallel to, the east side of the mountain. Erosion caused by this uplift has resulted in extensive landslides in the tuff breccias forming steep cliffs and deep ravines marking the vertical extent of the tuff breccias. Erosion has removed the majority of the tuff cone, leaving only the southwest edge of the structure.
Mary Quiroga

Title: Entrepreneurship & Inequality
Funding Source: McNair Scholars Program
Mentor(s): Mehmet Tosun
Department: Economics
Institution: UNR

Increasingly, economists and the general population are concerned with the rising levels of inequality in the United States. As the US economy crawled out of the Great Recession, corporations were bailed out by the government and retained their profits while everyday people continued to struggle financially. Many economists agree that entrepreneurship ought to lead to growth. However as Americans have witnessed recently, not all growth is equitable. This study uses data from the Bureau of Labor Statistics, the US Census Bureau, and the Internal Revenue Service as well as Gini coefficients to compare levels of entrepreneurship and inequality in the United States at the county level. In the preliminary results, this study finds a positive relationship between entrepreneurship and inequality.

Kegan Rahe

Title: Reaction of Ketone Donors and Aldehyde Acceptors in the Synthesis of Unique Aldol Products
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Laina Geary
Department: Chemistry
Institution: UNR

The aldol reaction in organic chemistry is a powerful synthetic tool for the formation of a C-C bonds and has therefore been used extensively in many synthetic organic reactions since its discovery in the late 19th century. This reaction affords synthetic chemists the ability to expand the skeletal structure of organic molecules while retaining excellent stereo- and enantio selective control over the hydroxyaldehyde products. The aldol-type's reaction ability to induce asymmetrical hydroxyaldehyde formation is therefore of great synthetic use in the pharmaceutical, biological, and industrial sectors. This reaction, however, has been almost solely limited to the reaction between a carbonyl and a ketone, ester, or amide derived enolate. There have been fewer studies into aldehyde/aldehyde enolate reactions or, even more remotely, between aldehyde donors and ketone acceptors to produce similar hydroxyaldehyde products. The purpose of this research is to synthesize a hydroxyaldehyde is via the addition of a ketone acceptor to an aldehyde donor. This is accomplished by way of the hydrogen borrowing method using a ruthenium transition metal and secondary amine catalyzed reaction. In so doing, this reaction explores a new method to producing uniquely substituted aldol-type products. Mechanically, the ruthenium readily converts a primary alcohol to an aldehyde and yields a ruthenium hydride intermediate. Subsequently, the secondary amine organocatalyst preferentially condenses with the aldehyde over the ketone to form a nucleophilic enamine intermediate. The enamine/aldehyde adduct then reacts with the ketone to produce a hydroxyaldehyde product. This is then reduced back down to the alcohol by the ruthenium hydride; the ruthenium hydride prevents a retro aldol reaction and yields a diol aldol-type or enolate product.
Cassie Ramage

Title: Integrin Regulation of Birth Timing in Mice
Funding Source: IDeA Network of Biomedical Research Excellence (INBRE)
Mentor(s): Heather Burkin
Department: School of Medicine
Institution: UNR

The objective of our research program is to find ways to prevent babies from being born too early. The long-term goal is to identify methods to calm a woman’s uterus if it begins contracting early. Integrins are cell surface receptors found at focal adhesion sites that act as mediators between the extracellular matrix and the actin cytoskeleton to transmit mechanical signals into the cell. Our laboratory has previously shown that the integrin β1 increases during pregnancy in the uterine myometrium layer, and that an integrin blocking peptide and an integrin β1 blocking antibody reduced focal adhesion signaling response in response to stretch in a pregnant human uterine myometrial cell line. I hypothesized that the loss of this integrin will result in delayed uterine smooth muscle contractility. I used an inducible smooth muscle specific mouse line to inactivate the integrin in the myometrium during late pregnancy (systemic removal is embryonic lethal) to test this hypothesis. Itgab1tm1Efu mice were bred with mice that expressed Cre recombinase under the control of a tetracycline-responsive promoter element (tetO-cre) and a trans-activator gene under control of the transgelin (SM22alpha) promoter (Tagln RtTA). I compared the gestation period of triple transgenic mice (Itgab1tm1Efu tetO-cre + Tagln RtTA+) and fed doxycycline to the controls to determine if the myometrial knockout of integrin β1 affects the timing of delivery. So far experiments are underway with six mice in the doxycycline group and four controls. Additionally, to this point there has been no noticed change in behavior or lethargy in the experimental mice following the doxycycline treatment.

Daniel Raynor

Title: Quantifying Contributions of Snow-fed Rivers to Water Resources of Large Cities in the Western U.S.
Funding Source: NSF REU The Value of Snow
Mentor(s): Seshadri Rajagopal
Department: Geological Sciences and Engineering
Institution: UNR

Cities in the western US are usually at the foothills of mountains and derive significant portions of their water supply from snow-fed rivers. Due to increasing urbanization, demand for water is rising, though recent studies indicate that cities’ supply from snow accumulation and melt is changing variably across the west. Adapting to these changes in snow is a challenge for cities; to address it, we first need to quantify the extent of their reliance on snow-fed rivers. We identify 13 western US cities (with a total population of over 12 million people) and the headwater basins associated with their water supply to quantify: 1) How much annual precipitation falls as snow?; 2) How much annual surface water runoff comes from snowmelt?; and 3) To what extend does reservoir storage act as a buffer to changes in snow? Using climatological data from North American Land Data Assimilation Systems (NLDAS) and PRISM high-resolution spatial climate data, we establish that San Francisco derives the most (74%) of their water supply from snow among the selected cities, whereas, Portland derives the least (~0%). Analysis from the two datasets yield similar results, suggesting a defensible and accurate methodology for determining snowfall reliance. Although inter-annual snow variability is common, some cities with expansive reservoir storage infrastructure and capacity, such as San Francisco and Denver, are able to buffer their water supply for over three years. The findings demonstrate that western US cities are variably reliant on snow for water supply and that adaptation to changes in snow will be challenging.
Morgan Remick

Title: Basaltic Volcanic Vent on Granlibbaken Ridge West of Lake Tahoe May Be Remnants of Fissure Eruptions
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP
Mentor(s): Winifred Kortemeier
Department: Geological Sciences and Engineering
Institution: WNC

A basaltic volcanic vent is located on Granlibbaken Ridge and is about 2 million years old (Kortemeier, 2012). The field area encompasses approximately 27 acres, includes several near vertical cliffs, one vertical and is nearly a mile from the nearest hiking trail. The vent is made of two basaltic dikes that feed two parts of the vent. The dikes are approximately 235 feet apart and are separated from each other by a section of lava flows. Each dike has its own field of scoria cinders indicating that each dike had material erupting from it, both in the form of lava flows and pyroclastic material. The west-most dike have agglutinated spatter making up the top layer of it with solid lava exposed for over 50 vertical feet. The east-most dike has a little agglutinated splatter on the east side. The dikes may represent the remnants of eruptive fissures similar to those on the flanks of Kilauea volcano in Hawaii. The vent was originally thought to be approximately 19 acres but was found to be approximately 27 acres due to the discovery of the west-most dike and scoria field. Only a small part of the original volcanic vent is exposed due to two factors: glaciers scouring the northern side of the vent as they flowed down the Truckee River Canyon, and glaciers depositing till on top of the vent area, which covers up the vent on the south side. Because of this, determining the extent, shape, and size of the original vent has proven to be very challenging.

Manuel Retana

Title: Evaporation Model Development for Forced Helium Dehydration Process of Used Nuclear Fuel Canister
Funding Source: McNair Scholars Program
Mentor(s): Miles Greiner
Department: Mechanical Engineering
Institution: UNR

After being used, nuclear fuel assemblies are stored in a water pool for some period of time then transferred to a canister underwater. The canister is then lifted and drained. Some water may remain at the bottom and in the crevices of the canister. Essentially, all water and moisture should be removed to prevent corrosion and/or formation of combustible mixture of hydrogen and oxygen in the canister. Forced Helium Dehydration (FHD) is a process used for high burnup fuel in which heated helium is circulated through the canister to evaporate and remove moisture. The objective is to determine the amount of water remaining in the canister after FHD. In this work, a geometrically-accurate three-dimensional CFD model of a nuclear fuel canister is created to simulate FHD. ANSYS/Fluent CFD code provides a multiphase heat and mass transfer analysis to assess if FHD meets dryness requirements imposed by the U.S. NRC before the canisters are approved for long-term storage. The phase change model needs to consider model boiling, free surface evaporation, diffusion, and condensation to accurately simulate FHD. First, a simple 3D model of nuclear fuel assembly with a 3_3 array of heated rods is created. This model is used to test the developed evaporation model as it does not require a lot of simulation efforts (500,000 elements). Then, once the evaporation model is validated, it will be applied to 1/8 th full scale model (60 million elements) of nuclear fuel canister. A User Defined Function (UDF) will be used to apply the evaporation model to the simulations. Currently, both the 3_3 and the 1/8 th models have been completed and verified. The evaporation model will be completed and validated against analytical results. Finally, the evaporation model will be applied to the 1/8 th model to simulate FHD and estimate the remaining amount of water.
Rosemary Reyes

Title: A Visual Analysis of the Lake Tahoe Basin: Using Rephotography to Predict Wildfires
Funding Source: NSF REU The Value of Snow
Mentor(s): Peter Goin
Department: Art
Institution: UNR

From 1975 to 2014, 2,741 wildfires have occurred in the Lake Tahoe Basin. The reoccurrence of wildfires threatens the Lake Tahoe Basin's ecosystem. Through photography and rephotography, this project will provide a unique method for improving the predictability of fires. The pairs of photographs will show how the vegetation has changed over time in potentially post-fire locations while displaying locations that need fire mediation. This project will create thirty pre-fire photographic markers where the occurrence of fire probability is high. These photographic markers will be established in nine geographical sections that have had severe fire occurrences, high fire potential, and/or include geographical sections with highly volatile fuel loads. The nine geographical sections include McKinney, Gold Coast, Emerald Bay, Baldwin, South Lake Tahoe, Tahoe City, Carnelian Bay, East Shore North and South. These photographic markers will be established based upon the data from United States Geological Survey (USGS), Lake Tahoe Basin Management Unit, and historical photographs dating from 1876-1950. Particular attention will be paid to forests in locations that have not received sufficient fuel reduction treatments. Each marker will have four photographs made at the four compass points: true north, south, east and west. These photographs will provide visual data for later rephotography. Using rephotography provides an insight on the changes in the ecosystem, tree density, climate, and the effects of urbanization on the forest's landscape. This information will be accessible to the public through photographic archives and publications. An information packet will be mailed to fire ecologists, environmentalists, conservation foresters, forestry management within the USDA Forest Service, Lake Tahoe Basin Management Unit, Lake Tahoe fire services, California State Parks, California Tahoe Conservancy, Nevada state parks, Nevada Division of State Lands, and Tahoe Regional Planning Agency to monitor these points through time.

Bria Riggs

Title: Sense-of-Place and Environmental Action: Examining Awareness, Importance, and Preferred Payment Vehicles for Water Clarity Management at Lake Tahoe
Funding Source: NSF REU The Value of Snow
Mentor(s): Kimberly Rollins
Department: Economics
Institution: UNR

Environmental economists use economic theory and statistical methods to establish economic values and payment preferences for non-market environmental goods and services. Contingent valuation method (CVM), a stated-preference technique, is used to estimate total value (use and/or non-use values) of environmental damages and policies. In recent years, Lake Tahoe water clarity has been declining due to runoff and erosion from wildfire and the introduction of two aquatic invasive species, milfoil and Asian clams. This study examines preferred payment vehicles, awareness, and importance of various user groups in the Lake Tahoe region for the management of wildfire, milfoil, and Asian clams as a means of managing water clarity at the lake. Here we show that an individual's preferred payment vehicle, importance, and awareness of water clarity issues are correlated to their sense-of-place in regards to Lake Tahoe. Many individuals’ residences are not geographically within the Lake Tahoe Basin however some of these individuals self-identify as Lake Tahoe residents. We find that this population holds environmental issues at Lake Tahoe to be as important as true geographic Lake Tahoe residents; however, the awareness of such issues is much lower for the non-geographic, self-identified residents as compared to geographic residents of Lake Tahoe. We also show that preferences for specific payment vehicles do not vary across user groups. However, preferences for specific payment methods vary for the total surveyed population. By examining the preferences of the population in the Lake Tahoe region, this study informs policy-makers of potential payment schemes for water clarity management policies at Lake Tahoe.
The use of antibiotics in veterinary medicine is a practice generally used in agricultural meat production in order to treat sick animals and to prevent larger outbreaks of diseases. However, the use of antibiotics is still greatly debated; one of the reasons being the concentration at which the antibiotic is present in manure. The frequency that cow and swine manure is being used for the agricultural produce opens up the question of what affects antibiotics have on plant growth. Furthermore does the antibiotic affect the growth and reproductive ability of the plants it comes into contact with as well as the higher trophic systems involved in the ecosystem. In this project three antibiotics were evaluated, Sulfadiazine (SDA) Sulfamethoxazole (SMA) and Ciprofloxacin looking specifically at the dose effect when tested with Lepidium Sativum and the potential photolysis products. Increased concentrations for both Sulfadiazine (SDA) Sulfamethoxazole (SMA) showed negative impacts on plant growth, but had no apparent transformation products. A transformation product was found for Ciprofloxacin, as well as a correlation between the time the photoreaction occurred and the ratio of root to stem length.

Kaposi's sarcoma-associated herpesvirus (KSHV) is the eighth human herpesvirus (HHV8) of the herpes-virus family. KSHV infection is closely linked with several lymphoproliferative disorders including primary Effusion lymphomas (PELs) and Multicentric Castleman's disease (MCDs). Infected individuals have KSHV for their entire life in B and endothelial cells in dormant (latent) form in healthy individuals. However, in immune compromised individuals, virus reactivates frequently producing virion particles to infect fresh cells to promote tumorigenesis. Currently there are no specific drugs or vaccines available for KSHV treatment. This study focuses on evaluating the role of a G-quadruplex stabilizing compound on viral replication. We have previously shown that KSHV genome has a high guanine content that fold into structures called G-quadruplexes. Here, we have investigated whether stabilizing those G-quadruplexes will have an effect on viral gene transcription and protein synthesis. We analyzed mRNA levels of important viral genes, which showed reduction in vIRF3 in presence of BRACO19, a G-quadruplex stabilizing ligand. Determining the effects of BRACO19 on expression viral genes and DNA replication will provide targets to block KSHV pathogenesis.
Sydney Stracke

Title: Evaluating Quinoa Growth in Saline Conditions  
Funding Source: NSF REU The Value of Snow  
Mentor(s): Laurel Saito  
Department: Natural Resources and Environmental Science  
Institution: UNR

Salinization is the process in which large amounts of salt accumulate in soil and water and it is especially problematic in semi-arid and arid regions. Salinization can lead to the degradation of arable land and commercial crop production, and therefore can have negative economic impacts in (semi)arid regions. Halophytes, or highly salt-tolerant plants, thrive in saline conditions and some species may help remediate saline soils by taking up excess salt from marginal lands (i.e., agricultural lands that are no longer productive due to salinity). Quinoa (Chenopodium quinoa), a halophytic plant, can be cultivated in saline soils and is becoming popular for human consumption. Quinoa can also be used as an alternative food source for livestock instead of traditional grains and forage (e.g., corn and alfalfa) that cannot tolerate saline conditions. A 5-month long greenhouse study was conducted to assess how quinoa responds to different salinity levels. Quinoa was grown in soils having five salinity levels (2, 4, 6, 8 and 12 dS/m) and irrigated with water having four salinity levels (1, 2, 4, and 6 dS/m). This poster describes the response of leaf area, plant height, total above ground biomass and leaf salt content to the different salinity treatments. The results of this study will help determine how quinoa growth responds to different salinity levels and how it can benefit crop production on marginal lands. The data from this experiment will also be utilized to help parameterize a simulation model used for the assessment of management options and crop production of quinoa.

Alex Sung

Title: Quantitative Assay of Human Antibody-Dependent Cell-Mediated Cytotoxicity (ADCC) Using Peripheral Blood Mononuclear Cells (PBMCs)  
Funding Source: IDeA Network of Biomedical Research Excellence (INBRE)  
Mentor(s): Dorothy Hudig  
Department: School of Medicine  
Institution: UNR

ADCC can be essential for anti-viral immunity and supports many tumor immunotherapies. It is a challenge to quantify and one wants a fast assay that uses few lymphocytes when patient blood is limited. Three considerations affected our new assay design: 1) normal B cells within PBMCs introduce ‘cold target’ competition of radiolabeled tumor B cells if anti-B cell antibodies are present in the ADCC assays; 2) type 1 antibodies to CD20 B cell epitopes are internalized and cleared from the cell surface while type 2 anti-CD20 antibodies remain external; and 3) target cells with MHC I initiate KIR-regulation of lysis that will vary among donors. To address these issues, we used Daudi B leukemia cells that lack MHC I and pretreated the Daudi cells with the humanized nonfucosylated/glycoengineered monoclonal type 2 anti-CD20 antibody obinutuzumab (GA101 G2). Target cell pretreatment prevented ‘cold target’ competition. We used 4 hr 51Cr-release for its sensitivity and varied the PBMC to target (E:T) cell ratios to obtain lytic units. Flow cytometric counts of CD16A Fc-receptor positive cells with TrueCountR beads determined the exact number of ADCC effectors within the unfractionated PBMCs. There was low NK activity to Daudi cells, which required subtraction of simultaneous controls without antibody. We plotted ADCC activity as a log function of the E:T ratios and observed that ADCC was dependent upon interactions of multiple CD16A-positive effectors per target cell, which was expressed as lytic units per 106 CD16A cells, that varied 50-fold among donors. In addition, the linear slopes of CD16A cell lytic cooperativity varied 8-fold. In summary, we have established a fast quantitative assay for comparison of human ADCC that uses as few as 8 million PBMCs.
Title: What makes for a better ADCC Killer Cell: More Receptors or More Cytotoxic Protein or Neither?
Funding Source: IDeA Network of Biomedical Research Excellence (INBRE)
Mentor(s): Dorothy Hudig
Department: School of Medicine
Institution: UNR

Antibody-dependent cell cytotoxicity (ADCC) is a vital immune response that defends us against invasive viruses. The process of ADCC involves anti-viral antibodies attaching to an infected target cell and a natural killer (NK) cell carrying, CD16A receptors for the bound antibody, thereby attaching to and then destroying the target cell. The effectiveness of this process carries tremendous human variability that has yet to be well characterized. A novel chromium 51 assay was developed in order to better compare ADCC among healthy blood donors. Seven donors (with the same homozygous CD16A allele F/F) were characterized for ADCC using the novel assay. Flow cytometry was used to assess the CD16A receptor density on the receptor-positive cells and the amount of the cytotoxic protein perforin in these cells, to see if differences in these proteins are likely to affect ADCC. Maximal potential killing of each donor was calculated in terms of lytic units (LU) for 50% killing and of killing at an effector to target (E:T) ratio at 1:1. There was substantial variability among the 7 donors despite having a common F/F genotype. There was a 30.8 fold range among the donors ranging from 19.7 to 607.5 LU50/1 million CD16A cells. There was strong correlation between the LU50 and perforin but not between the LU50 and CD16A protein levels, meaning that perforin may be the limiting factor. Another correlation was between the % dead at the 1:1 effector to target ratio and perforin, which also supports the idea that perforin might be a determinant of an individual’s capacity for ADCC. We conclude that perforin is a limiting factor when there are high amounts of antibodies on infected ‘target’ cells.

Title: The Importance of Nurse Shrub Facilitation of Understory Vegetation Along an Aridity Gradient
Funding Source: NSF REU The Value of Snow
Mentor(s): Peter Weisberg
Department: Accounting and Information Systems
Institution: UNR

Arid environments feature the unique interspecific relationships of nurse plants that provide habitat amelioration and grazing protection for stress intolerant plant species. The stress gradient hypothesis (SGH) predicts that with increasing environmental stress, plant interspecific interactions will shift uniformly from negative to positive, or competitive to facilitative (Bertness & Callaway, 1994). SGH studies have since drawn both similar and contending conclusions; suggesting modifications to the linear model to better represent when negative outweighs positive interactions at the most extreme ends of the stress gradient (Michalet et al. 2006). We developed a study along the elevational gradient of Barrett Canyon, NV, to assess the differences in plant species abundance for underneath prominent nurse plant Artemisia tridentata, and in the interspaces between potential nurse shrubs. It was our goal to observe how plant interspecific interactions differed as stressors fluctuated geographically. It was expected that results would demonstrate a non-linear relationship between the elevational gradient and plant interspecific interactions, indicative of the canyon’s extreme climate and complex ecosystem influenced by heavy grazing. Measurements of vegetation cover and plant species abundance underneath A. tridentata and in the interspaces were collected from five study plots encompassing the polar ends of the canyon’s aridity gradient. An additional component of this study examined biotic stress influence by comparing inside and adjacent to a grazing exclosure at the most arid sample site. Initial results indicate that the SGH is not uniform for all environments and will change as potential plant stressors vary geographically. SGH generalizations are useful for scientist’s working to understand ecological impacts from climate change and poor land management practices, and future research will need to incorporate and thoroughly analyze a broader range of stressors and interspecific interactions.
Thanh Tran

Title: The Role and Mechanism of CFTR in the Dietary Obesity-Associated Liver Cancer
Funding Source: IDeA Network of Biomedical Research Excellence (INBRE)
Mentor(s): Dayue (Darrel) Duan
Department: School of Medicine
Institution: UNR

Liver cancer is one of the most common malignant tumors worldwide and is the second leading cause of cancer-related deaths. The cystic fibrosis transmembrane conductance regulator (CFTR) is an important ion channel in mammals. A defect in the CFTR gene results in cystic fibrosis, which is also correlated with an increased risk of various cancers, including thyroid, kidney, lung, and pancreatic cancer. Recent studies have also pointed out that obesity (Body Mass Index > 25) can cause a large increase in liver cancer risk, but these findings have not been further investigated. Whether CFTR is associated with obesity-related hepatic carcinogenesis is currently unknown. The potential role of CFTR chloride (Cl-) channels in hepatic carcinogenesis can be examined by using an animal model for dietary obesity in wild-type (CFTR +/+) and CFTR knockout (CFTR -/-) mice. Hepatic carcinogenesis models in dietary obesity were produced with two well-established protocols: 1) High-fat diet (HFD) food induced dietary obesity model; 2) low doses of Diethylnitrosamine (DEN), a hepatic procarcinogen. Abdominal ultrasounds were performed on each mouse on a regular basis monitored the progression of liver disease after the start of HFD or after injection of DEN. Most mice on HFD began to develop non-alcoholic fatty liver disease two-weeks of special feeding; however, the first mouse tumor did not appear until 14 weeks after HFD feeding began and DEN was administered. Tumor growth has been observed in both CFTR+/+ and CFTR-/-, all on HFD and injected with DEN, proving the model to be successful. After the 32nd week of feeding HFD or injection of DEN, a final ultrasound will be performed on all mice, and all livers will be rapidly excised for histological analysis, which will finally determine the potential role of CFTR in hepatic carcinogenesis.

Jacob Trapp

Title: MMP-2 and MMP-9 Regulation in Myometrial Cells and Tissue
Funding Source: Nevada Undergraduate Research Award
Mentor(s): Iain Buxton
Department: School of Medicine
Institution: UNR

Approximately 15 million preterm labor births occur annually. These children are prone to learning disabilities and other health problems. MMP-2 and MMP-9 are matrix metalloproteinases that aid in the degradation of the extracellular matrix. Evidence suggests these MMPs may be involved in regulating uterine contraction and birth time. Preliminary data from our laboratory indicates that MMP-2 and MMP-9 levels are increased in myometrial samples from preterm laboring patients and that a specific inhibitor of MMP-2/9 decreases oxytocin-induced contractility in pregnant myometrium. I have used confocal microscopy to detect and localize MMP-2 and MMP-9 in human uterine myometrial cells and tissue. Our results indicate that MMP-2 and MMP-9 are produced and secreted by human uterine myometrial cells, where they may exert local effects on contractility. I am also developing the techniques for ground state depletion microscopy and will utilize MMP antibodies in the future.
Justin VonTungeln

Title: Ecohydrologic Effects of Pinyon-Juniper Removal  
Funding Source: NSF REU The Value of Snow  
Mentor(s): Keirith Snyder  
Department: Natural Resources and Environmental Science  
Institution: UNR

In many semi-arid climates throughout the western United States, single-leaf pinyon (Pinus monophylla) and western juniper (Juniperus osteosperma) woodlands are expanding into formerly big sagebrush (Artemisia tridentate) dominated rangelands. The consequences of continued PJ expansion include; less shrubby habitat, less availability of forage/cover for animals, such as greater sage grouse (Centrocercus urophasianus), increased wildfire risk, and a change in water use by vegetation. This study is located in Porter Canyon experimental watershed (PCEW) (Desatoya Mountain Range, 39°28’ N; 117°37’ W) where PJ expansion has replaced a previously sagebrush dominated habitat. To quantify the ecohydrological effects of PJ expansion, manipulative tree falling treatments and intact control plots were established on east and west aspects of the canyon. Volumetric water content (VWC) probes, soil temperature iButtons, ultrasonic snow depth sensors, and phenology cameras were used to measure the treatment effects. These variables were compared during important phenological phases of each specific area. The resulting data demonstrates that VWC is responding to snow pack, soil temperature, treatment (removal of canopy vs intact canopy), and aspect. The east aspect had fewer days with snow on the ground, 74 vs 104, and had a higher average soil temperature, 11.8°C vs 8°C; which allowed the east aspect to have a much longer growing season, 225 days vs 147.5 days. Intact control plots had a longer growing season compared to the tree falling treatment sites, 194.5 days vs 178 days. As climate change progresses, PJ woodlands may continue outcompeting other vegetation communities, in turn making PJ expansion more widespread, resulting in numerous undesirable effects.

Sydney Weiss

Title: Changing Snowpack Dynamics Affecting Water Budgets in the Western US  
Funding Source: NSF REU The Value of Snow  
Mentor(s): Adrian Harpold  
Department: Natural Resources and Environmental Science  
Institution: UNR

Water supply from Western U.S. catchments is largely determined by snowmelt dynamics. Historical trends point to earlier snowmelt, slower snowmelt rates, and a great fraction of rain. Despite strong evidence that these trends in snowpack dynamics will shift earlier, the effects on water budget partitioning between evapotranspiration, runoff, and storage is poorly understood. The study applies HYDRUS 1-D modeling, the North American Land Data Assimilation System (NLDAS) forcing dataset using measured climate, and soil moisture at Snow Telemetry (SNOTEL) stations to investigate water budget partitioning under historical and hypothetical snow conditions. The HYDRUS models were calibrated to measured soil moisture data several SNOTEL sites. We applied 3 scenarios to simulate the impacts of climate change, precipitation data was assumed to be all rain, the timing of snowmelt was shifted earlier, and evapotranspiration rates were increased. We found that if precipitation shifted to rain only, deep soil drainage is less compared to the actual precipitation scheme in wet years. However, in drier years, rain only regimes produced a greater flux out of the bottom of the profile. A five percent increase in evapotranspiration rates decreased deep soil drainage, in some years, by 30 percent. These efforts suggest that interactions between climate and soil hydrology will control the sensitivity of future water availability to altered snowmelt dynamics in key mountain water supply areas.
John Whitefield

Title: Burn Severity: Botanical and Nutrient Effects  
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP  
Mentor(s): Beth Newingham, Beth Ledger  
Department: Natural Resources and Environmental Science  
Institution: UNR

The sagebrush steppe occupies approximately 45 million hectares in the western US and is an integral part of the economy due to domestic livestock grazing. Fires in the western US are increasing in size and frequency which is reducing the quantity and quality of the sagebrush steppe. After a wildfire, the Bureau of Land Management (BLM) may initiate an Emergency Stabilization and Rehabilitation treatment with the goal to 1) reduce or eliminate erosion, and 2) to reduce fine fuels accumulation by invasive species, such as Bromus tectorum (cheatgrass) and Taeniatherum caput-medusae (medusahead). Burning of organic material releases nutrients, the quantity and availability of which, depends on fire intensity and severity. This project examines how burn severity affects inorganic nitrogen sources and the post fire plant community. The location studied for this project was the Diamond Fire, northeast of Eureka, NV. Sites were stratified by a remotely sensed burn severity metric (Relative differenced Normalized Burn Ratio). At each of the twenty two sites, four sets of cation and anion exchange resins were deployed three times for approximately one month. Vegetation cover by species was sampled in July 2016. Results indicate that as burn severity increases, nitrogen fixing species and nitrate flux increases, while shrubs, perennial graminoids, and total percent cover decreases.

Joseph Woolford

Title: Optimization of the Sabatier Reaction via in-situ Adsorption by Zeolites for Production of Green Methane  
Funding Source: NSF EPSCoR Solar Energy-Water-Environment Nexus UROP  
Mentor(s): Ion Agirre-Arisketa  
Department: Chemical and Materials Engineering  
Institution: UNR

The depletion of fossil fuels and the inherent environmental downsides to utilizing them gives great incentive to find clean and renewable methods to source energy from. Following the Sabatier reaction CO2, captured from biomass, reacts with renewable hydrogen, produced from the electrolysis of water with excess electricity, to produce methane or substitute natural gas (SNG) with a byproduct of water. By applying Le Chatelier’s Principle, the in-situ adsorption of water with a hydrophilic material such as zeolite would drive the reaction to produce a higher grade of SNG suitable for injection into the natural gas grid and allowing the reaction to operate at lower pressures. Zeolites are constructed from a crystalline structure of SiO2 and AIO4 tetrahedra that creates a 3D structure. This structure allows for formation of small pores for a sieving effect to adsorb water from the gas mixture throughout the reaction. Another benefit of zeolites is the reversible adsorption of water. Two types of zeolites were tested, HZSM-5 and 4A. The extra framework cations increase the hydrophilicity of the zeolite, thus Ca2+ and Mg2+ cations were tested by introducing them into the zeolite framework via wet impregnation. Thermogravimetric analysis was conducted over a 24-hour period to measure the water sorption capacity of zeolites with and without extra framework cations. Reactions were also carried out in a pilot plant by introducing CO2, H2, and N2 at atmospheric pressure into a reactor with a catalytic bed at temperatures between 250-350°C. The exiting mixture was analyzed by micro gas chromatography throughout the reaction to determine conversion rates. It is suggested that different operating pressures be tested.