

CONCLAVE 2025

BYU Plant & Wildlife Sciences

The Plant and Wildlife Sciences Department at Brigham Young University invite faculty, staff, students and members of the community to come support graduate student research within our department at our Graduate Research Conclave. Our graduate students will give presentations on their current research projects and compete for prizes.

Thursday, November 20, 2025

Poster Presentation Session

Life Science Building
4th Floor South Hallway
10:00 am -12:00 pm

Oral Presentation Session

Life Science Building
Room 2145
2:00-5:00 pm



BYU Redd Center

Charles Redd Center for Western Studies

POSTER PRESENTERS

Katherine Bown

Laura Cate

Adam Clapier

Mark Foster

Mallory Hinton

Austin Housley

Raechel Hunsaker

Rance Jensen

Samuel Leigh

Kevin Royal

Tyler Stephens

Kayla Stephensen

Russell Torgersen

Ashlee Weight

Megan White



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Presenter – Katherine Bown

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Aspen Restoration in a Changing Forest: Evaluating Cable-Felling Impacts on
Plant and Wildlife Dynamics

AUTHORS: Katherine Bown, Dr. Randy Larsen

ABSTRACT

Quaking aspen (*Populus tremuloides*) is a foundational tree species that functions as a key component of plant and animal diversity. Aspen cover and regeneration rates are declining at unprecedented levels due to increased conifer expansion in mixed aspen-conifer forests. Restoration efforts are needed to reduce conifer cover, promote aspen regeneration, and simulate the natural disturbance cycle of mixed aspen forests. Elevated cable-felling is a novel mechanical treatment that removes old-growth conifer trees to promote aspen regeneration, but its effect on plant communities and wildlife remains largely unknown. Our objective is to evaluate the vegetative response of elevated cable-felling in aspen-conifer forests of central eastern Utah, as well as the nutritional and reproductive response of an indicator species: mule deer (*Odocoileus hemionus*). In 2024, we measured ten transects – eight located adjacent to treated areas and two within treated areas – to assess understory plant diversity and species density. Between 2023 and 2025, we captured 163 fawns from 109 pregnant does across both treatment and control areas. For each doe, we recorded an IFFB score, and for each fawn we measured birthweight, growth rate, and twinning rate. Our findings will help guide restoration strategies in aspen-conifer ecosystems by linking mechanical treatment effects to both vegetation recovery and wildlife performance.



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Presenter – Laura Cate

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Impact of Compost Quantity and Type on the Soil Microbiome and Phytochemical Production in Crop Plants

AUTHORS: Laura Cate, Dr. Sam St Clair

ABSTRACT

Over the last 100 years, the nutritional content of food has declined significantly, contributing to the rise in chronic disease. One of the most significant contributors to the decrease in nutritional quality of produce is the degradation of our soils through poor management practices that have damaged the soil microbiome. As the abundance and diversity of the soil microbiome have decreased, important interactions between soil microbes and plants have been interrupted resulting in lower phytochemical content in food. Addition of organic matter has been repeatedly shown to remediate the soil microbiome but the impact of type and complexity of compost and the concentration of the compost in the soil has not been widely studied. This experiment will examine how the type and concentration of compost added to degraded soils influences the abundance and diversity of the soil microbiome and how that affects the phytochemical content of vegetables grown in those soils. We predict that composts made with a wider variety of organic matter sources will result in more diverse soil microbiomes while the concentration will primarily impact the overall abundance of soil microbes. We predict that both higher diversity and higher abundance of soil microbes will produce more phytochemically dense foods.



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Presenter – Adam Clapier

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Early Life Through Recruitment: Influence of Litter Size on Survival of Mule Deer
(*Odocoileus hemionus*)

AUTHORS: Adam B. Clapier, Dr. Brock R. McMillan, Dr. Randy T. Larsen, Dr. Kent R. Hersey

ABSTRACT

Decisions to allocate resources that lead to the greatest fitness is the ultimate paradigm for all species of living organisms. The ideal strategy is to balance the optimal litter or clutch size with maternal ability to invest, or nutritional condition (Lack 1947, Smith and Fretwell 1974). Ungulates typically exhibit a life-history strategy of allocating a high amount of energy to produce relatively few, quality offspring. Mule deer (*Odocoileus hemionus*) produce an average of 1.7 fawns per reproductive cycle with the most common litter size being two (Anderson and Wallmo 1984, Forrester and Wittmer 2013). Our objective was to determine selective forces that influence litter size (captured over 1000 neonates). More specifically, we will estimate survival for singleton and twin mule deer fawns through recruitment or 12 months of life. We hypothesize that having twins increases the likelihood of having at least one offspring survive to recruitment and that singletons are produced as potentially the best strategy when nutritional condition or parental ability to invest is relatively low (Johnstone-Yellin et al. 2009). Further, producing a single offspring may maximize fitness for young females, or for old females under the reproductive restraint hypothesis. This logic would indicate an adjustment of litter size based on life stage to maximize lifetime reproductive success. Results of this study will enhance understanding of the influence of litter size on mule deer recruitment and population dynamics.



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Presenter – Mark Foster

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Banana Fiber Amendment for Greenhouse Growing Media

AUTHORS: Mark Foster, Dr. Bryan Hopkins

ABSTRACT

The pseudostem of the banana plant (*Musa* spp. L.) contains fibrous material with promising properties for use in agricultural and horticultural growing media. These fibers exhibit surfactant-like and hydrophilic characteristics, suggesting potential as a renewable, non-hydrophobic alternative to coconut coir and increasingly scarce peat moss. The objective of this glasshouse study, conducted in Provo, UT, USA, was to measure the effects of banana fiber on initial wetting and hydrophobicity compared to common growing medias. Seven media formulations were tested, with or without added surfactant: 1) calcareous clay loam soil, 2) peat moss, 3) banana fiber, 4) peat moss (50%)/bark (50%), 5) banana fiber (10%)/peat moss (40%)/bark (50%), 6) coconut coir (30%)/sand (60%)/compost (5%)/perlite (5%), and 7) banana fiber (30%)/sand (60%)/compost (5%)/perlite (5%). Equal volumes of air-dried media in 20 x 13 cm (diameter x depth) pots were wetted and weighed to measure initial water absorption, then saturated and allowed to dry for 56 d. Hydrophobicity was measured weekly beginning 26 d after saturation. Surfactant addition increased initial water absorption only in peat-based media (unless banana fiber was also included). Treatments containing banana fiber and coconut coir absorbed significantly more water than peat-based media, regardless of surfactant use. Water droplet absorption times indicated that all banana fiber treatments were nonhydrophobic, except for the peat moss mixture on three of the five measurement dates. In stark contrast, peat moss and coconut coir media were moderately to strongly hydrophobic in all other cases unless banana fiber was also included. These findings demonstrate that banana fiber can reduce hydrophobicity and improve wettability in growing media. Further research is warranted to determine the optimal proportion of banana fiber for enhanced water-holding capacity and supporting plant growth.



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Presenter – Mallory Hinton

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Survival and Habitat Selection of Male Greater Sage-Grouse in Strawberry Valley, Utah

AUTHORS: Mallory K. Hinton, Dr. Steven L. Petersen, Janae Radke, Heather L. Talley,
Dr. Randy T. Larsen

ABSTRACT

The greater sage-grouse (*Centrocercus urophasianus*; hereafter sage grouse) is a species of conservation concern in western North America for which additional information on movement and survival is needed. Strawberry Valley, located in central Utah, provides sagebrush habitat for a small (<500) population of sage grouse. This population has been negatively influenced by anthropogenic pressures, such as habitat fragmentation and the construction of Strawberry Reservoir. In response to the decline from a historical abundance of approximately 3,000 sage grouse, a long-term conservation and monitoring project was initiated in 1998 to stabilize and increase the population. The capture and marking of sage grouse in Strawberry Valley has become a routine part of furthering this research and conservation. Between 2018 and 2025, 31 male sage grouse were captured in Strawberry Valley using the nightlighting method and fitted with 22g GPS transmitters (GeoTrak, Inc.) that collected five locations per day. While much is known about male sage grouse during the lekking season (March-May), little is known about their survival and habitat use throughout the rest of the year (June-February), particularly in Strawberry Valley. Using GPS data, we will analyze yearly survival rates of male sage grouse in Strawberry Valley and evaluate age-specific differences in survival. We hypothesize that juvenile males have lower survival than adults. We will also identify factors determining habitat selection in male sage grouse. These findings will provide critical insight into the demographic challenges facing this small, isolated population and will inform targeted conservation strategies to support its recovery.



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Presenter – Austin Housley

WILDLIFE & WILDLANDS CONSERVATION, PHD STUDENT

TITLE: Using sUAS and Object Based Imagery Analysis to Monitor and Inventory Populations of the Rare Endemic St. Anthony Evening Primrose

AUTHORS: Austin Housley, Dr. Steve Petersen

ABSTRACT

Facilitating the monitoring of a rare endemic plant species is essential for current conservation strategies. As is often the case, land management is spread too thin over too large an area to easily complete population inventories on a regular basis. The use of small unmanned aerial systems (sUAS or drones) can aid in the monitoring of large areas in an expedited manner. Object-based image analysis (OBIA) and classification training in programs such as eCognition allow for the aerial imagery of these large areas to be quickly and easily scanned and processed to analyze trends in population dynamics and potential habitat loss of these rare plant species. The St. Anthony Evening Primrose (*Oenothera psammophila*) is a rare endemic plant species found only on the St. Anthony Sand Dunes (SASD) of Fremont Co. Idaho, USA. This endemic species faces potential threats from the natural movement of these dunes as well as increased recreational off-highway vehicle use on the SASD. This evening primrose species was a candidate species under the Endangered Species Act from 1975 - 1996 when it was removed from candidacy after a series of population surveys. In 2024, it was documented that the geographical distribution and number of St. Anthony Evening Primrose had decreased by 49% since the historical surveys conducted by the BLM in the 1990s. We hypothesize that drones can identify plants greater than ~10 cm in diameter. We also hypothesize that drones will accurately identify at least 60% of the true subpopulation size of St. Anthony Evening Primrose.



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Presenter – Raechel Hunsaker

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Wildfire Education in the Western US: Reviewing Precollege Standards and Opportunities for Integration

AUTHORS: Raechel E. Hunsaker, Elizabeth G. Bailey, Dr. Matthew D. Madsen, and Dr. April Hulet

ABSTRACT

Wildfire is a natural ecological process that shapes rangeland and forest ecosystems through nutrient cycling and succession. However, it also creates ecological, economic, and social challenges, including vegetation loss, soil degradation, suppression and recovery costs, and risks to wildland-urban interface communities. Despite its importance in western landscapes, it is unclear how precollege formal education addresses wildfire. Because today's students are tomorrow's land managers, policymakers, and community members, integrating wildfire topics into curricula can support informed decision-making and foster public understanding of fire management. We assessed how western U.S. science standards represent wildfire concepts and identified opportunities for stronger integration into precollege education. We coded grades 9-12 state science standards from the Intermountain West in MAXQDA Analytics Pro using terms from a wildfire conceptual model (e.g., *wildfire*, *climate change*, *biodiversity*). Then, coded data were analyzed in JMP to identify patterns and opportunities to incorporate wildfire topics. Although explicit references to *fire* or *wildfire* were rare, many standards contained concepts related to wildfire ecology and management. Overall, 10% of standards were strongly aligned, 13% moderately aligned, and 16% weakly aligned with wildfire concepts. A chi-square test of independence showed that alignment strength (strong, moderate, weak) differed across wildfire topics ($\chi^2 = 160.37$, $df = 16$, $p < 0.0001$). Strong alignment was most often associated with wildfire, followed by biodiversity and climate change, while least often associated with agriculture. Identifying these patterns helps pinpoint where curricula could better integrate wildfire concepts, revealing substantial opportunities to strengthen fire education within current state standards.



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Presenter – Rance Jensen

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Survival and Cause-Specific Mortality of Mule Deer in Southeastern Idaho

AUTHORS: Rance Jensen, Dr. Brock McMillan

ABSTRACT

Mule deer (*Odocoileus hemionus*) are a culturally, economically, and ecologically significant species across the western United States, supporting recreational hunting, tourism, and serving as a key component of predator-prey dynamics. While mule deer ecology has been extensively studied, foundational data on survival rates and cause-specific mortality remain absent for populations in the Intermountain West, particularly in Southeastern Idaho. Such information is critical for designing informed wildlife management and conservation strategies in the face of changing land use and environmental conditions. This study aims to establish baseline data on mule deer survival and mortality to support effective, long-term population management. In December 2024 and April 2025, we deployed GPS collars and eartags on 200 mule deer including 100 adult females, 26 adult males, 30 juvenile females, and 44 juvenile males. These individuals were monitored across seasons to record mortality events, and conduct necropsies to determine causes of death. We will use a Kaplan Meier survival curve to determine age-sex survival rates, and identify predominant mortality factors, including species-specific predation. Our findings will establish region-specific benchmarks and highlight ecological pressures unique to Southeastern Idaho. These insights address a critical knowledge gap and provide a scientific foundation for future conservation and wildlife management efforts in the Intermountain West.



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Presenter – Samuel Leigh

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Effects of Plant Arrangement and Soil Amendments on Shrub Establishment in Mine Reclamation

AUTHORS: Samuel Leigh, Dr. April Hulet

ABSTRACT

Shrubs play a critical role in mine reclamation by stabilizing soils, improving water retention, and supporting plant and wildlife communities. To improve shrub establishment success, reclamation projects often use shrub plugs to bypass the germination stage. However, newly planted plugs remain vulnerable to stressors such as wind exposure, temperature extremes, and low soil moisture. Planting shrubs in clumps rather than individually may increase survival by creating microclimates that buffer environmental stress, conserve soil moisture, and promote belowground interactions and nutrient cycling. This study evaluated how planting arrangement and soil amendment influence shrub survival, vigor, and the density of interseeded species. The experiment was established on two unvegetated mine tailings sites: one with uncapped tailings and the other recently capped with rocky topsoil. Each site was divided into two plots: one with soil amendments and one without. All plots were drill-seeded with a mix of forbs, grasses, and shrubs. Within each plot, subplots were established where shrub plugs were planted either in a grid pattern or in clumps. Four shrub species were included to assess treatment effects: big sagebrush, fourwing saltbush, Nevada ephedra, and rubber rabbitbrush. Results showed that clumped planting improved mean survival of rubber rabbitbrush from 58% to 85% across sites and amendments. Soil amendments, however, reduced survival of big sagebrush (94% to 80%) and Nevada ephedra (79% to 42%) across sites and arrangements. These findings highlight the importance of tailoring restoration strategies to species-specific and site-specific responses to planting arrangement and soil amendments.



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Presenter – Kevin Royal

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Pygmy Rabbit Occupancy: Change Over Time

AUTHORS: Kevin Royal, Dr. Randy Larsen

ABSTRACT

Pygmy rabbits (*Brachylagus idahoensis*) are currently under review for listing under the Endangered Species Act (ESA). However, their occupancy status across historical and contemporary ranges in Utah remains uncertain. To assess current population status, we compared contemporary pygmy rabbit occupancy with data collected 15–20 years ago. Preliminary analyses suggest that occupancy has remained stable in northern Utah but declined in central and southern regions. Our findings provide critical insight into occupancy trends of this rare species and will inform ongoing conservation and management efforts.



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Presenter – Tyler Stephens

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Public Health Dangers of a Drying Great Salt Lake

AUTHORS: Tyler Stephens, Dr. Ben Abbott

ABSTRACT

Terminal saline lakes are critical ecosystems that provide economic benefits, critical habitats, and protect public health in surrounding regions. However, many of these lakes are rapidly shrinking due to reduced water inflow, most often caused by upstream human diversions. As they decline, previously submerged lakebed sediments become exposed and are mobilized by wind, increasing airborne particulate matter in nearby communities. This dust exposure has been linked to many acute and chronic health conditions, posing significant risks to public health. The Great Salt Lake in Utah is one such lake imposing a public health threat to the millions who live in its vicinity. Despite growing concern, no comprehensive analysis has been conducted to quantify the health risks associated with the lake's desiccation. To address this gap, we conducted an expert assessment involving specialists in public health, toxicology, and air pollution to evaluate potential health outcomes linked to increased dust emissions from the exposed lakebed. Declining saline lakes around the world, where rising dust has already harmed public health, were used as a basis for comparison and informed the expert assessment. This expert-based approach offers an efficient and cost-effective way to quantify threats and communicate potential health risks to Utah's population. By communicating the potential health risks, this work aims to inform lawmakers and residents alike, motivating timely and effective restoration of the Great Salt Lake.



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Presenter – Kayla Stephensen

GENETICS & BIOTECHNOLOGY, MS STUDENT

TITLE: Genome Assemblies of Parents from a Cross between Quinoa and Pitseed Goosefoot

AUTHORS: Kayla Stephensen, Dr. Jeff Maughan

ABSTRACT

Quinoa (*Chenopodium quinoa*) is valued for its nutritional quality and potential to promote sustainable agriculture yet remains poorly adapted to environments outside its native range in the Andes Mountains. To expand its environmental tolerance, we developed an interspecific cross between a commercial quinoa variety (Cherry Vanilla) and a climate-resilient wild relative, Pitseed Goosefoot (*C. berlandieri*, accession BYU1866). We assembled high-quality chromosome scale genomes for both parents using long-read sequencing, yielding assemblies of 1.36 Gb (N50 = 71.4 Mb) for Cherry Vanilla and 1.29 Gb (N50 = 68.7 Mb) for BYU1866. These genomes will identify structural differences that may contribute to the reduced fertility observed in the hybrid cross. More importantly, these genomes provide a reference database for identifying genes linked to environmental tolerance and productivity. Combined with trait mapping, they will enable future breeding to enhance quinoa's resilience and yield.



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Presenter – Russell Torgersen

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Going with the Flow... Again

AUTHORS: Russell Torgersen, Dr. Steve Petersen

ABSTRACT

In arid landscapes, springs are disproportionately important ecological features, sustaining wildlife, insects, and diverse plant communities. Yet, many springs in Nevada's sagebrush-steppe were historically capped to divert water for livestock, degrading riparian zones and reducing surface water availability. Although spring restoration efforts are increasing, little is known about how these ecosystems recover following capping removal. Therefore, our research objectives are to evaluate recovery patterns in vegetation, hydrology, and habitat structure across restored springs to inform future management decisions and promote biodiversity in desert environments.

In 2016 and 2017, refuge staff and researchers from Brigham Young University experimentally restored springs at Sheldon National Wildlife Refuge (NWR) using a range of treatments: intact controls, capped troughs with leakage holes, and partial or complete springbox removal filled with sand or gravel. In 2025, we evaluated vegetation diversity, cover, frequency, and biomass using randomized transects; monitored wildlife and feral horse activity with game cameras; and mapped surface water and riparian vegetation after restoration. Data are being analyzed using parametric statistics in R[®]. This study is ongoing, with additional monitoring planned through the 2026 field season.

This work will provide evidence-based guidance for management at Sheldon NWR and offers broader lessons for restoring springs and riparian habitats in rangelands worldwide.



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Presenter – Ashlee Weight

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Creating Soil Structure Through Biocementation Using Bacteria from Local Soils

AUTHORS: Ashlee Weight, Dr. Brad Geary, Josh De Santiago, Dr. April Hulet, Dr. Neil Hansen,

and Dr. Matt Madsen

ABSTRACT

Large scale land disturbances frequently result in fine soil wind erosion, which has significantly altered native environments, removing essential minerals and degraded soil quality. Because this process impacts local ecology, there is growing interest in developing solutions that can restore affected landscapes and minimize wind erosion. One of the greatest challenges in recovery lies in the weakened soil structure and the lack of natural stability left behind during disturbances resulting in wind erosion. This study seeks to address this issue by using bacteria isolated from local soils to build soil structure with calcium carbonate bonded through a process called biocementation.

Biocementation is achieved by adding products like bacterial cultures, water soluble calcium, and urea, to induce microbial activity in the soil which can produce a hardened surface layer. This hardened crust-like structure provides the soil with additional stability and erosion control. In our study, biocementation was induced by applying locally isolated bacteria along with a feed solution ($\text{CaCl}_2 + \text{Urea}$) over oven-dried sand. Over several weeks, repeated applications of bacteria and feed solution were made. Resulting in soil strength as measured by a penetrometer. Once the optimal combination of bacteria and feed solution is established, field trials will be conducted using soils affected by wind erosion. These trials will further evaluate the potential of biocementation to mitigate erosion and address pollution problems in degraded environments.



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Presenter – Megan White

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Surviving the Alpine Extremes: Demography & Conservation of Critically Imperiled *Senecio fremontii* var. *inexpectatus*

AUTHORS: Megan White, Dr. Randy Larsen, Dr. Steve Petersen, Dr. Brock McMillan

ABSTRACT

Alpine plant communities occur above treeline in high-elevation environments where species endure low temperatures, strong winds, and intense solar radiation. Many alpine taxa are endemic with distributions restricted to narrow ecological niches. *Senecio fremontii* var. *inexpectatus* is a rare, long-lived perennial herb in the sunflower family (Asteraceae) endemic to the alpine zone of the La Sal Mountains in southeastern Utah, typically found above 3,000 meters on ridge crests and rocky slopes. This variety received a global conservation rank of G1 (“critically imperiled”) in 2017 due to its restricted range and ongoing threats from grazing, drought, and climate-driven shifts in snowmelt timing.

To better understand the population dynamics of this rare alpine plant, we monitored tagged individuals across four years on two alpine slopes. Data collection included plant size measurements, seedling recruitment, population density, seed set, and associated plant community composition. Motion-activated cameras were also used to document herbivory and human recreational activity. Preliminary results show that *S. fremontii* var. *inexpectatus* progresses through five distinct size classes and exhibits an average seed-to-ovule ratio of 0.54. Camera analysis revealed frequent visitation by humans, deer, and mountain goats, particularly near Mt. Tukuñivatz.

These findings represent the first demographic assessment of *S. fremontii* var. *inexpectatus* and highlight the vulnerability of small alpine populations to climatic stressors and grazing pressures.



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ORAL PRESENTERS

Melissa Burrell	2:05-2:15
Sarah Chan	2:20-2:30
Cooper Bond	2:35-2:45
Otto De Groff	2:50-3:00
Austin Housley	3:05-3:15
Madison Huie	3:20-3:30
Ciara Green	3:35-3:45
Ashley Marcheschi	3:50-4:00
Clarissa Peterson	4:05-4:15
Caden Seely	4:20-4:30
Chloe Denham	4:35-4:45



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Presenter – Melissa Burrell

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Impacts of Arbuscular Mycorrhizal Fungi on Plants in Degraded Soils

AUTHORS: Melissa Burrell, Ronni Stauffer, Sage Belnap, John Stromberg, Dr. Brad Geary, Dr. April Hulet, and Dr. Matthew Madsen

ABSTRACT

Soils degraded by anthropogenic disturbances often lack essential beneficial root-associated microbes that support plant diversity and productivity in healthy ecosystems. Arbuscular mycorrhizal fungi (AMF), in particular, are susceptible to such disturbances, frequently leading to their death and elimination from degraded sites. Arbuscular mycorrhizal fungi form symbiotic relationships with plant roots that improve nutrient uptake, particularly inorganic phosphorous, and increase drought tolerance by facilitating water absorption. Reintroducing AMF to degraded sites necessitates identifying the best method for sourcing and delivering high-quality inoculum. In this study, we assessed three inoculum sources: AMF collected from roots and soil at a local undisturbed site, AMF collected from roots and soil at a disturbed site, and a commercial inoculum. Although locally collected AMF is more labor-intensive to gather and propagate, it is adapted to the restoration site which can offer greater benefits than other inoculums. A site's disturbance history influences the AMF community; disturbed areas often favor early seral AMF species, while undisturbed sites support late seral species better suited to perennial plants. In contrast, commercial inoculum is widely available, contains a high propagule count, and is presumed to benefit a broad range of plants and functional groups. Our results illustrate that undisturbed native AMF inoculum significantly increased tiller density (1.49-fold) and above-ground biomass (2.14-fold) compared to the control, while neither commercial nor disturbed site inoculum improved plant growth. Root colonization increased under all inoculum treatments, but only undisturbed native inoculum translated colonization into greater plant performance. These findings demonstrate that undisturbed site AMF can substantially enhance plant growth in waste rock soils, whereas the commercial inoculum tested and AMF inoculum from disturbed sites were ineffective soil amendments despite inducing the root colonization.



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Presenter – Sarah Chan

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: Characterizing Dust Flux in Western United States Drylands

AUTHORS: Sarah Chan, Dr. John Chaston

ABSTRACT

Aeolian dust transport is prevalent in the drylands of the western United States, and continues to increase due to drought and rising global temperatures. In this observational study, dust samples were passively collected from MWAC (Modified Wilson and Cooke) sampler masts at 15 locations in Utah and Nevada. Sites represented five land-use types common in the Great Basin region: alluvial fan (AF), agriculture (AG), rangeland (DR), oil/gas (OG), and playa (PL), with three sites per land-use type. Agriculture and playa sites were distinct from other land-use types for mass. Additionally, site location impacted mass independent of land-use type. Sampler mast collection height also influenced mass collected, with low height (10 cm) collecting the highest mass. Particle size varied slightly by land-use type, with oil/gas sites representing the highest dust particle size. These results are informative in determining which land-use types are most represented in dust collected at sink sites. Further study is merited to fully characterize dust from these sources.



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Presenter – Cooper Bond

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Leveraging in-Situ Soil Sensors to Predict Field Capacity and Readily Available Water

AUTHORS: Cooper Bond, Dr. Neil Hansen

ABSTRACT

Soil Field Capacity (FC), the water content remaining in an initially saturated soil after drainage becomes negligible, and readily available water (RAW) are critical parameters for optimizing irrigation practices and managing water resources. Determining within-field variability of FC and RAW for precision irrigation applications can be challenging due to soil heterogeneity and spatially and temporally variable field conditions. With the rapid development of in-situ soil sensors, we hypothesize that in-situ volumetric water content (VWC) data can reliably estimate the soil field capacity and RAW more frequently and with greater spatially dense resolution than traditional data collection methods, empowering Variable Rate Irrigation (VRI) decisions.

To demonstrate this, in-site sensors were deployed across three irrigated agricultural fields in Utah and Idaho, to represent diverse soil, climate, and cropping systems and collected VWC data over several growing seasons. This data was then analyzed using an inflection point method to estimate FC and RAW. Sensor-based approaches demonstrated greater site specificity and high potential for consistency under realistic field conditions, highlighting its utility for precision irrigation. Compared against other traditional approaches, in-situ sensor-based methods better captured spatial FC variability, revealing the value of in-situ sensing approaches for understanding spatial variability of FC for precision irrigation.



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Presenter – Otto De Groff

WILDLIFE & WILDLANDS CONSERVATION, PHD STUDENT

TITLE: Post-fire Conifer Succession on the Mountain Home Range

AUTHORS: Otto De Groff, Dr. Steve Petersen

ABSTRACT

The Mountain Home Range (Beaver County, UT) reaches 2890 meters at “The Needle”. The Needle’s north aspect supports a mixed conifer forest composed of Great Basin bristlecone pine (*Pinus longaeva* D. K. Bailey, or PILO), Intermountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Mayr) Franco, or PSME), and white fir (*Abies concolor* (Gordon & Glend., or ABCO) Lindl. Ex Hildebrand). At high elevations (>2800 m) PILO is dominant, while fir gradually replaces PILO at ~2700 m. We collected core samples from trees in 4 numbered plots, each 20x20 meters, between 2830 and 2700 meters on The Needle. Plot 1 was highest and 4 lowest. The upper and lower plots (1 and 4) contained older trees (~350 years) than the two middle plots (2 and 3), where trees reached only ~100 years in age. Evidence of fire scarred, downed trees around the plots suggests that growth of trees in plots 2 and 3 represents post-fire forest regeneration. Additionally, reconstructed Basal Area Increment (BAI) measurements from plot 4 show general decreasing growth rates in the early and mid-1800s, followed by a sharp increase in growth at the latter end of the century. This suggests that some trees in plot 4 survived the stand-replacing fire, and all trees experienced post-fire growth increases. To determine the calendar year of fire occurrence in the area, we cut wedges from downed, fire-scarred trees in the vicinity of plots 2, 3, and 4. Cross dating of the remnant wood indicates fire occurrence in the late 19th century. Our tree ring reconstructions illustrate post-fire competition dynamics between PILO, PSME, and ABCO between about 1880 and 2020.



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Presenter – Ciara Green

WILDLIFE & WILDLANDS CONSERVATION, MS STUDENT

TITLE: The Demographic and Reproductive Analysis of *Castilleja parvula*

AUTHORS: Ciara Green, Madison Huie, Heather Shipp, Steven Flinders, Dr. Loreen Allphin

ABSTRACT

Alpine ecosystems are of particular importance to plant ecologists due to the high number of rare, endemic plant species that often occupy this vegetative zone. They are especially vulnerable to the impacts of ongoing climate change, increasing human activities, and encroachment of species from lower elevations. Alpine endemic plant species are of particular concern due to their rarity and extreme levels of endemism. Plant species in the Tushar Mountains ecosystem in Utah also face several additional pressures, including an introduced ungulate (mountain goat, *Oreamnos americanus*), domestic cattle grazing, and common human recreational activities (hiking, mountain marathons, off-road vehicle use, etc.). This study focused on one of these high-priority species, a previously largely unstudied rare alpine plant, *Castilleja parvula* Rydb. Four long-term monitoring plots were established across the geographic range of this rare endemic of the Tushar Mountains. We monitored demographic characteristics for five years at these plots. Each population was assessed for demography, population growth rates, population extinction trajectories, and other vital life history traits. Population analyses revealed that this plant, at all populations, has a high probability of becoming extinct without restoration interventions.



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Presenter – Austin Housley

WILDLIFE & WILDLANDS CONSERVATION, PHD STUDENT

TITLE: Evaluation of Habitat Suitability Models for the Wright Fishhook Cactus
(*Sclerocactus wrightiae*)

AUTHORS: Austin Housley, Dr. Steve Petersen

ABSTRACT

Identifying suitable habitat for plant species listed under the Endangered Species Act (ESA) is essential for their conservation because these species often have limited geographic ranges and specialized habitat niches. Habitat suitability models (HSM) are a type of statistical model that are useful for visualizing areas with habitat characteristics likely to support the species of interest. The Wright Fishhook Cactus (*Sclerocactus wrightiae* L.D. Benson) is an endangered species endemic to approximately 280,000 acres in and around the San Rafael Swell region of south-central Utah. This cactus species was listed under the ESA because of its limited distribution, low population numbers, and cryptic nature across the range. Habitat modeling is an important tool for the conservation of this species because of the challenges in quantifying potential habitat and locating individual cacti in the field. Expanding on research conducted in 2017 using a resource selection function (RSF) approach with intent to model distribution patterns of Wright fishhook cactus, we utilized a nonlinear Random Forest approach that handles complex relationships between presence and absence data. This improved HSM accurately predicted cactus presence (AUC = 0.982) and effectively distinguished between areas of high and low likelihood throughout the range of the Wright Fishhook cactus. Our results provide land managers with an accurate assessment of this endangered cactus' distribution. Our model also identifies areas of high likelihood for cactus presence to guide future conservation planning.



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Presenter – Madison Huie

WILDLIFE & WILDLANDS CONSERVATION, PHD STUDENT

TITLE: Monitoring of *Castilleja parvula* v. *parvula* herbivory from native and non- native herbivores in the Tushar Mountains, Fishlake National Forest, Utah.

AUTHORS: Madison Huie, Steven Flinders, Dr. Loreen Allphin

ABSTRACT

The Tushar Mountains, located near Beaver, Utah, provide critical alpine habitat for diverse flora and fauna, including 28 endemic plant species. The Tushar paintbrush (*Castilleja parvula* var. *parvula*) is listed as a high-priority species for conservation and is highly palatable, making it particularly vulnerable to herbivory. Native and nonnative ungulates, including mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), mountain goats (*Oreamnos americanus*), and domestic cattle (*Bos taurus*), have been observed utilizing this species. Small mammal herbivores, such as marmots (*Marmota flaviventris*), pikas (*Ochotona princeps*), and white-tailed jackrabbits (*Lepus townsendii*), also forage within these alpine communities, yet their influence is rarely quantified. To distinguish between the effects of ungulate and small mammal herbivory, paired exclosures were established in spring 2020 at four known *C. parvula* populations, each containing three treatments: open (accessible to all herbivores), ungulate-excluded, and fully closed (excluding all mammalian herbivores). Plant communities were monitored annually each September from 2020 to 2024 to assess total biomass, species-level cover, and utilization, as well as counts of *C. parvula* individuals. Camera traps were deployed near each exclosure to document herbivore activity. We also analyzed fecal DNA from marmots and pikas and compared it with previously analyzed samples from mountain goats and deer, confirming *C. parvula* consumption across herbivore guilds. Our data showed reduced herbivory, with higher total biomass and *C. parvula* counts within exclosures, indicating greater persistence where herbivores were excluded. Utilization was significantly lower in fully closed plots, highlighting the overlooked role of small mammals in shaping alpine plant communities.



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Presenter – Ashley Marcheschi

GENETICS & BIOTECHNOLOGY, MS STUDENT

TITLE: Nutrient-Deficiency-Induced Differential Gene Expression in Quinoa

AUTHORS: Ashley Marcheschi, Dr. Jeff Maughan

ABSTRACT

Quinoa (*Chenopodium quinoa* Willd.) is a nutritionally valuable, climate-resilient crop with broad adaptability, yet the molecular mechanisms underlying its response to nutrient deficiencies remain poorly characterized. Nutrient availability is a major factor limiting crop productivity worldwide, and understanding quinoa's genetic responses to nutrient deficiency is critical for developing resilient varieties capable of thriving in nutrient-poor soils. To investigate the underlying genetic responses, we conducted a hydroponic experiment using the quinoa line QQ74 under controlled deficiencies in 12 essential macro- and micronutrients. Leaf and root tissues were harvested 30 days post-planting, yielding 104 RNA samples, with four biological replicates per treatment arranged in a randomized complete block design. RNA-seq produced ~30 million high-quality paired-end reads per sample, which were analyzed for differential gene expression using DESeq2. PCA and heatmap visualization confirmed strong clustering by tissue and treatment, with no outliers detected. Preliminary results reveal distinct expression patterns between roots and leaves, revealing both nutrient-specific and shared transcriptional responses across deficiencies. Top differentially expressed genes were identified for each deficiency, including overlapping genes across treatments, and functional enrichment analyses of GO terms and protein domains highlighted key pathways involved in nutrient transport, metabolism, signaling, and hormone response. These findings provide new insight into quinoa's transcriptional adaptation to nutrient stress and offer candidate genes targets for breeding programs aimed at improving performance of quinoa in nutrient-poor soils.



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Presenter – Clarissa Peterson

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Hybrid Bermudagrass Dormancy Management in a Cool-Season Climate

AUTHORS: Clarissa Peterson, Dr. Bryan Hopkins

ABSTRACT

Hybrid bermudagrass (*Cynodon dactylon* [L.] Pers. × *C. transvaalensis* Burt Davy) (HBG) has a long dormancy period in cool-season climates, reducing its visual quality and, possibly, performance on sports fields and golf courses. However, its popularity is increasing in northern regions as a response to climate change and the demand for water-efficient turfgrass. A management trial was conducted with the objectives to evaluate overseeding HBG with perennial ryegrass and Kentucky bluegrass. Additionally, two amendment trials were conducted (one with a growth cover and one without) with the objectives to evaluate the following techniques on HBG: growth covers, colorants, fertilizers, surfactants, and organic acids. Preliminary results based on NDVI and visual ratings indicate that growth covers significantly delayed the onset of fall dormancy by ~30 days compared to the untreated control. Fertilizer and amendment combinations also improved turf quality when paired with growth covers. Overseeding alone resulted in a modest increase in green canopy cover, but its long-term effectiveness requires further evaluation. These findings suggest that integrating multiple strategies, such as growth covers and targeted inputs may enhance the seasonal performance and visual quality of HBG in northern climates.



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Presenter – Caden Seely

ENVIRONMENTAL SCIENCE & SUSTAINABILITY, MS STUDENT

TITLE: Tracing Microplastics from Polymer-Coated Urea: Urban to Agricultural Pathways and Environmental Fate

AUTHORS: Caden Seely, Dr. Bryan Hopkins

ABSTRACT

Polymer-Coated Urea (PCU) efficiently supplies nitrogen (N) to plants while minimizing nitrogen losses, but its residual polymers raise concerns about microplastic pollution in soil and water. The objective of this study is to determine the environmental fate and transport of PCU in urban and agricultural systems. Urban landscape treatments included: three landscape types with three fertilizer sources applied at four rates. Landscape types included: sod, mulched beds, and xeriscape. Fertilizer sources included: traditional uncoated urea, PCU, and liquid slow-release N, which were applied at 0, 25, 50, or 100% rates (all landscapes had 0 and 100%, xeriscape was also applied at 25% and mulched beds at 50% to match their needs). Agricultural treatments included a full factorial design in a sweet corn field, with same fertilizer sources at 0 or 100% rate as the urban landscape study. Runoff water was collected following two simulated rainfall events each year over two years. Sediment, $\text{NO}_3\text{-N}$, and microplastics were mostly eliminated with sod cover. Mulched beds resulted in higher visible microplastics despite less sediment than xeriscape. In the corn study, applying the fertilizer below the surface also mostly eliminated visible microplastics, but surface application did not. Although visible plastics from PCU were detected in runoff water in both studies, non-visible microplastics were essentially absent. Analysis of environmental fate of PCU is being conducted with paired soil samples from fields with a single historical PCU application. Plastic-safe materials are used to minimize contamination and ensure accurate detection of polymer particles.



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Presenter – Chloe Denham

ENVIRONMENTAL SCIENCE & SUSTAINABILITY

TITLE: Mitigating Herbivory Impacts on Aspen Forest Regeneration Through Fire and Mechanical Thinning in High-Grazing Landscapes

AUTHORS: Chloe Denham, Dr. Sam St Clair

ABSTRACT

Aspen-conifer forests are crucial habitats that support diverse species and contribute to overall forest health and biodiversity. In recent decades, many forest landscapes have experienced increased grazing pressure from elk, cattle, and deer, which can reduce forest recruitment and regeneration. This study aims to quantify the impacts of chronic herbivory on regenerating aspen-conifer forests and evaluate management treatments designed to mitigate those impacts. We established 34 plots across Monroe Mountain in central Utah, where grazing pressure is particularly high, and applied one of three treatments: prescribed burning, mechanical thinning, or no treatment. Controlled burns were applied to reduce fuel loads and encourage aspen regrowth, while mechanical thinning involved the removal of competing conifer species using logging machinery (feller buncher mounted on a skid steer) to decrease canopy cover and promote aspen regeneration. Within each plot, transect measurements were conducted to quantify aspen density, herbivory rates, elk and deer pellet counts, and recruitment of taller aspens (over 200 cm). We observed a significant reduction in aspen browsing in burned and mechanically thinned plots, suggesting reduced grazing pressure in treated areas. Over time, sucker density declined while the average aspen height increased across all treatments. These results suggest that chronic herbivory limits aspen recruitment in aspen-conifer forests but that large prescribed fires and mechanical thinning can alleviate these effects. The positive effects of these treatments may be due to induced secondary defense compounds and fast aspen growth that outpaced browsing pressure on regenerating stems.



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Thank you to all our graduate students for participating, as well as to our wonderful faculty for their willingness to be judges. We would like to extend a very special thank you to The Charles Redd Center, staff from the Harold B Lee Library, and BYU Graduate Studies for their support.



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