16th Annual

CAP LTER All Scientists Meeting and Poster Symposium

Friday, January 17, 2014

SkySong

ASU Global Institute of Sustainability

LTER

NSF

CAP LTER Sixteenth Annual Poster Symposium and All Scientists Meeting
January 17, 2014
Skysong, Scottsdale, Arizona

8:00 am Registration, coffee, and tea

8:30 am **Welcome**
- Nancy Grimm, Lead PI and Director of CAP LTER; Professor, School of Life Sciences

8:35 am **Advancing Science in Support of Water Policy and Urban Climate Change Adaptation**
- Dave White, PI and Co-Director, Decision Center for a Desert City; Associate Professor, School of Community Resources and Development

8:50 am **Adaptation Implementation: Efforts to Parlay Research into Action in Three Sectors**
- Joyce Coffee, Managing Director, Notre Dame Global Adaptation Index

10:00 am **Urban Biota and the Humans-as-Natural Lens**
- Paige Warren, Associate Professor, Environmental Conservation, University of Massachusetts

10:15 am **Environmental Justice, Spatial Patterning, and Sustainable Urban Form**
- Christopher Boone, Dean, School of Sustainability; Professor, School of Sustainability and School of Human Evolution and Social Change
- Abigail York, Associate Professor, School of Human Evolution and Social Change

10:30 am **Poster Session #1**

12:00 pm **Lunch**

1:30 pm **An Economic Perspective on the Role of Markets in Urban Ecology**
- Kerry Smith, Regents' Professor and W. P. Carey Professor of Economics, Department of Economics, W. P. Carey School of Business
- Joshua Abbott, Associate Professor, School of Sustainability
- H. Allen Klaiber, Assistant Professor, The Ohio State University

1:45 pm **Designer Ecosystems in the City**
- Nancy Grimm, Lead PI and Director of CAP LTER; Professor, School of Life Sciences

2:00 pm **What are Sustainable Urban Forms? Examining Patches, Networks, and Landscape Dynamics**
- Jianguo Wu, Professor, School of Life Sciences
- Billie L. Turner II, Gilbert F. White Professor of Environment and Society, School of Geographical Sciences and Urban Planning; Professor, School of Sustainability

2:15 pm **Poster Session #2**

3:45 pm **Adjourn**. All CAP ASM participants are invited to join the Global Institute of Sustainability for happy hour at the Sleepy Dog Brewery, 1920 E University Dr in Tempe (just west of McClintock), from 5:00-7:00 pm

2014 CAP LTER Symposium

Posters are listed alphabetically by first author with poster location number in parentheses.

Poster Session #1	Poster Session #2
Ayodele and Larson (38)	Alvarez-Guevara and Ball (1)
Banville et al. (21)	Barry et al. (37)
Bateman et al. (23)	Barton et al. (10)
Blasco et al. (40)	Bernier and students (in main area)
Cook and Hall (31)	Bratsch et al. (25)
Eager et al. (3)	Christman et al. (2)
Häb et al. (11)	Connors and Kane (26)
Holmes and Hall (5)	Davies and Deviche (22)
Larson et al. (33)	Fan et al. (39)
Li et al. (13)	Fernandez Alvarez (28)
Middel et al. (15)	Hutman and students (in main area)
Moreno et al. (42)	Heavenrich and Hall (4)
Muñoz-Encinas et al. (34)	Kruke et al. (12)
Palta and Grimm (7)	Marcotte et al. (6)
Pollard et al. (17)	McAlister et al. (14)
Rose et al. (9)	Milne et al. (16)
Rudd and Bateman (27)	Morgan et al. (30)
Ruddell and Chow (19)	Patarusuk et al. (8)
Sampson and Quay (45)	Ramos et al. (18)
Stotts et al. (44)	Reyna et al. (32)
Weaver and McGraw (29)	Rode et al. (36)
	Shorts et al. (46)
	Smith and Smith (41)
	Song et al. (20)
	Stevens et al. (24)
	Wolf et al. (43)
	Wyant et al. (35)

Speaker Bios

Joyce Coffee
Managing Director, Notre Dame Global Adaptation Index

Joyce Coffee is Managing Director of the Notre Dame Global Adaptation Index (ND-GAIN), functioning as the executive lead for the ND-GAIN Index and related adaptation research, outreach and implementation. In this position, Coffee works with ND-GAIN faculty and staff while engaging the private sector, policy makers and the non-governmental community to forward the impact and usefulness of the Index.

Coffee brings 20 years of experience in environmental leadership, risk management, performance measurement and sustainability execution to her role as Managing Director. Prior to coming to Notre Dame, she was a vice president at Edelman where she provided strategic counsel to global companies on corporate social responsibility and sustainability. Coffee has also directed the City of Chicago's Climate Action Plan, driving both climate mitigation and adaptation efforts. Coffee started her career as an urban environmental consultant with the World Bank and the USAID U.S.-Asia Environmental Partnership. Because of her diverse and extensive experience – particularly with corporate organizations, government agencies, and the NGO community - Coffee brings an essential understanding of the end-goals of all of these stakeholders and how ND-GAIN can advance their missions.

Coffee was a founding board member of the Alliance for Water Efficiency and a Great Lakes delegate to the Brookings International Young Leaders Climate Change Summit. She has been named a Chicago Council on Global Affairs Emerging Leader. Coffee is the author of the Climate Adaptation Exchange Blog.

List of Posters

***Indicates student poster.**

BIOGEOCHEMICAL PATTERNS, PROCESSES, AND HUMAN OUTCOMES

Alvarez Guevara, Jessica, and Becky Ball.** ***Moss nutrient plasticity over variations in soil resource availability in desert soils.

Christman, Max P., Becky A. Ball, and Sharon J. Hall.** ***Nutrient dynamics during photodegradation for **Ambrosia deltoidea** ***litter in an arid, urban ecosystem.***

Cook, Elizabeth M., and Sharon J. Hall.** ***Spatial distribution of co-occurring ecologically relevant urban air pollutants in Sonoran Desert.

Eagar, Jershon, Denise Napolitano, Aurelie Marcotte, Anthony Anderson, Joana Sipe, Blanca Rodriguez, and Pierre Herckes.** ***A study of organic compounds in haboob particulate matter.

Heavenrich, Hannah R., and Sharon J. Hall.** ***Hidden pools of nitrate in emerging 'sustainable' landscapes: A tradeoff between conservation and contamination?

Holmes, Caitlin V., and Sharon J. Hall.** ***Soil contamination and the implications for growing food in urban gardens.

Marcotte, Aurelie, Jershon Eagar, and Pierre Herckes.** ***Trace metals and inorganic species in time resolved haboob samples from ASU Tempe campus.

Palta, Monica M., and Nancy B. Grimm. ***Nutrient pulsing and attenuation in "accidental" urban wetlands.***

Patarasuk, Risa, Darragh O'Keeffe, Yang Song, Igor Razlivano, and Kevin R. Gurney. ***Assessing carbon dioxide emissions from U.S. large cities.***

Pollard, Lindsey D., Marena Sampson, Monica M. Palta, Michael Bernstein, Truman Combs, Xiaoli Dong, Stevan Earl, Nancy B. Grimm, Rebecca L. Hale, Amalia Handler, Emma Holland, Cathy Kochert, Jeremiah McGehee, Miquel Ribot, Danielle Shorts, Amanda Suchy, and Erin Worth. ***Greenhouse gas emissions in an urban landscape*****.**

Ramos, Jorge, Eric J. Chapman, and Dan L. Childers.** ***Spatial and temporal variability of annual greenhouse gas fluxes from constructed wetland in an arid region.

Rose, Christy J., Paul Westerhoff, and Pierre Herckes.** ***Chloroform from swimming pools, a significant source of atmospheric chloroform in Phoenix?

Shorts, D.[1], R. L. Hale[1], S. Earl[2], and N. B. Grimm[1,2].** ***Hydrological and geochemical correlations with potential denitrification rates in an arid, urban wash.

CLIMATE, ECOSYSTEMS, AND PEOPLE

Barton, Erin M., Miguel Morgan, Jennifer Learned, Sharon J. Hall, and Benjamin L. Ruddell. *Urban landscaping for microclimate control in arid lands: Can low-water intensive landscape designs provide heat mitigation services?

Häb, Kathrin, Ariane Middel, and Benjamin L. Ruddell. *Visualizing urban microclimate transect measurements.

Kruke, Laurel, Dave White, Kelli Larson, and Amber Wutich. *Climate change uncertainty and skepticism: A cross-country analysis.

***McAlister, Alyssa, Jose Rosales Chavez, Amber Wutich, Alexandra Brewis, Christopher Roberts, Jonathan Maupin, Dan Hruschka, and May Boggess. *Global ethnotheories of climate change and disease*.**

Middel, Ariane, Kathrin Häb, Benjamin L. Ruddell, Anthony J. Brazel, and Chris A. Martin. *Understanding the physical dynamics of microclimate: Ongoing research projects.*

***Milne, Jeff M., Matei Georgescu, David J. Sailor, and Melissa Hart. *Developing anthropogenic heating profiles for urban areas across the United States*.**

Ruddell, Benjamin L., and Winston T. L. Chow. *Microclimate analysis of observations in a master-planned residential community in Arizona.*

EDUCATION, OUTREACH AND RESEARCH SUPPORT

Hutman, Jon, Andrew Bernier, and their students. *Ecology Explorers: K-12 student contributions to the CAP LTER project.*

Sampson, David A., and Ray Quay. *A dynamic web interface for WaterSim 5.0.*

HUMAN DECISIONS AND BIODIVERSITY

Banville, Melanie J., Heather L. Bateman, Stevan R. Earl, and Paige S. Warren. *Long-term changes in urban riparian bird communities.*

Bateman, Heather L., Juliet C. Stromberg, and Melanie J. Banville. *Living in the city: Bird, herpetofauna, and plant communities along the Salt River in Phoenix, AZ.*

Bratsch, Katie, Rebecca Halpin, and J. Chadwick Johnson. *Male mate choice in black widow spiders: do males show courtship biases based on genetic variability.

Davies, Scott, and Pierre Deviche. *Breeding in an urbanizing world: Reproductive adjustments of seasonally breeding birds to urban areas.

Rudd, Beau, and Heather L. Bateman.** ***Trail disturbance on reptiles in the Phoenix mountain regional parks.

Stevens, Dale, Rebecca Halpin, and J. Chadwick Johnson.** ***Relative behavioral plasticity of an urban-exploiting reptile**.**

Weaver, Melinda, and Kevin J. McGraw.** ***Hot nights in the city: How seasonality affects behavioral and physiological traits in house finches (**Haemorhous mexicanus*****) across an urban gradient.***

Wyant, Karl A., Yevgeniy M. Marusenko, Sharon J. Hall, and John L. Sabo.** ***Dynamics of urban belowground food webs and land-use type in an arid ecosystem.

LAND USE, LAND COVER, LAND ARCHITECTURE, AND ECOSYSTEM SERVICES

Connors, John P., and Kevin Kane.** ***Shaping the city: Development trajectories and land system architecture in the Phoenix metropolitan area.

Fernandez Alvarez, Rafael.** ***Neoliberalism and parks: The urban political ecology of green public space in Mexico City.

Larson, Kelli L., Samantha Samples, and Mary Muñoz-Encinas. ***Homogeneity and heterogeneity in ecosystem service preferences for residents' landscape management across regions of the U.S.***

Li, Xiaoxiao, Yun Ouyang, and B. L. Turner II. ***Parcel-level land architecture and land surface temperature in the Phoenix metropolitan area.***

Morgan, Miguel, Erin M. Barton, Sharon J. Hall, and Jennifer Learned. ***Low impact development ordinances: How are they influencing urban landscape design?***

Muñoz-Encinas, Mary, Samantha Samples, and Kelli Larson.** ***Ecosystem services in residential land management: Expressed priories, distinctive dimensions, and regional comparisons.

Reyna, Janet, Matthew Bartos, and Mikhail Chester.** ***Life cycle assessment of ecosystem services: Phoenix building stock.

Rode, Sandra R., and Elizabeth Wentz.** ***Homeowner association landscape guidelines and household water usage.

WATER DYNAMICS IN A DESERT CITY

Ayodele, Deborah O., and Kelli Larson.** ***Water use and supply trends within the Sunbelt: A comparative analysis of Arizona and North Carolina.

Barry, Michelle C., Marisa Masles, and Paul Westerhoff.** ***Determining regional water quality trends and impacts of organic carbon, geosmin, and metals in central Arizona.

Blasco, Drew, Hannah McAtee, Amber Wutich, Alexandra C. White, Christopher M. Roberts, Dave D. White, Kelli L. Larson, and Alexandra Brewis.** ***Hard paths, soft paths or no paths? Cross-cultural perceptions of water solutions.

Fan, Chao, Baojuan Zheng, Soe W. Myint, and Rimjhim Aggarwal.** ***Changes in cropping intensity in Phoenix, Arizona and its implications for future agricultural water use.

Moreno, Hernan A., Dave D. White, Hoshin V. Gupta, Enrique R. Vivoni, and David A. Sampson. ***Predicting long-term hydrologic effects of the four forest restoration project at Tonto Creek Basin.***

Smith, Billy, and V. K. Smith.** ***Anticipating neighborhood level changes in water demand.

Song, Jiyun, Jiachuan Yang, and Zhihua H. Wang.** ***Modeling urban land-atmosphere interactions with enhanced urban hydrology.

Stotts, Rhian, Kelli Larson, Amber Wutich, and Alexandra Brewis.** ***Characterizing water risks and solutions cross-culturally: Results from the global ethnohydrology study.

Wolf, Amanda, Nancy B. Grimm, Julie Gwiszcz, Monica M. Palta, and David (Otto) Schwake.** ***Ecosystem services and trade-offs mediated by urban water bodies for homeless populations in Phoenix.

Abstracts

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

Alvarez Guevara, J., and B. Ball.** ***Moss nutrient plasticity over variations in soil resource availability in desert soils.

In deserts, moss may play an important role connecting soil and stream nutrient cycling, where stream nutrients are taken up by moss growing at the terrestrial-aquatic interface, which may be windblown into the surrounding soil to become an organic matter source in the soil. Despite its importance, very little is known about moss's role in biogeochemical cycles and how nutrient pulses (e.g., from N deposition in air pollution) will affect their functional significance as an integrator of nutrient cycling in deserts. Moss and soil were sampled from 15 sites in the Sonoran Desert in and around Phoenix, covering the city core and both upwind and downwind of the city. Samples were analyzed for C, N, and P content to compare the plasticity of moss stoichiometry over a gradient of soil resource availability. Results show that soil NO_3^- is positively correlated with moss %N. Thus, sites in the city core, subject to N deposition, tend to have higher soil NO_3^- and therefore moss with higher N content than the sites outside the city core. In contrast to moss N, moss %P was equivalent across all of the sites, and therefore did not vary with soil PO_4^{3-} availability. Results suggest that moss can retain excess N, despite the less predictable retention by vascular vegetation at these sites.

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Ayodele, D. O., and K. Larson.** ***Water use and supply trends within the Sunbelt: A comparative analysis of Arizona and North Carolina.

In many places, adaptation strategies are either focused on demand reduction or supply augmentation. This study investigates adaptation and water management strategies being employed within the Sunbelt by conducting a comparative analysis of water use (demand) and supply trends across Arizona and North Carolina between 1985 and 2005 by county. The aim of this analysis is to increase understanding of the influence of urbanization, climate (specifically in the form of drought), and water management on the use and distribution of water in water-stressed regions. The geospatial analysis of water demands was performed using a Geographic Information System (GIS) and the Statistical Package for Social Scientists (SPSS). With 5-year interval data from the U.S. Geological Survey (USGS) the water use variables analyzed include percent change in demands for public supplies and irrigated agriculture, and the supply variables include groundwater and surface water withdrawals. The results show a high degree of spatial variation within and across Arizona and North Carolina, largely as a result of growth, drought periods, and water policies. Compared to North Carolina, the southwestern state of Arizona tends to rely on non-renewable groundwater and water transfers (from agriculture to urban uses) to cope with drought and water scarcity. These patterns — which are institutionalized by the state — wide Groundwater Management Act-may be detrimental over the long-run since the 'fossil' aquifers in Arizona will eventually be depleted, and the phasing out of agriculture over time will diminish the short-term flexibility of using water transfers to adapt to shortages.

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Banville, M. J.[1], H. L. Bateman[2], S. R. Earl[1], and P. S. Warren[3]. *Long-term changes in urban riparian bird communities.*

Riparian zones are hotspots for biodiversity and provide critical resources for wildlife, including migratory birds. Urbanization impacts the site-level conditions in riparian zones and fosters altered biotic communities in surrounding landscapes, which may lead to altered biotic communities in riparian zones. Shifts in bird communities may occur slowly, and there are few long-term studies, especially in urban areas. The Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) program has been monitoring the bird populations within the Phoenix metropolitan area and its immediate surroundings since 2002. Twelve of the monitoring sites are riparian areas. These sites are interspersed between the metropolitan area and the urban fringe, and include a mix of sites that feature perennial or ephemeral water sources. Here, we used this long-term dataset to address two questions: (1) How does bird species composition vary among different types of riparian sites?, and (2) How has bird species composition changed over time? We used Nonmetric Multidimensional Scaling (NMDS) to evaluate seasonal (spring, winter) differences in bird species composition, and to evaluate changes in species composition over time. We used Principal Component Analysis (PCA) to explore variation in the habitat characteristics of the sites, at both the local scale and at a landscape scale. Important PCA components were selected and laid over the NMDS to relate environmental gradients to bird species composition. Overall, riparian sites appear to be shifting toward a more 'urban-like' species composition, and amount of impervious surface, water, and vegetation type influence the bird species composition.

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***Barry, M. C., M. Masles, and P. Westerhoff. *Determining regional water quality trends and impacts of organic carbon, geosmin, and metals in central Arizona*.**

Providing high-quality drinking water to consumers is a top priority of water providers in central Arizona. Among top water-quality concerns are the presence of carcinogenic disinfection byproducts (DBPs), taste and odor causing compounds, and metals. In collaboration with multiple municipalities (Phoenix, Scottsdale, Mesa, Tempe, Chandler, Glendale, and Peoria), private water companies (Epcor), and water conveyors (SRP and CAP), we have monitored the water quality of the surface water supply entering the water treatment plants (WTPs). Sampling began in 1999 and continues today. Water samples are collected, at a minimum, once a month from three terminal reservoirs, multiple canal locations, and inlets to WTPs servicing the majority of central Arizona. Water-quality analysis includes measurement of dissolved organic carbon (DOC) — a precursor to the formation of DBPs, the taste and odor-causing compound geosmin, and several metals. By examining the trends in the concentrations of these compounds over the past 10+ years several patterns began to be apparent. The concentration trends of these compounds show an increase in DOC during drought conditions, seasonal fluctuation of geosmin based on algal growth, and interesting variations in metals. The measured trends of these compounds are included as well as discussion of the implications of these trends on future water treatment efforts.

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Barton, E. M.[1], M. Morgan[2], J. Learned[3], S. J. Hall[3], and B. L. Ruddell[4]. *Urban landscaping for microclimate control in arid lands: Can low-water intensive landscape designs provide heat mitigation services?

Landscaped yards can potentially mitigate the urban heat island through shade and reduced heat retention — important ecosystem services in hot/dry cities. However, landscaping consumes water — a problem in water-scarce regions. Urban population growth combined with climate change will make it important to conserve water use in landscaping, while maintaining heat mitigation services that affect life quality.

This study investigates how groundcover type and shade affect air temperature. We hypothesize that shaded yards provide constant air temperature reduction regardless of the water use of the groundcover types. Shade and groundcover are known to be primary controls over surface temperatures, but they can also affect air temperatures. Microclimate sensors recorded the summer air temperatures in the yards of 11 individual homes. Air temperatures are analyzed based on average percent shade, percent grass, and advective air.

There is a negative correlation between percent shade and maximum daily air temperatures during times of average high and low advection. This finding is in line with previous studies indicating that shade is an important factor in urban climate. It also indicates the importance of the surrounding area's landscaping, as wind blows in heated/cooled air from surrounding landscapes. Groundcover does not appear to have a significant effect on temperature. A larger data set is needed to draw conclusions regarding how shade and groundcover interact to affect air temperature at the microscale. This work generates a number of questions on social and mesoscale factors of microclimate research that will be explored in further research.

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Bateman, H.L.[1], J. C. Stromberg[2], and M. J. Banville[3]. *Living in the city: Bird, herpetofauna, and plant communities along the Salt River in Phoenix, AZ.*

Riparian areas in arid regions provide important ecosystem services. Research is needed to determine effective ways to restore services to degraded urban riparian ecosystems and to assess restoration success. The Salt River in the Phoenix metropolitan area of central Arizona has been degraded by many factors including stream flow diversion. Portions of the river and its riparian zone have undergone active restoration; whereas, other reaches have revegetated in response to perennial discharge from storm drains and other urban inputs ("accidental wetlands"). Our project focuses on six urban and one non-urban, 1-km reaches along the Salt River. Our overall goal was to describe factors that influence wildlife in urban riparian ecosystems, to provide recommendation relating habitat and wildlife to restoration activities. During 2013, we observed 12 species of herpetofauna and 62 species of birds along the Salt River. Herpetofauna abundance differed by season but not by reach type. Bird communities along urban degraded reaches were dissimilar from non-urban reference and active and passively restored reaches. Degraded, perennial urban reaches lacked riparian and Sonoran Desert bird species. Plant species richness was equally high among sites during the spring. During the summer dry season, plant species richness was highest at passively restored perennial flow sites, intermediate at the actively restored site and non-urban reference site, and lowest along urban degraded reaches. Our results will provide recommendation to natural resource managers of urban areas relating habitat and wildlife to restoration activities.

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Blasco, D.[1], H. McAtee[1], A. Wutich[1], A. C. White[1], C. M. Roberts[1], D. D. White[2], K. L. Larson[3,4], and A. Brewis[1]. *Hard paths, soft paths or no paths? Cross-cultural perceptions of water solutions.

Cross culturally it is increasingly likely that "soft path" (e.g., behavioral or regulatory) approaches to water management will be suggested as solutions to the availability of clean, safe water. In this study we examined cross-cultural preferences for soft path vs. hard path (e.g., infrastructural) solutions. We developed a questionnaire using ethnographic field methods that surveyed four semi-rural/peri-urban sites (in Bolivia, Fiji, New Zealand, and the USA) to determine the common sources of water, threats to these sources, and the solutions to those threats. Using content analysis, we classified each respondent as naming either a "hard path" or "soft path" solution to threats to their water and then explored the distribution of hard and soft path solutions across the four sites. Our results indicate a relationship exists between the developmental status of the site and the common approach people would take to mitigate a threat. In less-developed countries, respondents identified "hard path" solutions more often than "soft path" solutions, and they were less likely to identify a solution to the perceived threat than those respondents in more-developed sites. In sites rich in water, respondents identified more "soft path" solutions than those in water-scarce sites. Overall, our findings indicate people are receptive to "soft path" solutions across the sites surveyed including those in water scarce areas. Further research should explore how effectively "soft path" solutions can be implemented in sites with financial and natural resource limitations.

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Bratsch, K., R. Halpin, and J. C. Johnson. *Male mate choice in black widow spiders: Do males show courtship biases based on genetic variability.

The majority of studies of mate choice concentrate on females choosing which male to mate with. This is because mating is generally more costly for females. Interestingly, past studies have shown that males also exhibit mating preferences in a variety of situations. One adaptive explanation for mate choice suggests that mating preferences by males and/or females might ensure optimal genetic variability. Genetic similarity or dissimilarity may cause a decrease in reproductive success for the male. Therefore males may use mating preferences to optimize the level of genetic variation in his mate. This is typically the case when a species has diverged into two populations. Human-induced rapid environmental change (HIREC) caused by urbanization could act as a mechanism of population differentiation within a species. There are two populations seen in the black widow spider, *Latrodectus hesperus*, one that lives in urban Phoenix and another that resides in the desert. This is an excellent species to study for mate choice because spiderlings can disperse great distances and therefore are able to come in contact with a spider of another habitat type or subpopulation within their own habitat. We investigated the male courtship bias of females from different locations. This was done by placing males in four webs of females from various habitat types and sub-populations and courting behavior was measured. We predicted males

would court most intensely with females from the same habitat type but different subpopulation in order to ensure the optimal level of genetic variability in his mate.

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Christman, M. P.[1], B. A. Ball[2], and S. J. Hall[3]. *Nutrient dynamics during photodegradation for* Ambrosia deltoidea *litter in an arid, urban ecosystem.

We know that photodegradation can cause significant mass loss and that lignin plays a dual role in the processes of degradation. This experiment attempts to assess the nutrient dynamics of nitrogen (N) and phosphorus (P) that occur while overall mass is being lost via photodegradation.

We took *Ambrosia deltoidea* litter from 5 sites within the Phoenix city core and 5 sites downwind of the city of Phoenix. Half of this litter was N and P enriched from a previous experiment and half was control. We split the litter into UV opaque and UV transparent litter bags that had holes punched in them to allow microbial interaction. These bags were picked up at sampling periods of 10, 20, 30, and 40 weeks. All samples were then tested for mass loss, lignin content, carbon (C) content, N content, and P content.

We found that downwind samples lost more mass than the core. There was little effect over time to N content and little disparity between the samples. P behaved as expected with an initial rise due to microbial interaction and then a decline as the microbes released P. One interesting result was an logarithmic-like decrease in C:N ratio and C:P ratio for the downwind samples but a fairly constant ratio in the core samples. Overall, we can conclude that P isn't affected significantly by photodegradation at either site, but N content in the core decreases over time, whereas N content at the downwind site stays constant.

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Connors, J. P., and K. Kane. *Shaping the city: Development trajectories and land system architecture in the Phoenix metropolitan area.

Our analysis seeks to understand the land-cover characteristics of urban development in the Phoenix, Arizona metropolitan area. While most discussion of urban land-cover change focuses on the conversion of agricultural or natural lands to urban uses, less attention has been given to changes in land cover at the micro scale. We use the high-resolution 2010 NAIP data (1-m) to analyze land architecture across spatial and temporal dimensions. Most extant literature argues that land fragmentation is greater in more recently developed areas near the urban fringe, though generally relies on much coarser resolution data which captures only some types of variation in urban development types. We created four transects across the city consisting of evenly spaced square windows. Several landscape metrics were calculated at each point along the transects and plotted to examine whether greater fragmentation is found toward the periphery. For each plot, we calculated the metrics with several buffer sizes in order to examine the metrics' sensitivity to plot (buffer) size. Because future land-cover outcome is thought to be dependent on prior land-use trajectory, we calculate the same metrics for Phoenix's census block groups, which we stratified by the time period during which most of the structures in the block group were constructed. ANOVA and post-hoc tests were run to evaluate the differences in land architecture based on the time period during which an area was developed. Our results demonstrate that urban landscape fragmentation is more scale-dependent than has been acknowledged in previous studies.

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Cook, E. M., and S. J. Hall.** ***Spatial distribution of co-occurring ecologically relevant urban air pollutants in Sonoran Desert.

Urban air quality is expected to significantly impact protected lands in urban and surrounding native ecosystems. Atmospheric reactive nitrogen (N), ozone (O_3) and carbon dioxide (CO_2) are elevated near human activities and individually act as a resource or stressor to ecosystems, but their co-occurring distribution in protected lands is uncertain. Air-quality monitoring programs routinely measure O_3 and nitrogen oxides (NO_x) in residential areas for human-health regulations, but other ecologically important compounds such as ground-level CO_2 and reactive N are not monitored in cities or remote protected lands. Using a spatially extensive design, we compared the distribution of atmospheric nitric acid (HNO_3), ammonia (NH_3), NO_x, O_3, and CO_2 concentrations in native Sonoran Desert within and surrounding Phoenix, Arizona. Additionally, we examined atmospheric N and O_3 concentrations in South Mountain Preserve along a 1,500-meter transect from the park exterior to interior. NH_3 gas is a significant component of urban atmospheric N concentrations with higher concentrations in urban desert open space parks than locations surrounding the city. In contrast, ozone — a plant stressor — reaches significantly higher concentrations in outlying desert areas east of Phoenix compared to urban locations. Accounting for diurnal variation, concentrations of ground-level CO_2 — a plant resource — ranged from 380-400 ppm but varied surprisingly little among locations. This study is the first to identify the distinct spatial pattern of co-occurring, ecologically important urban pollutants within protected lands. Our findings highlight the need for air quality monitoring with an expanded repertoire of compounds known to affect ecosystems.

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Davies, S., and P. Deviche.** ***Breeding in an urbanizing world: Reproductive adjustments of seasonally breeding birds to urban areas.

Urbanization is altering the environment at an unprecedented rate. Urban animals inhabit environments vastly different from those of their non-urban conspecifics and to survive they must adjust to these modified environmental conditions. For seasonally breeding birds, the timing of breeding has a considerable effect on fitness and reflects adjustments to local environmental conditions. We used a meta-analytical approach to compare the timing of seasonal breeding of birds inhabiting urban vs. corresponding non-urban areas. Our analysis included 24 published studies that encompassed a paired comparison of the same species in both urban and non-urban areas during the same breeding season. A comparison of lay-, clutch initiation-, and hatch-dates indicates that, on average, urban birds breed 8 days earlier than their non-urban conspecifics. Furthermore, effect size is related to the latitude of the city (i.e., urban and non-urban birds differ more, the lower the latitude). To identify the driving force behind this advancement, we also used meta-analysis to examine whether the change in timing of breeding is mirrored in the timing of gonadal development and the seasonal increase in plasma levels of reproductive hormones. Vernal gonadal development in both male (3 species) and female (1 species) birds occurs earlier in urban birds compared to their non-urban counterparts. However, this habitat-related difference is not associated with a difference in reproductive hormone levels between urban and non-urban birds. Thus, the observed difference in timing of breeding and gonadal development appears to be controlled by factors other than levels of reproductive hormone.

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Eagar, J., D. Napolitano, A. Marcotte, A. Anderson, J. Sipe, B. Rodriguez, and P. Herckes. *A study of organic compounds in haboob particulate matter.

Each July marks the beginning of the summer monsoon season in the southwestern United States. In Phoenix, thunderstorms are frequently preceded by dust storms, or haboobs. This suspends sand and dust in the air, allowing them to commingle with urban particulate matter (PM). However, the composition of haboob dust is not well known and it remains unclear whether the composition of haboob dust significantly impacts background urban PM. During the July 2013-September 2013 monsoon season, haboob PM and background urban PM samples were collected in Tempe, Arizona. The PM2.5 fractions (PM with aerodynamic diameters less than 2.5 micrometers) were analyzed by thermal optical transmittance to determine differences in atmospheric concentrations of organic and elemental carbon in background urban PM and haboob PM. The samples were then analyzed by GC/MS to identify alkanes and polycyclic aromatic hydrocarbons (PAH), while oxy-polycyclic aromatic compounds (OPAC) were analyzed by LC/MS. Comparisons of the organic composition of background urban PM and PM collected during a haboob will elucidate potential mutual sources as well as investigate potential scavenging and agglomeration activity. Future studies may involve the analysis of the PM>2.5 fractions (PM with aerodynamic diameters greater than 2.5 micrometers), since surface dust is generally composed of larger particles than aerosol PM emitted from vehicles and could have markedly different chemical compositions.

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Fan, C.[1], B. Zheng[1], S.W. Myint[1], and R. Aggarwal[2]. *Changes in cropping intensity in Phoenix, Arizona, and its implications for future agricultural water use.

Cropping intensity is defined as the number of crops per year per unit area of cropland. The pattern of cropping intensity varies widely in space and time due to an array of factors such as advances in technology, socio-economic factors, water availability, and climate change. The Phoenix Active Management Area (AMA) has experienced rapid urbanization since 1970s mostly through land conversions from agricultural lands to urban use. Our study aims to quantify the spatio-temporal pattern of cropping intensity in Phoenix AMA and explore the changes in agricultural water use as a consequence of increased cropping intensity. We used multi-temporal Landsat imagery to identify cropping intensity for years 1995, 2000, 2005, and 2010. Given the unique situation of our study area where winter crops are grown in October and harvested before March in the following year, previously established methodologies fail to identify the cropping intensity accurately with less flexibility and computational efficiency. Accordingly, a new algorithm was developed exclusively for mapping the cropping intensity in the Phoenix AMA while successfully addressing the issue of inter-year crops. Our preliminary results showed that the proportion of double-cropped farm lands has increased from 7.6% to 10% from 1995 to 2010. Further efforts will be put forth to evaluate the changes in cropping intensity at the irrigation district level. Results of our study will promote better understanding of the drivers behind this change, its impacts on agricultural water use, and implications for future water demands.

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Fernandez Alvarez, R.** ***Neoliberalism and parks: The urban political ecology of green public space in Mexico City.

This work presents Urban Political Ecology as a timely emerging suit of theoretical and methodological approaches useful to understand the socioecological production of uneven environments in Mexico City. Using four case studies of parks within the metropolitan area of Mexico City, this paper argues for a deeper and long-term commitment to understand the historical contexts in which social and environmental conflicts emerged. Following the work of Marxist urban political ecologists, the following work presents an analysis of green public space using GIS-generated maps and archival public documents as means to disentangle and critic the effects of local and global political economy in the production of inequitable socioenvironmental relations in the Mexican Distrito Federal. The analysis shows that green public space in Mexico City is overall insufficient and unevenly distributed among boroughs; parks in particular have been disappearing as a result of increasingly common "development strategies" influenced by a neoliberal political economy that favors capital accumulation rather than social needs. The driving forces responsible of the current deficit and uneven distribution of green public space in Mexico City are historically linked to early "processes of modernization" in the first decade of the twentieth century and perpetuated through time by deficient local decisionmaking processes induced by institutional negligence and corruption.

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Häb, K. [1], A. Middel[2], and B. L. Ruddell[3].** ***Visualizing urban microclimate transect measurements.

Urban microclimate research uses transects to retrieve continuous measurements of atmospheric variables along a determined route. By moving a vehicle equipped with a number of sensors through heterogeneously designed neighborhoods, the spatial variation of the measured values can be used to investigate the atmospheric impact of specific urban designs. Such assessments become even more reliable if transects are conducted for a larger number of points in time. This yields a complex data set that is multivariate, time-varying, spatially dependent, and afflicted with uncertainties due to sensor lags, making it difficult to analyze.

We present the current state of a visualization tool developed to support the analysis of such transect data. We designed the tool to show the transect data in their spatial context and to explore their time-varying character interactively. In detail, we display each measured variable as a color-coded wall winding along the transect route, which is rendered upon a high-resolution land-use map. The walls are stacked according to each variable's measurement height, allowing for a comprehensive view of the data. Increasing the thickness of the wall layers from top to bottom creates a representation that is robust to changes in perspective. In order to display the spatiotemporal characteristics of the values, flexible descriptive measures, such as the spatial or temporal average or spatial gradients, can dynamically be chosen by the user. In addition, the time series for selected measurement points is shown on demand. These functionalities support an iterative investigation of the data set.

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Heavenrich, H. R., and S. J. Hall.** ***Hidden pools of nitrate in emerging 'sustainable' landscapes: A tradeoff between conservation and contamination?

Cities across the U.S. are increasingly adopting sustainability principles in their design and management to provide ecosystem services and mitigate environmental harm. To achieve this goal cities are targeting reductions in household water use by promoting alternatives to water-intensive grass (mesic) lawns. In the Phoenix area, residents are encouraged through financial rebates to convert lawns to alternative landscapes composed of rock groundcover interspersed with drought tolerant, drip irrigated plants (xeriscapes). Conversion of lawn to xeriscape can decrease residential water and fertilizer use and thus is promoted as a sustainable choice to conserve water quantity and improve water quality. However, the resulting dramatic change in ecosystem structure may lead to ecological tradeoffs that could confound regional sustainability objectives. For example, nutrient transformations from organically bound to inorganically available and mobile may be significantly greater in a xeriscape than a mesic lawn, primarily due to a decrease in plant uptake. Following conversion to xeriscape, leaching of N could occur at an equivalent rate to leaching from intensively managed agricultural fields. We will compare soil nutrient cycling and retention in never converted mesic yards and xeriscapes across a chronsequence of time since lawn conversion. We expect that xeriscapes will hold greater pools of inorganic N and smaller pools of organic carbon (C) than mesic yards due to decreased plant N uptake and elevated N mineralization. We also predict the size of soil inorganic N pools will increase with depth as xeriscapes age due to NO_3^--N movement through soils following precipitation and irrigation events.

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Holmes, C. V., and S. J. Hall.** ***Soil contamination and the implications for growing food in urban gardens.

Urban gardens provide multiple ecosystem services for people and the environment. These practical spaces produce nutritious food, reintroduce natural scenery into metropolitan areas, and are an efficient way to support the local economy. Further, they provide socio-economic benefits for low-income communities, including education opportunities, access to healthier foods, and a common area for gathering. Nonetheless, there are risks associated with developing such a site within a major city. In particular, studies show that there are major health risks associated with consuming foods grown in soils that have been contaminated with industrial or agriculture compounds. Studies on plant uptake of metropolitan contaminants show that uptake is highest among leafy greens and root vegetables, some of the most important and common products of urban gardens. The extent of pollution of soils is proportionate to the distance from various sources, such as industrial sites and busy roadways. In this study, we will determine if urban gardens are safe to produce food for inner-city communities according to EPA regulation framework of Reasonable Maximum Exposure (RME) by sampling soils and plants from a range of existing urban gardens in the Phoenix-Metropolitan area. If the amount of contaminants in the soil does not exceed the RME, then a site is safe to produce food for human consumption. Levels of cadmium (Cd) and lead (Pb) will be measured in both soil and plant samples using a fluorometer. Additionally, an analysis of texture, pH, and micronutrients and macronutrients present will be evaluated from each site.

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Hutman, J.[1], A. Bernier[2], and their students. ***Ecology Explorers: K-12 student contributions to the CAP LTER project.***

Students from across the Phoenix metropolitan area have been collecting data in their schoolyards using Ecology Explorers protocols. Students from an AP Environmental Science class at a local charter school will present their research on arthropod abundance and distribution. A group of juniors from the Sustainability class in an Engineering, Science and Technology program will present their study on local eutrophication impacts.

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Kruke, L.[1], D. White[2], K. Larson[1,3], and A. Wutich[4].** ***Climate change uncertainty and skepticism: A cross-country analysis.

Research has demonstrated that public understanding of climate-change uncertainties influences citizen support for specific mitigation and adaptation strategies. Furthermore, research has documented various populations' perceptions and attitudes about the causes, impacts, and potential solutions and strategies concerning climate change. This literature shows that most people believe climate change is occurring in some form, but some uncertainties, skepticism, and misunderstandings still exist. Thus, it is critical to understand public perceptions of uncertainty and climate-change skepticism and the relations between these perceptions and policy preferences to inform education campaigns as well as the development of broadly acceptable policies. Although several studies have focused on residents' views in the United States and the United Kingdom, more research is needed to detail cross-cultural framing of climate change and associated uncertainties. This study addresses this need with data collected as part of Arizona State University's Global Ethnohydrology Study (GES), which in 2012 consisted of interviews in Australia, China, Fiji, Mexico, New Zealand, Switzerland, United Kingdom, and the United States. Informed by Whitmarsh's Skepticism Scale, a confirmatory factor analysis is used to test for dimensions of skepticism and climate-change uncertainty among this cross-country sample. The study also compares how dimensions of skepticism and uncertainty vary across countries with different social, economic, and environmental contexts. These findings not only advance knowledge about how people in different cultural contexts understand and frame climate change; they also provide insights on how best to communicate risks and climate change policies, and manage them in diverse settings.

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Larson, K. L.[1,2], S. Samples[2], and M. Muñoz-Encinas[2]. ***Homogeneity and heterogeneity in ecosystem service preferences for residents' landscape management across regions of the U.S.***

Ecosystem services link the ecological structure and functioning of ecosystems to beneficial outcomes for people. These include provisioning, regulating, supporting, and cultural services. While much research draws heavily on economic valuation techniques to measure the market value of ecosystem services, little work has examined cultural services in detail and most research has focused on natural ecosystems (e.g., wetlands, forests) rather than human-dominated ones. We fill these gaps by examining how ecosystem services are valued in peoples' landscaping decisions, wherein residential landscapes are positioned as the dominant human ecosystem in cities. In particular, we test the urban

homogenization thesis, which posits that the social-ecological characteristics — or, in our case, ecosystem service preferences — are common among people in diverse cities regardless of the biophysical conditions of regional, native ecosystems. In other words, we examine the degree to which regional conditions affect ecosystem service preferences across U.S. cities by comparing regions of the humid eastern U.S. to those in the arid western U.S. and cooler northerly cities to those in the warmer south. This analysis illuminates continental scale trends in land management decisions relative to more place-specific effects, thereby addressing the scales at which homogenization is evident — or not — across different urban ecosystems.

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Li, X.[1], Y. Ouyang[2], and B. L. Turner II[3]. ***Parcel-level land architecture and land surface temperature in the Phoenix metropolitan area.***

The relationship between land surface temperature (LST) and characteristics of the urban land system has received increasing attention in urban heat island research, especially for desert cities. This research generally employs medium or coarser spatial resolution data and primarily focuses on the effects of land composition, usually the amount or percent of one land-cover class on temperature. In this study, we explore the effects of land system architecture-composition and configuration of different land-cover classes on LST in the central Arizona-Phoenix metropolitan area at a fine-scale resolution, focused on the composition and configuration of single family residential parcels. A 1-m resolution land-cover map is used to calculate landscape metrics at the parcel level, and 6.8 m resolution data from the MODIS/ASTER are employed to retrieve LST. In addition, socio-economic factors are employed as explanatory variables to help control for potential neighborhood effects. Ordinary Linear Squares regression models examine the effects of landscape configuration on LST at the parcel scale, controlling for the effects of landscape composition and neighborhood characteristics. Results show that the configuration of parcels affects LST, revealing significant variable relationships between that architecture and LST at nighttime and daytime, and the role of the neighborhood effects on the outcomes.

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Marcotte, A., J. Eagar, and P. Herckes.** ***Trace metals and inorganic species in time resolved haboob samples from ASU Tempe campus.

During the summer months in Arizona, very intense dust storms, or haboobs, can occur. These dust storms can last from minutes to hours and can alter the aerosol content greatly on short time scales. Monsoon-like storms sometimes follow haboobs, which can scavenge the aerosol particles that were brought in by the dust storm. Understanding haboobs is of great importance in the Phoenix area as they can increase particulate matter (PM) and bring an influx of PM material from other locations. Deposition of PM may alter soil and water chemistry in the affected areas. In this work, we chemically characterize haboobs and their effect on the air quality in the Phoenix area. During the summer of 2013, PM2.5 and PM>2.5 aerosol samples were collected on the Arizona State University Tempe campus. Samples were collected before, during, and after haboobs to determine the time resolved effect of haboobs on PM in the Phoenix area. Samples were analyzed for trace metals by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), soluble iron content by a ferrozine/UV-Vis method, and major inorganic species by Ion Chromatography (IC). Changes in composition

with a focus on differences and communalities between haboob and non-haboob aerosols will be discussed. The duration of a haboob's effect on ambient PM concentrations will also be examined. A more complete understanding of the effect of haboobs on the Phoenix area could be helpful in making health recommendations for residents during the summer months.

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***McAlister, A.[1], J. Rosales Chavez[2], A. Wutich[1], A. Brewis[1], C. Roberts[1], J. Maupin[1], D. Hruschka[1], and M. Boggess[3]. *Global ethnotheories of climate change and disease*.**

Understanding more about the similarities and differences in cultural perceptions of climate change-related disease causation can better inform culturally specific public health measures. Using interviews conducted with 739 adults in nine diverse global locations ranging from Fiji and China to England and Phoenix, Arizona, this study explores (1) climate change-disease beliefs within and across diverse cultures and (2) comparisons between cultural and scientific models. A cultural consensus analysis was employed to identify a "culturally correct" model for each study site. Next, a scientific model was generated based on current scientific consensus regarding climate change-disease connections. Using the Quadratic Assignment Procedure (QAP), we determined the amount of correlation shared between the scientific model and each cultural model. The analysis revealed a high level of intercorrelation between the models of English speaking, industrialized sites such as Phoenix, Arizona. Additionally, cultural models from the non-English-speaking sites were highly intercorrelated with one another. Overall, the English-speaking sites tended to have more complex models with a greater density of causal links. Cultural models from the English speaking sites also demonstrated high levels of correlation with the scientific model. In comparison, the cultural models from the non-English-speaking sites exhibited little correlation with the scientific model. Based on these findings, we suggest that cultural beliefs related to climate change-related disease causation may be influenced by complex local factors. For example, differences in education and media influences along with localized differences in climate change impacts may, in part, contribute to divergences between the cultural models.

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Middel, A.[1], K. Häb[2], B. L. Ruddell[3], A. J. Brazel[4], and C. A. Martin[5]. *Understanding the physical dynamics of microclimate: Ongoing research projects.*

We present four ongoing projects that will help us to explain spatial and temporal microclimatic patterns, to understand the physical dynamics of microclimate through measurements and modeling, and to investigate how these dynamics affect thermal perceptions and comfort. The four projects combine detailed meteorological observations, thermography, and modeling to address the following key questions: How does microclimate vary between shaded and non-shaded land cover types at different times of day and year?; Which land-cover and shade combinations are most beneficial for thermal comfort?; and, How does land-cover patch size impact the spatial distribution of microclimates under various upwind speeds at different times of day and year?

Using the comfort model Rayman, the first project assesses the thermal benefits of tree canopy shade in two NDV neighborhoods based on hourly meteorological observations, thermographic images, and fisheye photography. In the second study, we develop a matrix

of select surface types and tree species in Power Ranch (Gilbert) to systematically sample and analyze microclimate under trees and engineered canopy in comparison to non-shaded land covers. Third, we are designing a visualization tool to explore multivariate relationship between microclimate, land cover, and upwind fetch, using mobile seasonal microclimate transects that were conducted in Power Ranch from 2011 to 2012. The fourth project uses ENVI-met to model microclimate in the Power Ranch neighborhood under randomly shuffled land cover patch scenarios for varying patch sizes. A comprehensive understanding of microclimate dynamics will foster the development of urban climate solutions for healthy, sustainable, semi-arid environments.

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Milne, J. M.[1], M. Georgescu[1], D. J. Sailor[2], and M. Hart[3]. *Developing anthropogenic heating profiles for urban areas across the United States.

Urban areas produce an urban heat island (UHI), which is manifest as warmer temperatures compared to the surrounding and less-developed areas. While it is understood that UHI's are warmer than their surrounding areas, attributing the amount of heat added by the urban area is not easily determined. Current-generation modeling systems require diurnal anthropogenic heating profiles. Development of diurnal cycle profiles of anthropogenic heating will help the modeling community as there is currently no database for anthropogenic heating profiles for cities across the United States. With more accurate anthropogenic heating profiles, climate models will be better able to show how humans directly impact the urban climate. This research attempts to create anthropogenic heating profiles for 61 cities in the United States. The method used climate, electricity, natural gas, and transportation data to develop anthropogenic heating profiles for each state. To develop anthropogenic heating profiles, profiles are developed for buildings, transportation, and human metabolism using the most recently available data. Since utilities are reluctant to release data, the building energy profile is developed using statewide electricity by creating a linear regression between the climate and electricity usage. A similar method is used to determine the contribution of natural gas consumption. These profiles are developed for each month of the year, so annual changes in anthropogenic heating can be seen. These profiles can then be put into climate models to enable more accurate urban climate modeling.

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Moreno, H. A.[1], D. D. White[1], H. V. Gupta[2], E. R. Vivoni[3], D. A. Sampson[1]. *Predicting long-term hydrologic effects of the four forest restoration project at Tonto Creek Basin.*

Understanding the effects of intensive forest thinning on the hydrology of semi-arid basins is critical to achieving water resources sustainability in the water limited southwestern US, where disturbances to headwater catchment forests, can scale up to significant perturbations of the basin-scale water balance components. In northern Arizona, the Four Forest Restoration Initiative (4FRI) is being developed with the goal of restoring 2.4 million acres of ponderosa pine along the Mogollon Rim. In this study, we examine the potential impacts of the 4FRI initiative on the hydrology of the Tonto Creek Basin, an important water

contributor to the Roosevelt Lake. Long-term (20 year) simulations conducted using tRIBS, a physically based spatially distributed model, reveal shifts in the spatio-temporal regimes, and in the triggering processes, of runoff and integrated discharge as a response to feasible forest thinning scenarios. Specifically, our analysis suggests that alterations to the interception, evapotranspiration, recharge and snow processes within the forested areas will result in changes to long term water yield, and to extreme (peak and low flow) values. The results are helping local and regional water managers and policy makers to better understand the potential consequences of intensive forest removal and thereby influence decision making related to land use and the management of water resources.

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Morgan, M.[1], E. M. Barton[2], S. J. Hall[2], and J. Learned[2]. *Low impact development ordinances: How are they influencing urban landscape design?*

Surface groundcover influences stormwater runoff. Groundcovers that are more impervious reduce the infiltration of water into the soil, thus the runoff increases. Greater runoff increases the opportunity for pollutants to enter storm drains. These findings have encouraged municipalities across the United States to apply ordinances that help decrease water contamination from stormwater runoff.

A popular ordinance in many cities is the implementation of Low Impact Development (LID) practices. To comply with ordinance, new development and redevelopment must design one or more of the five LID best management practices which include rain barrels, permeable pavement, planter boxes, rain gardens and dry wells. In Phoenix, LID ordinances will be implemented for all new development and redevelopment of any income level properties within the next five years.

In this study, we will assess the stormwater management practices of 12 residential properties of different income located across Phoenix. Specifically, we will collect percentages of pervious and impervious groundcovers, expecting to show that higher income properties have a greater percentage of impervious surfaces due to their expensive landscape design. We will also look at existing stormwater management practices in these properties and determine how future LID regulations will impact properties variably by income.

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Muñoz-Encinas, M.[1], S. Samples[1], and K. Larson[1,2]. *Ecosystem services in residential land management: Expressed priories, distinctive dimensions, and regional comparisons.

Ecosystem services (ES) link the ecological structure and functioning of ecosystems to beneficial outcomes for people. These include provisioning, regulating, supporting, and cultural services. While research commonly uses economic valuation techniques to measure the market value of ecosystem services, little work has examined cultural services in-detail and most research has focused on natural ecosystems (e.g., wetlands, forests) rather than human-dominated ones. We fill these gaps by examining how various landscaping services are valued, wherein residential landscapes are positioned as the dominant human ecosystem in cities. In particular, ES preferences for vegetation choices and overall yard management are examined across U.S. cities: Phoenix, Los Angeles, Minneapolis, Boston, Baltimore, and Miami. In general, the most important priorities for yard management are beautiful and

weed-free landscapes along with personal enjoyment and ease-of-maintenance. For vegetation choices, residents similarly prioritize beauty and ease-of-maintenance. Through factor analyses, the following dimensions of ES were also empirically identified: 1) preferences for flowers and plant diversity (Floral Biodiversity); 2) choices prioritizing plants that are native and attract wildlife (Local Nature Provisioning); 3) yard management for water quality, drainage, and soil nutrients (Supporting Environmental Services); and 4) landscaping decisions that reflect spiritual values, cultural heritage, and learning opportunities (Local Cultural Values). Other strong priorities focus on neatness and cost minimization. Across regions, we found both commonalities in certain ES preferences (e.g., aesthetics) as well as differences (e.g., Miami is distinctive in stronger ES preferences for vegetation that provides food, wildlife habitat, and cooling compared to other regions).

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Palta, M. M., and N. B. Grimm. ***Nutrient pulsing and attenuation in "accidental" urban wetlands.***

Increases in available nutrients are at the forefront of research concerns within the stream ecological community, and are expected to become more problematic under projected changes in climate. The aim of this research was to examine the effect of storm events on nutrient (total inorganic nitrogen, total organic carbon, phosphate) loading and attenuation along flowpaths in urban wetland networks along the Salt River in Phoenix, AZ. The wetlands are fed by storm water outfalls exiting industrial and residential areas. Samples were collected along flowpaths downstream of six large, perennially flowing outfalls during baseflow and immediately after storm events. During both summer and winter, total discharge into the wetlands increased during storm events as compared to discharge prior to storm events. Concentrations of some nutrients (phosphate, ammonium) were lower during baseflow conditions than immediately following storm events. Nitrate concentrations were high throughout the year. Inorganic nitrogen concentrations dropped over the length of flowpaths through the wetlands, indicating high attenuation capability, even during storms. Climate change models project increases in severe droughts and extreme precipitation events for the southwestern United States, which can lead to more sewage leakages and increases in contaminated runoff from urban surfaces. Wetlands are constructed or restored to mitigate nutrient contamination of wastewater. Our research indicates that even unintentionally created wetlands can serve to help reduce the amount of nutrients from stormwater outfalls. However, wetland restoration or design targeting increased water retention time may increase the capability of the Salt River to remove pollutants from stormwater.

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Patarasuk, R., D. O'Keeffe, Y. Song, I. Razlivano, and K. R. Gurney. ***Assessing carbon dioxide emissions from U.S. large cities.***

Carbon dioxide (CO_2) emissions, a primary greenhouse gas, are quantified at fine spatial and temporal scales. In our research project, named "Hestia," we estimate CO_2 emissions from natural gas, coal, and petroleum sources. These emissions are from different sectors including residential buildings, commercial buildings, road, railroads, airports, industrial facilities, and electrical production facilities. The CO_2 emissions were quantified on the hourly basis. Our prototypes cities include Indianapolis, Phoenix, Salt Lake City, and Los Angeles. The data sources include parcel data, which contains the building square footage, year-built, and building type. In addition, we used the hourly traffic data and National Emissions Inventory (NEI) air pollutant reports. We also utilize eQUEST, ArcGIS, and computer programming

languages to calculate the amount of CO_2 emitting from different sector. The results were calibrated with the Commercial Buildings Energy Consumption Survey (CBECS) and the Residential Energy Consumption Survey (RECS) as well as previous county-scale CO_2 emissions from the "Vulcan Project." We expect that each prototype city will show similar CO_2 emission patterns on the hourly basis; for example, high CO_2 emissions from the road sector during 7-9 am and 4-7 pm. The results obtained will be beneficial for city/regional/ environmental planners in the efforts to lower CO_2 emissions.

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Pollard, L. D.[1], M. Sampson[1], M. M. Palta[1], M. Bernstein[2], T. Combs[1], X. Dong[1], S. Earl[2], N. B. Grimm[1], R. L. Hale[3], A. Handler[1], E. Holland[1], C. Kochert[1], J. McGehee[1], M. Ribot[4], D. Shorts[1], A. Suchy[1], and E. Worth[1]. *Greenhouse gas emissions in an urban landscape*.

Carbon dioxide, methane, and nitrous oxide (CO_2, CH_4, N_2O, respectively) are the most influential greenhouse gases (GHGs). As centers of human activity and industry, cities are potential hot spots for the production of GHGs. Studies in the Central Arizona-Phoenix LTER have quantified emissions of NO_x, N_2O, CH_4, and CO_2 from soils in largely terrestrial environments and investigated the role of episodically flooded areas on potential denitrification. Yet few studies have examined areal emissions from these types of habitats. The purpose of this research is to examine GHG emissions from a larger range of habitat/patch types found in the Phoenix metropolitan area in order to better understand if, where, and when the urban landscape harbours hot spots or hot moments of trace-gas emission. The study captures trace-gas emissions over three seasons from fourteen patch types characterized as terrestrial, aquatic, or periodically flooded using gas chambers. We also examined effects of flooding on GHG emissions in periodically flooded patch types (e.g., irrigated lawns, washes, ephemeral wetlands). Patch types showed substantial variation in CO_2, CH_4, and N_2O flux. Some patch types demonstrated uniformly low (e.g., ponds) or high (e.g., xeric washes) emissions of all three gases. Others, like wetlands, had high emissions of one trace gas (e.g., CH_4) and not another (e.g., CO_2). These patterns suggest that heterogeneity in urban design results in spatial variation of GHG emissions, and that flooding in cities, whether intentional or incidental, is a key factor driving temporal patterns of GHG emissions.

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Ramos, J.[1], E. J. Chapman[1], and D. L. Childers[2]. *Spatial and temporal variability of annual greenhouse gas fluxes from constructed wetland in an arid region.

Wetlands support ecological functions that result in valuable services to society, including the purification of water. Wetlands are also sources of greenhouse gases (GHG), such as nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2). Many free-water surface constructed treatment wetland systems (CW) have been developed, but little is known about the contributions of CWS on GHG emissions in arid regions. Since 2011, Tres Rios CW in Phoenix, AZ has removed approximately 30-40% of excess nitrogen (NO_3^- and NH_4^+) from the surface water entering the CW; with most of the N uptake occurring within the vegetated marsh area. To increase our knowledge of ecosystem dynamics of CW in arid regions, we set to investigate the GHG emissions from the CW. Since the spring of 2012, we have been utilizing the floating chamber technique to collect gas samples from two transects (nearest to inflow and nearest to outflow) and along three gradient subsites within the transects.

From March 2012 to March 2013, we found seasonal significant differences in CO_2 and CH_4 fluxes, but not in N_2O fluxes. We found two significant spatial patterns in GHG fluxes in the CW, between the inflow and outflow transects and along the transect gradient subsites. Between the transects, we found significantly larger CO_2 and N_2O fluxes at the inflow compared to the outflow but not CH_4. Along the transect gradient, N_2O fluxes were significantly lower at the shoreline compared to CH_4 fluxes, where the lowest fluxes were observed at the open-water subsite. Due to the increased development of CWs, it is important not just to study their effectiveness in purifying water but also the design and environmental factors that might promote the emission of GHG.

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Reyna, J., M. Bartos, and M. Chester.** ***Life cycle assessment of ecosystem services: Phoenix building stock.

Current methods for assessing sustainability, such as life cycle assessment (LCA), generally focus on easily quantifiable indicators such as air emissions with no accounting for the ecosystem services that support human or industrial processes. More comprehensive, transparent, and robust methods are necessary to fully account for anthropogenic impacts on ecosystems and to create a holistic understanding of urban technosphere and ecosphere system interactions. Incorporating ecosystem service indicators into LCA is an important step in spanning this knowledge gap.

To explore the potential for ecosystem service assessment in LCA, this research compiles an inventory of the material volume of all buildings in Maricopa County and estimates the corresponding ecotoxicity, eutrophication, and acidification impacts. Furthermore, historical raw material production and consumption are compared to gage the relative contribution and estimate whether material production is predominately occurring in Arizona or elsewhere in the supply chain. Roughly 90% of the production processes are found to occur outside of Arizona, driven by imported steel and lumber.

This work demonstrates the power of data-driven tools in understanding aggregate impacts of human activity and the importance of incorporating geospatial supply chain assessment into these underlying datasets. Geospatial assessment will be especially critical in understanding ecosystem service impacts of human activities as local decisions might trigger impacts on distant ecosystems. Developing more robust LCA datasets with new indicators as well as improved geographic specificity is an important next step in improving the applicability of ecosystem service LCA.

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Rode, S. R., and E. Wentz.** ***Homeowner association landscape guidelines and household water usage.

Promoting water efficiency to protect our future is vital in all areas of the Southwest, and increasingly throughout the nation. Agencies at the local, state, and federal levels develop policies and use legal instruments to govern water use directly and indirectly. Discretionary outdoor water usage can account for 40-70% of a household's annual water use. The sizes, exposures, and configurations of lots, plant material installed in them, watering and maintenance practices of caretakers and other factors influence how much water is used. Consequently, policy-makers are keenly interested in identifying the types of policy that will have the greatest impact on this usage. In growing communities, homeowner associations (HOAs) have taken an active role in influencing choices that were previously considered

private. Because front yards comprise the shared "face" of the associations, most HOAs define and enforce guidelines for their landscaping in order to protect property values.

In this study, we investigate whether the front-yard landscaping guidelines that homeowner associations impose negatively affect the water use of their households. The study compares water usage of households within comparably aged neighborhoods in the City of Goodyear, including one that does not have an HOA. Preliminary findings and a discussion of methodology are provided.

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Rose, C.J.[1], P. Westerhoff[2], and P. Herckes[1]. *Chloroform from swimming pools, a significant source of atmospheric chloroform in Phoenix?

Chloroform is a well-documented disinfectant by-product (DBP) of water chlorination. Chloroform is an important atmospheric pollutant by its direct health effects as well as by its contribution to photochemical smog formation. Major sources of chloroform in the urban atmosphere are industrial operations such as pharmaceutical and refrigerant manufacturing as well as landfill processing. Chloroform outgassing from swimming pools is not typically considered a source of atmospheric chloroform because swimming pools are scarce compared to other sources. However, urban areas in hot climates such as Phoenix generally contain a substantial amount of swimming pools per capita, potentially resulting in significant atmospheric fluxes. In this study, formation of chloroform by aqueous chlorination of organic acids in simulated pool water is investigated using gas chromatography-mass spectrometry. Reaction precursors were chosen to mimic sunscreen contamination in swimming pools. Corresponding formation of chloroform and reaction kinetics are reported, and estimates are made to determine impacts on Phoenix air pollution.

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Rudd, B.[1], and H. L. Bateman[2]. *Trail disturbance on reptiles in the Phoenix Mountain Regional Parks.

Urbanization can be a source of habitat degradation, threatening species of herpetofauna. Recreation such as hiking, mountain biking, and horseback riding can have direct and indirect effects on wildlife and their habitats. Trail use can directly affect small reptiles by trampling or by disturbing refuges or breeding sites. Indirect effects can alter habitat by compacting soils, introducing weeds, causing erosion, reducing vegetation or ground cover, or cause behavioral responses in wildlife by eliciting a flight response. Our research objects were to investigate how reptile diversity and abundance and vegetation vary in relationship to trails. We conducted visual-encounter surveys for reptiles and quantified habitat characteristics along 20 m transects on trails paired with off-trail transects (150 m from trail) at Usery Mountain Regional Park and McDowell Mountain Regional Park. We detected 235 observations of 8 species of lizards and 2 species of snakes during 2013 summer surveys. Overall, reptile abundance was similar on and off trail; however, there were some species-specific differences. Common side-blotched lizards (*Uta stansburiana*) and zebra-tailed lizards (*Callisaurus draconoides*) tended to be more abundant on-trail compared to off-trail. Principal component analysis from surveyed habitat variables indicate variation between the two parks and between trail conditions at the McDowell Mountain Regional Park. The results of this project can provide information for natural resource managers of the Maricopa County Regional Parks. This project will allow CAP researchers and students to engage with the recently formed Conservation Alliance which seeks to study, restore, and promote the Phoenix Mountain Park system.

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Ruddell, B. L.[1], and W. T. L. Chow[2]. *Microclimate analysis of observations in a master-planned residential community in Arizona.*

Detailed, high-resolution meteorological measurements in urban areas are essential towards improving understanding of atmospheric processes, especially at the micro-scale (e.g. <100 m^2) where climatic influences on humans are greatest. In Phoenix, AZ, micro-climates of urban landscapes have been greatly modified from the native desert environment, especially in suburban areas where non-native lawns and trees are regularly utilized to reduce micro-scale climate discomfort. In this study, we present preliminary results from analyses of urban meteorological data taken within a large master-planned suburban residential neighborhood in metropolitan Phoenix (Power Ranch, Gilbert, AZ). Micro-scale climate data from (a) fifteen dedicated weather stations scattered throughout residential backyards, and from (b) periodic mobile traverses routed through a variety of land covers were compiled. Through GIS mapping and statistical analysis, these data are examined with respect to variations of temporal (e.g., summer vs. winter; diurnal changes in atmospheric stability) and spatial (e.g., land use and land-cover density; vegetation types) conditions. Correlations with residential outdoor water used for landscape irrigation are also investigated, and the implications towards general sustainability of the desert community are discussed. Lastly, these climate data will enable the validation of micro-scale urban climate models for future critiques and possibly improve the physical representation of the urban land surface and microclimate processes in these models.

*This material is being concurrently presented at the AMS 2014 meeting in Atlanta, Georgia.

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Sampson, D. A., and R. Quay. *A dynamic web interface for WaterSim 5.0.*

As a boundary organization the Decision Center for a Desert City (DCDC) promotes collaboration between scientists and decision makers. Our mission is to bridge science and policy (to foster knowledge-based decision making) and to study how decisions are made in the face of uncertainty. DCDC's water policy and management model for the Phoenix metropolitan area, termed WaterSim, represents one such bridging mechanism. We are developing WaterSim for research, education, and outreach. As part of an on-going restructuring of the WaterSim platform we are currently developing a web interface for WaterSim 5.0. This dynamic, adaptive interface will function across multiple platforms ranging from tablets to use in the Decision Theater. This browser-based software will provide access to the newest version of the WaterSim model that has, to-date, been an in-house software package. In this poster we present the up-to-date development of the interface, and we discuss the basic structure and function envisioned for the release scheduled to be completed by March of this year.

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Shorts, D.[1], R. L. Hale[1], S. Earl[2], and N. B. Grimm[1,2]. *Hydrological and geochemical correlations with potential denitrification rates in an arid, urban wash.

Although the absence of nitrogen (N) can be detrimental to many biological processes, in large quantities certain forms of N can be harmful to the environment. In arid, urban watersheds, N accumulates by fertilization, atmospheric deposition, and pet waste and may be transported to washes during storms. The main goal of this research was to ascertain how geochemical and hydrological factors influence denitrification and, therefore, affect the quantities of N exported from washes. In this study, we evaluated the effects of soil properties including moisture content, texture, and N concentrations on potential denitrification in a residential, desert wash. We sampled soil from a wash in Scottsdale, AZ during summer 2012. Denitrification enzyme assays (DEA) were used to measure potential denitrifcation rates within the wash. In addition, data on soil moisture content, soil texture, and N concentrations (nitrate [NO_3] and ammonia [NH_4]) were collected from co-located points within the wash. Our results indicate that the potential denitrification rates of this urban, arid wash were far lower than that of other ecosystem types throughout the Phoenix area. Furthermore, soil properties were not significantly related to potential denitrification rates. However, potential denitrification was spatially correlated to wash inlets, suggesting that other environmental factors not measured here may influence denitrification rates in these systems.

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Smith, B., and V. K. Smith. *Anticipating neighborhood level changes in water demand.

Methods that enhance policymakers' ability to anticipate transitions in water demands at the neighborhood level are important to water resource planning. These changes usually accompany changes in landscape at the parcel level and can be large. For example, recent studies by the Phoenix Water Department (Frost 2013) for an area in Phoenix in 2007, suggest a 200-gallon per day difference in water usage for mesic versus xeric landscapes. The objective of this research is to develop methods to estimate the factors that induce changes in landscape for different Phoenix subdivisions. The analysis will exploit a unique data set that links household water usage records to housing information and measures of vegetative cover. The research design hypothesizes that when homeowners decide to upgrade appliances in older homes; these choices signal efforts to modernize these homes. As a result indoor and outdoor water use patterns are likely to change. The modeling strategy links models for appliance replacement based on Energy Information Administration's Residential Energy Consumption Survey (RECS) to estimates of the changes in water use at the subdivision level. These changes take account of how water prices are changing over time. The framework will connect the models by matching the appliance predictions developed at the household level using RECS to the water usage records for houses using housing attributes.

The analysis makes three contributions:

- It estimates water demand elasticities allowing for neighborhood effects.
- It evaluates whether neighborhood level transitions in water demand can be measured.
- It uses complementary data to assist in anticipating the transitions.

Frost, D. 2013. Urban Demand Research Workshop: Landscape and Water Use Project. City of Phoenix Water Services Department, April 18, 2013. <http://dcdc.asu.edu/docs/dcdc/website/documents/9_DougFrost_WaterDemandResearchWorkshop041713.pdf>

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Song, J., J. Yang, and Z. H. Wang.** ***Modeling urban land-atmosphere interactions with enhanced urban hydrology.

Landuse landcover changes in urban area will modify surface energy budgets, turbulent fluxes as well as dynamic and thermodynamic structures of the overlying atmospheric boundary layer (ABL). To study urban land-atmosphere interactions, we coupled a single column atmospheric model (SCM) to a cutting-edge single layer urban canopy model (SLUCM) with improved representation of urban hydrological processes. Modification of surface parameters such as the fraction of vegetation and engineered pavements, and geometrical features of street canyon, etc. in SLUCM dictates the surface energy partitioning and turbulent transport of heat, moisture, and momentum fluxes. The land surface states then provide lower boundary conditions to the overlying atmosphere, which in turn modulates the modification of ABL structure as well as vertical profiles of temperature, humidity, wind speed and tracer gases. The coupled SLUCM-SCM model is tested against field measurements of surface layer fluxes as well as profiles of temperature and humidity in the mixed layer under convective conditions. After model test, SLUCM-SCM is used to simulate the effect of changing urban land surface conditions on the evolution of ABL structure and dynamics. Simulation results show that despite the prescribed atmospheric forcing, land surface states impose significant impact on the physics of the overlying vertical atmospheric layer. Overall, this numerical framework provides a useful standalone modeling tool to assess the impact of urban land surface conditions on the local hydrometeorology through land-atmosphere interactions. It also has potentially far-reaching implications to urban ecohydrological services for cities under future expansion and climate challenges.

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***Stevens, D., R. Halpin, and J. C. Johnson.** ***Relative behavioral plasticity of an urban-exploiting reptile*.**

Human-induced rapid environmental change (HIREC) presents an exciting opportunity to investigate how rapid urbanization affects the ecology of organisms that share human-dominated landscapes. By studying the relative behavioral plasticity of these "urban exploiters," we hope to understand why some taxa are able to thrive alongside humans while other taxa do not. The Mediterranean house gecko (*Hemidactylus turcicus*), an invasive urban pest with a cosmopolitan distribution, is commonly found in urban Phoenix neighborhoods. Past research on this organism's presence in urban environments has focused on population-level questions rather than underlying behavioral mechanisms. We hypothesize that this urban specialist is characterized by a high degree of behavioral plasticity, allowing it to respond well to HIREC. We collected 26 geckos from 6 sites across Phoenix and tested for relative behavioral plasticity by assessing habitat use, foraging voracity at varied levels of food deprivation, and reaction to predation risk. We discuss our findings with particular emphasis on the implications of these behavioral data for lizard population growth in urban habitat.

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Stotts, R.[1], K. Larson[2], A. Wutich[1], and A. Brewis[1]. *Characterizing water risks and solutions cross-culturally: Results from the global ethnohydrology study.

In this study, we examine how development status and climatic context of diverse countries affect cross-cultural perceptions of water risks and management solutions. Using ethnographic data collected in four semi-rural/peri-urban sites in Bolivia, Fiji, New Zealand, and the United States, we examine interview data for statements regarding risks (water quantity and water quality) and solutions (individual behavioral strategies, collective technological strategies, and collective policy/institutional strategies). Using content analysis, we test the following hypotheses: (1) residents in arid nations will be more concerned with issues of quantity; (2) residents in less developed nations will be more concerned with water quality; and (3) residents in less developed nations will be more focused on technological solutions. Our goal is to contribute to a limited but growing body of literature focused on how people conceptualize water risks and solutions across social and environmental contexts.

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Weaver, M. and K. J. McGraw. *Hot nights in the city: How seasonality affects behavioral and physiological traits in house finches (*Haemorhous mexicanus*) across an urban gradient.

Urbanization has been shown to affect local climate, best known in the "urban heat island" effect seen in many cities. This effect is thought to make cities warmer in the summer but also more moderate in the winter. However, less is known about how animal behavior is affected by seasonal differences between cities and surrounding rural areas. We identified both physiological traits (mass, breath rate) and behavioral traits (activity, stress behaviors) that may differ across seasons in house finches (*Haemorhous mexicanus*) from six different sites across an urban gradient in Phoenix, AZ. We then presented house finches with a challenge that should elicit stress behaviors (human approach) that we previously found to differ across an urban gradient. We recorded mass and breath rate before the trials and recorded behaviors both before and after the presentation of the stimulus, which included traits typically associated with boldness (time spent feeding, time spent hiding), activity levels (hops, flies) and stress levels (ruffles, bill wipes). We conducted this study both during two seasons. The winter season is typically thought to be low stress in Phoenix because food is abundant and birds are neither molting nor breeding. The molt season is high stress for the birds in that the Phoenix temperatures are extreme, food and water can be scarce and birds are losing all of their feathers and regrowing new ones. We found significant differences between both breath rate and behavioral responses across the two seasons, indicating that understanding animal response to urbanization may be further complicated by seasonal patterns.

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Wolf, A.[1,2], N. B. Grimm[2], J. Gwiszcz[3], M. M. Palta[2], and O. Schwake[4]. *Ecosystem Services and trade-offs mediated by urban water bodies for homeless populations in Phoenix.

Urban runoff entering stormwater outfalls in Phoenix have created "accidental" wetlands in the previously dry Salt River bed. Flowpaths from six outfall sites during the 2013 summer season were monitored for *Escherichia coli* (*E. coli*) loading levels and wetland-mediated attenuation rates of *E. coli* at points along each flowpath. Outfalls were also monitored for trash associated with human use of outfalls (bathing, washing), and levels of shade, temper-

ature, privacy, and vegetation coverage. These parameters were studied to assess extent of use and the ecosystem services and trade-offs provided by accidental wetlands to the homeless population in Phoenix. Trash monitoring indicated that individuals were using outfall water for bathing and washing, and wetland environments for heat mitigation and privacy. Our data suggest potential public health concerns, as pathogen and *E. coli* loads at the outfalls were found to exceed drinking water standards. Furthermore, fecal coliform counts were seen to spike into the thousands to tens of thousands of colonies per mL after storm events. Fecal contamination did, however, decrease as flowpaths traversed wetland environments. To determine the source of this fecal pollution, environmental *E. coli* isolates were analyzed using MALDI-TOF MS. Preliminary results indicate *E. coli* from outfalls in some instances demonstrate close correspondence in protein profiles with *E. coli* strains of human origin. Sucralose testing will assist in testing the conclusion that human waste is entering stormwater streams in Phoenix. Further analysis of environmental variables along flowpaths through wetlands may suggest ways in which wetland environments may removal pathogenic bacteria.

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Wyant, K. A., Y.M. Marusenko, S. J. Hali, and J. L. Sabo. *Dynamics of urban belowground food webs and land-use type in an arid ecosystem.

Arid ecosystems experience high rates of land-use change associated with urban development including the installation of managed xeriscapes and irrigated turfgrass lawns in residential and commercial areas. Previous research shows that regular application of water and fertilizers (N and P) in mesic, turfgrass lawns modifies soil microbial community structure, distribution, and function, which can alter N cycling pathways in arid cities. It is unclear how land-use modifications affect belowground microflora and fauna in urban areas, which, in turn, are the active drivers and regulators of urban biogeochemistry and soil function. The aim of our study is to resolve the questions: 1) Who are the major groups of soil flora and fauna in an urban belowground ecosystem and how do populations change during the dry and monsoon seasons? and, 2) How do landscape types affect the interactions between multi-trophic communities, soil properties, and nutrient cycling? In the summers of 2011 and 2012, we collected a series of 108 soil cores, split between the dry and monsoon seasons, in metro Phoenix. Soils were processed for flora and fauna, nutrient dynamic quantification, and microbial community molecular analyses. Our results indicate that mesic lawns harbor increased soil moisture over two seasons (dry and monsoon) relative to xeric and native desert sites. Our preliminary analyses indicate that mesic lawns support different microarthropod communities, including increased abundances of fungal feeding mites (Cryptostigmata and Mesostigmata) and a mostly predatory sub-order (Prostigmata).

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