NM EPSCOR & UNM CREST PRESENT

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HYATT REGENCY ALBUQUERQUE

POSTER SESSION ABSTRACTS

The Effect of Salinity on the Growth Rate *Nannochloropsis salina* Algae Cells

By: Jennifer Thompson, the University of New Mexico

Water and land are the largest resources needed in the cultivation of algae for biofuel production. It is necessary to find ways to cultivate algae without impinging on fresh water resources, especially in arid regions. Certain species of algae including *Nannochloropsis salina* can be cultivated in hypersaline environments. The purpose of this experiment was to test the effect that salinity has on the growth rate of *N. salina* algal cells with the intention of exploring alternative water sources that can be used for the cultivation of algae. *N. salina* is a marine algae therefore it was hypothesized that algal cells that were exposed to hypersaline growth media would experience a faster growth rate versus algal cells grown in hyposaline growth media. For this experiment, three *N. salina* algal cultures were grown in bioreactors in growth media of a specific salinity. The *N. salina* algal cultures were grown in bioreactors that contained growth media of either 50% (hypo), 100% (control), or 150% (hyper) the salinity of seawater. Chlorophyll content, optical density, photosynthetic electron transfer rate, and pH were measured on the cultures during the experiment. Quantitative analysis of experimental data strengthened the hypothesis that algal cells grown in hypersaline media experienced an exponentially higher growth rate. The increased growth rate of *N. salina* in hypersaline environments imply that algae may be cultivated for the production of biofuel in non-traditional water sources such as water from oil and gas production, thus limiting competition for fresh water resources in arid regions.

Key words: N. salina, algae, biofuel, alternative, water

Trace element mobility in water and sediments in a hyporheic zone adjacent to an abandoned uranium mine.

Claudia Roldan, University of New Mexico, Johanna M. Blake, University of New Mexico, Abdul-Mehdi, Ali University of New Mexico, Jose M. Cerrato, University of New Mexico, and Steve Cabaniss, University of New Mexico

The legacy of abandoned uranium mines lead to community concerns about environmental and health effects. This study focuses on a cross section of the Rio Paguate, adjacent to the Jackpile Mine on the Laguna Reservation, west-central New Mexico. Often, the geochemical interactions that occur in the hyporheic zone adjacent to these abandoned mines play an important role in trace element mobility. In order to understand the mobility of uranium (U), arsenic (As), and vanadium (V) in the Rio Paguate; surface water, hyporheic zone water, and core sediment samples were analyzed using inductively coupled plasma mass spectroscopy (ICP-MS). All water samples were filtered through 0.45µm and 0.22µm filters and analyzed. The results show that there is no major difference in concentrations of U (378-496µg/L), As (0.872-6.78µg/L), and V (2.94–5.01µg/L) between the filter sizes or with depth (8cm and 15cm) in the hyporheic zone. The unfiltered hyporheic zone water samples were analyzed after acid digestion to assess the particulate fraction. These results show a decrease in U concentration (153-202µg/L) and an increase in As (33.2-219µg/L) and V (169-1130µg/L) concentrations compared to the filtered waters. Surface water concentrations of U(171-184µg/L) are lower than the filtered hyporheic zone waters while As(1.32-8.68µg/L) and V(1.75-2.38µg/L) are significantly lower than the hyporheic zone waters and particulates combined. Concentrations of As in the sediment core samples are higher in the first 15cm below the water-sediment interface (14.3-3.82µg/L) and decrease (0.382µg/L) with depth. Uranium concentrations are consistent (0.047-0.050µg/L) at all depths. The over all data suggest that U is mobile in the dissolved phase and both As and V are mobile in the particular phase as they travel through the system.

Key Word:
Water
Sediment
Trace Elements

Natalie Correa
09/17/15

Abstract

Presentation title
Elemental Concentrations in Wildfire Ash

Authors and institutions
Natalie Correa, UNM undergraduate of General Biology; Dr. Johanna Blake, UNM Department of Earth & Planetary Sciences; Dr. Mehdi Ali, UNM Department of Earth & Planetary Sciences; Dr. Jose Manuel Cerrato Corrales, UNM Department of Civil Engineering; Dr. Rebecca Bixby, UNM Department of Biology; Alexander Clark, UNM undergraduate of General Biology.

Hypothesis and questions
Hypothesis*: Metals are concentrated in ash and their presence and speciation varies as a function of different tree species*. ***Questions***: What specific metal and non-metal elements are contained in wildfire ash and how much metal and nonmetal elements do different tree species contain? Long term: What could potentially happen when an excess of metals from wildfire ash enters freshwater ecosystems and what are some toxic metals to humans?

Abstract
Determine the concentration of metals and anions leached from solid ash from the Valles Caldera Natural Preserve. The following six tree species from the Valles Caldera Natural Preserve have been sampled for this study: Quaking Aspen, Blue Spruce, Western Juniper, Ponderosa Pine, Douglas Fir, and Gambel Oak. The ash samples were put through acid digestions (Aqua Regia) and metals were analyzed using Inductively coupled plasma-optical emission spectroscopy and the anions were measured using the mass spectroscopy.

Key Words
Heavy metals, wildfire ash, pH, water quality

Abstract:

When light breaks the long night: stratospheric ozone depletion in the Antarctic

Melissa Montoya, New Mexico Tech and Central New Mexico Community College; Dr. Ken Minschwaner, New Mexico Tech; Dr. Gloria Manney- New Mexico Tech, Northwest Research Associates.

During the winter, Antarctica experiences three to four months of darkness; it is during this time that the ingredients for ozone depletion start gathering. But it isn't until spring, when the sun reappears, that ozone depletion occurs. Stratospheric ozone is important to the global environment since it is responsible for controlling the temperature of Earth's stratosphere and absorbing ultraviolet UV-B radiation from the Sun. UV-B radiation increases the risk of skin cancer and cataracts, damages DNA, and leads to a suppressed immune system. Ozone recovery is happening, but it is a slow process which needs our continued attention; due to the Antarctic ozone hole, there has been significant changes in the Southern Hemisphere surface climate in the summer. Continued monitoring of the ozone hole is important in order to assure its recovery by controlling or completely removing the substances which cause rapid depletion, and to make sure that substances which are being used today won't cause the same amount of damage.

Keywords: Ozone, Antarctica, climate, health, depletion.

Evaluation of a Paraprofessional Delivered Diabetes Education Project with a South Valley clinic

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McNair Scholar program; [2]South Valley clinic; [3]Nutrition Program, Department of Individual, Family and Community Education, University of New Mexico (UNM); [4]Department of Health, Exercise and Sports Sciences, UNM

Diabetes-related disparities are evident in New Mexico and the South Valley. This study evaluated diabetes patient literacy and medication adherence and the effects of 3 months of telephone support by clinic paraprofessionals. Data were self-reported at baseline and 3 months and compared using the Chi-square test. At baseline (n=37), 37% of patients had low literacy, 50% had possibility of low literacy, and 13% had adequate literacy. Fifty-eight percent of patients (n=33) reported high medication adherence, 24% medium adherence and 18% low adherence. From baseline to 3 months, self-rated health and understanding of benefits of blood sugar control significantly changed.

Cultivation of locally adapted algal community on an Algal Turf Scrubber® for treatment of dairy wastewater

David Arellano, ENMU; Bin Bai, ENMU; Juchao Yan, ENMU

The pilot application of an Algal Turf Scrubber® at Eastern New Mexico University for treatment of dairy wastewater from a local dairy continues to show promise. Dairies and Cattle Farms make up a significant portion of eastern New Mexico's economy, and they produce millions of gallons of wastewater every year. Utilizing an Algal Turf Scrubber® could help treat millions of gallons of water and produce thousands of pounds of feedstock for cattle or algal biofuel production. Through collaboration with New Mexico State University, we found using oven dry weight and ash free dry weight are accurate ways to track algal growth at the site. By utilizing the data and comparing it with monitoring data collected from the site we can show the continued plausibility of an Algal Turf Scrubber® to treat dairy wastewater, even in a rural desert environment. We are looking further into increasing the effectiveness of the system by increasing the biodiversity of the algal community and finding new ways to manage the algal environment.

Keywords: algae, wastewater treatment, biofuel production

The effects of light and rainwater on the growth and metabolism of *N.salina* and *G.sulpuraria*

Shaleen Eickhoff

NM EPSCoR STEMAP 2015 Summer Research

Sandia National Laboratories

UNM

Abstract

What causes algal production to crash? What are the stressors that attack the algal cells causing them to die and a new batch to take its place? Isn't there a better way to produce bio-algal oil by re harvesting the same batch? If science were to find what the stressors of algal cells are and how these stressors affect the cells, then it may be possible to learn how to avoid having algal production batches crash. Instead scientists may be able to in the future harvest the same batch culture, meaning the algal cells can replicate making the cells/mL denser, which predictably produces more oil yield. Currently Microalgae have a dry mass yield of oil production between 30-65%, which is significantly higher than Rapeseed, Soya, Palm, and Jatropha oil production. The focus of this study is to show an increase in cell density and metabolism in both liquid and encapsulated cultures of *N. Salina* and *G. Sulphuraria.* This study will also highlight the differences between how a salt water yellow-green algae and freshwater red algae are affected by the same conditions and stressors. *G. sulphuraria* is expected to show equal to or greater performance at higher temperatures and changes in pH.

Assessing Uranium Contamination in Stream Sediment on the Navajo Nation

Brianne Willis

During the summer of 2015 through the EPSCoR funded STEMAP program, a team of hydrologist Dan Cadol, geochemist Bonnie Frey, grad student Reid Brown, myself, and another intern Sherwin Becenti, collected soil samples from streams and washes in the Navajo Nation to measure the heavy metal content washing down from upstream abandoned uranium mines.

This STEMAP project was funded because these abandoned uranium mines are still an ongoing health and safety risk to those in the area. Knowing the amount and type of contaminate in these washes and streams could help future cleanup efforts in this area.

After sieving, grinding, and then digesting the soil samples in acid, the samples were ran on an ICP-MS for metal content analysis. This machine gives us the data of the element and the amount in each particular soil sample we ran. We also did mass fraction of each sample to get a coarse sand content and finer grain content. Our hypothesis is that Uranium particles adsorbs to finer grain, silt, or clay material more readily than course materials. This is expected since fine grain materials have more pores and larger surface area by mass.

We find that there is more Uranium and other heavy metal content in the soil samples we took from the washes that have abandoned Uranium mines upstream of them. Our data also tells us that our hypothesis is supported by the fact that samples with high fine grain material content also hold high levels of Uranium contamination.

Keywords: Uranium contamination, ICP-MS, Navajo Nation

Determining Chemical Composition of Wildfire Ash Particulates

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(1) – University of New Mexico

Wildfires are known to wreak havoc on ecosystems, both locally and globally. In the southwestern United States, wildfires coupled with intermittent flow from monsoonal moisture create a system where large amounts of ash (up to 3 g/L) can wash into surrounding surface waters. Preliminary data shows that ash exposed to water greatly increases the concentration of redox active metals such as Fe and Mn in water. This may affect dissolved oxygen and pH in surface waters, creating acidic and potentially anoxic conditions. Using characterization methods such as scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM/EDX) and X-ray photoelectron spectroscopy (XPS), we will determine the surface features of ash particulates of spruce, ponderosa, and aspen trees. Understanding the elemental composition and surface characterization of these ash particulates will lead to future research in determining how these redox active metals affect water chemistry over time.

Keywords: Wildfire, Surface Waters, Dissolved Oxygen, SEM/EDX, XPS, Redox Active Metals

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Hydrothermal Liquefaction of Various Algae in Batch and Continuous Flow Reactors

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Abstract
Algae-based biofuels have attracted attention due to their advantages of not competing with land for food production, fewer terrestrial and weather limitations, higher growth rates, and strong CO_2-mitigation abilities. In recent years, there is a surge in research on hydrothermal liquefaction of algae since the feedstock does not need to be dried for processing. Hydrothermal liquefaction uses high temperatures (270 to 300°C) and high pressures (80-100 bar) to produce relatively high yields of bio-oil from algae. This study focuses on hydrothermal liquefaction of various algae under different temperature and pressure conditions in a bench-scale batch reactor and a pilot-scale continuous flow reactor. The composition of algae feedstocks and final products (e.g. aqueous phase, organic phase, and solid char phase) will be characterized to understand the energy balance of the processes. The yield, product distribution and higher heating value of bio-crude oil will be measured to compare the effects of different reactors on hydrothermal liquefaction of algae. The alkali content metal and nitrogen in the liquid slurry need to be reduced to prevent clogging in the hydrothermal liquefaction reactor and to increase final biofuel quality, respectively. In addition, as for the pilot-scale continuous flow reactor, there also must be a trade-off between a narrow reactor diameter to accommodate the high pressures of hydrothermal liquefaction and the tendency of algae particles to create clogs in the reactor plumbing over time.

Keywords: Hydrothermal Liquefaction; Algae; Bio-Crude Oil; Energy Balance

Evaluating Seasonal Streamflow Forecasts for Southwestern Snow Fed Rivers

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Abstract

Seasonal streamflow forecasts issued by the Natural Resources Conservation Service have been used for many years to help make decisions about water resource management in the state of New Mexico. Recent concerns by farmers and state lawmakers about perceived overestimates in forecast predictions have prompted the need to closely examine and identify factors that may aid in forecast improvements where needed. This study looked at the probabilistic distribution of seasonal streamflow forecasts issued by the Natural Resources Conservation Service from 2010-2014, for three sites in the Upper Rio Grande and Pecos River basins, and assessed how effectively forecasts predicted subsequent observed naturalized streamflow. The evolution of seasonal forecast through the forecast period was coupled with an evaluation of climate anomalies and snowpack for corresponding years. Potentially important links between climate variability and seasonal snowpack were found to have played a role in forecast accuracy. Predictions in the early part of the prediction season rarely captured observed streamflow, and this was linked to anomalously high temperatures and below average precipitation, and snowpack anomalies. We suggest that forecast users consider the entire spread of predicted streamflow values rather than just the 50% exceedance prediction, regarded by the Natural Resources Conservation Service as the best estimate, which had a tendency to overestimate resulting streamflow.

Key words: water resource management, streamflow, climate

Using ground-penetrating radar to image the near surface deformation of a fault zone, Denali Fault, central Alaska

Thomas W. Luckie, University of New Mexico; Dr. Lindsay Lowe Worthington, University of New Mexico; Dr. Sean P. Bemis, University of Kentucky; J. Kade Carlson, University of Kentucky; Wes Clary, University of New Mexico; Bradley Bishop, Brigham Young University

The use of ground-penetrating radar (GPR) can provide detailed, centimeter-scale resolution images of the subsurface to a depth of tens of meters. Alaska is one of the most seismically active areas in the United States, but few faults have undergone detailed studies of Quaternary stratigraphy and near-surface structure. In the summer of 2015, a pilot study collected and analyzed 2-D GPR data across the Denali Fault in central Alaska to help constrain near-surface deformation. A basic data processing flow and a 1-D, single-layer velocity model was applied in order to conduct preliminary interpretations. We observed clear reflections to a depth of ~7 m below the ground surface. Data collected at co-located paleoseismic trenching mimic the near-surface reflections and help ground-truth the GPR data. The combined data sets provide insight into the north-south limits of the deformation zone of the fault at this site, along with fault zone morphology at a shallow (<7 m) depth. However, farther from the trenching exposures, the GPR data were less clear as to whether it displayed any reflection patterns indicative of fault zones, which may be due to adverse environmental conditions for GPR implementation. The poor imaging leads to more speculative interpretations, making correlation between the trenching exposures and the GPR data difficult. This pilot study demonstrates the potential use of GPR in the characterization of faults and the advantages and disadvantages of using GPR in conjunction with trenching and outcrop interpretation.

Keywords: ground-penetrating radar, active faults, Denali Fault, Alaska

Glacial and Tectonic Interactions: Case Study SE Alaska

1. Wesley Clary (PhD Student) – University of New Mexico Department of Earth and Planetary Sciences
2. Dr. Lindsay Worthington (Advisor) -- University of New Mexico Department of Earth and Planetary Sciences

In the last decades research has shown that climate activity can be an important component of large scale tectonics. Glacial erosion and deposition, forced by climate patterns, affect mass balance in large-scale tectonically active regions as well as offshore depositional basins. One ideal natural laboratory to study these climate-tectonic interactions is offshore glacial-marine deposits in SE Alaska where an offshore accretionary wedge records glacial and marine sedimentation as well as faulting. This location is ideal because the offshore depositional basin is near the onshore sediment source which facilitates a short time between erosion and deposition as well as a relatively closed system from source to basin. Thanks to previous research efforts there is extensive data including sediment core, well log measurements, bathymetry, and offshore seismic reflection surveys available to aide in the interpretation of climate-linked glacial activity and fault activity. Detailed stratigraphic and structural interpretation of seismic reflection lines collected off the coast of SE Alaska allow for sequence interpretation of fault activity, glacial deposition, and climate change. Interpretation of sedimentation patterns with special focus on extent and style of glacial sedimentation and fault activity link these processes in space and time. Applied spatial-statistics provides a quantitative link between glacial activity and faulting by testing for shape similarity and proximity of related geologic features.

Keywords: tectonics, glaciers, seismology, stratigraphy

Ultra-fast time –resolved fluorescence spectroscopic characterization of rare earth metal-based nanomaterials.

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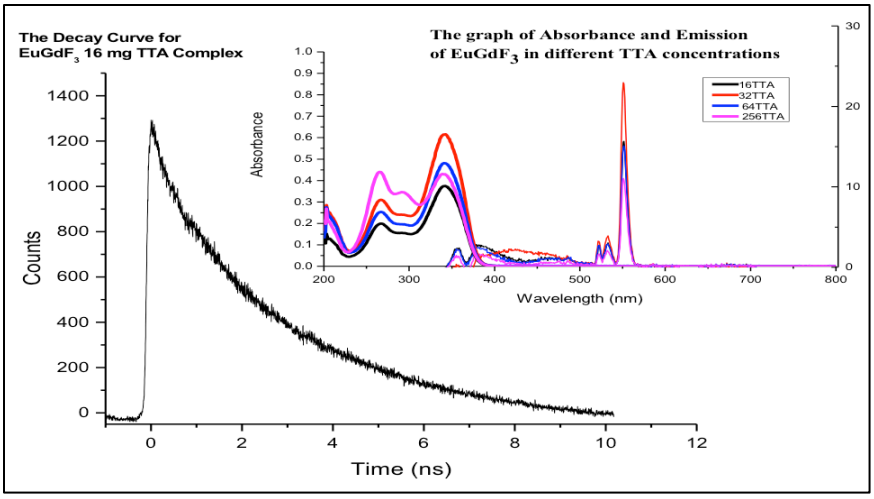
Abstract

Key Words: Fluorescence, Upconversion, Anisotropy, Time Correlated single Photon Counting

There is an increasing interest in utilizing rare earth based nano-materials for application such as light emitting diode, biomedical applications and other photochemical applications. The photochemical properties of theses materials play a crucial role in determining the feasibility of utilizing these nano-materials in these applications. The trivalent lanthanides Europium (III) doped inorganic lanthanide complexes are well known for high luminescent characteristics of Eu^{3+} ion and their dual functionality. In order to understand photophysical properties of these materials, we employ femto-second time resolved fluorescence up-conversion spectroscopy and fluorescence time correlated single photon counting spectroscopy. These investigations were supported by steady state absorption and fluorescence spectroscopy.

In these investigations, we studied 17 different samples including Europium doped Gadolinium Fluoride (Eu:GdF_3), Europium doped Sodium Yttrium Fluoride (Eu:$NaYF_4$), Europium doped Ytterbium Sodium Fluoride (Eu:$YbNaF_4$) coated with different amounts of thionyltrifluoroacetone (TTA), Europium doped ZnO coated with TTA and Eu:GdF_3 samples coated with TTA having several Eu^{3+} doping percentages. These were synthesized by one of our collaborators, Dr. Channa R De Silva.

These studies are focused on energy transfer mechanisms, excited state dynamics and fluorescence decay kinetics of these complexes. Absorption spectrum shows strong absorption of all these samples at around 340 nm. Excitation at 350 nm shows emissions for all samples at around 450 nm, 580 nm, 616 nm and 720 nm. The lifetime measurements of these samples using TCSPC data shows nanoseconds (ns) lifetime for all samples. Fluorescence upconversion anisotropy decay studies are underway to understand the energy transfer dynamics in these complexes.



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Evaluation of Arabidopsis thaliana: Photosynthesis

Diana Perales, Central New Mexico Community College; Darrell Horton, Shoshana Jaffe, Marissa Horjoe, and David Hanson Department of Biology, University of New Mexico

Arabidopsis thaliana have been transformed to over-express the photorespiratory enzyme, glycine decarboxylase (GDC-L). Our research was to evaluate the photosynthetic activity of *Arabidopsis thaliana*. For more than 30 years, photorespiration has been considered to be a wasteful process, requiring plants to use energy and release CO_2 in order to recycle one of the products of oxygen fixation by the photosynthetic enzyme RuBisCO. This side reaction partly reverses the major action of RuBisCO, the capture of CO_2 for the Calvin cycle in photosynthesis. Yet, these transformed plants suggest that photorespiration can be beneficial due to the increased expression of the enzyme GDC-L and increased rate of photosynthesis. We investigated how photosynthesis was increased. Specifically, to see if this was achieved through increased expression or activation of RuBisCO in response to the increased expression of GDC-L. Our research was performed by analyzing the RuBisCO activity and measuring the photosynthesis responses under multiple light exposures in both the wild type and the transformed plant (PSL-3). We found during the RuBisCO analysis, the wild type had more activity and higher photosynthesis than PSL-3. This should represent that there is more RuBisCO present in wild type than in PSL-3 but there is other data from our collaborators lab that contradict this idea. Additional data is needed to resolve the discrepancies between the two labs. It is possible that leaf and plant age varied between experiments and is responsible for the different results.

Risk Analysis of Recycling Containment and Treatment of Produced Water from Oil and Gas Production: A Conceptual Framework

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Abstract

Hydraulic fracturing and enhanced oil recovery (EOR) rely on the application of large volumes of water for energy production. In New Mexico, more than 5,000 acre-feet water was used in oil and gas production in 2014; these volumes are expected to increase over time in accordance with growth in the energy sector. In an effort to reduce impacts on limited freshwater resources, the New Mexico's Energy Minerals and Natural Resources Department (EMNRD) issued rule 19.35.34 to encourage reuse of produced water in oil and gas production by allowing for recycling containment and treatment facilities for produced water. Safeguarding fresh water resources from potential contamination due to siting, construction, and operation of such facilities calls for a risk based suitability analysis. This study describes a conceptual framework for risk assessment and response regarding the transportation, storage, and treatment of produced water. Deterministic and stochastic events associated with both fresh water contamination from recycling containment sites and the costs of construction, operation, and utilization of potential sites will be studied and classified. Probabilistic distribution of the occurrence and impacts from such events on the fresh water quality as well as costs will be derived from historical data and relevant literature. The results of this framework will be a parametric suitability index integrating technical constraints as well as the estimated risks. This suitability index will facilitate informed decision making in planning process for future containment facilities. A byproduct of this research is a map of fresh water vulnerability to contamination.

Keywords: produced water, recycling containment, risk assessment, suitability index

Modeling Bathymetry and Topography Maps Using an Augmented Reality Sandbox

AUTHOR
Ryan Pottenger, *Mesalands Community College*

ABSTRACT
Students enrolled in the Natural Sciences program at Mesalands Community College, study many geographic, geologic, and hydrologic concepts including how to read topography and bathymetry maps. To help students better understand these concepts, Mesalands Dinosaur Museum and Natural Sciences Laboratory became involved in a project to build a 3D visualization tool called an augmented reality sandbox. Using simulation and visualization software designed by Dr. Oliver Kreylos at University of California Davis, the sandbox utilizes a montionsensing input devise (Xbox Kinect 3D camera), and a short-throw data projector mounted above the sand to produce a virtual topography. The Kinect detects the distance to the sand below, and a visualization an elevation model with contour lines and a color map is cast from an overhead projector onto the surface of the sand. As the user moves the sand, the Kinect perceives changes in the distance to the sand surface, and the projected colors and contour lines change accordingly. Users can also create virtual rain, which will help explain catchment areas and watersheds.

KEY WORDS: Augmented Reality Sandbox, Watershed Modeling, Topography, Bathymetry

Experimental Design: Polycultures of 25 Common North American Freshwater Microalgae Species

Laura Jack, New Mexico State University; Wiebke Boeing, New Mexico State University

Purpose: The purpose of this study is to highlight the importance of an ecological approach in algal cultivation. By pairing monocultures with polycultures, comparing growth, lipid production and relative density, this study aims to identify freshwater microalgae species with positive allopathic interactions for scaled-up microalgal cultivation.

Methods: The 25 species will be grown in replicate monoculture and in all pairwise biculture combinations. Using a replacement-series design, species will be inoculated at 5,000 cells/mL each within a biculture and 10,000 cells/mL within a monoculture. Each of the 25 monocultures and 300 bicultures will be replicated twice, resulting in 625 total species/species assemblages. Species/species assemblages are cultured in 48-well plates containing 1 mL of standard Chu growth medium. Species' densities will be enumerated using a hemacytomer and compound microscope.

Results: We expect to see evidence of competitive interactions among green algal species. Most bicultures should have reduced cell densities when compared to their monoculture population. We will subdivide species' relative densities of the bicultures into categories to better understand the species interactions and possible competitive asymmetries. Each species in a biculture will either experience strong competition (relative density < 0.5), weak competition (1 > relative density > 0.5), or facilitation (relative density >1). We will plot the joint distribution of species' relative densities for each biculture. Lipid analysis of facilitating bicultures will be compared to monocultures.

Conclusions: Our results will inform us of which bicultures experience facilitation or competition. A follow up polyculture experiment will then test additional species combinations.

Keywords: Microalgae, Polyculture, Biofuel, Freshwater

Using geochemical tracers to understand geothermal flow pathways in northern New Mexico

Valerie Blomgren, Laura Crossey, Karl Karlstrom, Hyunwoo Lee, Tobias Fischer

Carbonic warm and hot springs extend NE of the Valles Caldera toward Taos NM. We examined a suite of springs NE of the caldera along the Jemez lineament. Springs were analyzed for the purpose of understanding deep flow pathways of the regional geothermal system. Spring groups differ in the eastern (Taos) versus western (Ojo Caliente and La Madera) regions. Throughout both regions helium isotope analysis reveals the presence of a mantle component; 0.32 R_c/R_a in west and 0.20 R_c/R_a in the east (R_A = $^3He/^4He$ ratio of air; R_c is air-corrected value). Additional tracers show that Ojo Caliente springs have $^{87}Sr/^{86}Sr$ ratios of 0.747 and Sr abundances of 1.35 ppm, reflecting water flow through granitic basement rock; the $^{87}Sr/^{86}Sr$ ratios at La Madera and Statue are 0.718, these values can be explained by mixing basement-influenced Ojo Caliente water and interaction with the less radiogenic limestone aquifer. Ojo Caliente and La Madera also have high CO_2 gas concentrations, 7.9 to 30.7%. These tracers suggest that Ojo Caliente waters travel north to La Madera, and the Jemez volcanic system supplies CO_2 leakage along faults of the Jemez lineament. CO_2 leakage is not as evident on the east side, which has less radiogenic $^{87}Sr/^{86}Sr$ ratios of 0.708 and lower CO_2, 1.36 to 4.27%. We conclude that western springs mixed with endogenic fluids derived in part from the Jemez Mountains whereas eastern springs are more meteoric, but still have $^3He/^4He$ ratios that suggest magmatic fluid input.

EFFECTS OF SILICA SOL-GEL ENCAPSULATION ON C. REINHARDTII METABOLISM

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With the goal of examining the effect of encapsulation on metabolism in the microalga *Chlamydomonas reinhardtii*, we have created a living hybrid silica sol-gel from encapsulated samples. The encapsulation matrix was formed by the condensation reaction of an alkoxide precursor, tetramethyl orthosilicate (TMOS). The silica sol-gel formed by TMOS, which removes the cytotoxic methanol side chains, is a biologically inert and rigid matrix which physically isolates and constrains cells. Previous research has given evidence of changes in gene expression (Dickson et al 2012) and increases in cellular metabolic products, such as photobiological hydrogen (Dickson et al 2009), when cyanobacterial cells are encapsulated. These results are thought to be due to the physical growth restriction of the matrix on the cells. Here we present physiological measures of cellular viability such as amount of chlorophyll present and photosynthetic oxygen evolution. It is our belief that by finding differences in photosynthetic and respiration rates between encapsulated and liquid cultures, we can support the idea that encapsulation causes cells to divert their energy expenditure from cell growth and division to increased metabolism. To this end, we created treatments that have previously triggered metabolic changes in liquid cultures (DeLong and Hanson 2011). Both the liquid and encapsulated cultures have been subjected to changes in temperature at different densities and then compared the metabolic responses between them. (Supported by NMEPSCoR and the University of New Mexico.)

Building a network from two networks: successes and challenges

Ayesha S. Burdett, New Mexico Museum of Natural History and Science (NMMNHS);

Mary Jo Daniel, Selena Connealy, New Mexico Experimental Program to Stimulate Competitive Research (NM EPSCoR)

The New Mexico Informal Science/Current Research Network focuses on two important issues—water and energy. We bring together a network of informal science education institutions (NM ISENet) with a network of researchers (NM EPSCoR) to enhance collaboration that will engage learners of all ages in STEM issues related to water and energy. The goal of this collaboration is to communicate important current research in two ways: (1) a series of statewide and regional meetings connect researchers to educators, the public and policy makers; (2) students and faculty engaged in research provide intellectual and material resources to inform ISE programs and exhibits. We have successfully hosted two annual meetings for the ISE Net community and a third meeting is currently being planned. However, the success of the regional meetings has been patchy; these events have been hosted by one or two core NM ISE Net institutions rather than by many institutions from throughout the state. We are working on the challenge to improve the distribution of regional meetings by developing “mini grants” to host these events. Another ongoing challenge is to improve communication between the two networks, and to understand the priorities and language of each network. Educators face the challenge of developing relationships with individual researchers when their time is already limited, while researchers do not always appreciate the opportunities for broader impact that NM ISE Net can provide. We continue to learn the best way to establish long-term collaborations.

Palladium nanoparticles supported on 3D-Graphene Electrocatalysts for Fuel Cells

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Fuel cells are one of the most promising sustainable energy technologies for energy conversion. However, current fuel cells rely on platinum electrocatalysts, which are expensive and lack long term stability.

Alternatively, Palladium (Pd) has been attracting growing interest due to their thermal stability and excellent activity. However, Pd nanoparticles used as catalysts for fuel cells are usually supported on amorphous carbon supports which are prone to corrosion. If has therefore become imperative to develop relatively cheaper catalytic materials with improved performance and durability.

In view of that, our present work adopts the Sacrificial Support Method developed at UNM for the synthesis of porous crystalline 3D-Graphene nanosheets. The nanosheets were then utilized as a support material for Pd nanoparticles deposited using the original Pd-precursor based Soft Alcohol Reduction Method. The obtained materials were comprehensively characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), and scanning transmission electron microscopy (SEM).

Our results show that the 3D-Graphene support materials had a high surface area (~300 m^2/g) and porosity. The Pd nanoparticles synthesized using ethanol as a reducing agent in the SARM fabrication method had an average size of 4.3 nm as well as the highest electrochemical activity and durability when supported on 3D-Graphene, with a peak current density of over 1550 A/g_{Pd} for ethanol electrooxidation.

The results from this research will not only lead to the development of highly efficient catalytic materials for fuel cells, but also lead to the advancement and successful commercialization of sustainable emerging energy technologies.

Keywords: energy, electrocatalysts, fuel cell, graphene

Title:

The effect of biofilm carrier length on nitrification in moving bed biofilm reactors: an examination of mixing intensity, shock loadings, and pH changes on biofilm activity

Authors:

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Abstract:

Free-floating attachment surfaces are commonly used in wastewater treatment, but little is known about media geometry affecting biofilm processes. The objective of this study was to compare nitrification and growth of biofilms grown on different length media in bench-scale moving bed biofilm reactors. The carriers were cut from high density polyethylene tubing with one media type one-third the length of the other, but with inner and outer diameter dimensions identical. Each bioreactor was continuously operated with coarse bubble aeration and provided with a high ammonium loading to promote greatly active nitrifying communities. Biomass measurements were taken regularly to observe growth. A series of variable velocity gradient (G) batch tests was executed to determine the effect of mixing on mass transfer through the biofilms of each media type. High ammonium and variable pH batch tests were also conducted to assess inhibition effects on nitrifiers. Greater biomass was consistently measured on the longer media despite both media types having similar ammonia uptake during continuous operation. Lower G values consistently produced a greater ammonia utilization in the short media biofilm than in the long media biofilm. However, at mid to high range G values, ammonia consumption was similar between both biofilms. Ends of media typically had greater biomass and greater nitrate production than middle sections, while ammonia consumption was similar along carrier length. Abrupt changes in ammonium concentration and pH produced significantly greater inhibition effects in the short media biofilm than in the long media biofilm, suggesting greater protection in the thicker biofilm.

Keywords:

Water, biofilms, bioreactors, nitrification, wastewater

Mantle CO_2 Degassing and Fluid Migration along Fault Networks in the Northwestern Albuquerque Basin and Valles Caldera

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The Rio Grande rift has active volcanism and faulting providing a field laboratory for examining links between mantle degassing and faults as conduits for fluids and volatiles. CO_2 flux measurements were taken at 6 sites in the northwestern Albuquerque basin and Valles caldera. All sites progress to the southwest from the caldera, down the rift-related Jemez fault network, to intersect with the Nacimiento fault. The instrument used to measure CO_2 flux was an EGM-4 CO_2 gas analyzer (PP systems) with an accumulation chamber. Individual diffuse and spring measurements (n) were obtained from each site at approximately 50 m spacing or less. Carbonic springs at Penasco Springs (n=41) and San Ysidro (n=261), and the carbonate-cemented Sand Hill fault (n=42), were targeted. The Sand Hill fault had the smallest maximum flux (8 g/m^2d). The other two sites are approximately equal distance between the Sand Hill fault and caldera sites. Our work suggests these sites reflect intersections of the Nacimiento fault with NE trending faults that connect to the Jemez fault network. The maximum diffuse flux recorded at San Ysidro (434 g/m^2d) and Penasco Springs (25 g/m^2d) are high, especially along the fault near springs. Maximum diffuse flux measurements of Alamo Canyon (20,906 g/m^2d), Sulphur Springs (2,400 g/m^2d), and Soda Dam (1,888 g/m^2d) at the Valles caldera geothermal sites (n=63, 59, and 92, respectively) are comparable to Yellowstone geothermal systems. Results indicate fault networks allow for volatile transport consistent with the geological occurrence of carbonate accumulations (travertines and cements) along the same structures.

Keywords: CO_2 Flux, Faults, Mantle, Albuquerque Basin, Valles Caldera

Assessing the Geomorphological Effects of Animal Exclosures on a High Elevation Stream in the Valles Caldera National Preserve, New Mexico

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Abstract:

Livestock grazing near streams can have adverse effects on channel geomorphology, including impacts on bank structure, channel characteristics, and recovery from disturbance. I am examining the effects of the exclusion of both native and domestic grazers on stream geomorphology at 3 animal exclosure locations on San Antonio Creek, Valles Caldera National Preserve, New Mexico. This study is designed to test the hypotheses that: 1) channels are deeper and narrower in areas where grazers are excluded 2) banks are deeper and bank angle is increased in areas where grazers are excluded 3) over-banking will occur at a lower discharge in areas where grazers are excluded. I used a theodolite to survey stream cross-sections located on San Antonio Creek at the end of grazing season. These cross-sectional coordinate data are being used to create representative 20-foot-long stream sections in the U.S. Army Corps of Engineer program HEC-RAS. I am using the spatial characteristics of the stream sections, such as bank depth, water depth at stream center, channel width, and bank angle, to statistically compare the different sample locations to one another. I am using this information to look for differences in channel and bank characteristics between each surveyed section, and also compare sections where grazers were excluded to sections where there is no exclusion. I am also using geographical information systems software, coupled with HEC-RAS, to construct a flood analysis in surveyed areas. Grazer exclusion as a passive restoration approach may be a cheaper management alternative compared to a more hands-on approach.

Keywords: Livestock exclusion, Channel morphology, New Mexico, High elevation streams

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Algal System for BOD and Nutrient Removal from Urban Wastewater – Pilot Scale Study

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Urban wastewater (UWW) treatment plants continue to depend on obsolete, multistage technologies that are energy intensive and unsustainable. UWWs are known to contain internal energy about 6.3 - 7.6 kJ/L, which is about 2-3 times the energy that is currently used for treating them; at the same time, valuable energy, carbon, and nutrient content of the wastewater are dissipated into the environment. The activated sludge process, for example, mineralizes valuable organic content of UWW aerobically to gaseous CO2; the nitrification/denitrification process converts ammonia content of the UWW to gaseous nitrogen and discharges into the atmosphere, instead of harvesting it for use as fertilizers.

This study demonstrates a single-step algal system where the selected strain, *Galdieria sulphuraria*, is shown to be capable of mixotrophic metabolism for simultaneous removal of carbon and nutrients from UWWs. The specific advantage of the mixotrophic system in general, and of *Galdieria sulphuraria* in particular, over the traditional heterotrophic bacteria-based systems stems from the fact that stoichiometric carbon-to-nitrogen (C:N) ratio in UWW is closer to that of algal biomass composition than to that of heterotrophic bacteria. Laboratory scale studies have been scaled up to 300L and 700L enclosed photobioreactors for testing under outdoor conditions at the Las Cruces Wastewater Treatment plant. This paper presents the temporal variations of BOD and nutrient removal capability of *Galdieria sulphuraria* from primary-settled UWW and an energetic analysis to demonstrate the net energy advantage of the algal wastewater treatment system over the traditional wastewater treatment process.

Keywords – Wastewater Treatment, Algal, Single- step, Mixotrophic

Reactor design and operation variables to improve mixed algae biomass production and stability

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Abstract

Imposing selection pressures on mixed communities of bacteria is commonly done to improve performance of activated sludge systems for wastewater treatment. Much less research has been done on reactor design and operation to impose selection pressures in algal poly cultures, in part because biofuels research has focused on algal mono-cultures. It is hypothesized that imposing a selection for algae with good flotation or settling characteristics will enrich for high biomass and/or lipid storage, and that imposing a selection pressure for settling or floating algae will improve solids separation, which is a major challenge in algal cultivation and recovery.

The objective of this study is to determine if poly cultures of algae can be enriched for useful functions, such as improved solids separation and/or lipid storage, by incorporating settling or floating phases to their operational cycle.

This study incorporated three sequencing batch reactors with defined media, run with a hydraulic residence time of two days, using varied cycle procedures: (1) continuous mixing, (2) wasting from the top after a settling phase (selecting for settled algae), and (3) wasting from the bottom after a settling phase (selecting for floating algae).

Initial results indicate that algae favored settling with larger biomass concentration (approximately 4000 mg suspended solids/L after 50 days), including larger flocs of algae/cyanobacteria, in the top wasting reactor after settling, which also yielded a low sludge volume index, indicating a well-settling biomass. Bottom-wasting resulted in low biomass (100 mg/L), indicating that flotation was a poor strategy for selection. Results from Percoll density gradients indicated biomass density was positively correlated with light exposure. These results could indicate that density is not the primary settling/flotation mechanisms and a motility mechanism could be playing a dominant role. Current work is investigating the effects of shorter settling times.

Evaluation of the accumulation of trace metals (As, U, Cr, Cu, Pb, Zn) on iron-manganese coatings on *in situ* stream pebbles and emplaced substrates

Margaret Turpin, Maria Armijo, Johanna Blake, Mehdi Ali, Laura Crossey, and Lina Hanson

Exposure to trace metals (As, U, Cr, Cu, Pb, Zn) has potential negative health effects on human populations and wildlife. Geothermal waters often have elevated concentrations of trace elements and understanding the geochemical cycling of these elements can be challenging. Previous studies have utilized *in situ* stream pebbles and glass or ceramic substrates with iron-manganese oxide coatings to understand contamination and or chemical cycling. This project's main focus is to develop an ideal tracing method using adsorption onto substrate surfaces and to define key parameters that are necessary for the phenomenon of adsorption between trace metals and these surface coatings to occur. Sampling locations include the Jemez River and Rio San Antonio in the Jemez mountains, northern New Mexico. Both streams have significant geothermal inputs. Pebbles and cobbles were gathered from the active stream channel. Factors such as leachate type, water pH, substrate type, coating accumulation period and leach time were all considered in this experiment. It was found that of the three leachates (aqua regia, 10% aqua regia and hydroxylamine), hydroxylamine was the most effective at leaching coatings without dissolving substrates. Samples leached with aqua regia and 10% aqua regia were found to lose weight and mass over the following 5, 7, and 10 day measurements. Glass beads were determined to be more effective than in stream pebbles as accumulation substrate: coatings were more easily controlled and monitored. Samples leached with hydroxylamine for 5 hours and 72 hours showed little difference in their leachate concentrations, suggesting that leach time has little impact on the concentration of leachate samples. This research aims to find the best method for trace metal accumulation in streams to aid in understanding geochemical cycling.

What's Inside an Invasive Frog? Sexual Comparison of Bullfrog Diet of the Mora River

Co-Author(s): Steven Salinas, Justin Siaz, Son Tran, Alfonzo Trujillo, Micah Dabough, Lisa McBride, Dr. Jesus Rivas New Mexico Highlands University

Invasive species are the single worst conservation problem at the species level worldwide. Invaders can negatively affect the diversity of native species via predation or competition for resources. American Bullfrogs was introduced in Northern New Mexico since the 1940s and because the introduction was so long ago there have been no quantification on the impact bullfrogs' cause on the native aquatic fauna. In this study I analyzed 600 stomach contents of bullfrogs in the Mora River over a four year period. The prey index of the frogs was split into male vs female categories showing the breakdown of diet preference between them. Further analysis showed differences in mass of prey, and comparisons of the most captured food. Most of the stomachs contained Northern Crayfish (Orconectes *virilis*) followed by whatever insect was abundant at the time. We found often some unidentified white slime that we believe may be from eggs masses of other amphibians or fishes as well as some mixed of stomach acids. Surprisingly, we did not find any leopard frogs in the diet of bullfrogs, however we did find a single Woodhouse Toad (Anaxyrus *woodhousii*)

Keywords: (Invasive Species, Climate Change, Bullfrogs)

The Ecological Role of Cougars within a Multispecies Predator-Prey System

Abstract

Community interactions play an integral part in the study of animal behavior. These interactions both shape and define how species coexist with one another. This creates a network of interconnectedness upon which organisms influence others. Such interactions help wildlife managers understand ecological systems in hopes of developing effective management plans to sustain and conserve both species richness and diversity. A focus on cougars (*Puma concolor*) within the Valles Caldera National Preserve and surrounding Santa Fe National Forest aims to provide information regarding their ecological role as an apex predator. More specifically, the investigation of cougar kill rates, prey composition, and kleptoparasitism by black bears (Ursus americanus) will be pursued. We hypothesize kill rates and prey composition are influenced by the degree of kleptoparasitism.

Economic Impact of Natural Gas Production in the San Juan Basin

Janak Joshi, University of New Mexico; Janie Chermak, University of New Mexico, Jennifer Thacher, University of New Mexico

Natural gas extraction contributes to the economy in many aspects. It creates employment opportunities for local communities and royalties for land owners. It also stimulates economic development in the local economy through revenue recycling. Finally, in New Mexico, the natural gas sector provides significant tax revenues to the local, state and federal governments. However, the true economic impact of natural gas production in the economy is more complicated. For instance, production comes with external costs, such as air pollution, water use, water contamination, and contributes to global warming. At the same time, there are additional positive benefits in terms of demand for additional labor, goods, and services. The objective of this research is to develop an economic assessment of natural gas production in the San Juan Basin considering the broader scope of impacts. The San Juan Basin contains one of the largest conventional fields in the U.S. and is the top natural gas producing region in New Mexico.

Keywords: Natural Gas, Economic Profits, San Juan Basin, New Mexico

Xanthophyll Analysis of High Desert Trees

Theresa Garcia, UNM; Dave Hanson, UNM; Linnea Ista, UNM;

Xanthophylls are light sensitive plant pigments that help compensate for free radicals by dissipating excess absorbed light energy. Light is a necessity for plant survival, but too much light can generate oxygen reactive species that can damage or even kill a plant. Plants adjust their light harvesting complexes to optimize light utilization, but this process is slow relative to daily environmental variation and the onset of stress. Xanthophylls can convert to light dissipating forms within minutes, so they provide a lot of flexibility plants need. Very little research has been done to explore these compounds in native New Mexican species Juniperus monosperma, and Pinus edulis, which grow in high light, upper elevations, and regularly experience drought. We developed a rapid and improved separation and analysis of the xanthophylls, violaxanthin, antheraxanthin, and zeaxanthin, through ultra-high pressure supercritical fluid chromatography. We then used this method to compare xanthophyll composition of both species grown under heat, drought, and combined heat and drought conditions.

Xanthophylls, Chromatography, Tree, Stress Conditions

Distortion Induced Acceleration of Intersystem Crossing

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ABSTRACT: Control of molecular excited state processes is important for understanding how to fully realize the potential of the molecular photonics and electronics fields. In order to obtain insight into atomic and vibronic level control of excited state lifetimes, we have initiated a study of new diimine platinum(II) dichalcogenolenes that possess charge-separated dichalcogenolene → diimine excited states. Square planar (dichalcogenolene)Pt(diimine) complexes have garnered considerable interest due to their rich photophysical properties, including their photoluminescence behavior. We use a combination of electronic absorption and transient spectroscopies, spectroscopic calculations, and group theoretical arguments to understand the remarkable dependence of excited state lifetimes on (1) the heteroatoms of the dichalcogenolene ligand, and (2) static distortions related to the acceptor ligand. Our results indicate that anisotropic covalency and low-symmetry distortions control spin orbit and vibronic spin orbit coupling, and these are the origin of enhanced $T_1 \rightarrow S_0$ intersystem crossing in these systems. Of particular interest is (dithiolene)Pt(biquinoline), which possesses a $T_1 \rightarrow S_0$ lifetime that is nearly two orders of magnitude less than that observed for (dithiolene)Pt(bipyridine). This is due to a strong static distortion driven spin-orbit coupling contribution that can be used to evaluate vibronic spin orbit coupling contributions to the $T_1 \rightarrow S_0$ lifetimes of other (dichalcogenolene)Pt(diimine) complexes.

Keywords: dithiolene, diimine, platinum, photoluminescence, electronic structure

Identification of cold-stress response genes in *Nannochloropsis salina* using RT-PCR

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Marine microalga *Nannocholoropsis salina* is famous for its high oil yield mainly triacylglycerides (TAGs) as neutral storage lipids in response to N deprivation and environmental stresses. One of the response products is polyunsaturated fatty acid (PUFAs), which is derived from lipid metabolism. Recent advances in molecular and genetic analyses of microalgae have uncovered some distinct and unique characteristics of microalgae pointing out towards the necessity to study lipid metabolism and molecular and genetic basis of lipid metabolic pathway. Genes encoding for these lipid biosynthesis enzyme can be found in various microalgae using these analyses. We found out that *Nannochloropsis salina* can accumulate 50% more polyunsaturated fatty acids (PUFAs) under low temperatures as compared to optimum conditions. We carried out a series of experiments to find out the genes, which express more in response to low temperatures through RT-PCR. We also performed a detailed analysis of total lipids extracted using FT-ICR and GC/MS.

Key words: Lipid metabolism, RT-PCR, PUFAs, gene expression

Characterization of physiological response in *Nannochloropsis salina* to cold stress

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Microalgae have the ability to adapt to several biotic and abiotic stressors that occur within the environment due to their metabolic plasticity. Changes in environmental conditions will mediate physiological responses, such as changes in nutrient uptake and photosynthetic activity, fluctuations in growth parameters, and modulation of lipid production. Exposure to low temperatures contributes significantly to regulating fatty acid pools; however, data are limited on the effects of cold stress on algal metabolism, such as chilling (below 15°C) and freezing (at 0°C). We relate the effects of decreased temperature to lipid production and composition of lipid profiles for *Nannochloropsis salina*, for the following range of temperatures: 5°C, 10°C, 15°C, 20°C and 25°C. We present a qualitative characterization of physiological changes in response to cold stress by examining the following: fluctuations in growth parameters through optical density (OD) measurements, changes in nutrient uptake by nitrate and phosphate analysis, and changes in photosynthetic activity through use of pulse-amplitude modulated (PAM) chlorophyll fluorometry.

Geochemistry of Sinkholes in the Santa Rosa, NM Area

Mariah Kelly, UNM; Laura Crossey, UNM; Rebecca Frus, UNM; Abdulmehdi Ali

In Santa Rosa, NM there are several bodies of water known as sinkholes, fed by an artesian aquifer (the Permian Bernal Formation). The sinkholes are perennial water sources that both host endemic species as well as provide water to the Pecos River. We examine twelve locations, including four sinkholes, three springs, two Pecos River locations, and three water wells to compare the different water chemistries and parameters to identify connections and processes occurring between the diverse water locations.

Data collected from the surface water and from wells are acquired by standard water sampling protocols. Samples that are collected from warm water vents at depths lower than 10 meters were taken using an original technique necessitated by the specific condition of the deep locations. We report temperature, pH, conductance, and major ion solute concentrations. All of the waters (sinkhole data (~18 °C, 7.3 pH, 3085µS); spring data (~18 °C, 5.7pH, 2530µS); Pecos River data (~17°C, 6.5pH, 2690 µS)) have a strong geochemical similarity to the regional aquifer (aquifer data (~18 °C, 6.8 pH, 2010 µS)). Additional effects on the waters include evaporation and mineral precipitation/dissolution. We use geochemical modelling codes to indicate the major ions composition and distribution as well as the saturation state with respect to minerals such as calcite and gypsum. The contribution of these artesian groundwater outflows is significant to the Pecos River, and take on additional importance given the projections of diminished stream flows in the future.

Stratigraphic relationships and physical properties of young sediment offshore southeastern Alaska

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Southeastern Alaska is home to one of the most actively deforming continental margins in the world, and temperate glaciers covering the area contribute to high rates of erosion and offshore sedimentation, making the Neogene sediment covering the offshore continental shelf an ideal location to study interactions between climate and tectonics. We present a high-resolution two-dimensional P-wave velocity model of the glaciomarine sediment and underlying basement in the area and compare to coincident seismic reflection profiles in order to determine lithologic boundaries and correlate with stratigraphic units observed onshore and in offshore boreholes. Data used in this study includes ~115 km of multichannel seismic reflection and coincident ocean-bottom seismometer wide-angle reflection and refraction data. In Yakutat Bay, sediment velocities are high (~ 4 km/s) compared to velocities farther offshore (< 3 km/s), possibly indicating greater compaction of the sediments in the bay. In the central portion of the shelf, three distinct refractions from sedimentary layers are observed and are interpreted as the Yakataga, Poul Creek, and Kulthieth Formations. Northern profiles show only two refractions from sedimentary layers. Basement refractions are observed in the north at close offsets, evidence of shallow basement that could be indicative of uplift in the bay. Our velocity profile used in conjunction with seismic reflection data shows transitions in dominant depositional processes over time in the central portion of the block and helps to provide a regional framework of the geometries of the sedimentary packages and their spatial relationship to major tectonic features.

Key-words: Offshore sedimentation, glacial sediment, Gulf of Alaska, compaction

Title: Forgiveness aversion: the influence of perceived forgiveness risks on forgiveness motivation

Authors & Institution: Angel De Nieves Arellano, New Mexico Highlands University; Ian Williamson, New Mexico Highlands University; Sierra Fernandez, New Mexico Highlands University.

Abstract: The attainment of forgiveness maybe hindered even though it is known to provide benefits in psychological, physical, and social ways (p.379). Research by Williamson and colleagues (2015) introduced the concept of forgiveness aversion, which is "an offense-specific motivational state based on perceived forgiveness risks" (p. 378). The dimensions of forgiveness aversion include unreadiness, emotional turmoil that prevents individuals from forgiving; self-protection, concern with how offenders will interpret; and face concerns, or preoccupation with personal reputation which prevents forgiveness. Four studies revealed differential predictors of the three dimensions of forgiveness aversion and found impediments to forgiveness to be situation-specific (Williamsons, Gonzales, Fernandez, & Williams, 2015). The focus of this research is to build on the prior studies by seeing whether the same processes of forgiveness aversion can be triggered in memory. The study had 222 student participants and used a 3 (Aversion Trigger: Rumination, Repeat Offense, or Revenge) x2 (Level: High or Low) experimental design, in which participants' were asked to recall one of six different experiences from their past. Such as, in the high rumination condition they were asked to remember "a time when you kept dwelling on the offense. You kept ruminating about what the person did to you". Individuals, who recalled memories of high rumination, repeat-offending, and/or revenge, were expected to show higher unreadiness, self-protection, and face concerns when respectively considering forgiveness. Individuals by contrast who considered memories that produced fewer thoughts of rumination, repeat-offending, and revenge, were expected to experience less forgiveness aversion and greater forgiveness motivation.

Keywords: Forgiveness, Motivation, Rumination

Membrane distillation in water treatment

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Abstract: Obtaining fresh water from water desalination is an attractive method to deal with the water crisis. How to achieve this goal efficiently both in technology and economy aspects are challenges to the researchers. Among many treatment options membrane distillation (MD) is a promising one. Driven by the vapour pressure difference between the porous hydrophobic membrane, the MD process has many attractive features. For example the operation temperature is not necessarily heated up to the boiling point, and the operation pressure is much lower than that used in some pressure-driven membrane processes like reverse osmosis (RO). Therefore, MD is expected to be a cost-effective process, and there is less requirement for the membrane too. And as a matter of fact, the MD process can achieve a theoretically 100% salt rejection. However the MD is also attended by some drawbacks such as low permeate flux (compared to other separation process, like RO), and the permeate flux is highly sensitive to the operation conditions, like concentration and temperature. This work demonstrated some efforts in morphology control and operation conditions selection to improve the performance of the MD process.

Keywords: Water Treatment, Membrane Distillation, Morphology

Short Duration Aquifer Test within a Fractured Crystalline Basement Reservoir, Truth or Consequences, New Mexico

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Keywords: High Permeability, Crystalline Basement, Geothermal, Aquifer Test, Hot Springs

Recent 2D hydrothermal modeling efforts published by Pepin et al. (2015) suggest that the low-temperature (~ 41°C) geothermal system in Truth or Consequences, NM is characterized by deep (2-8 km) groundwater circulation within permeable (10^{-12} m^2) fractured crystalline rocks. Their models were constrained by geochemistry, temperature, flow velocity, and carbon-14 data but lack calibration to aquifer test data. On June 13, 2015, we conducted an aquifer test in a newly drilled 73-meter deep geothermal well within the town's hot-springs district. The production interval of this well is 24 meters long and is within fractured Precambrian metamorphic rocks. We installed pressure transducers in the production well and in two observation wells to monitor water levels during the test. The production rate averaged 1.8 x 10^{-2} m^3/s (283 gpm) and the two observation wells were located 20 and 38 meters away from the production well, respectively. The two observation wells were shallower and completed in Quaternary alluvium. Production well water levels oscillated during the first two minutes of the aquifer test due to inertial effects. Net drawdown in the production well after 97 minutes of pumping was approximately 0.6 meters, while minimal drawdown was evidenced in the observation wells. Applying the Cooper-Jacob model provided a transmissivity estimate of 1.1 x 10^4 m^2/day and thereby a permeability range of 5 x 10^{-10} to 2 x 10^{-12} m^2. These results are further evidence that the crystalline basement rocks within the Rio Grande Rift can be remarkably permeable when significantly fractured.

Methods for protecting the growth of *G. sulphuraria* as wastewater

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Rationale

The algae strain called *Galdieria sulphuraria* has been used most recently in the treatment of municipal wastewater, reducing the levels of phosphates and nitrogen to comply with EPA regulations so that reintroduction of the wastewater into the ecosystem is energy positive and ecofriendly. This strain has been used because it is an extremophile in that it grows in low pH ranges and high levels of temperature. We have been monitoring the growth of *G. sulphuraria* in outdoor photo bioreactors for identifying crop protection methods and identification of infection sources which could limit the growth and productivity of the algae. While monitoring the algae, a fungal infection took place. We used methods to counter this and to our knowledge have succeeded thus far.

Keywords: Crop Protection, Algae

The Effects of Geothermal fluids on Surface Water Quality in The Jemez River System in Northern New Mexico

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Vanessa Ward, Rayanna Benally, Laura Crossey, Valerie Blomgren, Jared Smith, Karl Karlstrom

Geothermal fluids flow into the Jemez River, northern New Mexico, from the Valles Caldera. The river discharge levels (driven by both snowmelt pulses in the spring and monsoons in the summer) greatly influence the local downstream water quality. Water samples have been taken from a 43-kilometer reach of the Jemez River during the summer of 2015 and are compared to results taken along the same reach over the past decade. Methods included 'campaign style' bottle collections for laboratory chemical analysis of cations and metals, anions and alkalinity. Analyses along the studied reach do show three major and distinct geothermal input sites and continuous fluctuations in water quality due to seasonal snowpack melt, seasonal monsoons, and the geothermal fluid inputs. At low river discharges, it is common for many of the constituent concentrations to exceed the Maximum Contaminant Levels, for example sulfate, TDS and arsenic. Alkalinity is also influenced by high CO2 levels of the geothermal discharges.

As influences from climate fluctuations continue, the importance of monitoring of the local water systems can be seen, more importantly if temperatures continue to climb and drought conditions persist. Streams of the arid Southwestern US are particularly susceptible to water quality degradation coupled to declines in surface water supply due to the widespread presence of deeply-derived, saline groundwater inputs.

KEY WORDS geothermal fluids; discharge levels; water quality

Title: Alkalic epithermal gold mineralization, southwestern Platoro caldera: An examination of a shallow extinct geothermal system

Presenter: Hrncir, Jeffrey Department of Earth and Planetary Sciences, University of New Mexico

Abstract: The 29.7-28.4 Ma Platoro-Summitville caldera complex is host to a diverse class of polymetallic ore deposits, including the world-class gold deposit at South Mountain. New mapping of andesitic units that have been subjected to widespread epigenetic alteration has revealed a previously unrecognized gold deposit type formed at ~22 Ma hosted within subtle alteration facies at the distal end of an auriferous hydrothermal system. The anatomy of this geothermal system is examined through integration of field mapping and geochemical data. Highly anomalous values of gold, tellurium, antimony, arsenic, and halogens up to 6,000 times background abundance are juxtaposed with remarkably low base metal concentrations and total sulfide content. Together, these metal associations comprise a diagnostic trace element geochemical suite genetically related to low sulphidation epithermal deposits and specifically, the alkaline subclass. Pervasive K-metasomatism, chloritization, and hematization within the mineralized rocks provide additional support for the existence of a hydrothermal system dominated by neutral, low salinity aqueous fluid or vapor contributed from a mafic alkaline magmatic source in the subvolcanic environment. The failure to recognize large-scale disseminated gold deposits in the broader Rio Grande rift by explorationists may be attributed to the historic focus on acid-sulfate alteration styles within extinct geothermal systems rather than subtle alkalic facies that superficially resemble regional propylitic alteration. Predictive hierarchical exploration criteria are developed that suggest broadly favorable environments for further alkaline gold discoveries in other mineralized caldera centers and recently active hydrothermal sites within the influence of the greater Rio Grande rift system.

Keywords: gold, hydrothermal, rift

One way to reduce atmospheric CO_2 is through chemical carbon mitigation, an approach which traps atmospheric CO_2 and converts it to a useful product without the use of additional CO_2 generating power sources. This approach can lead to methanol as an end product, a potentially useful fuel. This idea of "methanol economy", pioneered by Chemistry Nobel laureate George Olah, has been highlighted as an alternative to using hydrogen as fuel because methanol is renewable and more readily transportable. The overall goal of this project is to catalytically convert CO_2 to formate ($CHOO^-$), and eventually to methanol (CH_3OH) using ambient solar energy.

This project is focused on evaluating different semiconducting materials as catalysts such as micron- and nano-sized zinc sulfide and copper oxide. Photo-experiments were performed using a buffer system and along with the above mentioned catalysts to test for formate production. Ion chromatography was used to quantify formate concentration. Based on our results, we have demonstrated that nanoparticulate zinc sulfide is a more effective photocatalyst than micron size ZnS in the photoreduction of bicarbonate to formate.

The next step is choosing a suitable photosensitizer that is able to donate electrons to an acceptor when exposed to sunlight. Our aims for this project include selecting both a semiconductor catalyst with valence band and conductor bands compatible with the HOMO and LUMO levels of macrocyclic photosensitizers in order to reduce carbon dioxide to formate (and eventually methanol) using ambient solar energy.

THE ECONOMIC IMPACTS OF WILDFIRES ON THE BUILT AND NATURAL CRITICAL CIVIL INFRASTRUCTURE

Natalia M. Sanabria, University Of New Mexico; Dr. Vanessa Valentín, University Of New Mexico

The impacts on critical civil infrastructure (e.g., water, telecommunications, transportation, etc.) due to major disaster events, can greatly affect the response times and effectiveness of emergency teams, the proper operation of critical facilities and the recovery time for the community. With natural disasters on the rise and the nation's infrastructure outdated and vulnerable, it is essential for agencies to have a plan of action for the allocation of funds to protect civil critical infrastructure.

Over the past decades, wildfires have increased in severity and frequency in response to changes in climate, especially in the Southwest where the arid climate, heat waves and droughts can have a dramatic effect on the risk of fire. This study explores the economic impacts of wildfire events on critical civil infrastructure and the costs associated to mitigation strategies. The proposed impact assessment framework can be incorporated in the decision making processes of watershed managers in order to consider the proper wildfire risk mitigation strategies that better protect and maintain the functionality of the infrastructure.

Keywords: wildfire, economic impacts, critical infrastructure

Preferences on Energy Regulations, Tradeoffs and How They Vary Across New Mexico

Kara Walter, University of New Mexico, Department of Economics
Jennifer Thacher PhD, University of New Mexico, Department of Economics
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There are tradeoffs between renewable energy and fossil fuels and within those categories. Recent regulation at the federal level (111D and Clean Power Plan) is creating changes in how states must act regarding carbon dioxide (CO_2). These regulations require states to develop a plan to cut CO2 emissions by choosing among plans suggest by EPA. Each of these plans will affect the state and counties to different degrees. This research develops a survey asking about preference for methods for states to meet these goals, examines preferences between renewable and fossil fuels and between natural gas and oil, develops a choice experiment, and asks about preference about hydraulic fracturing, oil and gas development, nuclear energy, infrastructure investment for energy, and regulations in the energy industry. In a state that consistently ranks in the top for fossil fuel production and has a large potential for renewable energy, we expect preferences on plans to vary across the state. This poster will discuss what we have learned thus far from focus groups and debriefings and plans for moving forward with the survey.

Keywords: energy economics, survey, tradeoffs, CE

Using Graphical Analysis and Geothermometry to Compare Water Chemistry among Various Sites throughout Colorado and New Mexico

Tanner Grulke, Laura Crossey, Valerie Blomgren and Karl Karlstrom, Dept. of Earth & Planetary Sciences, UNM

Graphical analysis can be a useful tool to visualize contrasting features between sets of water chemistries; we are using graphical tools for geothermal sites throughout Colorado and New Mexico. Our first goal was to compare major ions among a sample suite using ternary, Piper and chemical variation diagrams; these diagrams were created with the Geochemist's Workbench and Excel. Our second goal was to represent thermodynamic relationships among solutes using the excel spreadsheet created by Powell and Cumming (2010); this spreadsheet is useful in geothermal environments, as was the case for this study.

Another set of tools useful in the assessment of geothermal potential are chemical geothermometers. Chemical geothermometers take advantage of temperature dependent water-rock reactions. The geothermometers applied in this study used concentrations of dissolved silica, Na, K, Ca, Mg, and Li. Geothermometers can be used to assess possible reservoir temperatures from chemical data of surface waters. Geothermometers have some limitations when solute concentrations are affected by processes such as: mixing with other waters, dissolution or precipitation, ion exchange with surrounding materials, and residence time. We again used the Powell and Cumming (2010) spreadsheet application to calculate geothermometry data, and used this data to estimate reservoir temperatures.

The graphs and tools assessed for the purpose of our investigation were ternary diagrams (Cl-SO_4-HCO_3 and Na-K-Mg), the Piper diagram and geothermometers. We have found that combining graphical analyses facilitates rapid assessment of the geothermal potential over a wide area.

Powell, T. and Cumming, W., 2010, Spreadsheets for thermal water and gas geochemistry,: PROCEEDINGS, Thirty-Fifth Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, California, SGP-TR-188.

Use of Chemical and Isotopic Identifiers to Characterize a Uranium Contaminated Groundwater Plume in New Mexico

Mitchell Schatz, University of New Mexico, Jose Manuel Cerrato Corrales, University of New Mexico, Bruce Thomson, University of New Mexico, Curtis McHaley, U.S. Department of Energy

Groundwater in shallow aquifers near Milan, NM is the sole source of water for agriculture and human consumption. Beginning in the early 1950's the region experienced extensive mining of uranium and two uranium mills also located nearby. Groundwater in the region has high levels of uranium, selenium, nitrates, and vanadium, and has been found to be too contaminated for human use. Other sources of water have been provided to most residents in the region. Isotopic and chemical identifiers were used to help distinguish contaminants derived from anthropogenic and natural occurring sources near and the two milling sites. Private wells were sampled in the fall of 2015. Principal Component Analysis was used to display similarities and differences in groundwater chemistry for sampled wells, natural sources and uranium mill site groundwater. Several of the private wells had similar levels of contaminants as mill-derived water. Activity ratios (ARs) for uranium-234 and uranium-238 were used to determine the source of groundwater contamination. Dissolved sulfate in mill-derived groundwater was enriched with sulfur-34 whereas, natural occurring groundwater showed a depletion of sulfur-34. Other stable isotopes were used to determine sources of contaminants in the aquifers. The use of chemical and isotopic identifiers in this study help to determine that groundwater contaminants in private wells down gradient from the milling site were most likely derived from the mill site dewatering activities and not the natural occurring contaminants from Morrison formations in the San Mateo Creek basin aquifers.

Keywords: (Groundwater, isotopes, uranium, mining)

Complexation and Redox Reactions Affecting Uranium Recovery by In Situ Leaching

By Omar Ruiz, Johanna Blake, Jose Cerrato, Bruce Thomson

From 1950 to the early 1980's New Mexico played an important role in the production of uranium (U) for the nuclear power industry and the nation's weapon programs. Though the U mining and milling industry is largely dormant at present, increased interest in nuclear power as a CO_2 free power source has led to proposals for renewed development of U resources. In particular, U mining projects have been proposed using both underground mining and in situ leach (ISL) mining. The objective of this poster is to investigate metal speciation controlled by complexation, and redox reactions resulting from ISL U mining. In principle ISL mining will minimize waste by eliminating mill tailings, mine waste rock, mined dewatering, and radiation exposure. ISL mining has not avoided aquifer contamination and therefore an evaluation of complexation, and redox reactions affecting the interactions between U minerals and co-constituents, which may include but not limited to arsenic, chromium, molybdenum and, vanadium. Batch experiments of low grade ore were conducted and show that U and co-constituents are dissolved and need to be considered for aquifer remediation. Leach tests have been performed both with acids to determine the total metal concentrations, $NaHCO_3$ lixiviant was used to understand U and metal dissolution. The results of these experiments will be presented. The results will be used to develop an understanding of the effectiveness of ISL mining, the potential impacts on ground water quality, and will subsequently be used to develop strategies for mitigating the impacts of these activities.

Title: Beneficial Use of Produced Water in Pressure Retarded Osmosis

Adam Martinez, New Mexico Institute of Mining and Technology

Abstract:

Produced water is a waste stream from oil production that currently has no method of mitigation. The water is stored in wells, or injected into oil wells for waterflooding to extract more oil. This water is non-potable and has a very high TDS. Pressure retarded osmosis is a method of power generation using the salinity gradient across a membrane. The Hydranautics SWC-50LD membrane was tested for pressure retarded osmosis to generate power. The true permeance of the membrane was determined to be 0.142 LMHP, and used to properly calibrate the active area of the membrane. Seawater at 3.5% was tested to establish a baseline for the membrane power generation. The power for this salinity was found to be 0.5 W/m². Concentrate at 7% was also tested, and generated 1.2 W/m². Produced water was assessed using both tap water, and a makeup water with a TDS of 1.5%. The power generation was found to be lower for the makeup water case at 2 W/m², indicating internal concentration polarization within the membrane. The tap water case generated 3.5 W/m². In this case, this membrane and configuration does not offer optimum power generation, and hollow fiber membranes may be the direction to take for PRO.

Keywords:

Power, Produced Water, Total Dissolved Solids, Pressure Retarded Osmosis

Water Purification: Insights on the Catalytic Activity of Defect Free- and Rich-Molybdenum Disulfide (MoS_2) Nanosheets for the Photocatalytic Removal of Carcinogenic Chromium(VI) Ions

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Abstract. This work highlights an efficient water purification process utilizing cheap and environmentally benign molybdenum disulfide (MoS_2) as a (photo)catalyst. By controlling the molar ratio of Mo to S in their precursors, defects can be introduced in the MoS_2 nanosheet structures. Defect free- and rich- MoS_2 nanosheets are prepared by the one-pot hydrothermal process. Although there is a wide range of reports on the catalytic performance of defect rich-MoS_2 and its composites, a correlation between adsorption and corresponding photocatalytic behavior of defect free- and rich-MoS_2 is yet to be developed for water purification by removing carcinogenic Cr(VI). However, synthesis parameters and post-synthesis heat treatment offer interesting changes in the crystalline properties as well as the catalytic activities. MoS_2 nanosheets are characterized by XRD, BET isotherm, SEM, and TEM. Catalytic performances for Cr(VI) removal is measured at pH=4. Herein, we report (I) the determination of the BET surface area of defect free- and rich-MoS_2 to relate to their catalytic activities, (II) the establishment of the adsorption isotherm for Cr(VI) ions, and (III) the comparison of the photocatalytic removal of Cr(VI) for water purification as well as the realization of the influence of the post-synthesis heat treatment on MoS_2 nanosheets.

Solution Processed Strontium Titanate as a Cathodic Buffer Layer for Polymer Solar Cells

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Organic photovoltaics present an opportunity for economical, scalable power generation for the ever increasing energy requirements of the developing world. Metal oxides have been investigated as a potential replacement for current buffer layer to alleviate the degradation of the indium tin oxide (ITO) electrode/PEDOT:PSS or poly(ethylenedioxythiophene) poly(styrene sulfonic acid) interface as exposure to air facilitates harmful etching of the glass. Increased stability can be achieved by sandwiching the air-sensitive materials between less air sensitive materials and utilizing an inverted solar cell structure. With collaboration between NMSU and UNM, a thin film of strontium titanate was fabricated using a low cost, scalable polymer-assisted deposition method as an effective cathodic buffer layer utilizing the aforementioned inverted design. The polymer solar cells operating with a poly(3-hexylthiophene) (P3HT) / phenyl-C61-butyric acid methyl ester (PCBM) blend and the strontium titanate cathodic buffer layer exhibited favorable performance with a power conversion efficiency (PCE) of 3.5% and fill factor (FF) of 45%, which indicates that such a buffer layer produced through an economical synthesis provides a potentially attractive choice for low-cost organic solar cell fabrication.

Keywords: solar cell, polymer, strontium titanate

Lipid Extraction from Algal Biomass for Biofuel Production

Tanaka Pfupajena, Juchao Yan
Eastern New Mexico University

The majority of the fuels we use in our vehicles and other equipment on a daily basis are nonrenewable. As a result, the world is running out of supplies of fuels. Many alternatives to using natural reservoirs as sources of fuels have been exploited, among which, the use of algal feedstock as a source of biofuel has received enormous attention. Algal biofuel was studied for a long time, and has recently gained popularity again due to the global demand for transportation fuels, the greenhouse gas effects, and the energy security risks.

In this project we investigate the use of microalgae cultivated from dairy wastewater to produce biofuels. Algae offer an inexhaustible source of energy, nutrients and raw material. When microalgae are grown and harvested, the biomass obtained contains lipids which can be converted into biodiesels through chemical transformations. In this presentation, I will present my preliminary results on using Sohxlet extraction to extract the lipids, lipids characterizations by Gas Chromatography-Mass Spectrometry, and the separation of algal extracts by a reverse-phase column chromatography.

Keywords: microalgae, lipids, and chromatography

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Screening Test of Four Low Temperatures on a Natural Mixed Algal Population Preserved With Methanol or Dimethyl Sulfoxide for Viability and Identification of Reconstituted Species Analysis

Sarah Kintner, Nanoscience and Microsystems Engineering, University of New Mexico; Andrew Schuler, Department of Civil Engineering, University of New Mexico; David Hanson, Department of Biology, University of New Mexico; Abhaya. K. Datye, Chemical and Biological Engineering, University of New Mexico

Understanding the effects of freezing on mixed algal population cultures for later reconstitution is important for long-term culture reproducibility. This temperature screening study freezes a San Acacia Brine Pond mixed algal population with cryopreservants of methanol or dimethyl sulfoxide at four temperatures: 0, -20, -80, and -196 ºC, and reconstitutes the frozen algal samples to determine their viability and the species present. One flask was cultivated in the laboratory for 11 days. Each culture sample was mixed with either 5% or 10% methanol or dimethyl sulfoxide. The vials were placed in their respective freezer for 1 week and then reconstituted in 30 mL of media with all vials growing on a rotary table. Temperatures below -196 ºC grew only filamentous algae. **The culture day growth started by green appearance is: 0 ºC** - 5% and 10% dimethyl sulfoxide, day 10; **-20 ºC** - 5% dimethyl sulfoxide day 7, 10% dimethyl sulfoxide day 6; **-80 ºC** - 5% dimethyl sulfoxide day 7, 10% dimethyl sulfoxide, methanol 5%, and 10% day 6; **-196 ºC** - 5% and 10% dimethyl sulfoxide, 5% and 10% methanol day 6. **Algal (196 ºC) species greater than 5% of counts are: Seed Culture:** 23% Plectonema *Terebrans*, 53% Scenedesmus, 19% Chlorosarcinopsis; **5% dimethyl sulfoxide:** 60% Plectonema *Terebrans*, 8% Nitzchia, 21% Scenedsmus, 8% Chlorosarcinopsis; **10% dimethyl sulfoxide:** 88% Plectonema *Terebrans*, 12% Nitzchia, **5% and 10% methanol:** 95% Plectonema *Terebrans*. The best post-reconstitution growth and number of species occurred in 5% dimethyl sulfoxide cryopreservant from the -196 ºC reconstituted culture.

Keywords: Cryogenic freezing, mixed algal populations

Growing Microalgae in Dairy Manure Effluents for Sustainable Biofuel Production

Author1, Juchao Yan; Author2, Bin Bai

Microalgae hold promise as a sustainable source of biofuels based on their rapid growth and high lipid content. The objective of this study was to adapt microalgae cultivation on an algal turf scrubber® to local conditions (e.g., climate, dairy wastewater characteristics) for maximizing the productivity, which is critical to the future commercialization of algal biofuels. Analysis shows that ethanol, chloroform, and hexane are generally more efficient in the Soxhlet extraction of lipids than other solvents. Thin layer chromatography is used to explore the conditions for the separation of lipids and chlorophyll. For best separation, we have tried mixed solvents with various compositions. We have also used high performance liquid chromatography and gas chromatography-mass spectrometry to characterize the separation fractions.

Keywords: algal turf scrubber®,
productivity,
Soxhlet extraction,
separation lipids and chlorophyll

Comparison of Evapotranspiration Estimates Produced by the Simplified Surface Energy Balance (SSEBop) Model and a Portable Chamber Measurement Device

Keywords: Evapotranspiration, SSEBop, New Mexico

Ian Hewitt

NMSU/ NMWRRI

In New Mexico, there is currently an effort under the name of the Statewide Water Assessment aimed at producing a water balance for the entire state. A critical, and difficult to measure, component of this is Evapotranspiration (ET). This process is composed of evaporation and transpiration losses to the atmosphere. This component is critical as it is responsible for as much as 90 percent of the precipitation that falls returning to the atmosphere. Though there have been methods produced that accurately measure ET for several decades, none exist that can give continuous estimates across the state in a feasible manner.

As a solution to this, researchers for nearly two decades have been working with models that incorporate remotely sensed data from satellites. These have the benefit of producing spatially continuous surfaces of ET for large areas such as the state of NM. The problem is that there have been studies showing that these models have errors in the state upwards of 50 percent. One model has shown promise which is the Simplified Surface Energy Balance Operational (SSEBop) model. Adjustments have been made to the model in the past year and researchers believe it shows promise for use in NM. Here I will show recent estimates produced by the SSEBop in northern NM and comparisons with a portable chamber measurement device over different land cover classes and soil moisture conditions.

Authors:

Matthew Folsom, New Mexico Tech; Jeff Pepin, New Mexico Tech; Mark Person, New Mexico Tech; Shari Kelley, New Mexico Bureau of Geology and Mineral Resources; Lucas Blom, New Mexico Tech; Dave Love, New Mexico Bureau of Geology and Mineral Resources.

Abstract Text:

A comprehensive knowledge of the groundwater flow patterns associated with geothermal resources is critical to sustainable resource management and to discovering blind geothermal systems. Magnetotellurics (MT), which provides subsurface electrical resistivity information, has the ability to image geothermal reservoir features. We have used MT data along with 2D hydrothermal modeling, constrained by temperature, salinity and carbon-14 data, to explore possible deep groundwater circulation scenarios near the Sevilleta National Wildlife Refuge, in the Rio Grande Rift, central New Mexico. The area is underlain by a 100 to 150-m thick molten sill emplaced approximately 19 km below the surface. This sill is referred to locally as the Socorro Magma Body (SMB). Previous studies by Mailloux et al. (1999) and Pepin et al. (2015) suggest that the crystalline basement rocks in this region of the Rio Grande Rift can be significantly fractured to depths of 4-8 km and have permeabilities as high as 10^{-14} to 10^{-12} m^2. The combination of high permeability conditions and the SMB makes this region a promising candidate for discovering a blind geothermal system at depth. We constructed a 2D hydrothermal model that traverses a 64-km zone of active uplift that is associated with the SMB. We also completed a 12-km long, 9-station MT transect across a portion of this profile. Preliminary results suggest a deep convection-dominated system is a possibility. We hypothesize that using hydrothermal modeling in conjunction with MT surveys may prove to be an effective approach to discovering and managing deep regional hydrothermal resources.

Algal indicators of acidic inputs and intermittent flow in streams in the Valles Caldera National Preserve

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Biological diversity in aquatic ecosystems can be an indication of structure, function, and stability of the system. Diatoms and other algae often live within narrow environmental conditions, making them important ecological indicators of aquatic ecosystems. Algae respond to these environmental factors with changes in biomass and changes in species assemblages. For example, high conductivities and lower pH, caused by geothermal inputs, can dramatically influence water quality and biological communities in aquatic systems. Low pH, in combination with intermittent flow, may influence algal diversity in streams.

The relationship between pH and intermittent flow in Alamo Canyon (AC) and the Sulphur Creek watershed may be a contributing factor to the diversity of algal assemblages in three AC ponds that are fed by geothermal springs compared to algal assemblages located in downstream reaches of the Sulphur Creek watershed. This connection is likely to influence the chemistry of downstream waters and the composition of algal communities. Low flow, low pH, and high specific conductance can threaten designated uses in New Mexico state waters. Spatial and temporal characterization of the Sulphur Creek watershed through biological data collection and analysis may provide critical data for water quality designation of systems whose current designated use may be threatened due to naturally occurring and unique chemical properties. Utilizing algal assemblage diversity as indicators of water quality in geothermal- influenced waters may assist in the ongoing reclassification of the Sulphur Creek watershed.

Key Words: algae, water quality, geothermal, intermittent flow

Hydrochemistry of Sulphur and Alamo Creek, Valles Caldera: effect of geothermal systems on surface water quality.

Graham Thomas, Tanner Grulke, Laura Crossey, Karl Karlstrom, Valerie Blomgren, Jared Smith

The Valles caldera in northern New Mexico is a large, Quaternary silicic volcanic complex (1.25 Ma to 40 ka) containing a liquid-dominated geothermal system. Sulphur Springs and Alamo Canyon in the southwestern part of the caldera contain acidic geothermal features. In this study, we examine the hydrochemistry of the acid-sulfate waters and examine their influence on the surface waters draining the Valles caldera.

We sampled waters of Alamo, Sulphur, San Antonio and Jemez rivers during two campaigns in summer, 2015. To obtain pH, temperature and other initial parameters a field probe was placed in streams. After those are recorded two water samples are collected; one for bicarbonate concentrations and another for anion and cation concentrations. With over 23 samples collected, measurements had a wide range results such as pH ranges from 2.5 to 8.5, temperatures from 16 C° to 21 C°, metal concentrations up to 749 ppm. The acidic geothermal contributions have a major effect on the water quality in streams and shallow groundwater systems; especially pH, T, sulfate and metal content in the upper stream reaches of Alamo and Sulphur creeks. The water quality improves as waters from Redondo and the East Fork Jemez enter the stream system.

Using solute concentrations (including sulfate, chloride and bicarbonate) we are able to quantify the mass loading of geothermal constituents to the stream system, and predict the consequences of changes to future snowpack and runoff on water quality in the Jemez river system.

Keywords: Water Quality, Geothermal, Hydrochemistry, Valles Caldera, Jemez River