CAP LTER Twenty-fifth All Scientists Meeting
and Poster Symposium
Friday, January 13, 2023
ASU Skysong, Building 3, Synergy I & II

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

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

CAP JEDI Committee Update
Dr. Elizabeth Cook, Assistant Professor, Bard College, and Quincy Stewart, CAP Site Manager

ASU Community-Driven Archives Presentation, Jessica Salow, Assistant Archivist

9:45 a.m. **Keynote Presentation: Urban Air Quality and Environmental Justice**
Dr. Christine Fuller, University of Georgia and Dr. Jennifer Vanos, Arizona State University

Questions/Discussion

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

11:00 a.m. CAP V **Interdisciplinary Research Theme Introductions**

Research Question #1: Ecosystem structure and function and biogeochemical cycling; IRT name: **Ecosystem Structure & Functioning** (Leads: Ball, Grimm and Throop)

Research Question #2: Adaptation and eco-evolutionary dynamics in nonhuman urban organisms; IRT name: **Adapting to City Life** (Leads: Meerow, McGraw, Schell)

Research Question #3: Urban climate, heat, and air quality; ITR name**: Urban Climate and Air Quality** (Leads: Fuller, Hartnett, Hondula)

11:45 a.m. **LUNCH**

1:00 p.m. **Poster Session**

2:30 p.m. **CAP Interdisciplinary Research Theme introductions (cont.)**
Research Question #4: Urban nature and human perceptions, decisions, and wellbeing; IRT name: **Environment & Human Wellbeing** (Leads: Bateman, Coseo, Hale)

Research Question #5: Governance, environmental justice, and transformative futures; IRT name: **Governance & Just Transitions** (Leads: Berbes, Cook, Iwaniec, Meerow, Vanos, York)

3:15 p.m. **BREAK**

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

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

2023 CAP LTER Poster Symposium

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

Aparecido et al.
**Ballantyne et al.
**Caughman et al.
*Chandrakanthan and Herkes
*Cisco
Earl
*Enloe et al.
Fleming and Childers
**Gentry et al. (also includes graduate student)
*Haight et al.
Keith et al.
Lewis et al.
Li et al.
*Liao et al.
*Mitchell and Larson
*Polekoff et al.
*Price et al.
*Ramsey et al.
Reichman and Colbert
**Storey et al.
*Tarr et al.
*Trego et al.
*Unal Cilek and Middel
*Van Tol et al.
**Willis et al.
*Zhu and Larson

List of Posters

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

ADAPTING TO CITY LIFE

****Ballantyne, Brian, Beth Ponn, Tristan Pedroza, Damara Willis, and J. Chadwick Johnson.** ***Behavioral comparison of*** **Latrodectus geometricus** ***and*** **Latrodectus hesperus*.***

Enloe, Annika, Jeffrey Brown, Kelli L. Larson, and Heather L. Bateman.** ***Feeling rattled? Resident attitudes, urban habitat features, and patterns of snake removals in the Phoenix metropolitan are**a.**

Fleming, David, and Dan Childers. ***The effects of urbanization on the Phoenix metropolitan areas insect communities*****.**

Haight, Jeffrey D., Kelli L. Larson, Jeffrey A. Brown, Sharon J. Hall, and Jesse S. Lewis.** ***Social-ecological drivers of Phoenix residents' comfort living with wildlife.

Lewis, Jesse S., Jessie Dwyer, Jeffrey Haight, Kate Weiss, and Zachary Ziebarth. ***Predictive maps of habitat quality for multiple terrestrial wildlife species across the Phoenix Valley, AZ.***

Polekoff, Sarah E., Ray Pressman, and Kylie Maxwell.** ***Adapting to city life: Physiology and behavior of urban and desert house finch **(*Haemorhous mexicanus*).**

****Willis, Damara, Brian Ballantyne, Tristan Pedroza, and J. Chadwick Johnson.** ***Artificial lights at night and its impact on black widow spider behavior*****.**

CLIMATE AND HEAT

Aparecido, Luiza Maria T., Kallika Naylor, Isabella Werner, Raven Braithwaite, Ella Schmidt, Heather Throop, Jnaneshwar Das, and Kevin Hultine. ***Cooling capacity of urban trees exposed to thermal stress.***

Cisco, Jordan T.** ***The fate of microplastics in Tres Ríos Wetlands.

Keith, Ladd, Sara Meerow[†], Shaylynn Trego, and Erika Schmidt. ***Applying a plan integration for resilience scorecard for heat in Tempe, AZ.*** **([†]denotes presenting author).**

Li, Rui, Mikhail V. Chester, Ariane Middel, Jennifer K. Vanos, Danae Hernandez-Cortez, Isaac Newton Buo, and David M. Hondula. ***Effectiveness of travel behavior and infrastructure change to mitigate heat exposure.***

***Liao, Rosie D., Nico Franz, Laura R. Prado, Laura D. Steger, and Kelsey Yule. *Using the National Ecological Observatory Network (NEON) biorepository collections, samples, and data*.**

Price, Peter, Paul Coseo, and Ariane Middel. *Understanding the ecological design benefits and limitations of rooftop green spaces to reduce heat exposure for vulnerable residents.

Trego, Shaylynn, Sara Meerow, Aaron Flores, and Kelli Larson. *A longitudinal assessment of heat risk perceptions and adaptations in Phoenix, Arizona.

***Unal Cilek, Muge, and Ariane Middel. *Thermal comfort evaluation of green space geometries in different local climate zone: The case of hot-arid climate*.**

Van Tol, Zachary, Jennifer Vanos, Ariane Middel, and Kristin Ferguson. *The climate consequences of privatizing public spaces.

EDUCATION AND MANAGEMENT

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

Reichman, Anne, and Julia Colbert. *ASU Project Cities*.

GOVERNANCE AND INSTITUTIONS

Van Tol, Zachary, Jennifer Vanos, Ariane Middel, and Kristin Ferguson. *The climate consequences of privatizing public spaces.

PARKS AND RIVERS

****Gentry, Zoe, *Savage Cree Hess, Michele Clark, Liliana Caughman, Michelle Hale, and Nancy Grimm. *Living lands: Cultivating river stewardship through gameplay and storytelling.***

Lewis, Jesse S., Jessie Dwyer, Jeffrey Haight, Kate Weiss, and Zachary Ziebarth. *Predictive maps of habitat quality for multiple terrestrial wildlife species across the Phoenix Valley, AZ.*

***Ramsey, Luke, Daniel Childers, Elizabeth Makings, and Heather Bateman. *Biodiversity and community composition of accidental and restored urban Salt River wetlands*.**

****Storey, Garrett, Pierre Herckes, and Daniel Childers. *Ultra-trace analysis of plasticizers in constructed wetland ecosystem.***

***Unal Cilek, Muge, and Ariane Middel.** ***Thermal comfort evaluation of green space geometries in different local climate zone: The case of hot-arid climate*.**

Van Tol, Zachary, Jennifer Vanos, Ariane Middel, and Kristin Ferguson.** ***The climate consequences of privatizing public spaces.

RESIDENTIAL LANDSCAPES AND NEIGHBORHOODS

***Enloe, Annika, Jeffrey Brown, Kelli L. Larson, and Heather L. Bateman.** ***Feeling rattled? Resident attitudes, urban habitat features, and patterns of snake removals in the Phoenix metropolitan are*a.**

***Mitchell, Abigail, and Kelli L. Larson.** ***Nature interactions, social capital, and wellbeing in metropolitan Phoenix during the COVID-19 pandemic*.**

***Zhu, Qinnan, and Kelli L. Larson.** ***Residential vegetation changes and associated multi-scalar drivers in central Arizona, 2017-2021*.**

SCENARIOS AND FUTURES

Aparecido, Luiza Maria T., Kallika Naylor, Isabella Werner, Raven Braithwaite, Ella Schmidt, Heather Throop, Jnaneshwar Das, and Kevin Hultine. ***Cooling capacity of urban trees exposed to thermal stress.***

****Caughman, Liliana, Tanishq Jain[†], and Madison Harris[†].** ***Future scenarios using process tracing.*** **([†]presenting authors)**

***Unal Cilek, Muge, and Ariane Middel.** ***Thermal comfort evaluation of green space geometries in different local climate zone: The case of hot-arid climate*.**

URBAN DESIGN

***Ramsey, Luke, Daniel Childers, Elizabeth Makings, and Heather Bateman.** ***Biodiversity and community composition of accidental and restored urban Salt River wetlan*ds.**

WATER AND FLUXES

Aparecido, Luiza Maria T., Kallika Naylor, Isabella Werner, Raven Braithwaite, Ella Schmidt, Heather Throop, Jnaneshwar Das, and Kevin Hultine. ***Cooling capacity of urban trees exposed to thermal stress.***

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

Cisco, Jordan T.** ***The fate of microplastics in Tres Ríos Wetlands.

Ramsey, Luke, Daniel Childers, Elizabeth Makings, and Heather Bateman.** ***Biodiversity and community composition of accidental and restored urban Salt River wetlands**.**

****Storey, Garrett, Pierre Herckes, and Daniel Childers.** ***Ultra-trace analysis of plasticizers in constructed wetland ecosystem.***

Tarr, Kayla, Mikhail Chester, Daniel Childers, and Abigail York.** ***A social ecological technological analysis of urban ecological infrastructure for stormwater management in Phoenix, AZ.

Abstracts

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

Aparecido, L. M. T.[1], K. Naylor[2], I. Werner[3], R. Braithwaite[1], E. Schmidt[2,4], H. Throop[1,2], J. Das[1], and K. R. Hultine[5]. ***Cooling capacity of urban trees exposed to thermal stress.***

In arid regions where episodic heatwaves regularly occur, urban heat islands pose a major threat to human and environmental health. Urban vegetation is known for mitigating some of these threats by cooling the local surroundings through shade and evapotranspiration. However, choosing the appropriate tree species remains a challenge, as urban planners have little information on species' cooling capacities. Here, we investigated 1) how plant water use and shade projection differed across species; and 2) how these parameters changed from spring to mid-summer in Phoenix, AZ, USA when temperatures regularly exceed 40°C. We measured leaf stomatal conductance (gsw), leaf and whole-plant transpiration (Et), coupled with measurements of canopy temperature, canopy volume, and microclimate. Measurements were taken from mid-Spring and extended through pre-Monsoon and Monsoon summer (March-July 2021). Contrary to popular belief, exotic tree species did not significantly transpire more than native species on average or across seasons. While gsw declined as VPD and leaf temperature increased with summer conditions, an exception was observed in June 2021 in which both gsw and Et substantially increased after a heatwave event. That response was not observed in July 2021 due to a subset of species suffering from leaf thermal damage and possible loss of xylem conductivity. Eleven of the 14 species increased midday Et, contributing to enhanced canopy cooling, while the remaining three species suppressed water loss in response to thermal stress. Importantly, species that were highly susceptible to thermal stress had reduced canopy cover which compromised their capability of projecting shade during the warmest and driest period of the year. Ultimately, *Pinus eldarica, Cupressus arizonica, Chilopsis linearis, Fraxinus velutina*, and *Searsia lancea* were proven to be the best tree options for Phoenix landscaping as these species provide intermediate-full shade across seasons, relative to water use under arid conditions.

[1]School of Earth and Space Exploration, Arizona State University, Tempe, AZ; [2]School of Life Sciences, Arizona State University, Tempe, AZ; [3]Ira A. Fulton Schools of Engineering, Arizona State University, Tempe, AZ; [4]Paradise Valley High School, Phoenix, AZ; and [5]Desert Botanical Garden, Research, Conservation, and Collections, Phoenix, AZ.

****Ballantyne, B.[1], B. Ponn[1], T. Pedroza[1], D. Willis[2], and J. C. Johnson[1].** ***Behavioral comparison of* Latrodectus geometricus *and* Latrodectus hesperus.**

Invasive species have become ubiquitously known for outperforming and often times displacing native species. Whether they've been intentionally or unintentionally introduced, invasive species have a propensity to damage ecosystems causing detrimental effects on the rest of the community. Zebra mussels, for instance, have become a nuisance in the Great Lakes altering trophic dynamics of existing wildlife causing great harm to native species. In the case of *Latrodectus geometricus*, or the Brown Widow, relatively little is known regarding its successful invasion into the United States. First discovered in Florida during the 1930's, the Brown Widow spider has displaced other *Latrodectus* species in their native locations and has spread to parts of Texas, South Carolina, and California. Like other *Latrodectus* species, the Brown Widow spider has done incredibly well in urban environments and persists despite competition in what would presumably be a similar ecological niche. To gain a better understanding of the Brown Widow, we conducted a comparison of both the Brown Widow spider and the Western Black Widow spider (*Latrodectus hesperus*). Spiders were measured on web building activity, response to prey introduction and fecundity. Web building activity was measured over a 60-minute interval documenting movement every five minutes, response to prey introduction was also measured over a 60-minute interval recording time and type of response while fecundity was measured by size and number of eggs within an egg sac. With these measurements, we hope to garner a better understanding of the Brown Widow spider and its ability to outperform native species.

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****Caughman, L.[1], T. Jain[†2], and M Harris[†1]. *Future scenarios using process tracing*. ([†]denotes presenting authors).**

This study explores the use of transformative urban scenarios and timelines as a planning tool for addressing future challenges in the South Phoenix region. We conducted workshops in which members of the public developed action plans for various potential events occurring between the present and 2080. To evaluate the process of timeline development, we employed process tracing as a methodology to analyze the actors, actions, and observable manifestations involved. Our analysis of the resulting five timelines revealed a skewed distribution, with a greater concentration of actions occurring in the first two-thirds. In addition, we found that the public played a significant role in the decisions and implementations depicted in the timelines, indicating a strong sense of agency and control over the future of their community. A common theme across the timelines was a focus on sustainability, with a goal of promoting environmental welfare and social and economic equality. This research is ongoing, and further analysis will be conducted to draw conclusions.

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

Microplastics are pervasive contaminants that are found in all environments. They are defined as plastic particles that are less than 5 mm in size. Microplastics can be of primary origin (intentionally manufactured at a microscopic size) or result from secondary degradative processes. 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. Microplastics can also act as vectors of other organic contaminants in soils. Therefore, there is an urgent need to assess the extent of microplastics contamination and their impact on the environment.

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 was performed to obtain insights into possible sources and toxicity of microplastics. Raman characterization for microplastics in 2015 soil samples revealed an array of polymers including Polyethylene, Polystyrene, Polyvinyl chloride, Polyamide, Polyester, Polypropylene. Approximately 75% of all sites contained Polyethylene. A majority of microplastics remain chemically unidentified.

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Cisco, J. T.** ***The fate of microplastics in Tres Ríos Wetlands.

Plastics are an emerging issue in aquatic ecosystems due to their slow degradation and ability to fragment into smaller more mobile parts. Concluding this process, plastics <5mm are categorized as Microplastics, MPs. Currently, the majority of MPs studies bring attention to marine pollution and the impacts that follow. However, it remains high priority to understand how MPs move through urban aquatic environments and the impacts this may have for urban ecosystems. Little is known about how MPs move through urban water systems, such as wetlands, and how much, if any, remains trapped in elements such as soil or plant life. The analysis of MPs using Tres Ríos, a tertiary wastewater treatment wetland, as the study site helps to shed light on the most likely source-occurrences of MPs. Through slight modification of NOAA's standard procedure for processing MPs, soil, plant, and water samples were collected along major access points within the system including inflow and outflow. Tres Ríos showed high variability of presence in soil samples while relatively consistent plastic presence in water throughout the system. As this study is currently on-going, atmospheric plastics and vegetation samples could provide the necessary evidence to determine unaccounted for components in this setting. In addition to understanding the movement of MPs, morphological characteristic including size, color, and shape were recorded to assist in furthering current knowledge in the field. These current results indicate MPs are leaving the system at a similar rate that they are entering. Due to the accumulation of MPs in soil samples, atmospheric pollution may be key to further understanding the interactions and connections within the system.

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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], J. Brown[2], K. L. Larson[3,4], and H. L. Bateman[1].** ***Feeling rattled? Resident attitudes, urban habitat features, and patterns of snake removals in the Phoenix metropolitan area**.**

Understanding how wildlife interact with humans and the built environment is critical as urbanization contributes to habitat change and fragmentation globally. In urban and suburban areas, wildlife and people are often in close quarters, leading to human-wildlife interactions

(HWI). In the greater Phoenix Metropolitan Area, Arizona, HWI can include reptiles such as venomous and nonvenomous snakes. Rattlesnake Solutions, LLC, a local business, removes and relocates snakes from homes and businesses in the Phoenix area and, as a collaborator, has provided records of snake removals. We assessed multi-scale habitat associations of HWI from residential yards at snake removal locations and random locations. At the neighborhood scale (n = 60), we found that removals occurred in yards with abundant cover opportunities. At the landscape scale, (n = 764), nonvenomous snakes in the family Colubridae (e.g., gopher-snakes) were removed from areas of higher urbanization than venomous snakes in the family Viperidae (e.g., rattlesnakes). Clients of Rattlesnake Solutions, LLC, were asked to answer a short survey regarding the circumstances of their snake removal event and their attitudes, perceptions, and experiences with snakes. From this survey (n = 271), we determined that people with prior snake experiences have more positive attitudes and intentions towards snakes. Those with prior snake experiences were more consistent across their responses than those without prior snake experiences. Continuing inquiry into the urban ecology of these snakes is important to fostering coexistence between the snakes and people that call Phoenix home.

[1]Arizona State University, College of Integrative Sciences and Arts, Mesa, AZ 85212; [2]Department of Biology, La Salle University, Philadelphia, PA; [3]Global Institute of Sustainability and Innovation, Arizona State University, Tempe, AZ 85287-2404; and [4]School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ 85287-5302

Fleming, D., and D. Childers. *The effects of urbanization on the Phoenix metropolitan areas' insect communities.*

Insects are a key ecological community. Their presence in human environments is crucial for plants, as pollinators, as decomposers of organic matter and as the base of environmental food webs. Both the continued urban sprawl of the Phoenix metropolitan area and the effects of climate change have put a large stressor on the insect community population in and surrounding the city. Their decline in numbers affects not only the health of their surrounding environment but other ecological communities.

For over two decades, CAP LTER scientists have been collecting ground-based arthropods (i.e., insects, spiders, mites and collembola) via pitfall trapping in a variety of habitats inside and outside the Phoenix metropolitan area. This research will focus on how insect communities specifically have fared in desert, mesic and xeric habitats around the region. These data can be used to show long-term ecological trends in insect populations as an overall community, and also to pinpoint which communities have been most affected by sprawl and climate change. Through analysis, the data shows that insect populations have had a rapid decline both inside the Phoenix area, as well as in the surrounding, outlying desert.

This data can also be invaluable going forward to study the root cause of this decline by cross-comparison of other datasets. For example, by utilizing multiple CAP LTER datasets, connections can be made between plant abundance (as it varies between desert, mesic and xeric habitats) and the population size of associated insect communities. In addition, connections can be made from the decline in insect population and other ecosystems' abundance (i.e., using CAP LTER's bird census for connections with insectivorous birds).

Central Arizona–Phoenix Long-term Ecological Research, Global Institute of Sustainability and Innovation, Arizona State University, PO Box 878204, Tempe, AZ 85287-8204

Gentry, Z., *S. C. Hess[2], M. Clark[2], L. Caughman[2], M. Hale[3], and N. Grimm[2]. *Living lands: Cultivating river stewardship through gameplay and storytelling.*

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

To address the interlinked issues of cultural erasure, nature literacy, and language loss, this project uses a game that is co-developed by native teens and community advisors to strengthen relationships with the Salt River. In this game, players assume the roles of various animals that inhabit the river, and navigate a mosaic of human-environment interactions while trying to meet their own needs. By telling stories about the Salt River's inhabitants and reading their original names, players practice thinking about their environment through a more indigenous framework. This helps challenge colonial narratives and renew healthy relations with the river. The project ultimately aims to nurture the sense of kinship and understanding in indigenous youth as the next generation of river stewards. Additionally, production and dissemination of this game is inexpensive, ensuring accessibility across communities.

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Haight, J. D.[1], K. L. Larson[2], J. A. Brown[3], S. J. Hall[1], and J. S. Lewis[4]. *Social-ecological drivers of Phoenix residents' comfort living with wildlife.

Human-wildlife coexistence in cities depends on how residents perceive and interact with wildlife in their neighborhoods. An individual's attitudes and responses to wildlife are primarily shaped by their subjective cognitive judgments, including multi-faceted environmental values and perceptions or risks or safety. However, experiences with wildlife could also positively or negatively affect an individual's environmental attitudes, including their comfort living around wildlife. Current understanding of human-wildlife coexistence has been limited by most previous research having focused on ameliorating conflicts on conflicts with individual problematic species, particularly in rural environments. To address this research gap, we explored potential for both positive and negative interactions with multiple wildlife species within an urban residential context. We used data collected via a 2021 survey across twelve neighborhoods of the Phoenix Metropolitan Area, AZ (i.e., CAP's Phoenix Area Social Survey) to examine the degree to which residents' comfort living near different wildlife species (coyotes, foxes, and rabbits) relates to the environment in which residents live, relative to their values and attitudes as well as personal characteristics. We found that residents' greater comfort living near wildlife was most strongly associated with pro-wildlife value orientations, reflecting the expectation that attitudes toward wildlife are primarily driven be an individual's value-based judgements. Furthermore, attitudes were also associated with sociodemographic factors (e.g., age and pet ownership) and environmental factors predicted to influence residents' nature-based experiences and familiarity with wildlife. Specifically, residents living closer to desert parks and preserves were more likely to have positive attitudes toward both coyotes and foxes, species generally regarded as being of greater risk to humans and domestic animals. By improving understanding of what drives attitudes toward urban wildlife, these results can help managers effectively evaluate the potential for human-wildlife coexistence through strategies to mitigate risk and facilitate stewardship.

[1]School of Life Sciences, Arizona State University; [2]School of Geographical Sciences and Urban Planning, Arizona State University; [3]La Salle University; and [4]College of Integrative Science and Arts, Arizona State University

Keith, L.[1], S. Meerow[2†], S. Trego[2], and E. Schmidt[1]. *Applying a plan integration for Resilience Scorecard™ for heat in Tempe, AZ.* (†denotes presenting author).

The number of dangerously hot days and the need for communities to equitably plan for heat resilience are increasing from the combination of climate change and the urban heat island (UHI) effect. While planners increasingly recognize this imperative, there are many barriers they face including a lack of research-based heat guidance for planning processes, underdeveloped regulatory structures, along with 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. As part of the Tempe Cool Kids, Cool Place, Cool Futures project supported by the Robert Wood Johnson Foundation, we used the Plan Integration for Resilience Scorecard™ for Heat approach to evaluate how the City of Tempe's existing network of plans addresses heat. More specifically, we evaluated how land use policies in the general, climate action, hazard mitigation, and sustainability plans would affect the UHI and mapped policies to census tracts to examine their spatial distribution and net effect on heat mitigation. We compared the results with heat exposure and social vulnerability data to assess policy alignment with heat risks and identify opportunities for improvement throughout the city. We shared the methodology and results with city officials, youth council members, and other stakeholders in a participatory workshop, where workshop participants applied a simplified version of the plan analysis methodology themselves, leading to fruitful discussions about effective heat planning.

[1]University of Arizona, School of Landscape Architecture and Planning; and [2]School of Geographical Sciences and Urban Planning, Arizona State University.

Li, R.[1], M. V. Chester[1, 2, 3, 5], A. Middel[4,5,6], J. K. Vanos[3], D. Hernandez-Cortes[3,7], I. N. Buo[8], and D. M. Hondula[4,5]. *Effectiveness of travel behavior and infrastructure change to mitigate heat exposure.*

Urban heat exposure is an increasing health risk among urban dwellers. Many cities are considering accommodating active mobility, especially walking and biking, to reduce urban-induced anthropogenic greenhouse gas (GHG) emissions. However, promoting active mobility without proper planning and transportation infrastructure to combat extreme heat exposure may cause more heat-related morbidity and mortality in the climate change future. This study estimated the effectiveness of active trip heat exposure mitigation under built environment and travel behavior change. Simulations of the Phoenix metro region's 624,987 active trips were conducted using the Activity-based travel model (ABM), simulated Mean Radiant Temperature (TMRT), transportation network, Local Climate Zones, and supplemental data. Two cooling scenarios were designed to identify the cool corridors with the low-temperature and represent different built environment cooling levels. Travelers experienced TMRT heat exposure ranging from 29°C to 76°C (84°F to 168°F) on the simulation day. In the same cooling scenario, behavior changing cooled up to ten times more trips than the built environment changing. Active trips reduced an average of 1.2°C to 3.7°C based on different scenarios when the networks were fully converted to the cool corridors. The marginal benefit of the cooling decreased from over 1,000 trips/km when less than 10 km of corridors were converted to less than 1 trip/km when all corridors were transformed. The results revealed that heavily traveled corridors should be prioritized with limited resources, and the best cooling results come from environment and travel behavior change together. This study confirmed prior efforts in personal heat exposure studies that individual-level heat exposure provides more precise insights into how people are exposed to heat.

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***Liao, R, N. Franz, L. R. Prado, L. D. Steger, and K. Yule. *Using the National Ecological Observatory Network (NEON) Biorepository collections, samples, and data*.**

The National Ecological Observatory Network (NEON) is a continental-scale project designed to facilitate monitoring and forecasting of ecological and evolutionary change. This 30-year project produces and openly publishes 181 ecological, climatological, and genomic data products collected from 47 terrestrial and 34 freshwater aquatic field sites. In addition to providing these rich datasets, NEON simultaneously collects over 100,000 physical samples and specimens each year. The NEON Biorepository at Arizona State University curates these samples into more than 60 unique collections and enables their use in research. There are currently over 319,000 samples available for researcher use. The collections include invertebrates, aquatic and terrestrial plants, microalgae, environmental samples, microbes, tissues, genomic samples, and vertebrates. The Biorepository uses best practices from natural history collections to preserve samples and maximize their research potential and longevity. All samples are easily searchable online in the NEON Biorepository Data Portal, and the team works with researchers to find samples that fit their needs and fulfill loan requests. To date, the NEON Biorepository has helped to fulfill 47 sample use requests and 18,000 samples are involved in current and pending requests. Projects that use these samples cover a wide variety of topics, including phylogenomics, systematics, host-pathogen interactions, microbiome evolution, population genetics, trait evolution, and metagenomic and eDNA method development.

NEON Biorepository, School of Life Sciences, Arizona State University, Tempe, AZ 85287-4108

Lewis, J. S.[1], J. Dwyer[1], J. Haight[2], K. Weiss[2], and Z. Ziebarth[2]. *Predictive maps of habitat quality for multiple terrestrial wildlife species across the Phoenix Valley, AZ.*

Understanding habitat relationships for species is essential to wildlife conservation, especially in relation to human activities. This information can be used to create predictive maps of habitat quality and landscape connectivity for species, which can be used to manage landscapes to conserve wildlife populations. In addition, results of wildlife-habitat relationships can be leveraged to ask a diversity of additional research questions. However, little information is available on habitat relationships and landscape connectivity for a suite of wildlife species in relation to urbanization and other landscape factors throughout the desert southwest, and the Phoenix Valley in particular. Across the CAP LTER study area, we have maintained two wildlife camera studies, including across the Phoenix Valley (n=50 wildlife cameras) and along the Salt River (n=43 wildlife cameras), and have documented a suite of species including bobcat, coyote, gray fox, javelina, mountain lion, mule deer, rabbits (cottontail and jack rabbit), raccoons, roadrunners, skunks, and several other species. Using occupancy models, we have evaluated how urbanization, plant productivity, water, topography, amount of natural vegetation, distance to open space park, and other landscape factors influenced the habitat relationships of multiple wildlife species, and created predictive maps of habitat quality across the Phoenix Valley. Species-habitat relationships will be used to create maps of landscape connectivity and identify important habitat patches and connections among them to assist with conservation efforts. In addition, this information can be used in multiple potential collaborations, such as relating species distributions to socio-economic factors, areas of human-wildlife interactions, and other questions. Ultimately, results from this research can be used by managers to proactively work with people to promote wildlife conservation across landscapes influenced by human activities.

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Mitchell, A.[1], and K. L. Larson.[1,2]** ***Nature interactions, social capital, and wellbeing in metropolitan Phoenix during the COVID-19 pandemic.

Understanding how nature interactions impact human wellbeing in an urban setting is especially pertinent during the COVID-19 pandemic given the increased isolation and anxieties experienced by many people. Promoting wellbeing is a core tenet of sustainability vis a vis human development and wellbeing. The pandemic, and subsequent stay-at-home orders, provides a unique opportunity to examine the impacts of different types of nature interactions – for example, gardening, hiking, or visiting parks—on human wellbeing. Through a quantitative analysis of the 2021 Phoenix Area Social Survey (PASS) dataset, we explore how distinct nature recreation activities affected different realms of residents' wellbeing during the COVID-19 pandemic. In addition to changes in gardening, hiking, and visiting local parks, we also examine how local environmental satisfaction and social capital in residents' neighborhoods affect three distinct measures of wellbeing: overall life satisfaction, physical health, and mental health. Specifically, we ask: what types of nature engagement and local environmental and social factors best explain various wellbeing measures during a pandemic? Using regression models, our results indicate that the local social and environmental attributes of neighborhoods have a greater impact on wellbeing than nature recreation during COVID or otherwise, though the factors affecting wellbeing vary across the three dimensions. Establishing the influence and effects of the COVID-19 pandemic will enable later research to investigate trends and drivers of human wellbeing to support sustainability goals.

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Polekoff, S. E., R. Pressman, and K. Maxwell.** ***Adapting to city life: Physiology and behavior of urban and desert house finch (*Haemorhous mexicanus*).

Urban environments generally have reduced biodiversity, but some species thrive and reach higher abundances in urban compared to non-urban environments. Urban populations often differ from their non-urban counterparts behaviorally and physiologically, but few studies focus on multiple traits in the same individuals. To address this issue, I am investigating the effects of urbanization across multiple physiological and behavioral traits in the house finch, *Haemorhous mexicanus*, a widespread and locally abundant native songbird. I am measuring multiple indicators of oxidative stress as well as exploratory behavior in individual, wild birds sampled in urban and Sonoran Desert environments. The goal of this project is to identify behavioral and physiological differences between urban and desert populations, and to determine whether associations between oxidative stress and behavior are consistent across contexts. I captured over 160 house finches between 2020 and 2022 during both breeding and nonbreeding seasons, from a total of four locations across the Phoenix valley. I observed differences in both behavior and physiology between desert- and urban-dwelling finches. Urban house finches were more exploratory than desert house finches. Additionally, several factors were influenced by both season and habitat. During the breeding season, desert house finches have lower breath rate in hand, lower body fat, and higher oxidative damage as compared to urban and winter birds. Overall, urban finches do not appear to face any oxidative challenge as I had predicted; instead, urban resources may buffer finches from the harsh desert environment during the hot breeding season. Lead author is a graduate student.

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Price, P[1], P. Coseo[1], and A. Middel[2].** ***Understanding the ecological design benefits and limitations of rooftop green spaces to reduce heat exposure for vulnerable residents.

As cities in the Southwest grow and increase in density, designers and property developers are integrating new typologies of vegetated rooftop amenity spaces, which go beyond first-generation green roofs by creating usable outdoor green spaces. Multifamily housing that integrates rooftop green spaces has become common in new urban development in cities like Phoenix and Tempe. Yet, research on these new types of green spaces is limited. These spaces may provide ecosystem service benefits for users such as access to nature and cultural services like community gardens. This study creates an evidenced-based understanding for rooftop green spaces as a nature-based design solution for compact cities. 21st century designers must understand how these novel urban green spaces impact communities' health and well-being. Mirabella at ASU is a compact high-rise residential community adjacent to the ASU Tempe campus that has rooftop green space amenities designed for its resident population of older adults. Older populations have an increased risk of negative health outcomes caused by exposure to high temperatures, but some of the risk may be mitigated by providing access to quality shade and green spaces. This study aims to understand how shade from built structures and plants on the rooftop green space at Mirabella can impact mean radiant temperatures (MRT) and residents' thermal perception. We'll also examine the roles of irrigation and evapotranspiration from plants in reducing MRT, as previous studies have found that shade and evapotranspiration can significantly reduce the MRT experienced by people in green spaces. This study will partner with Mirabella residents to research the benefits and limitations of rooftop community gardens and try to develop design-solution guidance for designers.

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Ramsey, L.[1], D. Childers[1], E. Makings[2], and H. Bateman[3].** ***Biodiversity and community composition of accidental and restored urban Salt River wetlands**.**

In rapidly urbanizing areas of the desert Southwest, wetland ecosystems are vital for humans and nonhumans alike. Urban river reaches provide myriad ecosystem services, including habitat corridors, heat mitigation, flood protection, and denitrification. They are also shaped by many social, ecological, and technological factors, including stormwater infrastructure, species introductions, and direct use. The Salt River (On'k Akimel) is an example of this complexity. Across less than 60 km as it enters the Phoenix Area, the Salt River is dammed, diverted, re-filled, clear-cut, restored, and ignored.

CAP's Salt River Biodiversity Project (SRBP) began in 2012, measuring plant, reptile, amphibian, and bird communities in seven differently managed reaches of the urban Salt River along a gradient of urbanization. This subsequent study examines biodiversity and community composition in a subset of three SRBP sites (Rio Salado, Price Rd., and Tonto) from 2012-2022. These sites are perennially flowing, enabling a more abundant community of plants and animals than at dry sites, but all three are managed in different ways and home to different ecological communities.

Rio Salado Habitat Restoration Area is a multi-million dollar restoration project in downtown Phoenix, sustained by groundwater and stormwater infrastructure. The accidental wetland at

Price Rd. is sustained by runoff from highway, parking lots, and agriculture. Tonto is on the urban periphery and managed by the US Forest Service. Its flow is regulated by dams in response to demands for irrigation, drinking water, recreation.

These sites all experience different urban pressures, and undergo different changes in species richness and evenness, including species introductions and disappearances. Monitoring how wetland communities shift over time is key to understanding urban ecosystems as a whole, and this study, conducted collaboratively by CAP and local stakeholders, provides a snapshot of these vital ecosystems' responses to a decade of rapid urbanization.

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Reichman, A., and J. Colbert. *ASU Project Cities*.

Recently awarded the 2022 President's Medal for Social Embeddedness, ASU Project Cities is a unique, high-impact program within the Sustainable Cities Network in the Global Institute of Sustainability and Innovation. Established in 2017, Project Cities connects higher education with local communities, creating a powerful combination of knowledge and know-how. ASU students in designated courses work directly with a local community partner on predetermined sustainability-related projects and challenges. Led by ASU faculty, students from multiple disciplines research difficult problems chosen by the partner and propose innovative sustainability solutions that enable progress toward a better future. Over the past five years, Project Cities has partnered with four communities in Arizona to facilitate 75 projects led by 35 faculty across eight ASU colleges, directly engaging over 1,000 undergraduate and graduate students. The continued success of Project Cities demonstrates the opportunity for this program to catalyze research, teaching, and social embedded partnerships towards a sustainable future.

The win-win-win design of the Project Cities program seeks to serve local communities, ASU faculty, and ASU students. Communities benefit from the partnership through research-backed solutions to their most complex challenges, as well as expert guidance from ASU students and faculty on new sustainability opportunities for their communities. The partner communities benefit from additional capacity from students and faculty to further projects that might be in need of a fresh perspective. Participating faculty members have the opportunity to provide a real-world experience for their students, as well as the chance to engage with other faculty on transdisciplinary projects. Through this project-based learning experience, faculty members themselves work on community-based challenges, while increasing student engagement through student-driven work.

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****Storey, G.[1], P. Herckes[1], and D. Childers[2]. *Ultra-trace analysis of plasticizers in a constructed wetland ecosystem.***

The concentrations of plasticizer compounds that pass through wastewater treatment facilities are relevant to the ecological health of downstream ecosystems and urban areas due to their ecotoxicity, tendency for bioaccumulation, and the emerging concern about their effects on public health. However, plasticizer concentrations in a constructed wetland environment have rarely been studied in the United States, prompting quantification of such compounds in the Tres Rios Constructed Wetlands which are sustained by the effluent of the 91st Avenue Wastewater Treatment Plant in Phoenix, Arizona.

The concentrations of four common plasticizer compounds (dimethyl, diethyl, di-n-butyl, and bis(2-ethylhexyl) phthalate) at five sites across the wetland surface water were quantified using solid-phase extraction followed by GC/MS. The sampling period includes four sample sets taken from March 2022 to September 2022, giving temporal data in addition to spatial concentration data. Quantification and quality control are performed using internal standard calibration, replicate samples, and laboratory blanks.

Higher molecular weight plasticizers, such as di-n-butyl and bis(2-ethylhexyl) phthalate, accumulated in the wetland surface water at detectable concentrations, ranging from 8 ng/L to 7349 ng/L and 4 ng/L to 27876 ng/L, respectively. The order of magnitude in the minimum and maximum concentrations are fairly typical when compared to other surface water analyses. Concentrations for dimethyl phthalate and diethyl phthalate were typically less than 50 ng/L and were often below the method detection limit. The spatial and temporal variations are discussed in depth in the poster.

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Tarr, K.[1], M. Chester[2], D. Childers[1], and A. York[3].** ***A social ecological technological analysis of urban ecological infrastructure for stormwater management in Phoenix, AZ.

Urban ecological infrastructure (UEI) is defined as all parts of a city that support ecological structure and function. In the past 60 years, green urban ecological infrastructure for stormwater management has emerged as a viable alternative to traditional, gray infrastructure systems in the Phoenix metropolitan area. Advantages of using UEI over gray infrastructure include providing multiple benefits with one system and increased flexibility and adaptability. These advantages are especially attractive in the face of rapid social and environmental changes affecting the Phoenix area, although the use of UEI in a semi-arid environment presents unique challenges. The first goal of my research is to understand the uses of UEI in the Phoenix metropolitan area, including the institutional drivers behind these uses. The second goal is determining the eco-hydrological characteristics of UEI systems that influence its treatment of stormwater, focusing on two study sites of different scale in the Phoenix metropolitan area: Indian Bend Wash Greenbelt in Scottsdale and Orange Mall on Arizona State University's Tempe campus. The third goal is to assess civil engineering academic requirements at ASU to understand how these requirements address UEI, if at all, and how it may be included. Overall, my goals are 1) to collect data on stormwater treatment from a small-scale UEI site; 2) to contextualize these data within the geographical and institutional conditions under which they exist; and 3) to recommend strategies for incorporating UEI into civil engineering education.

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Trego, S[1], S. Meerow[1], A. Flores[1], and K. Larson[2].** ***A longitudinal assessment of heat risk perceptions and adaptations in Phoenix, Arizona.

In the US, extreme heat kills more people than all other extreme weather events combined and is a leading cause of weather-related mortality worldwide. Epidemiological studies have documented disparities in heat-related morbidity and mortality based on older age, racial/ethnic minority, and low socioeconomic statuses. The urban heat island (UHI) effect is responsible for a large share of rising temperatures in urban areas, leaving cities and their residents at an elevated risk for extreme temperatures. Phoenix is one of the hottest cities in the US and is significantly impacted by the UHI. Metro Phoenix experienced an average temperature increase of 4.3°F (2.4°C) from 1970 to 2018, which is more than twice the average rate of increase across the contiguous US. It is no surprise that Phoenix is at the forefront of implementing heat-specific policies and initiatives. Heat is a complex and multi-scalar hazard and any comprehensive effort to govern it needs to address all scales of risk, however. A crucial part of this is understanding how residents perceive heat risks. Drawing on a longitudinal analysis of household Phoenix Area Social Survey (PASS) data from 2017 and 2021, this study examines how perceptions and adaptations are evolving in one of the hottest and fastest-warming cities in the US.

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Unal Cilek, M.[1,2], and A. Middel[2].** ***Thermal comfort evaluation of green space geometries in different Local Climate Zone: the case of hot-arid climate.

In recent years, the strategies about the urban heat stress mitigation has developed with 3D climate model. To create a cooler urban surface, urban green infrastructure are important in addition to urban 3D morphology, geometry, and surface characteristics.

The main research questions are as follow:

- Which geometric characteristics is suitable/unsuitable for LCZ?
- How orientation and tree canopy was affected the UGS thermal comfort?
- How tree canopy change the thermal condition of the UGS?

This study aimed to statistically determine the suitable urban green space (UGS) geometry in different local climate zone (LCZ) for hot-arid climate. It combined the LCZ, 3D model results and statistical analysis. Study methodology comprises three stages. Firstly, the geometric characteristics of green spaces (area size, aspect ratio, and orientation) and building type of LCZ (LCZ 1-6) were determined. Secondly, mean PET for each UGS and LCZ classes were obtained from ENVI-met for three canopy cover (0%, 50%, 100%) scenario. Finally, suitable and least suitable UGS characteristics were determined according to the statistical significance of PET differences ($p > 0.05$) using the one-way ANOVA with post-hoc Tukey-HSD test analyses of pairwise comparisons.

This study presents the preliminary results of the post-doc project which title is “Determination of Optimum Green Space Characteristics in terms of Thermal Comfort for the Building Types in Local Climate Zone”. Study’s results can serve as a guide for future researchers and decision makers to standardize UGS characteristics in different urban morphologies and to develop climatically comfortable UGS designs and plan strategies that can be implemented in future cities.

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Van Tol, Z.[1], J. Vanos[1], A. Middel[2], and K. Ferguson[3].** ***The climate consequences of privatizing public spaces**.**

Among the multiplicity of implications housing imparts on an individual, climate exposure may be one of the least understood. People experiencing homelessness are not a monolith. Personal characteristics interact with the climate and political landscape to dictate individualized levels of vulnerability and needs. Despite the allure of purportedly public spaces—such as parks—policy often works to reinforce a social hierarchy that predicates status and access to space on material wealth (i.e., housing status). Municipalities sometimes implement rules under the guise of ‘public health and safety’ that obscure a clear partiality given to housed individuals who possess the social capital required to occupy public spaces. For example, as a part of their “Accelerated Encampment Response” program, the City of Tempe is removing individuals from riparian zones along the Salt River. This decision then pushes people into parks where they are met with opposition from housed residents. Even with valid concerns for individuals who sleep in public spaces, questions remain about access to geographic alternatives and the incurred heat and air pollution exposures associated with less vegetated spaces.

There is a significant gap in understanding how policy influences climate exposure among those experiencing homelessness that must be remedied if we truly value the idea of climate justice. How does regulating public spaces alter heat and air pollution exposure among those experiencing homelessness? Historical analysis of the regulatory state can help to explain the current political landscape and modern mechanisms that perpetuate housing-related climate inequities.

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Willis, D.[1], B. Ballantyne[2], T. Pedroza[2], and J. C. Johnson[2]. ***Artificial lights at night and its impact on black widow spider behavior.*

Urbanization brings forth a myriad of environmental challenges that can significantly affect animals that inhabit these landscapes, such as the presence of artificial lights at night (ALAN). For most animals, a normal light-and-dark cycle is critical for their circadian rhythm to function properly, affecting both physiological and behavioral systems. These effects have been well documented in vertebrates and invertebrates alike, especially in nocturnal animals. Thus, for the nocturnal and urban-adapted black widow spider (*Latrodectus mactans*), the presence of ALAN may impact their behavior compared to no lights at night. We explored this hypothesis in two ways: First, we investigated if wild urban spiders prefer to build their webs at certain nighttime light levels. Second, we captured 12 desert spiders and 12 urban spiders and placed 6 of each under ALAN conditions, and the other 6 in natural, dark night conditions. We noted if they were active, and tested 3 types of behaviors: voracity, web building, and anti-predator. For the first investigation, we found that the black widows did not show any preference to building their webs at certain light levels. For the second, we found that there was 1) no difference in activity between the two light treatments, 2) no difference in voracity time between the two light conditions; but the natural light spiders did respond more to the before-feeding artificial prey trials, 3) no difference in web building between the ALAN and natural light spiders; however, desert spiders did build more than urban spiders, and 4) no difference in antipredator reactivity between the ALAN and natural light spiders. These results indicate that black widows are behaviorally unaffected by ALAN. This may greatly impact why they are an incredibly successful urban pest, as they do not shy away from lights nor change their behavior when exposed to them.

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***Zhu, Q.[1], and K. L. Larson[2].** ***Residential vegetation changes and associated multi-scalar drivers in central Arizona, 2017–2021*.**

Human management of residential yards affects the provisioning of ecosystem services and disservices and, therefore, is central to residential landscape sustainability. In the U.S., raditional industrial lawns, which constitute a monoculture of green, neat, and weed-free turfgrass, are the dominant yard type from residential landscapes. However, accumulating research has shown the environmental hazards of lawns, such as intensive irrigation, high inputs of fertilizers and pesticides, and negative impacts on biodiversity. At the same time, developing lawn-alternative landscapes, such as climate-adapted xeric yards and wildlife-friendly yards with desert plants and varied vegetation, can mitigate the environmental problems of lawns and increase vegetation structure and attendant ecosystem services. Despite the promotion of lawn-alternative practices, only a few studies have explicitly investigated parcel-scale vegetation changes in residential contexts. In addition, knowledge of varied drivers associated with yard vegetation changes in urban environment are needed to inform the transition toward more sustainable residential landscapes and to produce contextual strategies of desired urban greening. Therefore, I will address these gaps by analyzing data from the 2021 Phoenix Area Social Surveys (PASS) to answer (1) to what extent have residents made different types of vegetation changes in their yards, including the addition and removal of trees and desert plants, over the past five years? (2) how are different attitudinal, social, and structural factors at various scales—parcel/household, neighborhood, and municipal—influencing different vegetation changes in the recent past? The results of this research will inform landscape sustainability by identifying potential pathways to residential yard changes that offer a multitude of services while being appreciated and maintained by residents.

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