CAP LTER Twenty-fourth All Scientists Meeting
and Poster Symposium
March 25, 2022

Friday, March 25, 2022

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

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

9:15 a.m. **Keynote Presentation: Living for the city: Exploring the social-ecological drivers of urban biodiversity**
Dr. Christopher J. Schell, Department of Environmental Science, Policy, & Management, University of California at Berkeley

10:15 a.m. **BREAK**

10:30 a.m. **Interdisciplinary Research Theme Updates #1**

Adapting to City Life
Parks and Rivers
Water and Fluxes
Climate and Heat

11:30 a.m. **LUNCH**

12:30 p.m. **Poster Session #1: Graduate Students**

1:45 p.m. **Interdisciplinary Research Theme Updates #2**
Residential Landscapes and Neighborhoods
Governance and Institutions
Urban Design
Scenarios and Futures

2:45 p.m. **Poster Session #2: Undergraduate students, faculty, staff, and other CAP community members**

4:00 p.m. **CAP Equity Circle**

5:00 p.m. **Final announcements and wrap-up > CAPpy Hour @ Bitters.**

2022 CAP LTER Poster Symposium

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

**Aguilar et al.
Andrade et al.
**Asari et al.
**Avilez et al.
*Brandi et al.
Brown and Larson
*Buo et al.
*Chandrakanthan and Herckes
*Cocroft and Hall
**Davitt and Larson
**Drake and McGraw
*Dwyer and Lewis
Earl
*Enloe et al.
*Guzman-Echavarria et al.
*Haight et al.
**Harris and Bateman
Johnson et al.
*Karanja et al.
*Keith et al.
**Kreisler et al.
*Morales Guerrero et al.
**Nguyen et al.
Proffitt et al.
Sampson et al.
*Schneider et al.
*Seelig et al.
**Sehner et al.
*Weiss et al.
*Wright et al.
*Zhu et al.

List of Posters

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

ADAPTING TO CITY LIFE

****Asrari, Hasti. Juan Maldonado Ortiz, Keaton Coker, Todd Sandrin, and J. Chadwick Johnson. *The effects of urbanization on the internal microbiome of an urban arthropod pest, the western black widow spider.***

Buo, Issac, Valentina Sagris, Jaak Jaagus, and Ariane Middel. *High-resolution shade and sky view factor maps from LiDAR for cool corridors planning.

Cocroft, Alexandreana, Jesse Lewis, Susannah Lerman, Jeffrey Haight, Zachary Ziebarth, Isabella Escobedo, Marisela Campana, Madison Hatcher, Juan Paredes, Jennifer Ortega, Amy Sheldon, Rafael Salas, Sakura Sinroll, and Sharon J. Hall. *Investigating the influence of socio-demographic variables on urban mammal communities.

****Davitt, Akilah, and Kelli Larson. *Conservation of threatened and endangered species in the Phoenix metro area using social media.***

****Drake, Dean, and Kevin McGraw. *Plasma protein in house finches: Effects of season, disease state, and urbanization.***

Dwyer, Jessie, and Jesse S. Lewis. *Habitat use and occupancy of bats across the gradient urbanization and seasons.

Enloe, Annika M., Heather L. Bateman, Kelli L. Larson, and Jeff A. Brown. *Feeling rattled: Linking attitudes and habitat features to patterns of snake occurrence in urban landscapes.

Haight, Jeffrey D., Sharon J. Hall, Solny A. Adalsteinsson, Adam A. Ahlers, Julia Angstmann, Whitney J.B. Anthonysamy, Elizabeth Biro, Barbara Dugleby, Mason Fidino, Travis Gallo, Austin M. Green, Laurel Hartley, Mark J. Jordan, Cria A.M. Kay, Elizabeth W. Lehre,; Robert A. Long, Brandon MacDougall, Seth B. Magle, Darren Minier, Chris Mowry, Maureen Murray, Kristina Nininger, Mary E. Pendergas, Katie R. Remine, Travis Ryan, Carmen Salsbury, Christopher J. Schell, Cagan Sekercioglu, Catherine J. Shier, Kelly C. Simon, Colleen C. St. Clair, Theodore Stankowich, Cassondra J. Stevenson, Dave Will, Jacque Williamson, Larry Wilson, Amanda J. Zellmer, and Jesse S. Lewis. *Human-driven landscape changes and species traits shape mammal communities across North American ecoregions.

****Harris, Brandi and Heather L. Bateman. *Body size is smaller in urban lizards.***

Johnson, J. Chadwick, Jared Rusnak, Damara Willis, Carlos Orteaga, Riley Hayes, and Alexandreana Cocroft. *Black Widows at Walgreens: The thermal microclimate of an urban pest.*

****Kreisler, Avin G. Anthony J. Basile, and Karen L. Sweazea. *The majority of avian blood metabolites are not altered in urban environments: Results From a systematic review.***

****Nguyen, Olivia L,. Heather L. Bateman, Daniel L. Childers, Jeffrey Haight, Sharon J. Hall, Nicola Koper, Kelli L. Larson, and Jesse S. Lewis. *The effects of the COVID-19 pandemic on human behavior and wildlife populations along the gradient of urbanization.***

Schneider, Florian A. Karthik Kulkarni, Suren Jayasuriya, and Ariane Middel. *Project MaRTiny – A new low-cost, IoT sensor measuring thermal conditions and space use.

Weiss, Katherine C. B., Jesse S. Lewis, Savage C. Hess, Jan Schipper, and Beckett Sterner. *Assessing the ecological and nutritional drivers of coyote (Canis latrans) diets along the Salt River corridor.

CLIMATE AND HEAT

Brandi, Also, and Robert Balling, and Matei Georgescu. *An analysis of 71 years of daily precipitation in Arizona.

Buo, Issac, Valentina Sagris, Jaak Jaagus, and Ariane Middel. *High-resolution shade and sky view factor maps from LiDAR for cool corridors planning.

Guzmán-Echavarría, Gisel, Jennifer Vanos, and Ariane Middel. *Can a reliable personal heat exposure assessment encompass more than a "one-size-fits-all" thermal index approach?

****Harris, Brandi and Heather L. Bateman. *Body size is smaller in urban lizards*.**

Johnson, J. Chadwick, Jared Rusnak, Damara Willis, Carlos Orteaga, Riley Hayes, and Alexandreana Cocroft. *Black Widows at Walgreens: The thermal microclimate of an urban pest.*

Karanja, Joseph, Dan Wanyama, and Lawrence M. Kiage. *Weighting mechanics and the spatial pattern of composite metrics of heat vulnerability in Atlanta, Georgia, USA.

Keith, Ladd, Sara Meerow, Shaylynn Trego*, Erika Schmidt, Lauren Jensen, Philip R. Berke, Joseph DeAngelis. *Evolving a plan integration for resilience scorecard for heat (PIRSH).*

Schneider, Florian A. Karthik Kulkarni, Suren Jayasuriya, and Ariane Middel. *Project MaRTiny – A new low-cost, IoT sensor measuring thermal conditions and space use.

****Sehner, Brian, Amy E. Frazier, and Billie L. Turner II. *Connectivity of thermal refuges in the surface urban heat island.***

Wright, Mary K. David Hondula, and Kelli Larson. *A meta-analysis of social and environmental factors predicting household-level heat-related illness in Phoenix, Arizona.

EDUCATION AND MANAGEMENT

Earl, S. R. ***ASU and CAP LTER research data solutions.***

PARKS AND RIVERS

****Aguilar, Sofia Leanne M., Sajad I. Al-Zubaidy, Julian R. Arrieta, Camryn T. Barbosa, Helena Hanna, Kendra Lemke, Sara M. Marshall, Nathan G. Mitchell, Madison H. Newell, Annette R. Palumbo, Johnathon E. Ramirez, Anastasia K. Stats, Kendra D. Conrow, Richard B. Bireley, Ken G. Sweat, and Maxwell C. K. Leung.** ***Precision remediation with industrial hemp: Human activities, exposure, and the environment.***

Cocroft, Alexandreana, Jesse Lewis, Susannah Lerman, Jeffrey Haight, Zachary Ziebarth, Isabella Escobedo, Marisela Campana, Madison Hatcher, Juan Paredes, Jennifer Ortega, Amy Sheldon, Rafael Salas, Sakura Sinroll, and Sharon J. Hall.** ***Investigating the influence of socio-demographic variables on urban mammal communities.

Dwyer, Jessie, and Jesse S. Lewis.** ***Habitat use and occupancy of bats across the gradient urbanization and seasons.

Haight, Jeffrey D., Sharon J. Hall, Solny A. Adalsteinsson, Adam A. Ahlers, Julia Angstmann, Whitney J.B. Anthonysamy, Elizabeth Biro, Barbara Dugleby, Mason Fidino, Travis Gallo, Austin M. Green, Laurel Hartley, Mark J. Jordan, Cria A.M. Kay, Elizabeth W. Lehre,; Robert A. Long, Brandon MacDougall, Seth B. Magle, Darren Minier, Chris Mowry, Maureen Murray, Kristina Nininger, Mary E. Pendergas, Katie R. Remine, Travis Ryan, Carmen Salsbury, Christopher J. Schell, Cagan Sekercioglu, Catherine J. Shier, Kelly C. Simon, Colleen C. St. Clair, Theodore Stankowich, Cassondra J. Stevenson, Dave Will, Jacque Williamson, Larry Wilson, Amanda J. Zellmer, and Jesse S. Lewis.** ***Human-driven landscape changes and species traits shape mammal communities across North American ecoregions.

****Harris, Brandi and Heather L. Bateman.** ***Body size is smaller in urban lizards***

****Nguyen, Olivia L,. Heather L. Bateman, Daniel L. Childers, Jeffrey Haight, Sharon J. Hall, Nicola Koper, Kelli L. Larson, and Jesse S. Lewis.** ***The effects of the COVID-19 pandemic on human behavior and wildlife populations along the gradient of urbanization.***

RESIDENTIAL LANDSCAPES AND NEIGHBORHOODS

Andrade, Riley, Nathan Shipley, Dana Johnson, and Kelli L. Larson. ***Yard management implications for people's experiences with desert wildlife in shaping a sense of place.***

****Avilez, Dayanara, Kelli L. Larson, Jorge Morales Guerrero, Jeffery Brown, Akilah Davitt, Zane Encinas, Jose-Benito Rosales Chavez, and Janelle Siefert.** ***Residents' experiences***

and attitudes toward urban wildlife: Implications for human-wildlife coexistence and outcomes.

Brown, Jeffrey A., and Kelli L. Larson. ***The 2021 Phoenix Area Social Survey (PASS): Overview and investigating temporal trends.***

Cocroft, Alexandreana, Jesse Lewis, Susannah Lerman, Jeffrey Haight, Zachary Ziebarth, Isabella Escobedo, Marisela Campana, Madison Hatcher, Juan Paredes, Jennifer Ortega, Amy Sheldon, Rafael Salas, Sakura Sinroll, and Sharon J. Hall.** ***Investigating the influence of socio-demographic variables on urban mammal communities.

****Davitt, Akilah, and Kelli Larson.** ***Conservation of threatened and endangered species in the Phoenix metro area using social media.***

Enloe, Annika M., Heather L. Bateman, Kelli L. Larson, and Jeff A. Brown.** ***Feeling rattled: Linking attitudes and habitat features to patterns of snake occurrence in urban landscapes.

Haight, Jeffrey D., Sharon J. Hall, Solny A. Adalsteinsson, Adam A. Ahlers, Julia Angstmann, Whitney J.B. Anthonysamy, Elizabeth Biro, Barbara Dugleby, Mason Fidino, Travis Gallo, Austin M. Green, Laurel Hartley, Mark J. Jordan, Cria A.M. Kay, Elizabeth W. Lehre,; Robert A. Long, Brandon MacDougall, Seth B. Magle, Darren Minier, Chris Mowry, Maureen Murray, Kristina Nininger, Mary E. Pendergas, Katie R. Remine, Travis Ryan, Carmen Salsbury, Christopher J. Schell, Cagan Sekercioglu, Catherine J. Shier, Kelly C. Simon, Colleen C. St. Clair, Theodore Stankowich, Cassondra J. Stevenson, Dave Will, Jacque Williamson, Larry Wilson, Amanda J. Zellmer, and Jesse S. Lewis.** ***Human-driven landscape changes and species traits shape mammal communities across North American ecoregions.

Morales Guerrero, Jorge, Jose-Benito Rosales Chavez, Kelli L. Larson, Dayanara Avilez, Jeffrey Brown, Akilah Davitt, Zane Encinas, and Janelle Siefert.** ***Human-wildlife interactions: Implications for human-wildlife coexistence and human health outcomes**.**

Zhu, Qinnan, Kelli Larson, and Megan Wheeler.** ***How yard management priorities and the extent of yard changes contribute to residents' yard satisfaction.

SCENARIOS AND FUTURES

****Aguilar, Sofia Leanne M., Sajad I. Al-Zubaidy, Julian R. Arrieta, Camryn T. Barbosa, Helena Hanna, Kendra Lemke, Sara M. Marshall, Nathan G. Mitchell, Madison H. Newell, Annette R. Palumbo, Johnathon E. Ramirez, Anastasia K. Stats, Kendra D. Conrow, Richard B. Bireley, Ken G. Sweat, and Maxwell C. K. Leung.** ***Precision remediation with industrial hemp: human activities, exposure, and the environment.***

Proffitt, David G., David Iwaniec, Nancy B. Grimm, Elizabeth Cook, and Marta Berbes. ***Estimating greenhouse gas emissions from long-term future development scenarios.***

Sampson, David A., Giuseppe Mascaro, Ross Maciejewski, Rimjhim Aggarwal, Dave D. White, Hessam S. Sarjoughian, Fan Lei, Xin Guan, Adil Mournir, and Matyn Roy Choudbury. *Modeling and visualizing food-energy-water (FEW) interactions at the metropolitan scale*.

URBAN DESIGN

Buo, Issac, Valentina Sagris, Jaak Jaagus, and Ariane Middel. *High-resolution shade and sky view factor maps from LiDAR for cool corridors planning.

Schneider, Florian A. Karthik Kulkarni, Suren Jayasuriya, and Ariane Middel. *Project MaRTiny – A new low-cost, IoT sensor measuring thermal conditions and space use.

****Sehner, Brian, Amy E. Frazier, and Billie L. Turner II. *Connectivity of thermal refuges in the surface urban heat island.***

WATER AND FLUXES

**** Aguilar, Sofia Leanne M., Sajad I. Al-Zubaidy, Julian R. Arrieta, Camryn T. Barbosa, Helena Hanna, Kendra Lemke, Sara M. Marshall, Nathan G. Mitchell, Madison H. Newell, Annette R. Palumbo, Johnathon E. Ramirez, Anastasia K. Stats, Kendra D. Conrow, Richard B. Bireley, Ken G. Sweat, and Maxwell C. K. Leung. *Precision remediation with industrial hemp: human activities, exposure, and the environment.***

Chandrakanthan, Kanchana, and Pierre Herckes. *Spatial and temporal distribution of soil microplastics in Phoenix, including the surrounding areas of the Sonoran Desert.

Seelig, Matthew, Becky Ball, Yue Wang, and Sharon Hall. *Temporo-anthropogenic dynamics of soil biogeochemistry in the Phoenix metropolitan.

Abstracts

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

****Aguilar, S. L. M.[1], S. I. Al-Zubaidy[1], J. R. Arrieta[1],, C. T. Barbosa[1], H. Hanna[1],, K. Lemke[1], S. M. Marshall, N. G. Mitchell[1], M. H. Newell[1], A. R. Palumbo[1], J. E. Ramirez[1], A. K. Stats[2], K. D. Conrow[1], R. B. Bireley[1], K. G. Sweat[1], and M. C. K. Leung[1]. *Precision remediation with industrial hemp: human activities, exposure, and the environment.***

Arizona is a rapidly growing state in a desert. As the population increases, it becomes more difficult to meet the demand for water quantity and quality. With the passage of the 2018 Farm Bill, industrial hemp – low-THC strains of Cannabis sativa – can now be legally grown in the U.S., offering a novel means for cannabinoid, grain, and fiber production. One of the less mentioned uses of industrial hemp is phytoremediation, which leverages the ability of C. sativa to sequester minerals and other chemical pollutants from the environment. We are currently conducting big data and spatial analyses of i.) the contaminant toxicity of arsenic and selenium based on research literature and U.S. EPA ToxCast database; ii.) the human activities that produce mineral contaminants in Arizona, including highway traffic, airport uses, military site discharge, and mining; iii.) the connection to the U.S. EPA Superfund sites; and iv.) the suitability of using industrial hemp to remediate these contaminated areas. Further studies will identify the endangered species in Arizona that can best benefit from environmental remediation with industrial hemp.

[1]School of Mathematical and Natural Sciences, Arizona State University, Glendale, AZ; and [2]Master of Advanced Studies in Geographic Information Systems, School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ

Andrade, R.[1], N. Shipley[2], D. Johnson[3], and K. L. Larson[4]. *Yard management implications for people's experiences with desert wildlife in shaping a sense of place.*

Sense of place is a multi-dimensional concept that weaves social construction, the biophysical environment, and human behaviors together. Sense of place is important for understanding urban sustainability because it may motivate people to protect, maintain, or otherwise change aspects of the landscape to meet their expectations. However, it is unclear how interactions with wildlife as part of the biophysical environment may play a role in constructing a sense of place, or if these experiences promote engagement in behaviors to support conservation. Here, we look to understand the relationship between human-wildlife interactions and wildlife-friendly yard management through sense of place using a case study from the Phoenix metropolitan area. To do so, we integrated responses from the 2017 Phoenix Area Social Survey (n=496) with bird monitoring points within the survey neighborhoods (n=36). We operationalized sense of place in relationship to local desert bird diversity in residential yards and neighborhoods as (1) attitudes towards the desert and (2) neighborhood place attachment. We used non-constrained ordination (NMDS) to identify social-ecological patterns between bird community composition and survey responses. We then used a structural equation model (SEM) to test if desert bird diversity in a neighborhood influenced sense of place to predict wildlife-friendly yard management (e.g., bird feeding, providing a bird house, subsidizing water, or planting native vegetation), controlling for income and legacy effects as important yard management constraints. We found that desert bird diversity positively influenced sense of place, as well as perceptions of cultural ecosystem services provided by the

birds in a neighborhood. Furthermore, we established a link from desert bird diversity to wildlife-friendly yard management through neighborhood place attachment and perceptions. Overall, our research demonstrates how local human-wildlife interactions may foster a sense of place to influence the uptake of conservation behaviors that may iteratively go on to support wildlife throughout the urban landscape.

[1]Department of Wildlife Ecology and Conservation, University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL 32611; [2]Data and Innovation, City of Madison, 210 Martin Luther King Jr. Blvd., Madison, WI 53703; [3]Institute for Resources, Environment, and Sustainability, University of British Columbia, AERL Building 429-2202 Main Mall, Vancouver, BC V6T 1Z4; and [4]School of Geographical Sciences and Urban Planning, School of Sustainability, Arizona State University, 800 Cady Mall, Tempe, AZ 85287.

****Asrari, H.[1], J.M. Ortiz[2], K. Coker[1], T.R. Sandrin[1], and J.C. Johnson[1]. *The effects of urbanization on the internal 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 investigated the internal 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 were collected from sites across a gradient of land use previously well studied by CAP-LTER scientists. Additionally, a small sample of lab-reared spiders was added to provide insight into how a controlled diet and habitat influence the internal microbial framework of those raised in the lab. The microbial DNA from the whole spider was isolated and 16s rRNA gene sequencing was done to identify, classify, and quantify the microbes within the samples. A better understanding of internal 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 Mathematical and Natural Sciences, Arizona State University, Glendale, AZ 85304; and [2]Genomics Core, Biodesign Institute, Arizona State University, Tempe, AZ 85281

****Avilez, D.[1], K. L. Larson[1,2], .J. Morales Guerrero[1], J. Brown[3], A. Davitt[1], Z. Encinas[1], J. Rosales Chavez[2], and J. Siefert[2]. *Residents' experiences and attitudes toward urban wildlife: Implications for human-wildlife coexistence and outcomes.***

As urban ecologists and planning professionals pursue wildlife conservation and human wellbeing, research into the opportunities and challenges to promoting the coexistence of people and diverse wildlife is important for urban and landscape sustainability. In this study, we qualitatively explore human-wildlife interactions in and around participants' home environments and neighborhoods, as well as in the greater Phoenix area, to understand how they view and act toward diverse wildlife in our desert metropolis. This project involved content analysis of semi-structured, open-ended interviews—conducted primarily by undergraduate student researchers—using a convenience sample of Phoenix area residents (n=24). Interesting paradoxes emerged from interviews, with many interviewees emphasizing a lack of wildlife in the city but later explaining their interactions with diverse urban wildlife—from coyotes and foxes

to birds and bees to lizards and insects. This poster details residents' complex views of wildlife and how they varied by taxa, location, and other factors such as their knowledge, experiences, and social interactions. We present recommendations for shifting people's experiences and attitudes such that human-wildlife interactions in metropolitan regions may enhance biological conservation and coexistence toward the wellbeing of both people and diverse wildlife using participants' narratives.

[1]School of Sustainability, Arizona State University, PO Box 875502; [2] School of Geographical Sciences and Urban Planning, Arizona State University, PO Box 875302; and [3]Global Institute of Sustainability and Innovation, Arizona State University, PO Box 875504.

Brandi[1,2], A., and R. Balling[1,2], and M. Georgescu[1,2,3].** ***An analysis of 71 years of daily precipitation in Arizona.

Arizona is characterized by a dry and hot climate and a semi-desert landscape that are expected to be severely affected by projected global warming and climate change. Higher temperatures are expected to increase the amount of moisture in the atmosphere which would in turn lead to an increase in intensity and decreases in duration of precipitation events. Extreme precipitation in semi-desert landscapes tends to result in flash floods and landslides that can be dangerous for infrastructures and populations. However, heavy but less frequent precipitation can result in relative reductions in evaporative losses and increased water availability in xeric ecosystems and constitute an important water supply for dams and reservoirs. Despite of the importance of understanding how climate change is expected to affect extreme precipitation in the area, little attention has been given to the subject so far. In this study we analyze daily precipitation records from a suite of 43 random distributed weather stations of the Global Historical Climatological Network daily (GHCND). We investigate linear trends of 11 precipitation indexes for a time period ranging from 1950 to 2020, on both annual and monthly time scales. Preliminary correlation analysis results show an increase in extreme precipitation and a decrease in the number of consecutive wet days for almost all stations located south of the 34 N parallel on an annual time scale. While the monthly time scale analysis shows extensive reduction of all indexes across entire Arizona for the months of June and July and an increase in total precipitation for the northernmost stations in the central and northern part of the state.

[1]School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ; [2]Urban Climate Research Center, Arizona State University, Tempe, AZ; and [3]Global Institute of Sustainability and Innovation, Arizona State University, Tempe, AZ.

Brown, J. A[1]., and K. L. Larson[2]. ***The 2021 Phoenix Area Social Survey (PASS): Overview and investigating temporal trends.***

The Phoenix Area Social Survey (PASS) is a long-term survey conducted every five years since 2001 to assess Phoenix metropolitan area residents' perceptions, values, and behaviors towards key environmental topics. The survey also investigates respondents' perceptions towards their neighborhood and collects socio-demographic information. Although PASS is a longitudinal survey, it is under-utilized as a dataset to analyze temporal patterns. In part, the lack of temporal analysis is due to the difference in sampling methods (i.e., number of neighborhoods) across years and changes in survey questions across years. The design of PASS 2021 addresses focused heavily on resampling prior respondents and increasing the sample size of under responding neighborhoods to increase the ability to make direct comparisons between results from PASS 2017 and PASS 2021. A total of 509 individuals responded to PASS 2021. Of the 509, 121 individuals also completed PASS 2017, allowing for

direct investigations into how individuals' perceptions, attitudes, and behaviors changed over the last five years. This poster highlights the spatial distribution and demographic patterns of PASS 2021 respondents. We also illustrate how perceived quality of life has changed for respondents of PASS over time—specifically, across 2006, 2011, 2017, and 2021—to highlight how PASS is not only a helpful tool for investigating questions at a single point in time but may also be analyzed as time-series data for understanding temporal social-ecological dynamics in metro Phoenix, Arizona.

[1]Global Institute of Sustainability and Innovation, Arizona State University, Tempe, AZ 85287; and[2]School of Geographical Science and Urban Planning, Arizona State University, Tempe, AZ 85287

Buo, I.[1], V. Sagris[1], J. Jaagus[1], and A. Middel[2].** ***High-resolution shade and sky view factor maps from LiDAR for cool corridor planning.

Mean radiant temperature (MRT), i.e. the heat load on the human body, is a major driver of outdoor human thermal comfort in hot dry environments. Although MRT is important to quantify pedestrian thermal exposure in cities, city-wide data are difficult to obtain. Observations lack spatial coverage, and existing simulation tools are difficult to scale up and are highly sensitive to urban form. The sky view factor (SVF, amount of visible sky on the hemisphere) and dynamic, time and day dependent shade patterns are paramount for calculating MRT. We developed open geospatial processing tools in Python and R to calculate the SVF and diurnal shade distribution in the Phoenix metropolitan area from a high resolution (~5 points per m2) LiDAR point cloud. We generated a digital surface model (DSM) through point triangulation and calculated the SVF and shade distribution in the metropolitan area at 1-m resolution. SVF results were validated using a point based SVF dataset derived from Google Street View imagery and showed good agreement. In future work, the SVF and shade maps will serve as input to the simulation tool SOLWEIG to model diurnal MRT distributions for Maricopa County to assist the City of Phoenix in defining “Cool Corridors” that will be accessible for all residents. This research will provide scripts to calculate MRT from arbitrary point clouds, which will facilitate large-scale analyses of human thermal exposure in the absence of ancillary data.

[1]Department of Geography, University of Tartu, Estonia; and [2]School of Arts, Media and Engineering, School of Computing and Augmented Intelligence, Arizona State University, Tempe, AZ, USA

Chandrakanthan, K. and P. Herckes.** ***Spatial and temporal distribution of soil microplastics in Phoenix, including the surrounding areas of the Sonoran Desert.

Microplastics are rapidly emerging anthropogenic stressors that pose a threat to biodiversity and ecosystem functioning. They are defined as plastic particles that are less than 5 mm in size. Microplastics are either intentionally manufactured at a microscopic size or result from the fragmentation of larger plastic litter. While the ubiquitous nature of microplastics in water has been well documented, studies on their distribution in soil environments are limited. Understanding their distribution in soil is important as microplastics can affect soil structure, composition, and microbial activity. In addition to eliciting direct toxicity, microplastics can also act as vectors of other organic contaminants in soils.

Here we study the spatiotemporal distribution of microplastics in urbanized and agricultural areas of metropolitan Phoenix, including the surrounding areas of the Sonoran Desert. Soil samples collected by CAP-LTER from the Ecological Survey of Central Arizona (ESCA) 200-point survey (2005 and 2015) were used for the project. Samples were processed using established methodologies and, optical microscopy was used to obtain quantitative information on microplastics. The microplastic abundance in soil samples from 2015 ranged from 122 to

1399 microplastics/kg with a heterogeneous distribution depicting no clear spatial trends. Results for the temporal occurrence indicate a general increase in the abundance of microplastics from 2005 to 2015. Chemical characterization using micro-Raman spectroscopy will be performed to obtain insights into possible sources and toxicity of microplastics. The results from this research work will help suggest locations that were possibly prone to microplastics pollution. The obtained results will aid CAP-LTER in initiating studies that assess the effects of microplastics on soil health and soil microbiota.

School of Molecular Sciences, Arizona State University, Tempe, AZ 85281

***Cocroft, A.[1], J. Lewis[2], S. Lerman[3], J. Haight[1], Z. Ziebarth[1], I. Escobedo[1], M. Campana[1], M. Hatcher[1], J. Paredes[1], J. Ortega[1], A. Sheldon[1], R. Salas[1], S. Sinroll[1], and S. J. Hall[1].**
Investigating the influence of socio-demographic variables on urban mammal communities.

Urban wildlife communities are structured by numerous ecological and anthropogenic filters that benefit some species over others. Described first by CAP scholars with reference to vegetation, the luxury effect hypothesizes that patterns of urban biodiversity are positively related to income of residents. Although informative, income is only one of a suite of sociodemographic factors that can shape landscape structure. Biodiversity patterns may also be shaped by social legacies such as historic redlining and ethnicity, but these factors and their interactions are understudied and may be masked by patterns of income alone. To unpack the luxury effect, we ask: How do landscape and sociodemographic factors such as neighborhood income and ethnicity influence mammal community occupancy and activity patterns in community parks across metro Phoenix? We deployed an array of 28 wildlife cameras across an income and ethnicity gradient during the summer of 2021. We hypothesized that income would positively relate to mammal species richness, mammal community composition would vary with ethnicity, and mammal species occupancy would be best explained by including income and ethnicity in models. We captured approximately 36,000 photos across 73-92 effort days with a naïve mammal species richness of 10 across all community parks. Preliminary data analyses show naïve mammal richness in community parks is positively related to average household income and negatively to percent Latinx residents in surrounding neighborhoods. Naïve occupancy of species across all sites varied, with domestic species of dogs and cats having the highest naïve occupancies and black-tailed jackrabbits having the lowest. High-Latinx sites have zero detections for coyotes or desert cottontail rabbits, and a naïve occupancy of one for domestic cats, in contrast to low-Latinx sites having high coyote naïve occupancy and median cat and desert cottontail. Further evaluation is needed to unravel the impacts of social variables on urban mammal communities.

[1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287- 4501; [2]College of Integrative Colleges and Arts, Arizona State University 7271 E. Sonoran Arroyo Mall, Mesa, AZ 85212-6415; and [3]USDA Forest Service, Northern Research Station, Amherst, MA 01003.

****Davitt, A., an K. L. Larson.** ***Conservation of threatened and endangered species in the Phoenix metro area using social media.***

As we construct pillars of sustainability to help current and future generations exist comfortably on Earth, preventing biodiversity loss provides stability for all of the planet's systems. Our livelihood depends on complex ecosystems of amphibians, mammals, birds, reptiles, fish, and invertebrates. However, increases in climate variability, urbanization, and other anthropogenic factors threaten over one million species of plants and animals and accelerate the extinction rate at least hundreds of times faster than the past 10 million years.

Wildlife conservation protects by preserving the sanctity of existing habitat and ecosystems and increases the likelihood of species survival. Social media is one of the many tools used to disseminate information about wildlife conservation. Conservationists can use a myriad of platforms to connect with people interested in aiding wildlife.

In Arizona, 800 species of mammals, birds, and reptiles coexist with humans. The state is afflicted by mining, water diversion, and rapid urbanization, causing extreme species loss. Threatened and endangered species are especially at risk with dwindling population sizes. According to AZ Game and Fish, ten species (excluding fish) are threatened or endangered in Maricopa, Pinal, and Gila counties. This project aims to educate the public about species in jeopardy by creating informative social media posts based on input from interviews with ecologists and content creators and a survey (n=111) about social media behaviors. Instagram was selected as the platform for the social media posts, and the post material was created on Procreate and Canva.

School of Sustainability, Arizona State University, PO Box 875502, Tempe, AZ 85287-5502.

****Drake, D.[1], Kevin McGraw[2]. *Plasma protein in house finches: effects of season, disease state, and urbanization.***

Bioindicators of wildlife health are useful tools for studying the viability of various organisms and populations, and can include a range of phenotypic variables, such as behavior, size, and physiological parameters, such as circulating hormones and nutrients. Few studies have investigated the utility of total plasma protein as a predictor of environmental or nutritional variation among birds, as well as variation across different seasons and life-history stages. Prior research has demonstrated that degree of urbanization can predict variation in plasma protein in birds, and we aimed to study this relationship in house finches, as well as expanding to include variables like sex, season, body condition, disease state, and molt status. We sampled blood from house finches (*Haemorhous mexicanus*) across three seasons (winter, summer and fall) measured plasma protein levels using a Bradford assay. We also collected data including condition, sex, and poxvirus infection state at capture, as well as fecal samples to assess gut parasitism (coccidiosis). During the fall season we also estimated molt status (as number of actively growing feathers and percent molt completion). We found circulating plasma to be lower in the fall during molt than during winter or summer. We also found links between circulating protein and molt state, pox presence, and capture site, with pox-infected and suburban birds having higher total plasma protein, and birds in more intense molt also having higher levels of circulating protein. Our results supported our hypothesis that more intense body molt (which demands considerable protein for feather synthesis) and degree of habitat urbanization would correlate with plasma protein levels, but further work is needed to understand why protein levels were elevated in pox-infected birds.

[1]Barrett, The Honors College, Arizona State University, Tempe, AZ 85287; and [2]School of Life Sciences, Arizona State University, Tempe, AZ 85287.

Dwyer, J. M., and J. S. Lewis. *Habitat use and occupancy of bats across the gradient of urbanization and seasons.

Urbanization, occurring across a gradient from low- to high-density development, is a primary driver of landscape change that can affect biodiversity. Animals balance trade-offs in obtaining resources and avoiding anthropogenic disturbances across the gradient of urbanization to maximize their fitness. However, additional research is necessary to understand seasonal variations in how animals respond to urbanization, particularly in arid regions. Our

objective was to evaluate the response of a suite of bat species to urbanization and whether species shifted their response to urbanization across seasons. We predicted that the response of bats to urbanization would differ among species, with some species being more sensitive to urbanization than others. We also predicted that bat species would increase use of moderate and highly urbanized areas in the summer season, where food and water resources were assumed to be greater compared to wildland areas. To test these hypotheses, we used stationary acoustic bat monitors to sample 50 sites across the gradient of urbanization in the Phoenix metropolitan area during four seasons. Consistent with predictions, bats in our study exhibited varying responses to urbanization, with most species being more sensitive to urbanization. Counter to our predictions, however, most bat species did not appear to shift their response to urbanization across seasons. For bats that were sensitive to urbanization, the cost of anthropogenic disturbances in urbanized areas appeared to outweigh the benefit of obtaining available resources, even in the summer season. Results from this study can help inform management plans to conserve bats across landscapes that experience varying levels of urbanization.

College of Integrative Sciences and Arts, Arizona State University, 7001 E Williams Field Rd, Mesa, AZ 85212

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

The Arizona State University Research Data Management Office, 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.

[1]Global Futures Laboratory, Arizona State University, Tempe, AZ and [2]Knowledge Enterprise Research Data Management Office, Arizona State University, Tempe, AZ

Enloe, A. M.[1], H. L. Bateman[1], J. A. Brown[2], and K. L. Larson[2,3].** ***Feeling rattled: Linking attitudes and habitat features to patterns of snake occurrence in urban landscapes.

Understanding how wildlife is adapting to urban environments is critical as urbanization contributes to habitat change and fragmentation globally. Patterns of human-wildlife interactions can be informative when trying to ascertain information about urban wildlife and possible conflicts with humans. In Phoenix, Arizona, these conflicts commonly involve reptiles, especially venomous and nonvenomous snakes. Researchers have partnered with a local business, Rattlesnake Solutions, LLC, which removes and relocates snakes from residential yards and businesses in the greater Phoenix area. This partnership has provided records of snake removals to pair with CAP LTER long-term social and ecological datasets. We used these datasets to compare occurrence patterns and habitat preference among snake taxa in urban Phoenix. During 2021, we measured snake habitat along 100m front yard transects in residential areas with snake removals and from randomly paired residential areas. We found that snakes were more likely to be removed from neighborhoods that were relatively close to desert parks/desert open space, and that nonvenomous snakes were removed more frequently from areas of higher urbanization than venomous snakes. Along with habitat features, social data was collected on perceptions of snakes. Clients of Rattlesnake Solutions, LLC, were asked to answer a short survey regarding attitudes towards snakes that mirrors questions asked in the 2021 Phoenix Area Social Survey (PASS). From the social surveys, we found that both clients

of the snake removal service and PASS respondents felt snakes were important part of the desert ecosystem, 80% and 70% respectively. Although PASS respondents were split on if okay to kill snakes, 70% of clients say it was not okay to kill snakes, perhaps suggesting that clients view using the snake removal service as a stewardship action.

[1]College of Integrative Sciences and Arts, Arizona State University, Mesa, AZ 85212 [2]School of Sustainability, Arizona State University, Tempe, AZ, USA; and [3]School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ, USA.

Guzmán-Echavarría, G.1, J. Vanos2, and A. Middel[3]. *Can a reliable personal heat exposure assessment encompass more than a "one-size-fits-all" thermal index approach?

Recent work advocates the need for test methods that comprehensively describe individuals' personal heat exposure (PHE) and give information focused on groups of concern to avoid misclassifications of health impacts. Assessing PHE implies evaluating people's actual thermal interactions with the everyday spaces in which they live, work, and play, both indoors and outdoors, to detect, for example, whether they are at risk of an increased core body temperature. Heat balance in humans has been used to derive heat stress indices. Still, those indices are not flexible for gaining person-specific knowledge because they assume a thermal experience for an "average human" (often a middle-aged white male) across all contexts. In this work, a human-environment heat transfer model is used to illustrate why it is valuable to move away from "one-size-fits-all" thermal indices for heat stress and strain prediction to support risk management strategies. Three personal profiles (middle-aged female and male, and elderly female) and three contrasting climates (cities of Phoenix, Miami, New Orleans, and Baltimore) are used to show the differences in required and possible evaporative heat losses under various test cases that can lead to dangerous thermal conditions. Results reveal critical details that can be overlooked by assuming that physiology between people is equivalent, that they perform similar activities throughout their day, and that temperature and relative humidity are sufficient to assess PHE. Moreover, results display those different types of heat (e.g., hot humid, hot dry) across hot climates do not elicit the same thermal response from the body. Finally, we outline criteria for providing reliable PHE from physiologically based methods to overcome these difficulties. A more realistic PHE can help identify the different levels of risk that the same dangerous heat event may pose to a wide range of groups, especially the most vulnerable.

[1]School of Geographical Sciences and Urban Planning, Arizona State University, P.O. Box 875302, Tempe, AZ 85287-5302; [2]School of Sustainability, Arizona State University, PO Box 875502, Tempe, AZ 85287-5502; and [2]School of Arts, Media and Engineering, PO Box 875802, Tempe, AZ 85287-5802.

****Harris, B., and H. L. Bateman*. *Body size is smaller in urban lizards.***

Lizards have adapted to habitats found in urban environments and some species could alter body size and condition in response to urbanization, driven by an increase in resources, reduction in predators, or effects from the urban heat island. Using data from two mark-recapture projects, we evaluated if common lizards from central Arizona exhibited morphological differences between urban and non-urban habitats; if seasonal variances in male and female activities create uneven sex ratios; and if tail regeneration (as a proxy for predation pressure) is more common in non-urban than in urban environments. The urban dataset is an open source, long-term herpetological study at the Gateway Airport in Mesa, Arizona, and the second is from a non-urban study site on the lower San Pedro and Gila Rivers in Pinal County, Arizona. We choose tiger whiptail lizard (*Aspidoscelis tigris*) to compare mass, snout-vent length (SVL), sex ratio, and proportion of lizards with regenerated tails from urban and non-urban areas. Overall

there was no variation in body mass seasonally, but urban lizards were significantly smaller than non-urban lizards, SVL was slightly different seasonally and also smaller in urban lizards. Whiptail males were more abundant than females at both urban and non-urban sites and 30-40% of lizards had regenerated tails at both sites. A male-skewed sex ratio could be explained by the absence of sperm-storage in females and a surplus of males may serve to maximize reproductive potential. We predicted that urban lizards would have smaller body sizes if driven by the urban heat island effect (and not resource availability), because smaller animals have more surface area and can gain and loose heat more rapidly.

College of Integrative Sciences and Arts, Arizona State University, Mesa, AZ 85212

Johnson. J. C.[1], J. Rusnak[1], D. Willis[1], C. Orteaga[1], Riley Hayes[1], and A. Cocroft[2]. *Black Widows at Walgreens: The thermal microclimate of an urban pest.*

The urban heat island (UHI) is increased temperatures (especially at night) due to the retention of heat by built structures. The UHI burden has been shown to be greater in poor communities. Urbanization often reduces species diversity, while other species (e.g. pests) thrive. The 'luxury effect' hypothesizes a positive relationship between a neighborhood's median income and local urban biodiversity. The Black Widow spider, *Latrodectus hesperus*, a superabundant pest species in metro Phoenix, AZ, experiences a dramatic UHI of 4-6 ℃. Here we test whether black widow abundance is inversely correlated with income (a reverse luxury effect), and whether this pest's thermal microclimate predicts abundance. We find no evidence to support either prediction. We discuss what factors are most likely to explain urban biodiversity.

[1]School of Mathematical & Natural Sciences, Arizona State University, West campus; and [2]School of Life Sciences, Arizona State University, Tempe

Karanja, J.[1], D. Wanyama[2], and L. M. Kiage[3]. *Weighting mechanics and the spatial pattern of composite metrics of heat vulnerability in Atlanta, Georgia, USA.

This study constructs two biophysical metrics; one based on Land Surface Temperatures (LST) and an integrated spectral index. The latter is an aggregate of Normalized Difference Vegetation Index (NDVI), Normalized Difference Bareness Index (NDBaI), Normalized Difference Water Index (NDWI), and Normalized Difference Built-up Index (NDBI). The goal is to determine how disparate weighting techniques, data transformation approaches, and spatial visualization pathways influence the computation of composite heat metrics. Using composite images made of aggregated images from late May to Early September within Google Earth Engine, we generated four composites by combining biophysical metrics with SoVI using equal and Eigen-based weightings informed by Principal Component Analysis (PCA). We compared equal interval classification, global and local Moran's as pathways for spatial visualization of hotspots. We utilized several data transformation techniques in a Geographic Information System (GIS), including rescaling, reclassification, zonal statistics, and spatial weighting. Mann Kendall and Sen's Slope detected and quantified monotonic trends in each spectral index. The results show that the LST biophysical metric and its composites indicate increased heat susceptibility over time, with disproportionately exposed core metro counties. The integrated spectral index and its proxies showed reduced vulnerability hence not a good proxy for LST. At the same time, the Mann Kendall and Sen's Slope found persistent increases in NDVI and NDWI and decreases in NDBI and NDBaI. However, opposite trends were evident in core city counties. The LST-based composites and spectral indices-based composites varied in the spatial-temporal distribution of hotspots. Disparate weighting mechanics, data transformation

techniques, and visualization alternatives influence the magnitude and spatial-temporal distribution of heat hotspots.

School of Geographical Sciences and Urban Planning, Arizona State University; [2]Department of Geography, Environment and Spatial Sciences, Michigan State University; and [3]Department of Geosciences, Georgia State University.

Keith, L.[1], S. Meerow[2], S. Trego[2], E. Schmidt[1], L. Jensen[3], P. R. Berke[3], and J. DeAngelis[4].
Evolving a plan integration for resilience scorecard for heat (PIRSH).

The combination of climate change and the urban heat island (UHI) effect is increasing the number of perilously hot days and the need for communities to equitably plan for heat resilience. While planners increasingly recognize this imperative, they face many obstacles including a lack of research-based heat guidance for planning processes, underdeveloped regulatory structures, as well as siloed research, decision-making, and community plans. Planning for heat resilience requires an integrated planning approach that coordinates strategies across community plans and uses the best available heat risk information to prioritize heat mitigation strategies for the most vulnerable communities.

With support from NOAA and in partnership with the American Planning Association, this project developed a methodology for assessing heat resilience planning. We adapted the Plan Integration for Resilience Scorecard approach, originally developed for flood risk, to the unique challenges of extreme heat. The resulting Plan Integration for Resilience Scorecard for Heat (PIRSH) methodology was applied in five geographically diverse U.S. communities that participated in the NIHHIS-CAPA UHI campaign (Boston, MA, Baltimore, MD, Fort Lauderdale, FL, Seattle, WA, and Houston, TX). We developed a typology of heat mitigation strategies through an expert elicitation and literature review process. For each community we evaluated how policies in community plans would affect the UHI and mapped them to city districts to evaluate their spatial distribution and net effect on heat mitigation. The resulting PIRSH scorecard was then combined with heat hazard vulnerability data to assess policy alignment with heat risks and identified opportunities for improvement.

[1]School of Landscape Architecture and Planning, University of Arizona, Tucson, AZ; [2]School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ; [3]Department of City and Regional Planning, University of North Carolina, Chapel Hill, NC; and [4]American Planning Association.

Kreisler, A. G.[1], A. J .Basile[1], and K. L. Sweazea[1,2]. ***The majority of avian blood metabolites are not altered in urban environments: Results from a systematic review.*

It is estimated that the North American bird population has decreased by 2.9 billion since 1970 and the urban environment may be partly responsible. Therefore, the aim of this project was to conduct a systematic review to identify whether birds residing in an urban environment have altered blood metabolites compared to rural birds. Three scientific databases were searched (PubMed, Web of Science, and SCOPUS) to identify articles that met inclusion criteria: examined at least one blood metabolite concentration in at least one avian species in an urban and rural environment. The literature search yielded 151 unique articles and 50 articles met inclusion criteria which produced 283 datasets (one species and one metabolite). Ninety-two unique metabolites were identified and were grouped into 13 categories: immunology, glucose, reproductive hormones, vitamins, cortisone, carotenoids, oxidation and antioxidant, thyroid hormones, triglyceride, melatonin, hemoglobin, fatty acids, and others. Most datasets included male and female (81%) adult (53%) birds and included 29 unique species. Studies were predominately conducted in Sweden (59%) and included 27 unique first authors with a mean publication year of 2013 ± 8.19. Across all datasets, 54% showed no differences in blood

metabolite concentrations between urban and rural, with 24% and 22% having higher and lower concentrations in the urban group compared to rural, respectively. For most metabolite groups (n=11/13), the largest effect was no difference between urban and rural groups. Glucose (n=5 datasets) and cholesterol (n=3 datasets) were two categories wherein the majority of datasets (60% and 67%, respective) showed a higher concentration in the urban group compared to rural. Corticosterone was most often studied (n=25 datasets), where 64% showed no difference between urban and rural groups. Overall, with the exception of glucose and cholesterol, an urban environment does not appear to be associated with major changes in avian blood metabolites.

[1]School of Life Sciences, Arizona State University, 427 East Tyler Mall, Tempe AZ, 85287; and [2]College of Health solution, Arizona State University, 550 North 3rd street, Phoenix AZ 85004.

Morales Guerrero, J[1]., J. B. Rosales Chavez[2]., K. L. Larson[1,2]., D. Avilez[1]., J. Brown[1,], A. Davitt[1], Z. Encinas[1], and J. Siefer[1]. *Human-wildlife interactions: Implications for human-wildlife coexistence and human health outcomes.

Over half the world's population lives within urban areas. As people concentrate in urban centers, many residents may lose the opportunity to interact with and experience nature. This disconnection with nature has fueled concerns that human wellbeing may be negatively impacted by urban living through limited exposure to natural settings and associated declines in wellbeing. Within the past twenty years, however, research has grown to quantify how experiences and exposure to nature influence the health and well-being of people. In this study, we examine the full array of potential positive and negative health outcomes from people's interactions with wildlife, specifically considering physical, mental, spiritual, and social health. The data for our analyses constitutes people's narrative responses and explanations from semi-structured interviews (n=24) conducted in metropolitan Phoenix, Arizona during the spring of 2021. Results from the interviews show that participants' experience with wildlife and the effects on the different health dimensions were influenced by the type of wildlife interactions, as well as the participants' perception of wildlife. This analysis is part of a larger research project aimed at assessing the potential for people and wildlife to co-exist in metropolitan regions, to foster an ecological civilization that enhances the well-being of both people and wildlife.

[1]School of Sustainability, Arizona State University, Tempe, AZ 85287, and [2]School of Geographical Science and Urban Planning, Arizona State University, Tempe, AZ 85287

****Nguyen, O. L.[1], H. L. Bateman[2], D. L. Childers[3], J. Haight[1], S. J. Hall[1], N. Koper[4], K. L. Larson[3,5], and J. S. Lewis [2]. *The effects of the COVID-19 pandemic on human behavior and wildlife populations along the gradient of urbanization.***

Humans can greatly affect wildlife populations and behavior through structural and behavioral disturbances, which can be particularly pronounced along the gradient of urbanization. For example, in wildland areas where human development is largely absent, the presence of humans can be either low or relatively high due to human recreation. On the other end of the gradient, in urban and suburban areas, human development is greatest and is typically associated with high levels of human presence. Importantly, although anthropogenetic structural characteristics are relatively static along the gradient of urbanization for a given period, the presence of humans in recreational settings can be dynamic on daily and seasonal scales, which can affect wildlife populations and behavior. The onset of the Covid-19 pandemic created a unique opportunity to evaluate how a rapid change in human behavior can affect wildlife populations and behavior along the urbanization gradient. Here, we present on project objectives evaluating (1) how human behavior changed in response to the Covid-19 pandemic along the gradient of urbanization and (2) the response of wildlife species to changing human

behaviors. Using a before-after-control-impact (BACI) study design, we will evaluate how changing human behavior influenced wildlife species by comparing time periods before and during the Covid-19 pandemic, which substantially altered human behavior, but not structural characteristics along the gradient of urbanization. We will use wildlife camera data to evaluate a suite of species with varying levels of sensitivities and daily activity patterns. We predicted that wildlife species would increase their use of areas if human activity decreased, such as in more urbanized areas, but would decrease their use of wildland areas associated with high human recreation if human activity increased. This project can help us better understand how structural and behavioral characteristics of humans' shape wildlife populations along the gradient of urbanization.

[1]School of Life Sciences, Arizona State University, Tempe, AZ, USA; and 2College of Integrative Sciences and Arts, Arizona State University, Mesa, AZ, USA; [3]School of Sustainability, Arizona State University, Tempe, AZ, USA; [4]Natural Resources Institute, University of Manitoba, Winnipeg, Canada; and [5]School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ, USA.

Proffitt, D. G.[1], D. Iwaniec[2], N. B. Grimm[3], E. Cook[4], and M. Berbes[5]. *Estimating greenhouse gas emissions from long-term future development scenarios.*

Cities are important loci for global climate change mitigation due to their concentrations of human populations, economic capital, and demand for natural and manufactured resources. Urban areas account for more than 70 of global energy use and associated greenhouse gas (GHG) emissions, and just 100 cities account for 18 percent of the world's carbon footprint resulting from the consumption of goods and services. However, U.S. cities' ability to reduce GHG emissions is hampered by a lack of coordination across jurisdictions, limited regulatory authority over key sources of GHG emissions – particularly electricity production – and a dearth of robust planning tools that can estimate the potential GHG reductions from city-scale development strategies. To help cities identify and prioritize urban development strategies that reduce consumption of fossil fuels, we develop a consumption-based model that estimates GHG emissions reductions from changes to transportation systems, building codes, and other urban-development strategies that can be implemented by municipalities under existing legal and regulatory frameworks. We apply the model to Phoenix, Arizona – a desert city in the U.S. Southwest where GHG emissions are relatively high compared to other large U.S. cities – by estimating GHG emissions from six different scenarios for the city's long-term future. The scenarios were co-produced by the CAP Scenarios & Futures IRT, local government officials, and civil-society organizations. Each represents a different vision for the development of Phoenix in 2060. Comparing estimated demand for electricity and travel demand among the scenarios highlights how municipal-level decisions about the provision of transportation infrastructure, land-use patterns, and building standards affects GHG emissions.

[1]Global Institute of Sustainability and Innovation, Arizona State University, 800 South Cady Mall, Tempe, AZ 85281; [2]Andrew Young School of Policy Studies, Georgia State University, 55 Park Place N.E., Atlanta, GA 30303; [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [4]Environmental Science, Barnard College, 3009 Broadway, New York, NY 10027 and; [5]Marta Berbes-Blazquez, Faculty of Environment, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada N2L 3G1

Sampson, D.A[.1,2,4], G. Mascaro[3], R. Maciejewsk[i4], R. M. Aggarwal[1,2], D.D. White[1], H.S. Sarjoughian[4], F. Lei4, X. Guan[3], A. Mounir[3], and M. R. Choudhury[2]. *Modeling and visualizing food-energy-water (FEW) interactions at the metropolitan scale.*

The food, energy, and water (FEW) sectors (as networked material and energy flows) form a biophysical system constrained by governance and urban infrastructure domains; embedded legacy and socio-economic underpinnings create disparate—and uneven—water and energy rights for this urban metabolism. In South-central Arizona irrigated agriculture must also be

considered when examining the urban FEW nexus due to its political power and its dominant water use in the region. Our team developed a framework (FEWsim) to examine the FEW nexus for the Phoenix Metropolitan Area. FEWsim incorporates a scenario generator-user interface (UI) to control simulations of a coupled FEW model that writes to a database from which a visualization “front-end” displays model outputs. The model was parameterized for the Phoenix Active Management area (AMA) using 11 years of empirical data. The coupled model incorporates an agronomic statistical model (SM) and two off-the-shelf software programs (WEAP-MABIA and LEAP). The SM estimates the cropping patterns of six dominant crops in the metro area which the MABIA agricultural module of WEAP uses to simulate, among other things, crop yield and crop water use. The water model WEAP estimates the regional water supplies and demand for the AMA. Estimates of water conveyed, pumped, and treated within WEAP are shared with the LEAP energy model that calculates the energy requirements for the network. This architecture enables us to examine scenarios that include, in part, changes in the crops planted and their effect on water use, urban growth and water policy and use, and potential shifts in the energy sectors over time; the coupled model permits examination of the FEW nexus for the AMA. Our project will examine climate-induced impacts on water and energy use for the AMA as driven by CMIP5 and CMIP6 GCM scenarios. Our efforts support policy discourse for integrated nexus governance in the region.

[1]Julie Ann Wrigley Global Futures Laboratory, [2]School of Sustainability, [3]School of Sustainable Engineering and the Built Environment, [4]School of Computing, Informatics, and Decision Systems Engineering, Arizona State University, Tempe, AZ 85287

Schneider, F. A.[1], K. Kulkarni[-2], S. Jayasuriya[-2], and A. Midde[l2,3]. *Project MaRTiny – A new low-cost, IoT sensor measuring thermal conditions and space use.*

The urban thermal environment is highly diverse due to its heterogeneous composition of urban ecological infrastructure and the built environment. Shade one side of the street may provide heat relief in the summer, while sun-exposure on the other side of the street may cause pedestrian discomfort or heat stress. To mitigate heat in public spaces, thermal conditions must be assessed in the context of human exposure and space use. Additional environmental variables that impact the human energy budget are required, such as humidity, wind speed, and radiation in places where people are outdoors. In this context, the biometeorological instrument platform MaRTy has been used to comprehensively measure the thermal environment and address this gap. Yet, continuous long-term measurements of microscale thermal conditions over a larger-than-neighborhood area at a frequency higher than every hour is currently not feasible using MaRTy or other sensing approaches (e.g., weather stations, remotely sensed images). We present a hardware and software setup of a stationary novel, low-cost thermal and visual sensing device (MaRTiny). The system collects prior mentioned meteorological data, concurrently counts the number of people in the shade and sun, and streams the results to an AWS server. Here we present the system and preliminary validation results using MaRTy as a reference platform during two fieldwork days in Kiwanis Park, Tempe, AZ. The sensor lays the foundation for research in urban climate science to investigate how people use public spaces under extreme heat to inform active shade management and urban design in cities.

[1]School of Sustainability, College of Global Futures, Arizona State University; [2]School of Computing and Augmented Intelligence, Arizona State University; and [3]School of Arts, Media, and Engineering, Arizona State University

Seelig ,M.[1], B. Ball[1], Y. Wang[1],, and S. Hall[2]. *Temporo-anthropogenic dynamics of soil biogeochemistry in the Phoenix metropolitan.

Soil properties in the Phoenix valley have undergone changes since its settlement in the early 1900s due to direct and indirect influence irradiated from human management. Previous studies have indicated that past human land-use decisions altered the amount of soil nutrient quantities, and soil that underwent certain land-use treatments remain distinct after decades of discontinued treatment. However, it is currently unclear what temporal trends different land-use treatments may be causing. The Ecological Survey of Central Arizona (ESCA) provides an opportunity to assess how anthropogenic land-use treatments affect soil features comparatively and temporally throughout the Phoenix Metropolitan Area. In this research, we use the ESCA dataset to ask: how are land-use treatments driving biogeochemistry dynamics between treatment types, and how are different land-use treatments changing through time? Principal Components Analysis and t-distributed stochastic neighbor embedding were first used to clarify biogeochemical signals within the data, then linear mixed effect models were used to assess anthropogenic and temporal factors effects on local soil biogeochemistry. We found that 1) Desert and agricultural land uses are the most distinct in soil biogeochemistry, with residential and other urban land uses being less distinct from each other. 2) Biogeochemistry is changing over time in specific land-use factors, as well as broadly about the Phoenix metro. 3) Soil water content, inorganic carbon, C:N, and nitrate signatures are the primary drivers of variation between different land-uses. This suggests that human inputs are the primary cause of change to soil chemistry with irrigation and fertilization likely being the most notable human practices altering soil chemistry.

[1]New College of Interdisciplinary Arts and Sciences, Arizona State University, West campus; and [2]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501.

****Sehner, B.[1], A. E. Frazier[1], and B. L. Turner II[1,2]. *Connectivity of the thermal refuges in the surface urban heat island.***

Habitat connectivity is a key component of conservation planning because it promotes processes such as dispersal, movement, gene flow, migrations, and repopulation. Connectivity is usually conceptualized in terms of land cover, but in urban areas, connectivity of thermal refuges may be equally important for the integrity of populations. Using Phoenix, Arizona as a case study, we ask (1) Does the surface urban heat island (SUHI) effect (and thermal refuges within) manifest as islands and archipelagos in the Phoenix metropolitan area? If so, how do these patterns change over time? (2) How has the connectivity of thermal refuges changed over the last 25 years (1985 to 2020), and are patches of refuge becoming less connected over time? We computed land surface temperature (LST) for the period 1985-2020 using Landsat imagery and generated a set of patch-based spatial pattern metrics to measure the spatial distribution (e.g., size, isolation, etc.) of thermal refuge patches. We then computed the probability that patches were connected at various dispersal distances relevant to species in Phoenix to measure how the connectivity of thermal refuges has changed over time. The SUHI manifests as islands and archipelagos with cooler refuges reducing in size over time and patches under 35°C disappearing completely by 2015. The probability that patches are connected has decreased over time, with agricultural areas providing critical, large thermal refuges for species, particularly around the periphery of the Phoenix metropolitan area.

[1]School of Geographical Sciences and Urban Planning, Arizona State University, PO Box 875302, Tempe, AZ 85287-5302; [2]School of Sustainability, Arizona State University, PO Box 875502, Tempe, AZ 85287-5502.

Weiss, K.C.B.[1], J.S. Lewis[1], S.C. Hess[1], J. Schipper[2], and B. Sterner[1]. *Assessing the ecological and nutritional drivers of coyote (Canis latrans) diets along the Salt River corridor.

Human-coyote conflicts often center around food, especially the consumption of domestic pets, trash, or entering residential areas in search of prey. Yet, it is unknown how urbanization influences coyote diets, given prey availability, competition, and nutritional needs. In association with the CAP LTER and Urban Wildlife Information Network (UWIN)'s Salt River Wildlife Project, we placed 41 remote wildlife cameras and collected coyote scat along ~70km of the Salt River across two seasons to discern the relative importance of ecological conditions and nutritional limitations on coyote diets between urban and reference sites, as determined by 1km NLCD buffers. Season 1 included scat from April – June 2021 and photos from March – June 2021, while Season 2 included scat from November 2021 – January 2022 and photos from October 2021 – January 2022. For camera photos currently processed (March – April 2021), coyote naïve occupancy across all sites was 0.93, 1.0 in urban sites, and 0.85 in reference sites. Meanwhile, lagomorph species—a common prey source for coyotes—had a naïve occupancy across all sites of 0.78, 0.90 in urban sites, and 0.65 in reference sites. Species ID for a subset of coyote scat was confirmed through DNA analysis, with funding provided by the 2021 CAP LTER Graduate Grant. To identify the relative importance of urbanization, competition, and prey availability in determining coyote diets, we will use novel approaches that combine spatio-temporal occupancy data of both competing and prey species with frequency of occurrence data from coyote scats. We will also use nutritional geometric approaches to identify if coyotes regulate, maximize, or limit their intake of protein in urban-associated compared to reference sites along the Salt River. By understanding how ecological and nutritional constraints influence coyote diets—and subsequent occupancy and potential conflict near urban areas—we can better inform management approaches that promote human-coyote coexistence.

[1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; and [2]Field Conservation Research Dept, Arizona Center for Nature Conservation/Phoenix Zoo, Phoenix, AZ, USA

***Wright, M. K., D. Hondula, and K. Larson. *A meta-analysis of social and environmental factors predicting household-level heat-related illness in Phoenix, Arizona*.**

The social and environmental characteristics that make residents more vulnerable to heat-related mortality and morbidity have been the subject of extensive study, particularly in the hot, desert city of Phoenix, Arizona. As part of this effort, numerous social surveys have been conducted in the Phoenix area over the past decade (including the Phoenix Area Social Survey (PASS)). Social surveys are highly valuable to the heat vulnerability research community because they are time and resource-intensive to collect, yet are the only way to obtain information related to households' adaptive capacity to heat and experiences with heat that do not necessarily result in formal medical care or mortality. Unfortunately, the findings from these surveys are often not published and the administration of the surveys in Phoenix has been fairly disparate. Thus, to synthesize the valuable knowledge contained in these surveys, we conducted a meta-analysis of the various risk factors predicting heat-related illness using eight heat-oriented social surveys conducted in Phoenix over the past decade to address how survey measures of adaptive capacity are related to incidence of heat-related illness. Our results indicate that residential indoor temperatures play a significant role in occurrence of heat-related illness. Cost limitations on air conditioning use and not using central air conditioning were significantly related to incidence of heat-related illness. Similarly, when residents report being "too hot in their home" during the summer they are twice as likely to experience heat-related illness. This is the first effort to synthesize valuable findings from the many disparate surveys which have been conducted in Phoenix, and, to the best of our knowledge, the first scientific effort in the literature to synthesize heat-health relationships collected from social surveys.

School of Geographical Sciences and Urban Planning, Arizona State University

Zhu, Q.[1], K. Larson[1], and M. Wheele[r2]. *How yard management priorities and the extent of yard changes contribute to residents' yard satisfaction.

Residential landscapes play an important role in urban ecosystem services and human well-being. The typologies, structures, and functions of residential yards are influenced by diverse yard management priorities, such as enhancing yard aesthetics, minimizing maintenance costs, and providing habitat for wildlife. Residents motivated by different priorities are likely to make different changes in their yards. Although making changes is likely to contribute to residents' satisfaction with their current yards, the extent of changes might not always be enough to reflect their personal preferences. For example, residents may be dissatisfied with their yards, especially if front yard choices are constrained by neighborhood norms or local regulations. To better understand landscape change and residents' yard satisfaction, we need to look at these dynamics in relation to yard management priorities since relatively little research has focused on such relationships. Based on a 2018 survey conducted in four neighborhoods (n=105 yards) of the Phoenix metropolitan region, we address three questions in this study: (1) how is yard satisfaction associated with the extent of changes people have made to their front and back yards, (2) how does this "satisfaction-change" relationship differ between the front and back yards? and (3) focusing on front yards only (given the data available), how are residents' yard management priorities correlated with their yard satisfaction and the extent of change? We examine six management priorities: aesthetic values, ease-of-maintenance, relaxation, neighborhood norms, rules compliance, and wildlife gardening. This study will enhance our understanding of residential landscape changes while providing insights on related motivations and human well-being in the urban ecosystem of Phoenix, Arizona.

[1]School of Geographical Science and Urban Planning, Arizona State University, Tempe, AZ 85287; and [2]San Francisco Estuary Institute, Richmond, CA 94804