FRSES 2021

ORAL PRESENTATIONS

Landscape & Movement Ecology Session - Oral Session 1, March 3, 11:30 AM - 12:45 PM MST

Evaluating Climate Change Effects on Yellow Warblers Using Telomeres as a Biomarker of Fitness - Marina Rodriguez

The ability of populations to persist when faced with changing conditions depends on their capacity to adapt. The genomic vulnerability measurement tells us how much allele frequencies need to change for populations to keep up with predicted changes in climate by 2050. In Yellow Warblers, the most vulnerable populations reside along the Rocky Mountains. These vulnerable populations are also currently undergoing population declines, suggesting that they may already be experiencing negative impacts from climate change. The relationship between genomic vulnerability and population trends is not conclusive, however, and a direct link between genomic vulnerability and fitness is needed to confirm that vulnerable populations are currently undergoing declines due to climate change. A biomarker that captures individual fitness is telomere shortening. Telomeres protect the chromosomes and shorten with age and stress. The correlation between telomere loss and survival in many species has led to telomere shortening rate being used as a fitness proxy in many studies. My proposed work will use telomere shortening to indicate fitness loss resulting from climate across Yellow Warbler range. The goal of my proposed work will be to develop biomarkers to test the hypothesis that high genomic vulnerability is correlated with current fitness.

Estimating Population Connectivity of Black Bears (Ursus americanus) in the Crown of the Continent Ecosystem with Spatial Capture-Recapture Models - Sarah Carroll

Landscape connectivity and corridor science is increasingly applied in conservation and land management decisions, highlighting the need to evaluate, refine, and advance methods used to estimate connectivity. Typical connectivity estimation methods often do not incorporate local population abundance (density) information, though density influences dispersal processes and thus the spatial structure and connectivity of populations. We applied recently developed spatial capture-recapture models to estimate density-weighted connectivity of black bears (Ursus americanus) in the northern Crown of the Continent ecosystem in northwest Montana. Using genetic capture-recapture data with detections of 598 individuals, we estimated landscape resistance to individual movement and subsequently density-weighted population connectivity. Female and male bears differed in their movement response to landscape variables that influence connectivity. This study contributes to methods development in the growing field of landscape connectivity research. The resulting connectivity maps can be applied to support landscape management and prioritize potential future highway mitigation efforts in Glacier National Park and the greater Crown of the Continent ecosystem.

Drivers of population-specific timing of migration: a genomic approach in the Common Yellowthroat - Taylor Bobowski

Migration, the seasonal movement of animals, allows organisms to exploit seasonally favorable

conditions across a large geographic area. Despite this common purpose, distinct populations of the same species can exhibit dramatically different patterns of movement. Large, population-specific differences in timing of migration in migratory birds have been shown, but the underlying causes of these patterns are still unclear. Here, we test the hypothesis that breeding ground ecology drives population-specific differences in timing, as populations have adapted to the onset of spring on their respective breeding grounds. We use the Common Yellowthroat as a study species, due to their large breeding range, clear population differentiation, and a library of over 2000 samples collected over an eleven year period during the spring migration. We assess key sites along the migratory corridor and demonstrate that population specific differences in migratory timing are consistent over large timespans. Utilizing genomic data, we then predict the breeding destinations of migrants and link their timing to spring onset.

The Effect of Landscape on Population Connectivity of a Keystone Species - Sean Streich
Fragmentation of habitat and populations is an ongoing issue in wildlife conservation. Persistence of occupied areas is important to maintaining stable populations but ongoing persistence without gene flow can lead to genetic bottlenecks and decreased population fitness. In order to evaluate conservation needs and create informed management strategies for species of conservation concern it is important to understand how species move across the landscape and between populations. Methods used in landscape genetics can allow the evaluation of how certain landscape features explain genetic differentiation between populations. The program Circuitscape is a powerful tool which models gene flow between populations across a resistant landscape as electric current moving across a circuit with resistors and conductors. The Gunnisonâ€™s prairie dogs have experienced population declines and have lost much of the historic habitat and population connectivity. To evaluate how landscape affects population structure, I used Circuitscape to test which landscape features resist gene flow. A final landscape model was then selected to predict the relative levels of gene flow that exist between currently occupied populations.

Landscape Ecology & Global Change - Oral Session 2, March 3, 1:00 - 2:15 PM MST

Dynamics of Salix spp regrowth following Tamarix spp removal - Alexander Goetz
Removal of invasive Tamarix in the American Southwest reduces habitat availability for the endangered Southwestern willow flycatcher (Empidonax extimus trailii, abbr. SWFL), which nests in Tamarix in the absence of native Salix canopy; restoration must balance SWFL conservation with promoting native plants. Using a large dataset of Tamarix removal sites, we asked the following questions: (1) Does removal of Tamarix lead to Salix growth? (2) Which Tamarix removal methods promote Salix growth? (3) What environmental conditions are associated with more Salix cover? We used mixed models to predict response of Salix cover to multiple environmental and restoration factors. Finally, we compared Salix cover change over time with Tamarix cover change over time, both overall and by removal method. We found that (1) while decreased Tamarix cover was associated with an increase in Salix, there was still a net loss of canopy cover. (2) We did not find a significant difference in Salix cover by Tamarix removal method, but herbicide sites had higher Salix cover. (3) We found that soil and climate characteristics could partially predict Salix cover. This suggests that Tamarix removal may not

lead to favorable outcomes for SWFL conservation but that environmental characteristics make some sites better restoration candidates than others.

Investigating causes of extirpation and projecting range losses due to climate change for the Wyoming ground squirrel, Urocitellus elegans - Austin Nash

Predicting how wildlife species will respond to future environmental change is a Grand Challenge in ecology and this information allows wildlife managers to enact proactive conservation measures instead of reactively protecting declining species. Correlative species distribution models are a promising technique to rapidly generate spatially explicit predictions of habitat suitability but often rely on assumptions of niche conservatism, environmental variables that are biologically meaningful, and are limited by presence data availability. In this study I use museum specimen data, citizen science data, and field surveys to generate occupancy and MaxEnt species distribution models for the Wyoming ground squirrel, Urocitellus elegans to understand how the species has responded to change in the past and how they might respond future environmental change. The project is currently ongoing with the final season of fieldwork to be completed summer 2021. Occupancy models were generated with this presence/absence data to identify important environmental variables that predict site persistence and SDM's will be used to predict range shifts. By creating predictive models informed from ecological theory, ecologists can better understand how wildlife will respond to environmental change and provide this information to land managers.

ENSO drives a dipole of masting in dry forests of the western US - Andreas Wion

Masting, or the synchronous and episodic production of seed crops across large distances, is likely driven by synchrony in climate, but we don't fully understand how patterns of synchronous seed production decay over space, or how these patterns change from year to year. In this study, we explore the synchrony and asynchrony of masting in two masting conifer species at opposing ends of a precipitation dipole. We quantified 1174 site-years of cone production in two widely distributed conifer species (Pinus edulis and Pinus ponderosa) across a large portion of their overlapping distribution in the western United States. We decomposed the variability of cone production using empirical orthogonal function analyses, and related the dominant interannual trends to warm-season precipitation and ENSO dynamics during our study period. The results describe a primary, synchronous mode of masting that is shared across species and positively associated with growing-season precipitation across our study region. We also describe a north-south dipole in masting, in which cone production is asynchronous between northern and southern regions of our study area and tracks winter ENSO dynamics.

Climate Change, Precipitation Seasonality, and Unexpected Consequences of Shifting Patterns of Water Availability in Ecosystems - Olivia Hajek

Seasonal timing of rainfall is an important driver of grassland ecosystem function and structure. In temperate grasslands, timing of water availability is a primary control over grassland production and phenology, and whether or not rainfall is occurring in the spring or summer can have significant consequences. There are three primary mechanisms by which seasonal patterns of water availability can shift: directional changes in precipitation inputs, extreme precipitation years, and changes to potential evapotranspiration (PET) outputs. Using a N-S transect across the central US Great Plains, we looked at weather stations with over 100 years of climate data to evaluate these three mechanisms. There is evidence for a slight increase in annual precipitation,

but we did not find any directional shifts in precipitation patterns over time at any of the sites. Instead, we found that extreme drought and increases in PET with rising temperature shift seasonality of the water balance with the southern half of the US Great Plains experiencing significant impacts. These findings have important implications for grassland structure (C3 vs. C4 abundances) and function, particularly as it relates to carbon cycling, since the timing water availability exerts significant control.

Soil Ecology & Agriculture Biology - Oral Session 3, March 3, 2:30 - 3:45 PM MST

Regenerative agriculture adoption and carbon sequestration potential in the Northern Great Plains - Ellie Ellis

The Northern Great Plains (NGP) ecoregion of the US encompasses 24% of all US cropland and is the leading agricultural region for spring wheat, dry beans, cattle, and other major commodity crops. Soils throughout the region have been degraded and depleted of organic matter as a consequence of conventional practices, such as annual crop-summer fallow rotations and intensive tillage. Regenerative agriculture (RA) is gaining popularity throughout this region as an alternative to conventional practices, because of its potential to regenerate degraded lands, increase agroecosystem resilience, and bolster rural livelihoods. RA is defined by a set of principles and practices that vary between farms and ecological settings. RA principles include: 1) reducing mechanical soil disturbance; 2) maintaining continuous soil cover; 3) increasing biodiversity; 4) integrating crop and livestock production, and 5) designing farm systems in the context of the ecosystem in which they are situated. RA practices include high diversity cover cropping, no-till, agroforestry, rotation with perennial forage crops, integrative livestock management, and more. When practices are designed to meet the specific challenges of the agroecosystem at hand, RA has the capacity to increase soil organic matter content, improve water infiltration and retention, and improve nutrient retention and recycling – all of which can increase system resilience to projected climate changes and contribute to carbon sequestration. While the agroecosystem benefits and carbon sequestration potential of RA are widely promoted by regenerative farmers, food processing companies, and policy makers, the quantifiable benefits of RA require on-farm verification. Specifically, the impacts of applying multiple regenerative practices to one system, as is required to comply with the principles of RA, calls for further research and modeling using a systems-based framework. The proposed study will collect soil health measurements on paired RA and conventional farms to compare the effects of different management practices. The results of this study will contribute to biogeochemical process-based models of management practices and GHG management. Additionally, socio-economic factors, including cost-benefit analysis, farm-level profitability, and social environmental justice aspects of RA, will be evaluated.

Water deficit stress and crop species impact microbiome selection preferences in corn and sugar beet - Kate Bazany

Crop microbiomes influence the fitness and yield of the host plant by altering everything from nutrient and water acquisition, to biotic and abiotic stress resistance. However, development of rational microbiome-based approaches for improving crop yield and productivity is currently hindered by a lack of understanding of the major biotic and abiotic factors shaping the crop microbiome under relevant field conditions. To examine the impact of crop species and

irrigation conditions on microbiome selection, we profiled bacterial and fungal communities associated with both above and below ground compartments of corn and sugar beet crops grown in irrigated and non-irrigated conditions in Colorado, Nebraska, and Montana. By examining bulk and rhizosphere soils, we found that corn and sugar beet select unique microbiomes, and that selection preferences vary with irrigation treatment. We are now employing machine learning and network-based approaches to determine complex interactions among microorganisms, their plant host and the environment. Insights into these complex interactions will help advance our understanding on the ecological processes that govern microbiome assembly and will be crucial in the development of targeted and effective microbial amendments that can improve crop fitness and productivity in novel environments.

Identifying the characteristic scope and scale of wolf-livestock conflicts: Drivers of wolf depredation reporting and compensation use by livestock producers - Rae Nickerson

With the continuing reestablishment of wolves (Canis lupus) across the American West, it is likely that more livestock producers will be exposed to wolf-related conflict such as livestock depredation. The financial implications of wolf conflict can be significant depending on the context of an individual livestock operation. Conflict reduction tools, programs, and policies aimed to ameliorate the financial risks associated with wolves are provided by state and federal agencies as well as some NGO's. However, we still know very little about how livestock producers perceive of these tools, policies, and programs, or whether those perceptions influence producer use of the tools, policies, and programs available to them. Compensation programs that pay producers for wolf depredation are the most readily available, and therefore most utilized program for ameliorating the financial costs of wolves. These programs are increasingly controversial, both as a means to foster tolerance for wolves and regarding the extent to which they adequately address costs. Yet for many producers, compensation remains the only program they can access. Understanding producer perspectives on, and use of, compensation programs and their associated processes can help policy makers and wildlife managers design programs that better serve producer needs. We designed a survey based on a modified version of the Theory of Planned Behavior to identify the socio-psychological factors driving producer compensation use as well as depredation reporting behavior as the two behaviors are intimately linked. We also used a Discrete Choice Experiment to model producer interest in alternatives to traditional compensation programs. Preliminary results show that the level of satisfaction among producers for current compensation programs is mixed, and most producers believe their actual losses to wolves are not represented in the amount of compensation available to them. Additionally, having access to payment for direct losses was preferred over other potential payment options. We hope these findings will help inform the development of a compensation program for Colorado producers that reflects the unique needs of producers operating on landscapes with wolves.

Spatial variation in the direct and indirect contact rates at the wildlife-livestock interface for informing disease management - Anni Yang

The transmission dynamics of shared pathogens are influenced by both intra- and inter-species interactions, which makes the characterization of multi-species contact networks essential for disease management. Yet, little is known about the factors shaping rates of different contacts at the wildlife-livestock interface, especially the role of indirect contact via shared resources and the effects of livestock management. Our objective was to quantify direct and indirect contact

rates among wild pigs and cattle on a commercial cow-calf operation in Florida. Using GPS data from 20 wild pigs and 11 cattle, we employed a probabilistic framework to estimate rates of three types of contacts, including direct contact, indirect contact via pastoral environment, and indirect contact via cattle supplements. Our results suggested daily direct contact rates among wild pigs was about twenty times higher than pig-cattle direct contact rates. Indirect contact rates among and between wild pigs and cattle via naturally occurring resources were widespread and spatially heterogeneous. More indirect contacts occurred at liquid molasses tubs than other cattle resources. Our results can inform risk assessment and control strategies for controlling transmission of shared diseases.

Behavioral Ecology - Oral Session 4, March 4, 9:00 - 10:15 AM MST

Effects of Individual-level Differences in Metabolic Rate on Honeybee Colony Resource Acquisition - Julian Cassano

Metabolic rate (MR) is the fundamental biological rate at which organisms consume, process and expend energy and is considered by many to be a fundamental driver for structure and function throughout all levels of biological organization. One of the basic mechanisms by which MR directly impacts life history traits - such as survival and reproduction - is through its influence on foraging behavior which drives the acquisition of energy, including the energy needed to forage. This suggests that individuals with different MR likely vary in their foraging strategies and such diversity adds a further level of complexity in groups such as social insects, where energy acquisition and fitness of the colony is a collective and emergent outcome of such individual differences. Previous studies have shown European Honeybee (Apis mellifera) foragers follow energetic currency models and maximize their energetic efficiency while foraging. Using artificially selected genetic lines with different MR phenotypes, my project investigates whether individuals from these genetic lines maximize foraging currencies differently, and thereby differ in their lifetime contribution to colony performance. This provides insight into the emergence of group phenotypes based on individual MR in a social insect with large agro-ecological implications.

Do elephants have names? Vocal labeling in African elephants. - Mickey Pardo

Using learned vocal labels to refer to individuals or objects is a central feature of human language, yet the evolutionary origins of this ability are poorly understood. Elephants are among the few mammals capable of learning to produce new sounds, but it is unknown how they use this ability in the wild. To test the hypothesis that elephants vocally label, or name, individual conspecifics, we recorded calls from individually identified wild elephants that were directed towards known individual receivers and measured both source- and filter-related acoustic features of these calls. We used a conditional inference random forest model to classify calls according to the identity of the receiver and to derive proximity scores for each possible pair of calls. Calls from the same caller directed to the same receiver were more similar than calls from the same caller directed to different receivers, suggesting that individual callers modify their calls according to the identity of the receiver. Moreover, calls from different callers directed to the same receiver were more similar than calls from different callers directed to different receivers, suggesting that different callers use similar acoustic features to address the same receiver.

Novel sexual signals and implications for reproductive isolation in T. oceanicus - Sophia Anner & Sophie Fitzgerald

Populations of the Pacific field cricket have recently demonstrated rapid evolutionary change with the emergence of a novel sexual signal (purring). At least three distinct male morphs, silent, typical, and now purring, exist concurrently in several Hawaiian populations. To establish current rates of reproductive isolation between the described three morphs, we paired males and females from populations that contain typical, purring, and silent males in a 3 x 3 fully factorial experimental design, generating nine total types of within-morph (homotypic) and between-morph (heterotypic) mating trials. Mounting rates differed significantly among the nine possible pairings. Females from all populations were over twice as likely to mount typical males and did so in the shortest duration of time, implying a strong preference for the typical call. However, homotypic and heterotypic pairings were equally likely to end in mounting and took equivalent amounts of time, suggesting there is no current reproductive isolation. Finally, females from the silent population were equally likely to mount both typical and silent males suggesting that female preference for homotypic males has increased over time. The implications of future increased reproductive isolation and potential speciation justifies the need to describe current mating patterns.

Personality traits mediate the effect of anthropogenic noise pollution in eastern bluebirds - Heather Kenney

We asked whether anthropogenic noise and animal personality interact to influence the settlement patterns and parental behaviors of individual eastern bluebirds (Sialia sialis) in a suburban landscape. We collected repeated measures of neophobia, aggression, and nestling feeding rate in adult bluebirds while manipulating the sound environment at nest boxes. First, we added a recording of traffic noise during the nestling stage. We found that when exposed to experimental noise, there was a weak pattern for high-aggression birds to feed more than low-aggression birds. In a second experiment, we manipulated the noise environment during territory establishment, nest-building, and egg-laying. We found that low aggression females tended to settle in noise-treated nests, and these females delayed egg-laying by an average of four days, although this was not statistically different from controls. These results suggest that female aggression level is important for mediating the effects of anthropogenic noise pollution on this population bluebirds. By identifying the role of personality in mediating human impacts on animal populations, we can implement more finely tuned conservation and management programs.

Human Dimensions - Oral Session 5, March 4, 1:30 - 2:45 PM MST

The many hats of a citizen science project leader: Perspectives from current citizen science leaders - Dani Lin-Hunter

Citizen science involves public participation in science and is common in ecology. It is often touted as being beneficial to science and volunteers. Science outcomes include answering questions at large scales and collecting cost-effective data. Volunteer outcomes include job experience and learning. However, citizen science is not a panacea of public engagement, as achieving these outcomes requires hard work by project leaders. I conducted phenomenological interviews with project leaders (n=65). I asked about their experiences working with volunteers, how they set and evaluated goals, what challenges they faced, and how they addressed them. I

found that project leaders play diverse roles in projects as data managers, science communicators, business managers, IT support, volunteer trainers, and more, With these different roles comes the need to balance different people's interests in the project (e.g., meeting volunteers' motives vs. scientists' data need). Thus, project leaders have to navigate complex social networks for which training in the biophysical sciences alone often fails to prepare them. Research on the under-studied perspective of project leaders can inform resources and professional development to future citizen science practitioners to better achieve both scientific and volunteer outcomes.

Altering socio-ecological structure through community-based coastal conservation in Sri Lanka: A ray of hope for the Lankan coasts - Ahalya Arulnayagam
Located in the mid of the Indian Ocean, Sri Lanka harbors a wide array of coastal ecosystems ranging from coral reefs mangroves, seagrasses, sandy beaches, salt marshes, sand dunes, and other coastal wetlands; which delivers rich biodiversity as well as higher livelihood prospects. With its 1620-kilometer long coastal line, the coastal ecosystems serve as a focal point of economic activities that contributes to 40% of the country's GDP. Fisheries (80%), tourism (80%), and agriculture (15%) predominantly found to be pivotal livelihood activities strengthening the country's economy. With the increase in population (~22M in 2018) and urbanization, resource overexploitation resulted in the depletion and degradation of coastal ecosystems; consequently ending up in coastal erosion, altered water quality, and loss of biodiversity stock. Hundreds of aimlessly implemented conservatory actions have failed throughout the last decade. This has put a question on the country's biological richness and economic viability.

Urban natural gas leaks: An environmental justice concern? - Seongwon Im
Natural gas leaking from local distribution systems emits the greenhouse gas methane (CH4) and occasionally develops into explosion hazards, making them both a climate and safety burden. These leaks are potentially non-randomly distributed in a city, thus exposing some populations to disproportionate risk. Environmental Justice (EJ) broadly refers to the idea that the benefits of environmental amenities be distributed equitably across various sociodemographic groups, and that environmental burdens be eliminated, or their burdens similarly shared. We leverage the results of mobile methane surveys in 12 cities to examine patterns in the frequency of natural gas leaks and analyze revealing vastly different rates of natural gas leaks both among and within cities. Within cities, we utilize spatial conditional autoregressive (CAR) models to explore the relationship between leak frequency and census tract EJ predictors like percent people of color. Our findings indicate that the age of a city's infrastructure is associated with the rate of leaks, and even after accounting for infrastructure age, disparities in leak rates continue to exist as a function of sociodemographic characteristics. Our analysis provides a framework for utility companies to evaluate the integrity and equity of their distribution systems.

Evolutionary Biology - Oral Session 6, March 5, 9:00 - 10:15 AM MST

Evolutionary rescue in source-sink environments: When does dispersal best facilitate recovery in declining sink populations? - Lily Durkee
A critical goal of modern evolutionary ecology is to establish how to effectively manage

populations in human-altered habitats. Source-sink dynamics can arise when a population with a high fitness (source) exists that is able to support a declining population (sink) through immigration. Dispersal can prolong extinction and provide novel genetic material that can allow the sink population to adapt and recover. However, dispersal among habitats that differ in quality can also create a homogenization effect that prevents adaptation to local conditions. Source-sink dispersal, therefore, can promote adaptation and evolutionary rescue, or it can prevent adaptation, limiting population fitness. This study evaluated source-sink dispersal using the red flour beetle, Tribolium castaneum. Three dispersal strategies were chosen that were guided by current conservation recommendations: 1 migrant per generation, 5 migrants per generation, and a single large dispersal event. The impacts of one-way source to sink dispersal were assessed by tracking population size and fitness over multiple generations. By investigating these management recommendations, this work seeks to determine the effectiveness of each strategy for both recovering long-term fitness and promoting adaptation to a novel environment.

High genetic connectivity in a patchily distributed alpine specialist - Matt DeSaix

Anthropogenic climate change is having profound effects on biodiversity and species with patchy distributions are expected to experience an outsized effect of climate change due to increased habitat fragmentation. Alpine species may be particularly vulnerable to climate change because they tend to have patchy distributions across altitudinal sky islands and climate change may make these patches even more discontinuous. Range contraction due to climate change (historical or contemporary) is well-documented in alpine species as distributions shift to higher elevations and rapid range contraction may lead to inbreeding depression in small, isolated populations. However, with sufficient gene flow, small, discontinuous populations can potentially persist with limited genetic consequences. Here, we use the Brown-capped Rosy-Finch (Leucosticte australis) as a model species for studying the genetic consequences of small populations with highly mobile individuals. L. australis is an alpine specialist and is near-endemic to the Colorado Rockies. Population structure analyses revealed high range-wide genetic connectivity apart from Pike's Peak, which also had some of the lowest genetic diversity. Pike's Peak had high proportions of long runs of homozygosity, suggesting recent inbreeding. Additional work will use genome-wide heterozygosity to characterize demographic history across the breeding range.

Improving the Efficiency of DNA extractions for Avian Climate Change Research - Noelle Mason

Because birds are ubiquitous throughout the world, tracking population trends has become a critical indicator of biodiversity loss across species. Genetic tools can be used to assess which populations are most threatened by climate change but rely on the efficient extraction of DNA from avian blood, samples are often limited. Manufacturer extraction kits offer a standardized approach to DNA extraction from blood, but need modification for optimal yield. I anticipate that modifying the recommended protocol to include enzymatic enhancement buffer ATL and increasing the incubation time will yield higher quantities of DNA extract. In preliminary results from 4 replicates of 6 total individuals of 2 species , the addition of Buffer ATL roughly doubled the DNA extraction yield when incubated for ten minutes. When incubated with Buffer ATL for 24 hours, the yield nearly quadrupled. Based on a mixed-effects model created in JMP, I found statistical significance in mean DNA yield per trial. Improving the quality and quantity of DNA

extractions will increase the accuracy of studies understanding the evolutionary responses of birds to climate pressures, helping to inform conservation policies in a changing world.

Patterns of change in bird song characteristics across space and time. - Karina Sanchez
Animal vocalizations adapt to local habitats to improve transmission of signals to receivers. However, environments are continuously changing due to urbanization and wildlife are responding to these changes. Studies show birds alter their frequency (pitch) and amplitude (volume) of their songs to avoid being masked by noise. Other birds shift the dawn chorus in areas with anthropogenic light. Some songbirds learn these songs from other individuals and songs heard more often or associated with reproductive success, are more likely to be passed on to the next generation. This cultural transmission of song can result in change over time in certain song forms and could set urban populations up for the success of a specific song type. Therefore, urban and non-urban populations may face very different trajectories in song evolution. In this study, we use historic and recent song recordings from the Museum of Vertebrate Zoology at Berkeley to investigate changes of Spotted towhee (Pipilo maculatus) songs over 45 years and across an urban to rural gradient in California. Preliminary data suggests that birds in 2015 sing songs that may be better adapted for anthropogenic noise pollution and that cultural evolution can act on independent song elements over time based on their function.

Disturbance & Community Ecology - Oral Session 7, March 5, 10:30 - 11:45 AM MST

Repeat short-interval fires drive changes in forest structure, composition and carbon in Interior Alaska - Kate Hayes
Fire is the primary driver of forest structure, composition and carbon in boreal regions across both temporal and spatial scales. Warming temperatures are linked with an increase in fire frequency across boreal Interior Alaska, leading to an acceleration of repeat short-interval reburning (fires occurring within 50 years or less of one another). Questions remain regarding how increased short-interval fires will drive shifts in forest structure and composition. We quantified forest structure and composition in boreal black spruce forests that have burned once, twice or three times across the last 70 years, well outside historic norms. Our results show that reburning drives shifts in regeneration from conifer stands to deciduous-dominated landscapes. We also report initial results on the resulting shift in forest biomass. This work expands our understanding of the impact of short-interval fires in Alaska, and contributes to our knowledge of carbon cycle shifts driven by warming temperatures and increasing fires in the boreal system.

Grassland plant communities across a broad resource gradient respond variably to chronic nitrogen addition - Mary Linabury
Extreme anthropogenic nitrogen deposition may release systems from nitrogen-limitation, which could result in marginal changes to ecosystem structure and function, or extreme changes, such as ecosystem collapse. In tandem, rainfall variability continues to intensify, which can highly limit or strengthen the effect of nitrogen, as photosynthesis is colimited by water and nitrogen. This research seeks to better understand these forces, their interaction, and resulting plant community response in two grassland systems across a large environmental gradient. The hierarchical response framework (Smith et al. 2009), predicts resource alteration will modify

individual physiologic response, then precipitate species abundance reordering. After four years of nitrogen addition, biomass significantly increased within our mesic tallgrass prairie, yet our arid shortgrass system responded primarily through species reordering. This discrepancy may be explained by precipitation: year significantly affected biomass production at both sites, which indicates that yearly precipitation variability was the primary driver of biomass change; extreme water limitation in the arid grassland may have barred further biomass production. These findings indicate that nitrogen-water colimitation may play a large role in community response.

The interaction of wildfires and beaver dams on aquatic insects - Kelley Sinning
Fire disturbance on terrestrial ecosystems is a response that most everyone is familiar with, however the impact of fire on freshwater invertebrate communities is lesser known. With rising global temperatures causing recurrent crown fires that are damaging to water systems, it is imperative to better understand how aquatic invertebrates serve as a food source for higher trophic levels and contribute to nutrient cycling. Due to increased fire, beaver reintroductions, and specifically beaver dams, have been shown to be effective and economical solutions to raising the water table and creating refuges from fire. Studying the relationship between beaver dams in fire disturbed areas and the taxonomic richness of aquatic insects will help scientists better understand how beaver conservation can be used in future habitat management during climate change. By taking samples of aquatic insects upstream and downstream of beaver ponds along a stream in a part of Wyoming impacted by the 2018 Ryan Fire, we expect to better understand how beaver dams affect the functional groups and taxonomic richness of macroinvertebrates post-fire.

A novel biofilm microcosm to assess how host-associated microbes prevent pathogen establishment - Melissa Chen
Host-associated microbiota provide a variety of benefits to hosts, including possible protection from the establishment of pathogens. In the amphibian system, there is strong evidence that the host skin microbiome plays an important role in mediating the establishment of the fungal skin pathogen Batrachochytrium dendrobatidis (Bd), which is responsible for recent global declines in amphibian populations. However, the mechanisms through which host-associated microbes prevent Bd establishment are not well understood. Here, we use a novel biofilm microcosm system to assess how microbial richness, Bd-inhibitory potential, and biofilm thickness correlate to Bd establishment. We find that bacterial richness and biofilm thickness are correlated, and increasing both decreases Bd establishment. We also find that co-culture of bacteria with each other and Bd significantly increases probability and potency of Bd inhibition, even when individual strains are not Bd-inhibitory in monoculture. These findings have implications for future conservation efforts in the amphibian system: bacterial probiotic candidates used to inhibit Bd establishment should be assessed in mixed communities, rather than alone. Additionally, these results provide insight on how microbes interact and compete with harmful pathogens on host tissue in general.

Ecosystem Modeling & Ecosystem Ecology - Oral Session 8, March 5, 12:00 - 1:15 PM MST

Contributing Factors to Adult Female Survival in a Population of Ground Squirrels - Rachel Kanaziz

A central tenet of natural selection is that individuals should maximize their contribution to population succession by favoring particular traits, chief among them are the primary components of an individual's fitness: reproductive success and survival. Because access to resources is often limited, these life history traits often compete, causing a fitness trade-off measured as the cost of reproduction Here, we sought to estimate this trade-off in a short-lived, hibernating mammal, the golden mantled ground squirrel (GMGS), Callospermophilus laterali. We used 25 years of data (1995-2020) collected from a population of GMGS at the Rocky Mountain Biological Research Laboratory in Gothic, Colorado. We tested the effect of relevant reproductive traits (e.g. reproductive status, age of first reproduction, litter size, litter mass, litter emergence timing), environmental factors (e.g. snow cover phenology, growing season length, summer rainfall), and population size on adult female survival using Cox proportional hazard models. Results indicated that reproductive traits and environmental conditions both explain significant variation in annual survival. This knowledge could be paired with climate change data to predict effects on components of fitness, life history trade-offs, and abundance compared to other populations or species.

Effects of plant quality on host-parasitoid interactions in a quantitative food web - Christine Folks

One of the most enduring questions in ecology is how top-down and bottom-up effects structure communities. Plant quality affects trophic interactions by altering insect behavior, morphology, and life history traits, but its effects on food web structure remain unclear. Gall-forming insects are particularly useful for studying multitrophic interactions through quantitative food webs because they and their parasitoids are stationary within galls, where each trophic level depends entirely on its host for resources. The gall wasp Aulacidea acroptilonica was introduced to Colorado to control the invasive Russian knapweed. Russian knapweed quality is expected to exert cascading bottom-up effects through trophic levels by influencing gall wasp abundance and size, as predicted by optimal foraging theory. Abundance and parasitism rates will be used to calculate food web metrics: generality, vulnerability, linkage density, and connectance. To examine host-parasitoid size relationships, gall diameter and parasitoid hind tibia length will be measured. Plant nutritional content, height, and stem, bud and flower numbers will be recorded. General Linear Models will be used to analyze sources of variability in food web metrics and size relationships. Path analysis will be used to visualize the relative strength of food web interactions.

Understanding the heterogeneity of nutrient limitation in tropical lake ecosystems - Jemma Fadum

While phytoplankton growth in temperate lakes is typically limited by phosphorus (P), limitation in tropical inland waters is less predictable. Limitation regimes range from macronutrients (N, P or N and P colimitation) to micronutrients (i.e., silicon and iron) to light. Not only are there differences in limitation regimes between lakes, but there is also often considerable diversity of dominant limitation within a given lake. These variations in limitation can be spatial, temporal or a combination of both types of heterogeneity. To explore ecosystem level drivers of these complicated and diverse limitation regimes in tropical lakes, we conducted a meta-analysis of available studies and identifies five categories of drivers: Land use and land cover (LULC), inter-annual climate variation, intra-annual patterns in precipitation and stratification, lake morphology and pulse events. Understanding drivers of limitation regimes is particularly

important to ecosystem health because though there are numerous factors to consider in predicting cyanobacteria blooms, N limitation is commonly regarded as a basic precursor to cyanobacterial dominance. An improved understanding of the conditions which promote N limitation may prove to have important implications for the sustainable management of freshwater ecosystems.

Role of physical disturbance size on natural recovery patterns of biological soil crusts on the Colorado Plateau - Sierra Jech

Biocrusts are complex communities of microorganisms with many important functions in dryland systems including soil stabilization. Prior work indicates that after human disturbance, biocrust recovery rates are highly variable, dependent on biotic and abiotic factors. One barrier to biocrust recovery in restoration settings is microbial propagule availability. Propagule dispersion is thought to occur via lateral growth, aeolian transport, and overland flow. Moreover, propagule limitation may be magnified by the size of the surface disturbance. To test these hypotheses, mature biocrusts on the Colorado Plateau were scraped off soil surfaces in four differently sized plots (< 1m2) at two separate sites. These plots were monitored for unassisted biocrust recovery after two years. Over 80% of sampled points exhibited high soil stability. There were no site differences and no differences in the level of development or soil stability measures for plots of different sizes. Additionally, there was a random pattern to biocrust recovery that is more in line with aeolian deposition or overland flow than lateral growth. These results help to inform restoration efforts on the Colorado Plateau with microbial limitation in recovering soils likely controlled by both aeolian deposition and overland flow.

POSTER PRESENTATIONS

Using bird host ecology to inform patterns of avian influenza prevalence: Spatial autocorrelation over network space – Brooke Berger

A pathogen is rarely uniformly distributed across its entire geographic range. Determining what biological and environmental factors drive this heterogeneity can be challenging at broad spatial scales. Examining spatial autocorrelation of disease prevalence is a valuable first approach to deciphering what these underlying mechanisms are. In the avian influenza (AI) disease system migration of wild waterfowl reservoir hosts may drive broad scale patterns of prevalence. During long distance migrations, hosts can skip over hundreds of miles of habitat between stopovers. In these cases, geographic distance between prevalence measurements may not be the most biologically relevant way to define nearness. Instead, we propose an autocorrelation analysis where spatial nearness is defined by a weighted adjacency matrix. This matrix will be populated using a weighted, directed bird migration network constructed from USGS band recovery data for Northern Pintail ducks. If we see significant autocorrelation using network nearness it would suggest that host migration is an important driver of AI prevalence at broad spatial scales. This would also suggest that, in pathogen systems where hosts migrate, network adjacency may be a more biologically relevant measure of "distance" than geographic distance.

Food web responses to species losses can provide insight into ecosystem service vulnerability – Aislyn Keyes

Human-driven threats are changing biodiversity, impacting ecosystem services. The loss of one

species can trigger secondary extinctions of additional species, because species interact — yet the consequences of these secondary extinctions for ecosystem services remain underexplored. Herein, we compare robustness of food webs and the services they provide; and investigate factors determining service responses to secondary extinctions. Simulating twelve extinction scenarios for estuarine food webs with seven ecosystem services, we find that food web and service robustness are highly correlated, but that robustness varies across services depending on their trophic level and redundancy. Further, we find that species providing ecosystem services do not play a critical role in stabilizing food webs whereas species playing supporting roles in services through interactions are critical to the robustness of both food webs and ecosystem services. Together, our results reveal indirect risks to services through secondary species losses and predictable differences in vulnerability across ecosystem services.

Clark's nutcracker (Nucifraga columbiana) forest habitat use and resource selection In Yellowstone National Park – Thomas McLaren

Clark's nutcrackers (Nucifraga columbiana) harvest and cache seeds from many conifer species across their range. Evidence indicates that multiple seed resources in any region are important to sustaining nutcracker populations. Their coevolved mutualism with whitebark pine (Pinus albicaulis), a declining species, raises concern for future seed dispersal dynamics. To understand how nutcrackers use forest habitat within Yellowstone National Park, we established transects and point count surveys using distance sampling methods, relative cone abundance indices, and behavioral observations in different forest communities. By surveying nutcracker abundance during summer and fall seed harvesting and caching we hope to determine which forest types in the park are used by nutcrackers and how variation in cone production influences their use within and across years. Preliminary modeling trends show the highest numbers of birds in whitebark pine forest. Additionally, we observed high annual and spatial variation in transects in limber pine and Douglas-fir conifers also used as seed resources within the park. We expect this project to result in a habitat use model that integrates detectability based on distance sampling analysis and a power analysis for use in development of a monitoring protocol.

Identifying conservation units in the threatened species Canada Warbler (Cardellina canadensis) – Caitlin Miller

Conservation units (CUs) are populations that are considered distinct for conservation purposes. CUs can be defined by multiple methodologies, which can lead to discordance between what populations are prioritized for conservation management depending on what methodology was used to define CUs. The Canada Warbler, a migratory songbird that ranges from Canada to the United States (US), is considered threatened in Canada but not in the US. It remains unclear if conservation management strategies should be different for the species in the US versus Canada. Our research aims to determine what CUs are appropriate for the Canada Warbler by combining evolutionary history and adaptive potential across the species range. To do so, we determined the overall population structure to represent evolutionary history and gene-environment correlations for signals of environmentally-linked adaptive potential. From our preliminary results, we found that population structure suggested an east/west divide in evolutionary history and that adaptive potential was higher in the eastern portion of the range. These results suggest that the management of the Canada Warbler may be better coordinated in CUs that divide the range between the eastern and western edges, but more research is necessary to include population demographics when determining CUs.

Climate change education in rural schools – Madison Scheer
Earth system science (ESS) education is becoming more important as our understanding of climate change (CC) increases. Climate literacy, however, is threatened by political discourse regarding the anthropogenic causes of CC, which is especially heightened in rural spaces. For this study, we chose to explore how rural rangeland teachers explain and perceive their own climate change education (CCE) instructional choices. This phenomenological study describes the lived experiences and perceptions of the study participants (nine rural teachers). There were four major findings, teachers: 1) perceived that they maintained objectivity by not making definitive scientific claims about CC, 2) expected students to find their own evidence of CC, 3) do not model scientific reasoning about CC, and 4) do not prioritize ESS curriculum. By learning how rural science teachers communicate CC in their classrooms, these data can be used (1) by communication experts to collaborate with teacher educators on how to effectively communicate SSIs and (2) to develop resources for teachers as they build both curricular materials and instructional strategies around CC arguments. Research focused on climate literacy is fundamental to creating an informed generation capable of making conservation, land stewardship, and natural resource management decisions.

Cattle as Partners in Conservation: Collaborative Management of Government-Owned Lands – Anna Clare Monlezun
Could conceptualizing cattle as partners in conservation be a win-win for the livestock and rangeland conservation sectors, resolving the [often] paradoxical objectives of food production and natural resource management? To learn more about collaborative grazing management on Colorado's rangelands, we are investigating partnerships between private ranchers and government land managers along the Front Range. Our study uses a holistic model to evaluate the three pillars of sustainability (ecological, economic, and social) and address these landscapes as complex social-ecological systems. The ecological component examines soil health measures of organic carbon, total nitrogen, and water infiltration, and vegetation measures of biodiversity, plant community composition, and forage nutritive quality. The socio-economic component explores the values, attitudes, and perspectives of diverse stakeholder participants regarding the ecosystem services produced by collaborative grazing management. These data will be combined into a system dynamics model, an applied, interactive tool. The model will examine relationships and interactions among ecological and socio-economic themes, allowing us to apply context-specific variables to generate and visualize management alternatives to inform adaptive and integrated decision-making.

Reduction in winter snowpack drives changes in growth and survival of temperate plants – Annelise Rue-Johns
Winter ecology in much of the world is driven by the presence and persistence of snowpack. The climate change-induced reduction of this snowpack has caused widespread mortality of Alaska yellow cedar (Callitropsis nootkatensis), as well as declines in annual growth of sugar maple (Acer saccharum). While the loss of snowpack is currently restricted to temperate regions adjacent to snowless regions, climate change is expected to convert snow- to rainfall in a much larger region within the next 100 years. This will expose many more snow-adapted species to novel conditions. Loss of persistent winter snowpack is thus a novel but widely occurring disturbance agent. This research examines the existing literature on the effects of snow loss on tree species, with the goal of identifying patterns and thresholds that may be useful when

describing future impacts of snow loss on a larger scale. Preliminary results indicate that most species experience either no effects or negative effects (mortality, declining productivity, etc.) as a result of declining snowpack. Root freezing is the most commonly proposed mechanism, but few studies definitively test this hypothesis. These preliminary results show a need for more comprehensive research focused on the mechanisms and patterns of mortality and damage caused by climate-induced snow loss.

House sparrow social hierarchy in urban environments – Sarah Bicocchi

House sparrows (Passer domesticus) are closely associated with human development, being found near both rural and urban structures. Differences in resources and potential threats in these areas may result in differences in sparrow behavior. Social hierarchies of sparrows within an urban environment were assessed via observation of birds at a feeding station. Observations included the sequence and gender of the bird arrivals, time spent at the feeding station, and time between successive bird arrivals. Some individuals were identified by feather anomalies and color patterns. Observations were conducted at an apartment located near downtown Casper, Wyoming, occurring on four consecutive days during the breeding season in May 2020. From data collected, it appears that female house sparrows take more initiative when foraging for food, arriving earlier at the station. The females were often the earliest to arrive and tended to stay the longest. This may indicate that the females are more dominant than the males during this time in the spring breeding season. In addition, various sub-flocks were noted, indicating that the sparrows may form triads to forage in. The benefit of such sub-flocks, and comparison of similar behavioral observations in rural foraging groups represent future questions we would like to address.

Structure and scale in spatially synchronous southeastern US trout populations – George Valentine

The salmonid species brook trout (Salvelinus fontinalis), rainbow trout (Oncorhynchus mykiss), and brown trout (Salmo trutta) are important cultural and economic resources in the southeastern USA. As projected climatic changes increase water temperatures and alter flow regimes across their range, these coldwater species will face major challenges. Recent studies have shown that populations exhibiting spatial synchrony are more vulnerable to broad-scale threats such as climate change. We assess the scale and structure of spatial synchrony in trout abundance using 30+ years of multi-pass electrofishing data from 346 sites in North Carolina. Asynchrony between locations will be assessed by pairwise comparison using Mantel tests. We expect that spatial synchrony resulting from the Moran effect will be generally mediated by habitat heterogeneity, specifically by covariates such as groundwater influence, elevation, and topography. Insights gained from this study will be employed in expanding the investigation to include data from Georgia to Maine. Our findings will inform regional interagency cooperation to monitor trout resources by accounting for the spatial scales of synchrony.

Using drones to create a new multifaceted fire severity index – Lauren Lad

Unmanned Aerial Vehicles (UAVs) are a relatively new technology with potential to improve the spatial and temporal scales of fire ecology. Ecological changes are ecosystem specific, and as such, no single measure of change can be applied universally. As a result, fire effects field observations are commonly assessed as an aggregation of visual changes in vegetation color and size. When translated to remote sensing, such metrics can include spectral information such

as vegetation indices or structural information such as tree crown volume or base height. Existing remote sensing strategies focus on either structural or spectral changes to vegetation (Lentile et al., 2006). However, the use of UAVs allows for the capture of both spectral and structural data at the tree-level. Additionally, the ability to control the temporal resolution of observations facilitates the use of spectral indices that relate pre- and post-fire conditions and capture the complex and dynamic changes resulting from fire (McCarley et al., 2017). The proposed research will explore changes in structural and spectral metrics to provide a comprehensive assessment of ecological change following fire. Combinations of these metrics will be analyzed for creation of a new fire severity index which can be applied at the individual tree level.

Examining the effects of forest conditions on defoliator outbreaks under varying climatic conditions – Olivia Santiago

Concurrent with warm and dry conditions, irruptive insects have caused widespread tree damage and mortality in temperate forests worldwide over the past two decades. Such mortality has important consequences for carbon cycling, habitat provisioning, timber and recreational industries. In the western United States, the irruptive folivore responsible for the most damage is the western spruce budworm. Despite the devastating impact of the WSB on western forests, the drivers of WSB outbreaks are not yet fully understood. Western spruce budworm (WSB) outbreaks may increase in frequency and severity with the onset of climate change, although the drivers that control the population dynamics of this species are not fully understood yet. Here, I will discuss the effects of climate variability at the interannual, interannual, and multidecadal scale on periods of widespread WSB outbreak in the Southern Rocky Mountains of Colorado. I hypothesize that the driver may be (a) above average summer moisture that increases foraging availability, (b) drought that increases foraging quality, or their temporal interaction. To address these hypotheses, I will present preliminary analyses from a multicentury record of WBS outbreak derived from tree-ring methods. I will then contrast these findings with existing research.

Application of high-resolution satellite imagery to classify treeline conifer species in Rocky Mountain National Park – Laurel Sindewald

Since the launch of Landsat 1 in 1972, Landsat has provided an important, continuous dataset for monitoring agriculture, assessing forest fire extent and severity, and mapping landcover among other applications. Until recently, however, the spatial, radiometric, and spectral resolution of satellite imagery have been too coarse to be useful for distinguishing or mapping plant species in mixed communities. Species-level classification can be done using hyperspectral imagery in combination with lidar collected from aircraft, but this approach is costly and impractical for large-scale studies. The use of high-resolution satellite imagery to estimate forest composition at the species level would enable mapping of tree species at fine scales over large distances for a fraction of the cost. Treeline communities in general are not well-characterized by species because of inaccessibility. We are exploring the use of 1.24 m resolution, 8-band multispectral imagery from Maxarâ's WorldView-3 satellite to distinguish limber pine (Pinus flexilis) from Engelmann spruce (Picea engelmannii) and subalpine fir (Abies lasiocarpa) in treeline communities in Rocky Mountain National Park.

How does land tenure drive rural land cover change: Evidence from buffer area communities surrounding protected areas in Madagascar – Stephen Chang

Local communities are deeply affected by the way they can interact with land and natural resources. Land tenure, livelihood choices, ecosystem services, and economic factors are all intricately connected on many scales, from local to global. Although only in my first semester, my research attempts to clarify the link between land tenure and land cover change in the environs of several protected areas in Madagascar. By incorporating data from different rapid and participatory rural appraisal methodologies collected in the late 1990s by a team of diverse interdisciplinary and international researchers with remote sensing methodologies, I intend to shed some light on the relationship between different tenure systems and socioeconomic factors existing within rural communities and the corresponding changes in landcover. Understanding the complex linkages between rural livelihoods and natural resources is essential to making prudent land management decisions that help societies remain resilient in the face of increasing climate uncertainty.

Variation in Benthic Littoral Zone and Pelagic Algal Productivity in the Sierra Nevada, California – Caitlin Charlton

Observations of benthic algae have increased in recent years across mountain lakes in the western United States, similar to lakes across the globe. While there is quantitative knowledge on the effects of nutrient pollution and warming temperatures on increasing overall lake productivity, knowledge of what drives variation in benthic productivity between lakes is largely unknown. Littoral zone benthic incubation experiments were performed in lakes across Sequoia and Yosemite National Parks during summer 2018 and 2019 to estimate benthic gross primary productivity (GPP), capturing a drier, warmer year (2018) and a wetter, cooler year (2019). Benthic GPP varied by an order of magnitude between lakes (0.02 – 2.50 ug O2/cm^2/hr). Pelagic chlorophyll a values were on the order of ultra-oligotrophic (0.05 – 3.15 ug/L). Despite different climatic conditions between years, GPP values correlated most strongly with total dissolved nitrogen (TDN), total dissolved phosphorus (TDP) and basin aspect, where as chlorophyll a most strongly related to TDN, surface water nitrate and annual precipitation. The lack of correlation between benthic and pelagic productivity suggests that pelagic productivity is more strongly influenced by climatic factors, whereas littoral habitats are more directly influenced by nutrient fluxes.

Uncovering mechanistic underpinnings of regenerative farming systems on soil organic carbon – Aaron Prairie

Regenerative farming practices such as no-till, diversified cropping rotations, reduced synthetic input, cover crops, and livestock integration systems have the potential to address worsening trends in soil degradation and climate by enhancing soil organic carbon (SOC) and reducing GHG emissions, but they are rarely considered together on a system level. SOC is very complex and requires separation into multiple components with contrasting properties and behavior in order to study and predict its dynamics. Separating SOC into particulate (POC) and mineral-associated (MAOC) forms, two SOC components that are fundamentally different in terms of their formation, persistence, and functioning, is now recognized as the leading strategy to understand and predict broad-scale SOC dynamics to provide recommendations to managers and policymakers. We will quantify POC and MAOC stocks in soils collected from 24 farms (96 fields) enrolled in the General Mills regenerative agriculture initiative in Kansas. Combining

SOC pools data with management, soil health, and biodiversity data we will advance our understanding of the mechanisms promoting SOC storage, and quantitatively assess the ability of a range of regenerative agro-ecological approaches to stimulate long-term SOC sequestration, as well as maintain soil health.

Bird diversity in relation to vacant lots and unmaintained parks in inner-city Detroit – Michael Barker

Detroit is a post-industrial city that has experienced rapid rates of human population decline, resulting in a large number of unmaintained parks and vacant lots. While emerging evidence suggests that vacant lots may have deleterious effects on human health, little is known about the value of these features for providing avian habitat. Understanding how to restore these areas to foster a higher abundance and diversity of birds could benefit both human health and local biodiversity. We evaluated species richness and diversity of the avian community in 9 unmaintained parks from 2019-2020. We collected passive acoustic recordings in June or July of each year and counted vocalizations of each avian species identified in spectrograms. We examined the relationship between species diversity from acoustic recorders and those derived from eBird citizen science checklists. Using modelled avian diversity across Detroit, we tested the influence of the density of vacant lots, unmaintained parks, and vegetation type and structural complexity from the Normalized Difference Vegetation Index (NDVI). We conclude that restoring vegetation structure in unmaintained parks and vacant lots could benefit urban avian populations. Restoration projects should be co-developed with local communities to ensure benefits for birds and neighborhood residents.