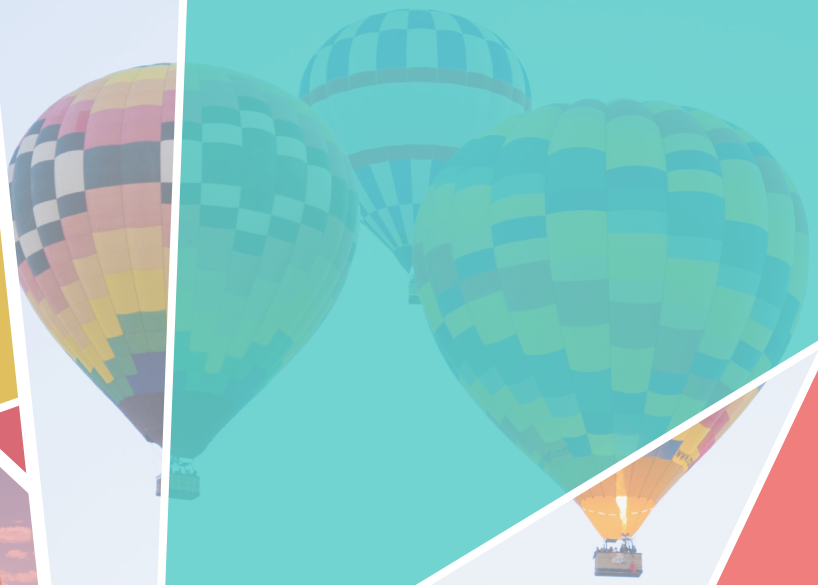
NEW MEXICO ACADEMY OF SCIENCE

2016 RESEARCH SYMPOSIUM

05 NOVEMBER 2016

EMBASSY SUITES, ALBUQUERQUE, NM

Symposium Program



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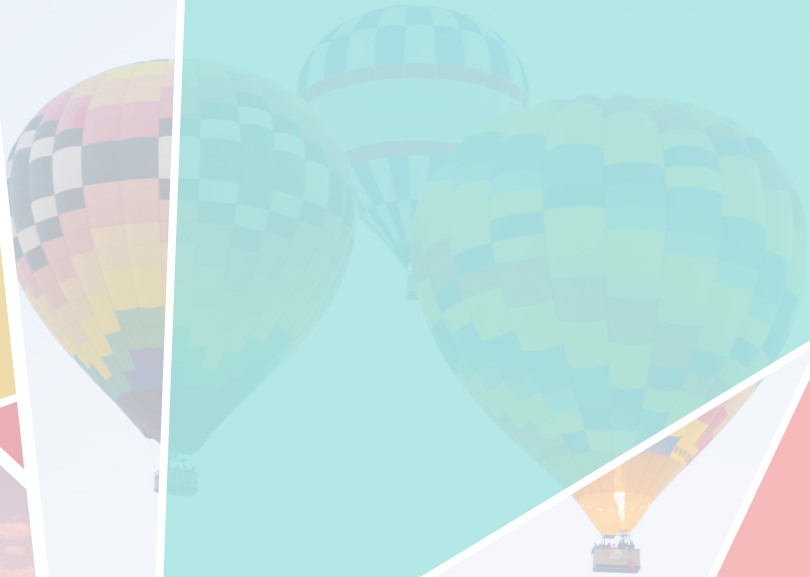

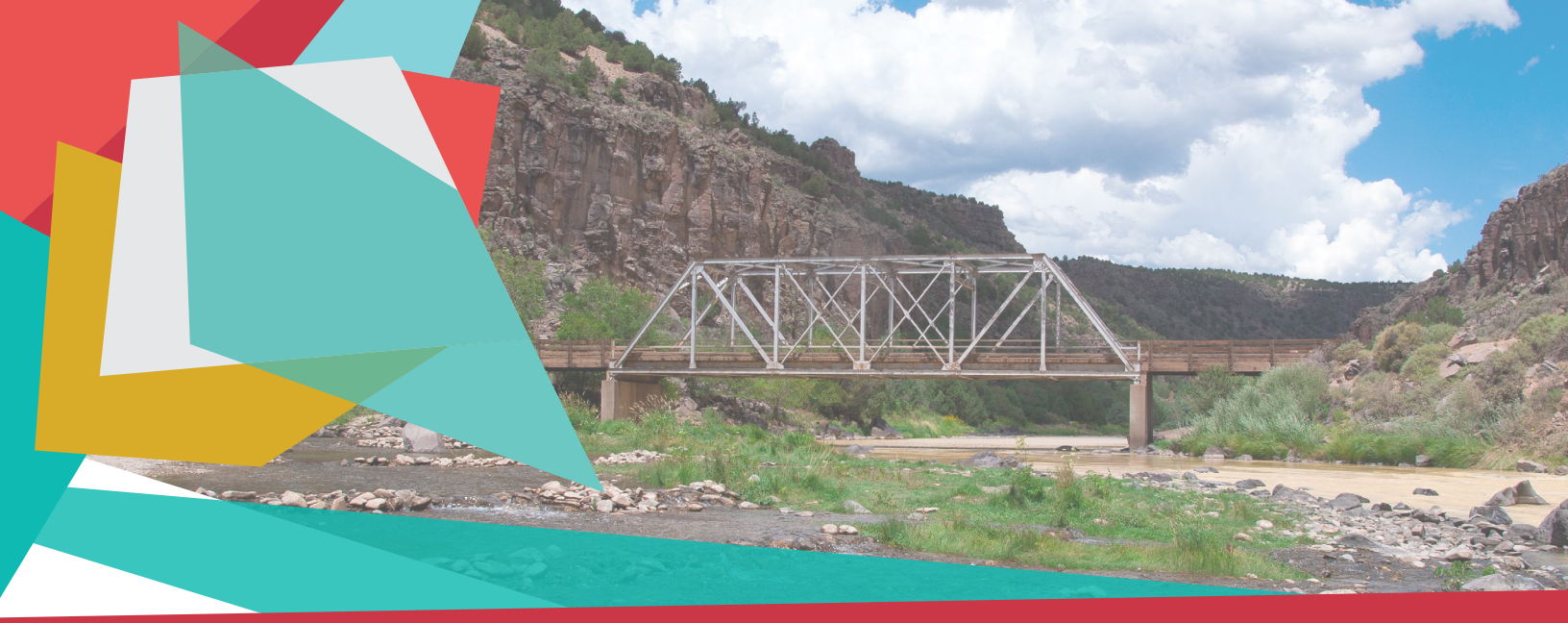

NEW MEXICO ACADEMY OF SCIENCE

2016 RESEARCH SYMPOSIUM

Agenda

8:45 am	Registration check-in
9:00 am	Pre-conference session (45 minutes) *Setting Expectations and Maximizing Benefits of a Scientific Meeting*
10:00 am	Morning Concurrent Sessions (A-D)
11:40 am	Luncheon with Keynote: Sandra Begay *Walking in Beauty on an Ever-changing Path*
1:15 pm	Poster Competition Session
2:45 pm	Afternoon Concurrent Sessions (E-H)
4:30 pm	Reception and Awards *Heavy appetizers and no-host bar*
5:30 pm	Adjourn

About the Sponsors

New Mexico Academy of Science

Founded in 1902, the New Mexico Academy of Science has been in continuous existence since 1915. The Academy is a member of the National Association of Academies of Science (NAAS) and an affiliate of the American Association for the Advancement of Science (AAAS). The New Mexico Academy of Science works with teachers, state agencies, and the legislature to establish appropriate standards for the teaching of the sciences. The Academy can also act as a resource center, providing scientific advice and expertise to these groups and others. The Academy Goals are to foster scientific research and scientific cooperation, increase public awareness of the role of science in human progress and human welfare, and promote science education in New Mexico. Visit www.nmas.org to learn more.

UNM Center for Water & the Environment

The mission of the Center for Water and the Environment at the University of New Mexico (UNM) is to increase the participation of underrepresented minorities (URM) in science, technology, engineering and math (STEM) professions while conducting cutting-edge research into technological and engineering-based solutions to problems with water and the environment, in a framework that considers the social, economic, policy, regulatory, and legal implications. Practical solutions to problems related to water availability in arid environments and in times of drought, and problems associated with energy generation and consumption are particularly relevant, in light of the criticality of these issues to the state of New Mexico, the southwestern United States, and their global importance. Learn more at cwe.unm.edu.

New Mexico EPSCoR

The New Mexico Experimental Program to Stimulate Competitive Research (NM EPSCoR) is funded by the National Science Foundation (NSF) to build the state's capacity to conduct scientific research. The infrastructure and activities of Energize New Mexico are designed to support shared–use equipment, engage new research and community college faculty, and support the STEM pipeline by training teachers, undergraduate and graduate students, and post–doctoral fellows. Research findings are communicated broadly through partnerships with New Mexico's museum network, a citizen–centric web portal, and vibrant, experiential programs targeting K–12 students. Visit www.nmepscor.org to learn more about NM EPSCoR, and visit www.nsf.gov/epscor to learn more about the NSF EPSCoR initiative and other jurisdictions.

Welcome from NMAS

On behalf of the New Mexico Academy of Science, I would like to welcome each of you to the 2016 Research Symposium! NMAS is pleased to partner with New Mexico EPSCoR and sponsor this annual conference to promote science and science education in our community. Our keynote speaker, Sandra K. Begay is a Principal Member of Technical Staff at Sandia National Laboratories, and has been a UNM Regent, a UNM Foundation Board Member, and Executive Director for the American Indian Science & Engineering Society. Join us for her lunchtime presentation, a day of interesting and engaging presentations by students and professors, and finally for the poster awards as well as the NMAS Outstanding Teacher awards in our state.

Shanalyn A. Kemme

Shanalyn A. Kemme
NMAS President

Pre-Conference Session

Setting Expectations and Maximizing Benefits of a Scientific Meeting

Attending and presenting your scientific work can be intimidating but can also be fun and offer lots of new experiences and opportunities. Before the main conference begins, we will share our experiences and offer suggestions about why you should attend meetings as well as the things to do and things to avoid to get the most of your conference experience.

Presented by Dr. Nancy Hurtado-Ziola, co-director of the Initiative to Maximize Student Development (IMSD) Program out of the Biology Department at the University of New Mexico, Mr. James Cajete, Senior Software Engineer at Honeywell Defense and Aerospace Systems and Mr. Michael Gonzales, Bioinformatics and Outreach Consultant and Treasurer of the New Mexico Academy of Sciences.

Keynote Speaker

Sandra Begay

Walking in Beauty on an Ever-changing Path

As Native woman engineering, I have had unique career opportunities from managing facility projects to supporting Executive strategic plans to leading a national non-profit. Today, I am working to "save the planet" by supporting Native American tribes with their renewable energy projects. I was taught as a Navajo woman that I should "Walking in Beauty—Navajo way of life" no matter the situation. Join me as I share my journey along an ever-changing path.

A former regent of the University of New Mexico, Ms. Begay joined Sandia National Laboratories in 1992 and is now a Principal Member of its Technical Staff. She heads Sandia's technical efforts in the Renewable Energy Program to assist Native American tribes with renewable energy development. Ms. Begay is a former Executive Director of the American Indian Science and Engineering Society (AISES), former chair of the AISES Board of Directors, and the recipient of the AISES Lifetime Achievement Award. Ms. Begay recently received the Alumni Circle Award from the National Action Council for Minorities in Engineering (NACME) for her lifetime contributions to the advancement of Native American students in science, technology, engineering and math (STEM) education and careers.

Jodie Guillen

Moriarty Middle School, Moriarty

Jodie Guillen is currently a science teacher for 6th and 7th grades at Moriarty Middle School in Moriarty, NM. She is committed to providing her students with authentic, hands-on, learning experiences for the 21st Century, including the daily use of technology. She is pursuing a master's degree in Curriculum and Instruction from Grand Canyon University, and was one of a limited number of educators selected from around the planet to attend Space Camp this past summer in Huntsville, Alabama.

In 2015 and 2016, Ms. Guillen was selected to participate in the Research Experience for Teachers (RET) at the University of New Mexico where she worked in engineering labs with professors and students and developed project-based learning units which have been approved for publication on Teach Engineering, a national database for teachers. She credits the RET program with introducing her to grant writing. She has used her skills to gain funds for an afterschool STEM program, a 3D printer, and special programs including planetarium presentations, Solar Outreach, the Google Expeditions Program, and the Sally Ride EarthKAM program (as well as badly needed basic supplies) for her Title 1, minority-majority, rural school.

She is also one of five teachers recently selected as a Jacob's Educator for the 2016-2017 school year. This prestigious award recognizes preK-12 teachers from throughout the U.S. who use technology to support inquiry-based teaching in their classrooms. During her tenure as a Jacob's Educator she will be working with the School of Education at Indiana University Bloomington to create research-to-practice briefs that will provide outreach to other teachers on research with technology.

"Jodie has continued to pursue experiences that have the potential to forever alter the course of her students' lives."

New Mexico Academy of Science
Award for Outstanding Science Teaching

"Mr. Sebastian is a champion for his students and an adamant believer in the power of inquiry science instruction."

Kevin Sebastian is currently a 3rd grade dual-language teacher at El Camino Real Academy, Santa Fe Public Schools, Santa Fe, NM. He is an adamant believer in the power of inquiry science instruction in both English and Spanish to nurture his students to become the scientists they naturally are. He broadens his students' perspectives as he guides them through the scientific practices of data collection, discovery, argumentation, and discussion.

Mr. Sebastian earned an M.Sc. degree in Agronomy from Oregon State. Prior to becoming a teacher he worked for seven years on different agricultural projects in several countries in Latin America. He received his teaching certificate through the Santa Fe Community College Teacher Academy.

For the past eight years he has been the science fair coordinator for El Camino Real Academy. He says "I like the science fair process, as it allows our students to have direct contact with scientists (the judges) and enables students to share their ideas with a wider audience. I think science truly allows students to think outside the box. I never tire of watching their delight upon making new discoveries and their eagerness to share with others their newfound knowledge."

Kevin Sebastian

El Camino Real Academy, Santa Fe

Morning Sessions
Topics & Locations

SESSION A: ENERGY & ECONOMICS

SIERRA BALLROOM III
Moderator:
Anton Sumali,
Sandia National Laboratories

Modeled impacts of economics and policy on historic uranium mining operations in the Grants Mineral Belt, New Mexico
Katie Zemlick, University of New Mexico

The impact of air pollution on emergency room visits for respiratory diseases in New Mexico
Na Lu, University of New Mexico

Willingness to pay to meet clean power plan requirements: Evaluation of New Mexico's options to meet requirements
Kara Walter, University of New Mexico

State and local potential socioeconomic and environmental impacts from proposed renewable energy projects: A case study of New Mexico
Jamal Mamkherzri, University of New Mexico

Waste or Resource? Understanding the trade-offs between produced water management strategies in New Mexico
Katie Zemlick, University of New Mexico

SESSION B: SYNTHESIS & CATALYSTS

SANDIA BALLROOM I
Moderator:
Shanalyn Kemme,
Sandia National Laboratories

Reactive transport of U and V from abandoned mine waste sites
Sumant Avasarala, University of New Mexico

Semiconductor-based photocatalysis for the production of solar fuels: photoreduction of bicarbonate to formate via zinc oxide photocatalyst
Victoria Risley, New Mexico Tech

A novel gated charge transfer complex with large ligand folding distortion
Jing Yang, University of New Mexico

Utilizing negative electron affinity semiconductors in photocatalyzed reduction of nitrogen to ammonia
Michael Heagy, New Mexico Tech

Morning Sessions (continued)

SESSION C: GEOLOGIC PROCESSES IN NEW MEXICO

SANDIA BALLROOM II

Moderator:
Jayne Aubelle,
NM Museum of Natural History & Science

Zinc, lead, copper, chromium, and arsenic accumulation associated with naturally accumulating iron-manganese oxide coatings on in-situ stream substrates in streams comparing geothermal and non-geothermal waters
Margaret Turpin, University of New Mexico

Textural analysis of Picuris-Pecos Fault deformation: Dalton Canyon, New Mexico
Wesley Clary, University of New Mexico

Influence of Laramide deformation on the Proterozoic basement in the southern Sangre de Cristo Mountains, New Mexico
Zakiya Shivji, New Mexico Highlands University

Seismic and gravitational modeling of White Sands, New Mexico
Jason Butts, University of New Mexico

Geothermal influences on water quality in the Jemez River
Chris McGibbon, University of New Mexico

SESSION D: TECHNOLOGY & TOOLS

SANDIA BALLROOM III

Moderator:
Michael Gonzales,
New Mexico Academy of Science

NASA Swarmathon—Southwestern Indian Polytechnic Institute
Emery Sutherland, Southwestern Indian Polytechnic Institute

Counting individual algae species from mixed population images with public domain software Ilastik and ImageJ
Sarah Kinter, University of New Mexico

What is the best placement to maximize the effectiveness of smog-reducing materials?
Rowan Cahill, Theodore Goujon, Lisel Faust, and Ramona Park, Santa Fe High School

Afternoon Sessions
Topics & Locations

SESSION E: SPECTROSCOPY & THEORY

SIERRA BALLROOM III
Moderator:
Anton Sumali,
Sandia National Laboratories

Ultrafast fluorescence emission decay dynamics of CdSe and CdSe/ZnS quantum dots using femtosecond time-resolved fluorescence upconversion spectroscopy
Ruwini Rajapaksha, New Mexico Tech

Molecular rectification behavior of the pyranopterin ligand of molybdoenzymes
Laura Ingersol, University of New Mexico

Quantum mechanics of palladium clusters
James McKeough, Northern New Mexico College

New insights into molecular rectification
Ranjana Dangi, University of New Mexico

SESSION F: WATER IN NEW MEXICO

SANDIA BALLROOM I
Moderator:
Shanalyn Kemme,
Sandia National Laboratories

The social construction of water and water use in the CAERT Curriculum
Kristin Waldo, Eastern New Mexico University

Assessment of potential impacts on water resources posed by hydraulic fracturing in San Juan County, NM
Jayvion Chee, Navajo Technical University

Transboundary aquifer assessment program
Maria Milanés-Murcia, New Mexico Water Resources Research Institute

Exploring web GIS tools for hydraulic fracturing
Elliot Burns, Navajo Technical University

Afternoon Sessions (continued)

SESSION G: RENEWABLE ENERGY RESOURCES

SANDIA BALLROOM II

Moderator:
Jayne Aubelle,
NM Museum of Natural History & Science

Algal research at Eastern for wastewater treatment and biofuel development
Juchao Yan, Eastern New Mexico University

Multi-omics studies of Nannochloropsis salina cultivated under suboptimal temperatures
Saba Gill, New Mexico State University

Ten years of projects in alternative energy, renewable energy, and energy efficience at SIPI (2007–2016)
Nader Vadiee, Southwester Polytechnic Institute

Optimization of lipid extraction from microalgae cultivated on dairy wastewater
Tanaka Pfupejena, Eastern New Mexico University

SESSION H: BIOLOGY & ECOSYSTEMS

SANDIA BALLROOM III

Moderator:
Michael Gonzales,
New Mexico Academy of Science

Submerged aquatic macrophytes (SAMs) in the sky: At home in high elevation streams
Virginia Thompson, University of New Mexico

Using GIS and drone technologies to analyze anthropomorphic changes in the Navajo commercial forest over the past 40 years to improve management and sustainable use on the Navajo Nation
Steven Chischilly, Navajo Technical University

The effects of avian decomposition on sunflower vegetation at 20°C
Shaleen Gearhart, Eastern New Mexico University

Poster Session Participants

Poster session participants are listed alphabetically by last name of registered presenter

Improved algal productivity & wastewater bioremediation by pH correction in an outdoor pilot Algal Turf Scrubber®

David Arellano, Graduate Student, Eastern New Mexico University

Growing algae in dairy manure effluents for sustainable biofuel production

Bin Bai, Graduate Student, Eastern New Mexico University

Seismic and gravitational modeling of White Sands New Mexico

Jason Butts, Undergraduate Student, University of New Mexico

Assessment of potential impacts on water resources posed by hydraulic fracturing in San Juan County, New Mexico

Jayvion Chee, Undergraduate Student, Navajo Technical University

Understanding Growth Behavior of Alumina (Al_2O_3) and Boehmite ($AlO(OH)$) Nanoparticles

Maddison Casillas, Undergraduate Student, Sandia National Laboratories

Surfactant and Rheologically Varied Copper N-inks

Francesca Fasulo, Undergraduate Student, Sandia National Laboratories

A comparison of resistivity imaging techniques using 1D, 2D, and 3D MT inversions in the middle Rio Grande Rift, New Mexico

Matthew Folsom, Graduate Student, New Mexico Tech

Bioremediation of high-nutrient dairy wastewater using air-lift photobioreactors

Shaleen Gearhart, Undergraduate Student, Eastern New Mexico University

Algal sequestration of heavy metals from mine waste effluent

Roya Ghorbani, Graduate Student, New Mexico State University

***Molecular and biochemical characterization of suboptimal temperature induced responses in* Nannochloropsis salina**

Saba Gill, Graduate Student, New Mexico State University

Non-anthropogenic CO_2 degassing: Is the Socorro Magma Body emitting CO_2?

Brittany Griego, Undergraduate Student, University of New Mexico

The synthesis of metal silica-based nanomaterials

Fernando Guerrero, Undergraduate Student, Sandia National Laboratories

The synthesis of copper precursors for alkoxide and nanoparticle production

Benjamin Hammel, Undergraduate Student, Sandia National Laboratories

Algal-based single-step urban wasterwater treatment
Shanka Henkanatte-Gedera, Graduate Student, New Mexico State University

Quantium mechanics of palladium clusters
Ajit Hira, Faculty, Northern New Mexico College

Characterization of thin-film copper using in situ environmental transmission electron microscopy
Chris Hirani, Undergraduate Student, University of New Mexico

Geothermal potential of New Mexico "smokers": spring vents that show mantle degassing, high CO2 content, and distinctive microbiology communities along the Jemez lineament and Rio Grande Rift
Benjamin Holt, Graduate Student, University of New Mexico

Analyzing temporal dynamics of natural gas demand in New Mexico
Janak Joshi, Graduate Student, University of New Mexico

Nutrient recovery from algal based wastewater treatment system
Moshen Karbakhshravari, Graduate Student, New Mexico State University

Chlorella *vs.* Coelastrella*: Allelopathic interaction*
Kelly Laje, Graduate Student, New Mexico State University

A comparison of population demographics and body condition of Western River Cooter, Pseudemys gorzugi, between two distinct regions of their distribution
Andrew Letter, Graduate Student, Eastern New Mexico University

Morphologically controlled Bi_2O_3 nanomaterials
Jessie Linder, Undergraduate Student, Sandia National Laboratories

Anatomical observation on abortive seeds in endangered dove tree (**Davidia involucrata**)
Zhiming Liu, Faculty, Eastern New Mexico University

The impact of air pollution on emergency room visits for respiratory diseases in New Mexico
Na Lu, Graduate Student, University of New Mexico

Different parameters controlling the biocrude yield in hydrothermal liquefaction of microalgae
Kwonit Mallick, Graduate Student, New Mexico State University

State and local potential socioeconomic and environmental impacts from proposed energy projects: A case study of New Mexico
Jamal Mamkhezri, Graduate Student, University of New Mexico

Geothermal membrane distillation in industrial greenhouse application
Carolyn Medin, Graduate Student, New Mexico Tech

A hydrogeochemical analysis and recharge evaluation of Cienega Spring located in the Sandia Mountains, NM
Alexandra Minitrez, Undergraduate Student, University of New Mexico

Carotenoid synthesis and lipid production of a Chlorococcum sp.
Sa'Rae Montoya, Graduate Student, New Mexico State University

***Characterization of growth and lipid profile in the red alga* Galdieria sulphuraria**
Khadijeh Mozaffari, Graduate Student, New Mexico State University

Cation exchange in PbTe quantum dots
Tom Nakotte, Graduate Student, New Mexico State University

The synthesis of copper and metal nanoparticles
Thao Nguyen, Undergraduate Student, Sandia National Laboratories

No title provided
Holly Nummerdor, Undergraduate Student, Western New Mexico University

Semiconductor photocatalysis of bicarbonate to solar fuels: Formate production from copper (I) oxide
Hanqing Pan, Graduate Student, New Mexico Tech

Film study of pellet-clad interactions using cerium oxide as a surrogate
Diana Perales, Undergraduate Student, Sandia National Laboratories

Microalgal crop protection by allelopathic control
Hanah Rheay, Undergraduate Student, New Mexico State University

Solar energy assisted water purification: Incorporation of an environmentally benign porous graphitized carbon nitride photocatalyst with graphitized polyacrylonitrile for efficient oxidation of toxic arsenite
Stephanie Richins, Undergraduate Student, New Mexico State University

Solar assisted model aircraft for rangeland monitoring
Andrew Rodriquez, Undergraduate Student, New Mexico State University

Thin layer g-C_3N_4 nanosheets for enhanced visible-light photocatalytic activity
Swagotom Sarker, Graduate Student, New Mexico State University

Bioremediation using microalgae and biotechnology involving produced water extracted during hydraulic fracking operations in New Mexico
Jonathan Schwilling, Undergraduate Student, Santa Fe Community College

Using electromagnetic geophysics to better understand geothermal systems in New Mexico
Michelle Sherman, Undergraduate Student, Santa Fe Community College

Synthesis and spectroscopic investigation of substituted salen and phthalocyanine chelating ligands
Orion Staples, Undergraduate Student, University of New Mexico

Ecological changes due to water level fluctuations in Conchas Reservoir
Terrill Stowe, Undergraduate Student, Mesalands Community College

Hydrogeochemistry of Sulphur Creek and Alamo Canyon, Valles Caldera: Effect of geothermal systems on surface water quality
Graham Thomas, Undergraduate Student, University of New Mexico

An investigation of the carotenogenesis of two North American microalgae
Aubree Turner, Undergraduate Student, Eastern New Mexico University

Zinc, lead, copper, chromium, and arsenic accumulation associated with naturally accumulating iron-manganese oxide coatings on in-situ stream substrates in streams comparing geothermal and non-geothermal waters
Margaret Turpin, Undergraduate Student, University of New Mexico

The social construction of water and water use in the CAERT Curriculum
Kristin Waldo, Faculty, Eastern New Mexico University

Willingness to pay to meet clean power plan requirements: Evaluation of New Mexico's options to meet requirements
Kara Walter, Graduate Student, University of New Mexico

Reactor design and operation variables to improve mixed algae biomass production and stability with the addition of sodium bicarbonate
Derek Wichhart, Graduate Student, University of New Mexico

Metabolomic and lipidomic profiling in* Nannochloropsis salina *under sinusoidal temperature control
Stephanie Willette, Graduate Student, New Mexico State University

Assessing uranium contamination in stream sediment on the Laguna and Isleta Pueblos
Brianne Willis, Undergraduate Student, Eastern New Mexico University

Morning Session Abstracts

SESSION A: ENERGY & ECONOMICS

Modeled impacts of economics and policy on historic uranium mining operations in the Grants Mineral Belt, New Mexico

KATIE ZEMLICK, UNIVERSITY OF NEW MEXICO

The Grants Mineral Belt in Northwestern New Mexico was at the forefront of the nuclear age, producing more uranium than any other mining district in the U.S. for more than three decades until the early 1980s. This region is also unique because these historic activities have been studied and quantified over the last three decades, providing a unique opportunity for evaluating the factors that influenced past mining operations. The objective of this study was to improve understanding of the role that economic and policy factors played in the operation of mines in the Grants region using a system dynamics modeling framework. Mines operating from 1948 to 1980 were grouped by size and type and optimal price and competition values were quantified over four policy environments resulting from federal legislation and policies associated with U markets. The results of this work found that as the industry evolved over time, the influence of these factors changed and that they did not impact all mining operations equally. Changes in price and competition from larger mines influenced open and closure and varied in response to national U and nuclear policy. Perhaps because small mines operated only in the nascent stages of U policy development, results for medium and large mines were more accurately represented historic data than did small mines. Perhaps more significant than the modeled results was the development of a modeling framework to understanding the relationships between price and policy on U mining operations that have been widely discussed but never quantified. This approach has utility in understanding the dynamic relationships between natural resource development and economics subject to changing policy and regulatory environments.

Keywords: uranium mining, economics, policy, systems modeling

The impact of air pollution on emergency room visits for respiratory diseases in New Mexico

NA LU, UNIVERSITY OF NEW MEXICO

Though the impact of air pollution on health has been addressed in existing literature, little research has been conducted in areas with moderate levels of air pollution. Air pollution in New Mexico mainly comes from coal-fired power plants in Northwest, oil and gas production in San Juan and Permian Basin, transportation and energy consumption in the middle Rio Grande Area. As Clean Power Plan proposed, reducing coal-fired power plants will also lower the air pollution level, which will reduce total health cost in New Mexico. This paper utilizes a fixed effect panel model to estimate the impact of three major air pollutants on emergency room visits for respiratory diseases in New Mexico. Employing a dataset covering five counties in New Mexico from 2010-2014, we find that ozone has a significant impact on respiratory emergency room visits. The result indicates that 1 ppb (2% of current level) decrease in monthly average ozone level will on average decrease 1.887 emergency room visits per 100,000 people per month for respiratory diseases. Using San Juan County as an example, if we reduce 5 ppb of monthly average ozone level by implementing Clean Power Plan, there will be about 12 less ER visits for respiratory diseases per month. In separate analysis on different age groups, the effect of ozone on respiratory emergency room visits is significantly positive for children age 1-14 and adults age below 45 which might be caused by more exposure to air pollution than other age groups.

Keywords: air pollution, ozone, emergency room visits, New Mexico

Willingness to pay to meet clean power plan requirements: Evaluation of New Mexico's options to meet requirements

KARA WALTER, UNIVERSITY OF NEW MEXICO

New Mexico (NM) is a top US fossil-fuel producer and energy contributes to the state's budget—over 30% of the General Fund in 2013. A push towards renewables through the renewable portfolio standards and the Clean Power Plan (CPP) to reduce emissions could impact this. While the CPP lets each state choose their own path for reductions, suggested methods are to improve coal efficiency or increasing natural gas use and/or renewables. Specifically, NM's reduction requirement is 36% from 2012 levels (EPA 2015). The state's energy plan argues for an "all of the above approach" (NM EMNRD 2016). The extant literature primarily focuses on comparing preferences for characteristics and tradeoffs between different renewable energies. We contribute to this literature by considering the tradeoffs between energy sources themselves, that is fossil fuels and renewables, when policy requires a change in the energy mix. To evaluate NM's response to the CPP, we employ a choice experiment and evaluate each of NM's options to meet the requirements. Utilizing multinomial logit and random parameter models we find observable differences in preferences (living in fossil fuel producing county, climate change opinion, and political leanings) and unobservable heterogeneity. The difficulty in developing policy under these conditions is evident if we consider the largest electricity provider in the state's plan to increase electricity from nuclear power. We find significant variation in preferences; some are highly supportive of nuclear while others are highly opposed. These outcomes suggest challenges in energy policy development, but also directions residents will support.

Keywords: energy preferences, choice experiment, carbon emission reduction

State and local potential socioeconomic and environmental impacts from proposed renewable energy projects: A case study of New Mexico

JAMAL MAMKHEZRI, UNIVERSITY OF NEW MEXICO

Recent federal legislation, such as Clean Power Plan, is motivating the move away from coal-fired electricity generation to increase renewable resources. This provides a mechanism that can result in reduced Greenhouse Gas emissions and saving water, but may also impact economic growth and jobs in the state. The goal of this research is to assess the trade-offs of increasing renewable energy at the county and plant level in terms of jobs and economics, as well as greenhouse gas emissions and water. An analysis of these twelve potential renewable energy projects, constituting nearly 1,202 MW of power capacity, are estimated to result in close to 4,753 job-years during construction period from 2015 to 2019 in New Mexico. Over the operations period beyond construction, we demonstrate that statewide projects are estimated to result in 131 onsite jobs and 183 total jobs annually over the life of the plants. These projects are mainly located in the eastern part of New Mexico, which is a potential boom for economic development of the area. The expected amount of electricity that could be generated from these 12 renewable energy plants and replacing equivalent amount of coal-fired electricity would result in saving 44,000 million gallon of water, along with avoiding 81 million tons of greenhouse gases.

Keywords: renewable energy, economic impacts, environmental impacts

Waste or resource? Understanding the trade–offs between produced water management strategies in New Mexico

KATIE ZEMLICK, UNIVERSITY OF NEW MEXICO

Hydraulic fracturing (fracking) has revolutionized the fossil fuel industry by enabling oil and gas production from low-porosity shale reserves. However, fracking itself requires large volumes of water and subsequent oil and gas production generates large volumes of produced water which has historically been considered a waste product requiring disposal. However, in arid regions such as New Mexico, produced water reuse is increasingly being

considered as a resource that may reduce demand for limited freshwater supplies, diminish costs associated with transportation and deep well disposal, and reduce the risks for injection induced seismicity. The objective of this study is to quantify the spatial variation in energy demands and costs associated with produced water management strategies using a spatially-based system dynamics model. Management strategies include procurement and transportation of fresh water for fracking, treatment and reuse of produced water for fracking, and transportation and disposal of produced water via deep well injection. Results indicate that conventional disposal is in many cases less energy intensive than treatment and reuse, but fresh water acquisition can exceed energy requirements for produced water disposal in some regions of the state. In addition, the costs and energy requirements associated with produced water management vary dynamically, where changes in oil and gas production impact both fresh water availability and deep well disposal capacity. This approach highlights the spatial and temporal variation in energy requirements and tradeoffs between produced water management choices, energy, costs, and impacts on critical freshwater resources.

Keywords: produced water, hydraulic fracturing, systems modeling

SESSION B: SYNTHESIS & CATALYSTS

Reactive transport of U and V from abandoned mine waste sites

SUMANT AVASARALA, UNIVERSITY OF NEW MEXICO

In this study, we investigate the reactive transport of uranium (U) and vanadium (V) from abandoned mine wastes collected from Blue Gap/Tachee, AZ by integrating flow through column experiments, reactive transport modelling (PFLOTRAN), and electron microscopy. Transmission electron microscopy (TEM) integrated with selected area electron diffraction (SAED) and electron dispersive spectroscopy (EDS) was used to identify amorphous and crystalline U-V phases in unreacted mine waste sediments. The sediments were sequentially reacted with 18MΩ water (pH 5.4), 10mM HCO_3^- (pH 7.9) and 10mM CH_3COOH (pH 3.4) to simulate relevant oxidizing conditions encountered at the Blue Gap/Tachee mine site and investigate the reactive transport of U and V. Reactive transport simulations of mine wastes reaction with 10mM HCO_3^- and CH_3COOH suggest dissolution of U-V bearing mineral phases as a key process controlling transport of U and V, attributing difference in their release to different U and V phases, possibly to the identified multi-crystalline U-V phases. Therefore, this study provides insights of interfacial processes affecting the transport U and V in water resources adjacent to mine wastes.

Keywords: uranium, vanadium, mine wastes, transport modeling

Utilizing negative electron affinity semiconductors in photocatalyzed reduction of nitrogen to ammonia

MICHAEL HEAGY, NEW MEXICO TECH

Since the discovery of the Haber-Bosch process for the production of ammonia from nitrogen, a few milestones have advanced this technological challenge. Beginning with dinitrogen cleavage coupled to Mo-Mo triple bond formation and other methods will be discussed. More recently in 1983, the solar-driven catalytic conversion of nitrogen to ammonia over semiconductor materials was reported at UCSD. This study indicated that sands from various geographic locations reduce N_2 from the air to NH_3 and traces of N_2H_4 on exposure to sunlight. From this standpoint, our team seeks to focus the sun's energy using the latest developments in semiconductor and hole-transport catalysis and theory. More recently, attention has centered on semiconductors with a large band gap and a conduction band edge that lies above the vacuum level. This special property, initially reported with diamond, is termed negative electron affinity (NEA).

Keywords: photocatalysts, negative electron affinity, nitrogen

Semiconductor-based photocatalysis for the production of solar fuels: Photoreduction of bicarbonate to formate via zinc oxide photocatalyst

VICTORIA RISLEY, NEW MEXICO TECH

Over the years, there has been a growing interest in solar fuels, which utilizes CO2 and sunlight as a sustainable energy source. In this study, micron- and nano-sized zinc oxide (ZnO) particles, as well as ZnO nanorods, were used as photocatalysts for the reduction of bicarbonate to formate. ZnO was chosen because of its comparable band gap energy to TiO_2, a well-known photocatalyst that has proven to be efficient in bicarbonate reduction. ZnO is also non-toxic, earth-abundant, and can be synthesized easily and at low cost. The photocatalysts were tested in a bicarbonate buffer solution using two different hole scavengers (isopropyl alcohol and glycerol) using a solar simulator with air mass coefficient 1.5 (AM 1.5) to mimic natural sunlight. Formate production was quantified using ion chromatography, and productivity reached 35.4 mM Formate/g cat-hr. Glycerol was found to be a superior hole scavenger than isopropyl alcohol. Solar energy is an important renewable form of energy, and this study will help better understand the fundamentals of photophysics and catalysis processes.

Keywords: bicarbonate photoreduction, zinc oxide, formate, photocatalyst

A novel gated charge transfer complex with large ligand folding distortion

JING YANG, UNIVERSITY OF NEW MEXICO

A novel metallo-dithiolene complex, $MoO(SPh)_2(^iPr_2Dt^0)$ (where $(^iPr_2Dt^0$ = N,N'-isopropyl-piperazine-2,3-dithione), was synthesized and examined with X-ray crystallography. This compound possesses a remarkable "envelope"-type fold angle (~70°) along the S-S vector on the $^iPr_2Dt_0$ side and bending upward toward the terminal oxo ligand. This is the largest fold angle observed for any Mo-dithiolene compound. Electronic absorption and resonance Raman spectroscopies have been used to probe the fundamental electronic structure of this system that is responsible for the large fold angle distortion. Interligand thiolate → dithione charge transfer (LL'CT) leads to an intense optical transition observed at ~18 000 cm^{-1}. Combined spectroscopic studies and computational work reveal the presence of a strong orbital mixing between occupied and low-energy-lying virtual orbitals with $Mo(x^2–y^2)$ orbital character. Vibronic coupling involving a very low energy total symmetric folding mode results in a strong pseudo Jahn–Teller effect, which drives the large fold-angle distortion to yield a double-well potential in the electronic ground state.

Keywords: molybdoenzymes, electron transfer, pyranopterin, rectifier

SESSION C: GEOLOGIC PROCESSES IN NEW MEXICO

Zinc, lead, copper, chromium, and arsenic accumulation associated with naturally accumulating iron-manganese oxide coatings on *in-situ* stream substrates in streams comparing geothermal and non-geothermal waters

MARGARET TURPIN, UNIVERSITY OF NEW MEXICO

Geothermal trace metals (As, Cr, Cu, Pb, Zn) can have negative health effects on humans and wildlife. Previous studies utilized in situ pebbles, glass, or ceramic substrates with iron-manganese oxide coatings to understand chemical cycling. Here we develop a tracing method in a distal geothermal environment (upper San Antonio river, Valles Caldera, NM) using adsorption onto substrate surfaces to better understand trace metal transport. We focus on natural oxide-hydroxide accumulation on 24mm silica bead substrates at sites near and away from geothermal inputs. Results show that adhesion of iron and manganese oxides were closely correlated at both sites and showed a positive trend of accumulation over an 8 week trial period. Manganese at the thermal vent showed

a decrease at the 6 week mark potentially indicating an unknown component of reduction for that metal. The adsorption of arsenic, chromium and lead on iron-manganese oxide coatings were significantly higher on substrates in the geothermally influenced waters than those not near the thermal input. All trace metals in the study were shown to have patterns of adsorptions and desorption over the course of the trial.

Keywords: trace metals, geothermal, water quality

Textural Analysis of Picuris–Pecos Fault Deformation: Dalton Canyon, New Mexico

WESLEY CLARY , UNIVERSITY OF NEW MEXICO

The Picuris-Pecos fault has been shown to have about 40 km of observed dextral strike slip separation due to to various contributions of Laramide, Pennsylvanian, and/or Precambrian age fault slip and reactivation (e.g. Cather et al., 2000; Erslev et al., 2004; Sanders et al., 2006). Based on the regional cooling history, deformation in the Precambrian would likely be ductile while more recent deformation would be dominated by brittle features. Original field workers interpreted the main phase of deformation along the Picuris-Pecos to be Precambrian, and interpreted the observed deflection of folded units near the fault to be ductile and relatively high temperature. Other more recent studies have shown large offsets in Pennsylvanian rocks, and have proposed the main phase of dextral separation to have occurred during the Ancestral Rocky Mountain orogeny. Petrographic and structural analysis by Luther et al., 2012 proposed that ~2.5 km of observed refolding in the Hondo syncline was likely at brittle-ductile conditions and predated, or formed during, the inception of dextral shear possibly associated with Grenville age activities. In order to evaluate hypotheses proposing brittle or ductile deformation we present a pilot textural study of the Picuris-Pecos fault at Dalton Canyon based on field measurements such as foliations, and petrographic analysis of oriented thin sections collected in the area. We approach ductile deformation using a spatial analysis of foliations in the McClure quadrangle to quantify orientation near the fault, and we quantify brittle deformation by comparing grain size distributions in cataclasite samples near the fault zone.

Keywords: fault, textures, deformation, spatial analysis

Influence of Laramide deformation on the Proterozoic basement in the southern Sangre de Cristo mountains, New Mexico

ZAKIYA SHIVJI, NEW MEXICO HIGHLANDS UNIVERSITY

The Las Vegas Range of the southern Sangre de Cristo Mountains is part of the southern-most subrange of the Rocky Mountains west of Las Vegas, New Mexico. Structures associated with the late Mississippian to early Permian (320-270 Ma) Ancestral Rocky Mountain orogenic event first deformed the Paleozoic cover strata that were deposited into a series of intracratonic basement uplifts. Evidence of Ancestral Rocky Mountain deformation are shown by the N-NW to S-SE striking structures throughout Colorado and New Mexico; however, many of these structures are overprinted by ones associated with the Late Cretaceous (80-55 Ma) Laramide Orogeny which resulted in broad folds, sedimentary basin development, and numerous range-frontal reverse faults. Uplift of these basement blocks and deformation of the Paleozoic-Mesozoic cover has implications for intraplate deformation, reactivation of older structures, and understanding the response of the continental lithosphere to compressive stress. The purpose of this study is to determine if, and how much, Laramide deformation affected the Proterozoic basement blocks. We hypothesize that the basement rocks were uplifted as largely intact and unrotated blocks. We further submit that Laramide deformation was accommodated in the basement by cleavage development and shearing at the Proterozoic contact - the Great Unconformity. The degree of cleavage development provides some evidence on the amount of strain the rocks have experienced. Paleomagnetic data will constrain the timing of deformation by determining the age of the magnetization (i.e. Late Paleozoic versus Late Cretaceous). To accom-

plish this, macrostructures (fractures, foliations, and cleavages) have been measured in the field and compared to original basement structures. Preliminary results infer that the original basement regional structures trend NW - SE while at the Great Unconformity contact, fractures trend NE to SW and dip to the east, which supports formation during Laramide deformation.

Keywords: Laraminde Deformation, Sangre de Cristos, geologic influence

Seismic and gravitational modeling of White Sands New Mexico

JASON BUTTS, UNIVERSITY OF NEW MEXICO

The purpose of this presentation will be to present further research of the region and to answer the following questions using seismic and gravitational modeling of White Sands National Monument (WHSA). WHSA is the largest gypsum dune field in the world and was formed ~7000 years ago with the retreat of Pleistocene Lake Otero: 1) What controls the location of the western dune front? The western dune front of WHSA has remained relatively fixed as shown by measurements from 1944 to 2010. This behavior is quite different from other dune fields in the region that show migration up to 35 m per year. The hypothesis is that the dune front is pinned to a now buried paleo-shoreline of Lake Otero; 2)What is the relationship between subsurface structure of the Tularosa Basin and the dune field? Fault and block geometries in our study area are currently unknown. Previous gravitational modeling has shown that the highest measurements stand in the deepest part of the basin. From this we can hypothesize that Lake Otero regressed towards the deepest part of the basin and the dune field migrates over the highest part of the basin along with the Jarilla Fault that flanks the eastern edge of the basin. Our methods include seismic and gravitational imaging and modeling that will provide a detailed image of the upper 50-100 meters and 101 km respectively. Expected outcomes, results, and conclusions of this project will provide further knowledge of the subsurface structure and the underlying basin for our study area of WHSA.

Keywords: seismic, gravity, acquisition, imaging, basin

Geothermal influences on water quality in the Jemez River

CHRIS MCGIBBON, UNIVERSITY OF NEW MEXICO

The Valles Caldera is an ideal natural laboratory for testing multi-tracer hydrochemical models of geothermal fluid outflow and mixing in distal portions of geothermal systems. Springs with an endogenic component provide evidence of the plume, while the Jemez River provides a location for mixing of different end-member fluids. The models are of relevance for exploiting geothermal potential and understanding threats to water quality. The Valles Caldera is part of a hydrothermal system which has seen extensive study with focus on assessing geothermal potential. The outflow system, the Baca Plume, flows along the fault network in San Diego Canyon. Two pathways have been suggested for the plume, one discharging at Soda Dam and the other at Jemez springs. Questions remain about the extent of the plume and distal effects of the Valles Caldera, with current research suggesting a connection to springs across the Nacimiento Mountains. Geothermal groundwater components lead to degradation of water quality in the Jemez River, a snow melt dominated system, and associated alluvial aquifer; a problem for local stakeholders. With climate change forecasts predicting reduction in snow pack, the contributions to surface water from springs takes on greater significance. Our pilot studies and historical work have used major ion and gas chemistry, and stable isotopes to define the geothermal plume and highlight mixing of different end member fluids. Preliminary geochemical mixing models show that springs at Soda Dam and Jemez Springs do not fall along a simple binary continuum. The significant differences in hydrochemistry suggest complex fault-related flow-paths.

Keywords: water quality, geothermal, jemez mountains, groundwater

NASA Swarmathon – Southwestern Indian Polytechnic Institute

EMERY SUTHERLAND, SOUTHWESTERN INDIAN POLYTECHNIC INSTITUTE

The NASA Swarmathon (nasaswarmathon.com) competition was developed by Dr. Melanie Moses and her team from the Moses Biological Computer Lab at the University of New Mexico. The first competition took place April 2016 with two more years of competitions planned. Swarmathon consisted of students automating a group of rovers (Swarmies) to collect as many April Tags as possible during a timed event (256 tags available). The Swarmies operated autonomously and can be programmed to communicate and interact as a collective swarm. There was both a physical (real world) competition and virtual (simulated) competition. The preliminary competition consisted of three rovers collecting as many april tags as possible during 30 minute heats in a 15m square arena. If teams made it to the finals the rovers increased to six, the arena increased to a 22m square and the time limit to one hour. The goal of the competition was to get students excited about STEM and thinking creatively to solve challenges. There were 12 teams nationally competing in the physical competition and 23 teams competing in the virtual competition.

Keywords: NASA, rovers, competition, simulations

Counting individual algae species from mixed population images with public domain software Ilastik and ImageJ

SARAH KINTNER, UNIVERSITY OF NEW MEXICO

Current algal research aims to determine the effects of algal communities on various analytically derived parameters such as lipid and chlorophyll concentrations. The total cell count of individual species or genera within a mixed algal culture is often desired but has not been made available except by hand. The purpose of this presentation is to provide researchers a new method for counting algae populations from mixed culture images using public domain, software Ilastik software (version 0.5, ilastik.org) and ImageJ (version >= 1.46, https://imagej.nih.gov/ij/). In the Ilastik software, the researcher outlines separate populations on different layers and then generates .png image of each layer. Once Ilastik has trained on the first image, it can determine the individual populations for another image unsupervised. Next, the .png images are processed through an ImageJ script, which generates counts and other parameters for each layer which are saved to an Excel spreadsheet. The image data below comes from a mixed algal population, which was taken from an Olympus BX51 microscope using a hemocytomer at either 100X or 400 X magnifications using the counting method described. The average growth rate results of two 100X algae genus (n=3) from a mixed population nitrate-limited media study (day one to five) are: genus Plectonema 814,100 cells/(ml x day) and the genus Chlorosarcinopsis 677841 cells/(ml x day). Applying the two public domain software packages, Ilastik and ImageJ, can assist the researcher in determining algae population counts much more rapidly than by hand.

Keywords: Ilastik, ImageJ, counting algae species, algal populations

What is the best placement to maximize the effectiveness of smog reducing materials?

ROWAN CAHILL, THEODORE GOUJON, LISEL FAUST, AND RAMONA PARK, SANTA FE HIGH SCHOOL

Air pollution is a major contributor to many detrimental health and environmental issues around the world. As such, companies worldwide have been creating materials aimed at passively reducing smog concentrations in urban environments. Titanium oxide (TiO_2), a photocatalyst, is at the center of this research. The goal of this simulation was to find the most effective placement of TiO_2 bearing materials in an urban environment, from ground level

infrastructure to the rooftops of high rises. Over the course of this experiment, we have researched the variables that contribute to the creation and dispersal of air pollution, as well as the materials currently in production. The model was created using NetLogo. Its primary subroutines are the diffusion of smog and the smog's interaction with buildings along a stretch of road within a rudimentary cityscape. Full coverage application of titanium oxide bearing materials is most effective for the reduction of smog, however, it is not the most cost effective. A bottom application would be more economically feasible and the second most effective up to a point, roughly mid-day, at which time it is overcome by the smog and falls behind. We anticipate that the data acquired from our simulation could be utilized by city planners to maximize smog reduction. On a large scale and over an extended period of time this could contribute to a reduction in smog related illness and deaths, as well as global temperatures.

Keywords: pollution, reduction, smog, titanium oxide, urban

Afternoon Session Abstracts

SESSION E: SPECTROSCOPY & THEORY

Ultrafast fluorescence emission decay dynamics of CdSe and CdSe/ZnS quantum dots using femtosecond time-resolved fluorescence upconversion spectroscopy

RUWINI RAJAPAKSHA, NEW MEXICO TECH

Among all synthesized colloidal quantum dots (CQDs), Cd chalcogenide (CdX; X= S, Se, Te) QDs are the most interested and widely used due to their potentials in QDs sensitized solar cells, sensing, photocatalysis and bio-labeling/bioimaging for clinical diagnostics. Investigations of photophysical dynamics/kinetics of these CQDs are essential in order to use them in above applications. Our studies are focused on investigating the ultrafast flores-cence decay dynamics of various commercially available CQDs using fluorescence upconversion spectroscopy. These studies are focused on extending the studies that have been done so far in the field of CdSe core and CdSe/ZnS core shell type quantum dots using fluorescence upconversion spectroscopy. For our studies, commercial available CdSe, CdSe/ZnS and CdS samples having wide range of band gap energies were selected. During these studies we investigated the dependence of decay dynamics with core only materials and core/shell materials by selecting six samples of CdSe and CdSe/ZnS core/shell samples. Each CdSe core sample studied along with core shell sample with same absorptions and emissions. Furthermore, the study was extended to understand the effect of shell thickness on fluorescence decay dynamics. With these studies we intend to offer a better and complete insight about photoinduced ultra-fast fluorescent decay dynamics of these core/shell QDs.

Keywords: core-shell quantum dots, fluorescence upconversion spectroscopy

Molecular rectification behavior of the pyranopterin ligand of molybdoenzymes

LAURA INGERSOL, UNIVERSITY OF NEW MEXICO

Molybdenum plays an indispensable role in human metabolism, global nitrogen and sulfur cycles, the formation of greenhouse gases, bacterial detoxification pathways and anaerobic respiration, and is critical for maintaining human health and ecological balance. To become catalytically active it must be incorporated into a molecular scaffold by complexation with a singular ligand known as the pyranopterin, an arrangement commonly referred to as Moco, the nearly ubiquitous molybdenum cofactor found in molybdoenzymes. Molybdoenzymes typically catalyze the two-electron oxidation or reduction of a substrate coupled to oxygen atom transfer. The pyranopterin can adopt several distinct oxidation and tautomeric states, which we hypothesize contributes to its suspected role as an electron transfer conduit during the redox reactions catalyzed by molybdoenzymes. Our calculations reveal that the fully reduced tetrahydro pyranopterin functions as a molecular diode, and demonstrates a rectification ratio of ~3.4 at ±0.4V. The rectification behavior at ±0.4V is ascribed to the eigenstate containing primarily LUMO character entering the bias window at forward, but not reverse, bias. These results suggest that the tetrohydro form of the pyranopterin serves as an electron transfer conduit mediating vectorial electron transfer and favoring the dithio-lene group as the electron donor. Our calculations further elucidate the nature of the transmission eigenchannels to determine how electron transfer capability is facilitated by the orbital contributions of this unique ligand.

Keywords: molybdoenzymes, electron transfer, pyranopterin, rectifier

Quantum Mechanics of Palladium Clusters

JAMES MCKEOUGH, NORTHERN NEW MEXICO COLLEGE

We study the chemisorption of different atomic and molecular species on small clusters of metallic elements, by examining the interactions of H, H_2, Li and O adsorbates with Pdn clusters (n = 2 through 24). Such a study can reveal the effects of substrate geometry on the behavior of adsorbates. Transition-metal clusters, such as palladium clusters, are suited for the study of quantum size effects and for formation of metallic states, and are ideal candidates for catalytic processes. In this presentation, we focus on the properties clusters Pd_2 through Pd_{24}. Hybrid ab initio methods of quantum chemistry (particularly the DFT-B3LYP model) are used to derive optimal geometries for the clusters of interest. We compare calculated binding energies, bond-lengths, ionization potentials, electron affinities and HOMO-LUMO gaps for the clusters. Of particular interest are the comparisons of binding strengths at the three important types of sites: edge (E), hollow (H), on-top (T), threefold sites and fourfold sites. Effects of crystal symmetries corresponding to the bulk structures are investigated. The capacity of Pd clusters to adsorb H atoms will be considered. Admixture of Pd clusters with Ni atoms will be examine in our future work.

Keywords: palladium, clusters, computational

New insights into molecular rectification

RANJANA DANGI, UNIVERSITY OF NEW MEXICO

Metal complexes of donor-bridge-acceptor (D-B-A) biradical constitutional isomers (D: S=1/2 ortho-semiquinonate, **SQ**; A: S=1/2 nitronlynitroxide, **NN**) serve as constant bias analogs of molecular current rectifying devices. Biradical electronic couplings (HDA) for asymmetric bridges (B = thiophene-pyridine, **T-P** and pyridine-thiophene, **P-T**) are described in terms of McConnell's electronic coupling theory and Nitzan's correlation between electronic coupling and conductance. Magnetic exchange couplings are used to estimate a rectification ratio (RR), yielding gDTPA/gDPTA = 0.88. Analysis of molecular conformations show that changes in the intrabridge torsion angle can change the sign of the RR. The small RRs inferred from this study result from electronic coupling being mediated by a highly symmetric **P-T**/**T-P** bridge LUMO, which promotes the electronic coupling in these biradicals. We show how the biradical approach can be used to derive key structure-property relationships that allow insight into the choice of bridge fragments for molecular rectification. Transport calculations support both the exchange coupling-based calculation of the RR, the preferred conductance direction as well as the orbital nature of the eigenchannel.

Keywords: molecular rectifier, electronic coupling, donor–bridge–acceptor

SESSION F: WATER IN NEW MEXICO

The Social Construction of Water and Water Use in the CAERT Curriculum

KRISTIN WALDO, EASTERN NEW MEXICO UNIVERSITY

The CAERT Curriculum was created as a resource for agricultural and environmental educators in order to provide secondary students the necessary intellectual and practical training for sustainable agriculture. Given the critical water issues in New Mexico, our research objective was to identify cultural water discourse across a purposeful sample of the New Mexico CAERT Curriculum. We asked: Within the CAERT Curriculum, how are humans situated within the socio-ecological system and what is the relationship between human activity and water? Qualitative content analysis using first cycle domain coding and second cycle taxonomic coding revealed that the human-environment interaction within the CAERT Curriculum is largely consistent with the empty world socio-ecological regime arising during the Industrial Revolution. These findings are significant because the empty world regime is grounded in the assumption of resource abundance, an assumption that is inconsistent with

resilience and adaptive responses to critical water issues. The implication is that the cultural lag in the CAERT Curriculum may actually exacerbate system decline, contrary to its intended purpose.

Keywords: water, CAERT curriculum, socio–ecological system, sustainable agriculture

Assessment of potential impacts on water resources posed by hydraulic fracturing in San Juan County, New Mexico

JAYVION S. CHEE, NAVAJO TECHNICAL UNIVERSITY

The state of New Mexico is one of the Major extractors and producers of crude oil and natural gas production ranking 6th in national production respectively. Most of the oil and gas production happens in two counties which make 80-143 million annually; Lea and San Juan county. Including the rest of the state, there are approximately 110,000 wells in New Mexico and about 90% of these employ a technique called hydraulic fracturing which is an effective but highly controversial mining technique. Hydraulic fracking is a technique that uses thousands of gallons of water to fracture the bed rock to allow oil or natural gas to flow upwards. This process involves shooting water down mixed with a cocktail of chemicals, many if not all are dangerous. Due to a loophole in environmental laws companies are not required to clean or recycle the water. This along with improper storage and treatment has led to many incidents of spillage resulting in severe water contamination. This has become a severe concern especially in the San Juan area where fracking has recently been sourced closer to agricultural areas that depend heavily on ground water. This project was completed so residents of impacted areas could address concerns and misconceptions about hydraulic fracturing. The project was a collaboration of Jayvion Chee along with the resources of Kiksapa Consulting, LLC and Navajo Technical University.

Keywords: water resources, hydraulic fracturing, contamination assessment

Transboundary aquifer assessment program

MARÍA E. MILANÉS-MURCIA, NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

Groundwater represents the major available source of freshwater in the world. More than half the world's population depends on groundwater as a primary water source. Irrigation and domestic uses are the main sectors of the society demanding water from aquifers. Increases in population and excessive amounts withdrawn have caused a rapid depletion of groundwater level. Contamination of aquifers is another problem, which makes it very difficult to clean up groundwater; prevention, assessment and monitoring are essential to protect groundwater resources. The U.S. – Mexico Tansboundary Aquifer Assessment Act (Public Law 109-448) was signed into law by the President of the United States on December 22, 2006. This Act authorizes the Secretary of the Interior, through the U.S. Geological Survey (USGS), to collaborate with the States of Arizona, New Mexico, and Texas through their Water Resources Research Institutes (WRRIs) and with the International Boundary and Water Commission (IBWC), stakeholders, and Mexican counterparts (Chihuahua and Sonora) to develop mapping, modeling of priority transboundary aquifers and hydrogeologic characterization (Public Law 109-448). Section 4 of the Act established the U.S.-Mexico transboundary aquifer assessment program (TAAP), which is a distinctive Federal agency – university – binational partnership and establishes the methodology and implementation of the Act. Current cooperation efforts with Mexico were shown in the binational meeting regarding the transboundary aquifers between the United States and Mexico hosted by IBWC last September 29th in El Paso, addressing current efforts, next steps and future objectives. This research provides conservation policies among both countries able to ensure the sustainable development in a cooperative framework.

Keywords: transboundary, groundwater, cooperation

Exploring web GIS tools for hydraulic fracturing

ELLIOT BURNS, NAVAJO TECHNICAL UNIVERSITY

This research is a continuation of Mr. Jayvion Chee's project about hydraulic fracturing in New Mexico, specifically in the Lea and San Juan County. Hydraulic fracturing is a technique that uses thousands of gallons of water to fracture the bed rock to allow oil or natural gas to flow upwards. To accomplish this research is to use a combination of online resources such as Mapbox and Leaflet along with a bit of programming to construct a fully interactive map for better analysis for online users. The purpose of this research is to understand the mobility and accessibility of common Geographic Information Systems (GIS) tools in a webpage viewed on a desktop and mobile device. When viewing interactive maps online, the common uses often foreshadow the underlying tools needed for analysis. This would give the public a better look at where exactly in New Mexico hydraulic fracturing is occurring and using web GIS tools to see how effective hydraulic fracturing is bad for our environment. Also with Mr. Jayvion Chee's previous work about hydraulic fracturing, we're going to implement his work to make into a interactive application for non-GIS users. This research will allow implementation of tools common place in GIS software in webpage for better mobility and analysis for local users.

Keywords: GIS, hydraulic fracturing, applications

SESSION G: RENEWABLE ENERGY RESOURCES

Algal research at Eastern for wastewater treatment and biofuel development

JUCHAO YAN, EASTERN NEW MEXICO UNIVERSITY

Eastern New Mexico University in Portales, New Mexico is well suited for exploring novel, sustainable technologies to turn dairy and cheese plant wastewaters into biofuels and other valuable chemicals. In this talk, I will talk about our significantly enhanced algal productivities of filamentous algae in dairy manure effluents on an outdoor pilot unit called Algal Turf Scrubber (ATS®), simply by controlling the pH of the effluents through shading the carbon recovery unit. A special emphasis will be on nutrient removal. I will also talk about our efforts in producing bioethanol through fermentation of algal biomass and in treating dairy and cheese whey wastewaters in indoor, air-lift photobioreactors. I am grateful for the financial support from NSF-EPSCoR and Eastern New Mexico University.

Keywords: wastewater treatment, filamentous algae, and biofuels

Multi-omics studies of *Nannochloropsis salina* cultivated under suboptimal temperatures

SABA GILL, NEW MEXICO STATE UNIVERSITY

American Heart Society recommends consumption of 1g Omega-3 fatty acids per day to prevent heart diseases. The oleaginous marine microalga Nannochloropsis salina has received attention for its high oil yield (37-60% wt.) and production of the dietary polyunsaturated fatty acids, ω-3 eicosapentaenoic acid (EPA). The incorporation of unsaturated fatty acids into membrane lipid pools is particularly important for maintaining membrane fluidity and cellular structure at suboptimal temperatures. We found that N. salina grown under "cold stress" (≥10°C below optimal temperature) results in increased desaturation of fatty acids. Here, we demonstrate the effects of cold stress under 16:8 hr day:night cycle on N. salina using four temperature regimes: 5°C, 10°C, 15°C and 25°C, where 25°C was used as control. Physiological stress was determined by measuring growth rate, chlorophyll fluorescence and dissolved oxygen measurements. Total lipids were measured using FAME analysis. Gene expression studies were carried out targeting the genes involved in Kennedy pathway for tri-acylglycerol (TAG) synthesis. We performed Fourier Transform Ion Cyclotron Resonance (FT-ICR) mass spectrometry to study the variation in different lipid classes under sub optimal temperatures. Metabolomics was carried out using GC TOF MS, and the results were analyzed for statistical significance using MetaboAnalyst V3.0

Keywords: gene expression, Kennedy pathway, cold stress, FT-ICR, metabolomics

Ten years of projects in alternative energy, renewable energy, and energy efficiency at SIPI (2007 – 2016)

NADER VADIEE, SOUTHWESTERN INDIAN POLYTECHNIC INSTITUTE

The Southwestern Indian Polytechnic Institute's (SIPI) renewable energy program seeks to establish renewable energy technology hardware on and around the campus, which will supplement and create the educational resources to teach renewable energy courses at its campus. Under the program, SIPI will design, install, operate, and maintain photovoltaic, wind and solar hot water systems to be located at the SIPI campus and educate and train Native American students in renewable energy technology. SIPI's vision is to establish a Renewable Energy Program whose goals are: to prepare students both for technical careers in renewable energy technologies and for their pursuit of advanced studies in renewable energy engineering and technology; to demonstrate and provide examples on SIPI's campus of the practical uses of renewable energy technology for its students, its faculty, and the community at large; and to employ renewable energy technologies to produce useful and environmentally benign energy on the SIPI campus, while simultaneously providing students with the opportunity for hands-on experience with these systems.

Keywords: educational projects, renewable energy, efficiency, SIPI

Optimization of lipid extraction from microalgae cultivated on dairy wastewater

TANAKA PFUPAJENA, 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 going to eventually run out of supplies of fuels. In addition, the current fuel sources are environmentally unfriendly, releasing greenhouse gases into the atmosphere. 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. Funded by the NSF, at Eastern, we are cultivating algae on an outdoor pilot unit—Algal Turf Scrubber®—in dairy manure effluent for wastewater treatment and sustainable biofuel production. Algae offer an inexhaustible source of energy, nutrients and raw materials. When microalgae are grown and harvested, the biomass obtained contains lipids, which can be converted into biodiesels through chemical transformations. One of the main difficulties in implementing the use of algae for biofuel on a wider scale, is the inefficient methods of lipid extraction, and the current methods used do not exhaustively extract all the lipids, and are costly, thereby making the wide scale production of algae not economically feasible compared to the current natural fuels being used. In this project I investigated ways to maximize the amount of lipids extracted and develop simple extraction procedures that do not require a lot of energy to successfully extract the lipids required for the production of the biofuels. I used Gas Chromatography - Mass Spectrometry to characterize the extracted lipids. In addition, I will also investigate how to utilize the remaining material after the extraction is completed.

Keywords: biofuel, lipid extraction, and wastewater treatment

SESSION H: BIOLOGY & ECOSYSTEMS

Submerged aquatic macrophytes (SAMs) in the sky: At home in high elevation streams

VIRGINIA THOMPSON, UNIVERSITY OF NEW MEXICO

Submerged aquatic macrophytes (SAMs) are key species when present in aquatic ecosystems, but are not a ubiquitous aquatic ecosystem component. When present, they perform multiple ecosystem functions including water

quality enhancement, provision of habitat structure and food sources, and nutrient cycling. Normally studied in low elevation, low gradient, often highly impacted river systems, SAMs were found in multiple high elevation (2,500 m) stream systems in the Jemez Mountains. However, little was known about SAM communities in this area. We studied physical (geomorphology: depth, width, velocity, estimated discharge, and stream gradient) and biological parameters (% cover, biomass, and plant tissue stoichiometry) of three Jemez Mountain river systems that contained SAM species in some locations to assess the SAM community. A Principal Components Analysis (PCA) and Mann-Whitney U tests showed that the physical parameters in surveyed systems differ in sites with and without macrophyes present. While there were no differences in biomass found in each system, there was a difference in the percent composition of different species in each system. Elodea average nutrient content was 35%, (C), 2.8% (N), and 0.6% (P), consistent with other reported measures. Although elevation is a common limiting factor in biogeographic ranges of other plants, these results imply that elevation alone may not be key to shaping the geographic range of these macrophyte communities.

Keywords: submerged aquatic macrophytes; aquatic ecosystems; high elevation

Using GIS and drone technologies to analyze anthropomorphic changes in the Navajo commercial forest over the past 40 years to improve management and sustainable use on the Navajo Nation

STEVEN CHISCHILLY, SR., NAVAJO TECHNICAL UNIVERSITY

Through the use of historical maps and current technology in Geographic Information Systems, Remote Sensing, and Drone Technology, Mr. Chischilly and Mr. Clyde intend to measure how anthropomorphic effects have changed the Navajo Commercial Forest over the past 50 years on the Navajo Nation. Partnerships have been forged with Navajo Nation Fish and Wildlife and Navajo Forestry in this initiative and with their guidance we map how human inhabitation, livestock grazing, road building, home site construction, and other human induced changes have affected timber resources related to timber volume, structural diversity, wildlife habitat, and riparian areas. We hope to provide this research and subsequent maps to the Navajo Nation natural resources programs for their use in management, planning, and harvesting and use of forestry products.

Keywords: GIS, drone technology, Navajo Nation, anthropomorphic changes

The effects of avian decomposition on sunflower vegetation at 20°C

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Decomposition can affect not only the soils micro organismal communities but also the vegetation. The depth of decomposition influenced physical and chemical features of the sunflowers. Changes were noted in plant height, chlorophyll content and pH, and leaf and bud morphology. Plant height was retarded by decomposition, yet leaf breadth was increased. Chlorophyll pH decreased but overall chlorophyll content increased in the presence of decomposition. These changes may have significance in a practical sense by providing a tool to identify potential clandestine burial sites, either by direct observation or by remote sensing sensitive to differences in chlorophyll content.

Keywords: decomposition, vegetation, morphology

Poster Session Abstracts

Poster session participants are listed alphabetically by last name of registered presenter

Improved algal productivity and wastewater bioremediation by pH correction in an outdoor pilot Algal Turf Scrubber®

DAVID ARELLANO, EASTERN NEW MEXICO UNIVERSITY **JUCHAO YAN, EASTERN NEW MEXICO UNIVERSITY**

The Algal Turf Scrubber (ATS) Project at Eastern New Mexico University (ENMU) has had an exceptionally productive year. By changing construction and influencing certain parameters, a correction in pH has been achieved; from a daily pH cycle of approximately 9.5–11.0 to approximately 7.3–7.6 reliably. This change in pH has led to distinctive improvements to the overall project goals of algal biomass generation and bioremediation of readily available wastewater. The biomass productivity has increased nearly eight times over previous year's data, from 0.74 g AFDW m^{-2} day^{-1} in 2015 to 5.98 g AFDW m^{-2} day^{-1} in 2016, with an organic content increasing by as much as 10%. Bioremediation became quantifiable, with removal rates of ca. 0.71 mg L^{-1} h^{-1} for s-TKN (i.e., simplified-Total Kjeldahl Nitrogen) and 0.17 mg L^{-1} h^{-1} for ortho-phosphorus. With 2016's growing season coming to a close, 2017 looks to be highly productive and advancing year for the ATS Project at ENMU.

Keywords: algal productivity, bioremediation, and nutrient removal

Growing algae in dairy manure effluents for sustainable biofuel production

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The continued use of petroleum-based fuels is becoming unsustainable because of the diminishing fuel reserves worldwide. Algae, renewable biofuel feedstocks, have grown in importance as green and sustainable fuels. Filamentous algae, for example, are capable of growing rapidly under a variety of conditions and of eliminating the nutrients from an overlying water stream. We have adapted filamentous algae cultivation in dairy manure effluents on an Algal Turf Scrubber® to our local conditions. An ATS is an engineered, high-turbulent aquatic system to cultivate benthic filamentous algae for the removal of pollutants. We have closely monitored the cultivation broth, including pH, temperature, conductivity, oxidation reduction potential, and nutrients. We have used Soxhlet extraction to extract the lipids, and also used high performance liquid chromatography to separate the extracts. Our goal is to maximize the algal productivity in an outdoor setting for enhanced biofuel production and wastewater treatment.

Keywords: filamentous algae, lipid extraction, and chromatography

Seismic and gravitational modeling of White Sands New Mexico

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The purpose of this presentation will be to present further research of the region and to answer the following questions using seismic and gravitational modeling of White Sands National Monument (WHSA). WHSA is the largest gypsum dune field in the world and was formed ~7000 years ago with the retreat of Pleistocene Lake Otero: 1) What controls the location of the western dune front? The western dune front of WHSA has remained relatively fixed as shown by measurements from 1944 to 2010. This behavior is quite different from other dune fields in the region that show migration up to 35 m per year. The hypothesis is that the dune front is pinned to a now buried paleo-shoreline of Lake Otero; 2)What is the relationship between subsurface structure of the Tularosa Basin and the dune field? Fault and block geometries in our study area are currently unknown. Previous gravitational modeling has shown that the highest measurements stand in the deepest part of the basin. From this we can hypothesize that Lake Otero regressed towards the deepest part of the basin and the dune field migrates over the highest part

of the basin along with the Jarilla Fault that flanks the eastern edge of the basin. Our methods include seismic and gravitational imaging and modeling that will provide a detailed image of the upper 50-100 meters and 101 km respectively. Expected outcomes, results, and conclusions of this project will provide further knowledge of the subsurface structure and the underlying basin for our study area of WHSA.

Keywords: seismic, gravity, acquisition, imaging, basin

Assessment of potential impacts on water resources posed by hydraulic fracturing in San Juan County, New Mexico

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The state of New Mexico is one of the Major extractors and producers of crude oil and natural gas production ranking 6th in national production respectively. Most of the oil and gas production happens in two counties which make 80-143 million annually; Lea and San Juan county. Including the rest of the state, there are approximately 110,000 wells in New Mexico and about 90% of these employ a technique called hydraulic fracturing which is an effective but highly controversial mining technique. Hydraulic fracking is a technique that uses thousands of gallons of water to fracture the bed rock to allow oil or natural gas to flow upwards. This process involves shooting water down mixed with a cocktail of chemicals, many if not all are dangerous. Due to a loophole in environmental laws companies are not required to clean or recycle the water. This along with improper storage and treatment has led to many incidents of spillage resulting in severe water contamination. This has become a severe concern especially in the San Juan area where fracking has recently been sourced closer to agricultural areas that depend heavily on ground water. This project was completed so residents of impacted areas could address concerns and misconceptions about hydraulic fracturing. The project was a collaboration of Jayvion Chee along with the resources of Kiksapa Consulting, LLC and Navajo Technical University.

Keywords: water resources, hydraulic fracturing, contamination assessment

Understanding growth behavior of alumina (Al_2O_3) and boehmite (AlO(OH)) nanoparticles

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Alumina (Al2O3 or aluminum oxide) is an important metal oxide used in variety of applications due to its chemical and thermal stability. Nanoscale powders can be useful as an integral ink material used in direct write (robocasting) processes as well as in numerous commercial products such as electronics and paints. Critical to these applications is understanding how Al2O3 crystals grow under various processing conditions in order to control its properties. In order to understand growth behavior of Al2O3 nanoparticles, the effect of precursor on nanoparticle phase and morphology was examined within solution processing routes. Solution nanoparticle processing routes (e.g., glycothermal, solvothermal, and solution precipitation) were used to lower the temperatures and/or pressures required to reach the α-Al2O3. Powders were isolated and examined with X-ray Diffraction and Electron Microscopy. Depending on processing route, wires, plates, or spherical particles of boehmite or alumina were obtained. Full details on the synthesis and characterization on alumina and boehmite will be presented. This work was supported in part by Laboratory Directed Research and Development (LDRD), Department of Energy (DOE), Geothermal Technologies Office (GTO) under the Office of Energy Efficiency and Renewable Energy (EERE), and by the Sandia STAR Program. Sandia National Laboratories, a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Keywords: nanoparticles, alumina, metal oxides, microscopy, boehmite

Surfactant and rheologically varied copper N-inks

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Direct write manufacturing is a method that provides precision when printing things like electronics for computer chips. Currently silver nanoinks are in demand due to silver's high conductivity; however, silver is very expensive, so we have been investigating the use of copper as an alternative. Copper has comparable conductivity but is much more cost competitive. The copper nanoparticles were synthesized using a newly developed, simple, low-temperature route that employs octylamine and hexadecylamine only! Once we verified that we had clean Cu np, formulation of the nanoinks (N-inks). Additives such as solsperse and benzotriazole were added to the inks to increase dispersion and reduce the potential oxidation of the nanoink. The viscosity of the nanoink was also varied by increasing the weight percent of copper and then measured using a rheometer. All aspects of the synthesis, formulation and properties of the inks will be presented.

Keywords: wire manufacturing, copper, nanoparticles, nanoinks

A comparison of resistivity imaging techniques using 1D, 2D and 3D MT inversions in the middle Rio Grande Rift, NM

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Twelve magnetotelluric (MT) soundings were collected along a 40 km profile crossing the Rio Grande rift and a portion of the Socorro Magma Body. A comparison of 1D, 2D and 3D inverse models highlight the strengths and weaknesses of the respective methods. 2D inversion results are distorted by the 3D nature of the data at longer periods, producing conductive artifacts at depths greater than 3 km. We demonstrate through a 3D forward modelling exercise how it is possible to recreate this effect by placing large resistive and conductive features off of an otherwise perfectly 2D resistivity model. Investigators that image deep conductors using 2D inversion codes should consider the influence of off-axis 3D features. The models outline the geometry of syn-rift and pre-rift sediments at the "Socorro Constriction", the southern terminus of the Albuquerque Basin. A strong, northward trending conductor 2-3 km deep and less than 2 ohm-m is coincident with the rift, creating a reversal of induction arrow directions at this point. This is interpreted as deep basin brines, perhaps influenced by evaporates hosted in the Permian Abo and Yeso formations. It has been noted that Rio Grande salinity increases in a stepwise manner, coincident with the terminal ends of sedimentary basins. Our geophysical models suggest a possible connection between rift-bounding faults and deep sedimentary brines, which likely impact the water quality of the Rio Grande. Future work includes adding additional MT stations to better constrain off-axis features and their relationship to the Rio Grande.

Keywords: magnetotelluric, Socorro Magma Body, Rio Grande Rift, resistivity modelling

Bioremediation of high-nutrient dairy wastewater using air-lift photo bio-reactors

SHALEEN GEARHART, EASTERN NEW MEXICO UNIVERSITY
JUCHAO YAN, EASTERN NEW MEXICO UNIVERSITY

The approach uses eight Air-Lift Photo Bio-Reactors designed to increase the algal morphology for easy harvesting and dewatering, and recycling and reuse. By culturing both a polyculture, along with three pure cultures from UTEX of both fresh water and salt water species. Skeletonema costatum (salt water), Dunaliella salina (high-brackish saltwater), and Chlorella sp. (fresh water), by altering the concentration of the effluent, the algal processing will theoretically remove organic substances from the water that are otherwise inhibitory to the reuse prospects for the water. Our goal in the indoor cultivation in conjunction with the ENMU ATS project is to create a proof of concept case. Do the algae in fact purify the wastewater? If so what data can we collect to prove this

point? The nutrients that the algae will be consuming from the wastewater set the upper limit for biomass production. The daily rate of biomass production should be hyperbolically related to the external nutrient supply rates. We will be focusing on testing organic weight + dry ash (silt) weight, pH, concentration of nutrients/effluent, Total Dissolved Solids (PPM/PPT), Conductivity (µs/Ms), light intensity, light dark cycle, flow of air, and temperature. We will use an UV-vis spectrometer, which will give us an ideal of the optical density of the culture. All these tests and data will then come together to help support our argument that bioremediation could theoretically increase the morphology of the algae for the purposes mentioned above.

Keywords: polyculture, bioremediation, wastewater

Algal sequestration of heavy metals from mine waste effluent

ROYA GHORBANI, NEW MEXICO STATE UNIVERSITY **OMAR HOLGUIN, NEW MEXICO STATE UNIVERSITY**

Heavy metal pollution is common all over the world. Of the many negative effects associated with heavy metal contamination, one concern is the impact on crops including plants irrigated with contaminated surface water and or growing on contaminated soils show a reduction in growth, performance, and yield. Subsequently soils polluted by heavy metals can also causes organ damage, cancer, and economical losses. This is why today, human beings are concerned with finding new methods for remediation of surface waters contaminated with heavy metals. In this investigation we evaluated soils for heavy metal contamination obtained from the surrounding areas impacted by the Gold King Mine spill of 2015. Air dried soils samples were microwave acid digested and heavy metals were measured using inductively coupled plasma/optical Emission spectrometry (ICP-OES). In the study, found the metals of concern in Animas River Contaminated Soils were Aluminum(AL), lead(Pb), arsenic(AS), zinc(Z), calcium(Ca), chromium(Cr) copper(Cu), manganese(Mn) and iron(Fe). Based on our analysis of the metals identified to be of concern we evaluated the potential for a microalgae *Galderia sulpharia* to effectively remove those metals in culture solution and present.

Keywords:* Galderia sulpharia*, heavy metal sequestration, water contamination, Gold King Mine spill

Molecular and biochemical characterization of suboptimal temperature induced responses in *Nannochloropsis salina*

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Oleaginous microalga *Nannochloropsis salina* is known for its potential as a source of renewable bio-fuel due to its high oil yield. In addition *N. salina* is also a source for the value added polyunsaturated fatty acids (PUFAs) with relative high level of n-3 eicosapentaenoic acid (EPA). Lipid productivity and composition of oleaginous microalgae is variable and dependent on strain selection and environmental growth conditions. When environmental conditions lead to suboptimal temperatures aka: "cold stress" one of the response of the organism is to increase PUFAs metabolism leading to an increase in membrane fluidity decrease the negative impact that near freezing temperatures have on cellular components. In this study we report on the effect of suboptimal temperatures from 200C to 50C on the growth, physiological measurements and fatty acid profile of *N. salina*. In addition we investigated the fatty acid composition of different lipid species, lipid gene expression and how metabolic alterations and remodeling occur in various lipid pools with specific interest in TAGs.

Keywords: lipid metabolism, RT–PCR, PUFAs, gene expression, GC/MS, FT/ICR

Non–Anthropogenic CO_2 degassing: is the Socorro Magma Body Emitting CO_2?

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Fault networks can provide pathways for fluids (water and gas) to the surface. Magma bodies (such as the Socorro Magma body, SMB, in NM) beneath Earth's surface also release CO_2 to the surface. Recent work has provided information on CO_2 flux and defined background, diffuse, and endogenic sources in the Albuquerque basin and Valles Caldera. Our main focus was to measure the active CO_2 flux in the Rio Grande Rift south of any previously measured CO_2 emission sites and was specifically across the margin of the Socorro Magma Body. Geological evidence, in the form of numerous travertine deposits associated with bounding rift faults co-located with the SMB, indicates persistent recent outgassing in this region. The method used was an EM-5 with a soil respiration chamber and an infrared detector to enable direct measurement of the flux of CO_2 from the ground being studied. After surveying the western part of the Socorro Magma body in the Sevilleta Wildlife Preserve, we found that there was a small amount of CO_2 being emitted by non-anthropogenic means (non-biological). To differentiate between anthropogenic and non-anthropogenic we had a minimum flux of 0.084 to 1.01 g/m²/d, which we defined as background flux to a maximum flux of 3.02 to 9.06 g/m²/d, which is substantially above background flux. Compared to previous works on the Valles Caldera, the data we collected for this project is only a small fraction compared to 170,000 g/m²/d. This preliminary work indicates that the Socorro Magma Body is emitting currently emitting diffuse CO_2.

Keywords: degassing, Socorro Magma body, fault networks, CO_2

The synthesis of metal silica based nanomaterials

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Metal silica-based ($MSiO_x$) materials have found use in scintillator applications due to their intense luminescent response upon exposure to radiation sources. The metals in these silicates have been reported from across the periodic table but when doped with lanthanide (Ln) cations are especially sensitive and luminescent. The production of metal silicates has been widely investigated using a variety of synthetic pathways. For routes that employ metal alkoxides ($[M(OR)_n]$), the metal silicate products are typically generated from the reaction of the desired metal precursor with a $Si(OR)_4$ or employing metal siloxide $[M(OSiR_3)_x]$ precursors. However, these approaches have met with varying degrees of success in converting to the desired $MSiO_x$. This lead us to investigate tris(trimethylsilyl)silanol ($HOSi(Si(CH_3)_3)_3$ or H-SST) modified [Group 4 and 5 $[M(OR)_n]$ as precursors to MSiOx materials. These SST derivatives generated a core@shell geometry as identified by TEM analysis. As we search to expand the utility of the SST ligand and generate scintillators, exploration of the lanthanide cations is warranted. This poster will present on the synthesis of the H-SST ligand, the development of a series of lanthanide amide precursors and the conversion of. All of these will be characterized by a variety of analytical means. Once isolated, their conversion to nanomaterials core@shell will be explored. This work involves the use of air-sensitive synthesis techniques (i.e., Schlenk lines and gloveboxes) and a variety of analytical methods including: FT-IR s, elemental analysis, X-ray diffraction, electron microscopy, and other methods.

Keywords: nanomaterials, metal silica

The synthesis of copper precursors for alkoxide and nanoparticle production

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The potential utility of copper alkoxides ($Cu(OR)_x$) as a component of a flow battery was investigated. A variety of precursors were synthesized and characterized prior to battery studies. For this report, we investigated the utility of pyridine 2,-6 dimethanol (H_2-2OPy) as a modifier for Cu(I) and Cu(II) metal centers. The Cu(II) product was identified as $[Cu(\mu\text{-}2OPy)]_2$. The synthesis and characterization of this complex will be presented. The stability in

water of the Cu(II) and Cu(I) were investigated as well for determination of utility in the battery application. An alternative use of the $[Cu(\mu\text{-}2OPy)]_2$ precursor was serendipitously determined as a low temperature preparation of 50 – 80 nm Cu nanoparticles. This poster will report on the variety of precursors, the conditions under which they were synthesized and their material properties.

Keywords: nanoparticles, copper alkoxides, battery application

Algal based single-step urban wastewater treatment

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Present-day urban wastewater (UWW) treatment infrastructure continues to depend on obsolete, multistage technologies to treat UWW that consume significant fossil-fuel derived energy and are unsustainable. Recognizing the value of organic carbon and nutrients contained in UWW, wastewater is now being regarded as a renewable source from which energy, water and nutrients can be harvested for the beneficial use rather than mineralizing and dissipating them into the environment. For example, the activated sludge process that is in use today dissipates more than 50% of valuable organic carbon content in UWW as carbon dioxide while the subsequent nitrification/denitrification step converts most of its ammoniacal nitrogen to inert nitrogen gas. This paper reports a single-step, algal-based wastewater treatment system where the selected strain, *Galdieria sulphuraria*, is shown to be capable of mixed photoautotrophic and heterotrophic metabolism for simultaneous removal of dissolved organic carbon and nutrients from UWWs meeting the mandated discharge standards. Results from laboratory tests scaled up to pilot scale tests conducted under outdoor conditions in batch and fed-batch mode are presented to document *Galdieria sulphuraria*'s ability to treat raw primary effluent to discharge standards with minimal energy input compared to the traditional bacterial-based system.

Keywords: **Galderia sulpharia*****, wastewater treatment, urban wastewater, algae***

Quantum mechanics of palladium clusters

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We study the chemisorption of different atomic and molecular species on small clusters of metallic elements, by examining the interactions of H, H_2, Li and O adsorbates with Pdn clusters (n = 2 through 24). Such a study can reveal the effects of substrate geometry on the behavior of adsorbates. Transition-metal clusters, such as palladium clusters, are suited for the study of quantum size effects and for formation of metallic states, and are ideal candidates for catalytic processes. In this presentation, we focus on the properties clusters Pd_2 through Pd_{24}. Hybrid ab initio methods of quantum chemistry (particularly the DFT-B3LYP model) are used to derive optimal geometries for the clusters of interest. We compare calculated binding energies, bond-lengths, ionization potentials, electron affinities and HOMO-LUMO gaps for the clusters. Of particular interest are the comparisons of binding strengths at the three important types of sites: edge (E), hollow (H), on-top (T), threefold sites and fourfold sites. Effects of crystal symmetries corresponding to the bulk structures are investigated. The capacity of Pd clusters to adsorb H atoms will be considered. Admixture of Pd clusters with Ni atoms will be examine in our future work.

Keywords: palladium, clusters, computational

Characterization of thin-film copper using in situ environmental transmission electron microscopy

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Corrosion costs the U.S.A. a few percent of its GNP annually. Atomic scale characterization offers detailed dynamics of corrosion for fundamental understanding. We prepared thin-films (~70 nm) of copper, a model metal system, on single crystal NaCl substrates using e-beam evaporation. We performed in situ reduction/oxidation of Cu within a Hitachi H9500 environmental transmission electron microscope. The Cu films were annealed in hydro-

gen gas to remove the native oxide and to create clean copper facets, and then exposed to oxygen gas at 250°C. We noticed facet-dependent differences at the early stages of Cu-oxide growth in situ, where the relative oxidation rates by facet varied such that (100) < (110) < (111). These results can be used to guide future work on how to control corrosion by manipulating the crystal planes and surface defects used in corrosion-protection applications including municipal water transport, turbine blades, and integrated circuits.

Keywords: copper, oxidation, TEM, characterization

Geothermal potential of New Mexico "smokers": spring vents that show mantle degassing, high CO_2 content, and distinctive microbiology communities along the Jemez lineament and Rio Grande rift

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This study is a compilation of water and gas data from springs and wells throughout New Mexico. The springs discussed here have detectable mantle-derived helium, are located along major faults, have high P_{CO2}, are generally travertine depositing, and are located above areas of low mantle velocity. This combination of parameters helps identify windows into zones of high crustal permeability and flux of deeply derived fluids within regions of extension and high heat flow. Springs and wells with the highest helium isotope ratios in NM (non-atmospheric-like $^3He/^4He$ (R/R_A) and elevated He/Ne in groundwater) are located above the Valles Caldera (3.86 to 6.16 R_A), Rico area of SW Colorado (4.75-5.88 R_A), NM Bootheel area (up to 4.23 R_A), Bravo Dome (up to 3.78 R_A), and Socorro magma body (NM Tech wells = 1.41 to 1.91 R_A). Lowest, non-mantle-like values (< 0.1 R_A) are seen in San Juan and parts of Delaware basins. The best correlation between $^3He/^4He$ values and deep geophysical parameters is relative S-wave velocity (at 60 and 195 km), consistent with mantle partial melt as the deep source of helium- and CO_2-bearing volatiles. Helium isotope values do not correlate strongly with crustal thickness suggesting that crustal conduit systems may be less important than mantle source regions. Multiple tracer geochemical analyses include helium and carbon isotopes that can help evaluate fluid mixing end members, fluid pathways, and geothermometry of deeper fluids. Combined with other geothermal datasets, these data provide part of an exploration strategy for geothermal systems in New Mexico.

Keywords: geochemistry, mantle degassing, geothermal, CO_2 flux, helium isotopes

Analyzing temporal dynamics of natural gas demand in New Mexico

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Natural gas is an increasingly valuable fuel source in the context of growing environmental and energy security concerns. Despite the relative abundance of the natural gas reserves, it is an exhaustible resource. Moreover, the natural gas consumption is not free from environmental externalities. Integrated energy planning requires a wide range of well-informed policy tools to deal with the multitude of issues associated with the energy sector (e.g. ensuring reliable supply, neutralizing the growing consumption and promoting energy source diversity). A key to this includes a superior understanding of both supply and demand response. The extant literature primarily focuses on comparing demand response across states. We contribute to the literature by developing a demand analysis dis-aggregated to the state level. We estimate natural gas demand function at the state level and for the residential, commercial, industrial and electric sectors in New Mexico, by utilizing monthly data from 2001 to 2016. We find that own price of natural gas at the state level as well as in the sectoral demand estimations has a significant impact on the natural gas consumption while income effect is weak. The change in natural gas demand

ranges between -0.01% to -0.4% for one-dollar increase in its price in different sectors. The impacts of heating and cooling degree days on consumption are positively significant at the state level, and in the residential, commercial and electric sectors, while such impacts are not significant in the industrial sector. Substitutability between natural gas and petroleum oil is also not significant.

Keywords: natural gas, consumption, price effect, New Mexico

Nutrient recovery from algal based wastewater treatment system

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Growth of global population continues to exert stress on three resources essential for mankind: food, energy, and water. On-going research at New Mexico State University is developing an algal-based process configuration to recover and recycle resources within the food-energy-water nexus in an energy-efficient and sustainable manner. The proposed approach is based on the following premises: i) urban wastewaters (UWW) that are rich in organic carbon and nutrients (nitrogen, N, and phosphates, P) can serve as medium to cultivate energy-rich algal biomass; ii) algal biomass cultivated in UWW could be processed by hydrothermal liquefaction (HTL) to produce biofuels; iii) nutrients in the byproducts of HTL could be extracted to formulate crop fertilizers; and iv) the effluent from the process could be tailored as agriculture-quality water for food-crop cultivation. Objective of this study is to demonstrate the ability of the above process in recovering crop fertilizers from UWW. Algal biomass cultivated under field conditions in primary-settled urban wastewater was used in this study. Byproducts resulting from hydrothermal liquefaction of the biomass were processed in this study to produce struvite for use as fertilizers. Results to be presented include physical/chemical characterization and separation of the N and P from the aqueous stream and biochar resulting from HTL, and the conditions for precipitating N and P as struvite powder. It is concluded that P extraction from biochar is a pH dependent process, and P recovery of up to 90% is achievable through struvite precipitation.

Keywords: wastewater treatment, urban wastewater, algae, nutrient recovery, hydrothermal liquefaction

Chlorella vs. *Coelastrella*: Allelopathic interaction

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Invasion of outdoor cultures by weedy algal species presents difficulties in the cultivation process for biodiesel production. Minimizing such risks/scenarios is critical to efficient biomass cultivation and the future of algal based energy. We observed an invasive algal species in outdoor cultures of *Chlorella sorokiniana*, which we isolated and genetically identified as a novel strain of *Coelastrella sp*. (Genbank 18S RNA sequence accession number KP167584). A series of experiments was conducted to observe the interaction between the novel *Coelastrella sp*. and *Chlorella sorikiniana*, in which an allelopathic compound secreted from *Coelastrella sp*. is suspected to cause growth inhibition of *Chlorella sorikiniana*. We report the interaction between both species of algae when grown as a bi-culture under laboratory conditions, as well as the possible identity of the aforementioned allelopathic compound using HPLC analysis.

Keywords: **Coelastrella sp.,** **Chlorella sorikiniana,** ***algae, alleopathic interations***

A comparison of population demographics and body condition of Western River Cooter, *Pseudemys gorzugi*, between two distinct regions of their distribution

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Western River Cooter, Pseudemys gorzugi, is one of the least studied species of freshwater turtles in North America, with very little known about their biology. In the US, species occur only in New Mexico and Texas and their range is restricted to the Pecos and lower Rio Grande Basin. Western River Cooter is listed as a state threatened species in New Mexico and near threatened by the International Union for Conservation of Nature (IUCN). Given their conservation status, it is important to monitor populations of Western River Cooter across their range. In this study, we compared population demographics and body condition indices between two distinct regions of P. gorzugi distribution: Black River in New Mexico and Devils River in Texas. In New Mexico, we collected 196 turtles during 2016 field season, while in Texas, we collected 170 turtles during 2015/2016 field seasons. Our preliminary analyses show that there are fundamental differences in demographic parameters between New Mexico and Texas populations. While Texas population consists of larger turtles and adults only, New Mexico population contains turtles of all age classes (i.e., hatchlings, juveniles, and adults). Analysis of body condition between two separate populations will help further our understanding of P. gorzugi ecology and create opportunities for future studies, such as resource availability and food habits.

Keywords: Western River Cooter, animal population, distribution

Morphologically controlled Bi_2O_3 nanomaterials

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During our investigation in the synthesis of scintillator material bismuth germanium oxide (BGO), hexagons of bismuth oxide (Bi_2O_3) was observed. Due to its electronic conductor properties, it became of interest in generating morphologically varied Bi_2O_3 nanomaterials. The initial study focused on modifying bismuth nitrate hydrate with a variety of 'poisons' under solvothermal conditions. This was followed by a study concerning the ligands bound to the Bi (i.e, Bi-O vs Bi-N vs Bi-C) and their impact on the final morphology. This required the synthesis of in-house precursors. A comparison (PXRD, SEM, TEM) of commercial versus in-house precursors, their ligand set, poisons, and processing impact on the final morphology will be reported.

Keywords: morphology, nanomaterials, Bi_2O_3

Anatomical Observation on Abortive Seeds in Endangered Dove Tree (*Davidia involucrata*)

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Dove tree (*Davidia involucrata*) is an endangered species endemic to China. Reproduction of dove tree is difficult due to its low fecundity. Seed abortion has been thought as one of the key factors limiting its sexual reproductive capability. In this project four hundred fruits were collected from ten dove trees randomly selected from a naturally distributed population in Hunan Province of central China. The fruits were weighed and their length and width were measured. The fruits were dissected to expose the seeds. The number and shape of normal seeds and aborted seeds were recorded. Seed abortion ratios were then calculated. Preliminary analysis of the dissected fruits and seeds showed the fruit of dove tree had an eight-carpel structure. In most fruits the number of normal seeds was one to three, indicating more than half of the seeds were aborted. The number of aborted seeds was not related to the weight and length-width ratios of the fruits; furthermore, the aborted seeds were much smaller than the normal seeds. This observation confirmed that seed abortion is a serious problem and could be a limiting factor for reproduction in this endangered species. Further study of seed abortion at the cellular and molecular level will be useful for addressing the issue of offspring production and the survivability of this endangered species.

Keywords: dove tree,* Davidia*, seed abortion, endangered

The impact of air pollution on emergency room visits for respiratory diseases in New Mexico

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Though the impact of air pollution on health has been addressed in existing literature, little research has been conducted in areas with moderate levels of air pollution. Air pollution in New Mexico mainly comes from coal-fired power plants in Northwest, oil and gas production in San Juan and Permian Basin, transportation and energy consumption in the middle Rio Grande Area. As Clean Power Plan proposed, reducing coal-fired power plants will also lower the air pollution level, which will reduce total health cost in New Mexico. This paper utilizes a fixed effect panel model to estimate the impact of three major air pollutants on emergency room visits for respiratory diseases in New Mexico. Employing a dataset covering five counties in New Mexico from 2010-2014, we find that ozone has a significant impact on respiratory emergency room visits. The result indicates that 1 ppb (2% of current level) decrease in monthly average ozone level will on average decrease 1.887 emergency room visits per 100,000 people per month for respiratory diseases. Using San Juan County as an example, if we reduce 5 ppb of monthly average ozone level by implementing Clean Power Plan, there will be about 12 less ER visits for respiratory diseases per month. In separate analysis on different age groups, the effect of ozone on respiratory emergency room visits is significantly positive for children age 1-14 and adults age below 45 which might be caused by more exposure to air pollution than other age groups.

Keywords: air pollution, ozone, emergency room visits, New Mexico

Different parameters controlling the biocrude yield in hydrothermal liquefaction of microalgae

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Research into alternate sources of fuel or renewable energy reveal many promising ideas for alternative energy sources. One of these possibilities is converting biomass to biofuel. Under high pressure and temperature, microalgae can be polymerized to biofuel. There are some thermo-chemical processes available to convert the biomass like pyrolysis and gasification, but these processes require dry feedstock. Thus these processes encounter large energy loss by vaporizing the moisture. Hydrothermal Liquefaction (HTL), a high temperature, high-pressure polymerization process, can convert wet biomass, including water to biocrude oil, biochar, and nutrient rich water. The biocrude obtained from HTL are environmentally friendly and can be directly used as fuel or can be upgraded to transport fuel. Many researchers are working on increasing the efficiency of HTL. In the present study an attempt is made to optimize the HTL reactor for maximizing the biocrude yield. Batch reactions are carried out to correlate the biocrude yield with different parameters like the reaction temperature (300°C - 350°C), reaction time (30 mins – 60 mins), initial solid concentration (5% - 20%) and also different species with different lipid contents. Experiments are also carried out to see the effect of different cultivating medium (wastewater and freshwater) on the crude yield after HTL. Experimental results show that different operating conditions can result in the biocrude yield to vary between 5% and 60%. These parameters are also related to the amount of heavier biocrude oil produced. This paper carefully examines and explains the relationships between the operating conditions and the biocrude yield to be able to optimize a HTL batch scale reactor for maximum crude yield.

Keywords: hydrothermal liquefaction, biocrude, alternative fuel, algae

State and Local Potential Socioeconomic and Environmental Impacts from Proposed Renewable Energy Projects: A case study of New Mexico

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Recent federal legislation, such as Clean Power Plan, is motivating the move away from coal-fired electricity generation to increase renewable resources. This provides a mechanism that can result in reduced Greenhouse Gas emissions and saving water, but may also impact economic growth and jobs in the state. The goal of this research is to assess the trade-offs of increasing renewable energy at the county and plant level in terms of jobs and economics, as well as greenhouse gas emissions and water. An analysis of these twelve potential renewable energy projects, constituting nearly 1,202 MW of power capacity, are estimated to result in close to 4,753 job-years during construction period from 2015 to 2019 in New Mexico. Over the operations period beyond construction, we demonstrate that statewide projects are estimated to result in 131 onsite jobs and 183 total jobs annually over the life of the plants. These projects are mainly located in the eastern part of New Mexico, which is a potential boom for economic development of the area. The expected amount of electricity that could be generated from these 12 renewable energy plants and replacing equivalent amount of coal-fired electricity would result in saving 44,000 million gallon of water, along with avoiding 81 million tons of greenhouse gases.

Keywords: renewable energy, economic impacts, environmental impacts, job comparison

Geothermal membrane distillation in industrial greenhouse application

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Masson Greenhouse is a large-scale indoor greenhouse that employs geothermal brackish water for space heating. Coupling heat exchangers with membrane distillation (MD) would allow Masson to simultaneously extract energy and water from the geothermal fluid thereby reducing the cost of water purification for irrigation. Polyvinylidene fluoride (PVDF)-based hollow fiber membranes (HFMs) were fabricated via the dry-jet wet-spinning process and the structure of the membranes was characterized using porometry and scanning electron microscopy. A bench-scale MD system was set up with the PVDF HFMs to evaluate the effects of membrane post-treatment, temperature gradient, and thermal boundary layer on the water flux.

Keywords: membrane distillation, geothermal water, irrigation, water purification

A hydrogeochemical analysis and recharge evaluation of Cienega Spring located in the Sandia Mountains, NM

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In the southwestern United States, water resources are increasingly depleted due to multiple demands including anthropogenic use and climate change. Springs are particularly sensitive to change, and also serve as an important habitat. In an effort to assist water managers, we report on the status of springs in the Sandia mountains, New Mexico. We focus on Cienega Spring, located in the East Mountain area, and serves as a water source to over 50 surrounding homes. The spring is tapped by pipes using gravity, overflow supplies a stream and wetlands. Total discharge rates are unknown, as is any seasonal change in discharge. In order to examine potential hydrologic flowpaths, we perform a hydrogeochemical analysis on the spring and compare with regional groundwaters. We have also installed continuous sensors to examine seasonal fluctuations in recharge and use. By performing a hydrogeochemical analysis and recharge evaluation, a proper conclusion can be determined for Cienega Spring and provide further insight on spring flow sustainability.

Keywords: hydrogeochemistry, spring water, groundwater

Carotenoid synthesis and lipid production of a Chlorococcum sp.

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As the shift toward environmentally renewable resources occurs algae cultivation for lipids, co-products and biomass, as a source of antioxidants, food, livestock feed, cosmetics and renewable fuel feedstock is of continuing growing interest. In this work we describe the profile and content of carotenoids and lipids of a promising microalgae identified as a Chlorococcum sp. Experiments were performed in environmental photobioreactors (ePBRs) and incubators under constant, low and high intensity irradiance. Metabolite, lipid, and carotenoid profiles determination was done during the transition from green vegetative cells to the highly pigmented carotenogenic cells. The objective of this work was to gather a better understanding of carbon allocation and lipid synthesis/remodeling events of the Chlorococcum sp. strain under increased photooxidative stress and other environmental stressors. This biochemical basis of the relationship between stress inducing conditions, carotenoid synthesis, high lipid content and fatty acid composition is beneficial for further increasing the productivity and economic development of this Chlorococcum strain.

Keywords: carotenoids, fatty acids, lipids, photooxidative stress, renewable resources, microalgae

Characterization of growth and lipid profile in the red alga *Galdieria sulphuraria*

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The present study was conducted to analyze the biomass and lipid accumulations in the red alga Galdieria sulphuraria under mixotrophic conditions. It has also proven that G. sulphuraria to be useful for biofuel and other valuable compound production. In recent studies, it has been seen that sugar beet molasses and glucose yielded higher biomass and lipid content. However, these studies have not led to the analysis of the role of other sugars as the carbon sources. The first goal of this research effort is to evaluate the biomass and total fatty acid, lipid and Calvin cycle in different sugars as carbon sources. According to this study the specific growth rate was higher when the cells were grown under mixotrophic culture condition on equal molar concentration of C atoms from glucose, fructose, sucrose and glycerol. However, maximum biomass production was achieved in the cultures grown on glucose and glycerol as the carbon sources. These results showed that glycerol is the best carbon source for the Galdieria growth under mixotrophic condition. Furthermore, we present the amount of total lipids and fatty acids and metabolism in the mixotrophic culture conditions.

Keywords: **Galdieria sulphuraria**, ***biomass, mixotrophic culture, lipid analysis***

Cation exchange in PbTe quantum dots

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Core/Shell nanocrystal quantum dots have become very popular structures over recent years due do their applications in solar cells, detectors, and light emitting devices. Lead chalcogenide (PbS, PbSe, and PbTe) quantum dots have emerged as a building block for many innovative photovoltaic devices, with PbTe quantum dots being the least well studied due to their instability when exposed to air. Using an in solution cation exchange method at low temperatures (80°C) we have synthesized PbTe/CdTe (core/shell) quantum dots that display a type-I band structure and have well defined cores by TEM imaging. The cation exchange reaction was monitored with absorption, PL, and TEM imaging, to relate shell thickness to reaction time. After the reaction time was optimized to yield a shell thickness of 1 nm, layer-by-layer shell growth techniques were employed in an attempt to grow a CdSe shell onto the PbTe/CdTe quantum dots. The PbTe/CdTe/CdSe structure is a good candidate for carrier multiplication, which is an important factor for high performance solar cells, due to the large conduction band offset of CdSe compared to PbTe.

Keywords: quantum dots, solar cells, PbTe

The synthesis of copper and metal nanoparticles

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Direct Write manufacturing is a method that can precisely print microcircuits and computer chips. Currently, silver nanoinks are in demand due to silver's high conductivity; however, silver is very expensive, so we have been investigating the use of copper as an alternative. Copper (I) has comparable conductivity, but is much more cost competitive. The copper nanoparticles were synthesized using a newly developed, simple, low-temperature route that employs octylamine and hexadecylamine only. Once we verified that we had clean copper nanoparticles, formulation of the nanoinks (N-inks) began. Additives such as Solsperse and benzotriazole were added to the inks to increase dispersion and reduce the potential oxidation of the N-inks. Also, the viscosity of the N-inks were varied by increasing the weight percent of copper and then measured using a rheometer. All aspects of the synthesis, formulation and properties of the inks will be presented.

Keywords: nanoparticles, copper, conductivity

No title provided

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Energy research plays an important role in meeting the need for affordable energy in our technological society. Conventional sources from fossil fuels have received increasing competition from alternative energy sources whose environmental impact is less pronounced. Mother Nature, as usual, has led the way featuring an organism that is highly efficient at transforming solar energy into lipids and fats that can then be converted into a diesel-like fuel. Biodiesel from algae has an alluring appeal similar to producing power from burning garbage whereby an otherwise nuisance species becomes a valuable resource. Algae can be grown at a lower cost compared with other higher maintenance feedstocks such as corn because of its more aggressive and flexible nature. The algal biomass is dried and the lipids within extracted with organic solvents. These extracted compounds are then converted into fatty acid methyl esters (FAMEs) which are chemically similar to conventional diesel fuel. This project addressed several challenges that exist in making algal biofuels cost-effective. Because a great variation in the yield of lipids from algae is observed depending on growing conditions, our experiments explored the optimization of these parameters using carefully developed analytical methods. Pitfalls associated with growing algae will be presented. In addition, a qualitative analysis of the complex FAMEs mixture resulting from our particular algae growth methods will be presented including the pros and cons of how variation in FAMEs would affect the production of useful bio-products.

Keywords: energy, biodiesel, fatty acid methyl esters

Semiconductor photocatalysis of bicarbonate to solar fuels: Formate production from copper (I) oxide

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In this study, micron- and nano-sized copper (I) oxide (Cu2O) were chosen as photocatalysts for the reduction of bicarbonate to formate using ambient solar energy. Cu2O was chosen because it is nontoxic, earth abundant, and because its band gap resides at energies comparable to ZnS; a proven photocatalyst in bicarbonate reduction. In our comparative study, composite nanoparticles having a silver core encapsulated by Cu2O shell (Ag@Cu_2O) were synthesized to demonstrate their ability to enhance photocatalysis. Lastly, silver nanoparticles (AgNP) were added to Cu_2O in solution to improve bicarbonate reduction by acting as a plasmonic sensitizer. These experiments mark the first set to utilize Cu_2O as a photocatalyst in a cooperative role with metallic nanoparticles and core@ shell structures toward enhancing bicarbonate reduction to formate. To achieve these goals, these photocatalysts were tested in solution phase for their ability of bicarbonate reduction. They were studied in two different hole

scavengers (isopropyl alcohol and glycerol) using a solar simulator with air mass coefficient 1.5 and 0 (AM 1.5, AM 0) filters. Formate production increased significantly with AM 0 solar irradiation due to the inclusion of the ultraviolet portion of the solar spectrum, and nano-particulate Cu_2O showed improved photocatalysis relative to micron Cu_2O. Green chemistry solvent, glycerol proved to be a far superior hole scavenger in comoparison to 2-propanol. AgNP added to Cu_2O showed no enhanced formate production, while $Ag@Cu_2O$ showed considerable enhancement. We attribute these marked production improvements to direct electron transfer (DET) from metal to semiconductor, and plasmon-induced resonant energy transfer (PIRET).

Keywords: solar fuels, formate production, copper oxide

Film study of pellet–clad interactions using cerium oxide as a surrogate

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Nuclear reactors are powered by radioactive fuel pellets that are stacked together into so-called 'fuel rods'. These fuel rods last about three years in the reactors and are then considered 'spent fuel'. They must be removed and disposed of, which is really storage. During storage, it is reported that the outer surface of the pellets swell and comes in contact with the inner surface of the container (cladding). The integrity of the storage of this spent fuel is dependent of the pellet-clad (P-C) interaction; however, little is known about what occurs at this interface. Therefore, this project is aimed at developing a computational model verified with experimental data that details this interaction. Surrogates, such as cerium oxide (CeOx), are often used in place of studying 'hot' spent fuel. For this effort, thin and thick films of CeOx deposited onto Zircaloy were analyzed using PXRD and TEM in attempt to mimic the P-C interactions. A number of commercial and in-house synthesized precursors were evaluated for film production. The initial results from this study and their comparison to real-life samples will be presented.

Keywords: pellet–clad interactions, nuclear storage, cerium oxide

Microalgal crop protection by allelopathic control

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Mass cultivation is an important process that still needs significant improvement to make algae a viable source of renewable energy. The allelopathic interaction in polycultures of *Chlorella sorokiniana* LANL1228 and *Coelastrella* sp. was investigated to determine if this phenomenon could be utilized as a crop protection strategy. The culture exudate was collected, purified, and used to introduce allelopathic compounds into 96-well microplates for cultivation of algae. Exudate bioassay experiments were performed with three exudates (*Chlorella* 1228 exudate, *Coelastrella* exudate, 50/50 polyculture exudate) each at five concentration treatments. Fractionation of the exudates was performed using solid-phase extraction in methanol. The fractions were used to culture bioassays of *C. sorokiniana* LANL1228 in 96-well microplates. Based on bioassay activity, fractions were classified as either active or non-active, and analyzed using Fourier transform ion cyclotron resonance mass spectrometer (FT-ICR MS) to identify presence of allelopathic agents. Based on experimental results, *Coelastrella* is identified as a superior competitor and the interaction is classified as a negative allelopathic interaction. Allelopathic compounds are only present in exudates procured from cultures with *Coelastrella* under direct competition with *Chlorella*. The exodume of algal interactions as shown by FT-ICR MS is complex and chemically diverse. Two fractionation regions of allelopathic activity suggest there are two potential compounds or compound classes to be elucidated. The observed allelochemical interaction likely includes long-chain fatty acids, wax esters, or another lipid type compounds. Selective use and design of polycultures is a likely solution to prevent negative allelopathic interactions and will be investigated.

Keywords: energy, algae, polycultures, allelopathic agents

Solar energy assisted water purification: Incorporation of an environmentally benign porous graphitized carbon nitride photocatalyst with graphitized polyacrylonitrile for efficient oxidation of toxic arsenite

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The presence of toxic arsenic in various water bodies is a matter of concern in New Mexico. It is urgent to develop an efficient process for toxic and carcinogenic arsenic removal from water, while this contaminant is sourced from mining, industrial waste, etc. Recently, graphitized carbon nitride g-C_3N_4 with proper bandgap (2.7 eV) has attracted increasing attention. However, the efficiency for g-C_3N_4 needs further improvement due to its low charge separation efficiency and low surface area. Polyacrylonitrile (PAN) is an inexpensive polymer, when it is heated, it will form graphitized g-PAN with graphite-like sheet network structure, which is expected to facilitate the charge separation efficiency and larger surface area of g-C_3N_4. In this work, we report the synthesis of g-C_3N_4 and its composites with g-PAN with different compositions; characterization including their BET surface area, morphology, crystal structure and microstructure by N_2 adsorption and desorption, electron microscopies, x-ray diffraction and Raman spectroscopy. Their photocatalytic oxidation of As(III) under visible light irradiation as a function of the percentage g-PAN in g-C_3N_4 is evaluated. The correlation between their photocatalytic performance with their composition, microstructure, and surface area will be discussed.

Keywords: water purification, photocatalysts, oxidation

Solar assisted model aircraft for rangeland monitoring

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Rangeland crop monitoring with remote controlled aircraft is inexpensive and very effective. Combustion engine powered models do however have a limited flight time of typically about 20 minutes. This projects aims at developing a hand-made aircraft model that is battery powered during takeoff and solar powered during cruise (based on Las Cruces ambient data) to allow for day-long eco-friendly and quiet flights. Performance estimates have shown that a 12ft wing span model with 10lb empty weight would be able to carry a 5lb payload. The full-scale aircraft will be covered with more than 40 5x5in monocrystalline solar cells. To test the aerodynamics and handling a half-scale model was recently built and test flown. The half-scale model also helped clarify questions we had about the full-scale design. The full-scale model is and exact 1:2 scale of the half-scale model except for the fuselage which was altered to accommodate instrumentation. The full-scale has to be exceptionally light weight and aerodynamically efficient to be able to cruise solely on solar power according to prior calculations. Towards this end work on a fiberglass composite fuselage shell has been completed. The final wing has been designed and is currently being built. This current research that I am working on will fly on solar power and monitor crop rangeland efficiently and inexpensively.

Keywords: rangeland monitoring, model aircraft

Thin layer g–C_3N_4 nanosheets for enhanced visible–light photocatalytic activity

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Bulk graphitic carbon nitride (g-C_3N_4), a photocatalyst, was synthesized by annealing at an elevated temperature under air in a muffle furnace. The transformation from bulk to thin layer was performed using the ultrasonication and the hydrothermal process. While XRD, TEM, and FTIR confirm formation of the photocatalyst, photocatalysis analysis demonstrates that thin layer g-C_3N_4 significantly improves rhodamine-B reduction under the photoillumination. Electrochemical analyses reveal that thin later g-C_3N_4 possesses reduced resistivity in contrast to bulk catalyst and n-type behavior.

Keywords: g–C_3N_4, photocatalysis, rhodamine–B, n–type

Bioremediation using microalgae and biotechnology involving produced water extracted during hydraulic fracking operations in New Mexico

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Oil and Gas companies extract approximately 28 billion gallons of produced water annually during fracking operations in New Mexico. This figure spikes to 880 BGY on a national level. Produced water presents high contents of impurities and therefore, should be remediated to provide an alternative water resource and avoid further environmental contamination. Nationally, the amount of fresh water extracted annually since 2005 exceeds over 239 billion gallons. The ultimate goal is to recycle produced water in order to reduce the need to extract fresh water. Microalgae such as *Nannochloropsis salina* and *N. oculata* strains have demonstrated the ability to remove impurities from produced water. The biomass that is created by the microalgae could then be used in anaerobic digestion as a value added product. Modification by biotechnology may result in the ability for this water to be recycled by oil and gas companies during fracking operations, while meeting the ultimate goal of releasing treated waters safely back into the environment. Recycling produced water would alleviate the strain on our limited reserves of fresh water. Current levels of human growth will force us to find intelligent, sustainable ways to manage our limited and precious resources. Water is the primary vital resource, as it is critical to sustaining life and the natural balance of the environment.

Keywords: **N. salina, N. oculata*, produced water, oil & gas, recycled water, fresh water, biotechnology, microalgae***

Using electromagnetic geophysics to better understand geothermal systems in New Mexico

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Understanding the groundwater flow patterns of known geothermal systems is critical for developing prospecting methodologies. It is likely that there are many undiscovered geothermal systems in the Rio Grande rift of New Mexico that have no surface expression. In this study, we focused on better understanding the Truth or Consequences, NM and Rincon, NM geothermal systems. Alamosa Creek is the hypothesized upstream end of the Truth or Consequences system, where groundwater temperatures are approximately 35 °C at depths less than 200 m. Rincon is one of the hottest systems in the State with shallow temperatures upwards of 100 °C. Previous studies suggest that shallow geothermal systems in the rift are commonly attributed to deep circulation in crystalline basement rocks. The geothermal fluids ascend to shallow depths through permeability windows in overlying confining units. We used electromagnetic (EM) geophysics to try to image the geothermal upflow zones in our study areas. Magnetotellurics (MT) and transient electromagnetics (TEM) are two EM methods that have the ability to map subsurface electrical conductivity. Geothermal waters are often more conductive than their surroundings, making their flow patterns apparent in EM results. We collected 10 MT stations and 37 TEM stations along Alamosa Creek and 5 TEM stations along a fault zone in Rincon. The results from both study areas are consistent with focused geothermal flow along fault zones. It is believed that these faults provide windows for groundwater to ascend from great depth. Ongoing MT work aims to constrain the circulation depth of both systems.

Keywords: permeability, hydrologic windows, geothermal, electromagnetics

Synthesis and spectroscopic investigation of substituted salen and phthalocyanine chelating ligands

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This research focuses on the synthesis and characterization of novel, substituted Salen-type and phthalocyanine ligands and their respective metal complexes. These compounds present interesting and potentially applicable spectroscopic properties for a variety of industrial applications including subterranean fluid-flow monitoring. Through simple and high-yielding methods we have successfully synthesized a large number of novel, thermally

stable, and variably soluble Salen-type and phthalocyanine derivatives. Focusing on first-row transition metals we were able to synthesize numerous coordination complexes with unique and distinct variations in infrared and Raman spectroscopic frequency shifts. These compounds also can be designed to be soluble in either hydrocarbon or aqueous solutions, thus giving flexibility to possible uses. All of the synthesized compounds have been characterized by a variety of techniques including single-crystal X-ray analysis. Metal-ligand exchange reactions using these new complexes will also be discussed.

Keywords: phthalocyanine ligands, subterranean fluid–flow monitoring, spectroscopy

Ecological changes due to water level fluctuations in conchas reservoir

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The United State Army Corps of Engineers (USACE) began the construction of Conchas Dam in 1939 as part of the New Deal Program. The dam is located downstream from the convergence of the South Canadian and Conchas Rivers, northwest of Tucumcari, NM. Water stored in the Conchas Reservoir is transferred to the land in the Conchas Canal and its branch, the Hudson Canal. These canals deliver the water to a distribution system named the Arch Hurley Conservation District; and the Bell Ranch, located northeast of the reservoir. Water is released into the canals by the USACE to maintain a permanent pool elevation of 4,155 feet above mean sea level. However, dramatic effects of climate changes in 2002 to 2013 caused large and extended water-level fluctuations (WLF). According to the U.S. Drought Monitor, the state of New Mexico experienced the highest level of drought, "exceptional", between 2002 and 2013. The WLF affected the ecosystems of Conchas in several ways: aquatic habitats and feeding and breeding grounds were lost; the absence of aquatic plant life affected the amount of dissolved oxygen in the reservoir; and pH levels rose. The study uses USACE data to consider the ecological effect WLF had on Conchas Reservoir. Elevation data provided by USACE is compared to the dissolved oxygen and pH reading taken by USACE monthly. The amount of water released to the Bell Ranch and Arch Hurley Conservation District were considered when determining elevation.

Keywords: water–level fluctuations, drought, Conchas Reservoir, climate change

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

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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 Creek and Alamo Canyon in the southwestern part of the caldera contain acidic geothermal features. There are also other snow fed tributaries such as Redondo creek that feed into the Jemez river. In this study, we examine the hydrochemistry and diffuse gas input into the acid-sulfate waters and examine their influence on water quality of the surface waters draining the Valles caldera. Waters from several tributaries as well as the Jemez river were sampled in multiple campaigns in 2015. These results were compared with prior studies at the same locations. We report hyrdochemical results for 23 waters. Sampled waters exhibit pH ranging from 2.5 to 8.5, temperature from 16 C° to 21 C°, and total dissolved solids range from less than 100 ppm at Redondo up to 1370 ppm at Soda Dam Spring. Major, minor and selective trace elements were also quantified in each sample. Using solute concentrations (including sulfate, chloride and bicarbonate) we are able to quantify the mass loading of geothermal constituents to the stream system. Elevated sulfate levels correspond with low pH in the waters and serve as a proxy for geothermal input in the upper reaches. In addition to the water parameters, diffusive CO2 flux measurements have been taken in the study area to quantify the CO2 released in association with thermal features. The acidic geothermal contributions have a major effect on the water quality in streams and shallow groundwater systems; especially pH, temperature, sulfate and metal content in the upper stream reaches of Alamo and Sulphur creeks. This study has implications for quantifying influence of geothermal inputs to the Jemez river with changes in discharge.

Keywords: water quality, geothermal, hydrochemistry, Valles Caldera, Jemez River

An investigation of the carotenogenesis of two North American microalgae

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The research investigates two North American microalgae. One species of Haematococus pluvialis and two species of Coelastrella were analyzed. The goal is to determine which health beneficial antioxidants, otherwise known as carotenoids, each species produce when stressed. The species of algae were stressed using fluorescent lighting and an altered media. The media is deprived of nitrogen, therefore reducing carbon fixation. The media has never before been used with these specific species of algae, proving this research unique. The algae were stressed and observed for 12 days. The carotenoid profile presented lutein as the most abundant antioxidant produced in all three species. Lutein can be used to prevent several eye diseases. The results of the study may provide a more environmentally friendly source for antioxidants that have been proven beneficial to human health.

Keywords: microalgae, human health, carotenoids

Zinc, lead, copper, chromium, and arsenic accumulation associated with naturally accumulating iron–manganese oxide coatings on in-situ stream substrates in streams comparing geothermal and non-geothermal waters

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Geothermal trace metals (As, Cr, Cu, Pb, Zn) can have negative health effects on humans and wildlife. Previous studies utilized in situ pebbles, glass, or ceramic substrates with iron-manganese oxide coatings to understand chemical cycling. Here we develop a tracing method in a distal geothermal environment (upper San Antonio river, Valles Caldera, NM) using adsorption onto substrate surfaces to better understand trace metal transport. We focus on natural oxide-hydroxide accumulation on 24mm silica bead substrates at sites near and away from geothermal inputs. Results show that adhesion of iron and manganese oxides were closely correlated at both sites and showed a positive trend of accumulation over an 8 week trial period. Manganese at the thermal vent showed a decrease at the 6 week mark potentially indicating an unknown component of reduction for that metal. The adsorption of arsenic, chromium and lead on iron-manganese oxide coatings were significantly higher on substrates in the geothermally influenced waters than those not near the thermal input. All trace metals in the study were shown to have patterns of adsorptions and desorption over the course of the trial.

Keywords: trace metals, geothermal waters, in-situ streams

The social construction of water and water use in the CAERT Curriculum

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The CAERT Curriculum was created as a resource for agricultural and environmental educators in order to provide secondary students the necessary intellectual and practical training for sustainable agriculture. Given the critical water issues in New Mexico, our research objective was to identify cultural water discourse across a purposeful sample of the New Mexico CAERT Curriculum. We asked: Within the CAERT Curriculum, how are humans situated within the socio-ecological system and what is the relationship between human activity and water? Qualitative content analysis using first cycle domain coding and second cycle taxonomic coding revealed that the human-environment interaction within the CAERT Curriculum is largely consistent with the empty world socio-ecological regime arising during the Industrial Revolution. These findings are significant because the empty world regime is grounded in the assumption of resource abundance, an assumption that is inconsistent with resilience and adaptive responses to critical water issues. The implication is that the cultural lag in the CAERT Curriculum may actually exacerbate system decline, contrary to its intended purpose.

Keywords: water; CAERT Curriculum, socio-ecological system, sustainable agriculture

Willingness to pay to meet clean power plan requirements: Evaluation of New Mexico's options to meet requirements

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New Mexico (NM) is a top US fossil-fuel producer and energy contributes to the state's budget—over 30% of the General Fund in 2013. A push towards renewables through the renewable portfolio standards and the Clean Power Plan (CPP) to reduce emissions could impact this. While the CPP lets each state choose their own path for reductions, suggested methods are to improve coal efficiency or increasing natural gas use and/or renewables. Specifically, NM's reduction requirement is 36% from 2012 levels (EPA 2015). The state's energy plan argues for an "all of the above approach" (NM EMNRD 2016). The extant literature primarily focuses on comparing preferences for characteristics and tradeoffs between different renewable energies. We contribute to this literature by considering the tradeoffs between energy sources themselves, that is fossil fuels and renewables, when policy requires a change in the energy mix. To evaluate NM's response to the CPP, we employ a choice experiment and evaluate each of NM's options to meet the requirements. Utilizing multinomial logit and random parameter models we find observable differences in preferences (living in fossil fuel producing county, climate change opinion, and political leanings) and unobservable heterogeneity. The difficulty in developing policy under these conditions is evident if we consider the largest electricity provider in the state's plan to increase electricity from nuclear power. We find significant variation in preferences; some are highly supportive of nuclear while others are highly opposed. These outcomes suggest challenges in energy policy development, but also directions residents will support.

Keywords: energy preferences, choice experiment, carbon emission reduction, random parameter logit, CPP

Reactor design and operation variables to improve mixed algae biomass production and stability with the addition of sodium bicarbonate

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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 polycultures, in part because biofuels research has largely focused on algal mono-cultures. It is hypothesized that imposing a selection for algae with improved settling characteristics will provide enrichment for high biomass and/or lipid storage, and that imposing a selection pressure for settling algae will improve solids separation, which is a major challenge in algal cultivation and recovery. The objective of this study was to determine if polycultures of algae can be enriched for useful functions, such as improved solids separation and/or lipid storage, by incorporating a settling phase into the operational cycle and to observe what the effects of excess carbon in the form of bicarbonate are. This study incorporated three sequencing batch reactors with defined media, run with a hydraulic residence time of two days in reactors 1 and 2 (R1 and R2) and five days in the control, and a solids retention time of twenty-three days in reactors 1 and 2 and five days in the control. The settling time was one hour in reactors 1 and 2, with no settling phase in the control. The solids separation was assessed using the sludge volume index (SVI) test and settelabilty. The experiment was run in two phases; the first was run with carbon addition, and the second was run with excess carbon addition. Results demonstrated that incorporation of a settling phase improved mixed culture sedimentation. For example, the reactors that included a settling phase (R1 and R2) produced biomasses with a sludge volume index (SVI) value of 222 and 944 ml/g respectively and good solids separation values (90 % or more); the control reactor with no settling phase produced biomass with an SVI of 773 ml/g and a solids separation value of 32 %. SVI is a commonly applied settelability parameter used in wastewater treatment systems, with lower values indicating better settling biomass.

Keywords: algae biomass, photobioreactors, polycultures

Metabolomic and lipidomic profiling in *Nannochloropsis salina* under sinusoidal temperature control

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The growing demand for large-scale sustainable, low-cost production of polyunsaturated fatty acids (PUFAs), carotenoids, and other high-value bioproducts has led to increased research in prospective microalgal species within the past several decades. The oleaginous marine microalga Nannochloropsis salina has received attention for its high oil yield (37-60% wt.) and production of the dietary PUFA ω3 eicosapentaenoic acid (EPA). Marine microalgae found in temperate waters are subject to dynamic temperature fluctuations, which require mechanisms for temperature modulation. The incorporation of unsaturated fatty acids into membrane lipid pools is particularly important for maintaining membrane fluidity and cellular structure; therefore, the composition and content of membrane lipid pools is thought to be heavily regulated by temperature. Previous research has shown that N. salina grown under "cold stress" (≥10°C below optimal temperature) results in both increased lipid production and desaturation of fatty acids. Reduced biomass productivity is a consequence of cold stress; however, regulation of cold stress through sinusoidal temperature control has been shown to reduce the effect on growth. Here, we demonstrate the effects of cold stress under 12:12 hr sinusoidal control on N. salina using four temperature regimes: 5°C, 10°C, 15°C and 20°C that all increase to 25°C during peak light intensity, while the control is maintained at a constant temperature of 25°C. Physiological stress is determined through growth rate, chlorophyll fluorescence and dissolved oxygen measurements. Metabolomes were sequenced and quantified using GC TOF MS, and the results were analyzed for statistical significance using MetaboAnalyst V3.0. In addition, a pathway enrichment analysis was performed using VANTED V2.6.3 that reveals depletions in TCA cycle intermediates, particularly acetyl-CoA pools, under cold stress. Total fatty acid (TFA) content is quantified using fatty acid methyl ester analysis, and increases in both the amount and desaturation of fatty acid pools are observed at lower temperatures. Whole lipidome profiling is performed using FT ICR MS, and at reduced temperatures there is an increased proportion of EPA in both triacylglycerol and membrane lipid pools.

Keywords: algae biomass, photobioreactors, polycultures

Assessing uranium concentration in stream sediment on the Laguna and Isleta Pueblos

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As a summer internship through a New Mexico EPSCoR funded STEMAP program. Myself and another intern worked with the uranium team from New Mexico Tech. Were we collected sediment samples from streams and washes on Laguna and Isleta Pueblo lands. These samples were collected to analyze the heavy metal content washing down from upstream uranium mines. This research program was funded because the uranium legacy these mines left behind are still a present health and safety risk to those that live in the area. Knowing the type and quantity of heavy metals washing down these washes, could help with further clean up or reclamation efforts in the area. Samples were collected from the Rio Puerco, San Jose, Del Valle, and Paguate washes. The samples needed to be dried, sieved, ground into a fine powder, then digesting in acid. Analysis of heavy metals was done using an ICP-MS for heavy metal content. We also performed a mass fraction of grain size on each sample to get a course sand content vs. the finer grain content. Our hypothesis being that uranium particle adheres to larger surface area by volume to the clay material better than course sand. Uranium concentrations were present on samples we collected from the washes downstream of the main uranium mines. Our data also supported our hypothesis when we correlated the amount of finer grained material a sample had with the concentrations of uranium that was present.

Keywords: water quality, uranium, Isleta Pueblo, Laguna Pueblo