23rd Annual

CAP LTER All Scientists Meeting and Poster Symposium

Thursday-Friday, May 6-7, 2021

Virtual

ASU Julie Ann Wrigley Global Institute of Sustainability
Arizona State University

LTER

NSF

CAP LTER Twenty-third All Scientists Meeting
and Poster Symposium
May 6 & 7, 2021

Thursday, May 6, 2021

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

9:15 a.m. **Keynote Presentation**
Dr. Jose-Benito Rosales Chavez, Assistant Professor, School of Geographical Sciences and Urban Planning, Arizona State University.

10:00 a.m. **Interdisciplinary Research Theme (IRT) Updates #1**

Water and Fluxes – Becky Ball
Urban Design – Paul Coseo
Scenarios and Futures – Marta Berbes, Elizabeth Cook, Nancy Grimm, and David Iwaniec
Governance & Institutions – Dave White & Abigail York

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

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

12:30 p.m. **Theatre of the Oppressed – Hosted by the CAP LTER Justice, Equity, Diversity, & Inclusion (JEDI) Committee**

2:00 p.m. **Announcement of Poster Results / End**

Friday, May 7, 2021

09:00 a.m. **Interdisciplinary Research Theme Updates #2**

Parks & Rivers – Heather Bateman & Jesse Lewis
Residential Landscapes & Neighborhoods – Kelli Larson & Susannah Lerman
Climate and Heat – David Hondula
Adapting to City Life – Kevin McGraw & Paige Warren

10:00 a.m. **Equity Circle with the CAP LTER JEDI Committee**

11:00 a.m. **BREAK**

11:15 a.m. **CAP Service Award / CAP V Presentation + Q&A**

12:00 p.m. **End**

2021 CAP LTER Poster Symposium

Posters are listed alphabetically by first author. *Indicates a graduate student poster and **undergraduate student poster.

**Asrari
**Avilez, Davitt, and Siefert
Bateman et al
*Bearman et al
*Bisht et al
Brown et al
*Clark and Johnson
*Cocroft and Hall
*Dwyer and Lewis
Earl
*Elser et al
**Encinas et al
*Gholami et al
*Haight et al
Hartnett et al
*Helmrich and Elser
Lewis et al
**Liddle et al
*Polekoff et al
*Schneider and Cordova
Sauer et al
*Trakas et al
Vanos et al
**Williamson and Ball

Keynote Speaker Bio

Dr. Jose-Benito Rosales Chavez is an assistant professor in the School of Geographical Sciences and Urban Planning at Arizona State University. He obtained his Masters in Public Health in Nutrition from the University of Minnesota and his Ph.D. in Global Health from Arizona State University. He studies the food environment with a focus on community development, access to food, culturally relevant food sources, eating behaviors, health outcomes, and social determinants of health.

Working with underrepresented populations: Availability, density, and distribution of street food stands

This presentation explores street food stands. Street food stands are an element of the food environment where ready-to-eat foods and beverages can be purchased. Street food stands are an important source of food and income for millions of people in low- and middle-income countries. While street food stands can be studied using a food justice, food access, sustainability, or structural violence approach, most studies have focused on the link between street food consumption and food-borne diseases. Additional research is needed to understand the role that street food stands play in the food environment. In this presentation, the availability, density, and distribution of street food stand throughout a Mexican city will be discussed. This presentation will also cover challenges and solutions when working with underrepresented populations such as street food vendors.

List of Posters

***Indicates graduate student poster and ** indicates undergraduate student poster.**

ADAPTING TO CITY LIFE

****Asrari, Hasti. *The effects of urbanization on the gut microbiome of an urban arthropod pest, the western black widow spider*.**

Bateman, Heather, Jeff A. Brown, Kelli L. Larson, Annika Enloe, Riley Andrade, and Bryan Hughes. *Unwanted residential wildlife: Evaluating social-ecological patterns for snake removals.*

Clark, Ryan, and J. Chad Johnson. *Spiders in the desert, city and laboratory: What the behavior of black widows can teach us about the impact of urbanization.

***Cocroft, Alexandreana, and Sharon Hall. *Assessing the influence of income and ethnicity on wildlife in residential neighborhoods*.**

Dwyer, Jessie M., and Jesse S. Lewis. *Urban association of bats varies seasonally in relation to forage and water availability.

Haight, Jeff, Sharon J. Hall, and Jesse S. Lewis. *Wildlife communities respond to urban landscape characteristics across the Phoenix metropolitan area.

Lewis, Jesse. Kate Weiss, and Zachary Ziebarth. *Wildlife populations in relation to urbanization and landscape features along the Salt River Valley, Arizona*.

Polekoff, Sarah, Wan Rong Chua, Ray Pressman, and Pierre Deviche. *Exploratory behavior of urban and desert House Finches.

Vanos, Jennifer, Chingwen Cheng, Paul Coseo, Aaron Hess, Allison Ross, Adora Shortridge, Steven Zuiker, Elizabeth Ferguson, Annette Schmidt, Brian Winsor, and Victoria Garrison. *Reimagining outdoor play and learning environments in South Phoenix: An overview*.

CLIMATE AND HEAT

Gholami, Mansoureh, Alberto Barbaresi, Ariane Middel, Daniele Torreggiani[1], and Patrizia Tassinari. *Evaluating the impact of urban trees on thermal comfort in Imola, Italy and Tempe, USA.

Li, Rui and Mikhail Chester. *Repurposing Mesoscale Traffic Models for Insights into Traveler Heat Exposure Mitigation: ICARUS and the case of Phoenix.

Schneider, Florian A., and Johny Cordova. *COPE Phoenix - COol Pavement Evaluation Phoenix.

EDUCATION AND MANAGEMENT

Earl, S. R. ***CAP LTER informatics: Data management for project investigators and the scientific community*****.**

GOVERNANCE AND INSTITUTIONS

Helmrich, Alysha, and Stephen Elser.** ***Green infrastructure for the Anthropocene: An early career perspective.

PARKS AND RIVERS

Cocroft, Alexandreana, and Sharon Hall.** ***Assessing the influence of income and ethnicity on wildlife in residential neighborhoods**.**

Dwyer, Jessie M., and Jesse S. Lewis.** ***Urban association of bats varies seasonally in relation to forage and water availability.

Haight, Jeff, Sharon J. Hall, and Jesse S. Lewis.** ***Wildlife communities respond to urban landscape characteristics across the Phoenix metropolitan area.

RESIDENTIAL LANDSCAPES AND NEIGHBORHOODS

****Avilez, D., Davitt, D., Siefert, J., Encinas, Z., Larson, K.L., Brown, J., and Morales-Guerrero, J. Residents' Attitudes and Experiences with Urban Wildlife: Implications for Human-Wildlife Coexistence.**

Brown, J.[1], S. J. Hall[2], S. Lerman[3], K. Larson[4], and A. Cocroft[2]. ***Perceptions or presence: investigating individuals' Reporting of mosquitoes as a problem*****.**

Cocroft, Alexandreana, and Sharon Hall.** ***Assessing the influence of income and ethnicity on wildlife in residential neighborhoods**.**

****Encinas, Zane, Kelli Larson, and Jeff Brown.** ***Human-Wildlife Interactions through the Lens of iNaturalist Website Posts.***

Gholami, Mansoureh, Alberto Barbaresi, Ariane Middel, Daniele Torreggiani[1], and Patrizia Tassinari.** ***Evaluating the impact of urban trees on thermal comfort in Imola, Italy and Tempe, USA.

Haight, Jeff, Sharon J. Hall, and Jesse S. Lewis.** ***Wildlife communities respond to urban landscape characteristics across the Phoenix metropolitan area.

SCENARIOS AND FUTURES

Bisht, Vanya, Amanda Kuhn, Morales Gerrero, Monique Franco, Carrillo, Teo Argueta, and Marta Berbes-Blazquez. *Engaging K-12 students in co-designing green urban futures.

Elser, Stephen, Marta Berbes-Blazquez, Elizabeth M. Cook, Nancy B. Grimm, David M. Iwaniec, Yeowon Kim, and Marissa A. Matsler. *Future ecosystem services: Insights from participatory scenario workshops from nine cities in the United States and Latin America.

URBAN DESIGN

Bisht, Vanya, Amanda Kuhn, Morales Gerrero, Monique Franco, Carrillo, Teo Argueta, and Marta Berbes-Blazquez. *Engaging K-12 students in co-designing green urban futures.

****Chandra, Kerrala, and Chingwen Cheng. *Analysis of the role of public participation in the implementation of green infrastructure projects in Phoenix, Arizona.***

Gholami, Mansoureh, Alberto Barbaresi, Ariane Middel, Daniele Torreggiani[1], and Patrizia Tassinari. *Evaluating the impact of urban trees on thermal comfort in Imola, Italy and Tempe, USA.

Helmrich, Alysha, and Stephen Elser. *Green infrastructure for the Anthropocene: An early career perspective.

***Trakas, Amanda, Paul Coseo, and Chingwen Cheng. *Where the water flows: plant community profiles in natural desert xeroriparian environments*.**

WATER AND FLUXES

***Bearman, S., J. Das, and H. Hartnett. *The dread pirate robots: Autonomous mapping of water temperature and salinity in Tempe Town Lake*.**

Hartnett, Hilairy, Crystal Alverez, and Elinor Sauer. *The neverending story - 16 years of water quality measurement in Tempe Town Lake.*

****Liddle, D.[1], B. Ball[2], and J. Nishimura[2]. *Urban forestry as a carbon offset method at ASU West campus*.**

Sauer, E., D. Glaser, and H. Hartnett. *On the road to quantifying whole-lake metabolism in Tempe Town Lake.*

****Williamson, Maya, and Becky Ball. *Soil community responses to multiple co-occurring forms of human-Induced environmental change*.**

Abstracts

All abstracts are listed alphabetically by first author. * indicates graduate student poster and **undergraduate student poster.

****Asrari, H. *The effects of urbanization on the gut microbiome of an urban arthropod pest, the western black widow spider*.**

With increasing urbanization, organisms face a myriad of novel ecological challenges. While the eco-evolutionary dynamics of urbanization are currently receiving a great deal of attention, the effect of urban disturbance on the microbiome of urban organisms is relatively unstudied. Indeed, studies of the microbiome may illuminate the mechanisms by which some species thrive after urbanization (pest implications), while other species go locally extinct (biodiversity implications). We will investigate the gut microbiome of the Western black widow spider (*Latrodectus hesperus*) across a gradient of land use. *L. hesperus* is an ideal model system to work on as they are a pest species of medical importance in urban ecosystems, often forming dense urban infestations relative to the sparse populations found in their native Sonoran Desert. Spiders will be collected from sites across a gradient of land use previously well studied by CAP-LTER scientists. The DNA of the gut will be sampled, isolated, and 16s rRNA gene sequencing will be done to identify, classify, and quantify the microbes within samples. A better understanding of gut microbiome diversity, and its relationship to diet, environment, health, and fitness, will improve our understanding of the costs and benefits of urbanization for organismal performance and ecosystem health.

[1]School of Mathematicsl and Natural Sciences, Arizona State University, West campus.

****Avilez, D., Davitt, D., Siefert, J., Encinas, Z., Larson, K.L., Brown, J., and Morales-Guerrero, J. *Residents' Attitudes and Experiences with Urban Wildlife: Implications for Human-Wildlife Coexistence.***

Past research on human-wildlife interactions (HWI) has focused on a specific species or a set of species with commonalities; yet understanding diverse HWI can inform the coexistence of people and wildlife in cities. We therefore examine residents' experiences with, perceptions of, and actions toward diverse wildlife taxa; we also specifically examine HWI in relation to birds, coyotes, and snakes. Analyzing data from 24 semi-structured interviews with residents of metropolitan Phoenix, Arizona, we explore: 1) To what extent are residents comfortable encountering diverse wildlife taxa where they live, and why? 2) How do people respond similarly or differently to encounters with birds, coyotes, and snakes? And 3) How do memorable encounters with wildlife influence people's views and actions toward them? We found that despite varying perceptions of and attitudes toward wildlife, residents often respect—and are willing to coexist with—diverse wildlife taxa. Even negative HWIs--including fear of wildlife such as coyotes and snakes--often result in concerns for the wildlife involved and an interest in protecting them. Specific, memorable HWIs include direct and indirect encounters with wildlife; both the perceived rarity of wildlife and regularly occurring encounters can potentially lead to memorable HWI. Childhood interactions with animals, include those in captivity, particularly influence positive attitudes and behaviors toward urban wildlife into adulthood. Ultimately, increasing people's experiences with wildlife, especially youth, can help mitigate negative views and actions toward wildlife while increasing support for wildlife conservation and an ecological civilization of coexistence in urban ecosystems.

Bateman, H.[1], J. A. Brown[2], K. L. Larson[2,3], A. Enloe[1], R. Andrade[4], and B . Hughes[5]. *Unwanted residential wildlife: Evaluating social-ecological patterns for snake removals.*

Snakes are globally threatened due to anthropogenic pressures. Conflicts between snakes and people occur when residents encounter snakes in their home environments. In collaboration with a local business that provides snake removal services (Rattlesnake Solutions, LLC), we examined records from over 2,000 snake removals in Phoenix metropolitan area during 2018-2019. We examined removal locations in relation to neighborhood-level socioeconomic attributes from the American Community Survey and individual demographics from a social survey of 494 respondents (CAP LTER PASS). Over 68% of removals were of the venomous Western Diamond-backed Rattlesnake (*Crotalus atrox*), which is the most common species in the area observed in community-sourced data (iNaturalist) and publications. Snakes were frequently removed from neighborhoods with wealthier and more highly educated residents, greater proportion of Latinx residents, and recently constructed homes. Individual perceptions of snakes as problematic were not related to the number of snakes removed. This research is the first to analyze snake removals in a social-ecological context and underscores the conservation benefits of researchers partnering with a local business to gain spatial and temporal information on an elusive taxon. Future work will link snake removals to front yard habitats and deploy a social survey to compare believes of snake removal clients to the general public via CAP PASS during 2021.

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***Bearman, S., J. Das, and H. Hartnett. *The dread pirate robots: Autonomous mapping of water temperature and salinity in Tempe Town Lake*.**

Tempe Town Lake is a small, urban reservoir in the heart of Tempe, Arizona. The water quality of Tempe Town Lake has been continuously monitored for the past 16 years by collecting hand samples and using a data sonde to gain insights into the temporal patterns of biotic and abiotic parameters in the lake. Due to accessibility challenges, the data collected thus far is limited to two locations in the lake. We are developing technology and methodology to increase the spatial resolution of data collection in the lake by using a sonde attached to an autonomous boat. The current goal is to produce 3D maps of temperature and salinity, as well as pH, dissolved oxygen, and chlorophyll that identify gradients in these parameters. So far, we have used our system to autonomously collect surface temperature data in a grid pattern, demonstrating that we have the ability to collect spatial data in the x-y directions. Our system will also include a winch that will allow us to obtain vertical profiles for each parameter at every x-y location. This 3D data will allow us to examine variations in biogeochemical and physical processes in the lake. A flexible system like this will also allow us to ask more specific spatial questions in the future, such as potentially tracking a plume of water input after a storm event, or using in-situ measurements to guide optimal sample collection.

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Bisht, V.[1], A. Kuhn[2], M. Gerrero[3], M. Franco[4], Carrillo[5], T. Argueta[5], and M. Berbes-Blazquez[1]. *Engaging K-12 students in co-designing green urban futures.

When it comes to the design of urban greenspaces K-12 students are often an overlooked stakeholder group despite being some of the main users and beneficiaries of urban green infrastructure. Therefore it is important for urban researchers, city planners and policy makers to capture the future visions of this critical stakeholder group. This is especially important for K-12 students and educators belonging to underrepresented populations of the city. In this project, we have collaborated with teachers and middle school students of the Academia del Pueblo Elementary Charter School in South Phoenix (which offers a bilingual, collaborative learning curriculum for its community members) to co-design sustainable urban futures of green space in downtown Phoenix.

The project is executed in two steps: a) we collaborate with school teachers to co-design an environmental justice curriculum that can be taught at the middle school level, and b) we co-teach this curriculum to middle-schoolers while also engaging them in participatory methodologies to co-create sustainable future scenarios for urban greenspace. We use participatory methodologies of photovoice, story-telling, and scenario building to co-create sustainable urban futures. We identify five types of nature that are important for this demographic: parks and greenspace; pass-by nature; nature at home; outdoor nature; and nature in the community.

We have also partnered with Chispa AZ, a local environmental justice advocacy group, to teach and empower middle school students in keeping their elected officials accountable and advocating for just and sustainable urban futures. The project is expected to provide new insights for community perspectives on sustainable urban futures design. It will also improve the research and decision making capacity of the Phoenix metropolitan area for sustainability planning. It will also help in enhancing the community outreach work for CAP-LTER by increasing our engagement with young stakeholders in the city.

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Brown, J.[1], S. J. Hall[2], S. Lerman[3], K. Larson[4], and A. Cocroft[2]. *Perceptions or presence: investigating individuals' Reporting of mosquitoes as a problem*.

Mosquitoes and the diseases they carry are a threat to human health worldwide, with many diseases that were once isolated to tropical regions becoming more prevalent in urban areas. With increasing urbanization and global temperature, the overlap between people and mosquitoes has risen and, in urban systems, humans may increase mosquito abundance by providing anthropogenic breeding locations. Management of mosquitoes, therefore, depends on residents to help control populations. However, the willingness of individuals to engage in control measures may depend on whether these individuals perceive mosquitoes to be a problem in the first place. Working with the Maricopa County Vector Control, we examined the distribution of mosquitoes throughout the Central Arizona-Phoenix Long-Term Ecological Research Program's (CAPLTER) study site. We compared information on mosquito distribution with social data from the Phoenix Area Social Survey (PASS) and landscape-level features to assess what factors influence residents' perceptions of mosquitoes as a problem. Results from our model indicate that the abundance of mosquitoes around a resident is only one factor of residents' perception of mosquitoes as a problem, with the strongest predictor being if residents perceive their neighborhoods as messy. Results from this work match other findings that show

peoples' perceptions of the distribution and abundance of wildlife rarely match the ecological reality. The study's findings imply that reducing mosquito abundance may not reduce complaint calls about mosquitoes and that manager needs to consider social factors in addition to ecological ones.

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***Clark, R.[1], and J. C. Johnson[2]. *Spiders in the desert, city and laboratory: What the behavior of black widows can teach us about the impact of urbanization*.**

Our planet is rapidly urbanizing. Understanding the ecological effects of urbanization is considered to be a grand challenge for ecologists. For example, biodiversity may be compromised by urbanization. Animal behavior is one trait that may explain why some species thrive after urbanization while others go locally extinct. Here we followed 22 adult females of the Western Black Widow, *Latrodectus hesperus*, from both urban Phoenix and Sonoran desert habitats. We began by looking for behavioral differences (boldness and voracity) between urban and desert spiders under natural field conditions. We then brought both urban and desert spiders back to the laboratory to see how behavior changed. Our field assays found no behavioral differences between urban and desert spiders. Similarly, our laboratory assays showed no differences between urban and desert spiders once in this common garden laboratory environment. However, we did find differences in field behavior versus laboratory behavior. While we interpret the lack of behavioral differences to generally favor the conclusion that black widow behavior is highly plastic and context-dependent, we were also surprised to find little evidence that a spider's body condition predicted its behavioral expression. Lastly, while voracity behavior did not differ from the field to the laboratory, we did find that behavior was much more repeatable in the laboratory than the field, and that boldness and voracity were strongly positively correlated in the laboratory but not the field. Interestingly, this correlation, indicative of a behavioral syndrome (or animal personality), was not apparent under field conditions.

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***Cocroft, A., and S. Hall. *Assessing the influence of income and ethnicity on wildlife in residential neighborhoods*.**

Wildlife communities are structured by numerous ecological filters in cities that influence their populations, with some species even managing to thrive in urban landscapes. The "luxury effect" is the hypothesis that urban biodiversity is positively related to income of residents. Although informative, the luxury effect does not describe all patterns between socio-demographic factors and wildlife, but has led to research on other socio-demographic factors that shape biodiversity. Socio-demographic factors, such as income and ethnicity, are vastly understudied, and the interactions between these factors and urban structural inequalities may be masked by income. In this research, I aim to unpack the luxury effect by including landscape and socio-demographic factors that may have influence on wildlife communities within neighborhoods throughout the Phoenix metropolitan area. I ask: how does neighborhood income and ethnicity independently affect wildlife community composition in neighborhoods across the Phoenix metro area? This question will be explored through the deployment of wildlife cameras within ~40 community parks throughout metropolitan Phoenix in neighborhoods of four socio-demographic types: high income, low income, high LatinX, and low LatinX. I predict

that mammal species richness will be highest in parks within higher income neighborhoods, similar to patterns for birds and plants. However, I predict that wildlife communities will differ between dominantly LatinX and White neighborhoods independent of income, potentially related to the distribution of free-roaming domestic animals. This work will contribute to environmental justice through the inclusion of underrepresented low income and LatinX communities within ecological research and inform the long term dataset PASS.

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Dwyer, J. M., and J. S. Lewis.** ***Urban association of bats varies seasonally in relation to forage and water availability.

Animals respond to landscape modifications in order to balance trade-offs to maximize their fitness. In particular, urbanization, occurring across a gradient from low- to high-density development, is a major driver of landscape change that can affect biodiversity, where some species benefit, and others are negatively impacted. Bats play important roles in ecosystems around the world and can be sensitive to urbanization. In addition to urban intensity, bat habitat use is influenced by food and water availability. However, it is unclear how these trade-offs potentially change temporally in environments with dramatic shifts in resource availability across seasons. Our objective was to evaluate seasonal variation in bat habitat use across a gradient of urbanization in an arid region. To achieve this, we deployed acoustic bat monitors at 50 sites across the Phoenix metropolitan area with varying levels of urbanization during each of the four seasons of 2019. We expected bat habitat use to vary in relation to urban intensity, plant productivity and distance to water. As expected, some bat species were most associated with wildland areas, whereas other bats were most likely to use areas of moderate to high levels of urbanization, such as the Mexican free-tailed bat (*Tadarida brasiliensis*), which remained urban associated year-round. In addition, habitat use of some bat species along the gradient varied seasonally in relation to plant productivity and distance to water, indicating seasonal changes in trade-offs. Results from this study can help inform management plans to conserve bats across landscapes that experience varying levels of urbanization.

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Earl, S. R. ***CAP LTER informatics: data management for project investigators and the scientific community.***

The CAP LTER addresses the challenges of curating and disseminating research data with a robust Information Management System (IMS) that benefits CAP LTER investigators and the broader scientific community. The CAP LTER IMS facilitates the ingestion of research data and metadata from the project's long-term monitoring programs and project investigators. CAP LTER data are archived with the Environmental Data Initiative, which provides long-term storage and access to research data. Research data are also cataloged by the DataONE federation, which greatly enhances their discoverability. Through these resources, data from the CAP LTER's long-term monitoring programs and project investigators are available to the community as building blocks for future research efforts. For project investigators, submitting data

through the CAP LTER meets the data publishing requirements set by funders and publishers, and each data set is given a citation with a Digital Object Identifier (DOI) that a data provider may reference. The CAP LTER Information Manager is available to assist with the data publishing process, data management plans, and generally to provide guidance regarding effective approaches to managing research data.

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Elser, S.[1], M. Berbes-Blazquez[2], E. M. Cook[3], N. B. Grimm[1], D. M. Iwaniec[4], Y. Kim[5], and M. A. Matsler[6]. *Future ecosystem services: Insights from participatory scenario workshops from nine cities in the United States and Latin America.

Urban ecological infrastructure (UEI) generates ecosystem services in cities. As more people move to cities, it is essential for UEI and associated ecosystem services to be integrated into urban planning to reach desirable futures. Scenario planning is used to envision alternative futures and pathways to achieve them. We ask, how do cities differ in how they incorporate UEI and ecosystem services into their future scenarios? To answer this, we analyzed strategies co-developed during participatory scenario workshops held in Baltimore, MD; Hermosillo, Mexico; Miami, FL; New York, NY; Phoenix, AZ; Portland, OR; San Juan, PR; Syracuse, NY; and Valdivia, Chile. We used clustering techniques to compare UEI strategies across all nine cities. We further analyzed transcriptions from Miami and Phoenix to compare the ecosystem services that were mentioned in each of the five scenarios from those two cities. In Miami and Phoenix, analogous scenarios could be directly compared (e.g., scenarios focused on extreme heat in both Miami and Phoenix). We found that UEI strategies were common across all cities, accounting for 27% of total strategies. Further, we found four distinct clusters of scenarios based on the types of UEI mentioned in strategies (green, blue, turquoise, and brown UEI), with 67% of the scenarios fitting into clusters that were overwhelmingly dominated by green UEI strategies. For ecosystem services, we found that cultural services were most frequently mentioned, followed by regulating and provisioning services. Phoenix scenarios mentioned more ecosystem services than those from Miami. Analogous scenarios from Miami and Phoenix mentioned similar types of ecosystem services. Our results illustrate some of the desired ecosystem services and UEI in future scenarios, which could help support urban decision-makers when planning for resilience to extreme climate events.

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****Encinas, Z., Larson, K.L., and Brown, J. *Human-Wildlife Interactions through the Lens of iNaturalist Website Posts.***

iNaturalist is an online website that allows users to post their observations of particular wildlife. This publicly-available dataset allows us to explore how posts reflect human-wildlife interactions across space and time. We obtained data on observations uploaded to iNaturalist from 01/01/16 - 12/31/18, in Maricopa County and ran a statistical analysis to investigate if the average amount differed between taxonomic classes (ANOVA). We used GIS software to assess the spatial distribution of the iNaturalist posts for diverse taxa. In particular, we address the following research questions: 1) How have iNaturalist posts changed over the three-year time period, and how are they distributed across wildlife taxa? and 2) How are the iNaturalist posts of diverse wildlife taxa spatially distributed in relation to land use/cover and major Urban Ecological Infrastructure? Despite significant increases in the number of users on the site each year, the

mean and median observations have remained constant. The increases in the number of users may signal the potential of new technological opportunities such as iNaturalist to incentivize and popularize human-wildlife interactions. Additionally, we found that neither taxa nor observations are distributed evenly over the study site. Results from the ANOVA test show that taxa are not observed at the same frequencies, with Aves being observed most frequently. These preliminary findings provide the foundation for future research into the identification of specific functional traits that make a species "worth uploading" and to explore the distributions of observations throughout various socio-economic areas.

Gholami, M.[1], A. Barbaresi[1], A. Middel[2], D. Torreggiani[1], and P. Tassinari[1]. *Evaluating the impact of urban trees on thermal comfort in Imola, Italy and Tempe, USA.

As tree planting has become a priority for many cities around the globe to combat urban heat, the need to optimize tree placement for maximum cooling benefits has increased due to limited resources. In this context, micro climate modeling has emerged as tool to assess the thermal impact of urban design and landscaping strategies on human thermal exposure and comfort. Yet, modeling neighborhood micro climate at high spatial resolution using computational fluid dynamics (CFD) models that simulate air temperature, wind flow, and radiant fluxes in complex urban settings is time-consuming and requires extensive computing power. This study introduces a Python-enhanced hybrid approach for simulating the diurnal impact of street trees on Mean Radiant Temperature (MRT) and thermal comfort (Universal Thermal Comfort Index, UTCI) based on a 3D model in Rhino, EnergyPlus, and Ladybug components in grasshopper. The model was tested in two contrasting climates: hot and humid Imola, Italy, and hot and dry Tempe, Arizona, USA. Model output for Tempe was validated for hot summer days in June 2018 through human bio-meteorological observations at select locations on Arizona State University's Tempe campus using the MaRTy cart. Model statistics and error metrics show that the model performs well and reliably simulates intra-neighborhood distributions of MRT and UTCI at a fraction of time required for CFD modeling. Built on open-source software, the model provides a low-cost, computationally efficient solution to assessing neighborhood design strategies for cities.

[1]Department of Agricultural and Food Services, University of Bologna; and [2]School of Art, Median and Engineering, Arizona State University, Tempe, AZ

Haight, J., S. J. Hall, and J. S. Lewis. *Wildlife communities respond to urban landscape characteristics across the Phoenix metropolitan area.

Human activities can alter wildlife populations and communities in cities by augmenting resources that are limiting within the natural environment. In arid ecosystems, anthropogenic provisioning of food and water may provide relatively stable year-round resources within urban areas, compared to natural desert areas. In this study, we examined how a community of mammals and ground-dwelling birds respond to urbanization within and surrounding the Phoenix metropolitan area. Our primary objectives were to evaluate (1) how community characteristics (e.g. species richness) vary in relation to social-ecological landscape characteristics, including urbanization and vegetation, (2) if species richness varied according to seasonal vegetation patterns, and (3) whether ecological guilds (i.e., carnivores and herbivore) exhibited varying relationships across the urban-rural gradient. Throughout 2019, we deployed a randomized array of 50 camera traps across a gradient of urbanization and modeled the occupancy of 22 species observed during spring (April) and summer (July). As predicted, species richness declined with increasing urbanization and increased with higher plant

productivity across both seasons. Both carnivore and herbivore guilds responded similarly to urbanization, with guild richness declining with greater urban land cover in each season. Lastly, we found that seasonal differences in productivity – which were greatest at urban sites – did not correspond to seasonal differences in species richness. Our findings suggest that the urban arid environment may be associated with greater seasonal variability in resources than predicted and highlight how the hypothesized seasonality of urban-rural gradients used for assessing wildlife communities requires further consideration.

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Hartnett[1,2], H. C. Alverez[1], and E. Sauer[2]. ***The neverending story - 16 years of water quality measurement in Tempe Town Lake.***

Tempe Town Lake in downtown Tempe, AZ is a man-made lake isolating a short segment of the Salt River channel. We have been monitoring basic water chemistry and dissolved organic carbon (DOC) in the lake over the period 2005-2021. Temperature, conductivity, and rainfall data are used to assess dry seasons and wet seasons. Dissolved oxygen provides information about biological production and consumption, and regularly exhibits strong supersaturation. Discharge data from the Maricopa County Flood Control district provide information about external sources of water to the lake. Dissolved organic carbon concentrations change seasonally and appear to reflect both climatological variation (monsoons) and human water management (dam releases). Fluorescence analysis of dissolved organic carbon provides information about the types of organic carbon compounds present in the complex mixture. This presentation provides an updated look at the long term time-series data and poses a set of questions that we hope to examine in the next stage of CAP-LTER research.

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Helmrich, A.[1], and S. Elser[2].** ***Green infrastructure for the Anthropocene: An early career perspective.

Climate-related disruptions expose the obduracy of existing urban systems built to deal with conditions of the past without the needed flexibility to address the challenges of the Anthropocene. Green infrastructure (GI) is a promising tool of resilience with the potential to address these disruptions. While GI's benefits span social, ecological, and technological dimensions, GI is frequently studied from a single disciplinary standpoint (e.g., the US often focuses on stormwater management and less on socio-ecological aspects). This emphasis supports traditional infrastructure institutional practices in GI implementation and is maladaptive toward social and ecological transformation. To better position GI for resiliency, we need to examine GI through robust interdisciplinarity, and propose the social-ecological-technological systems (SETS) lens as a framework. We present perspectives from a group of early career researchers and practitioners with diverse disciplinary backgrounds who participated in a 4-day symposia series. Throughout the symposia, participants led a collaborative autoethnographic study to generate holistic principles for GI design, implementation, and maintenance. The emergent principles emphasize process transparency; stakeholder and community engagement; simultaneous consideration of SETS objectives; and adaptive management to 1) address previously dismissed needs and emergent issues and 2) clarify responsibilities for increased accountability. These principles challenge existing procedures surrounding GI and present a research agenda to move toward more holistic implementation.

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Lewis, J.[1], K. Weiss[2], and Z. Ziebarth[2]. *Wildlife populations in relation to urbanization and landscape features along the Salt River Valley, Arizona*.

We initiated a research project starting in December 2020 to study wildlife populations along the Salt River corridor in the Phoenix-Valley of Arizona. The primary objective of this research project is to understand how wildlife populations respond to varying levels of urbanization (ranging from wildland to highly urban areas), as well as other landscape factors, such as vegetation, water, and habitat heterogeneity, through time. The entire wildlife community will be monitored, with some key focal species including coyote, gray fox, javelina, cottontail rabbit, jackrabbit, mule deer, bobcat, mountain lion, roadrunners, Gambel's quail, and domestic cat. To conduct field work, 43 remote wildlife cameras were placed at least 1 km apart along the Salt River. These cameras will operate during four seasons each year. This is a collaborative research project with the Central Arizona–Phoenix Long-Term Ecological Research (CAP LTER) program and Urban Wildlife Information Network (UWIN). In addition, we are collaborating with a diverse group of land management agencies, including the US Forest Service and cities of Mesa, Tempe, and Phoenix. This project is also supporting collaborative research projects with graduate students, such as PhD student Kate Weiss who is evaluating coyote diet via the collection of scats along transects associated with the wildlife cameras. Although results are preliminary, we have already documented a suite of wildlife species spanning the urban gradient and look forward to using data from this project to evaluate diverse research questions and explore collaboration opportunities with other members of the CAP community.

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Li, R. and Chester, M. *Repurposing Mesoscale Traffic Models for Insights into Traveler Heat Exposure Mitigation: ICARUS and the case of Phoenix.

Climate change is expected to increase the frequency and intensity of the heat waves in urban areas. Urban heat exposure poses threats to public health, residents' quality of life, and cities' economic growth. Although cities have been motivated to deploy a variety of mitigation and adaptation strategies in response to urban heat, data regarding spatial and temporal patterns in personal heat exposure are scarce. Mesoscale traffic models provide a potential to study the spatial and temporal pattern of residents' heat exposure in the city. ICARUS is a simulation platform developed based on the Mesoscale traffic models for analyzing people's heat exposure. ICARUS was developed by a team of engineers, environmental scientists, and public health scientists. It combines a state-of-the-art activity-based travel model, an indoor exposure model, environmental hazard models, and infrastructure data to estimate the effects of environmental effects on individual's heat exposure in cities. In this poster, we will demonstrate the method of ICARUS and show a case study in which we implemented ICARUS to the City of Phoenix.

****Liddle, D.[1], B. Ball[2], and J. Nishimura[2]. *Urban forestry as a carbon offset method at ASU West campus*.**

As part of Arizona State University's net-zero carbon initiative, 1000 mesquite trees were planted on a vacant plot of land at West campus to sequester carbon from the atmosphere. Urban forestry is typically a method of carbon capture in temperate areas, but it is hypothesized

that the same principle can be employed in arid regions as well. To test this hypothesis a carbon model was constructed using the pools and fluxes measured at the Carbon sink and learning forest at West Campus. As an ideal, another carbon model was constructed for the mature mesquite forest at the Hassayampa River Preserve to project how the carbon cycle at West Campus could change over time as the forest matures. The results indicate that the West Campus plot currently functions as a carbon source while the site at the Hassayampa river preserve currently functions as a carbon sink. Soil composition at both sites differ with inorganic carbon contributing to the largest percentage at West campus, and organic carbon at Hassayampa. Predictive modeling using biomass accumulation estimates and photosynthesis rates for the Carbon Sink Forest at West Campus both predict approximately 290 metric tons of carbon sequestration after 30 years. Modeling net ecosystem exchange predicts that the West Campus plot will begin to act as a carbon sink after 33 years.

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Polekoff, S., W. R. Chua, R. Pressman, and P. Deviche. *Exploratory behavior of urban and desert House Finches.

Urban animals face evolutionarily novel environmental conditions. Past avian studies reported behavioral and physiological effects of urban living, but the mechanisms that underlie these effects remain poorly understood. In particular, behavioral and physiological differences between environments may reflect either adaptation to urban environments or phenotypic adjustments to local conditions that are related, e.g., to food availability. In addition, results of previous studies vary across species and cities. For example, urban birds are often more exploratory than rural birds, but some studies found the opposite or no habitat-related differences in exploratory behavior. Our research investigates exploratory behavior and morphological correlates in urban- and desert-dwelling Haemorhous mexicanus (House Finch). We predict urban House Finches to show more exploratory behavior than their desert counterparts. To test this prediction, we sampled House Finches at an urban site (Arizona State University, Tempe campus) and a nearby Sonoran Desert site (McDowell Mountain Regional Park) during the non-breeding seasons of 2020 and 2021. We captured finches using seed-baited traps, bled and measured them, and marked them with tarsal color bands for identification purposes before release. Exploratory behavior was tested in the field using a mobile, collapsible wooden chamber with pegs inside. We found a site-specific effect of body fat on exploratory behavior, but sites did not differ in average behavior. Blood samples will be used to determine endocrine status and oxidative status.

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Schneider, F. A.[1,2], and J. Cordova[3]. *COPE Phoenix - COol Pavement Evaluation Phoenix.

In late summer of 2020, the City of Phoenix (COP) applied CoolSeal, a novel reflective coating, on 36 miles of asphalt roads to create cool pavement that mitigates urban heat. COPE Phoenix is a joint 1-year project between Arizona State University (ASU) and the COP to evaluate the effectiveness and durability of the cool pavement. The study focuses on multiple heat metrics: near surface air temperature, near surface radiant temperature, asphalt surface temperature, and in-ground asphalt temperature. Multiple methods are used to collect data, create impactful visual documentation, and learn about the residents' perception of the cool pavement. Under hot and sunny conditions, data was collected in three treated neighborhoods

during four times of day between August and September using two in-situ platforms: (1) MaRTy, a mobile biometeorological instrument platform that measures mean radiant temperature, air temperature, relative humidity, wind speed, and ultraviolet radiation, and (2) Vehicle traverses with thermocouples and an infrared thermometer measuring air and asphalt surface temperature. Long-term monitoring of in-ground asphalt temperature using iButtons and monthly spectroradiometer readings of the reflective coating will be continued throughout the project. Additionally, between August and October, helicopter overflights were performed to visually document the neighborhood surface temperature with infrared imagery before sunrise and at noon. Further, a community survey is being developed to understand the residents' perception of the cool pavement. We will provide an overview of COPE Phoenix and share preliminary results of conducted fieldwork to illustrate the impact of reflective coating on the urban environment.

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Sauer, E., D. Glaser, and H. Hartnett. ***On the road to quantifying whole-lake metabolism in Tempe Town Lake.***

Surrounded by the bustle of an ever-growing city, Tempe Town Lake offers a great opportunity to understand how anthropogenic forces can impact an aquatic environment. Fifteen years of chemical water quality data for the lake has been gathered as discrete samples, roughly twice a week. This data set reveals long term temporal patterns that are due to both human activity and natural processes. In 2018, CAP-LTER installed an automated dataSONDE that collects water quality data every 30 minutes. This higher frequency data collection allows us to examine processes that happen on shorter time scales. My work was first to verify the accuracy of the SONDE's measurements by comparing it with our long term data set. We are now modeling whole lake metabolism using the open-source R package: LakeMetabolizer. Thus far, we have assembled the SONDE data for temperature, dissolved Oxygen, and depth along with publicly available wind speed, sunrise and sunset information. The goal is to calculate weekly average gross primary production, respiration, and net ecosystem production rates over the course of 2018-2021. This poster presents the background on the model, the components necessary for the model's function and my results to date.

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Trakas, A., P. Coseo, and C. Cheng.** ***Where the water flows: plant community profiles in natural desert xeroriparian environments**.**

The expansion of landscape and urban greening initiatives within the built environment are increasingly designed to include urban ecological infrastructure (UEI) elements to reduce the reliance on potable water used for irrigation. UEI elements such as recessed planting areas and curb cuts allow for the passive management of stormwater through conveyance and infiltration into the soil along with the providing valuable co-benefits. Implementation of UEI elements such as recessed planting areas, or bioswales, into the built environment of a hot, arid urban environment requires additional consideration of both plant species and placement within the bioswale. Plant community survey of dry riparian, or xeroriparian communities of the Sonoran Desert offers a valuable opportunity to examine both of these factors. In this study, five different xeroriparian (wash) locations were surveyed from three different CAPLTER sites located within

Phoenix. The plant communities were identified in approximate 9m x 9m side sections of the wash and included 4-10 individual plants in each community. The species name, height and spread, along with location within the swale were recorded to determine the species diversity and richness at each site along with species prominence at the bottom, terrace or top level of the wash. The location of individual plants within the architecture of the xeroriparian communities varied according to the individual species and was compared to existing local resources. Three key species, Parkinsonia florida, Larrea tridentata, and Encelia farinosa were found at all five sites and their recorded observations in this study offer possibilities to expand recommendations for planting within recessed planting areas within the built environment.

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Vanos, J.[1], C. Cheng[2], P. Coseo[2], A. Hess[3], A. Ross[4], A. Shortridge[1], S. Zuiker[5], E. Ferguson[2], A. Schmidt[5], B. Winsor[6], and V. Garrison[6]. *Reimagining outdoor play and learning environments in South Phoenix: An overview*.

Paideia Academies in South Phoenix has ambitiously set out to build natural play and learning environments (NPLE), demonstrating to the wider community the possibilities for school spaces to be more comfortable, healthier, and environmentally friendly spaces for children to learn and play.

NPLEs exhibit miniature natural landscapes full of compelling play and learning opportunities, ready to be discovered by children through innovative and sustainable solutions. NPLEs support improved comfort, air, cognitive function, physical activity, mental health, and behavior for various ages and abilities. In these spaces, children are surrounded by hills, gardens, sandpits, trees, orchards, climbing walls, rocks, streams, caves, bioswales, labyrinths, sundials, and other natural features that help children discover nature while they play and build social cognitive, and motor skills. No such school playspace exists in Maricopa County.

This poster will overview past, ongoing, and future initiatives in the schoolyard, including the school's new #TakeItOutside curriculum involving environmental literacy and an outdoor garden; "Green-STEAM"-based learning, physical activity levels, sun, heat, and air pollution measurements, and sustainable water use. Implementing and testing these ideas allow us to challenge long-held assumptions about modern playgrounds and apply cutting-edge health and education research to a new environment. The research is also a pilot demonstration that will create baseline data and a needs assessment for other schools throughout the county, state, and country to implement the NPLE concept. It is bridging gaps across research, teaching, and socio-environmental impacts that are not currently being assessed by schools, districts, and communities, particularly in low-income areas.

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****Williamson, M., and B. Ball. *Soil community responses to multiple co-occurring forms of human-Induced environmental change*.**

Human-induced climate change causes a multitude of issues for the environment, such as increasing temperatures and altered precipitation patterns. This is expected to cause decreased precipitation, but an increase in the frequency of extreme rainfall. One area most highly affected from these issues is the Sonoran Desert, specifically the

Phoenix metropolitan area where urbanization is happening rapidly due to it being one of the fastest growing cities in the United States. The purpose of this research is to show how soil communities respond to increasing temperatures, altered precipitation patterns, nitrogen, and urbanization in Phoenix, Arizona. Soil was collected from inside and outside the city, from both control plots and plots with added nitrogen. Respiration rates, bacterial biomass, nitrate, nitrite, and ammonia levels were measured on soils incubated at average Phoenix temperature as well as soils incubated at a 2º C increase under a factorial change in precipitation of decreased frequency and increased precipitation size to account for projected climate change. Results show that respiration and mineral nitrogen were significantly altered by precipitation pattern. This shows that changes in precipitation will interact with urbanization to change soil processes.

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