Twenty-sixth Annual All Scientists Meeting and Poster Symposium
Friday, January 12, 2024
ASU Skysong, Building 3, Synergy I & II

8:30 a.m. **Registration/Breakfast**

9:00 a.m. **Introductions, State of the Program Address, CAP Service Awards**
Dr. Dan Childers, Director, CAP LTER and Professor, School of Sustainability

Introduction
Dr. Francisco (Paco) Moore, Program Director, LTER Division of Environmental Biology, National Science Foundation

CAP JEDI Committee Update

ASU Community-Driven Archives Presentation
Jasmine Torrez **&** Jessica Salow, Archivists

9:45 a.m. **Keynote Presentations**

"What Happens After the Land Acknowledgement Statement? Building Community with Indigenous Partners in the CAP LTER Region"
Dr. Michelle Hale, Teaching Professor in ASU American Indian Studies program

"Drivers of Ecological Change in Cities: Backyards Matter!"
Dr. Margaret Stanley, School of Biological Sciences – Te Kura Mātauranga Koiora | University of Auckland – Waipapa Taumata Rau

Q&A, Led by Dan

10:45 a.m. **BREAK**

11:00 a.m. **Poster Session**

12:00 p.m. **LUNCH**

1:00 p.m. **CAP V Integrated Research Theme (IRT) Updates**

Ecosystem Structure & Functioning (Leads: Ball, Grimm, & Hartnett)
Adapting to City Life (Leads: Bateman, McGraw, and Schell)
Urban Climate & Air Quality (Leads: Fuller, Hondula, and Vanos)
Environment & Human Wellbeing (Leads: Clark, Coseo, and Hale)
Governance & Just Transitions (Leads: Berbes, Cook, Iwaniec, Meerow, and York)

2:15 p.m. **BREAK**

2:30 p.m. **Community Time**

Introduction
Monique Franco, Education and Outreach Manager, CAP LTER

Guest Presentations:
Jorge Morales Guerrero (they/he) - Chabochi/Mestize/Mexicane, Postdoctoral Research Scholar, School for the Future of Innovation in Society
Julian Zepeda - Chispa AZ, Senior Community Organizer
Reggie Carrillo (he/him) - Chicano-Mexican American-AZ(LAND) CEO + Founder
Vanya Bisht - AzLand (Research Communications) and Postdoctoral Fellow, University of Waterloo

Q&A, Led by Monique

3:30 p.m. **Equity Circle**

4:30 p.m. **Final announcements and wrap-up > CAPpy Hour @ Trevor's Bar and Lounge**

2024 CAP LTER Poster Symposium
Book of Abstracts

Posters are listed by presenter.

Graduate Students

Undergraduates

Faculty

High School Students

Staff

Community Member

Postdoctoral Student

Crichlow, T.[1]., P. Coseo[2], C.T. DesRoches[1,3], R. Melnick[1], D. Pataki[1]. *Neighborhood Tree Satisfaction for Environmental Justice*

IRT: Environment and Human Wellbeing

Environmental justice (EJ) requires a fair distribution of benefits, meaningful participation in the decision-making process, and recognition of marginalized individuals' unique needs and preferences. In cities across the US, the distribution of trees tends to disproportionately advantage white and affluent residents, which constitutes an environmental injustice. Methods of determining tree canopy distribution usually rely on GIS and Census data alone, leaving participation and recognition out of consideration. Measuring satisfaction with trees offers a more complete picture of how trees and their benefits are distributed. This research uses the 2021 Phoenix Area Social Survey data to analyze the relationship between tree canopy and satisfaction with neighborhood trees and both the individual and the neighborhood level. Linear regression with control variables (income, race, college attainment, and homeownership) and interactions were used. Results indicate that tree canopy is only significant in 7 of 30 models. This suggests that tree canopy somewhat explains tree satisfaction, but the variables income, race, college attainment, and homeownership are more significant. This indicates that to understand EJ implications of tree canopy, researchers should look at more than simply the spatial distribution of trees.

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[3] School of Historical, Philosophical & Religious Studies, Arizona State University, PO Box 874302, Tempe, AZ 85287-4302

Ferguson, M. J. [1], E. Vivoni[1], and E. Saffell[2], *Drivers and Trends in Pan Evaporation for an Arid Urban Environment*

IRT: Urban Climate and Air Quality

According to climate models, warming trends in the southwestern United States will lead to significant increases in evaporation rates from the land surface and open water bodies. Nevertheless, the low number of long-term, operational Class-A pan evaporation devices in the region hinders the ability of the scientific community to ascertain these projected outcomes. Pan evaporation devices provide an integrated measure of local atmospheric water demand and can be used to estimate evaporation losses from open water bodies. In this study, we analyze data from the only currently operational long-term Class-A pan in the Phoenix metropolitan area within central Arizona. Through exploratory data analysis, we reveal intra-seasonal to inter-annual time scale trends and identify linkages to atmospheric drivers, including air temperature, wind speed, atmospheric humidity, and solar radiation, drawn from nearby meteorological stations. Datasets from a short-term eddy covariance station installed in a well-watered turf grass in Phoenix are compared to concurrent local pan evaporation measurements to derive a

location-specific pan evaporation coefficient. Furthermore, we compare pan evaporation estimates to a number of established meteorological variable-dependent evaporation equations to assess their utility for open water evaporation rates. Understanding the drivers and trends in pan evaporation rates in an arid urban environment is considered useful for water budget calculations for artificial lakes, open canals, and residential pools and may provide further insight on evaporative demands under periods of extreme heat waves and for future climate conditions.

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Gilman, J.[1] and J. Wu[2], *Identifying broken linkages coupling water availability and dryland urbanization for sustainability: The case of the Phoenix Metropolitan region, USA*

IRT: Environment and Human Wellbeing

One third of the world's largest cities are located in drylands, where much of future urbanization is projected to occur. This is paradoxical and unsustainable considering water scarcity in drylands, which is exacerbated by climate change. Thus, it is critical to better understand why and how dryland urbanization and water scarcity are decoupled so that sustainable measures can be designed. Focusing on the Phoenix Metropolitan Area (PMA) of the United States, we addressed the following questions: 1) What are the relative influences of water and economic factors on urbanization in recent decades? 2) Which linkages connecting water storage to urban development have been decoupled? and 3) How can water availability and development be better coupled to improve regional sustainability? We tested the relationships between economic factors, water availability, and urbanization, with Pearson Correlation Analysis and Structural Equation Modeling. We found that, from 1986 to 2019, urban population growth and urban land expansion in the PMA were driven by economic factors, and not influenced by fluctuations in water supply. We identified specific broken linkages among water storage, water deliveries, municipal water supply, and urbanization, which must be coupled to enforce water availability constraints on urban expansion in the context of climate change. Our study has important implications for dryland urban sustainability as urbanization on borrowed water is, by definition, unsustainable.

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McGraw, K.[1] and R. Hammond[1], *Comparative ecophysiology of doves in the desert: impacts of season, sex, and habitat urbanization*

IRT: Ecosystem Structure and Functioning, Adapting to City Life, Environment and Human Wellbeing

Extreme (e.g. deserts) or rapidly changing (e.g. urban) environments provide natural laboratories to investigate how organisms physiologically cope with challenging conditions. Areas that are home to both types of environment (e.g. urban desert) and to closely related species allow for excellent, comparative tests of how challenging environments may similarly or differently shape organismal physiology. Here we studied several physiological parameters – levels of circulating glucose, ketones, and carotenoids, as well as body condition – in two congeneric species of dove (mourning dove, *Zenaida macroura*; white-winged dove, *Zenaida asiatica*) that inhabit urban and suburban environments in the Phoenix, Arizona metropolitan area. During the breeding season of 2023 (May-August), we specifically examined whether there were similar or different effects of month, sex, and habitat type (urban v. suburban) on these physiological parameters in the two dove species. We found several consistent patterns in both doves: (1) males circulated a higher concentration of plasma carotenoids than females, (2) males were in better body condition (higher residual mass) than females, and (3) urban doves circulated a lower concentration of ketones in blood than did suburban doves. However, we also found two different trends between the species – unlike in mourning doves, male white-winged doves circulated higher levels of glucose than females, and in white-winged doves we found month-to-month differences in levels of both ketones (spiking in July, a record-breaking month for intense heat in the area) and a circulating carotenoid (b-cryptoxanthin, which steadily declined from May-August). In sum, these results reveal several consistent physiological patterns in congeneric dove species, despite notable life-history differences between them (e.g. white-winged doves are neotropical migrants and significantly larger in body size than mourning doves), though we found some nuanced differences in physiology that may relate to the unique life-histories of the two species (e.g. thermal sensitivity, winter migratory diet).

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Nguyen, O. L. [1], D. Childers[2], J. Haight[1], and J. S. Lewis[3]. *The effects of the COVID-19 pandemic on human behavior and wildlife populations along the gradient of urbanization.*

IRT: Adapting to City Life

Humans can influence wildlife populations and behavior through structural and behavioral disturbances, which vary across the gradient of urbanization. Although anthropogenic structural disturbances are relatively static for a given period, human activity can be dynamic on daily and seasonal scales, which can affect wildlife. The sudden onset of the COVID-19 pandemic created a

unique opportunity to evaluate how a rapid change in human behavior affected wildlife populations along the gradient of urbanization. Using a before-after-control-impact (BACI) study design, we evaluated how changing human behavior influenced wildlife species by comparing time periods before and during the COVID-19 pandemic. The objectives of this project were to utilize data gathered from 50 wildlife cameras distributed throughout the Phoenix Valley, AZ to evaluate (1) how human behavior changed in response to the COVID-19 pandemic and (2) occupancy and daily activity patterns of wildlife species (i.e., bobcat, coyote, and Harris antelope squirrel) in response to changing human behaviors. We found that human activity increased in low levels of urbanization areas during the COVID-19 pandemic but did not change in highly urbanized areas. Despite the increase in human activity in low urbanized areas, wildlife species' relative habitat use was unchanged. However, species' daily activity patterns had varying results. Harris antelope squirrel exhibited increased diurnal activity in low urbanized areas, coyote exhibited increased nocturnal activity in highly urbanized areas, and bobcats did not demonstrate a response. This project can help us to better understand how structural and behavioral characteristics of humans shape wildlife populations along the gradient of urbanization.

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Polekoff, S. E.[1] and Deviche, P.[1] *Meta-analysis of oxidative stress in urban birds.*

IRT: Adapting to City Life

Urban environments expose their inhabitants to many potential stressors including chemical pollution, noise and light pollution, and increased disease vectors. These stressors can increase the organism's exposure to and/or production of pro-oxidants which, unless compensated by antioxidants, can result in oxidative stress and lead to physiological damage and pathologies. We meta-analyzed 23 published studies to test the hypothesis in urban birds that exposure to pro-oxidants is associated with elevated oxidative damage but also with upregulated levels of antioxidants and, therefore, not with a state of oxidative stress. We found in urban avian populations that pro-oxidant sources in plasma (ω-6 fatty acids and nitric oxide synthase) tend to be higher whereas antioxidant capacity tends to be lower than in corresponding non-urban populations. However, we did not observe consistent trends across studies in levels of specific antioxidants (endogenous or diet-derived). Furthermore, the level of oxidative damage varies seasonally, with urban birds sampled in late summer having less oxidative damage than corresponding non-urban birds; during the breeding and winter seasons, we observed no consistent trends. This difference may relate to studies sampling in late summer having been conducted in hot, arid regions. We also observed that when controlling for season, urban house sparrows, the species with the largest sample size, experience higher oxidative damage than non-urban sparrows. These analyses support the hypothesis that urban birds have higher pro-oxidant exposure than non-urban birds. They also suggest that urban birds have lower

antioxidant capacity and that differences between conspecific urban and non-urban populations are variable, possibly reflecting a role for factors such as the city location and the species considered.

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Price, P.[1], P. Coseo[1], and A. Middel[1]. ***Understanding The Ecological Design Benefits and Limitations of Rooftop Green Spaces To Reduce Heat Exposure For Vulnerable Residents***

IRT: Urban Climate and Air Quality

This study investigates the impact of rooftop green spaces on mean radiant temperatures (MRT) and thermal perception among older adults in a retirement community. Given the heightened vulnerability of older populations to heat-related health risks, the research explores the potential of green spaces in mitigating these risks through shade and vegetation. Examining the role of built structures, plants, irrigation, and evapotranspiration, the study employs a participatory approach, collaborating with residents to gather experiences and insights. The findings will contribute to an evidence-based understanding of rooftop green spaces and community gardens as nature-based design solutions for denser, more vertical desert cities. The research aims to generate design solution guidance, emphasizing benefits and limitations specific to the context of older adult community outdoor spaces.

Biometeorological data from the "MaRTy" mobile station and the new “MaRTiny” fixed station will be collected and compared to user thermal perceptions reported in survey and semi-structured interview responses. Transect routes will be co-created with residents, and resident focus groups will co-research heat experiences, with the goal of capturing perceptions and MRT conditions. Expected outcomes include valuable insights informing designers of urban neighborhoods and a better understanding of the benefits and limitations of this emerging rooftop green space typology in the context of heat-related issues in desert urban environments. The study seeks to provide guidance for designers, planners, and developers working towards creating more sustainable and healthful urban environments.

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Ramsey-Wiegmann, L.D.[1], Childers, D.L., Makings, E.[2], Bateman, H.[3], and Green, H.[4]
Combining Art and Ecology to Understand Changing Biotic Communities of the Urban Salt River.

IRT: Ecosystem Structure and Functioning, Adapting to City Life, Environment and Human Wellbeing

While most of the urban Salt River has been dry since Granite Reef Diversion Dam's construction, human activity provides water year-round to several parts of the riverbed, sustaining wetland landscapes in the core of one of the country's largest and fastest-growing urban areas. CAP LTER's Salt River Biodiversity Project has been monitoring these ecosystems since 2012 to understand how urbanization, climate change, and management affect plant and animal communities. At last year's ASM, I presented preliminary findings from the project, and this year I will provide a more comprehensive review of changes and trends in three of these urban wetlands. Each site's land use history and management approach shape plant and animal communities. This study reveals unique changes at each site–such as increasingly abundant grasses where feral horses graze and increasing bird diversity in restoration areas. Some overarching trends also were clear, such as the decline of reptile populations and increasing plant cover at urban sites.

To visualize these trends in a more experiential and artistic way, we also integrated printmaking, papermaking, and landscape management into our data visualizations. We collaborated with the City of Phoenix and Audubon Southwest to remove unwanted species from the Rio Salado Restoration Area and used these plants to make paper used for hand-printed community composition charts. These art pieces are on display at the Nina Mason Pulliam Rio Salado Audubon Center as a part of their outreach galleries. This art project created a space where researchers, land managers, the public, and the plants themselves can collaborate, integrating CAP's long-term research with the communities that call the Salt River home.

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Tarr, K.R.[1], M. Chester[2], D.L. Childers[3], and A. York[4]. ***A Social Ecological Technological Analysis of Urban Ecological Infrastructure for Stormwater Management in Phoenix, AZ.***

IRT: Adapting to City Life, Ecosystem Structure and Functioning

Urban ecological infrastructure (UEI) is defined as all parts of a city that support ecological structure and function. In the past 60 years, green urban ecological infrastructure for stormwater management has emerged as a viable alternative to traditional, gray infrastructure systems in the Phoenix metropolitan area. Advantages of using UEI over gray infrastructure include

providing multiple benefits with one system and increased flexibility and adaptability. These advantages are especially attractive in the face of rapid social and environmental changes affecting the Phoenix area, although the use of UEI in a semi-arid environment presents unique challenges. This project assesses the ability of a stormwater UEI system in Tempe, Arizona to prevent flooding and improve stormwater runoff water quality as well as reviews the design requirements for stormwater infrastructure in Phoenix. Water quality analysis was performed on stormwater runoff samples collected from a small-scale bioretention basin on Arizona State University's Tempe campus. In addition, hydrological parameters such as the quantity of runoff leaving the study site and soil moisture data were analyzed. The results indicated that the bioretention basin system was effective at managing water quality and flooding, although there were limits to the system's abilities to control flooding. These empirical data were complemented by a thematic content analysis of Phoenix's stormwater management plans and reports on these stormwater management plans to understand if stormwater UEI is incorporated into Phoenix's stormwater management strategies. The findings from this project provide insight into the performance of stormwater UEI in the Phoenix area and how these stormwater UEI systems may be represented by city design standards.

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Zhu, Q[1]., and K. L. Larson[1,2] ***Multi-scalar Drivers of Residential Vegetation Changes in Metropolitan Phoenix, Arizona***

IRT: Environment and Human Wellbeing

In the arid southwestern U.S., urban greening strategies have been promoted to alleviate ecosystem disservices associated with lawns, including the adoption of xeric yards with desert-adapted floras and gravel groundcover and wildlife-friendly yards with complex vegetation structure and composition. Scant studies have investigated the extent of different vegetation changes in urban greening practices and the complexity of associated human drivers. We addressed this gap by analyzing survey data from two survey periods (2017 and 2021) to answer the following questions: to what extent have residents from metropolitan Phoenix made different vegetation changes in their yards over the last decade, and how do multi-scalar human drivers affect different vegetation changes? We found a sustainable trajectory for residential vegetation changes in Phoenix since mid-2010s, with declining additions of grass and increases in trees and desert plants across residential neighborhoods. Aesthetics was an influential driver of both tree planting and native gardening. Additionally, tree planting was associated with anthropocentric values (i.e., low-maintenance needs), while desert plant additions reflected the appreciation of nature (i.e., attitudes towards the desert) and environmental concerns (i.e., supporting wildlife). Institutions such as local government programs might shape residents' vegetation choices, as tree planting differed among municipalities. We also found

counterintuitive influences of residential tenure controls on landscaping decisions. Specifically, renters were more likely to add yard trees compared to homeowners. Our results inform landscape sustainability by identifying potential pathways to residential yard changes that offer a multitude of services while being appreciated and maintained by residents.

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Ballantyne, B.[1], and J.C. Johnson[1]. *Phenotypic change across time in fire ants (S. xyloni) due to growing impervious surface area in Phoenix, AZ.*

IRT: Adapting to City Life

We used to assume that evolution by natural selection required an enormous amount of time to take place. But recent work on organismal responses to urbanization suggests that rapid evolution can occur. We looked to utilize 25 years of CAP LTER arthropod sampling data by measuring collections of the common fire ant, *Solenopsis xyloni,* across 12 urban and desert sites within the Phoenix Metropolitan area. We hypothesized that increased urbanization may impose strong selection on organisms and result in phenotypic change over this time period. A total of 1,150 samples were imaged and measured using ImageJ, and averages for each body part were taken for each year and site. Most body parts showed less than a 0.02mm change in size, while both the scape and antenna decreased by 0.09mm and 0.06mm, respectively. Antenna to body length ratio decreased by 0.016mm and club to body length increased by 0.007mm. These results suggest these morphological traits are relatively stable over this time period. Long term datasets such as these are necessary to search for evidence of rapid phenotypic change.

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Beltran, M.E.[1], and D. L. Childers[2,3]. *Exploring Tres Rios Wetlands through Soil and Plant Nutrient Dynamics.*

IRT: Ecosystem Structure and Functioning

Wetlands stand out as exceptionally productive ecosystems that hold a diverse array of species including insects, plants, and mammals, with a habitat rich in resources and environmental abundance. They also play a crucial role in supporting and benefiting humans by naturally improving our water quality, providing flood protection, and creating opportunities for recreational activities. Given the advantages provided by wetlands, they have grown to be of particular interest in urban settings. With Arizona's growing population and an escalating demand for resources, particularly water, establishing resilient infrastructure capable of long-

term maintenance and meeting residents' needs is vital for living in Arizona and cities with similar environments. A good portion of the current research on wetlands reviews them in temperate climates, leaving a visible gap in understanding their dynamics in arid environments like Arizona. In working in the Wetland Ecosystem Ecology Lab (WEEL), we aim to review soil and plant nutrient data collected from the Tres Rios Wetland in Phoenix, AZ. This work is also valuable knowledge for cities with similar climates and aids in reviewing the overall dynamic of the system. Additionally, evaluating aspects of the plant community within a constructed wastewater treatment wetland is valuable in determining the system's productivity and health. This knowledge serves as a foundation for enhancing ecosystem management and improving current practices in constructed wastewater treatment wetlands, thereby contributing to a more sustainable and resilient environment in the future for urban environments.

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Beltran, M.E.[1], and K. L. Larson[2,3]. *Demographic Influences on Attitudes toward Bats and Other Pollinators*

IRT: Environment and Human Wellbeing, Adapting to City Life

Pollinators occupy a crucial place in facilitating essential plant reproduction processes, thereby supporting plant diversity and productivity and agricultural productivity. The range of pollinator species is broad, including vertebrate pollinators like bats and birds. Despite their critical role, global attitudes and support of certain pollinators seem to vary within communities, influencing our approach to addressing environmental threats and implementing protective measures. Bats, among these pollinators, have garnered an unfavorable public perception established by their overall image in cultures and media, and connection to zoonotic diseases. Simultaneously, they face threats like urbanization and impacts of climate change on their communities. Current research on bats primarily focuses on addressing their economic and ecological contributions, while social science studies examine the relationships among people’s knowledge, experiences, and attitudes. A deep understanding of how demographic factors contribute to negative attitudes is vital for implementing bat conservation strategies efficiently within local communities. Our study seeks to review how attitudes among metro Phoenix residents vary across multiple pollinators by using 2021 Phoenix Area Social Survey (PASS) responses. We will also examine how these attitudes align with specific demographics, particularly within Hispanic communities. Specifically, residents were asked to indicate their level of dislike or like of four pollinators, bats, bees, butterflies, and hummingbirds on a 5-point scale. From the survey analysis, we found that respondents primarily had stronger dislike for bats and bees. Hispanic residents were also shown to have a higher dislike of all pollinators, which was strongest for bats and bees. Obtaining these insights on how ethnicity and other demographics affect feelings

towards pollinators can aid in conservation initiatives to protect animal populations while addressing public views and potential concerns.

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C. Henry[1], N.Doud[1], and K.L. Larson[2]. *Residents' attitudes toward distinct wildlife: The role of Wildlife Values and Desert Affinity*.

IRT: Environment and Human Wellbeing, Adapting to City Life

Residents' attitudes towards wildlife impact the way species are managed and protected within urban landscapes. Measuring support or opposition towards different wildlife species is important for adjusting management to better reflect and address constituents' views of wildlife. Research evaluating attitudes towards different desert species in Phoenix and other metropolitan regions is lacking, and an understanding of how attitudes vary across taxa can further the potential for human-wildlife coexistence within urban landscapes. This study seeks to identify how urban residents' attitudes vary across native wildlife found within the Phoenix area, including the Desert Tortoise, Roadrunner, Quail, Jackrabbit, Gila Monster, Javelina, and Rattlesnake. We also examine how attitudes toward different wildlife relate to wildlife value orientations and desert affinity. Factor analysis distinguished between attitudes toward benign (Desert Tortoise, Roadrunner, Quail, and Jackrabbit) versus potentially threatening (Gila Monster, Javelina, and Rattlesnake) wildlife. Among the wildlife value orientations, protectionism and appreciation most influenced support for benign wildlife such as the Roadrunner and Quail, whereas the domination beliefs most affected opposition to protecting Rattlesnakes and Javelina. Residents' stronger connections to the desert, measured as desert identity, were most linked to greater support for iconic desert wildlife, including the Gila Monster, Desert Tortoise, and Roadrunner. To foster coexistence, conservationists could emphasize the protection of appreciated, iconic wildlife such as the Desert Tortoise and Roadrunner, whereas they need to manage negative sentiments and potential interactions with Rattlesnakes and Javelina.

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Claus, A. L.[1] and Johnston, M. A.[1] *Capturing Carabid Diversity Over Time: The Necessity for Long-Term Sampling*

IRT: Ecosystem Structure and Functioning

How much sampling is needed to understand ground-dwelling arthropod communities? We examined data from NEON, or the National Ecological Observatory Network, which collects long-term ecological data from 47 terrestrial sites across the United States in order to examine ecosystem change over time. NEON's carabid collection utilizes pitfall traps at each terrestrial field site, and sampling occurs biweekly. Sampling data is used to estimate species totals within a given ecosystem; the length of sampling is critical in order to provide an accurate estimate of species diversity. We examined NEON carabid data from each of the field sites and looked at those beetles specifically identified by an expert taxonomist. We explore how long it takes to fully sample carabid diversity at a field site and find that, on average, it took 4.9 years to get to 90% of the current known species totals at these sites. This provides an important baseline for future sampling and suggests that studies attempting to track community changes in ground-dwelling arthropods sample for a minimum of 5 years in order to capture the majority of species in that area.

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Fenlon, A., K. Cortes-Hernandez, M. Prebus, N. Upham, D. Rivera, and D. Rowsey. *Species Boundaries of Montane Forest Peromyscus of the Santa Catalina Mountains* (Rodentia: Cricetidae)

IRT: Ecosystem Structure and Functioning

The Madrean Sky Islands of southeastern Arizona are reservoirs of regional biodiversity. Historically, their critical position between the Mogollon Rim and the Sierra Madre Occidental has established the montane archipelago as a bridge between the United States' and Mexico's montane biotic communities, yet the region's mammals are understudied despite this significance. *Peromyscus melanotis*, the black-eared deer mouse, is implicated in this unique biogeography, for it is contested whether its range extends from the Sierra Madre Occidental into the Sky Islands. Morphological data refute this hypothesis, yet mitochondrial data support it. Here, we employ Bayesian inference with nuclear genetic data from Sky Islands individuals and other Mexican *Peromyscus* to definitively test for *P. melanotis*' presence, which will have consequences in wildlife management, Madrean biogeography, and southwestern mammal systematics. We describe our planned approach, expectations, and progress in the project thus far, with attention given to how the complex taxonomy of the widespread genus *Peromyscus* complicates the question of this montane rodent's presence.

Gentry, Z.[1,4], A. Cázares[1,4], S. C. Hess[2], M. Clark[2], L. Caughman[2], M. Hale[3], and N. Grimm[2].
Living Lands: Co-creating a Storytelling Game to Nurture River Relations and Language-Learning Along the Salt River

IRT: Environment and Human Wellbeing

The Salt River flows through what is currently called the City of Phoenix. This river holds great cultural and ecological significance to the Akimel O'odham, Piipaash, Yavapai, and Ndee peoples. However, damming and diversion have degraded much of the river, divesting Piipaash and Akimel O'odham farms of water, and eroding the ability of all nations to maintain relationships with this unique ecosystem. Rapid urbanization and sprawl have since led to further habitat loss, altering relations with both the riverbed and outlying desert. Indigenous youth are arguably the most impacted, as they navigate a legacy of assimilation and theft of ancestral riverine homelands.

To address the interlinked issues of cultural erasure, nature literacy, and language loss, this project uses a game that is co-developed with native teens and O'odham educators to strengthen relationships with the Salt River. In this game, players assume the roles of various animals that inhabit the river, and navigate a mosaic of human-environment interactions while trying to meet their own needs. By telling stories about the Salt River's inhabitants and reading their original names, players practice the O'odham language and learn about one another's relationship with the environment through Indigenous Storywork. The project ultimately aims to renew healthy relations with the river, challenge colonial narratives, and nurture a sense of kinship and understanding in indigenous youth as the next generation of river stewards. To acknowledge stories as data and respect Indigenous data sovereignty, the O'odham-language version of the game is held within the Salt River Schools system (an extension of the Salt River Pima-Maricopa Indian Community.)

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Sophia Koutsogiannis[1], Nathan Upham[1], and Dakota Rowsey[1], ***Bringing Dark Mammalian Trait Data to Light Through Standardized Digitization***

IRT: Ecosystem Structure and Functioning

Data that exist within an organization's system but remain unreachable to the public, also known as dark data, are considered a serious setback to scientific research. Too often, data remain solely in the database of a single organization's physical files, unable to be accessed by those who can't physically reach it. Such is the case with trait data associated with mammal natural history specimens, which are recorded on natural history specimen tags, field notes, and other

data sources archived in natural history collections, but are rarely available in digital form. The goal of the RANGES trait data project is to bring the individual level trait data that exist solely in the collections of many institutions to light through the process of digitization. I have developed and undertaken a comprehensive digitization workflow incorporating specimen tags and field notes of voucher specimens held in the Arizona State University Mammalogy Collections so that the information contained in them can be accessed, referenced, and used by other scientists worldwide. So far, I have been able to digitize a total of 112 of our approximately 9300 specimens, 111 of which had unique data associated with them that had yet to be uploaded online. So far these data include 28 species from 10 families. The data I am making available to the public will prove immensely useful in answering a number of research questions ranging from reproductive fecundity to evolutionary and ecological change over time, to differences in phenotypes in and between species, and more. When combined with the broader dataset from other participating institutions, my work will help establish more effective baseline trait data and ways of digitizing those data for other collections and future specimen records.

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Haden Pittson[1], and Kelli Larson[1,2], *In the Eyes of the Beholder: An Examination of Park Equity through the Lens of Resident Satisfaction*

IRT: Governance and Just Transition, Environment and Human Wellbeing

An under-considered factor in the study of park equity is residents' subjective views of parks. Our research explores the (in)equitable distribution of parks based on residents' satisfaction with different types of parks in local neighborhoods of metro Phoenix, AZ. Understanding public perceptions is critical to equitable park access because subjective views often determine park visitation more than objective metrics. To explore this research gap, we analyzed data from the 2021 Phoenix Area Social Survey (PASS) to answer the questions: 1) based on residents' subjective views, how (in)equitably distributed are different types of parks? and 2) how do sociodemographic factors affect park satisfaction along with park visitation and access measures? In this poster, we report the frequency of survey responses from two questions which generated six variables that reflect residents' perceptions of parks (i.e., the amount and quality of local parks, plus the amount of desert preserves) and visitation rates (i.e., to neighborhood parks, desert preserves, and lakes or other water bodies). To analyze the differences in residents' subjective views and usage of parks, we compared mean responses among different racial and ethnic groups for each variable. We found that Latinx residents visit all parks less than non-Latinx residents. Lastly, we ran a preliminary regression model to assess how visitation, various park access metrics, and socio-demographics affect residents' overall satisfaction with local parks. Our models showed that White residents were more satisfied than Latinx and Black residents local parks. The explanatory variables that most explained park satisfaction were park visitation and Latinx ethnicity. Other significant variables included race and age, and less so, distance to nearest park and income. These results suggest an inequitable distribution of park

satisfaction in the Phoenix area, which underscores the importance of incorporating residents' subjective views in park planning efforts.

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Nadia Upah[1] and Pierre Deviche[1], *Physiological Effects of Heat Exposure in a Native Bird*

IRT: Adapting to City Life

Climate change and urbanization are associated with increased ambient temperature. This increase may impact native species negatively, but whether this is the case is poorly understood, as are the underlying mechanisms. To address this question, we determined the effects of heat exposure ("heat stress") in captive House Finches, *Haemorhous mexicanus*, a species that is native to Arizona and is ubiquitous in urban environments. After a period of acclimation to captivity, birds obtained from the metropolitan Phoenix population were held in individual cages and exposed either to 95 C (n = 10; chronic heat stress group) or to 68 C (n = 10; control group) for three weeks. We measured the food intake, body mass, fat reserves, and blood parameters (plasma concentrations of ketone bodies, glucose, and uric acid) of each finch before (acclimation) and during the period of experimental treatment. Blood parameters were measured immediately after removal of a bird from its home cage and again after 30 minutes of mild acute stress (restraint). Acute stress increased plasma ketone bodies and glucose, and decreased plasma uric acid. Chronic heat stress influenced only plasma glucose, which was lower in experimental than in control finches. In addition, heat-stressed birds maintained higher fat reserves than control birds despite lower food consumption, suggesting reduced metabolic rate. The results suggest that this reduction is accompanied with preferential use of glucose over lipids as a source of metabolic energy. They are among the first to demonstrate metabolic adjustments to chronic heat exposure in a wild urban avian population.

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Urban, J.[1], G.J. De Leon[2], C. Livingston[2], R. Sainz[2], L.D. Steger[2], K. Yule[2], L. Zamora Chavez[2], and R. Liao[2], *Exploring the National Ecological Observatory Network (NEON) Biorepository Herptile Collections and Data*

IRT: Ecosystem Structure and Functioning

The Arizona State University (ASU) National Ecological Observatory Network (NEON) Biorepository serves as a vital data and sample resource for researchers interested in answering a variety of questions related to ecological and evolutionary change at a continental scale. The

NEON Biorepository at ASU was established in 2019 to archive the over 100,000 samples and specimens collected annually at NEON's 81 field sites, 9 of which are co-located with LTER sites, for the 30-year duration of the project. Currently housing over 450,000 samples comprising 60 unique collections, this project provides a diverse selection of samples to the research community. Focusing specifically on the NEON herptile collections, we aim to highlight the diversity of herptile species collected at the project's 47 terrestrial field sites. This collection can enhance our understanding of the drivers of herptile diversity, population dynamics, and geographical distributions. NEON's co-collection of a wide variety of rich biological and environmental datasets will further enable researchers to understand the diverse factors influencing how herptiles are responding and adapting to environmental alterations, such as climate change, and contribute valuable knowledge to inform conservation and management strategies.

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Wooden, J.[1], R. Liao[1], K. Yule[1], J.E. Taylor[1], L. Steger[1], *Building the National Ecological Observatory Network's Mammalian Parasite Collection*

IRT: Adapting to City Life

The National Ecological Observatory Network (NEON) is a continent-wide project dedicated to facilitating long-term monitoring and predictions of future ecological changes. NEON archives over 100,00 physical samples and specimens each year with the NEON Biorepository at Arizona State University, including the 600–800 small mammals collected annually from 45 terrestrial field sites. During preparation, mammal vouchers are examined for endo- and ectoparasites. To date 1,500 small mammal vouchers have been examined, resulting in the collection of 621 parasite samples. The ectoparasites range anywhere from ticks and mites, to lice and botflies! My role in this project is to image and identify the ticks and mites and to create a photographic guide that can be helpful in future studies of these important ectoparasites. Though NEON is in its early stages of full-scale operation, this ectoparasite collection is growing rapidly and the 30 year duration of NEON will provide powerful insights into the spatial and temporal patterns of small mammal-parasite associations. We invite you to explore this rapidly expanding and diverse repository of parasites and learn how the NEON parasite collection and pathogen data can support your research.

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Upham, N., D. Rivera, L. Zamora Chavez, G. De Leon, M. Pierce, S. Hall, J. Baez, M. Jones, D. Rowsey, *Investigating the island biodiversity of Arizona small mammals and their pathogens*

IRT: Ecosystem Structure and Functioning

Urban ecosystems are rapidly growing in central Arizona, spanning diverse patch types from yards to open-space parks and desert remnants. At the same time, the montane forests of nearby Madrean sky islands have been isolated from each other for many thousands of years. This array of habitat islands of varying ages and origins within a four-hour drive from metro Phoenix makes for a fascinating theater in which to study island biodiversity dynamics. Are classical biogeographic principles of species-area and -isolation effects sufficient to explain community assembly in urban islands relative to baselines from nearby natural habitat islands, or do non-analog outcomes result from the suite of human modifications to landscapes? Our research group at ASU is establishing the Arizona Island Biodiversity (AZ iBio) Project, a multi-taxon effort to investigate the extent to which different wild species are able to remain ecologically connected – exchanging both genes and pathogens – across varied habitat islands. We are planning to start rodent surveys in 2024 of urban habitat islands of metro Phoenix (sampling mainly at CAP LTER sites) and in montane pine-oak/conifer forests of the Madrean sky islands (specifically the Galiuros, Winchesters, Dragoons, and Chiricahuas). This work builds on pilot studies of rodents and shrews in the Santa Catalina Mtns conducted from 2021-2023 with the ASU Natural History Collections. We plan to continue and expand this work on small mammals, adding bat species to enable tests of how differing dispersal abilities predict inter-island connectivity patterns. Importantly, this work will constitute the first systematic surveys of small mammals at several of the sites, and the first efforts to preserve tissue samples (e.g., liver, kidney, lung, blood, feces) for metagenomic analyses of gene flow and pathogen sharing (i.e., sequencing of all DNA present in a given sample). At the project's core, we aim to test whether the extent of current genetic connectivity predicts the pathogens that are shared (i) among species; (ii) among individuals within species, and (iii) among tissue types within individuals. By conducting both urban-adjacent and montane habitat surveys, we aim to unify perspectives on these ecosystems under the framework of island biodiversity theory. In doing so, we will establish highly relevant baselines of genetic connectivity within species of rodents, bats, and shrews for conservation and management decisions in Arizona.

Wu, J.[1], *Landscape sustainability science: a transdisciplinary framework for studying and improving the urban-rural regional system.*

IRT: Environment and Human Wellbeing

Two observations motivate me to give this presentation. First, achieving urban sustainability should be the ultimate goal of all urban studies. But this has never been the case and still is not. Without a common goal, multidisciplinary and interdisciplinary studies of cities cannot

necessarily contribute to the understanding, much less improvement, of urban sustainability. Urban and rural areas are often treated as different types of ecosystems or landscapes, but in reality they depend on each other for survival and prosperity – in most if not all regions around the world. Second, it is easy to imagine that urban sustainability cannot be possibly achieved without the sustainability of its neighboring rural landscapes, and vice versa. Although studies focusing only on either urban or rural areas are needed, their contributions to regional and global sustainability are limited. Nevertheless, studying urban and rural areas together as an integrated regional (landscape) system is only in its infancy. To promote such studies, here I introduce a new transdisciplinary framework, Landscape Sustainability Science, which is a place-based, use-inspired science of understanding and improving the dynamic relationship between ecosystem services and human well-being in changing landscapes. At the core of landscape sustainability is the landscape pattern-ecosystem services-human wellbeing nexus that couples urban and rural areas through intrinsic linkages and extensive feedback loops. I will discuss the conceptual framework, core research questions, and key approaches of landscape sustainability science which can help promote a new generation of "urban" ecological and sustainability studies that actually go beyond the urban boundary to embrace the coupled urban-rural regional landscape.

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Kelley, A.[1], Stephenson, A.[1], Zhan, C.[1], Nair, G.[1], Rodriguez, I.[1], Rodriguez, J.[1], Santiago-Aguiluz, J.[1], Jiminez, J.[1], Smith, L.[1], Monjaraz, N.[1], Roza, N.[1], Varahagiri, S.[1], Ostman, R.[2], Pilarski, N.[3], and Weller, N.[2]. ***Make Games, Save the Planet: A Teen-developed Video Game about Drought and Sustainability***

IRT: Governance and Just Transitions

The goal of the Make Games, Save the Planet program is to use games and storytelling to raise awareness for important issues that affect everyone, and give young people a voice in fixing these issues. We are a group of twelve teens that have come together to create a video game highlighting the effects and complexities of drought. Our game, 2175, is a choice-action game that follows a newcomer to the city. They learn about the water regulation system they live in, and work to learn the truth about the severe drought they coexist with. We focus on the political, economic, and social issues surrounding drought through a water trading system that shows the struggles of this drought-ridden future, as well as potential paths forward. Our team worked in two groups. The narrative group worked on the story, the mechanics, the choices, and the characters. The design team worked on the environments, design, and the art style. By the spring 2024, we will have a playable game that we will test with students in high schools around Arizona. By the summer, we hope 2175 will be available in game stores such as Steam for everyone to play and enjoy. This poster will share more about our process, the game, and our plan for testing the game with varied audiences.

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Munoz Encinas, M.[1], Vanos, J.[1], and Guardaro, M.[1], **An Overview of HeatReady Initiatives – Addressing Extreme Heat Challenges.**

IRT: Environment and Human Wellbeing, Governance and Just Transitions

The HeatReady Initiatives — comprising HeatReady Schools, HeatReady Neighborhoods, and HeatReady Cities—strategically confront the multifaceted challenges posed by extreme heat while emphasizing community resilience and equity.

Within the HeatReady framework, HeatReady Schools emerge as pivotal community hubs, shaping the safety and well-being of students, educators, and families. Recognizing the profound impact of heat conditions in schools on the broader community, this initiative, initiated in 2017, aims to formalize and enhance school heat preparedness. By investigating key factors for becoming HeatReady, including perceptions, reactions, and mitigation strategies during heat emergencies, the program seeks to establish guidelines and strategies for safer learning environments.

Complementing this effort, HeatReady Neighborhoods delve into community-driven strategies, leveraging neighborhood assets to address extreme heat challenges. Through collaboration with community groups, engaged citizens, and neighborhood organizations, the initiative optimizes the "heat resource shed," tailoring interventions to community needs, especially in areas affected by inequities.

Meanwhile, HeatReady Cities, led by Phoenix's Office of Heat Response and Mitigation (OHRM), spearheads comprehensive efforts to combat urban heat in one of the hottest U.S. cities. The OHRM focuses on heat response and mitigation, coordinating year-round programs and policies to lower urban temperatures and safeguard public health. Collaborating with various entities, it tracks trends, collects vital data, and shares innovative solutions, contributing to a collective effort to address the challenges posed by extreme heat.

These HeatReady Initiatives underscore the significance of preparedness, response, and collaboration in mitigating the health risks linked to extreme heat. By investing in community engagement, policy implementation, and data-driven strategies, the Phoenix Metro Area endeavors to build resilience and foster equity in the face of escalating heat-related challenges.

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Earl, S. R.[1,2] *ASU and CAP LTER research data solutions*

The Arizona State University (ASU) Research Data Management Office (RDMO), the ASU Library, and CAP LTER Information Manager offer research data management services and technology solutions for ASU research projects. This research data management team can assist with, among others, the preparation of data management plans, undertake technology needs assessments for your project, provide subsidized computing resources and data storage, and assist with data publication. Here, we provide information about these services and how to access them.

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Uhey, D. A.[1], Hofstetter, R. W.[1], Earl, S.[2], Dwyer[3*], J. M., Holden, J.[3], Sprague, T.[4], and Rowe, H[3,5]. *Living on the edge: The sensitivity of arthropods to development and climate along an urban-wildland interface in the Sonoran Desert.*

IRT: Ecosystem Structure and Functioning

The preservation of undeveloped land near urban areas is a common conservation practice. However, ecological processes may still be affected by adjacent anthropogenic activities. Ground-dwelling arthropods are a diverse group of organisms that are critical to ecological processes such as nutrient cycling, which are sensitive to anthropogenic activities. We studied arthropod communities in Scottsdale's McDowell Sonoran Preserve located in a heavily urbanized part of the Sonoran Desert, Arizona, U.S. We compared arthropod biodiversity and community composition at ten locations, one pair of sites in the Preserve interior and four paired sites of one urban edge and one interior site. In total, we captured and identified 25,477 arthropod individuals belonging to 287 lowest practical taxa (LPT) over eight years of sampling. This included 192 LPTs shared between interior and edge sites, with 44 LPTs occurring exclusively in interior sites and 48 LPTs occurring exclusively in edge sites. We found two site pairs had higher arthropod richness on the Preserve interior, but results for evenness were mixed among site pairs. Compositionally, the interior and edge sites were more than 40% dissimilar, driven by species turnover. Importantly, we found that some differences were only apparent seasonally; for example, edge sites had more fire ants than interior sites only during the summer. We also found that temperature and precipitation were strong predictors of arthropod composition. Our study demonstrates that climate can interact with urban edge effects on arthropod biodiversity.

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