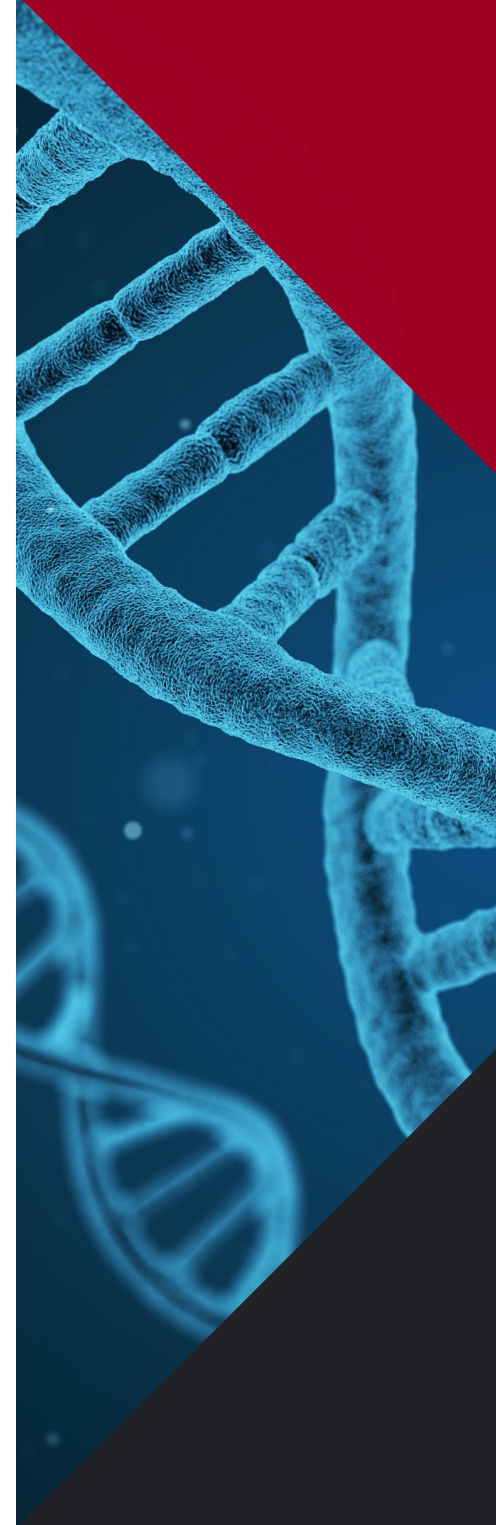




EASTERN WASHINGTON UNIVERSITY

EWU CSTEM AND MCNAIR SPRING RESEARCH SYMPOSIUM

JUNE 2, 2021
ONLINE





Schedule

9:00 – 9:15 am – Symposium opening remarks (*location, Zoom Main Room*)

9:15 – 10:10 am – Social Justice in Research Panel (*location, Zoom Main Room*)

10:10 – 10:15 am – Symposium Orientation (*location, Zoom Main Room*)

10:15 – 11:50 am – Morning Research Presentations

- **Session 1 (am) – Prairie Restoration** (*location, Zoom Breakout Room #1*)
- **Session 2 (am) – Social Science / Humanities** (*location, Zoom Breakout Room #2*)
- **Session 3 (am) – Fisheries / Water Quality** (*location, Zoom Breakout Room #3*)
- **Session 4 (am) – Material Science** (*location, Zoom Breakout Room #4*)

12:00 – 1:00 pm – Brown Bag Lunch with EWU Alumni (*location, Zoom Main Room*)

1:00 – 2:30 pm – Afternoon Research Presentations

- **Session 5 (pm) – Regional Ecology** (*location, Zoom Breakout Room #5*)
- **Session 6 (pm) – Microbiome** (*location, Zoom Breakout Room #6*)
- **Session 7 (pm) – Disease Ecology / COVID** (*location, Zoom Breakout Room #7*)
- **Session 8 (pm) – Computation / Modeling** (*location, Zoom Breakout Room #8*)

2:30 – 2:45 pm – Symposium closing remarks (*location, Zoom Main Room*)

Symposium Registration Link: <https://bit.ly/3boX8YV>

Social Justice Panel Link: <https://bit.ly/2S0uAhR>

MENT Capstone Zoom Link: <https://ewu.zoom.us/j/91392123429>

EWU CSTEM & McNair Spring Research Symposium
Social Justice in Research Panel
McNair Alumni Plenary Session



**Wednesday:
June 2, 2021
from 9am-10:15 am**

Please join us in the virtual celebration of
the social justice panel



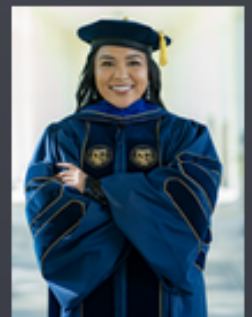
S. Omar Jobe, PhD



Frank King, PhD



**Yvonne P.
Sherwood, PhD**



**Laura Zamudio-
Orozco, PhD**

EWU CSTEM & McNair Spring Research Symposium

Social Justice in Research Panel

McNair Alumni Plenary Session



**S. Omar Jobe,
PhD**



Omar Jobe's Bio: <https://bit.ly/3uVYTod>

University of Wisconsin-Madison, Endocrinology and
Physiology; MBA, University of Wisconsin-Madison
EWU McNair Cohort 2006; EWU Bachelor's degree
2008: Biology major

**Current Position: Sr. manager, Medical Science Liaison,
Edwards Lifesciences**

EWU CSTEM & McNair Spring Research Symposium

Social Justice in Research Panel

McNair Alumni Plenary Session



**Yvonne P.
Sherwood**



Yvonne Sherwood's Bio:

<https://bit.ly/3hxbuKG>

Assistant Professor, University of Toronto, Mississauga
EWU McNair Cohort 2008; EWU Bachelor's degrees 2011

**Teaches: Indigenous Peoples: Legal Orders and Law;
Indigenous Rights, Resistance and Resurgence**

EWU CSTEM & McNair Spring Research Symposium

Social Justice in Research Panel

McNair Alumni Plenary Session



**Frank King,
PhD**



Frank King's Bio: <https://bit.ly/2RWvI5X>

Washington State University, American Studies
EWU McNair Cohort 2004; EWU Bachelor's degree 2006: History
major; Africana Studies and Anthropology minors

**Current Positions at University of Wisconsin-Platteville:
Executive Director: Diversity, Equity, and Inclusion; Special
Assistant to the Senior Diversity Office; and Associate Professor
and Program Coordinator: Ethnic Studies**

EWU CSTEM & McNair Spring Research Symposium

Social Justice in Research Panel

McNair Alumni Plenary Session



**Laura Zamudio-
Orozco, PhD**



Laura Zamudio-Orozco's Bio:

<https://bit.ly/3u0oSJP>

Florida International University, Math Education
EWU McNair Cohort 2013; EWU Bachelor's degree 2015:
Mathematics Education major; Spanish minor

**Current Position: Assistant Professor of Mathematics and
McNair Program Coordinator at Heritage University**

EWU CSTEM & McNair Spring Research Symposium

Brown bag careers lunch with EWU alumni

Wednesday: June 2, 2021



Please join us in the virtual celebration of the brown bag alumni/careers lunch and learn with EWU Alumni

12:00 p.m. Brown Bag Lunch with EWU alumni



Registration link: <https://bit.ly/3boX8YV>



Lunch Panelists (*location, Zoom Main Room*)

Jeffrey Collins

Completed his Ph. D. at WSU
Computational fluid dynamics engineer at SimuTech Group

Chris Jenkins

Completed his Ph.D. in Geology at Carleton University (Ontario, CA)

Michelle Keller-Pearson

Completed her Ph.D. in Cellular and Molecular Biology, University of Wisconsin-Madison
Faculty at Spokane Falls Community College
EWU McNair Alum

Trevor Kirby

Current Ph.D. student at Washington State University in Pharmaceutical Science and Molecular Medicine
EWU Biology M.S. Alum

Hung Nguyen

Completed M.S. in Computational Finance and Risk Management, University of Washington
Cloud operations engineer, Atrip
EWU B.A. in Applied Mathematics, B.S. in Economics
Frances B. Huston Award

Sara Page

Software development engineer, Clearwater Analytics
EWU B.A. in Mathematics with a concentration in Computer Science
Frances B. Huston Award

Arin Preston

Current Ph. D. Student at University of Notre Dame
Research Assistant at Nanomaterial Fabrication Research Lab

Christina Ramelow

Current Ph.D. student in Neuroscience at Emory University
EWU McNair and Biology M.S. Alum

EWU CSTEM & McNair Spring Research Symposium

Student Research Presentations

Wednesday: June 2, 2021

**10:15 a.m. Research
Presentations**



**1:00 p.m.
Research
Presentations**



Please join us in the virtual
celebration of the student
research presentations

There will be **55** research
presentations!

Registration link:

<https://bit.ly/3boX8YV>

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 1 (am) - Prairie Restoration (*location, Zoom Breakout Room #1*)

Moderators: Erin Dascher and Becky Brown

Grad student assistant: Dana Colley

1-1 @ 10:15 15-min

Giovanna Bishop

Impacts of rock climbing on lichen and bryophyte cliff communities in northwestern North America

1-2 @ 10:30 15-min

Chandler Lymbery

An Investigation of Atmospheric Nitrogen Deposition Using Lichens

1-3 @ 10:45 15-min

Brendan Booth

Business as Usual: Altered Abundances of Conata Basin Mixed Grass Prairie Ecosystem Spells Disaster for the Conservation Outlook of *Mustela Nigripes* (Black-Footed Ferret)

1-4 @ 11:00 15-min

Emma Hoskins

Can the reconstruction of prairie plant communities also re-establish pollinator communities and plant-pollinator interaction networks?

1-5 @ 11:15 15-min

Seth McCullough

Effect of Biochar Additions in Palouse Prairie Restoration on Several Soil Perimeters

1-6 @ 11:30 15-min

Kristy Snyder

Analysis of the role of annual seeds and biochar in Palouse prairie restoration

1-7 @ 11:45 5-min

Rachael Pentico

Plant Soil Feedbacks Vary with Aspect in Palouse Prairie Remnants

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 2 (am) – Social Science / Humanities *(location, Zoom Breakout Room #2)*

Moderator: Cynthia Dukich and Cori Jaeger

Grad student assistant: Chris Harding

2-1 @ 10:15 15-min

Alexis Lisandro Guizar-Diaz

Indentured Servitude in the 21st Century? A Case Study on Agricultural Labor Employment

2-2 @ 10:30 5-min

Theresa Lee

Prisoner Reentry: College Perceptions of Reentry Barriers in a Northwest Community

2-3 @ 10:37 5-min

Alexandria Coronado

Impacts of COVID-19 on Food and Housing Student Resources at Universities in State of Washington

2-4 @ 10:45 5-min

Lisbeth Banuelos

Latinx First-Generation Students' Academic Experience: The Role of Institutional Supports During a Pandemic

2-5 @ 10:52 5-min

Christina Hudson

The Characterization of African Religions

RESEARCH PRESENTATIONS—TIMES AND TITLES

Session 3 (am) - Fisheries / Water Quality (*location, Zoom Breakout Room #3*)

Moderators: Paul Spruell and Camille McNeely

Grad student assistants: Tyrel Long and Ben Thompson

3-1 @ 10:15 15-min

Nicholas Broderius

Effects of Beaver Dam Analogs on Stream Ecosystem Function of Crab Creek, WA

3-2 @ 10:30 15-min

Hannah Coles

Measuring the efficacy of translocating Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) in two streams in the Pend Oreille Basin

3-3 @ 10:45 5-min

Kacie Evans

Crayfish Abundance in the BDA Reach of Crab Creek

3-4 @ 10:52 5-min

Collin Hendricks

Estimation of the Degree of Hybridization Between Westslope Cutthroat Trout and Rainbow Trout in the Pend Oreille River

3-5 @ 11:00 15-min

Alicia Cozza

Evaluating the Reliability of Environmental DNA to Describe Fish Community Composition: A Comparison to Traditional Electrofishing

3-6 @ 11:15 15-min

Mori Williams

Nutrient Concentration for Cyanotoxins at Turnbull Abstract

3-7 @ 11:30 15-min

Ronald Scerbicke

The interaction of phosphorus and nitrogen on productivity across lakes in Eastern Washington

3-8 @ 11:45 5-min

Roxanne McPeck

Microplastic Contamination and Bacterial Abundance in Coastal, Lake, and Tap Waters

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 4 (am) - Material Science *(location, Zoom Breakout Room #4)*

Moderators: Awlad Hossain and Heechang (Alex) Bae

Grad student assistant: Craig Wells

4-1 @ 10:15 15-min

Joshua Morton

Increased IPN composite strength using a flexible epoxy and rigid acrylate matrix

4-2 @ 10:30 15-min

Ellie Gardner

Analysis of Weathered Gasoline, Diesel, and Kerosene in Arson Scene Investigations by Gas Chromatography Mass Spectrometry

4-3 @ 10:45 5-min

Mori Williams

Henry's Law Constant for Chloroform and Deuterated Chloroform

4-4 @ 10:52 5-min

Konstantine Geranios Quantum Chemical Calculations of the Thermochemical Properties of Ammonia Synthesis

4-5 @ 11:00 15-min

Michael Campbell

Effects of Acetone Vapor Post-Treatment on the Tensile Strengths of 3D Printed Parts

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 5 (pm) - Regional Ecology (*location, Zoom Breakout Room #5*)

Moderators: Peggy O'Connell and Camille McNeely

Grad student assistant: Chris Harding

5-1 @ 1:00 15-min

Sarah Deshazer

Occupancy patterns of elk, deer, and moose on Turnbull National Wildlife Refuge

5-2 @ 1:15 15-min

Lucy Roussa

Freshwater Algae of Turnbull National Wildlife Refuge

5-3 @ 1:30 15-min

Jonah Cwik

Analyzing Lethal *Batrachochytrium dendrobatidis* Frog Fungus vs. Beneficial Probiotics at Turnbull National Wildlife Refuge

5-4 @ 1:45 15-min

Krista Dodd

Frog skin microbiome community structure in comparison to the fungal pathogen *Batrachochytrium dendrobatidis*

5-5 @ 2:00 15-min

Amanda Chandler

A survey of lichen species in the endangered Palouse Prairie region of Washington state

5-6 @ 2:15 5-min

Ashley Destin

Size Scaling in the Skull of North American Felids as Adaptations for Prey Acquisition

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 6 (pm) - Microbiome (*location, Zoom Breakout Room #6*)

Moderators: Javier Ochoa-Reparaz and Jeni Walke

Grad student assistants: Nicole Hamada and Craig Wells

6-1 @ 1:00 15-min

Shelby Fettig

Effects of Nutrition on Honey Bee Gut Microbiome, Disease Occurrence, and Hive Growth

6-2 @ 1:15 15-min

Macee Mitchell

Evaluating the Relationship Between Pesticides and the Gut Microbiome of Honey Bees (*Apis mellifera*) using Field and Laboratory Approaches

6-3 @ 1:30 5-min

Tyrel Long

In vitro effects of CNS inflammation in intestinal barrier disruption

6-4 @ 1:37 5-min

Makenna Britton

A Survey of Endosymbionts in Pine Trees With and Without Gall Rust

6-5 @ 1:45 15-min

Hannah Kohl

Evaluating the Effects of Intestinal Bacteria's Production of GABA Neurotransmitter on an Animal Model of Multiple Sclerosis

6-6 @ 2:00 15-min

Dechen Edwards

Metal-exposed clams exhibit different investment in somatic growth and reproduction

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 7 (pm) - Disease Ecology / COVID (*location, Zoom Breakout Room #7*)

Moderators: Krisztian Magori and David Daberkow

Grad student assistants: Tyrel Long and Ben Thompson

7-1 @ 1:00 5-min

Belen Longoria

Survey of *Radix auricularia* and trematode prevalence in three lakes at Turnbull National Wildlife Refuge

7-2 @ 1:07 5-min

Laura Mertens-Plowman

West Nile Virus and Domesticated Horse Survey Study

7-3 @ 1:15 15-min

Misha Lehmann

Senior Thesis: Statistical Analysis and Computational Model for the Online School Experience in COVID-19

7-4 @ 1:30 15-min

Tiffany Jordan

Behavioral differences in urban *Sciurus carolinensis* with reduced human interaction on Eastern Washington University and Gonzaga University campuses

7-5 @ 1:45 5-min

Michael Stralser

Tick density and distribution in the greater Spokane area

7-6 @ 1:52 5-min

Sarah Deshazer

Environmental Surveillance of Mosquito Populations at Turnbull National Wildlife Refuge

7-7 @ 2:00 5-min

Roxanne McPeck

Student Involvement in the Development and Preliminary Results of the COVID-ADAPT Simulation Model

RESEARCH PRESENTATIONS – TIMES AND TITLES

Session 8 (pm) – Computation / Modeling (*location, Zoom Breakout Room #8*)

Moderators: Viktoria Taroudaki and Andrew Oster

Grad student assistant: Dana Colley

8-1 @ 1:00 5-min

Ariana Fox

Predicting Domestic Box Office Revenue

8-2 @ 1:07 5-min

Nyibol Thareek

Mitochondrial excitability and its ability to support waves of calcium

8-3 @ 1:15 15-min

Joshua Anderson

Evaluation of House Dust Mite Cultivation and Harvesting

8-4 @ 1:30 15-min

Jordan Driscoll

An Implementation of the Minimax Algorithm

8-5 @ 1:45 5-min

Blake Chalpin

Artificial Intelligence Requisition Engine: Automating Data Entry in Healthcare with Machine Learning

8-6 @ 1:52 5-min

Aulane Mpouli

Molecular Dynamic Simulation Study of ITPA-ITP Protein-Ligand Complex

8-7 @ 2:00 5-min

Joah Robak

The Dancing Data Table: A New Way of Experiencing Data Presentations

8-8 @ 2:07 5-min

Nhat Nguyen

Chaos, Solitons and Fractals: Laser modulation

8-9 @ 2:15 15-min

Brendan Booth

Computational Study of the inhibitory mechanism of the human kidney-type glutaminase (KGA)

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Joshua Anderson

Evaluation of House Dust Mite Cultivation and Harvesting

Authors: Anderson J, Bai X

Mentor: Dr. Xiuqin Bai

House dust mites are microscopic arachnids that inhabit almost every environment populated by people. They feed on dead human skin cells and are known to cause an allergic response in a significant portion of the population world-wide. It is possible to cultivate dust mites at an industrial scale and to separate the resulting cultures into their body and fecal portions. One such process for the creation and purification of house dust mite body and fecal material has been examined in detail using a series of statistical methods. Principal component analysis followed by a series of model evaluation using least squares regression were used to isolate key variables and to build a fitted multivariate multiple regression model. This model simultaneously predicts the expected output for body and fecal portions from one full run of the process examined, based on input values for selected predictor variables.

Lizeth Banuelos

Latinx First-Generation Students' Academic Experience: The Role of Institutional Supports During a Pandemic

Authors: Banuelos L, Ziehnert A

Mentor: Dr. Aryn Ziehnert

The Latinx population has become the largest minority group in the United States, now representing more than 18% of the U.S. population. However, Latinx first-generation students still fall behind non-Latinx students in educational achievement. This study seeks to examine the Latinx first-generation academic experience amidst a pandemic, with an emphasis on looking at their perceived stress related to academics, their academic self-efficacy, and their knowledge/feelings toward institutional supports. To accomplish this, I examine the roles of institutional and familial supports, as well as, the factors contributing to the educational achievement gap including language, cultural barriers, socioeconomic status, lack of funding, lack of diverse faculty, lack of access to educational resources, and a lack of educational knowledge. I also examine the psychological effects the educational gap has on Latinx first-generation students in terms of social emotions, stress and coping, and academic self-efficacy. A convergent mixed methods approach will be utilized, incorporating both quantitative and qualitative data in order to provide a more comprehensive understanding of Latinx students' perceived academic experience amidst the COVID-19 pandemic. Results of this study will help understand the academic Latinx first-generation college student academic experience and find ways to narrow the educational achievement gap.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Giovanna Bishop

Impacts of rock climbing on lichen and bryophyte cliff communities in northwestern North America

Authors: Bishop G, Harrison GR, Magori K, O'Quinn R, Allen JL

Mentor: Dr. Jessi Allen

Cliff-dwelling biodiversity is threatened by the increasingly popular sport of rock climbing. In cliff ecosystems lichens and bryophytes are often the most abundant and diverse organisms. Here we report how the popularity, difficulty, and age of rock climbing routes impacts bryophytes and lichens at two different climbing areas in Spokane County, WA, USA. We compared sixteen rock climbing routes with adjacent unclimbed cliff face for abundance and diversity of lichens and bryophytes from 254, 0.5m² plots. To control for variation among paired transects across sites we collected slope and rock heterogeneity for each plot, and aspect, and canopy cover per transect. For climbed transects we recorded route age, difficulty, popularity, and approach distance. Linear mixed effect models were used to test how rock climbing impacts lichens and bryophytes. Lichen and bryophyte cover was higher overall in unclimbed transects compared to climbed transects. Route age and plot height explained most of the variation in lichen and bryophyte cover. New county records and rare species were found including the lichens *Henrica americana* and *Umbilicaria vellea* and the liverwort *Frullania californica*. Our results highlight the importance of including detailed lichen and bryophyte diversity when creating data-driven management plans for rock climbing areas.

Brendan Booth

Computational study of the inhibitory mechanism of the human kidney-type glutaminase (KGA)

Author: Booth B, Houndonougbo Y

Mentor: Dr. Yao Houndonougbo

Kidney type glutaminase (KGA) is the full-length splice variant of glutaminase which is involved in the transportation and conversion of glutamate into glutamine—an essential step in amino acid catabolism which is frequently exploited by certain cancers to fuel microenvironment restructuring for metastasis through the process of glutaminolysis driven glutamine addiction. Targeted inhibitors of KGA shunt both the energy and anabolic ingredients for tumoral growth away from glutamine addicted cancers—starving them and leading to apoptosis of cancerous tissue. 6-diazo-5-oxo-L-norleucine (DON), and Bis-2-(5-phenylacetamido-1,3,4-thiadiazol-2-yl)ethyl sulfide (BPTES) are two inhibitors of kidney type glutaminase activity. Here, we present in silico binding simulations and molecular dynamics of the kidney type glutaminase homotetramer. Our simulation indicated that solvation access to the SER286 active site for each subunit occurs in a stepwise fashion, such that only one active site exhibits solvation access at a time with the multimeric enzyme. Binding studies revealed that both BPTES and DON exhibit low binding affinities for the rigid enzyme.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Brendan Booth

Business as Usual: Altered Abundances of Conata Basin Mixed Grass Prairie Ecosystem Spells Disaster for the Conservation Outlook of *Mustela Nigripes* (Black-Footed Ferret)

Authors: Booth B, Bastow J

Mentor: Dr. Justin Bastow

Prairies are one of the most endangered habitats on earth and are reliant on the ecosystem engineering of prairie dogs. *Cynomys ludovicianus* (black-tailed prairie dogs) support the largest wild endangered *Mustela nigripes* (black-footed ferret) colony complexes located within in the Conata Basin area of the Buffalo Gap National Grasslands Park in South Dakota. The Conata Basin is dominated by *Bouteloua gracilis* (blue grama), *Bouteloua dactyloides* (buffalo grass), and *Agropyron smithii* (western wheatgrass) which provide the bulk of *C. ludovicianus* diet. We investigated the role that climate change would have on the abundances of these five organisms in the Conata Basin using the Wallace ecological niche modeling R-shiny application and QGIS. As expected the business as usual climate pathway had the most profound effect on restructuring the dynamics of the Conata prairie ecosystem with *M. nigripes* abundances in 2070 dropping to a third of their current projected average abundances, while the biome is predicted to become dominated by homogenous grassland species *B. dactyloides*. We demonstrate how *C. ludovicianus* is poised to increase the prevalence of disease within the area and call for forward thinking now to plan appropriately for climate change to avoid a potential local extinction event for *M. nigripes*.

Makenna Britton

A Survey of Endosymbionts in Pine Trees With and Without Gall Rust

Authors: Britton M, Burke E, Headlee C, Parsley L, Rehm S, Stanley B, Stevens M, Magori K

Mentor: Dr. Krisztian Magori

Pine gall rust is a common pine tree fungal disease in the Pacific Northwest. It is caused by *Peridermium harknessii*, which is an autoecious, endocyclic, rust fungus that grows in the vascular cambium of its host. It is known that the presence of endosymbiotic organisms can alter the way that a pathogen interacts with its host. Because of this, our objective is to assess whether there is a significant difference in the endosymbionts present in trees that are infected with gall rust versus trees that are not infected. We plan to do this by culturing the endosymbionts found in the needles of pine trees from a variety of geographical locations in the Pacific Northwest. After a culture has been grown, they will be visually analyzed in order to determine which endosymbionts are present in each. We expect to find differences in the abundance and diversity of fungal endosymbionts found within the needles of trees that have been infected with gall rust versus trees that have not been infected. This will contribute to an understanding of how endosymbionts interact with this disease.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Nicholas Broderius

Effects of Beaver Dam Analogs on Stream Ecosystem Function of Crab Creek, WA

Authors: Broderius N, McNeely C

Mentor: Dr. Camille McNeely

This study documents the effects of beaver dam analogs (BDAs) on nutrient transport, fish community composition, macroinvertebrate drift, and benthic macroinvertebrate communities. In 2019, the U.S. Fish and Wildlife Service and Natural Resource Conservation Service placed 25 BDAs in Crab Creek near Harrington, WA. BDAs are structures placed in streams to mimic the hydraulic effects of beaver activity and are increasingly used as a stream restoration technique. However, there is limited research on their impacts on stream ecosystem function. The primary goal of placing these BDAs in the stream was to impound sediment and create a new floodplain at the currently incised stream channel. I sampled fish communities and benthic and drifting invertebrates in 4 reaches of Crab Creek, including the reach where BDAs were installed during fall of 2020, and monitored nutrient concentrations upstream and downstream of these reaches from September 2020 through April 2021. Among fish, I observed significantly more red-sided shiners (*Richardsonius balteatus*) ($p < 0.002$) in the BDA reach. This research will ultimately contribute to the current limited understanding of the effects of BDAs on stream ecosystem function.

Michael Campbell

Effects of Acetone Vapor Post-Treatment on the Tensile Strengths of 3D Printed Parts

Authors: Campbell M, Hudson T, Levchenko V, Bae H, Michaelis M

Mentors: Dr. Heechang (Alex) Bae and Dr. Matthew Michaelis

Previous research tested the effects of a five-second acetone vapor bath on various samples, proving that their fatigue strength increased from the vapor bath after being heat dried for several days. The acetone vapor smooths the outer surface of the sample, decreasing the amount of stress concentration factors. This research will expand upon the previous research and test what effects the acetone vapor bath for a longer time will have on the tensile strength of vertically and horizontally printed samples. The heat drying time, which is the most effective method to cure the sample, will remain constant, thereby showing any trends in the data resulting from a shorter or longer bath time. Vertical layer-to-layer samples are inherently weaker than horizontal samples due to the stress concentration factors from the orientation of the grain of the sample. Testing different print sample orientations against different bath times will show if the print orientation matters more or less as the sample is exposed to the acetone vapor for longer periods of time.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Blake Chalpin

Artificial Intelligence Requisition Engine: Automating Data Entry in Healthcare with Machine Learning

Authors: Chalpin B, Taroudaki V

Mentor: Dr. Viktoria Taroudaki

This thesis will examine the task of automating the process of scanning and analyzing medical requisitions with the goal of identifying key-value pairs. More specifically, how machine learning can automate this process. In the healthcare industry today, one of the leading causes of employee burnout is "data entry." This refers to the manual entry of medical data from digital requisitions and forms. What takes a healthcare worker up to five minutes can take artificial intelligence under a minute. In addition to this, the risk of human error is significantly reduced if not eliminated. Healthcare workers can then spend more time where they are needed and less on administrative tasks that can be automated. This paper will look at how we can develop and achieve a solution to this problem by combining current Optical Character Recognition (OCR) technologies with machine learning. We will name this solution Artificial Intelligence Requisition Engine (AIRE). We will then investigate the performance and results of our solution. Finally, we will discuss further work and other industries that can benefit from AIRE.

Amanda Chandler

A survey of lichen species in the endangered Palouse Prairie region of Washington state

Authors: Chandler A, Allen J

Mentor: Dr. Jessica Allen

The Palouse ecoregion, once dominated by temperate prairies, exists as highly fragmented remnants in southeast Washington, north-central Idaho, and northeast Oregon. Transformation of nearly all of this ecosystem into farmland and the subsequent takeover by invasive grasses has situated the Palouse among the most critically endangered ecoregions in the United States. The resulting decline in overall biodiversity has long prompted need for further study and, though conservation interest in the Palouse has recently increased, research concerning lichens is severely lacking. The compilation of a preliminary annotated species checklist of extant Palouse lichen taxa through extensive voucher specimen collection, along with examination of historical records, will allow future studies to identify changes in lichen community compositions and inform lichen conservation. A total of 1,432 voucher specimens were collected across three major protected areas, including Kamiak Butte County Park (KBSP), Palouse Falls State Park (PFSP), and Steptoe Butte State Park (SBSP). Approximately 46% of collected material are crustose species, 43% are foliose, and 11% are of fruticose thallus morphology. The soil paint lichen (*Acarospora schleicheri*), a terricolous species considered rare to eastern Washington, was found at two highly disturbed localities within PFSP. Identification of all samples to species is still in progress.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Malaxhi Chukwu

Assessing Developmental Policies Implemented in the Global South and its Consequences for the Global South since the mid-20th Century

Authors: Chukwu M, Sharifi M

Mentor: Dr. Majid Sharifi

This paper employs an empirical analysis of extant literature on developmental policies in the Global South from the Western states and the East, particularly China, to critique both failed policies implemented in the Global South. Past economic developmental approaches, such as the structural adjustment policy in the 20th century, millennium development goals, and sustainable development goals in the 21st century designed to improve the Global South, have been nothing but failure. In fact, these policies have not improved life for many people in the Global South; instead, their hardship has been increased because of policy failures or met with limited success, which meant the Global South continued to lag in progress, trapped in abject poverty. The West's failed developmental policies increased the Global South's poverty, pollution, political instability, and social fragmentation, leading China's momentum to offer its alternative developmental policy through infrastructural projects and loans without restraint. Some scholars regard China's loan behaviors as the 21st-century recolonization of the Global South by China. Currently, China's "One Road, Many Dreams" anticipates developing underdeveloped countries. Despite China's focus on infrastructure development and non-political interference, a careful evaluation suggests that more dilemmas are on the rise due to the highly increased debt by Global South. This paper reviews the pervasive developmental stages and their consequences in Niger Delta, Laos, Burman/ Myanmar, and Sri Lanka. After previewing this background and providing context, this paper argues that these policies helped facilitate human insecurity in the global South and demand for a holistic developmental approach in Global South.

Hannah Coles

Measuring the efficacy of translocating Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) in two streams in the Pend Oreille Basin

Authors: Coles H, Spruell P

Mentor: Dr. Paul Spruell

Evaluating the efficacy of translocating fish species to expand their native range is critical to ensuring that these translocations are successful, especially for native Westslope cutthroat trout (WCT; *Oncorhynchus clarki lewisi*) populations in the Pend Oreille River Basin, Washington, United States. The Kalispel Tribe of Indians Natural Resources Department (KNRD) have translocated WCT from different stock populations into two creeks, Cee Cee Ah Creek (CCA) and Paqua Creek, upstream of fish barriers, expanding the amount of suitable habitat for these two translocated populations and providing refuge from the predation by and competition with introduced eastern brook trout (*Salvelinus fontinalis*). KNRD surveys in 2013 and 2014 found that the WCT populations have not been utilizing all the available habitat and exhibit deviations from Hardy-Weinberg proportions, indicating that the populations are evolving from their stock populations. The purpose of this project is to compare the distribution of WCT individuals among the different habitat characteristics in CCA and Paqua Creek and to determine if Hardy-Weinberg proportions have been restored to equilibrium when compared to their stock populations. This project will also establish if the WCT populations have depleted their resources or have a sustainable source of benthic invertebrates in the reaches they reside.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Alexandria Coronado

Impacts of COVID-19 on Food and Housing Student Resources at Universities in the State of Washington

Authors: Coronado A, Upton L

Mentor: Dr. Lindsey Upton

Food and housing insecurity are generally defined as when an individual faces uncertainty of being able to access adequate resources to fulfill healthy living needs (Gallegos, Ramsey, & Ong, 2014; Coleman-Jensen, Steffen, & Whitley, 2017). Often, we overlook places where food and housing insecurity are experienced, including across college campuses. This study seeks to address the lack of current research on the comparative analysis on food and housing support services in higher education. Attention will be focused on the impact the COVID-19 global pandemic has had on public university food and housing programs in the State of Washington. In-depth interviews with university administration have been conducted to examine the impact on these resources that address the issues of food and housing insecurity among university students and how their operations have changed during the 2020-2021 academic year.

Alicia Cozza

Evaluating the Reliability of Environmental DNA to Describe Fish Community Composition: A Comparison to Traditional Electrofishing

Authors: Cozza A, Spruell P

Mentor: Dr. Paul Spruell

Fish biodiversity acts as an indicator of a river's health. Knowing which species are present in a river over time is crucial to river monitoring efforts. Traditional fish sampling requires invasive and often time-consuming methods which can limit their application. Environmental DNA (eDNA) metabarcoding is increasingly used as an alternative method to measure species richness. This approach uses water samples from a waterbody to extract DNA and next-generation sequencing to target regions of the DNA that are then compared to known sequences to identify species. eDNA metabarcoding has proven to be more sensitive at detecting cryptic species and species at lower abundance levels, however, the nature of eDNA makes it susceptible to environmental effects. Understanding how abiotic factors such as temperature, pH, and discharge rate affect the degradation and the transport of eDNA in lotic waters is vital to assessing the accuracy of eDNA results and, in turn, reproducing this sampling method. Our objective is to determine how results from eDNA metabarcoding compare to electrofishing in streams, how the local seasonal changes affect these comparisons, and how the bioinformatics methods applied to the resulting sequences can affect the outcome by varying the stringency in what constitutes a positive detection.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Jonah Cwik

Analyzing Lethal *Batrachochytrium dendrobatidis* Frog Fungus vs. Beneficial Probiotics at Turnbull National Wildlife Refuge

Authors: Cwik J, Walke J

Mentor: Dr. Jenifer Walke

In recent years, amphibian populations have been greatly affected by the skin fungus, *Batrachochytrium dendrobatidis*. Approximately 32% of amphibian populations are in danger of declining beyond repair. However, some members of the skin microbiome of amphibians can be beneficial as they are capable of fighting off this fungus and preventing disease. In this study, I tested the hypothesis that skin bacteria on Columbia Spotted Frogs (*Rana luteiventris*) are capable of inhibiting *B. dendrobatidis* growth and may contribute to this frog species' general resistance to chytridiomycosis. To test this hypothesis, I isolated skin bacteria from 11 frogs across three wetland sites at Turnbull National Wildlife Refuge (TNWR) in eastern WA in August and September 2020. Skin swab samples from each frog were plated onto R2A agar and incubated at room temperature for one week. Morphologically-distinct colonies (=morphotypes) were isolated into pure culture and preserved in cryoprotectant at -80C. I isolated a total of 104 isolates (average number of unique morphotypes per frog: 8.4, range: 5-14, n = 8 frogs) that will be identified with 16S rRNA gene sequencing and tested for anti-*B. dendrobatidis* properties. Future experimentation will utilize these isolates in hopes to find species capable of protecting amphibians from *B. dendrobatidis*.

Sarah Deshazer

Environmental surveillance of Mosquito Populations at Turnbull National Wildlife Refuge

Authors: Deshazer S, Magori K

Mentor: Dr. Krisztian Magori

Mosquitoes are one of the deadliest vectors in the world. They transmit diseases such as Malaria, Dengue fever, and West Nile Virus, and are responsible for millions of deaths every year. Here in the United States mosquitoes carrying West Nile Virus, were responsible for the three largest outbreaks of neuroinvasive disease in our recorded history. Under the supervision of Dr. Krisztian Magori's lab, students from Eastern Washington University have collected data on mosquito species abundance at Turnbull National Wildlife Refuge (TNWR) for the past six years. In 2020, I collected and identified to species level 5,638 mosquitoes. Mosquitoes were captured from two locations on the TNWR using a CO₂-baited CDC light traps and euthanized in a -80 F freezer. Concurrent with the previous year's data, there was an increase in abundance of the species *Culex*, the vector responsible for carrying West Nile Virus.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Sarah Deshazer

Occupancy patterns of elk, deer, and moose on Turnbull National Wildlife Refuge

Authors: Deshazer S, Mahon C, O'Connell M

Mentor: Dr. Margaret O'Connell

Aspen forests support high biodiversity in eastern Washington, therefore a primary management focus of Turnbull National Wildlife Refuge (TNWR) in recent decades has been enhancement of its aspen forests. Management has included the use of prescribed burns to stimulate aspen growth and the initiation of an annual elk hunt to reduce the browsing impact on young aspen. To monitor elk and other ungulate (moose and deer) use of the refuge and browsing activity, remote motion-activated cameras were installed at 5 sites around the refuge. We analyzed images from March 2018 and July 2019 to address the following questions. Does occupancy of each species vary between sites? Do temporal changes with respect to season and the annual elk hunt affect detection probabilities of the three species? Presence and absence data for each species per site were summarized on a biweekly basis. We used the program Presence to model site occupancy and detection probabilities. Preliminary results suggest differential occupancy of the refuge by the three ungulate species.

Ashley Destin

Size Scaling in the Skull of North American Felids as Adaptations for Prey Acquisition

Authors: Destin A, Case J

Mentor: Dr. Judd Case

This comparative study explores the relationship between skull morphology and general body size among felids, mustelids, and canids; with a focus on North American felids, as it relates to prey acquisition. Previous studies have focused on the evolution of the carnivore skull shape, which include the species examined in this study. Using measurement methods laid out by Radinsky (1981a; 1984), the size of skull components were compared to overall body size to determine the rate of scaling of skull features with body size. Statistical evaluations of skull measurements within and between the three selected North American carnivore groups indicated which features scaled with body size; skull length, jaw length, and tooth row length. Additionally, some of these skull features showed significant correlation with the body size of possible prey, indicating there are limitations on prey size based on skull parameters related to bite strength. When compared against body size, measurements relating to the temporalis muscle didn't fit the regression lines as well as other data, indicating that the temporalis doesn't scale directly with body size which is a major component in bite strength differences related to prey size that can be taken.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Krista Dodd

Frog skin microbiome community structure in comparison to the fungal pathogen *Batrachochytrium dendrobatidis*

Authors: Dodd K, Walke J

Mentor: Dr. Jenifer Walke

The fungal pathogen, *Batrachochytrium dendrobatidis* (Bd), has led to the decline and extinction of many amphibian populations, but some bacteria in the skin microbiome produce anti-Bd metabolites. Preliminary data suggest Bd-infected frogs have significantly different microbiomes than uninfected frogs. However, sample sizes were limited, and the degree of annual variation in this pattern is unknown. Therefore, my study will expand upon this work and assess amphibian host-microbiome-pathogen interactions at Turnbull National Wildlife Refuge (TNWR). TNWR frogs will be swabbed in Spring 2021, and the culture-independent bacterial community data will be correlated with Bd infection intensity, which will be measured using qPCR. A second swab from the same frogs will be plated onto R2A media to obtain pure cultures to be tested in co-culture assays with Bd, and the anti-Bd isolates will be identified by 16S rRNA gene sequencing. I expect frogs that have dissimilar microbiomes to have different Bd infection levels, frogs that have a more diverse microbiome to have lower infection levels, and microbes that have anti-Bd properties to be present and in more abundance on frogs with lower infection intensities. If these hypotheses are supported, a probiotic of the anti-Bd microbes could be developed to protect threatened amphibians.

Jordan Driscoll

An Implementation of the Minimax Algorithm

Authors: Driscoll J, Xu B

Mentor: Dr. Bojian Xu

In this project, we consider the algorithm, strategy design, and implementation for variations of a 4-letter word game. Two 4-letter words are connected if they only differ at one letter. For example, ties and pies are 4-letter words that are connected. We consider all the 4-letter words in the English language. We consider two types of games on these words. Game 1: Given two words, w_1 and w_2 , find the fastest route of connecting words that one can follow to travel from w_1 to w_2 , if such a route exists. Game 2: Given a starting word w , the computer and a human take turns to traverse connecting words. No word can be visited more than once. The goal of both the computer and the human is to choose a word that has no connecting words, trapping their opponent. We model the collection of all 4-letter words as an undirected graph G , where each vertex represents a word and two vertices are connected if their represented words are connected. For efficient graph operations, we designed and implemented a customized data structure to represent the graph. The data structure uses both the hashing technique and a balanced search tree. We solved Game 1 by using a graph search algorithm on G . Either a breadth first or depth first search suffices. In Game 2, our job is to design smart game strategies for the computer to beat the human. We use a decision-tree based approach as the AI for the computer to make the best move. Given the current game state, we explore all possible game moves to a certain depth of the search space. The depth of the search depends on the computational time and space budget we have. We organize these moves into a tree, where each tree node represents a game state. A child node in the tree represents a game state that can be achieved by a single move from the state represented by the parent node. We designed a nontrivial score function that represents the chance for the computer to win for each move. After every move by the human, we build a new tree and compute the score function of every tree node recursively using a bottom-up approach via tree's depth first search. The computer always makes the move whose score is the highest among all possible next moves that the computer can make.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Dechen Edwards

Metal-exposed clams exhibit different investment in somatic growth and reproduction

Authors: Edwards D, Joyner-Matos J, Nezat C

Mentor: Dr. Joanna Joyner Matos

Aquatic habitats impacted by anthropogenic activities such as mining can contain metal mixtures of nonessential and essential trace metals. The consequences of chronic exposure to metal mixtures on the life history of benthic organisms are unclear. We use an energy-budget based methodology to ask whether exposure to metal mixtures influences the life histories of freshwater fingernail clams (*Sphaeriidae*). Fingernail clams are small, cosmopolitan, sedentary bivalves found at sediment-water interfaces. The clams are hermaphroditic and ovoviviparous, releasing shelled young that are developed inside parental brood pouches. Previous work indicates that reproductive output is correlated with adult size in benign environments. Sampling four impacted environments and one benign lake environment, we measured clam somatic growth (adult shell length) and brood production. We found that clams living in a benign lake display significantly larger shell length ($p < 0.001$) and greater reproductive effort ($p < 0.001$) than clams living along a lake polymetal gradient.

Kacie Evans

Crayfish Abundance in the BDA Reach of Crab Creek

Authors: Evans K, McNeely C

Mentor: Dr. Camille McNeely

Crab Creek is a perennial stream in the Columbia Basin area of Washington state. Along a 1 km stretch of Crab Creek near Harrington, WA the U.S. Fish and Wildlife Service installed 25 beaver dam analogs (BDAs). BDAs are small, human-made dams made to slow water to create a habitat for animal diversity. Crayfish are abundant in regions along Crab Creek; the creek is reputed to be named for them. I hypothesize they might be more abundant within the BDA reach if more sediment is trapped by the BDAs. In addition, I hypothesize that adult crayfish might be associated with a silt substrate while juveniles may be associated more with cobble & pebble substrate. Benthic samples were collected in September 2020 within 4 different study reach locations along Crab Creek by Canby Bridge as well as Rocky Ford Bridge. These include the BDA restoration reach, upstream and downstream controls, and a reach with fewer previous impacts (Rocky Ford Bridge). We have identified that the crayfish are native *Pacifastacus leniusculus* and not a non-native species. I will continue to count and measure crayfish from the 4 reaches to determine if abundance or age-distribution is affected by restoration status or substrate type.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Shelby Fettig

Effects of Nutrition on Honey Bee Gut Microbiome, Disease Occurrence, and Hive Growth

Authors: Fettig S, Walke J

Mentor: Dr. Jenifer Walke

Honey bees (*Apis mellifera*) are major pollinators of many important food crops, but population declines are threatening global food security and ecosystem health. Honey bees face several stressors, such as nutritional stress, weather changes, and pathogens. Similar to human health, the gut microbiome of the honey bee is hypothesized to affect the bee's overall health by supporting host metabolism and immune system. However, it is unclear how these stressors affect the gut microbiome of honey bees. Malnutrition is a major contributor to honey bee stress and can cause a feedback loop that influences other health factors such as immunocompetence and dysbiosis. The gut microbiome and nutrition are interconnected factors that support immunocompetence and metabolism of nutrients. Nutritional supplementation could fortify bees against other stressors such as pathogen and parasite pressure. This study explores how nutritional supplementation made of protein, vitamins, and minerals found in plant nectar changes gut microbiome structure, disease, and overall colony health. While data suggests that supplemental nutrition may not have had an impact on hive health, gut microbiota present at the beginning of the experiment correlated with hive survival, suggesting that bacteria present in the spring may have an impact on surviving during times of stress.

Ariana Fox

Predicting Domestic Box Office Revenue

Authors: Fox A, Lynch F

Mentor: Dr. Frank Lynch

The film industry is ever growing, and with many highly anticipated films slated to release in the coming years, choosing to invest in some of these films could lead to a high payoff. However, many films will show profits far less than their budget, so investors must figure out which films will have the most success and are worth the investment. Factors such as the company producing the film, the budget, the genre, and the Motion Picture Association of America ratings can influence how much money a movie will make at the box office. In this study we use box office data from 2012-2018 to utilize the statistical method of analysis of variance in order to create a model that can be used to predict box office revenue for movies released in 2019. We then compare these predictions to the true revenue in order to determine the success of the model.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Ellie Gardner

Analysis of Weathered Gasoline, Diesel, and Kerosene in Arson Scene Investigations by Gas Chromatography Mass Spectrometry

Authors: Gardner E, Steiner W

Mentor: Dr. Wes Steiner

Analyzing structures and characteristics of petroleum products such as gasoline, kerosene, and diesel fuels and how they weather under certain environmental conditions is becoming more important for investigators to understand to help them piece together what happened at a scene; in particular, arson scenes. Petroleum products are made of hydrocarbons, and are classified as having paraffins, olefins, naphthene or aromatics. These chemical composition differences between them are not easily distinguished however, which is why the use of gas chromatography mass spectrometry (GC-MS) for the analysis of various organic compounds is helpful, compared to other techniques used that were less successful. Burning of these petroleum products alters their structures and how they would appear on fire debris and being able to identify which type of accelerant was used is crucial. Using technology such as GC-MS to classify the petroleum products before and after they have burned is the central objective of this project.

Konstantine Geranios

Quantum Chemical Calculations of the Thermochemical Properties of Ammonia Synthesis

Authors: Geranios K, Houndonougbo Y

Mentor: Dr. Yao Houndonougbo

The synthesis of ammonia is of vital importance as the world food production relies on substantial amounts of ammonia-based fertilizers. The current industrial process of the synthesis of ammonia is linked to the use of fossil fuels and natural gas. Consequently, sustainable process for the production of ammonia is highly beneficial. High level theoretical calculations are important in the exploration of alternate strategies for the production of ammonia. In this work, we report the results of quantum chemical calculations for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$. We have used NWChem software to calculate the enthalpies, entropies, and Gibbs energies of formation of NH_3 . The molecules were first subjected to molecular mechanics using the universal force field, then geometry optimization and vibrational frequencies calculations were performed using density functional theory (DFT). The electronic energies were obtained using coupled cluster calculations with single and double excitation and non-iterative triples. This study is an important step toward the understanding and the improvement of ammonia synthesis process.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Alexis Lisandro Guizar-Diaz

Indentured Servitude in the 21st Century? A Case Study on Agricultural Labor Employment

Authors: Guizar-Diaz AL, Elias E

Mentor: Dr. Edwin Elias

Agricultural work, especially the most degraded and intensive of roles, has primarily been filled by both domestic and undocumented migrant laborers. Recently, there has been a growing emergence of utilizing subcontracted labor. From 2007-2017 there has been an increase of over 1000% of requested H-2A guest workers in Washington State. In this presentation, I explore the cause of this exponential increase and analyze how capital has structured labor conditions through draconian legislations which have enabled subcontracted workers to be exploited by the agricultural industry.

Collin Hendricks

Estimation of the Degree of Hybridization Between Westslope Cutthroat Trout and Rainbow Trout in the Pend Oreille River

Authors: Hendricks C, Spruell P

Mentor: Dr. Paul Spruell

Populations of native westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) inhabit the lower Clark Fork/Pend Oreille River system where they live alongside non-native rainbow trout (*Oncorhynchus mykiss*). In this study we will determine the frequency of hybridization and levels of admixture between these two species. Samples were collected from ten WSCT populations in tributaries of Lake Pend Oreille. Electrofishing along with angling was used to temporarily capture fish and a small fin clip was taken as a genetic sample. Extraction of DNA was completed using DNeasy Extraction Kit (Quiagen) following the manufacturer's instructions. Samples were then sent to Washington Department of Fish and Wildlife (WDFW) for SNP genotyping. This panel included four loci that are diagnostic for WSCT and RBT. We will use the genotypes at these loci to identify hybrids and estimate the proportion of admixture in each population. Data analysis for admixture estimations is currently in progress.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Emma Hoskins

Can the reconstruction of prairie plant communities also re-establish pollinator communities and plant-pollinator interaction networks?

Authors: Hoskins E, Brown R

Mentor: Dr. Rebecca Brown

Pollinating insects are declining globally largely from habitat loss. Ecological restoration provides an opportunity to support pollinator conservation by increasing resource availability and landscape connectivity. However, grassland restoration often fails to re-establish plant communities with historic levels of plant diversity and floral abundance. This begs the question, how much does this matter for ecosystem function? Do restored grasslands still provide ecological value? Can sites with fewer floral resources support pollinators and maintain the complex network of interactions between plants and pollinators? To answer these questions, I used an ecological network approach, which unlike simple abundance and diversity measures, accounts for how species interact, allowing ecologists to detect differences not only in species composition but also in network structure. I hypothesized network structure in reconstructed sites would be less complex or stable because of lower floral abundance than remnant prairie sites. Plant-pollinator-interaction networks were measured June-Sept at three reconstructed and three remnant Palouse Prairie sites by recording each interaction between the reproductive part of the flower and pollinator along four, 100-m transects. Flower density and diversity were measured in 25-m² plots along each transect. This produced twenty-four plant-pollinator networks to calculate metrics describing network structure and evaluating species roles within each network.

Christina Hudson

The Characterization of African Religions

Authors: Hudson C, Nsombi O

Mentor: Dr. Okera Nsombi

The purpose of this inquiry is to explore the gaps in religious studies as they pertain to African religions. This inquiry will be conducted through content analysis of the top 20 religious studies journals to assess how often African religions are mentioned and the how they are characterized. Assuming gaps are found, observing these gaps and the portrayals would highlight the ways we can expand the current survey of world religions within higher education. Doing so may allow for a more accurate depiction of the contributions of African cultures to world development. This will also help to reshape education in such a way that better tells the story of human development, cultural exchange, and interconnectedness.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Tiffany Jordan

Behavioral differences in urban *Sciurus carolinensis* with reduced human interaction on Eastern Washington University and Gonzaga University campuses

Authors: Jordan T, Magori K

Mentor: Dr. Krisztian Magori

The eastern gray squirrel (*Sciurus carolinensis*) is a synanthropic animal that is very common on university campuses. Previous studies have found differences in flight initiation distance attributed to habituation to human exposure. My objective is to find differences in behavior in squirrels at Gonzaga University and Eastern Washington University (EWU) since the pandemic has changed human interactions with the squirrels at each campus. EWU moved to an online format once the pandemic began. Gonzaga has remained mostly in person with many people active on campus. My study includes testing flight initiation distance with the squirrels on both campuses to determine what level of threat they consider humans to be. I expect to find significant differences in the habituation levels at the different schools. My study also includes recording the squirrels to monitor their behavior patterns with an ethogram and observe any differences between the two populations. I plan to continue these protocols through Fall quarter when EWU returns to campus to monitor the effects of changing human density levels.

Hannah Kohl

Evaluating the Effects of Intestinal Bacteria's Production of GABA Neurotransmitter on an Animal Model of Multiple Sclerosis

Authors: Kohl H, Staben K, Shi X, Linton R, Sargent A, Dowling K, Long T, Castillo A, Gibson KM, Rouillet J, Ochoa-Repáraz J

Mentor: Dr. Javier Ochoa-Repáraz

Gamma aminobutyric acid (GABA) is an inhibitory neurotransmitter. Past studies have indicated that GABA production by gut bacteria decreases in patients with multiple sclerosis (MS) and the administration of GABAergic compounds ameliorate the progression of experimental autoimmune encephalomyelitis (EAE), a murine model of MS. We investigated whether modifying mice microbiota with GABA-producing bacteria influences EAE severity. We genetically modified *Lactococcus lactis* adding a plasmid containing increased copies of the gene, encoding glutamic acid decarboxylase (GAD), the enzyme that synthesizes GABA. This modified *L. lactis* strain (GAD-*L. lactis*) expressed enhanced GAD levels and produced significantly increased GABA compared to our control (*L. lactis* strain containing an empty plasmid (P-*L. lactis*)). EAE-induced C57BL/6 mice were divided into three groups (n = 10/group): sham (treated with medium); treated with P-*L. lactis*; and GAD-*L. lactis*. The mice were treated orally 5 times a week with 0.1ml of media and 5×10^8 CFU of bacteria. GAD-*L. lactis* significantly reduced disease severity measured by mouse weight and EAE clinical scores compared to both the P-*L. lactis* and sham groups. Our results indicate that oral treatment with a probiotic strain that produces enhanced GABA levels protects against the progression of CNS demyelination.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Theresa Lee

Prisoner Reentry: College Perceptions of Reentry Barriers in a Northwest Community

Authors: Lee T, Upton L

Mentor: Dr. Lindsey Upton

The United States has experienced an enormous rise and fall in crime rates, while incarceration rates have continued to soar. One of the many pressing concerns about the era of mass incarceration, especially in times where decriminalization of drug offenses occurs, communities are faced with increases in returning inmates and resources needed for successful reentry. This study is focused on community perceptions of college students toward barriers faced regarding incarceration, prisoner reentry, and improving recidivism rates in communities. Qualitative data are collected from interviews and focus groups conducted in an Inland Northwest community, to shed light on the community's perception of barriers to reentry that might interrupt successful reentry for inmates or that may be viewed as more helpful for inmates' successful reentry. This research extends our understanding of community perceptions of barriers faced in interrupting the cycles of incarceration as well as provides an assessment and evaluation of what exists, what is needed, and what has worked in this community. The research has implications for local criminal justice reform efforts to better provide services and resources for returning inmates.

Misha Lehmann

Statistical Analysis and Computational Model for the Online School Experience in COVID-19

Authors: Lehmann M, Taroudaki V

Mentor: Dr. Viktoria Taroudaki

COVID-19 has led to substantive and unprecedented changes in education. The surprising dearth of work examining COVID-19 and education drove this research. The project began with a statistical survey distributed to students and faculty in Spokane-area higher education and led to a modified survey and computational tool for faculty and administrators. The results received were helpful in identifying correlations and building a model based on multivariate regressions that predicts satisfaction. The computational tool allows the user to input survey results and threshold, compute predicted satisfaction, provide statistical analyses of the results, and based on these analyses and thresholds set by the user makes recommendations to the faculty member or administrator sending out the surveys.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Tyrel Long

In vitro effects of CNS inflammation in intestinal barrier disruption

Authors: Long T, Xutong S, Castillo A, Jean-Baptiste R, Gibson M, Ochoa-Repáraz J

Mentor: Dr. Javier Ochoa-Repáraz

Dysbiosis of the microbiome of the gastrointestinal tract has been recently observed in multiple sclerosis (MS) patients and animal models. Dysbiosis could affect the integrity of the gut epithelium and contributes to increased severity of disease. TNF- α is a proinflammatory cytokine produced by infiltrating inflammatory cells and increased TNF- α is found in the brains of MS patients. It has been shown to disrupt the gastrointestinal barrier. We propose evaluating the effects of dysbiosis and TNF- α produced in the context of CNS inflammation on the integrity of the intestinal epithelial barrier. In vitro, Caco-2 cells were plated forming a monolayer on transwell plates. The monolayer was exposed to TNF- α concentrations comparable to levels found in experimental autoimmune encephalomyelitis (EAE) mice, a murine model of MS. The impact of gut dysbiosis on intestinal barrier integrity was measured by exposing the monolayer to EAE and non-EAE gut contents. Measurements for the monolayer were performed using transepithelial electrical resistance (TER) and the flux of fluorescein isothiocyanate (FITC)-labeled dextran. mRNA expression levels were determined by immunoblot and quantitative RT-PCR. These methods combined will measure the monolayer permeability and be further used to study the connection between MS and permeability in conjunction with *in vivo* studies.

Belen Longoria

Survey of *Radix auricularia* and trematode prevalence in three lakes at Turnbull National Wildlife Refuge

Authors: Longoria B, Baldwin T, Hopkins K, Magori K

Mentor: Dr. Krisztian Magori

Radix auricularia (big-ear radix snail), an aquatic pulmonate gastropod mollusk in the family Lymnaeidae, is an invasive species in the United States originating from Europe and Asia. In Washington state, especially Eastern Washington, *R. auricularia* has been found to thrive in freshwater bodies with little current and high levels of nutrient enrichment. We are interested in investigating the presence of trematodes in *R. auricularia* at Turnbull National Wildlife Refuge (TNWR) in Cheney, WA. The objective of this project is to survey three lakes (Blackhorse Lake, Pines Lake, and Kepple Lake) separated by at least 100 meters, for *R. auricularia*, to compare the proportion of gastropods parasitized by trematodes. We hypothesize that the gastropods will be infected with trematodes because they are an intermediate host. Snails will be collected by hand or net and put into containers under a light source to stimulate cercariae shedding (larval and infectious form of trematodes). Sequencing will be performed to determine presence of the genus *Trichobilharzia*, a causative agent of cercarial dermatitis ("swimmers' itch"). We expect to find this genus of trematode because of documented cases of cercarial dermatitis in Washington and hope our project may be helpful in determining parasite abundance across the three lakes.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Chandler Lymbery

An Investigation of Atmospheric Nitrogen Deposition Using Lichens

Authors: Lymbery C, Bastow J

Mentor: Dr. Justin Bastow

The development of the Haber-Bosch process has resulted in an increase in biologically available nitrogen. Lichens are symbiotic communities primarily composed of a fungus and a photosynthetic partner of either a green alga, a cyanobacterium, or both. The lichen's body is in equilibrium with the surrounding atmosphere. Consequently, lichens have been used for monitoring atmospheric sulfur dioxide deposition and other forms of air pollution. However, relatively few studies have explored the stable isotope composition of lichens. Lichens possessing a cyanobacterial photobiont are capable of fixing N₂ gas, thus they should display a distinct $\delta^{15}\text{N}$ value closer to zero than those with green algal symbionts. Furthermore, $\delta^{15}\text{N}$ signatures from lichens in urban areas should differ significantly from those in rural settings. Lichens of each type of photobiont were collected from two sites close to human sources of fixed nitrogen (Mirabeau Point Park and Drumheller Springs) and a site farther from anthropogenic nitrogen sources (Turnbull National Wildlife Refuge) to compare their stable isotope composition. In addition, we performed a community analysis of macrolichens to test for shifts in species composition. As we are waiting on stable isotope data, I will be presenting the results of our community analysis.

Seth McCullough

Effect of Biochar Additions in Palouse Prairie Restoration on Several Soil Parameters.

Authors: McCullough S, Bastow J

Mentor: Dr. Justin Bastow

Palouse prairie once covered 16,000 km² of eastern Washington and northern Idaho, but less than 1% of the original vegetation remains because of conversion to agriculture. The remaining Palouse prairie is highly fragmented. Eastern Washington University is planning to restore 120-acres of farmland back to native Palouse prairie. This site will serve as a model for restoration of an endangered ecosystem and will provide recreational and educational opportunities for the local community. A 15-acre pilot site is being developed to test the effectiveness of several different restoration techniques. I have been gathering baseline soil data for the whole restoration site and the pilot site. The goal of this research is to determine what effects biochar additions have on the field's carbon storage, pH, moisture retention, soil organic matter, and the soil food web. Nematodes can be used as biological indicators of soil food webs. Data that I have collected from the pilot site suggests that soil nematode abundance has increased by around 53% between control plots and plots with high concentration of biochar. Results from this research can be used by EWU to monitor the progress of the restoration and can help in future decision making surrounding the project.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Roxanne McPeck

Microplastic Contamination and Bacterial Abundance in Coastal, Lake, and Tap Waters

Authors: McPeck R, DeYoung D, Fisher E, Danielle DeYoung, Elizabeth Fisher, Murro Te Y, Magori K

Mentor: Dr. Krisztian Magori

Microplastics (plastic fragments, particles, and fibers smaller than 5 mm) contaminate nearly every ecosystem on Earth. Through providing carbon sources and novel substrates for biofilm formation, they have myriad interactions—mostly unknown—with the microbiota of various bodies of water. In our study, we investigate microplastic abundance, bacterial abundance, and if there is any correlation between them in Washington State coastal, lake, and tap waters. Our location foci are on the western Washington coast and Greater Spokane area lakes and tap water systems. We hypothesize a positive relationship between microplastic contamination and bacterial abundance, which we will investigate through microscopic visual quantification of microplastics and quantification of bacteria through the proxy of culturable colony-forming units (CFUs). We intend to further elucidate any differences in bacterial communities by performing metabolic analyses and sequencing of the 16S rRNA gene for the most abundant morphotypes. We hope these analyses will provide data on microplastics and bacterial abundance in these local water sources and particularly on whether there is a relationship between the two, which might provide a basis for further investigation into how microplastics affect the structure and function of bacterial assemblages in water.

Roxanne McPeck

Student Involvement in the Development and Preliminary Results of the COVID-ADAPT Simulation Model

Authors: McPeck R, Horton R, Murro Te Y, Magori K

Mentor: Dr. Krisztian Magori

Since its appearance in late 2019, the novel coronavirus SARS-nCoV-2, which causes COVID-19, has had wide-ranging, disruptive effects on society, including here at Eastern Washington University. A computer model called COVID-ADAPT is being developed to aid EWU (and eventually other facilities) to make evidence-based decisions for managing infection risk. COVID-ADAPT is an individual-based stochastic discrete-space simulation model of airborne disease transmission and infection control practices in Susceptible-Exposed-Infectious-Recovered (SEIR) transmission systems, developed by Dr. Krisztian Magori. As students working with him, our role has been to leverage literature to fine-tune parameters, research student health behaviors, map EWU facilities to the model's grid-based system, predict dormitory-specific student movement and socialization patterns, develop user-friendly instructions for map creation, and prioritize new features based on firsthand knowledge of the student population. Current investigations include running the model to simulate effects of masking, vaccination, and double occupancy dorm rooms on infection rates and proportions in various scenarios and analyzing the resulting data. Here we discuss the student side of the development of this model and the results of simulations with various combinations of the above interventions.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Laura Mertens-Plowman

West Nile Virus and Domesticated Horse Survey Study

Authors: Mertens-Plowman L, Miller A, Poole L, Seely E, Magori K

Mentor: Dr. Krisztian Magori

West Nile virus is a zoonotic arthropod-borne virus that transfers from mosquitoes to humans and horses which causes neurological symptoms in horses including extreme weakness, fever, abnormal behavior, and even death. Horses in particular have a much higher rate of infection making the recommended vaccination schedule of every six months especially important to follow. Infection in horses can serve as an early warning sign for a heightened chance of human infection in a given area, which makes this an important study for public health. The objectives of this study are to determine the vaccination rate for West Nile virus per horse in the Spokane area and to explore the reasons people choose to vaccinate or not vaccinate. This survey study will include a focus on the correlation between the owner's knowledge level regarding West Nile virus and their choice to vaccinate. We will be using Survey Monkey as well as printed versions of our survey to conduct our study with a goal of at least thirty respondents. We will be collecting data both through social media, like horse groups in the Spokane area; and in person at local veterinary clinics, collecting all data from the Spokane area. We are expecting a correlation between knowledge level and vaccinations, with owners having lower knowledge levels less likely to vaccinate and owners with higher knowledge more likely to vaccinate. The results from this study will contribute to the understanding of why people decide to vaccinate horses or not. This survey study can be applied in helping to improve public outreach efforts to increase vaccination rates.

Macee Mitchell

Evaluating the Relationship Between Pesticides and the Gut Microbiome of Honey Bees (*Apis mellifera*) using Field and Laboratory Approaches

Authors: Mitchell M, Steele J, Franzese D, Walke J

Mentor: Dr. Jenifer Walke

Gut microbiomes are essential in the overall health of many organisms. However, the presence and abundance of these microbes may be altered by environmental factors, such as exposure to pesticides. The goal of this project was to understand whether the honey bee (*Apis mellifera*) gut microbiome is impacted by pesticide exposure. Accordingly, we tested bees from 24 hives across eastern Washington using HPLC-MS for the presence and concentration of six commonly used agricultural pesticides, and characterized their gut microbiomes using 16S rRNA gene amplicon sequencing. We found that the neonicotinoid insecticide, imidacloprid, was present in 41.7% of all hives sampled, with variable levels across hives. Furthermore, bees with and without imidacloprid had distinct gut microbiomes. Next, we measured growth of bee gut bacteria exposed to three imidacloprid treatments (high, medium, low) in 96-well plate assays. Our preliminary results indicate the majority of isolates exhibited reduced growth compared to controls, even in low concentrations of imidacloprid. However, several isolates were robust to altered growth. Additionally, multiple strains of the same bacterial species showed variation in their growth responses to pesticide exposure. Our combined field and laboratory results about the host-microbe-pesticide interactions can have important implications for bee, and thus ecosystem, health.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Joshua Morton

Increased IPN composite strength using a flexible epoxy and rigid acrylate matrix

Authors: Morton J, Weber G

Mentor: Dr. Gary R. Weber

This investigation proposes the strengthening of composite materials by the combination of a rigid epoxy and a flexible acrylate into a matrix adhesive, forming Interpenetrating Polymer Networks (IPN.) Prior research into IPN explored two-stage curing of a rigid acrylate network first and then a more flexible epoxy component. This was viable due to a feature of two-component systems that is the tendency of the highest surface energy element preferentially bonding to a solid. This study reverses the constituent properties, making use of a rigid epoxy and a flexible acrylate, and suggests that such an arrangement should result in positive synergy and exceed the strength proposed by the Rule of Mixtures. To make such a determination, tensile and short beam shear tests were employed. Casts of control groups as well as those of the IPN were fabricated using CNC routed aluminum molds. Short beam shear specimens were fabricated by hand-layup and cut from a larger laminate to meet ASTM specifications. Ultimately, the data seems to support IPN as a superior matrix adhesive to pure resin or epoxy, with average strengths in excess of that proposed by the Rule of Mixtures.

Aulane Mpouli

Molecular Dynamic Simulation Study of ITPA-ITP Protein-Ligand Complex

Authors: Mpouli A, Houndonougbo Y

Mentor: Dr. Yao Houndonougbo

The binding relationship between a protein and ligand is one of the most significant interactions to occur in the human body. These bonds are a key pair for the balance and regulation of biological functions. Inosine Triphosphate Pyrophosphatase (ITPA) is a defensive protein whose function is to cleanse intracellular nucleotide pools from the harmful effects of inosine and xanthine triphosphates. In particular, when ITPA is bound to Inosine Triphosphate (ITP), the protein-ligand complex regulates inosine concentration in the body, prevents genomic damage, mutation and cancers. While there are many tools to study such complexes, computational methods such as docking, and simulations are of great importance. In this study, Autodock 4 software was used to predict ITPA-ITP complex. The best conformation of the docked complex was subsequently subject to molecular dynamics (MD) simulations with the GROMACS software to further explore the protein-ligand interactions and its stability. This study provides a basis for ITPA protein engineering.

ABSTRACTS

(IN ALPHABETICAL ORDER, BY PRESENTER'S LAST NAME)



Nhat Nguyen

Chaos, Solitons and Fractals: Laser modulation

Authors: Nguyen N, Aragoneses A

Mentor: Dr. Andres Aragoneses

Complex dynamic systems are crucial in today's world as operations increasingly rely on a network of interconnecting systems. However, comprehending the complexity that lies within the systems is difficult, so finding out unique patterns and behaviors will help reach that goal. Focusing on the analysis of a diode laser under external periodic modulation, we define new quantifiers that can unveil hidden correlation in the chaotic signal of a diode laser with external forcing in the spiking regime. This regime and modulation are relevant as most complex dynamical systems present interesting behavior at the onset of chaos and under external forcing. We study different symmetries and patterns apparent in the system to determine constraints in the dynamics of the systems and identify these temporal correlations. With the new quantifiers we introduce, and exploring the Fisher-Shannon plane, we differentiate determinism from stochasticity in this highly chaotic system.

Rachael Pentico

Plant Soil Feedbacks Vary with Aspect in Palouse Prairie Remnants

Authors: Pentico R, Brown R

Mentor: Dr. Rebecca Brown

Plants alter the biotic and abiotic characteristics of the soil they grow in, which can alter future plant survival, through a process known as plant-soil feedbacks (PSFs). PSFs play a key role in succession and invasion by nonnative species. In the semiarid Palouse Prairie Ecoregion, aspect can affect microclimate, with harsher conditions on south-facing slopes. Aspect also is related to invasion in this ecosystem, with increased invasion on south-facing slopes. My objective was to determine if the effects of aspect on invasive species are mediated by PSFs. To test this, I conducted a greenhouse experiment using two native and two invasive prairie species, inoculated with soils collected from north- and south-facing slopes on Palouse Prairie remnants. The control group consisted of only autoclaved soil, whereas the slope treatment pots consisted of 20% living soil. There were 10 replicates per treatment. Germination and plant growth were measured after five weeks. Native species had higher growth rates when inoculated with north-slope soil, while invasive species growth rate was not affected. However, invasive species had higher germination rates when inoculated with south-slope soil. These findings suggest that slope aspect influences PSFs and we can implement this knowledge into invasive species management in endangered ecosystems.

ABSTRACTS

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Joah Robak

The Dancing Data Table: A New Way of Experiencing Data Presentations

Authors: Robak J, Yasmin S

Mentor: Dr. Shamima Yasmin

In data visualization applications, such as heatmap-based presentations, bars are color-coded and variables are represented by colors. In 3D heatmaps, bars can be depth-enhanced according to values of variables. While working on the dancing data table, authors explored nature's bounty. For example, an assortment of colors during tulip festivals gives the impression of a naturally created heatmap. Winds in grass fields inspired to encode variations in terms of velocities, hence, the term "dancing" data table. In the dancing data table, a virtual grass field is divided into rows and columns. Rows signify different observations while columns represent variables. Each bar in a traditional heat map corresponds to a cell in the grass field of the dancing data table, where grass blades in a particular cell have the same color and height; they sway with the same velocity. This redundant mapping of variables to color, height, and velocity makes the presentation diverse; variables become more distinct from each other in comparison with pure color-based presentations. This allows users to readily perceive variations among variables by comparing either color, height, or velocity of grass blades in different cells. The dancing data table can interactively upload data tables of varying sizes.

Lucy Roussa

Freshwater Algae of Turnbull National Wildlife Refuge

Authors: Roussa L, McNeely C

Mentor: Dr. Camille McNeely

I investigated water quality and the relationship between nutrient availability and algal communities in three watersheds within Turnbull National Wildlife Refuge. Due to their diversity and adaptations to nutrient conditions, planktonic algae are excellent indicators of water quality in ponds and lakes. My field work took place during the months of July, August, and September 2020. I used a YSI multimeter to measure temperature, pH, dissolved oxygen, and conductivity. Concentrations of total nitrogen, nitrate, ammonium, total phosphorus, and orthophosphate were measured using an Alpkem 3 flow analyzer. Chlorophyll concentrations were determined by *in vivo* fluorometry. Microscopy was used to determine abundance of each of the following Divisions of algae: diatoms, cyanobacteria, and green algae. My hypotheses were that higher nutrient concentrations are associated with higher abundance of algae, algal abundance will change seasonally, and wetlands within the refuge will display signs of eutrophism, such as low dissolved oxygen and visible algal growth. I observed seasonal changes in the algal community with an increase in diatoms and a decrease in cyanobacteria and green algae over the summer. I also observed a positive relationship between algal abundance and available nitrogen. Overall, nutrient concentrations and signs of eutrophication were reduced compared to previous summers.

ABSTRACTS

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Ronald Scerbicke

The interaction of phosphorus and nitrogen on productivity across lakes in Eastern Washington

Scerbicke R, Black R

Mentor: Dr. Ross Black

Phosphorus and nitrogen are two of the most important nutrients in lakes when it comes to productivity. The varying concentration of nitrogen and phosphorus can cause lakes to be limited by one of the nutrients. The objective of the study is to better understand how nitrogen and phosphorus interact with each other, identify how primary production is being limited, and if limitations shift seasonally. To accomplish these objectives, nitrogen and phosphorus availability is experimentally manipulated in the laboratory and chlorophyll abundance is used to measure algal growth. The experiment has and will be conducted in Fall 2020 and Summer 2021. Water was collected from nine lakes across Eastern Washington in Fall 2020. Samples were incubated for three days in the laboratory with varying phosphorus and nitrogen concentrations. Growth of algae from the samples was measured as chlorophyll and determine the productivity of the sample. The results of Fall 2020 samples show that nitrogen was the limiting nutrient across the region. I predict that nitrogen will also continue to be limiting in the summer samples.

Kristy Snyder

Analysis of the role of annual seeds and biochar in Palouse prairie restoration

Authors: Snyder K, Brown R

Mentor: Dr. Rebecca Brown

The Palouse Prairie in Eastern Washington is a critically endangered grassland in need of restoration. Eastern Washington University (EWU) has begun to restore 120 acres of Palouse Prairie on campus; however, there is much uncertainty about the most effective restoration approach. Research areas Palouse practitioners that are notably lacking include soil seed banks, annual seeds, and biochar. Therefore, we are conducting a three-part study: a soil seed bank analysis, an annual seed broadcasting experiment, and a biochar addition experiment. We will compare species composition and germination phenology of soil seed banks among three Palouse remnants and the EWU restoration site. Additionally, we will compare species composition and cover between experimental plots with and without annual native seeds and biochar. We hypothesize that: 1) early germinating annual species will dominate soil seed banks, 2) annual native seed addition will increase competition with annual invasive species, thus allowing for increased percent cover of native species and reduced proportion of nonnative species, and 3) biochar addition will increase soil moisture availability, subsequently increasing vegetation cover. This study will provide a much-needed understanding of Palouse Prairie soil seed banks and will inform restoration practitioners if using annual native seeds or biochar will improve their restoration outcomes.

ABSTRACTS

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Michael Stralser

Tick density and distribution in the greater Spokane area

Authors: Stralser M, Hurst J, Hahnenkratt J, Kilmok M, Estrella M, Swanson Q, Magori K

Mentor: Krisztian Magori

Ticks are known to carry various pathogens which can lead to diseases such as Rocky Mountain Spotted Fever, Lyme Disease, and Relapsing Fever. The goal of this project was to collect ticks at three locations in the greater Spokane area and map the species, density, distribution, and how population numbers progress throughout the spring season. These collection locations include Turnbull National Wildlife Refuge, Riverside State Park, and Dishman Hills Conservation Area. Ticks were collected by dragging a 1 by 1-meter corduroy sheet for a total of 30m² in each collecting location. Collected ticks were marked with a non-lethal marker on their backs to avoid counting individual ticks multiple times after release. Tick collection occurred in subsequent weeks and new ticks and re-captured ticks were recorded. Temperature, humidity, and shrub cover were documented to determine how those environmental factors affect individual tick species as well as total tick density. We expect that the density of adult ticks will be greater in areas of high shrub density, open pine stands, and will decrease as the season progresses and becomes drier.

Nyibol Thareek

Mitochondrial excitability and its ability to support waves of calcium

Authors: Thareek N, Oster A

Mentor: Dr. Andrew Oster

Mitochondria are principally known as the power-houses of cells and mitochondria dysregulation has been identified as a significant factor in many disorders and diseases, including diabetes, neurodegenerative disorders like Alzheimer's and Parkinson's disease. Mitochondrial DNA mutations have been found in various cancer cells. Mitochondria have been long known to sequester calcium; however, they can display a form of calcium excitability through the opening of the permeability transition pore (PTP). The PTP opening is followed by an unregulated release of calcium and a decrease in its electrochemical gradient inhibiting ATP production. In this work, we will be extending mathematical models of mitochondrial function, specifically with the aim to identify mitochondrial PTP's relationship to waves of depolarization and calcium release. The PTP is thought to be regulated by a variety of factors: pH, mitochondrial calcium load, and possible reactive oxidative species (ROS). We wish to identify the likely mechanisms underlying mitochondrial dysregulation that ultimately lead to cell death.

ABSTRACTS

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Mori Williams

Nutrient Concentration for Cyanotoxins at Turnbull Abstract

Authors: Williams M, McNeely C

Mentor: Dr. Camille McNeely

We analyzed concentrations of microcystins from cyanobacteria along with factors associated with cyanobacterial growth in wetlands of the Turnbull National Wildlife Refuge near Cheney, Washington. Due to anthropogenic sources such as agricultural run-off and discharge from wastewater treatment facilities, Turnbull has been observed in the past to have eutrophication and may be at risk for cyanotoxin production. Cyanotoxins have diverse health effects on animals such as organ damage, respiratory failure, skin irritation and fever. Our hypotheses includes: (1) at least some wetlands will contain measurable concentrations of microcystin, (2) cyanobacteria will be most abundant under high nitrogen conditions, and (3) cyanobacteria abundance will be positively correlated with indicators of eutrophication such as high chlorophyll concentrations. Major forms of nitrogen and phosphorus were analyzed using an Alpkem 3 flow analyzer. Chlorophyll and phycocyanin concentrations were determined using fluorometry and spectrophotometry. An ELISA-based test was used to determine concentrations of microcystins. Results revealed traces of microcystins in the water at TNWR with the lowest concentration at 0.49 ppb and highest concentration at 1.48 ppb. There is a positive correlation between phycocyanin and microcystins ($t = 4.36$) and a negative correlation between total nitrogen and microcystins ($t = -3.02$).

Mori Williams

Henry's Law Constant for Chloroform and Deuterated Chloroform

Authors: Williams M, Masiello A

Mentor: Dr. Anthony Masiello

According to Henry's law ($[S_g] = KHP_g$); at a constant temperature, the solubility of a gas in a liquid, S_g , is proportional to the partial pressure of the gas in contact with a liquid, P_g . The Henry's law constant (KH) is based on the intermolecular forces that exist between a compound and water. However, compounds such as chloroform and deuterated chloroform do not have the same Henry's Law constant despite having the same intermolecular forces. There is no explanation of why this is in neither the literature, nor are there many studies investigating the differences in the isotopologues in regards to Henry's law. The objective of this study is to calculate the Henry's Law constant of both chloroform and deuterated chloroform under various temperatures using FTIR spectroscopy, and to obtain precise data that can be used in developing theories that explain this observation.

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ACKNOWLEDGEMENTS



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