

Central Arizona – Phoenix Long-Term Ecological Research (CAP LTER)

Eleventh Annual Poster Symposium
January 15, 2009

Carson Ballroom, Old Main

AGENDA

- 8:30 am Coffee
- 9:00 am Welcome
- 9:10 am **Global Change in the Urban Century**
Nancy Grimm, Lead PI and Co-Director, CAP LTER and Professor, School of Life Sciences
- 10:00 am **Theoretical and Conceptual Themes in CAP LTER**
Jim Elser, Professor, School of Life Sciences
Christopher Boone, Associate Professor, School of Sustainability and School of Human Evolution and Social Change
Patricia Gober, Professor, School of Geographical Sciences
- 11:00 am Poster session #1
- 12:00 noon **Lunch, Global Institute of Sustainability - RSVP required**
Room 481
- 12:30 pm **Research Planning Meetings, Global Institute of Sustainability**
Rooms TBA - RSVP required
- 2:00 pm **Theoretical and Conceptual Themes in CAP LTER**
Scott Collins, Professor, Department of Biology, University of New Mexico
Kerry Smith, W.P. Carey Professor of Economics, W.P. Carey School of Business
Annim Wiek, Assistant Professor, School of Sustainability
- 3:00 pm Afternoon break
- 3:10 pm Poster session #2
- 4:10 pm Adjourn

2009 CAP LTER Symposium

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

Poster Session #1	Poster Session #2
Aggarwal et al. (7)	Barnett et al. (8)
Bang et al. (5)	Chow and Pope (4)
Conley et al. (1)	Cutts et al. (9)
Fox and Cutts (35)	Fokidis et al (26)
Hale and Grimm (15)	Funke et al. (30)
Hartnett et al. (17)	Gilbert and Gries (34)
Lerman and Warren (27)	Ibes et al. (10)
Lund et al. (19)	Hamilton and Hartnett (16)
McHale et al. (21)	Larson and Grimm (18)
Mercer and Larson (11)	Litteral and Wu (28)
Muñoz-Erickson (31)	Marusenko and Hall (20)
Ontiveros-Valencia and Stutz (29)	Prashad et al. (2)
Ruddell et al. (5)	Sampson and Gober (12)
Senneville (13)	Shipp et al. (22)
Sweat (23)	Sister et al. (6)
Turner (33)	Strawhacker et al. (32)
Zhang et al. (3)	Wutich et al. (14)
	Zhuo et al. (4)
Musheno and Elser (student table top exhibit)	

LIST OF POSTERS

LAND-USE AND LAND-COVER CHANGES

Shannon Conley, Justin Helepololei, and Abigail York. ***Trust Land Preservation, Development, and Direct Democracy***

Lela Prashad, Phil Christensen, Saadat Anwar, Eric Engle, and Scott Dickenshied. ***JEarth - Analytical Imagery Application for Practitioners and Researchers***

Sainan Zhang, Abigail M. York, and Christopher G. Boone. ***Monitoring Landscape Fragmentation with Rapid Urbanization in the Central Arizona – Phoenix Region***

CLIMATE-ECOSYSTEMS INTERACTIONS

Winston T. L. Chow, and Ronald Pope. ***Modeling Micro-scale Park-Cooling Effects Within the ASU Campus: An Evaluation of the Envi-Met Climate Model***

Darren Ruddell, Sharon L. Harlan, and Susanne Grossman-Clarke. ***Assessing Exposure and Experience with Extreme Heat in Phoenix, AZ***

Chona Sister, Christopher Boone, Jay Golden, Donna Hartz, and Wen-Ching Chuang. ***Spatial Analysis of Crime and Socio-economic Variables as Indicators for Heat-Health Vulnerability in Chicago, Illinois***

WATER POLICY, USE, AND SUPPLY

Rimjhim Aggarwal, Subhrajit Guhathakurta, Susanne Grossman-Clarke, and Vasudha Lathey. ***How do Variation in Heat Islands in Space and Time Influence Household Water Use? A Longitudinal Study of Single Family Residences in Phoenix***

Allain Barnett, Edward Jensen, and Paul Terek. ***Demographic Factors Influencing Water Quality Perceptions and Bottled Water Consumption***

Bethany Cutts, Ariana Fox, Allyn Knox, and Nicholas R. Moore. ***Chutes or Ladders? Examining the Roles of Geography and Ideology in Mediating the Relationship Between Information Providers and the Public's Environmental Awareness***

Dorothy C. Ibes, Kelli L. Larson, and Elizabeth A. Wentz. ***Human Ecological Concern about Resource Consumption at the Neighborhood-Level: Perceived Versus Actual Water Scarcity Risks in Phoenix, Arizona***

Chris Mercer and Kelli Larson. ***Public Perceptions of Drought and Support for Changes in Water Pricing and Use***

David A. Sampson and Patricia Gober. ***The Central Arizona Water-Energy Nexus: Estimates of Energy Used to Transport CAP Water Modeled Using WaterSim 3.4_DCDC***

Clea Senneville. ***Institutions, Linking Knowledge with Action, and Sustainability: A Case Study of the Arizona Water Institute***

Amber Wutich, Beatrice Crona, Mohan Seetharam, Patricia Gober, Paul Westerhoff, Zeenat Hasan, and Stacy Avent. ***Ethnohydrology: A Mixed Method Study of Local Water Knowledge***

FLUXES OF MATERIALS AND SOCIO-ECOSYSTEM RESPONSE

Rebecca Hale and Nancy B. Grimm. ***Spatial and Temporal Variability of Runoff Chemistry: Land Use Effects***

Alex Hamilton and Hilairy Hartnett. ***Black Carbon Concentrations in Urban and Rural Arid-land Soils***

Hilairy Hartnett, Jessie Shipp, David Lui, and Hillary Waterman. ***Dissolved Organic Carbon Dynamics in Tempe Town Lake***

Elizabeth K. Larson and Nancy B. Grimm. ***Nitrogen Gas Emissions from Stormwater Retention Basins During Wet Weather Events in the Phoenix Metropolitan Area: an Additional Ecosystem Service?***

Tracy J. Lund, Everett Shock, and Panjai Prapaipong. ***Geochemical Dynamics of a Spring-Fed Stream in an Arid Climate***

Yevgeniy Marusenko, Pierre Herckes, and Sharon Hall. ***The Fate of Combustion-Derived Carbon Deposition in Urban Soil***

Melissa R. McHale, Lawrence R. Baker, Brenda A. Koerner, and Nancy B. Grimm. ***Developing Carbon Budgets for Cities: Phoenix Metropolitan Region as a Case Study***

Jessie Shipp, Hilairy Hartnett, K. Lui, and Hillary Waterman. ***Temporal Trends in Dissolved Metal Concentrations in Tempe Town Lake***

Ken G. Sweat, Thomas H. Nash III, Panjai Prapaipong, and Paul T. Gremillion. ***Geographic Patterns and Temporal Trends of Trace Metal Deposition Using the Lichen Xanthoparmelia in Maricopa County, Arizona, USA***

Xaioding Zhuo, Panjai Prapaipong, and Everett Shock. ***Isotope Studies for the Sources of Urban Pb in the Soil of Maricopa County***

HUMAN CONTROL OF BIODIVERSITY

Christofer Bang, John L. Sabo, and Stanley H. Faeth. ***Is the Answer Still Blowing in the Wind? - Plant Growth in Urban Areas***

H. Bobby Fokidis, Miles Orchinik, and Pierre Deviche. ***Increased Territorial Responses in Urban Populations of Two Sonoran Desert Birds: Hormones or Ecology?***

Susannah B. Lerman and Paige S. Warren. ***Birds, Habitat, and Socioeconomic Factors: Exploring the Relationships in a Residential Landscape***

Jennifer Litteral and Jianguo Wu. ***Effects of Urbanization on Avian Species Diversity in the Phoenix Metropolitan Area: Patterns in Vegetation Fragments***

Aura Ontiveros-Valencia and Jean C. Stutz. ***Arbuscular Mycorrhizal Fungal and Dark Septate Endophytes Colonization of Plant Roots from Urban Desert Preserves and Surrounding Deserts***

HUMAN DIMENSIONS OF ECOLOGICAL RESEARCH

Benjamin M. Funke, Elizabeth M. Cook, Sharon J. Hall, Kelli L. Larson, Colleen Strawhacker, and Victoria Turner. ***Legacy Effects and the Social-Ecological Dynamics of Residential Landscapes: An Interdisciplinary Study in Phoenix, Arizona***

Tischa A. Muñoz-Erickson. ***A Process for Science-Society Interactions to Develop an Urban Long Term Research Area (ULTRA) Site in San Juan City, Puerto Rico***

Colleen Strawhacker, Elizabeth M. Cook, Kelli L. Larson, and Sharon J. Hall. ***Landscape Preferences and Yard Management: the Effects of Homeowners' Values on Residential Landscapes***

Victoria K. Turner. ***The Impact of Semi-Private Social Institutions on Residential Landscape Form and Ecological Structure in Phoenix, Arizona***

INFORMATION MANAGEMENT, OUTREACH, AND EDUCATION

Edward Gilbert and Corinna Gries. ***SYMBIOTA: An Innovative New Approach to Interactive Online Species Identification***

Birgit Musheno and Monica Elser. ***Ecology Explorers: K-12 Student Contributions to the CAP LTER Project***

Ariana Fox and Bethany B. Cutts. ***Effective Survey Implementation; Is My John Hancock Worth Two Dollars?***

ABSTRACTS

All abstracts are listed alphabetically by first author.



Aggarwal, R.¹, S. Guhathakurta^{1,2}, S. Grossman-Clarke¹, and V. Lathey¹. ***How do Variation in Heat Islands in Space and Time Influence Household Water Use? A Longitudinal Study of Single Family Residences in Phoenix***

Previous studies, using detailed cross-sectional data from 1998, have shown that heat island effects have a significant impact on water use in Phoenix. Although these results are reliable, cross-sectional data cannot capture all the complexities associated with the dynamics of this relation. Using information from repeated observations over different years helps control for unobserved heterogeneity and thus provides more robust estimates. In this study, we used panel data from 1990, 1995, and 2000, at the census tract level in Phoenix to estimate a fixed and random effects water consumption model. A modified version of the fifth-generation PSU/NCAR Mesoscale Meteorological Model (MM5) was used to estimate daily minimum and maximum 2-m air temperatures to capture the spatial variation in urban heat island for the three study years. The dependent variable in the consumption model is the single-family residential water use, averaged at the census tract level. Independent variables include simulated temperatures from the MM5 model, intensity of vegetation cover, housing and parcel attributes (such as, age of housing unit, lot size, and size of swimming pool), and demographic characteristics (such as household size, income and education). Our results show that not only has the heat island expanded spatially over the study period, but the elasticity of its impact on water consumption has also been intensifying. The study also reveals several other insights about how variables such as lot size, pool size, and intensity of vegetation cover either directly, or through their interaction with the heat island, impact water use.

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Bang, C. ¹, J. L. Sabo¹ and S. H. Faeth². ***Is the Answer Still Blowing in the Wind? - Plant Growth in Urban Areas***

Perennial plants grow significantly better in urban areas rather than open desert or remnant sites, despite being subject to same water conditions. It has been suggested that urban plants have higher gas exchange rates because of increased water availability. One hitherto overlooked, yet conspicuous difference in local climate is wind speed and its effect on productivity, an often ignored consequence of urbanization. We hypothesized that reduced wind in the city directly or indirectly increase plant performance. A reduction in wind speed in non-urban areas should therefore bring changes in biomass up to same level as in urban areas. To test this we exposed brittlebushes to different levels of urbanization and wind speed, keeping water availability and soil nutrients constant. In addition, we logged local climate variables such as temperature, soil moisture and relative humidity. Change in aboveground biomass was measured during the growth season. As predicted,

wind exposed plants in desert and remnant areas had a significantly lower biomass increase than wind protected plants, which increased similarly to exposed urban plants. This supports our hypothesis since wind exposed urban plants already experienced reduced wind speeds being located in the city. Since our wind-breaker treatments to some degree reduced direct sun exposure and slightly increased temperature and relative humidity, we do not claim that reduced wind speed is the single factor contributing to increased productivity. In conclusion, our results suggest that reduced wind speed facilitates processes leading to increased productivity, and should be incorporated in future simulation models.

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Barnett, A.¹, E. Jensen², and P. Terek². ***Demographic Factors Influencing Water Quality Perceptions and Bottled Water Consumption***

The goals of the Groundwater Management Act are to balance water supply with demand, and provide water of sufficient quality and quantity to a growing population in the Phoenix metropolitan area and Arizona. Given these goals, management strategies need to understand the perceptions of the citizens of Phoenix and how attitudes may change as demographics change. In addition to the well-documented influence that income and education have on perceptions, we hypothesized that tenure, ethnicity, and political views also play an important role in citizen's perceptions of water quality. To test these hypotheses, we conducted a survey at the Downtown Phoenix Public Market, on shoppers and vendors. Using a logit model ($R^2=0.43$, $p=0.0001$) the water-quality perception index generated was positively related to out-of-state origins, residence in central Phoenix, tenure, education, income, and respondents who were white, male, and liberal. In a second logit model ($R^2=0.44$, $p<0.0001$), respondents were more likely to drink bottled water when their perceptions of water quality were negative, and when they came from another state. Both models showed a number of significant or nearly significant interaction effects between demographics that played a role in bottled water use and perceptions of water quality. The results of this study both support and contradict previous studies, depending on demographic factors. Future studies that consider the spatial correlations between water perceptions and demographics may benefit researchers to better understand this phenomenon.

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Chow, W. T. L.¹, and R. Pope². ***Modeling Micro-scale Park-Cooling Effects Within the ASU Campus: An Evaluation of the Envi-Met Climate Model***

The urban heat island (UHI) is an inadvertent consequence of urbanization and results in elevated urban temperatures, potentially resulting in negative consequences in areas with existing high temperatures such as in Phoenix. One well-known method of mitigating UHI is to increase areas of green space, which

lowers ambient temperatures through increased evaporative cooling, i.e., the park cool island (PCI) effect. Observations of PCI are well-documented in urban climate through measurements; however, climate modeling of the PCI has not been as extensively researched, especially at a micro-scale level (i.e., less than 1 km²).

In this study, a micro-scale climate model (Envi-Met 3) simulated temperature fields for a small (400×300 m) study area within an area of the Arizona State University-Tempe campus. Results from the model simulations were compared to near-surface (0.1 and 2 m) temperature observations measured during an early morning traverse in October 2007. Both modeled and observed data were geo-referenced and subsequently input into a GIS. Interpolations of observed temperature data (e.g., through inverse-distance weighting and universal kriging) were also analyzed with modeled temperatures. Results of both (i) the model-predicted vs. observed data and (ii) modeled vs. interpolated data were subsequently evaluated through regression analysis and statistical difference measures.

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Conley, S., J. Helepololei, and A. York. ***Trust Land Preservation, Development, and Direct Democracy***

State trust lands are a unique public good governed by a trust mandate with a rich history. Increasingly these lands are playing an important role in the development the rapidly urbanizing western US. In this study, we discuss the history of state trust lands, followed by an examination of the history of property rights and how it relates to environmental politics. We explore the direct democracy literature focusing on studies of environmental ballot issues and referendum. For our main analysis, we examine the linkages between state trust land and direct democracy via a text analysis of ballot measures pertaining to state trust land governance. We analyzed ballot measures from seven states that pertained to state trust land use. These measures dated from 1918 to 2006, with the vast majority coming from Arizona. We utilized text analysis to identify and locate major topic codes. We then used principal component analysis to identify crosscutting themes in the ballot initiatives. We conclude the study with a discussion that situates our analysis within a broader contextual and historical landscape.

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Cutts, B. B.^{1,2}, A. Fox^{1,2}, A. Knox^{1,3}, and N. R. Moore⁴. ***Chutes or Ladders? Examining the Roles of Geography and Ideology in Mediating the Relationship Between Information Providers and the Public's Environmental Awareness***

Public information campaign evaluation methods often under value the impact of information and ignore the larger political context of the information being provided. While some studies focus on the impact of a one information program on one action, effort to educate the public can informally provide legitimacy to community

interests and empower political and community action beyond the individual or household level. Further, few studies have considered the potential impact of several programs administered by several organizations with overlapping geographic ranges. Using an environmental justice framework, we evaluate the landscape of opportunity to engage with information about water supply and water quality created by the 42 organizations serving metropolitan Phoenix. Contrary to predictions, percent Latino, renters, and school-aged children are positively related to high water information (WI) availability in our maps. However, preliminary results indicate that the content and framing of information may prevent these social groups from finding the information compelling or engaging. This indicates that spatial and ideological barriers to WI engagement may interact synergistically. This may lead to lower public awareness about water issues than would otherwise be expected given the prolific amount of information provided to the public. There is some evidence that the structure of interactions among water information providers may partially explain the mismatch between information being provided and that desired by the public.

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Fokidis, H. B., M. Orchinik, and P. Deviche. ***Increased Territorial Responses in Urban Populations of Two Sonoran Desert Birds: Hormones or Ecology?***

In many birds, the onset of breeding is marked by territory establishment and its subsequent defense from conspecific intrusion. Territories may be defended for various reasons including the monopolization of spatially limited resources. These resources can vary between habitats, which in turn may influence territorial behavior. We measured the territorial behavior of male Curve-billed Thrashers, *Toxostoma curvirostre*, and Abert's Towhees, *Pipilo aberti*, belonging to urban and rural Arizona populations through direct observation of birds in response to conspecific song playback recordings. Corticosterone (CORT) has been associated with avoidance behavior in some species. In circulation, most CORT in birds is reversibly bound to corticosterone-binding globulin (CBG) and this interaction presumably mediates the amount of free (unbound) hormone available to interact with cellular receptors. We measured total and estimated free plasma CORT concentrations in urban and desert thrashers and towhees and correlated these concentrations to behavioral responses to song playback. We also measured population densities of the two species in urban and rural areas as it may influence aggressive interactions between conspecifics. Both urban thrashers and towhees were significantly more aggressive than desert conspecifics parts but this difference was not related to total or free plasma CORT or to differences in population density between habitats. These results will be discussed in the context of the effects of urbanization on behavior and endocrine physiology.

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Fox, A., and B. B. Cutts. ***Effective Survey Implementation; Is My John Hancock Worth Two Dollars?***

Many survey researchers have observed declines in response rates. We tracked the response rates of public neighborhood surveys implemented by the ASU research lab between the years of 1973 and 2008 to better quantify the trend of response rates in Phoenix. Some methods of using personalized materials, monetary incentives, and making multiple contacts with respondents are known to increase response rates but require time and money. For Phoenix, we do not know the relative effect of each of these survey implementation methods. Within the Tailored Design Method (Dillman 2007), I have created a full-factorial experimental design to measure the relative effectiveness of two approaches to increasing response rates: highly personalized mailings and a token financial incentive. Half of the pre-survey alert letters and survey cover letters include hand signatures, while the other half will have electronic signatures. Across those groups, half receive a two dollar incentive. I discuss preliminary results in the context of my prediction that the token incentive will have the greatest impact on response rate with the highest response among the individuals that receive both a two dollar incentive and a personalized letter. I also examine demographic differences among each survey group. This study adds to the discussion surrounding response rates and efficient survey implementation methods. On a more local scale, future surveyors will be better equipped to understand the local acceptability of their response rates and avoid creating unforeseen biases in the type of respondents.

Dillman, D. A. 2007. *Mail and Internet Surveys: The Tailored Design Method*. 2nd ed., Wiley, Hoboken, NJ.

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Funke, B. M.¹, E. M. Cook², S. J. Hall², K. L. Larson^{1,3}, C. Strawhacker⁴, and V. Turner³. ***Legacy Effects and the Social-Ecological Dynamics of Residential Landscapes: An Interdisciplinary Study in Phoenix, Arizona***

Residential yards represent a significant fraction of the surface area of urban ecosystems. These landscapes, ranging from mesic to xeric, may operate similarly to highly managed agricultural landscapes with varying degrees of water and chemical inputs. As a part of an interdisciplinary workshop of natural and social scientists, we have developed an integrated conceptual model that explores the social and biophysical drivers of residential landscape structure and functioning. One of the primary findings emerging from this work is the importance of landscape legacies. Whereas previous research focuses primarily on ecological legacies in both the structure and function of managed landscapes, little work explores how these legacies interact with and influence the social institutions from which management practices emerge. By conceptualizing the social and ecological components of residential landscapes holistically, as a complex adaptive system, we explore the importance of past interactions within the system in order to better understand the evolution of social institutions relevant to residential landscapes over time. The development industry plays a key role in landscape management as a primary agent of

land-use change in cities across the globe. In this work, we will use interviews with housing developers and to explore the forces influencing residential landscaping decisions across time. Our findings will highlight the importance of integrated social-ecological research when studying human dominated landscapes.

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Gilbert, E., and C. Gries. ***SYMBIOTA: An Innovative New Approach to Interactive Online Species Identification***

The Symbiota/SEINet web application is a specimen-based virtual floristic model that is capable of dynamically generating identification keys for any taxonomically complex species list as denoted by specimen distributions or user input. This innovative data model and set of algorithms store morphological character data within a taxonomic hierarchy ensuring an efficient method for processing descriptive data and generating interactive keys for any subset of organisms. The implementation of inheritance and object oriented principles in Symbiota greatly reduces data entry efforts, handles species concepts for vastly different taxonomic groups in one system and accommodates multiple taxonomic views and phylogenies. Web-based data management tools allow the scientific community to collaboratively build a solid foundation of biological resources. The general public is then able to draw from this quality maintained dataset to define educational resources that are specifically geared to their local community. The flexibility of this system has enormous potential as it can be customized to meet a full spectrum of needs – from the middle school student just being introduced to local species to the professional taxonomist who expects a highly comprehensive dataset.

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Hale, R., and N. B. Grimm. ***Spatial and Temporal Variability of Runoff Chemistry: Land Use Effects***

Spatial and temporal heterogeneity are inherent features of all ecosystems, and the scales of resource variability can be used to understand the processes driving patterns over a range of spatial and temporal scales. Human activities routinely change the spatial and temporal distribution of resources. Some of these changes are intentional; e.g., control of flood waters and drinking supplies. Others are unintended; e.g., the fragmentation of landscapes increases variability at that scale. Much work has been done regarding the effects of human land-use changes on spatial variability of soil nutrients, showing decreased variance at the patch scale, and increased variance between sites. These changes in soil chemistry have implications for the distribution of runoff chemistry to streams and rivers. We used 15 years of stormwater data collected by the US Geological Survey (USGS) and the Flood Control District of Maricopa County and surface water quality data collected by the USGS to address the following questions. What are the scales of spatial and temporal variability of runoff chemistry and volume in Phoenix, AZ, an arid urban eco-

system? How do these patterns relate to land use and land cover? Finally, how do these patterns compare with those found in semiarid and mesic regions? Temporal variability is assessed for each catchment seasonally, annually, and over the entire dataset. Patterns are compared across land uses and catchment sizes. Spatial variability is compared between and within catchments using a nested watershed approach.

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Hamilton, A.¹, and H. Hartnett^{1,2}. ***Black Carbon Concentrations in Urban and Rural Arid-land Soils***

This study examines black carbon (BC) in soils from central Arizona. Black carbon (BC) is the product of incomplete combustion of biomass and fossil fuel. It has a wide range of physical structures from slightly charred biomass to soot carbon, that vary in size from millimeter-scale to submicrometer-scale, respectively. BC has been shown to make up a large portion (up to 50%) of the soil organic carbon pool. However, many uncertainties exist in global and regional BC budgets that are directly related to the wide variety of experimental techniques used to measure BC. Although traditionally thought to be quite refractory, it is now known that more BC is produced than is stored in sinks annually. Because of this imbalance, a more dynamic role for BC in the environment must be considered. Very little is currently known about BC reactivity in soil. Examining soils with both fossil fuel derived and biomass derived BC inputs can reveal information about BC functionality and aid in the understanding of it's role in earth's reactive carbon pool.

Total carbon, weight % organic carbon, weight % inorganic carbon and weight % BC were measured at various sites around the Phoenix, AZ, metropolitan area. Our results show that BC makes up from 0.01 to 0.78% of the total weight of soil which is an amount that corresponds to between 1.65 and 62.86% of the organic carbon pool. This indicates that a significant portion of the organic carbon in central Arizona soils can be defined as black carbon.

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Hartnett, H.^{1,2}, J. Shipp², David Lui², and H. Waterman³. ***Dissolved Organic Carbon Dynamics in Tempe Town Lake***

Urban lakes provide a range of ecosystem services to their communities but there is little information about the long term biogeochemical behavior of these systems. We have been investigating basic water chemistry and dissolved organic carbon dynamics in Tempe Town Lake, Tempe, AZ, since Jan 2005. This man-made lake provides both recreational and flood-control services. Over this four-year period, the lake has experienced two high-flow events (Jan 05 and Feb 08) that "reset" the lake with fresh water from the Verde and Salt Rivers. In between these two events the lake experienced little input of water, except for rainfall events and the regular inputs from recharge wells. There have been four monsoon periods over the time of our study; two years with relatively wet summers (2006, 2008) and two

years with relatively dry summers (2005, 2007). The bulk DOC concentrations in the lake are generally highest ($>6 \text{ mg C L}^{-1}$) during the winter high-flow events and can exhibit peak concentrations following summer monsoon storms. During dry periods the major ion chemistry in the lake reflects concentration increases due to evaporation; in contrast, DOC concentrations for the same periods decreases due to biological consumption and/or photochemical oxidation. Results from ESI-MS analysis suggests these periods each reflect very different DOC compositions and thus sources.

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Ibes, D. C.¹, K. L. Larson^{1,2}, and E. A. Wentz¹. ***Human Ecological Concern about Resource Consumption at the Neighborhood-Level: Perceived Versus Actual Water Scarcity Risks in Phoenix, Arizona***

Disconnects between people's thoughts and actions have implications for mitigating environmental risks and associated losses. Understanding those discrepancies is a key concern among risk perception scholars and environmental social scientists. The identification of areas with high water demand and low concern about water scarcity, for example, represent areas that could be targeted for conservation or further research. In this presentation, we explore the following question in the study area of Phoenix, Arizona: How do residents' concerns about water consumption correspond to actual residential water demand in neighborhoods? We focus on the neighborhood-level due to the "hyperopia effect," which is the tendency for people to exhibit diminished concern about risks at the local scale of human-environment interactions as compared to broader geographic scales. This effect is important because it may lead to a reduced sense of personal efficacy and responsibility for mitigating water scarcity. Water use data for the Phoenix area are combined with household survey data (n=808) capturing concern about water use. Respondents represent varied socioeconomic conditions from 40 representative neighborhoods. Utilizing multiple analytical methods, we mapped the spatial patterns of matches and mismatches in perceived versus actual water scarcity measures using GIS and statistical analysis of neighborhood attributes. In this poster, we present findings on the locations of low and high concern about water use relative to demand and associated determinants, such as urban structure and the cultural world views of residents in a rapidly growing desert metropolis of the Southwest.

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Larson, E. K.¹, and N. B. Grimm^{1,2}. ***Nitrogen Gas Emissions from Stormwater Retention Basins During Wet Weather Events in the Phoenix Metropolitan Area: an Additional Ecosystem Service?***

Retention basins are a common approach to managing excess stormwater, and are required by law for developments of a certain size and density. All of the runoff from a given area is directed into a recessed area where the water can then infiltrate into the soil or evaporate. Many studies have shown that stormwater often has high concentrations of nitrogen (N) compounds, but few studies, especially in arid environments, have investigated the impacts of these additions on soil microbial processes. If the N is transformed into gaseous end-products, it will be removed from the urban ecosystem, and thus the basins would be providing an ecosystem service. Otherwise the N may eventually be transported into groundwater. We applied the stable isotope ¹⁵N to two types of stormwater retention basins, grassy and xeriscaped, in order to assess N₂ and N₂O emissions after wetting. The use of the isotope enables tracking the nitrogen as it is transformed by microorganisms into various compounds, some of which are more serious pollutants than others.

Stormwater retention basins are a natural unit for management and planning, thus this research has a broader impact beyond contributing to ecological theory of urban systems. Insights from this work will create a direct benefit to society: planners, engineers, and managers will better understand how basin design influences the ability of the soils to improve water quality and reduce potential greenhouse gas emissions. Sufficient knowledge of ecological processes of and within cities is necessary for the future sustainability of urban socioecological systems.

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Lerman, S. B.¹, and P. S. Warren². ***Birds, Habitat, and Socioeconomic Factors: Exploring the Relationships in a Residential Landscape***

Managing residential landscapes for native birds and other wildlife could potentially reduce the negative impacts of urbanization on biodiversity. Residential landscape design in Phoenix, Arizona, is dominated by mesic (turf, water-dependent plants), and xeric (gravel, drought-tolerant plants) yards. These landscapes vary in design, vegetation composition and configuration. Birds demonstrate a strong association with their habitat, and based on previous urban bird studies, we know native birds have a greater association with native plantings. However, in urban landscapes, humans modify plant conditions and in essence, have created entirely novel plant communities. Therefore, to fully understand how birds respond to residential landscapes, we must also integrate socioeconomic factors driving the bird habitat in urban settings. We explored the relationship between socioeconomic factors, habitat characteristics, and bird distribution at 39 of the PASS bird monitoring locations at CAP LTER. Preliminary results suggest Hispanic neighborhoods are dominated by mesic designs while neighborhoods with high owner occupancy are dominated by xeric designs. We applied Redundancy Analysis to display socioeconomic and habitat characteristics with the bird community, and found that native bird species demonstrated statistically significant and strong associations with drought-tolerant trees and shrubs in higher income neighborhoods, while

generalist species demonstrated strong associations with water-dependent trees. Incorporating socioeconomic factors with urban bird studies will provide necessary information for urban planners who aim to create residential landscapes desirable for both birds and people.

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Litteral, J.¹, and J. Wu^{1, 2}. ***Effects of Urbanization on Avian Species Diversity in the Phoenix Metropolitan Area: Patterns in Vegetation Fragments***

Habitat loss and fragmentation are the primary cause of the deterioration of biodiversity. Urbanization is an important driver of these habitat changes that profoundly affect plants, animals, and ecosystem processes. Birds are ideal study organisms for estimating the effects of urbanization on species diversity. If habitat loss and fragmentation are limiting the avifauna community, it is likely that less mobile organisms are being affected as well. We used a stratified random sampling approach to assess the species richness of passerines in fifteen native vegetation remnants in the Phoenix metropolitan area. Community composition in each fragment was studied using the analysis of nestedness. Area and isolation were significantly correlated to the nested rank order of communities, indicating that both differential extinction and differential colonization of species were responsible for the non-random nested structure of the meta-community in this region. To further explore the influence of the urban matrix on differential colonization, the overall richness of bird species, the richness of specific feeding and nesting guilds, the richness of migratory and non-migratory groups, and the richness of synanthropic and non-synanthropic groups were regressed against land use pattern surrounding each fragment at multiple scales. Our results showed that land use pattern was more strongly correlated with synanthropic, non-synanthropic, migratory, non-migratory, insectivorous, nectivorous, and ground nesting subsets of the community than the overall species richness itself. Used together, analysis of nestedness and regression of land use variables, shed important light on the effects of urbanization in the Phoenix metropolitan region.

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Lund, T. J.¹, E. Shock^{1,2}, and P. Prapaipong¹. ***Geochemical Dynamics of a Spring-Fed Stream in an Arid Climate***

Bonita Creek, a spring-fed stream north of Payson, AZ, was studied to determine the geochemical dynamics of a minimally managed (i.e., minimal diversion of waters) stream in the arid southwestern U.S. The creek emerges from rock strata along the cliff face of the Mogollon Rim, flows for ~2.5 miles above ground, then re-infiltrates, presumably to emerge in the Verde river watershed, a major drinking water source for the Phoenix metro area. We installed an ISCO autosampler to sample the creek and provide a high-frequency database and timeline of geochemical conditions. When coupled with meteorological data collected from several local USGS, AZMET and residential weather stations, precipitation-dependent, geochem-

ical perturbations are clearly visible. Our preliminary results show that conductivity increases dramatically from the end of the winter rain and snow season (~mid-to-late February-ish) and reaches near-steady-state conditions by mid-August. Major ion concentrations as well as uranium and arsenic correlate strongly with the observed conductivity trend. Several other elements, including copper, iron and vanadium exhibit a downward concentration trend which appears anti-correlative with conductivity. During and immediately after rain events, calcium and magnesium concentrations spike downward by as much as 25% before returning to normal within 24 hours of the event. Conversely, potassium concentrations increase by a factor of 2 before returning to pre-rain concentrations.

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Marusenko, Y.¹, P. Herkes², and S. Hall¹. ***The Fate of Combustion-Derived Carbon Deposition in Urban Soil***

Urbanization has led to an increase of combustion-derived, organic carbon emissions that can deposit diffusely to soils within and surrounding our cities. One of the most common types of urban pollutants, Polycyclic Aromatic Hydrocarbons (PAHs), may be toxic and are detrimental to environmental quality. Despite this concern, there is a considerable gap in our knowledge about the health consequences, distribution, or environmental fate of PAHs in highly populated urban areas. Soil microorganisms utilize organic compounds as a resource, and they are known to degrade petroleum-based point source pollution in contaminated soil. However, little is known about their capacity to degrade diffuse carbon pollution deposited from the atmosphere. First, we are asking the question, what is the magnitude, distribution, and fate of non-point carbon pollution in an urban area? Also, can urban soil microorganisms metabolize combustion-derived organic compounds in urban soils and are they better adapted degraders compared to microbes away from the city? To accomplish our research goals, we will characterize PAHs and other anthropogenic compounds near roadway soils across the Phoenix valley, explore the abiotic and biotic fate of PAHs in soils, and assess the importance of microbial community structure in PAH dynamics. Preliminary data suggest that PAH concentrations in arid Phoenix soils are nearly an order of magnitude lower than expected based on data from other cities. We are currently exploring if road properties and soil conditions may be correlated with PAH concentrations, and if our soils have unique microbes that have the ability to degrade these compounds.

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McHale, M. R.¹, L. R. Baker², B. A. Koerner³, and N. B. Grimm¹. ***Developing Carbon Budgets for Cities: Phoenix Metropolitan Region as a Case Study***

Studies have shown that cities can alter regional carbon dynamics through changing ecosystem productivity, overall carbon cycling rate, and total carbon storage in vegetation and soils. Furthermore, people in urban regions import a large

amount of carbon in food and fuel, releasing most of this carbon into the atmosphere as CO₂. Numerous studies have attempted to quantify sources and sinks of carbon in urban areas, although a complete carbon budget for a city that accounts for total inputs, outputs, and storage within the ecosystem has yet to be fully accomplished. One challenge is to acquire the data necessary to accurately account for all carbon dynamics in these heterogeneous and complex ecosystems. Our goal was to estimate a budget for the Phoenix metropolitan area while developing a methodology for carbon budgeting in urban systems that can be applied to cities across the US. Only with comparable carbon budgets for multiple cities will we achieve understanding of the influence of urbanization on carbon dynamics. Our analysis shows when calculating certain variables like transportation emissions, results can vary up to 250% depending on the data source and methodology implemented (i.e., bottom-up vs. top-down). A common assumption is that productivity and carbon storage will increase with urbanization in arid systems due to water and nutrient inputs, as well as changes in vegetation structure; however, our results indicated that this may not apply to Phoenix, where residents design landscapes to conserve water. Even if all urban expansion was dedicated to landscapes designed for carbon sequestration and storage, vegetation and soils are unlikely to have a large effect on the carbon budget without significant changes in transportation and lifestyle choices.

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Mercer, C., and K. Larson. ***Public Perceptions of Drought and Support for Changes in Water Pricing and Use***

As the world becomes increasingly urban, drought studies must move from the farms to the city. This research examines public awareness of the ongoing drought in the Phoenix metropolitan area as a determinant of support for changes in water pricing and use. The way urban dwellers prepare for and respond to drought will determine the impacts on their lifestyles and livelihoods. The decision to prepare and respond is dependent on the recognition of the existence of the drought and its potential and realized impacts, but the urbanite's experience of water shortage is mediated through a managed system designed to provide reliable water regardless of climatic conditions. Because awareness of a hazard can trigger adaptation and adjustment, understanding the public's perception of drought and how that perception affects support for changes in water policy is important for water resource management. Preliminary research using the 2006 Phoenix Area Social Survey shows that support is slightly higher for new policies designed to reduce future water shortages when the respondent believes the area is in drought. Additionally, concern about the potential impact of drought and belief in the contribution of long-term drought to future water shortages correlate with increased policy support. Support for increasing the price of water is the only exception, and support for this policy change is lacking overall.

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Muñoz-Erickson, T. A. ***A Process for Science-Society Interactions to Develop an Urban Long Term Research Area (ULTRA) Site in San Juan City, Puerto Rico***

This poster presents initial efforts in the development of an Urban Long-Term Research Area (ULTRA) site with the U.S. Forest Service in San Juan, Puerto Rico. A key goal for this urban ecology proposal is to develop useful and relevant knowledge through an interdisciplinary and collaborative process with local stakeholders. To meet these goals, I designed an iterative process to assess local research priorities and initiate long term interactions with stakeholders. First, I reviewed and synthesized numerous scientific, policy and media documents to identify socio-ecological issues that the city faces. I then consulted with key stakeholders, including university researchers, governmental and civic society groups through interviews and surveys to inform problem definition and knowledge needs, as well as explore the plurality of perspectives and approaches to urban environmental issues in San Juan. A field trip through the main watershed of the city facilitated discursive interactions among natural and social scientists, and among scientists and community leaders. An interdisciplinary workshop followed to define research priorities and frame research questions based on the knowledge gathered through this preliminary assessment. This poster presents outcomes of these efforts and next steps in the development of this long term collaborative research proposal.

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Musheno, B.¹, and M. Elser². ***Ecology Explorers: K-12 Student Contributions to the CAP LTER Project***

Students from across the Phoenix metropolitan area have been involved in collecting population data in their schoolyards. Students from Birgit Musheno's high school biology class at Desert Vista collected and analyzed backyard bird data in spring '08. The top four posters from the class will be presented.

Dominic Chen and Connor McGee. *How Does Viewing Location Affect Bird Diversity?*
Christine Simmons, Autumn Tullock, and Anna Gunderson. *Do Different Environments Affect the Diversity of Bird Species?*

Margaret Nelson and Ashley Bennett. *Does the Surrounding Area of a Specific Location Alter the Number of Birds in the Selected Location?*

Jay Ryan and Jon Yamaguchi. *How Does the Vegetation of a Yard Affect the Quantity and Diversity of Birds That Pass Through It?*

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Ontiveros-Valencia, A., and J. C. Stutz. ***Arbuscular Mycorrhizal Fungal and Dark Septate Endophytes Colonization of Plant Roots from Urban Desert Preserves and Surrounding Deserts***

Arbuscular mycorrhizal fungi (AMF) form symbiotic relationships with plant roots and are of great importance in ecosystem health and functionality. Dark septate endophytes (DSE) constitute a root-colonizing fungi with a not yet determined eco-

logical role. This research evaluated AMF and DSE colonization in roots of woody plants and cacti/succulents found at two urban desert preserves and compared the colonization in similar plants from two sites located in the Sonoran Desert surrounding Phoenix, Arizona. Total colonization was highest in roots from one surrounding desert site (McDowell Mountain) and lowest from one urban preserve site (South Mountain Park), with similar levels found at the other two sites. Total AMF colonization was greater in woody plants in comparison to succulent plants except for South Mountain Park which had similar low levels of colonization. DSE were detected in all woody and succulent plants, but were at higher levels in roots of succulent plants at three sites. Our findings suggest that AMF colonization may be related with others factors besides site location. DSE colonization occurred in both woody and succulent desert plants suggesting that DSE may have an implied ecological role in arid ecosystems.

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Prashad, L., P. Christensen, S. Anwar, E. Engle, and S. Dickenshied. ***JEarth - Analytical Imagery Application for Practitioners and Researchers***

The 100 Cities Project is developing "JEarth", a set of analytical tools for viewing and processing Earth-based imagery including ASTER, Landsat, MODIS, and TIMS. We are building on the existing ASU/NASA tools for Mars, utilizing THEMIS imagery, including an adaption of THMPROC (<http://themis.asu.edu/thmproc>), a web-based, interactive tool for processing imagery (band combinations, destripe, dcs, and other remote-sensing processing), a Java application for spectral analysis of imagery, an adaptation of JMars (<http://jmars.asu.edu/>), and also a basic Google Earth/maps GIS application for both basic and advanced users to view imagery alongside vectors. We plan to produce a version of this application for the NSF Long-Term Ecological Research projects with these features:

- Incorporation of CAP LTER data
 - Connect to other LTER databases (BES LTER, CAS Urban LTER)
 - Portal where connected researchers and practitioners could upload their mappable data and have it shown on the map immediately
 - Connection to field campaigns with students (university or K-12) and have their measurements show up on the map immediately via a web form or through text messaging
 - Allow users to download the data they are interested in for desktop GIS analysis by querying the map and saving the results of the query as a GIS file
 - ASTER, Landsat, MODIS and other satellite imagery integration: ability to identify and query imagery information – such as vegetation, surface temperature, or albedo values
 - Integration with Mars Facility JMars system to display large data volumes quickly
- School of Earth and Space Exploration, Arizona State University, PO Box 871404, Tempe AZ 85287-1404



Ruddell, D. M.¹, S. L. Harlan², and S. Grossman-Clarke³. ***Assessing Exposure and Experience with Extreme Heat in Phoenix, AZ***

As rapid urbanization continues, the impacts of temperature extremes on human health and comfort in cities are also expected to increase as threshold temperatures of human tolerance are crossed more frequently and for longer periods of time. Scientific assessments of global climate change anticipate longer lasting, more intense, and more frequent heat waves over the next century. Heat islands created by development are increasing urban temperatures compared to surrounding rural areas. Aside from heat-related mortality studies, however, there is a lack of research examining the full range of human exposure and experience with extreme heat within the urban environment. This study combined modeling output on temperature variability for the summer of 2005 throughout the Phoenix metropolitan area with US Census data and two questions from the 2006 Phoenix Area Social Survey (PASS) regarding respondents' perceptions of heat and self-reported symptoms of heat stress. Employing the mesoscale Weather Research and Forecast (WRF) climate model to simulate local temperature variability throughout the region, analyses compared residents' perceptions of heat to scientifically-derived environmental conditions for selected heat events among forty diverse metropolitan neighborhoods. Research findings indicated: 1) exposure to extreme heat was variably distributed among people and places throughout the Phoenix metropolitan area; 2) residents' perceptions of temperature and self-reported experiences with heat-related illnesses were related to environmental conditions; and 3) the highest risk of exposure to extreme heat was among elderly, minorities, and low-income residents.

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Sampson, D. A., and P. Gober. ***The Central Arizona Water-Energy Nexus: Estimates of Energy Used to Transport CAP Water Modeled Using WaterSim 3.4_DCDC***

We modified a Decision Center for a Desert City (DCDC) version of the WaterSim water policy model to incorporate an energy component into our water modeling activities. Our objective was to evaluate the energy requirements for water transport into central Arizona along the Central Arizona Project (CAP) aqueduct. In conjunction we also examined energy expended on groundwater pumping. We modified WaterSim_3.0_alpha* – adapted by Mike Tschudi but written, in large part, by Tim Lant – to incorporate generic power equations (i.e., Hazen Williams). Our goal was to estimate the horsepower requirements for each of the five pumping stations along the CAP aqueduct between Lake Havasu and the CAP Interconnect (including water pumped into Lake Waddell and energy generated from water released). Aqueduct energy requirements for each pumping plant were parameterized using measured CAP flow metering and power metering data (Brian Henning, personal communication). We examined a base scenario and climate-induced reductions in CAP and Salt River Project (SRP) deliveries over a 25-year model projection simulation. Base simulations (using 1970 as an index year) for one year

indicate that moving 1.488 million acre feet (maf) from Havasu to the interconnect at Granite Reef required 2,374,576 Megawatt hours (MWh) of electricity. The difference between CAP delivery (for 2006) combined with the Salt River Project (SRP) release for 2006 and water demand as estimated by the model, resulted in an additional 204,191 MWh for groundwater pumping. We present the 25-year projections for base and climate change scenarios.

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Senneville, C. ***Institutions, Linking Knowledge with Action, and Sustainability: A Case Study of the Arizona Water Institute***

In its exploratory stage, this project is a study of the institutional role negotiating the relationships among knowledge and actions, for sustainability-oriented decisionmaking. Broadly, it relates to literature that investigates the ways in which science, diverse perspectives and training, and differentials of power and access affect policy. In this vein, the project analyzes the qualities of institutions devoted to facilitating communication, knowledge-sharing and collaboration, and supporting conditions for mutual understanding among actors and stakeholders of a particular problem context. It focuses on the Arizona Water Institute (AWI), which is an example of an organization that functions to support interaction among communities involved primarily in knowledge and information (e.g., university scientists), and communities involved in “action” (e.g., practitioners). It develops an evaluative framework, comprised of criteria based upon characteristics of sustainability and democracy, and attempts to operationalize what it means to “effectively” manage the interests and jurisdictions of these different communities (specifically involved in the governance of Arizona’s water). Research involves developing a deep understanding of AWI: what it sees its role as and how it is addressing and engaging with stakeholder needs – particularly the proposal review process, its allocation of funding, and “lessons learned” from completed collaborative projects. Further, this research examines AWI’s actions, processes, and outcomes relative to its stated objectives, identified stakeholder needs, and expectations. The evaluative framework is a working analytical device, which will frame document review, semi-structured interviews, online questionnaire, and focus groups, as well as the ultimate assessment of AWI’s capacity at the knowledge-action nexus.

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Shipp, J.¹, H. Hartnett^{1,2}, K. Lui¹, and H. Waterman³. ***Temporal Trends in Dissolved Metal Concentrations in Tempe Town Lake***

Tempe Town Lake represents a system where river water is taken from its natural flow, to become a man-made lake through the use of inflatable dams. This unique setup models larger river-reservoir systems and allows us to study management affects on a small, local scale. In January, 2008 the dams were released, enabling the Salt River to once again flow through Tempe. The dams were restored a month later, essentially isolating a plug of river water and refreshing the lake. By

comparing metal concentrations from before the dam release, during the river flow period, and after the dams were raised, we can evaluate the processes that affect metal concentrations as the river becomes a lake and evaluate the potential a reservoir may have to be a source or sink for certain metals.

We measured the concentrations of 35 dissolved elements using HR-ICPMS and major ions by ion chromatography on samples collected from September 2007 through May 2008. Daily sampling occurred during the period when the dams were down. Twelve of the 35 metals were river sourced, with increased concentrations during the flow event. Nineteen metals had reduced concentrations during high flow, and the remaining metals had no significant concentration variation throughout the sampling period. To understand why metals have different behavior we focused on the processes that affect metal concentrations: evaporation, adsorption/desorption, urban runoff, and biological activity. Trends and patterns among these metals, major ions, suspended sediment, and rain events, are examined to elucidate these processes.

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Sister, C.¹, C. Boone², J. Golden³, D. Hartz⁴, and W-C. Chuang³. ***Spatial Analysis of Crime and Socio-economic Variables as Indicators for Heat-Health Vulnerability in Chicago, Illinois***

In the face of global climate change, there is increased likelihood of extreme weather events, and in turn, greater risk to disasters. Emphasizing that disasters result from the impact of hazards on vulnerable people and that vulnerability varies differentially across a population the present study seeks to examine the socio-economic factors that may render specific groups vulnerable to extreme heat events. In particular, we focus on heat morbidity incidents in the City of Chicago across a five-year period (i.e., from 2003 to 2007), and examined these relative to the spatial patterns of socio-economic characteristics across the City. Results of our analyses show that in Chicago, the highest number of heat incidents occurred in areas characterized as recreational, commercial, and tourist destinations. Additionally, areas with higher incidence of heat morbidity tended to be places with high crime incidents. The rest of the variables examined, however, correlated only to a lesser degree with heat incidents. On the other hand, when we pulled out specific sub-areas, the ability of different combinations of variables to predict heat morbidity improved. These results suggest that across the City of Chicago, there is no one set of variables that can predict morbidity to heat. Given the particularity of places within the City, developing mitigation and adaptation strategies for extreme heat events for the City is especially rife with challenges. The implications of the results in relation to the broader social process in the City are discussed.

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Strawhacker, C.¹, E. M. Cook², K. L. Larson^{3,4}, and S. J. Hall². ***Landscape Preferences and Yard Management: the Effects of Homeowners' Values on Residential Landscapes***

Residential landscapes, such as household lawns and gardens, are an important part of the urban ecosystem. Grass lawns are the largest irrigated crop in the U.S., contributing to high rates of water and fertilizer use in cities. Human management of landscapes is a primary cause of global environmental change and the choices residents make in their yard maintenance can drastically impact the urban ecosystem. We know little, however, about what influences peoples' choices for particular landscape types, such as mesic (high water-use grass lawns) and xeric (low water-use plantings with crushed rock) yards, and choices about management practices for their yards.

Our research examines how the complex interactions of social factors, including homeowners' personal priorities, environmental perceptions and values, and institutional forces, drive both residents' landscaping preferences and their actual landscaping choices or decisions. We focus on the human drivers encompassing individual-level cognition (specifically, residents' values) and social-structural factors (household characteristics and institutions) in order to address the question: *To what degree do world view and environmental values relate to residents' expressed landscape preferences as well as the actual structure of yards at the individual household and neighborhood scales?* Our analyses integrate results from a social survey and an observational ecological field survey conducted at the household scale in four distinct neighborhoods in Phoenix, Arizona. Linking individual homeowners' values and preferences to their yard structure, the results of this study will provide further insight into the decision-making process of homeowners concerning their residential landscape.

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Sweat, K. G.¹, T. H. Nash III¹, P. Prapaipong², and P. T. Gremillion³. ***Geographic Patterns and Temporal Trends of Trace Metal Deposition Using the Lichen Xanthoparmelia in Maricopa County, Arizona, USA***

The epilithic lichen *Xanthoparmelia* spp. was used to assess atmospheric deposition of trace elements for Maricopa County, located in central Arizona, USA. The study area consisted of 27 locations in Maricopa County corresponding to a previous study (Zschau et al. 2003) along with new locations added to increase spatial resolution. Long-term temporal trends were assessed using additional lichens collected from the region in 1970-1973, focusing on decreases in Cu (copper) and Pb (lead) from the closing of copper smelters and the phase out of leaded gasoline and increases in Zn (zinc). Comparisons were also made to lichens collected from rural areas in and around Grand Canyon Park, Arizona, and analyzed with the same techniques. Lichens were analyzed by both cold vapor technique for mercury (Hg) and wet digested in a high pressure microwave oven and analyzed by high resolution ICP-MS for a suite of trace elemental concentrations. Initial research suggests higher levels of almost all metals (anthropogenic and geologic) in Maricopa

County. However, the highest locations for mercury were found in the northern areas, inside of the Navajo Nation. Initial multivariate analysis also suggests that lead in Maricopa County is now mainly from geologic sources, not anthropogenic as was concluded in the earlier work by Zschau et al (2003).

Zschau, T., S. Getty, C. Gries, Y. Ameron, A. Zambrano, and T.H. Nash III. 2003. Historical and current atmospheric deposition to the epilithic lichen *Xanthoparmelia* in Maricopa County, Arizona. *Environmental Pollution* 125: 21-30.

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Turner, V. K. ***The Impact of Semi-Private Social Institutions on Residential Landscape Form and Ecological Structure in Phoenix, Arizona***

A majority of new homes on the urban fringe of US metropolitan areas are managed by legal entities called homeowner associations (HOAs). HOAs exercise authority by virtue of their covenants, codes, and restrictions (CC&Rs), and increasingly these CC&Rs regulate the nature of residential landscapes in American cities. On the one hand, HOAs have been framed as an efficient and innovative response to both the developer's desire to efficiently sell a community of homes to the consumer's demand for amenities. On the other, they have been criticized as segregating entities that insulate residents from social-ills and economic stressors felt by populations living outside their bounds. Past research has examined the role of HOAs in social control and urban governance, but little attention has been paid to the effects of their regulations on residential landscape ecology.

Although little is known about the range of landscape packages and management options available to homeowners, their potential impact on landscape form, and therefore function, is potentially great. In addition to regulating architectural characteristics, CC&Rs specify the types of plants allowed and whether they receive water or chemical inputs. Residential yards can be conceptualized as managed landscapes with characteristics similar to agricultural lands. A sampling of CC&Rs from the Phoenix metropolitan area was gathered and coded for regulations relating to landscape form and function in order to determine the ways in which HOAs govern the ecological structure and management of residential landscapes. This information was then used to address the potential consequences of HOA management practices on urban residential landscape form and function.

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Wutich, A.¹, B. Crona², M. Seetharam³, P. Gober^{3,4}, P. Westerhoff⁵, Z. Hasan¹, and S. Avent¹. ***Ethnohydrology: A Mixed Method Study of Local Water Knowledge***

The Phoenix Ethnohydrology Study is a follow-up study to the Phoenix Area Social Survey II (PASS II), a 40-neighborhood survey conducted in greater Phoenix in the summer of 2006. Based on respondents' assessment of water quality in their neighborhood in PASS II, we selected a sub-sample of four neighborhoods for

additional in-depth study. The goal of the research, which was conducted in 2007-2008, was to assess the public's perception of water quality using innovative methods for understanding local ecological knowledge (LEK). We present preliminary results of research conducted using two methods: successive free listing and cultural consensus analysis.

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Zhang, S.¹, A. M. York², and C. G. Boone^{1,2}. ***Monitoring Landscape Fragmentation with Rapid Urbanization in the Central Arizona – Phoenix Region***

Urban sprawl and “leapfrog” development patterns increasingly fragment natural areas in the United States. Previous studies have shown that landscape fragmentation has important consequences on ecosystems and social implications. To gain a better understanding of the process of fragmentation, we are investigating the spatial and temporal pattern of fragmentation in the Phoenix metropolitan area. Methodologically, we test six selected fragmentation metrics (density, shape, contrast, contagion, interspersion and diversity metrics) across 12 valley city jurisdictions. Additionally, we use ArcGIS to conduct a fragmentation gradient analysis for 60 km from Phoenix urban center. The fragmentation of specific classes (including lower, middle and higher density residential area) is explored separately to reveal its relationship with different development styles. Data used in this research are from National Land Cover Dataset (NLCD) 1992 and 2001 derived from Landsat TM images. Initial results indicate that there is an obvious increase of fragmentation from 1992 to 2001 and the most rapid fragmentation area is located at around 40 km from the urban center. Comparing the 12 cities indicates that fragmentation phenomenon is not only related to land cover change, but also the distance to the urban center, and the development pattern – e.g., Fountain Hills and Chandler are both the cities with huge land cover change under urbanization, however, Fountain Hills changed more fragmented while Chandler did not. These study results should be linked with major drivers of fragmentation including land use policies, population density, and water availability for a cross-site comparative study in the future.

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Zhuo, X.¹, P. Prapaipong², and E. Shock^{1,2}. ***Isotope Studies for the Sources of Urban Pb in the Soil of Maricopa County***

Soil is one of the largest recipients of urban pollutants in the environment. Our preliminary study of Pb (lead) distribution in the soil of Maricopa County has exhibited strong urban influences on the hot spots of high Pb concentration. Eighty soil samples randomly selected from the 200-point survey were analyzed for Pb isotopic compositions with Inductively Coupled Plasma Mass Spectrometry. The

result shows that desert samples have large variations in isotope ratios (0.70 to 0.90 for $^{207}\text{Pb} / ^{206}\text{Pb}$, and 1.80 to 2.15 for $^{208}\text{Pb} / ^{206}\text{Pb}$) with a small concentration range (10 to 30 ppm), while urban samples have small variations in isotope ratios (0.80 to 0.85 for $^{207}\text{Pb} / ^{206}\text{Pb}$, and 2.00 to 2.10 for $^{208}\text{Pb} / ^{206}\text{Pb}$) but a big concentration range (10 to 200 ppm). The isotopic pattern for desert samples is similar to published bedrock minerals in Arizona. Our hypothesis is that urban Pb is from a single unknown source, because the isotopic composition is so tightly constrained. We are analyzing samples of roadside and railroad soil profiles to test if this urban input is from historical leaded gasoline, burning of coal, or other sources.

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