CAP LTER Central Arizona-Phoenix Long-Term Ecological Research

Tenth Annual Poster Symposium

Carson Ballroom, Old Main, Arizona State University
January 10, 2008

LTER

Global Institute of Sustainability
Arizona State University

NSF

Moving Forward: 10 Years of Socioecological Research in Central Arizona-Phoenix

CAP LTER Tenth Annual Poster Symposium
January 10, 2008, 8:00 am-4:10 pm
Carson Ballroom, Old Main

8:00 am **Continental Breakfast**

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

8:40 am **Introduction of Keynote Speaker**

8:45 am **Complexity, Resilience, and Uncertainty in Urban Ecosystems: Linking Observations, Models, and Scenarios**
Marina Alberti, *Associate Professor of Urban and Environmental Planning, Department of Urban Design and Planning, University of Washington*

9:45 am **Coffee Break**

10:00 am **Roundtable Discussion: Exploring Research Collaboration and Knowledge Exchange**
Moderator: Jim Holway, *Associate Director, Global Institute of Sustainability; Professor of Practice, Civil and Environmental Engineering, Ira A. Fulton School of Engineering*

11:45 am **Lunch**

12:45 pm **Integrative Project Area Mini-Workshops**

2:00 pm **Poster Session #1**
Coffee, tea, and refreshments

3:10 pm **Poster Session #2**
Coffee, tea, and refreshments

4:10 pm **Adjourn**

Keynote Speaker - Marina Alberti

Marina Alberti is Associate Professor of Urban and Environmental Planning in the Department of Urban Design and Planning at the University of Washington. She directs the Interdisciplinary Ph.D. Program in Urban Design and Planning and the Urban Ecology Research Laboratory. Her teaching and research are in urban ecology, particularly the impacts of alternative urban development patterns on ecosystem dynamics. She is the Principal Investigator on a number of research projects including an NSF grant for the Biocomplexity Program aiming to develop a simulation model that integrates urban development and ecological dynamics. As Part of the Puget Sound Nearshore Partnership project, she is currently leading an effort to develop future scenarios for the Puget Sound for 2050. Recently, she was awarded a new Biocomplexity Grant to study the emergent properties of urban landscapes in Seattle, WA and Phoenix, AZ. In her new book *Advances in Urban Ecology: Integrating Humans and Ecological Processes in Urban Ecosystems* (Springer 2008), Alberti articulates the need for a new synthesis between human and ecological research approaches to study urban ecosystems and their complex dynamics.

2008 CAP LTER Symposium

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

Poster Session #1	Poster Session #2
Ahmed et al. (21)	Aguilar et al. (54)
Bang et al. (43)	Avent et al. (34)
Buyantuyev et al. (5)	Balling et al. (22)
Cutts et al. (23)	Bachi and Rosenzweig (46)
Choi et al. (13)	Busse and Martin (4)
Darby et al. (35)	Cook et al. (14)
Davies and Hall (1)	Elder et al. (6)
Gartin et al. (25)	Escobar (24)
Gonzales et al. (15)	Gustafson et al. (36)
Hartnett et al. (17)	Hale et al. (16)
Hartz et al. (7)	Howard et al. (26)
Johnson et al. (49)	Clemens et al. (38)
Judkins (37)	Kiggins and Ingram (12)
Kapoor and Kinzig (51)	Kimmel-Guy (8)
Larson and Perrings (39)	Kitchen and Johnson (50)
Lee et al. (29)	Lee and Wentz (28)
Lerman and Warren (45)	Litteral et al. (48)
Musheno and Elser (57)	Martin and Busse (10)
Martin (9)	Marusenko and Hall (18)
Mensing and Brazel (11)	Muñoz-Erickson et al. (40)
Nguyen et al. (55)	Ruddell et al. (2)
Schaasfma et al. (3)	Senneville et al. (30)
Seetharam et al. (27)	Stutz (52)
Sister and Boone (41)	Subramanya et al. (56)

Poster Session #1	Poster Session #2
Stutz et al. (53)	Taylor-Taft and Faeth (44)
Sweat et al. (19)	Yabiku et al. (42)
Tschudi (31)	Zautner et al. (32)
Turner (33)	Zhuo et al. (20)
Warren et al. (47)	

LIST OF POSTERS

LAND-USE AND LAND-COVER CHANGES

The Comparative Ecology of Xeriscaped, Our Domesticated Deserts
Rachel C. Davies and Sharon J. Hall

Public Park Ecology and Neighborhood Crime: Assessing Resident Perceptions of Crime and Park Quality
Darren M. Ruddell, Sharon L. Harlan, Genevieve Luikart, and Susannah Lerman

Ancient Agriculture of the Perry Mesa Tradition in Central Arizona: Interpreting Ancient Land-use and Modern Landscapes
Hoski Schaafsma, Melissa Kruse, Will Russel, John Briggs, Kate Spielmann, and Sharon Hall

CLIMATE-ECOSYSTEMS INTERACTIONS

Characterization of Microclimates in North Desert Village Sites
Kendra D. Busse and Chris A. Martin

Effects of Land Cover Transformations on Surface Microclimate along an Urban-Rural Gradient in Phoenix
Alex Buyantuyev, Jianguo Wu, and Yun Ouyang

How Evapotranspiration Varies Across Urban Neighborhoods – Application of LUMPS Model
J. Elder, Susanne Grossman-Clarke, Anthony Brazel, H. Butler, and Chris Martin

Heat-Related Morbidity in Metropolitan Phoenix, Arizona (2001-2006)
Donna A. Hartz, Jay Golden, and Anthony J.Brazel

Mapping Vulnerability to Heat Stress in the Valley of the Sun
Alethea Kimmel-Guy

Annual Patterns of Thermodynamics and Surface Temperatures at the North Desert Village
Chris Martin

Effect of Landscape Design and Irrigation on Summertime Gas Exchange of Landscape Trees, Shrubs, and Herbs
Chris A. Martin and Kendra D. Busse

Rural to Urban Temperature Gradients: CAP LTER in Context of the Recent Trends in the Mojave and Sonora Desert Region
Hannah Mensing and Anthony Brazel

Prehistoric Population and Climate Variation in the Agua Fria Watershed of Arizona
Cara S. Kiggins and Scott Ingram

FLUXES OF MATERIALS AND SOCIO-ECOSYSTEM RESPONSE

Observing Extracellular Enzyme Activity (EEA) in the Sonoran Desert
Bony Ahmed, Ryan A. Sponseller, Nancy B. Grimm, and Sharon J. Hall

Comprehensive Water and Salt Flux Models for Urban Systems
Chi-Chi Choi, Paul Westerhoff, and John Crittenden

Residential Landscapes: Synthesis of the Literature and Preliminary Survey Results
Elizabeth M. Cook, Sharon J. Hall, and Kelli L. Larson

Atmospheric Dry Deposition of Gaseous and Particulate Nitrogen to Urban-Influenced Sonoran Desert Sites
Daniel A. Gonzales, Jonathan O. Allen, Ryan A. Sponseller, Sharon J. Hall, and Nancy B. Grimm

Aridland Urban Hydrology in Phoenix, AZ
Rebecca Hale, Nathan Toke, Nancy Grimm, and Ramon Arrowsmith

Biogeochemical Processes in Tempe Town Lake: Trends and Patterns in the Amount and Composition of Dissolved Organic Carbon
Hilairy Hartnett, Megan Kelly, Kathryn Mayer, and Hilary Waterman

Microbial Degradation of Non-point Hydrocarbon Pollution in Urban Soils
Yevgeniy Marusenko and Sharon Hall

Comparison of Trace Metal Deposition in Northern and Central Arizona
Ken C. Sweat, Thomas H. Nash III, Panjai Prapaipong, and Paul T. Gremillion

Factors that Contribute to Distribution Patterns of Trace Elements in Maricopa County
Xiaoding Zhuo, Panjai Prapaipong and Everett Shock

The Tucson Hummingbird Project: An Experimental Study of Community Ecology and Reconciliation on a City-Wide Scale (http://hummingbirds.arizona.edu)
Alona Bachi and Michael L. Rosenzweig

Variation in Arthropod Diversity, Guild Composition and Abundances along an Urban-Rural Gradient: Nine Years of CAP LTER Monitoring
Christofer Bang and Stanley H. Faeth

Urban Behavioral Ecology of the Western Black Widow (*Latrodectus hesperus*): From Solitary Desert Predator to Urban Pest
J. Chadwick Johnson, Claudia Ibeth Torres, Patricia Trubl, Ashley Gohr, and Melissa Rife

The Social and Ecological Construction of Protected Rainforests in Costa Rica's Osa Peninsula
Maya Kapoor and Ann Kinzig

The Effects of Relatedness, Age Differences, and Maternal Investment on Juvenile Cannibalism in the Black Widow Spider, *Latrodectus hesperus*
Kathryn A. Kitchen and J. Chadwick Johnson

Foraging Decisions, Bird Community Structure and Residential Landscapes: Finding the Links
Susannah B. Lerman and Paige S. Warren

Effects of Urbanization on Avian Species Richness in the Phoenix Metropolitan Area: Patterns in Vegetation Remnants
Jennifer E. Litteral and Jianguo Wu

Urban Tree Health in the Phoenix Metropolitan Area
Jean C. Stutz

Ground Arthropod Diversity at North Desert Village
Laura Taylor-Taft and Stanley Faeth

Do People Notice Birds?
Paige S. Warren, Susannah B. Lerman, and Sharon Harlan

Landscape Treatment and Residents' Satisfaction: Results from Wave 2 of the North Desert Village Social Survey
Scott Yabiku, David Casagrande, and Elizabeth Farley-Metzger

HUMAN DIMENSIONS OF ECOLOGICAL RESEARCH

An Environmental Justice Framework for Analyzing Obesigenic Environments: A GIS Analysis of Walkability, Park Access, and Neighborhood Demographics in Phoenix, Arizona
Kate J. Darby, Bethany B. Cutts, Christopher G. Boone, and Alexandra Brewis

An Assessment of Municipal Water Conservation Policy in Greater Phoenix, Arizona, 1980-2007
Annie Gustafson, Kelli Larson, Paul Hirt, and Lilah Zautner

Declining Cotton Cultivation in Maricopa County, Arizona: An Examination of Macro and Micro-Scale Driving Forces
Gabriel Judkins

Residential Water Use In Phoenix: Exploring Myths and Realities
Janet Clemens, Adam Greenwade, Annette Humm-Keen, Dave Keen, Paula Lucas, Adam Miller, Mary Lu Nunley, Ray Quay, Steve Rossi, Dale Vieregge

Valuing the Environment in Metropolitan Phoenix
Elisabeth K. Larson and Charles Perrings

Opportunities and Challenges to Linking Science and Policy in the Luquillo LTER: Preliminary Findings on Stakeholder Perspectives of Water Governance and Sustainability
Tischa A. Muñoz-Erickson, Kelli Larson, and Juan Declet

Park Access and Equity in Phoenix
Chona Sister and Christopher Boone

INFORMATION MANAGEMENT, OUTREACH, AND EDUCATION

Another Piece for the Metadata Management System at CAP
Raul Aguilar, Corinna Gries, and Inigo San Gil

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

AHIS Dataset Search Engine: An Intelligent Approach to EML Data Management
Hung V. Nguyen, Corinna Gries, and Hasan Davulcu

The Arizona Hydrologic Information System: Enhanced Data Accessibility Using Web Services
Shankara Subramanya, Corinna Gries, Kathy Jacobs, Wolf-Dieter Otte, Ramon Vazquez, Joe Abraham, Raul Aguilar, James McGill, and Huan Liu

New Informatic Model for Identifying Urban Plant Problems
Jean C. Stutz, Jordan Costello, Andrea Gerbasio, Corinna Gries, and Edward Gilbert

DECISION CENTER FOR A DESERT CITY

An Ethnohydrologic Evaluation of Water Quality in Phoenix, AZ
Stacy Avent, Amber Wutich, Beatrice Crona, Patricia Gober, Mohan Seetharam, and Paul Westerhoff

Sensitivity of Residential Water Consumption for the City of Phoenix, Arizona
Robert C. Balling, Jr., Patricia Gober, and Nancy Jones

Information Distribution Across Organizational Networks
Bethany B. Cutts, Allyn. K. Knox, and Nicholas R. Moore

A Scenario Based Assessment of Future Groundwater Resources in the Phoenix Active Management Area
Vanessa Escobar, Tim Lant, Jessica Block, Perry Miller, and Michael Tschudi

Focusing on Higher Quality Focus Groups
Meredith Gartin, Amber Wutich, Timothy Lant, Dave White, Kelli Larson, Susan Ledlow and Patricia Gober

Water Managers' Strategies for Addressing Uncertainty in Their Use of GIS for Decision-Making
Jason Howard, Kelli Larson, Dave White, and Elizabeth Wentz

Spatial Extrapolation Mapping Based on Aggregated Data: Countywide Extrapolation of Phoenix Water Use Data
Seung-Jae Lee and Elizabeth A. Wentz

Temporal Geographic Information System (TGIS) to Forecast Future Water Consumption in Phoenix, Arizona
Seung-Jae Lee, Elizabeth A. Wentz, and Patricia Gober

Water Resources, Climate Change and Institutional Vulnerability: A Case Study of Phoenix, Arizona
Mohan Seetharam, Bob Bolin, Brian Pompeii, and Patricia Gober

“Missed Opportunities” in Central Arizona Water Management: Reconciling the Local Supply of and Demand for Science
Clea Senneville, Kelli Larson, Amber Wutich, Tim Lant, Meredith Gartin, Dave White, Susan Ledlow, and Pat Gober

Using WaterSim for Education: A Work in Progress
Michael Tschudi

Pricing for Conservation: Response to Growth and Drought in Tucson and Phoenix
Victoria K. Turner

Water Vulnerability on the Urban Periphery: The Case of Metropolitan Phoenix, Arizona
Lilah Zautner, Kelli Larson, and Bob Bolin

ABSTRACTS

All abstracts are listed alphabetically by first author. Student posters are prefaced with an asterisk.

Another Piece for the Metadata Management System at CAP

Aguilar R.,[1] C. Gries[1], and I. San Gil[2]

CAP's metadata management system is being expanded to include the advantages offered by the latest technologies. An online editor and entry form for documents in the Ecological Metadata Language (EML) is being developed. Based entirely on XML, this smart editor offers auto-complete features from known choice lists, thesaurus automatic lookup, automatic save of typing, validation of metadata, and many other advance features that are already showing in popular web applications. A user management system allows for secure file access by individual users or groups. The editor accesses the EML files in a native XML database storing changes as the user enters them. The XML database is already being used to search for relevant datasets, display lists of datasets and the metadata in the CAP website, and access the actual data.

[1]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211
[2]LTER Network Office, Department of Biology, MSC03 2020 University of New Mexico, Albuquerque, NM 87111

*Observing Extracellular Enzyme Activity (EEA) in the Sonoran Desert

Ahmed, B.[1], R. A. Sponseller[2], N. B. Grimm[1], and S. J. Hall[1]

Decomposition of soil organic matter is a critical ecosystem process that recycles nutrients for plant sustenance and growth. Decomposition is carried out by microorganisms (bacteria and fungi) that exude extracellular enzymes into the soil environment to breakdown large, complex substances found in plants. Through this process, microorganisms are able to acquire macronutrients and carbohydrates for their own metabolism. Environmental conditions that lead to changes in soil pH, moisture, organic matter and nutrient availability, may lead to differential production of enzymes, as well as overall rates of extracellular enzyme activity (EEA). In the Phoenix metropolitan area, rapid urbanization has led to widespread land cover changes, as well as elevated rates of atmospheric N deposition. This research took advantage of these changes to ask how urbanization alters EEA in the Sonoran Desert. We predicted that EEA would differ between desert and residential land cover types and that elevated N deposition would increase activity of cellulose degrading enzymes while reducing activity of oxidative enzymes. Results of this study showed strong differences in EEA between residential and desert sites but not among deserts located inside versus outside the urban core. No strong significant change in EEA was observed in response to N fertilization of desert plots.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501
[2]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 83211, Tempe, AZ 85287-3211

***An Ethnohydrologic Evaluation of Water Quality in Phoenix, AZ**

Avent, S.[1], A. Wutich[1], B. Crona[2], P. Gober[2,3], M. Seetharam[3], and P. Westerhoff[4]

This research is being conducted as a joint project of the Central Arizona-Phoenix Long Term Ecological Research and Decision Center for a Desert City at Arizona State University (ASU), both National Science Foundation projects. This project is a follow-up to the Phoenix Area Social Survey II (PASS II), a 40-neighborhood survey conducted in greater Phoenix by ASU's Institute for Social Science Research in the summer of 2000. 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. Initial results from the PASS II study indicated that more than 40 percent of survey respondents were concerned about water supply, drinking water safety, accidental releases of industrial chemicals, and soil and groundwater contamination in Phoenix. Given the relatively high perception of water-related dangers, we intend to further investigate public perceptions of water quality and safety in Phoenix. The broad goal of this follow-up study is to assess the public's perception of water quality and attempt to determine the spatial differences in water quality perceptions across the Phoenix neighborhoods. The specific goal of this research is to use Cultural Consensus Analysis methodology to understand Phoenix residents' cognitive models of tap water quality, causes of water contamination, and appropriate mitigation actions in four Phoenix neighborhoods.

[1]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[2]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[3]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[4]Department of Civil and Environmental Engineering, Arizona State University-Tempe, PO Box 875306, Tempe, AZ 85287-5306

***The Tucson Hummingbird Project: An Experimental Study of Community Ecology and Reconciliation on a City-Wide Scale (http://hummingbirds.arizona.edu)**

Bachi, A.[1], and M. L. Rosenzweig[1,2]

Hummingbirds are native treasures we could potentially enjoy in our backyard. However, as a group, hummingbirds are jeopardized by development and of ~340 known species, 68 are Red listed. But development and biodiversity need not conflict, and cities may provide valuable surrogates for degraded habitats. The Tucson Hummingbird Project is a citizen-science, reconciliation ecology project. Its aim is to study community ecology, monitor and conserve hummingbirds in Tucson, Arizona.

During the past two years, over 100 local volunteers collected data in their backyards. Yards differed in vegetation, location, and type and level of resources (i.e., nectar plants and artificial feeders). Volunteers documented habitat use, foraging behavior, abundance and species interactions.

Results suggest how hummingbird communities are organized; and how habitats, artificial resources, and community ecology contribute to diversity and distribution in urban areas. Four species are most abundant in Tucson: Anna's, Black-chinned, Costa's, and Broad-billed hummingbirds. They vary in their distribution around Tucson. Diversity (rather than merely abundance) increased by augmenting resources. Competitive interactions revealed that hummingbirds chase conspecifics more than heterospecifics. We propose Aggressive Resource Neglect as the mechanism underlying these results.

Beyond studying community ecology in a large-scale experiment, we designed a model-system to monitor, conserve and augment native species, and provide stop-over habitats for

migrating ones. The latter is especially important in arid and semi-arid systems in light of increasing desertification. We basically demonstrated how we can reconcile a city in regards to hummingbird habitats. This was achieved with citizen scientists via outreach to the local community.

[1]Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ 85721
[2]The Alliance for Reconciliation Ecology, Tumamoc Hill, 1675 W Anklam Rd, Tucson, AZ 85745

Climate Sensitivity of Residential Water Consumption to Variations for the City of Phoenix, Arizona

Balling, Jr., R. C.[1], P. Gober[1,2,3], and N. Jones[2]

Water remains an essential ingredient for the rapid population growth taking place in Phoenix, Arizona. Depending upon the municipality, between 60 and 75% of residential water is used outdoors to maintain non-native, water-intensive landscapes and swimming pools. Residential water use in Phoenix should be especially sensitive to meteorological and climatic variations because of the strong emphasis on outdoor water use. This study explores the intra-urban spatial variations in the sensitivity of residential water consumption to atmospheric conditions. For 230 census tracts in the city, we developed time series of monthly water-use anomalies and compared them to monthly anomalies of temperature, precipitation, and the Palmer Drought Hydrological Index. We found that some census tracts have little-to-no sensitivity to weather and climate, while in others 75% of the monthly variance in water use is explained by atmospheric conditions. Greater sensitivity to atmospheric conditions occurred in census tracts with large lots, many pools, a high proportion of irrigated, mesic landscaping, and a high proportion of high-income residents. Low climatic sensitivity occurred in neighborhoods with large families and many Hispanics. Results suggest that local increases in temperature due to urban heat island effects and the buildup of greenhouse gases will increase water consumption most in more affluent, non-Hispanic neighborhoods.

[1]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[2]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

***Variation in Arthropod Diversity, Guild Composition and Abundances along an Urban-Rural Gradient: Nine Years of CAP LTER Monitoring**

Bang, C., and S. H. Faeth

Two assumptions associated with urbanization are that 1) diversity decreases in urban areas and 2) remnant or restored habitats will have or regain the same diversity as natural areas. Previous research has shown contradicting results for both assumptions. After nine years of monitoring arthropod communities in the Central Arizona–Phoenix (CAP) area, we focused on desert sites, desert remnant sites and two different landscaping categories: xeric yards and mesic yards. We combined data from annual pitfall sampling with data from 2000 and 2005 sweep net samples. The first assumption was not supported, while the second assumption was partially supported. Of particular note is the high variation in diversity between the years, where we were unable to detect a consistent pattern. The differences between the sampling methods are discussed. We provide recommendations for further monitoring and landscape planning.

School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

***Characterization of Microclimates in North Desert Village Sites**

Busse, K. D., and C. A. Martin

North Desert Village is an area of student housing located on the Arizona State University Polytechnic campus. Four treatments, each of which consist of six houses, their associated yards and a common area in the middle, were planted in four archetypes of landscape design styles found in the Phoenix metropolitan area. These four design styles were mesic (sprinkler irrigated turf), oasis (mixture of drip-irrigated trees and shrubs and sprinkler irrigated turf), xeric (drip-irrigated trees and shrubs) and native (non-irrigated trees and shrubs). In order to understand the relationship between landscape design and microclimate created by these landscapes, measurements were taken at 5.0-m increments along five transects in each of four study sites between 0900-1000, 1600-1700 and 2100-2200 Hr on clear calm days in mid-June and late August. These measurements included air temperature at 5.0 m, 2.0 m, 1.0 m, 0.5 m and 0.25 m, as well as relative humidity at 2.0 m and surface temperature. Air temperatures were measured with shielded copper constantan thermo-couples, except at 2.0 m where air temperature and relative humidity were measured by a shielded HMP45C-L probe. Surface temperatures were measured with an Apogee IRR-PN infrared thermometer. Surface temperatures in the native and xeric treatments were consistently warmer than in the oasis and mesic treatments. During the afternoon and evening hours the microclimates in the four treatments between 0.25 m to 2.0 m were different with the mesic treatment cooler. At 5.0 m above the landscape surface, air temperatures within all four treatments were similar.

Department of Applied Biological Sciences, Arizona State University-Polytechnic, 7001 E. Williams Field Rd, Mesa, AZ 85212

***Effects of Land Cover Transformations on Surface Microclimate along an Urban-Rural Gradient in Phoenix**

Buyantuyev, A.[1,2], J. Wu[1,2], and Y. Ouyang[3]

Expansion of urban area in the Central Arizona region begets drastic alterations of local climate. The rural-urban temperature differential, known as the Urban Heat Island (UHI), is characterized by warmer minimum nighttime temperatures within the urban core area and develops due to increased sensible heat flux to the atmosphere. Evapotranspiring vegetation, on the other hand, increases latent-heat exchange and significantly reduces temperature. Using ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) satellite data we assessed the magnitude of the surface UHI in Phoenix and related it to land-cover characteristics and vegetation cover (quantified as the Normalized Difference Vegetation Index or NDVI). We used two sets of day- and night-time images from the summer and late fall of 2003 to examine diurnal and seasonal differences in surface temperature patterns. We also investigated different pathways of land-cover transitions and related changes in NDVI, surface temperatures, and moisture content during a 20-year period (1985-2005) using Landsat satellite data. The three variables computed from Landsat were normalized and used to construct a 3-D scatterplot where temporal trajectories of urbanizing locations are quantified. The poster will present the analysis results from this research and illustrate the significant findings.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874601, Tempe, AZ 85287-4601
[2]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211,Tempe, AZ 85287-3211
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

***Comprehensive Water and Salt Flux Models for Urban Systems**

Choi, C. C., P. Westerhoff, and J. Crittenden

We developed models that describe the inter-linked urban water fluxes (drinking water, sewage, rainfall, etc) and associated salt fluxes. The model is based upon the same platform used by Decision Center for a a Desert City (DCDC; PowerSim) with the intent to provide a spatially explicit understanding of water and salt fluxes via integrated models.

Previously, the water and salt flux model was designed to accept either discrete data or simple algorithms that represent appropriate patterns of water supply/use/precipitation, outlined in the Continuing Research portion of the CAP2 proposal. This deterministic model was applied for the City of Scottsdale for one calendar year to determine water and salt fluxes.

Currently the model has been modified to adapt for the City of Goodyear, which has less infrastructure and treatment capabilities than Scottsdale. The stochastic model is designed to accept input parameters for different cities to establish a regional network of water and salt flux to simulate the fate of water and salt and provide spatial resolution to analyze water and salt fluxes across the CAP study area at different scales. The model is run for 25 years into the future. Water fluxes demonstrate the significance of outdoor residential irrigation on the loss of water from the ecosystem through evaporation, and consequently the accumulation of salt in vadose zone of residential yards.

Besides exploring the potential to regionalize the water and salt flux model, the model will be integrated into the WaterSim projects (DCDC) in efforts to widen the functionality of the model to provide salinity level and other contamination parameter.

Department of Civil and Environmental Engineering, Arizona State University-Tempe, PO Box 875306, Tempe, AZ 85287-5306

Residential Water Use In Phoenix: Exploring Myths and Realities

Clemens, J.[1], A. Greenwade[1], A. Humm-Keen[1], D. Keen[1], P. Lucas[1], A. Miller[2], M. L. Nunley[2], R. Quay[2,3], S. Rossi[2] , and D. Vieregge[1]

The City of Phoenix conducted a survey of 800 single-family households in Phoenix which included a telephone attitude survey, historical water use data, and site characteristics. Site characteristics included landscape type (turf, desert, mixed), lot size, sq ft of turf, presence of a pool. The survey was supplemented with 40-site case studies of the higher water users from the survey sample that included water use data logging, water audits and a more indepth interview and review of water use for each site. Several intervention methods were also studied among this sample including water conservation literature, water audit information, offering free evapotranspiration-based irrigation controllers, and chemical pool covers. The results challenge common perceptions about water use, attitude and behavior. Though recognition of water conservation reported action to conserve water were high, no correlation could be found between attitude, reported behavior and actual water use. Though several factors were found significant in explaining water use, standard deviation of water use was very high, even among subclasses. Case studies showed a high understanding of indoor water use and a low understanding of outdoor water use. Households with the highest water use and households with the lowest water use were found for all landscape groups. Large turf areas were found frequently to be deficit irrigated. Case study reveals that high water use may be more a result of lack of knowledge about how to care for landscape and pool than the actual landscape style or presence of a pool.

[1]BBC Research & Consulting, 3773 Cherry Creek North Dr, Suite 850, Denver, CO 80209
[2]Water Services Department, City of Phoenix, 200 W. Washington, Phoenix, AZ 85003
[3]School of Planning, Arizona State University, PO Box 872005, Tempe, AZ 85287-2005

***Residential Landscapes: Synthesis of the Literature and Preliminary Survey Results**

Cook, E. M.[1], S. J. Hall[1], and K. L. Larson[2,3]

In order to fully address the socio-ecological drivers of heterogeneous residential landscapes within the urban matrix, a broad literature review was conducted to attain a comprehensive understanding of residential yards. This synthesis highlights the well-studied components from the biological and social science perspectives, as well as identifies gaps in current knowledge. Within the field of ecology, studies of residential yards often focus on species abundance and composition in regard to urban biodiversity. A handful of studies have also begun to classify the soil characteristics and biogeochemical processing occurring in different yard treatments. However, most of these studies compare across yards; little work has been completed to quantify the heterogeneity within a single yard. In the social sciences, several studies classify homeowners' landscaping preferences and perceptions of various landscape types. These preferences are often related to landscaping practices, neighborhood standards, homeowner education, and cost. The integration of the social and ecological sciences at the fine scale of residential landscapes is a relatively unexamined area of study. The results from a preliminary survey of Phoenix area homeowners' preferences and yard management practices will be examined within the context of the current literature. This synthesis of the literature, as well as the survey results, will contribute to an integrated socio-ecological study examining the relationships among the drivers of human behavior, residential landscape management decisions, and the ecological responses.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501
[2]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

***Information Distribution Across Organizational Networks**

Cutts, B. B.[1,3], A. K. Knox[1,3], and N. R. Moore[2,3]

Public information is an important component of water management in metropolitan Phoenix, Arizona. Generating public awareness about water quality and water supply can lead to changes in decision making across a variety of scales; new knowledge can influence where people choose to live, household water efficiency, social norms about conservation, public action against pollution in local waterways, homeowner's association policies and even voting preferences. Many organizations provide water information to the Phoenix metropolitan population. Understanding the potential for interactions between these organizations to influence differences in individuals' engagement with water information is essential. By working together, organizations economize resources to produce more education opportunities. Successful education endeavors launched by one organization can be shared with other organizations through rapid methods of communication. However, this may result in exacerbated conditions of homophily or the existence of “group think” that constrains creativity among organizations. We use text analysis to identify dominant issue themes and motivational structures used in water education publications. We combine this with information about the network of weblinks shared between organizations to test hypotheses related to the network structure of local water education organizations and the similarity of issue coverage and motivational framing used by education sources. We also discuss the relative

role of different organizations in information sharing based on their position in the local network and connections to organizations outside of the network. Future work will use social network surveys to examine self-reported information sharing networks.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501
[2]Arizona Department of Environmental Quality, 1110 W. Washington St, Phoenix, AZ 85007
[3]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209

***An Environmental Justice Framework for Analyzing Obesigenic Environments: A GIS Analysis of Walkability, Park Access, and Neighborhood Demographics in Phoenix, Arizona**

Darby, K. J.[1], B. B. Cutts[2], C. G. Boone[1,3], and A. Brewis[1]

Access to parks and living in walkable neighborhoods promotes physical activity and meets environmental justice goals of fair distribution of amenities that improve health and well-being. Research increasingly demonstrates that the prevalence of obesity is affected by built environment factors that facilitate or hinder physical activity and consumption of healthy foods. When elements of the built environment negatively affect individuals' behaviors, these spaces are deemed “obesigenic.” Using GIS analyses in a case study of Phoenix, Arizona, we examine the distribution of walkable neighborhoods and access to parks. We test the hypothesis that social, economic, and demographic characteristics correlated with both higher exposure to environmental hazards and/or obesity risk — relative linguistic isolation, presence of children, lower income, and less education — are also associated with less walkable neighborhoods and lower access to parks. We find that subpopulations generally considered vulnerable to obesity are more likely to live in walkable neighborhoods and have better walking access to neighborhood parks than other groups. These results suggest that the physical activity benefits of walkable built environments may be offset by other social or built-environment characteristics.

[1]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[2]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

***The Comparative Ecology of Xeriscaped, Our Domesticated Deserts**

Davies, R. C., and S. J. Hall

Traditionally, restoration projects have focused on replacing non-native plants with native species, and assumed that restored ecosystem function would follow. However, increasing evidence indicates that function does not always follow form, particularly in highly altered environments such as urban areas. Humans manipulate the urban environment directly through irrigation, fertilization, and pruning, as well as indirectly through urban heat islands and the deposition of air pollution. We explored the relationship between native plants and belowground nutrient cycling across a gradient of human manipulation in Phoenix, Arizona. Three landscape types were considered: undisturbed Sonoran Desert outside the city, desert preserves within the urban airshed, and “restored” desert landscapes planted with native species within xeriscaped residential yards. We measured soil nutrient pools and dynamics with a spatially explicit sampling design surrounding two native Sonoran Desert plants common in residential landscaping: Brittlebush (*Encelia farinosa*, a fast-growing shrub) and palo verde (*Parkinsonia* spp., a tree). Direct human manipulation of the desert yards results in enriched and more evenly distributed soil properties and nutrient cycling compared to

desert sites. Resource islands beneath plants that characterize the Sonoran Desert are absent in desert yards. Pools of inorganic nitrogen are more than four times higher, while soil moisture and organic matter are two times higher in desert yards than in outlying desert. Palo verde and brittlebush leaves also contain more nitrogen in desert yards than in desert sites. The urban environment plays no more than a small role in these effects, as desert sites inside and outside the city were always statistically similar.

School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

***How Evapotranspiration Varies Across Urban Neighborhoods – Application of LUMPS Model**

Elder, J.[1], S. Grossman-Clarke[2,3], A. Brazel[1], H. Butler[1], and C. Martin[4]

First results of modeling efforts supported through the Decision Center for a Desert City to estimate outdoor water loss through evapotranspiration in the Phoenix metropolitan region are presented. The diagnostic Local-scale Urban Meteorological Parameterization Scheme (LUMPS) was applied for selected neighborhoods in Phoenix for a time period for which spatially explicit water consumption data for Phoenix were also available. The LUMPS model simulated neighborhood scale latent heat fluxes that were converted to a water flux into the atmosphere. Based on model results the common assumption that residential outdoor water use amounts to ~65% of the total residential water use was tested. In previous studies it was shown for other urban areas that LUMPS simulates the components of the urban energy balance (net all-wave radiation, heat storage, sensible heat, latent heat) consistently well with high accuracy. LUMPS input data are routine weather station data as well as site characteristics such as neighborhood fraction cover of irrigated vegetation, pools, and man-made surfaces. Those data were derived from remotely sensed data using GIS-techniques.

[1]Department of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[2]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511
[4]Department of Applied Biological Sciences, Arizona State University-Polytechnic, 7001 E. Williams Field Rd, Mesa, AZ 85212

***A Scenario Based Assessment of Future Groundwater Resources in the Phoenix Active Management Area**

Escobar, V[1,2]., T. Lant[1,2,3], J. Block, P. Miller[4], and M. Tschudi[1]

The availability of future water supplies in central Arizona depends on the interaction of multiple physical and human systems: climate, hydrology, water and land-use policy, urban-ization, and regulation. The problem in assessing future water supplies requires untangling these drivers and recasting the issue in a way that acknowledges the inherent uncertainties in climate and population growth predictions while offering meaningful metrics for outcomes under alternative scenarios. Further, the drivers, policy options, and outcomes are spatially heterogeneous — surface water supplies, new urban developments and changes in land-use will not be shared uniformly across the region. Consequently, different geographic regions of the Phoenix metropolitan area will be more vulnerable to shortages in water availability, and these potential vulnerabilities will be more or less severe depending on which factors cause the shortage.

The results of this research will make several contributions to existing literature and research products for groundwater conservation and future urban planning. It will provide location specific metrics of water vulnerability and offer a novel approach to groundwater analysis; it will demonstrate the XLRM framework with an application to central Arizona Water resources. Lastly, it will add to the WaterSim climate model by spatializing the groundwater component for the Phoenix Active Management Area.

[1]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[2]The Decision Theater, Arizona State University-Tempe, PO Box PO Box 878409, Tempe, AZ 85287-8409
[3]Department of Mathematics and Statistics, Arizona State University-Tempe, PO Box 871804, Tempe, AZ 85287-1804
[4]Fulton High-Performance Computing Center, Arizona State University-Tempe, PO Box 875206, Tempe, AZ 85287-5206

***Focusing on Higher Quality Focus Groups**

Gartin, M.[1], A. Wutich[1], T. Lant[2], D. White[3], K. Larson[4,5], S. Ledlow[5,6], and P. Gober[4,5,7]

The Decision Center for a Desert City is developing innovative tools and asking hybrid research questions to build a model of research to examine science and policy integration. Through the collaboration of stakeholders in focus group research, we are gaining insight into more rigorous forms of social science research. As a result of our group exercises, we find a range of sensitive topics dictated by climatic variability and local political discourse where its added value is rooted in the facilitation and integration of knowledge across various fields of research.

[1]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[2]Department of Mathematics and Statistics, Arizona State University-Tempe, PO Box 871804, Tempe, AZ 85287-1804
[3]Department of Community Resources and Development, 411 N Central Ave, Ste. 550, Phoenix, AZ 85004-0690
[4]Department of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[5]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511
[6]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211
[7]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 8528-8209

***Atmospheric Dry Deposition of Gaseous and Particulate Nitrogen to Urban-Influenced Sonoran Desert Sites**

Gonzales, D. A.[1], J. O. Allen[1,2], R. A. Sponseller[3], S. J. Hall[3], and N. B. Grimm[3]

Atmospheric deposition is an important vector for the transfer of anthropogenic nutrients to terrestrial ecosystems. In arid regions, such as the western United States, dry deposition is the dominant mechanism for pollutant deposition. Urbanization in this region magnifies the impact of atmosphere-land exchange by increasing the emissions of nitrogen pollutants. This additional atmospheric N is eventually deposited to the biosphere where it may affect receptor ecosystems.

Dry deposition fluxes of gaseous and particulate nitrogen were measured in the Phoenix, Arizona, metropolitan area, an arid region with significant atmospheric pollution, in order to examine patterns of nitrogen deposition at urban-influenced Sonoran Desert sites. Gas and particle concentrations were measured using a denuder and filter sampler system at three

Sonoran Desert sites located upwind, within, and downwind of the Phoenix urban core. Micrometeorological measurements were made at one Sonoran Desert site to estimate deposition velocities from meteorological data collected at each site. Modeled deposition velocities and measured concentrations were then used to infer dry deposition fluxes. Characteristic inferred nitrogen deposition fluxes were 0.92, 2.28, and 1.47 kg/(ha y) at the upwind, core, and downwind sites, respectively. The main contributor to nitrogen flux was nitric acid. Total deposition was an order of magnitude lower than previous estimates based on air quality modeling of high pollution episodes.

[1]Department of Chemical Engineering, Arizona State University-Tempe, PO Box 876006, Tempe, AZ 85287-6006
[2]Department of Civil and Environmental Engineering, Arizona State University-Tempe, PO Box 875306, Tempe, AZ 85287-5306
[3]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

***An Assessment of Municipal Water Conservation Policy in Greater Phoenix, Arizona, 1980-2007**

Gustafson, A.[1], K. Larson[2,3], P. Hirt[1], and L. Zautner[2]

A number of number of scholars and water policy analysts have praised Arizona's 1980 Groundwater Management Act (GMA) as a “progressive” and “visionary” piece of legislation. Hailed by Harvard University and the Ford Foundation as one of the country's most innovative state programs, proponents claim that the GMA is the most progressive and rigorous groundwater code in the nation. This poster seeks to demonstrate, however, that there is minimal action associated with Arizona's so-called commitment to a future of groundwater sustainability. Although the Arizona Department of Water Resources, the agency created to administer the GMA, sees itself as a figurehead for progressive groundwater management, a historical and geographical analysis of the municipal conservation program in the Phoenix region reveals that the Department has consistently refrained from using regulatory authority to punish water providers for non-compliance. What might have started out as a “progressive and rigorous” agenda in the early 1980s has been intentionally and systematically weakened over time. Consequently, the municipal water use sector in the Phoenix region is not achieving the “reasonable reductions in per capita use,” that the law requires. The broader significance of this research is that understanding urban water use patterns and evaluating the effectiveness of conservation policies is essential for avoiding impending water crises in Phoenix, Arizona, and in other rapidly growing metropolitan regions.

[1]Department of History, Arizona State University-Tempe, PO Box 874302, Tempe, AZ 85287-4302
[2]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

***Aridland Urban Hydrology in Phoenix, AZ**

Hale, R.[1], N. Toke[2], N. Grimm[1], and R. Arrowsmith[2]

To determine the effects of urbanization on hydrology we analyzed 30-40 year trends in hydrologic parameters in Phoenix, AZ, and performed a downstream flow analysis of Indian Bend Wash (IBW) to examine factors that may explain these changes. We coupled this analysis with observations of changes in urban infrastructure and urban form.

Streams in Phoenix did not demonstrate consistent trends in runoff, peak discharge, or flashiness, nor were these trends different than non-urban streams. Frequent flood events (<2-year recurrence interval) increased in magnitude for two urban streams perhaps suggesting that urbanization leads to more runoff. However, within IBW, analyses of stormwater flow and the location of pipes, roads, and retention basins, suggest some areas of the watershed are segmented into internally drained subsystems. Other parts of the watershed are rerouted around IBW or enter the channel at locations further downstream because of street and pipe conveyance. Therefore, rerouting of surface runoff may be as important as increased runoff generation in accounting for changes in hydrologic parameters.

Engineering practices that are meant to prevent runoff from reaching urban channels appear to be relatively successful. However, the effects of these changes on the variability and timing of stream flows is not consistent, thus the implications for ecosystem function are varied. This suggests that detailed case studies are necessary to determine the hydrologic outcomes of urbanization. Further analysis should allow us to systematically link development choices to hydrologic and ecological outcomes; important information for informed decision making.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501
[2]School of Earth and Space Exploration, Arizona State University-Tempe, PO Box 871404, Tempe, AZ 85287-1404

Biogeochemical Processes in Tempe Town Lake: Trends and Patterns in the Amount and Composition of Dissolved Organic Carbon

Hartnett, H.[1,2], M. Kelly[2], K. Mayer[2], and H. Waterman[3]

Tempe Town Lake is a man-made aquatic system in downtown Tempe, AZ. Daily water sampling was conducted from Jan.-Nov. 2005; since that time approximately weekly sampling has occurred at various times during the year. Measurements of pH, temperature, conductivity, and dissolved oxygen are made in situ. Water samples are collected for analysis of nutrients, dissolved organic carbon (DOC) and nitrogen and DOC characterization by electrospray ionization mass spectrometry. Dissolved carbon concentrations ranged from ~3.0 to 8.0 mg/L in 2005 and exhibit a significant increase during the summer monsoon period. In summer 2006 (during monsoon onset) DOC concentrations were ~5 mg/L, and in summer 2007 (2 months post-monsoon) DOC concentrations were ~4.0 mg/L. The results from the 2005 time-series sampling suggest that DOC in Tempe Town Lake responds seasonally to changes in inputs and biogeochemical processes over the course of the year. Data from the summertime sampling, while discontinuous, suggests there is also interannual variability in Tempe Town Lake DOC as well. This work will compare the timing and magnitude of changes in DOC concentration with the timing of rainfall events and lake management activities (algaecide application). We will also present DOC composition results from electrospray ionization mass spectrometry and assess differences in molecular-level change in DOC on seasonal and interannual time-scales.

[1]School of Earth and Space Exploration, Arizona State University-Tempe, PO Box 871404, Tempe, AZ 85287-1404
[2]Department of Chemistry and Biochemistry, Arizona State University-Tempe, PO Box 871604, Tempe, AZ 85287-1604
[3]Department of Chemical Engineering, Arizona State University-Tempe, PO Box 876006, Tempe, AZ 85287-6006

***Heat-Related Morbidity: Phoenix, Arizona (2001-2006)**

Hartz, D. A.[1], J. . Golden[2,3,4], and A. J.Brazel[1]

We examine the local climate conditions associated with the increased heat-related emergency dispatches (HRD - the 911 calls identified as heat-related illness) for metropolitan Phoenix, Arizona, from 2001 through 2006. The reputation of Phoenix is for being unbearably uncomfortable during its long, hot summer. Its historical mean monthly maximum temperatures reach over 33°C in May, rises to nearly 39°C in June and August, and tops out in July with a mean maximum temperature of 40°C. However, many days far exceed these mean maximum temperatures - often hitting temperatures into the mid to high 40s°C. The early summer season months have low humidity. However, from early July through early September is the monsoon season - which brings rising humidity along with the high temperatures. Phoenix's increasing temperatures associated with the urban heat island effect can exacerbate an already brutal climate. As would be expected, increasing summer heat brings increasing numbers of heat-related health emergencies. There are strong seasonality and diurnal patterns to the HRD. Not surprisingly, the average number of emergency dispatches tracks similarly to monthly mean temperatures, and with maximum diurnal temperature. However, days with a large number of heat emergency calls are highly variable throughout the warm months spanning April to September — most days having no calls and some days with more than 30. The HRD data set does not lend itself to simple explanations such as the maximum temperature, heat index or day of the week. For example, there are many days in April and May with sudden increases in heat-related emergency calls — days with low humidity, and relatively low temperatures — at least in comparison to the considerably hotter months of June and July. The study presents some of the patterns and complexities associated with the spikes in HRDs, primarily in relation to the local climate conditions, and also takes into consideration other possible contributing factors such as proximity to holidays.

[1]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[2]The National Center of Excellence: SMART Innovations for Urban Climate + Energy, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511
[4]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211

***The Use of GIS as a Decision-Support Tool by Water Managers in Phoenix, Arizona**

Howard, J.[1], K. Larson[1,2], D. White[3], and E. Wentz[1]

Water managers in the Phoenix metropolitan area must cope with uncertainty on a continuous basis. The levels of uncertainty in terms of data, climatic variability, global climate change, political context, and social environment are distinctively complex for water resource managers in water providing organizations. Knowing how water managers address uncertainty is important in understanding how large-scale uncertainties with water supply are addressed at the institutional level. Water managers need access to the right tools to help them assess conditions and data where the picture of reality may be obscured by inaccurate or incomplete data. GIS is a tool that can be directed toward that end. In order for GIS to be used effectively in that regard, it is important to understand how it is currently used by water managers. This research is guided by three questions. First, how do water managers address uncertainty in decision-making? Second, how is GIS used by water managers in decision-making? Third, how do water managers deal with uncertainty in their use of GIS? This poster will present the preliminary findings of the analysis of 12 interviews conducted with Phoenix-area water managers in 2005.

[1]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

[2]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511
[3]School of Community Resources and Development, Arizona State University-Downtown Phoenix, 411 N. Central Avenue, Ste 550, Phoenix, AZ 85004-2139

Urban Behavioral Ecology of the Western Black Widow (*Latrodectus hesperus*): From Solitary Desert Predator to Urban Pest

Johnson, J. C., C. Ibeth Torres, P. Trubl, A. Gohr, and M. Rife

The bite of a widow spider (*Latrodectus* spp., Theridiidae) has long been considered to be the most painful and dangerous of all North American spiders. One result of urban expansion into desert habitats is that humans are encountering widow spiders more frequently. Indeed, in Western cities such as Tucson and Phoenix, the local widow species, *L. hesperus*, is so common in and around homes that many residents, particularly those with small children, have begun contracting with pest control agencies to spray for widow spiders. Despite the fact that many pesticides are currently labeled for use against spiders, pesticides are, in fact, largely ineffective at killing web-building spiders such as widows. This is because widow spiders rarely leave their web and thus does not come into contact with toxins sprayed indiscriminately.

The combination of a rise in widow population numbers in urban habitats and the ineffectiveness and dangers of widespread pesticide use to combat widow spiders suggest that it is of paramount importance to develop an alternative approach to controlling the abundance of these spiders in urban habitats. Here we present a summary of several projects aimed at gaining a baseline understanding of the behavioral ecology of urban black widows, which will ultimately be compared to that of ancestral desert populations. We touch on a number of interesting behavioral questions including cannibalism among spiderlings, death feigning, wasteful killing and adaptive web building decisions. In addition, we describe ongoing projects that integrate population genetics and outreach education to further our research program.

Department of Integrated Natural Sciences, Arizona State University-West, PO Box 37100, Phoenix, AZ 85069

*Declining Cotton Cultivation in Maricopa County, Arizona: An Examination of Macro and Micro-Scale Driving Forces

Judkins, G.

Once the dominant location of cotton cultivation within the state of Arizona, Maricopa County has undergone significant changes during recent years, resulting in substantial shifts within the regional agricultural economy. The dramatic decline in cotton over the last nine years has prompted the question, what have been the major driving forces resulting in the pattern of decline experienced by Maricopa County's agricultural economy? As singular explanations of agricultural change are often insufficient, this research employs a methodology that combines macro-scale analysis of underlying (distal) driving forces, with interviews of cotton farmers to reveal how these forces have influenced their decisions through the mediation of other significant micro-scale factors. Pressure from the expansion of Phoenix's metropolitan region is identified as an important underlying driver of this land-use change, however fluctuations in the international price of cotton and favorable government subsidies are identified as additional key macro-scale influences on the extent of cotton cultivated. Interviews with growers highlight the importance of several micro-scale factors affecting the

land-use decisions of farmers, including personal perspectives, family situations and the impact of negative externalities from sprawl on active cultivation. The recent decline in cotton cultivation in Maricopa County is determined to have resulted from a combination of factors, operating at multiple scales, resulting in the conversion of large tracts of farmland to urban developments.

School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

***The Social and Ecological Construction of Protected Rainforests in Costa Rica's Osa Peninsula**

Kapoor, M., and A. Kinzig

The Osa Peninsula is the site of Costa Rica's first national park, created in 1975. Today, approximately 80% of the peninsula has some form of protected status. The rise in conservation areas in the peninsula have reflected a fundamental shift in the local economy from an agricultural to a tourism base, driven in part by a growing international appreciation of the peninsula's unusual biodiversity and high levels of local endemism. In this interdisciplinary masters project we are investigating whether there has been a concurrent metamorphosis in how local stakeholder groups in the Osa Peninsula perceive protected rainforests. At the same time, we are studying how changes in perceptions of the forests of the Osa Peninsula may drive changes in plant communities in the peninsula. We are addressing these questions through mixed social science and ecological research methods that include semi--tructured interviews and plant surveys. We collected the primary data for this research project from January-July 2007 and our data analysis is now underway. Here we describe our research methods and preliminary findings.

School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

***Prehistoric Population and Climate Variation in the Agua Fria Watershed of Arizona**

Kiggins, C. S, and S. Ingram

Examining people of the past and their interactions with the environment contributes to our understanding of human-environment interactions today. People lived within the Agua Fria river watershed, which runs south from central Arizona to the Salt River in the Phoenix Basin, for hundreds of years farming on the mesa tops and in the canyons. However, around AD 1200 habitation sites in the lower Agua Fria watershed show evidence of a wide scale movement out of the region, with a concurrent population increase in the upper Agua Fria watershed. Might climate change have contributed to these population movements within the Agua Fria watershed? The focus of this study is the population movements within the Agua Fria watershed of central Arizona around AD 1000-1400, and the environmental changes that may have contributed to people's decisions to move within the region. The environmental variables to be considered include precipitation, stream flow, and temperature with analysis examining the effects of these variables on the agricultural potential of the region.

School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402

***Mapping Vulnerability to Heat Stress in the Valley of the Sun**
Kimmel-Guy, A.

The staggering summer weather of Phoenix, Arizona, is undeniable. Average summer highs exceeding 100°F are typical and daily highs below 120°F are unremarkable. Many researchers predict that global climate change will result in increasing temperatures across the southwestern region of the United States. Under these conditions, the city's summer weather is not just uncomfortable; it can be deadly. Building on recent works that identify factors influencing vulnerability to heat stress, this research uses publicly accessible data to identify block groups in the Phoenix metropolitan area whose populations have a high potential of experiencing negative health impacts during times of extreme heat. To identify these potentially vulnerable populations, this research used US Census Block Group data for the Phoenix metropolitan area in ArcGIS to map each characteristic identified as influencing vulnerability. The results of this mapping were divided into quartiles, and each block group was assigned a score between 1 (lowest vulnerability) and 4 (highest vulnerability) for each characteristic, representing relative vulnerability by characteristic. Aggregation of these scores by block group provided an overall measure of each block group's potential vulnerability to heat stress. Finally, the categorical results for the metro area were mapped to display variations in overall potential vulnerability to heat stress. These variations provide a “quick look” at the distribution of potential vulnerability, allowing easy identification of areas requiring a more detailed assessment of vulnerability to heat stress. In addition, the resulting patterns of potential vulnerability align closely with the results of previous studies measuring environmental injustice indicators in Phoenix, suggesting that vulnerability to heat stress be considered as a local environmental justice indicator in future research.
School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

The Effects of Relatedness, Age Differences, and Maternal Investment on Juvenile Cannibalism in the Black Widow Spider, *Latrodectus hesperus
Kitchen, K. A., and J. C. Johnson

Spiders have proven to be exceptional systems for the study of cannibalism. Ecological factors such as population density and food limitation are clearly important determinants of cannibalism. In addition, cannibalism is often more frequent among unrelated individuals than it is among related individuals. Thus, kin selection appears to influence cannibalism in some spiders. Previous works have documented this in spider taxa that routinely encounter conspecifics (e.g., social species). However, the overwhelming majority of spider species are solitary and, to our knowledge, no study has reported evidence of kin selection shaping cannibalism in a solitary spider species. Here we examine factors influencing the cannibalistic behavior of a solitary spider, the North American black widow (*Latrodectus hesperus*). We report evidence that relatedness is negatively related to cannibalistic tendency in juvenile spiderlings. Cannibalism was not explained by a spiderling's condition as estimated by offspring number/egg sac mass. Finally, despite the fact that egg sac parameters did not explain cannibalism, family identity was a strong predictor of cannibalism. Specifically, some families took, on average, 2-3 days to cannibalize a related individual, whereas other families took 3 weeks to cannibalize a related individual, suggesting that cannibalism has a significant genetic basis. We discuss the implications of these results giving particular attention to the fact that the black widow's historical role as a solitary, desert predator has changed drastically in many urbanized areas of the desert Southwest. Urban black widows

occur in high-density populations, which are typified by heightened levels of social interactions.

Department of Integrated Natural Sciences, Arizona State University at the West campus, PO Box 37100, Phoenix, AZ 85069

***Valuing the Environment Metropolitan Phoenix**

Larson, E. K., and C. Perrings

One method for valuing environmental attributes is hedonic pricing. When people purchase a property, they are expressing their values and preferences regarding not only the characteristics of the property itself, but the locational and environmental characteristics of the neighborhood. By analyzing the relationship between house prices and environmental conditions, it is possible to estimate the value homeowners place on those conditions. This includes both amenities (such as proximity to parks, vegetation types or bird diversity) and dis-amentities (such as proximity to sources of noise or pollution). The method is appropriate where there are active, well-functioning property markets, and hedonic models have been successfully used to estimate people's willingness to pay for a range of both amenities and dis-amenties in urban areas. The Phoenix area, one of the most intensively studied urban ecosystems in the US, offers the opportunity to use this method to value many of the environmental changes associated with rapid urbanization in a desert environment. We combine spatially explicit data from the Maricopa County Assessor's Office on housing sales, socio-economic census data and environmental data from the Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) project and other GIS sources to create hedonic models of air and noise pollution, heat-island effects and access to desert ecosystems. This work complements other CAP LTER research which has found that vegetation, biodiversity, and pollution exposure are correlated with socio-economic indicators. This study's use of hedonic pricing, which focuses on actual rather than inferred behavior, will yield further insight into this coupled socio-ecological system.

ecoServices Group, School of Life Sciences, Arizona State University-Tempe, PO Box 874601, Tempe, AZ 85287-4601

Spatial Extrapolation Mapping Based on Aggregated Data: Countywide Extrapolation of Phoenix Water Use Data

Lee, S. J.[1], and E. A. Wentz[2]

Understanding water use in the context of urban growth and climate variability requires accurate representation of regional water use. It is challenging, however, because water use data are often unavailable, and when available they are geographically aggregated to protect the identity of individuals. This poster aims to map local-scale estimates of water use in Maricopa County, Arizona, based on data aggregated to census tracts and measured only in the City of Phoenix. To complete our research goals we describe two types of data uncertainty sources (i.e., extrapolation and downscaling processes) and then generate data that account for the uncertainty sources (i.e., soft data). Our results ascertain that the Bayesian Maximum Entropy (BME) mapping method of modern geostatistics is a theoretically sound approach for assimilating the soft data into mapping processes. Our results lead to increased mapping accuracy over classical geostatistics, which does not account for the soft data. The confirmed BME maps, therefore, provide useful knowledge on local water use variability in the whole county that is further applied to the understanding of causal factors of urban water demand.

[1]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[2]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

Temporal Geographic Information System (TGIS) to Forecast Future Water Consumption in Phoenix, Arizona

Lee, S. J.[1], E. A. Wentz[2], and P. Gober[1,2]

Predicting the dynamics of future residential water use in an arid city is a central input to facilitate future sustainability in the city. This study adopts Bayesian Maximum Entropy (BME) of modern geostatistics to account for composite space-time variability in historical water use data, and uncertain data (i.e., soft data) generated over future points. The soft data generation is based on using a stochastic empirical law between water use and secondary data (i.e., population growth), and integrating the soft data into mapping processes leads to increases of forecasting accuracy. The secondary data are projected at future points and they remain uncertain. We propose an adjusted stochastic empirical law that covers uncertainty in the secondary data, and hence a more generalized methodology to generate information-rich soft data. This updated soft information is processed in BME, which produces maps of water use until the year 2030. Our forecasting results indicate that Phoenix's residential water use increases until reaching a peak the years 2012 and 2017, and afterward gradually decreases by 2030. The developed methodology could be flexible enough to be applied to different forecasting applications, and a driving force to develop a more generalized method that uses a stochastic empirical law consisting of multiple independent variables that are closely related to water use whenever available.

[1]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[2]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

***Foraging Decisions, Bird Community Structure and Residential Landscapes; Finding the Links**

Lerman, S. B., and P. S. Warren

Urbanization, as it transforms natural biotic systems into human-dominated landscapes, has become recognized as one of the greatest threats to bird diversity throughout the world. However, certain landscape designs may provide mini refugia within urban areas, enabling the persistence of a natural bird community. Furthermore, numerous observational studies have demonstrated high densities but low diversity in urban areas, though the processes underlying these patterns still remain unclear. In arid cities, the availability of water encourages the persistence of high densities of exploitive and adaptive species within the lush, mesic landscapes. We predict that the high densities potentially lead to highly competitive individuals. Because of the increased competition, individuals must optimize their foraging, whereby greater efficiency ultimately translates to higher survival and reproductive success. Together with Citizen Scientists and high school students, we evaluated why certain birds are able to persist within clearly defined residential habitat parameters. By applying optimal foraging theory we measured foraging decisions (Giving Up Density - GUD) at artificial food patches and compared behavior between the two dominant landscape designs in Phoenix: mesic and xeric. Birds demonstrated a significant difference in foraging behavior between mesic and xeric yards, with birds foraging in mesic yards exhibiting greater foraging efficiency. This suggests that competition for food resources is greater in these mesic landscapes. In addition, these conditions may make it possible for certain urban-adapted species to out compete the native, desert-adapted species. We

recommend xeric landscape designs for future developments which potentially encourage a native bird community.

[1]Graduate Program in Organismic and Evolutionary Biology, University of Massachusetts at Amherst, Amherst, MA 01003
[2]Department of Natural Resources Conservation, Holdsworth Hall, University of Massachusetts at Amherst, Amherst, MA 01003

***Effects of Urbanization on Avian Species Richness in the Phoenix Metropolitan Area: Patterns in Vegetation Remnants**

Litteral, J. E., and J. Wu

Habitat loss and fragmentation are important causes of loss of biodiversity. Urbanization is an important driver of these changes in habitat quantity, quality and configuration. Birds are ideal study organisms for estimating the effects of urbanization on species richness due to their mobility. If habitat loss and fragmentation are limiting the avifauna community, it is likely that less mobile organisms, with similar habitat requirements, are being affected as well. We used a stratified random sampling approach to assess the species richness of passerines in 16 native vegetation remnants in the Phoenix metropolitan area. Previous Central Arizona–Phoenix Long-Term Ecological Research (CAP LTER) work on mapping the dominant vegetation of these areas was used as a guide for placing sampling points. Four vegetation classes were specified - *Ambrosia* dominant, *Larrea* dominant, *Encelia* dominant and mixed scrub. A sampling point was randomly placed within each vegetation type present, in each remnant, CAP LTER protocol was used to conduct point counts at 48 points to determine avifauna richness throughout the remnants. Counts were completed by the lead author, an undergraduate research assistant and four volunteer amateur birders from the Audubon Society. Initial regression results will be presented using data from the first spring field season of the project (April/ May 2007). The size, shape and isolation of each remnant will be compared to the species richness found within each remnant, respectively. Percent high and low density residential, industrial and urban land use surrounding each remnant will be calculated. Surrounding land-use data will also be compared to richness within each remnant.

School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

Annual Patterns of Thermodynamics and Surface Temperatures at the North Desert Village

Martin, C. A.

Above- and below-ground microclimate measurements are continuously being monitored at the North Desert Village (NDV) long-term experiment site. In this report, annual patterns of soil temperature and soil heat flux at 30 cm depth for the year 2007 were reported. Soil temperatures were recorded using copper constantan thermocouples. Soil heat flux measurements were made using HFP01SC-L Hukseflux self-calibrating soil heat flux plates. These microclimate data were recorded every 5 minutes and averaged hourly by fixed solar powered micrometeorological stations with a CR1000 datalogger that were located near the center of four of the five NDV treatment sites. The four treatment sites (average 6177 m^2 area) with micrometeorological stations are called mesic (spray irrigated turf grass), oasis (a mixture of spray irrigated turf and drip irrigated trees and shrubs), xeric (drip irrigated trees and shrubs), and native (non-irrigated trees and shrubs). All landscape surfaces without turf

grass are covered with 5 cm of light beige-colored decomposing granite mulch. Throughout the year, the soils underneath turf covered surfaces were generally cooler and demonstrated the greatest diel (24 hr) variation in soil heat flux.

Department of Applied Biological Sciences, Arizona State University-Polytechnic, 7001 E. Williams Field Rd, Mesa, AZ 85212

Effect of Landscape Design and Irrigation on Summertime Gas Exchange of Landscape Trees, Shrubs, and Herbs

Martin, C. A., and K. D. Busse

Diurnal patterns of gas exchange were measured on an assortment of landscape trees, shrubs and herbs during summer 2007 at the North Desert Village (NDV) long-term experiment site. The NDV experiment site consists of four treatment areas variously designed and irrigated to represent the breath of landscape design and irrigation practices observed across the greater Phoenix metropolitan area. The four treatments areas are: 1) Mesic [turf grass, sprinkler irrigated (77.4 l/m^2/month) exotic trees and shrubs]; 2) Oasis [turfgrass and decomposing granite, drip irrigated (16.4 l/m^2/month) exotic trees, shrubs and herbs]; 3) Xeric [decomposing granite, drip irrigated (1.8 l/m^2/month) exotic, shrubs and herbs]; and 4) Native (decomposing granite, non-irrigated native trees, shrubs and herbs). During summer 2007, gas exchange measurements were made with an LI-6200 portable photosynthesis system under clear sky conditions during morning (0700 to 0900 Hr), midday (1130 to 1330 Hr), and late afternoon (0600 to 1800 Hr). For all trees, shrubs and herbs, summer gas exchanges fluxes were generally highest during the morning except for herbs in the xeric and native treatments which had highest gas exchange fluxes at midday. Summer gas exchange fluxes were generally lowest for trees in the mesic treatment.

Department of Applied Biological Sciences, Arizona State University-Polytechnic, 7001 E. Williams Field Rd, Mesa, AZ 85212

***Microbial Degradation of Non-point Hydrocarbon Pollution in Urban Soils**

Marusenko, Y., and S. Hall

Urban soils are exposed to deposition of combustion-derived non-point pollution of carbon compounds that may provide an energy source for soil microorganisms. How are soil microbial communities changing as a response to hydrocarbon pollution? As a first step in this new research, we explored factors limiting the growth of microorganisms from native desert soils, in sites upwind, downwind, and in the urban core of the CAP study area. We collected soils from two patch types, under *Larrea tridentata* and in inter-plant spaces. In the laboratory, we incubated soils with water only (control) and labile carbon (as dextrose in water). We expected that microorganisms in the urban core region would show the greatest biomass and response to carbon additions. Microbial biomass in control soils was significantly higher under *L. tridentata*, but was not affected by landscape position relative to the city. However, although not significant, carbon additions increased respiration in soils from core and downwind regions. Soil organic matter was significantly correlated to microbial biomass across all treatments. These preliminary results suggest that the urban atmosphere may alter microbial communities, but that this effect may be indirectly due to alterations in soil organic matter due to increased plant production or atmospheric deposition under plant canopies in the urban core. In future research, we will test the microbial bioavailability of

carbon compounds characteristic of the urban atmosphere. Additionally, we plan to use molecular fingerprinting techniques to explore the microbial community structure and to test for specialized degrader microorganisms in urban soils.

School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

***Rural to Urban Temperature Gradients: CAP LTER in Context of the Recent Trends in the Mojave and Sonora Desert Region**

Mensing, H., and A. Brazel

A number of studies have found that urban temperatures appear to have increased more rapidly than rural temperatures in the last half of the 20th century. This is attributed to urban heat island (UHI) effects and other regional drivers. In this paper, the impact of these other regional drivers as a factor in regional climate change is examined through a survey of rural to urban temperature gradients over the past decade, and a five-to-six-decade-long regional temperature trend analysis. Temperature data from over 300 national weather stations from the Western Regional Climate Center database were analyzed to develop a picture of temperature trends since the mid-1900s in the Mojave and Sonora Desert region as the context for the Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) study area. The differences in average monthly minimum temperatures between urban and rural temperatures were significant, with degrees of urbanity determined from decadal population data. The regional trends in rural and urban sites put into context a more specific area of interest, the CAP LTER site and its urban climate and location within the desert ecosystem. Trends from the regional study will be applied to the area to determine the effect of regional drivers in comparison to the UHI effect of the Phoenix metropolitan area and to determine if the study site has shown anomalous change over the 10 years since the inception of CAP LTER compared to the rest of the Southwest.

School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

***Opportunities and Challenges to Linking Science and Policy in the Luquillo LTER: Preliminary Findings on Stakeholder Perspectives of Water Governance and Sustainability**

Muñoz-Erickson, T. A.[1], K. Larson[1,2], and J. Declet[2]

Scientists of the Luquillo Long-Term Research (LTER) Project have initiated a program to engage traditionally conflicting stakeholders in collaborative forums and discuss policy and science priorities for water management in the Luquillo Mountains region. Integral to this effort is the need to assess participants' understanding and satisfaction with this program in order to enhance its knowledge dissemination and integration purposes as they move forward in developing sustainable development scenarios for the area. At the same time, the current legal and institutional framework is undergoing numerous modifications (e.g., decentralization of water management operations and revisions of state Water Plan and municipal land use zoning regulations). This presents a dynamic context in which to analyze barriers and opportunities to effective water governance and sustainable water management. This poster presents a stakeholder analysis and a characterization of discourses that are emerging at multiple institutional scales in this region. Based on preliminary interviews, we examine the framing of water conflicts and stakeholder perspectives about water management, sustainable development, and the role of science in decision-making. While it

is too early to evaluate the effectiveness of this program, results show an overall satisfaction in terms of engaging multiple stakeholders, communicating information among different sectors, and serving as a platform for future discussions. Challenges to achieving objectives include divergent understandings about program objectives, unclear expectations of scientific information, and multi-scale divergence of development goals for the area. The implications of these findings are informative to other LTER sites or scientists working in the science-policy interface or water-related urban ecology research, as in the water-related efforts of the CAP LTER.

[1]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511
[2]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

***Ecology Explorers: K-12 Student Contributions to the CAP LTER Project**

Musheno, B.[1], and M. Elser[2]

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 '07. The top four posters from the class will be presented.

Which location do the birds think is the safest? By Jackson Du

How does the amount of species differ between urban and desert yards? By Hannah Fay and Jacob van Raaphorst

Does the presence of water influence the magnitude of bird activity? By Nathan Jack and Stephanie Kim

Does the presence of water effect the birds in a backyard? By Charmi Vasoya and Christina Manuele

[1]Desert Vista High School, 16440 S 32nd St, Phoenix, AZ 85048
[2]Global Institute of Sustainability, PO Box 873211, Arizona State University-Tempe, Tempe, AZ 85287-3211

***AHIS Dataset Search Engine: An Intelligent Approach to EML Data Management**

Nguyen, H. V.[1], C. Gries[2], and H. Davulcu[1]

Some times a user's search query may be an imperfect description of their information need. Even when the information need is well described, a search engine or information retrieval system may not be able to retrieve documents matching the query as stated. In this project, we develop a search engine empowered with text mining techniques for ecological datasets to bridge this gap. Although an increasing number of datasets are well-structured and documented in Ecology Markup Language - EML format and are available online it is still difficult for the data user to discover pertinent datasets. To take advantage of the available documentation we are developing a text mining technique to discover the correlations among terms and applying this term dependency indexing approach to develop a search engine that presents the user with meaningful keywords which will lead to the discovery of relevant existing datasets. In the first step, EML files, ecological publications, glossaries and lists of controlled vocabularies were analyzed to compute strongly correlated sets of terms. These terms are then used by the search engine to suggest related terms to the user to either narrow or expand the search. At every step the number of hits is refined and showcased to the user. The human evaluation shows that our approach yields high accuracy in terms of relevance in terms of both related keywords and datasets. In addition, we also

develop software that lets users or experts filter the meaningless keywords before the indexing process in order to produce more coherent correlated keyword list.

[1]Department of Computer Science and Engineering, Arizona State University-Tempe, PO Box 878809, Tempe, AZ 85287-8809
[2]Global Institute of Sustainability Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211

***Public Park Ecology and Neighborhood Crime: Assessing Resident Perceptions of Crime and Park Quality**

Ruddell, D. M.[1], S. L. Harlan[2], G. Luikart[3], and S. Lerman[4]

Phoenix area residents consistently rank public safety among the top three issues that matter most for a good quality of life. Literature on crime indicates that the physical environment in publicly accessible places has strong effects on neighborhood crime and often increases people's perceptions of danger in low-income central city neighborhoods. The “ecology of fear” hypothesis suggests that the types and maintenance of park vegetation and landscaping affect both the incidence of crime and public perceptions of it. Specifically, scholars have linked vegetation density with lower reported crime rates and increased perceptions of fear. This study considers land use and land cover (LULC) classifications and various vegetation indices to measure the biophysical environment of 17 parks within 14 neighborhoods being studied as part of the Phoenix Area Social Survey (PASS). Analyses examine the effects of park ecology on reported crime rates obtained from local police departments while incorporating resident perception on park quality and neighborhood safety.

[1]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[2]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[3]Environmental Studies, New College of Florida, Sarasota, FL 34234
[4]Graduate Program in Organismic and Evolutionary Biology, University of Massachusetts at Amherst, Amherst, MA 01003

***Ancient Agriculture of the Perry Mesa Tradition in Central Arizona: Interpreting Ancient Land-use and Modern Landscapes**

Schaafsma, H.[1], M. Kruse[2], W. Russel[2], J. Briggs[1], K. Speilmann[2,3], and S. Hall[1]

Recent surveys of large segments of Perry Mesa in the Agua Fria National Monument revealed a previously undocumented agricultural system. The newly discovered fields are associated with settlements of the Perry Mesa Tradition dating from ca. AD 1250-1375 and extend over hundreds of acres, incorporating many dry-land water and soil control features. These features are represented by a range of feature types including terraces, check-dams and areas cleared of stone to grow a variety crops from native and imported agave species, to cultivars such as maize and squash. The existence of these features has implications for current archaeological research regarding the sustainability of these prehistoric community and their interactions with the surrounding cultural groups. Our ongoing research is seeking to 1) quantify the land cultivated by each pueblo, 2) determine the types of ancient landscape modifications and degree of alterations needed to create persistent ecological legacies, and 3) provide this information to land managers regarding the extent of culturally modified landscape that exists within the National Monument for interpretive purposes and preservation.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

[2]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

Water Resources, Climate Change and Institutional Vulnerability: A Case Study of Phoenix, Arizona

Seetharam, M.[1], B. Bolin[1,2], B. Pompeii[1,3], and P. Gober[1,3]

We examine the security of water resources in Phoenix, Arizona, under different scenarios of climate change, consumption, and reductions of available surface water. As one of the fastest growing metropolitan areas in the US, with limited water supplies, Phoenix constitutes a key site for examining the projected effects of climate change on water resources. Water providers in the Phoenix Active Management Area rely on a mix of water sources to deliver to their customers. Primary sources include groundwater, water from the Salt/Verde watershed, water from the Colorado River, and effluent (water reuse). Water providers in Phoenix vary by the security of their water portfolios. Senior water rights holders have the most secure water portfolios while those with junior rights and those dependent on regulated groundwater are more vulnerable to reduced water availability. To assess institutional vulnerability to reduced water supplies available for delivery we consider three questions: 1. What are estimated population increases in each water provider's service area in 2030? 2. Based on current average water portfolio mixes, what is the current relative security of each provider's portfolio? 3. Using different climate scenarios for the Colorado and Salt-Verde watersheds, and projected increasing demands based on population growth, what patterns of institutional vulnerability appear likely to manifest themselves in 2030? We map patterns of projected institutional vulnerabilities and discuss options for mitigating potential impacts of climate change.

[1]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[2]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[3]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

***"Missed Opportunities"in Central Arizona Water Management: Reconciling the Local Supply of and Demand for Science**

Senneville, C.[1,2], K. Larson[3,4], A. Wutich[4,5], T. Lant[5,6], M. Gartin[4,5], D. White[2,7], S. Ledlow[1,5], and P. Gober[3,5]

Increasingly, scholarly research contends that the decision process is most capable of addressing societal goals when decision-making and science communities are integrated, enabling the coproduction of mutual interests. This is an exploratory study of a boundary organization in a water resource decision context in Phoenix, Arizona. Greater Phoenix comprises a complex arrangement of institutions governing water resources in the face of climatic variation and rapid urbanization. The uncertainty such sustainability challenges beget the decision process necessitate efficient, effective exchanges within the "hybrid space" generated by science-policy processes. We apply the "missed opportunity matrix" methodology to characterize the relationship between the provision of science and stakeholders' stated needs for it. The Decision Center for a Desert City has positioned itself at this nexus, and, in part to reconcile its apparent dissonance, presents WaterSim, an interactive water futures simulation model. This study is a preliminary analysis of the transcribed interactions among decision-makers during WaterSim I focus group sessions in Fall 2006, to

determine specifically what stakeholders need or do not need relative to what has been provided by the model. Demanded information includes stakeholders' jurisdiction-scale data and the ramifications of conservation policies. The number of statements indicating that other information is needed far exceed references to what is provided by or needed of the model that already exists. The objectives of this research aim to contribute to enhancing the effectiveness of environmental science-policy exchanges, by understanding the mismatches between the supply of and demand for information in the academic and management sectors.

[1]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511
[2]Consortium for Science, Policy, and Outcomes, Arizona State University-Tempe, PO Box 874401, Tempe, AZ 85287-4401
[3]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104
[4]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[5]Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209
[6]The Decision Theater, Arizona State University-Tempe, PO Box PO Box 878409, Tempe, AZ 85287-8409
[7]School of Community Resources and Development, Arizona State University-Phoenix, 411 N. Central Ave, Phoenix AZ 85004-2115

Park Access and Equity in Phoenix

Sister, C.[1], and C. Boone[2,3]

The equitable distribution of park resources in Phoenix metropolitan area was examined to test the environmental justice hypothesis that disadvantaged groups, specifically communities of color have disproportionately lower access to park resources. Utilizing the concept of Thiessen (Voronoi) polygons, we delineated park service areas (PSAs) such that every resident for each metropolitan area was assigned to the closest park. PSAs with high potential congestion (i.e., more residents per park acre) were deemed as having lower access. Results show that predominantly Latino communities in the Phoenix metropolitan area were typically located in relatively more dense neighborhoods with PSAs having higher levels of potential congestion. Areas with high levels of potential park congestion are also typically low-income. These groups (i.e., minority, low-income) therefore have lower access in terms of park acre per capita compared to predominantly White and relatively high income communities. Examining the distribution of parks in the Phoenix metropolitan area help elucidate how urban processes have helped shape the distribution of amenities, such as parks, across different groups in the population, allowing more access to some while excluding others.

[1]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211
[2]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[3]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

Urban Tree Health in the Phoenix Metropolitan Area

Stutz, J. C.

Despite the economic, aesthetic and environmental benefits of urban trees, assessments of urban tree health are rare. In this study, the health of trees was evaluated at 60 nonresidential sites in Phoenix metropolitan area. Tree canopy health was visually assessed for over

700 trees by considering branch dieback, density of foliage (species dependent) and discolored foliage with each tree placed into one of four categories (very good, good, fair or poor). Each tree was assessed for the presence and location of wounding, % canopy dieback, pruning problems (including topping, bark tearing, presence of large stub and flush cuts), and presence of known biotic (diseases and pests) and abiotic problems (stress and problems with unknown etiology). About two-thirds of the trees were classified to have very good or good canopy health. Despite this general trend, a significant number of trees (15%) were rated as having poor canopy health. Biotic and abiotic problems were detected in 90% of trees with poor canopy health. Physical/mechanical injury to roots, trunk or main scaffold branches was detected in half of the trees and pruning problems in 70% of trees. Biotic problems (diseases and pests) were detected in 40% of the trees assessed and abiotic problems in 23% of trees. The most common disease and pest problems included slime flux, sooty canker, wood decay, aphids and sapsucker bird damage. The most common abiotic problems were sunburn of tree bark (10%) and iron chlorosis (3%).

Department of Applied Biological Sciences, Arizona State University-Polytechnic, 7001 E. Williams Field Rd, Mesa, AZ 85212

New Informatic Model for Identifying Urban Plant Problems

Stutz, J. C.[1], J. Costello[2,3], A. Gerbasio[2,3], C. Gries[4], and E. Gilbert[4]

An informatic application is being developed to aid urban field biologists, environmental educators, students and residential homeowners in the identification of common disease, stress and pest problems of landscape trees and shrubs. The application utilizes the Symbiota Identification Key a PHP/MySQL platform-independent web application that was developed to integrate a number of previously established datasets to aid in plant identification. For this application, the user first views a list of common plant problems based on geographical criteria (in this case the Phoenix, Arizona metropolitan area). Once an initial checklist is assembled, the application allows users to select from a list of common symptoms and signs they may observe on landscape trees and shrubs. The program uses this information to reduce the number of possible identifications based on symptoms and signs. Possible causal agents for the user's problem are determined through browsing images and additional descriptive data. Links to other websites will provide additional information about each problem including management options.

[1]Department of Applied Biological Sciences, Arizona State University-Polytechnic, 7001 E. Williams Field Rd, Mesa, AZ 85212
[2]School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501
[3]Barrett Honors College, Arizona State University-Tempe, PO Box 871612, Tempe, AZ 85287-1612
[4]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211

Arizona Hydrologic Information System: Enhanced Data Accessibility Using Web Services

Subramanya, S.[1], C. Gries[2], K. Jacobs[3], W-D. Otte[4], R. Vazquez[5], J. Abraham[3], R. Aguilar[2], J. McGill[3], and H. Liu[1]

The Arizona Hydrologic Information System (AHIS) is the information infrastructure for the Arizona Water Institute. Its purpose is to provide access to data relevant to water-related research, technology, planning, education and outreach from multiple sources. Its goal is to catalog and document the data; develop cyber infrastructure to allow users to find access and obtain data online and provide online tools to analyze the data. To fulfill this goal we have developed the 'AHIS Web Service Infrastructure' to provide seamless access to the

data while hiding its complexity from the user and allowing a variety of applications and tools to access the data. The Web Service Infrastructure makes available online, the Arizona Department of Water Resources' Flood Warning System data (currently archived by Salt River Project and selected water data hosted by the Arizona Department of Environmental Quality). The AHIS Web Service infrastructure is beneficial to not only the data providing agencies but also researchers, scientists, policy makers, industry, and the general public.

[1]Department of Computer Science and Engineering, Arizona State University-Tempe, PO Box 878809, Tempe, AZ 85287-8809
[2]Global Institute of Sustainability, Arizona State University-Tempe, PO Box 873211, Tempe, AZ 85287-3211
[3]Arizona Water Institute, PO Box 210158B, 845 N. Park Avenue, Ste 532, Tucson, AZ 85721-0158
[4]Department of Computer Science, College of Engineering and Natural Sciences, Northern Arizona University, Flagstaff, AZ 86011
[5]Sustainability of Semi-Arid Hydrology and Riparian Areas, University of Arizona, PO Box 210158-B, Tucson, AZ 85721-0158

***Comparison of Trace Metal Deposition in Northern and Central Arizona**

Sweat, K. G.[1], T. H. Nash III[1], P. Prapaipong[2], and P. T. Gremillion[3]

Atmospheric deposition of trace elements to an epilithic lichen was assessed for an urban and rural area in Arizona, USA. The urban area consisted of 27 locations throughout Maricopa County corresponding to a previous study; the rural area was 51 locations throughout the combined lands of the Grand Canyon National Park, Grand Canyon Parashant National Monument and areas of the Navajo Nation. Additional samples of *Xanthoparmelia* spp. were obtained from Arizona State University lichen herbarium material (1970-1973) sampled from the region to explore temporal trends, with an emphasis on decreases in lead (Pb) and copper (Cu) from the phase out of leaded gasoline and closing of copper smelters and increases in zinc (Zn) from agriculture. Lichens were cleaned, homogenized and then samples were split to be analyzed by both cold vapor technique for mercury (Hg) and wet digested in a high-pressure microwave oven to analyze by high resolution ICP-MS for a suite of trace elemental concentrations [Aluminum (Al), Antimony (Sb), Arsenic (As), Barium (Ba), Bismuth (Bi), Cadmium (Cd), Caesium (Cs), Chromium (Cr), Cobalt (Co), Cu, Dysprosium (Dy), Erbium (Er), Europium (Eu), Gadolinium (Gd), Hafnium (Hf), Holmium (Ho), Iron (Fe), Lanthanum (La), Pb, Manganese (Mn), Molybdenum (Mo), Neodymium (Nd), Nickel (Ni), Niobium (Nb), Platinum (Pt), Praseodymium (Pr), Rhenium (Re), Rubidium (Rb), Samarium (Sm), Scandium (Sc), Selenium (Se), Silver (Ag), Strontium (Sr), Tantalum (Ta), Terbium (Tb), Thallium (Tl) Thorium (Th), Thulium (Tm), Tin (Sn), Titanium (Ti), Tungsten (W), Uranium (U), Vanadium (V), Ytterbium (Yb), Yttrium (Y), and Zn]. Replicate measurements of International Atomic Energy Agency 336 lichen standard reference material are in close agreement with the certified elemental compositions. Cluster analysis and principal components analysis are used to compare patterns of deposition from anthropogenic and geologic sources. Initial research suggests higher levels of anthropogenic metals in the urban areas, including a significantly higher average mercury level in the urban lichens, although Hg is also emitted by power plants within 100-mile radius of the Grand Canyon area.

[1]School of Life Sciences, Arizona State University-Tempe, PO Box 874601, Tempe, AZ 85287-4601
[2]School of Earth and Space Exploration, Arizona State University-Tempe, PO Box 871404, Tempe, AZ 85287-1404
[3]Department of Civil and Environmental Engineering, Northern Arizona University, PO Box 5621, Building 21/Room 132, Flagstaff, Arizona 86011

***Ground Arthropod Diversity at North Desert Village**
Taylor-Taft, L., and S. Faeth

While many studies have shown that urbanization and land-use type significantly impact species richness and evenness, few studies have investigated the mechanisms by which these changes occur. A residential neighborhood at Arizona State University at the Polytechnic campus has been designed with four different neighborhood landscape regimes and provides the ideal opportunity to explore how local neighborhood landscaping affects biodiversity and food web structure and function of arthropod communities. Species richness, abundance and evenness were compared for ground dwelling arthropods before and after the installation of the North Desert Village landscape treatments. This study can provide insights and understanding into the fundamental processes of how local landscaping practices alter diversity, relative abundances, and trophic structure of biological communities.

School of Life Sciences, Arizona State University-Tempe, PO Box 874501, Tempe, AZ 85287-4501

Using WaterSim for Education: A Work in Progress
Tschudi, M.

The Decision Center for a Desert City developed WaterSim, a computer simulation model of water consumption and availability in central Arizona, to communicate complex interrelationships among water, climate, and urban growth. Initially WaterSim was presented in Arizona State University's Decision Theater to facilitate discussions among city water managers about the consequences of different growth rates, climate conditions, and policy choices on future water availability. Later, we created a user-friendly Web interface for educators and the general public (http://watersim.asu.edu).

This poster will review the use of WaterSim on the Web in high school and college classrooms and its potential for education outside the classroom. WaterSim on the Web has averaged 13 visitors a day since it was launched in August 2007. Teachers at the K-12 and university levels have used it in a variety of courses and for a range of purposes. The poster provides an overview of these applications, including activities directly sponsored by DCDC, its current use in classes at the University of Arizona, and future plans.

Decision Center for a Desert City, Arizona State University-Tempe, PO Box 878209, Tempe, AZ 85287-8209

***Pricing for Conservation and Response to Growth and Drought in Tucson and Phoenix**
Turner, V. K.

Water, like many natural resources, has been conceptualized — and managed — as either a public good or a commodity. These conceptualizations are reified by institutional forces that yield dichotomous water pricing goals: conservation and revenue. Tucson and Phoenix illustrate this dichotomy well. Tucson uses an inverted block rate pricing structure in which price increases with usage are associated with conservation. Conversely, Phoenix uses a declining block rate structure in which price decreases for use above a certain threshold and does not encourage conservation. Both cities have become increasingly vulnerable to water shortages as rapid urban growth continues and the uncertainties of climate change complicate water supply models. Nevertheless, Tucson has chosen to embrace conservation and

Phoenix has not. Facing similar environmental concerns, differing institutional values account for differences in approaches to water management and conservation in the two cities. Water management choices also have different environmental justice outcomes, rendering certain groups more vulnerable to water shortages than others.

This paper illuminates the institutional differences driving water management decisions in Tucson and Phoenix and the resulting social justice ramifications using archival evidence, correspondence with water agencies, and secondary literature sources. Institutions imbedded in more liberal traditions, like those in Tucson, are more likely to conceive of water as a public good and to address conservation through pricing structures. Moreover, these liberal tendencies will better equip the city to address environmental justice issues associated with conservation.

School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

Do People Notice Birds?

Warren, P. S[1], S. B. Lerman[2], and S. Harlan[3,4]

Gradual environmental change is often thought to escape the detection of average citizens until conditions reach critical thresholds. Yet, the question is rarely asked, do people notice small changes in their local environments? Local extinctions in animal communities in urban areas are an example of this kind of gradual change. For example, in the years after establishment, suburban housing developments may gradually lose species richness. Human residents of these developments might or might not detect these shifts in the animal communities around them. In concurrent studies of bird communities and human neighborhood satisfaction, we asked whether variation in bird diversity accords with human perceptions of local bird diversity. Survey respondents were asked to rate the “variety of birds" in their neighborhood as being highly satisfactory to highly unsatisfactory, and in their ideal neighborhood from highly desirable to highly undesirable. Respondent's ratings of their ideal variety of birds were not correlated with satisfaction ratings or with actual diversity, though most rated it as having high or moderate desirability (81%). Satisfaction with the existing variety of birds, however, was significantly correlated with actual bird diversity (Rho=0.49, p=0.0001). Nearly twice as many respondents gave positive satisfaction ratings (93%) of bird diversity in neighborhoods with high actual bird diversity as in neighborhoods with low diversity (47%). Respondents' satisfaction with the variety of birds may simply reflect their general neighborhood satisfaction levels. Yet, the results are suggestive that people not only care about biodiversity in their local environs, but they notice its loss.

[1]Department of Natural Resources Conservation, Holdsworth Hall, University of Massachusetts at Amherst, Amherst, MA 01003
[2]Graduate Program in Organismic and Evolutionary Biology, University of Massachusetts at Amherst, Amherst, MA 01003
[3]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402
[4]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

Landscape Treatment and Residents' Satisfaction: Results from Wave 2 of the North Desert Village Social Survey

Yabiku, S.[1], D. Casagrande[2], and E. Farley-Metzger[3]

The North Desert Village experiment is a combination of efforts from both the biophysical and social sciences. In 2004, a pre-treatment social survey of housing residents was conducted. This was followed by manipulation that altered the landscapes of residents' homes and common areas to resemble typical landscaping archetypes in the Phoenix metropolitan area: native desert, xeric, mesic, and “oasis” (a combination of xeric and mesic elements). In 2006, the first post-treatment social survey of residents was conducted. Analysis of this post-treatment data showed that residents' satisfaction with their landscapes changed in response to treatment. Resident satisfaction and the landscapes treatments' water requirements were positively correlated. In addition, residents' landscape preferences changed little from 2004 to 2006.

[1]School of Social and Family Dynamics, Arizona State University-Tempe, PO Box 873701, Tempe, AZ 85287-3701

[2]Department of Sociology and Anthropology, Western Illinois University, Morgan Hall 403, 1 University Circle, Macomb, IL 61455

[3]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe, AZ 85287-2402

***Water Vulnerability on the Urban Periphery: The Case of Metropolitan Phoenix, Arizona**

Zautner, L.[1], K. Larson[2], and B. Bolin[3]

With the ongoing drought approaching a decade in Arizona, scholars, water managers and decision-makers have heightened attention to the availability of water resources, especially in rapidly growing regions where demand may outgrow supplies or where conflicts might erupt over competing demands for water. Community water system managing entities and the physical and social characteristics of a place mediate communities' vulnerability to hazards such as drought, in addition to their ability to cope with potential water shortages and other water- and climate-related risks such as flooding. Ongoing case study research in Buckeye and Cave Creek, Arizona, investigates water management issues in the context of unprecedented growth in the greater Phoenix region.

Buckeye, once a small agricultural town in the west Valley is wholly dependant on groundwater and currently planning for massive development to accommodate 325,000 new residents by 2025. Amid desert hills and near Tonto National Forest in the north Valley, Cave Creek is an upscale residential community suffering frequent water outages due to aging infrastructure and lack of system redundancy. This poster will illustrate comprehensive comparative assessments of water related vulnerability, with a focus on the unique physical and social factors that increase the potential for losses in each area. In this context, differential community water system management practices are explored to better understand the role that local water managers and decision makers have in mediating the effects of water scarcity on peri-urban communities.

[1]School of Geographical Sciences, Arizona State University-Tempe, PO Box 870104, Tempe, AZ 85287-0104

[2]School of Sustainability, Arizona State University-Tempe, PO Box 872511, Tempe, AZ 85287-2511

[3]School of Human Evolution and Social Change, Arizona State University-Tempe, PO Box 872402, Tempe AZ 85287-2402

Factors that Contribute to Distribution Patterns of Trace Elements in Maricopa County

Zhuo, X., P. Prapaipong and E. Shock

Trace elements such as lead (Pb), copper (Cu), and zinc (Zn) are components of automobile exhaust, and their distribution in the urban environment may be expected to correlate with patterns of traffic volume. In this study, historical traffic data were collected and distilled for each location in the CAP LTER 200-point survey through GIS analysis, and regressed against our preliminary trace element data from the top soils at the same locations. In every case, there is a somewhat stronger correlation between the trace element distribution patterns and traffic data from 1972 than with traffic data from 2004. This suggests that the accumulation of trace elements in the soil may have historical origins. However, the low regression coefficient indicates that there are other factors that influence trace elemental distribution. Answers may be found in our upcoming historical study of industrial emissions.

School of Earth and Space Exploration, Arizona State University-Tempe, PO Box 871404, Tempe, AZ 85287-1404

NOTES