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

Eighth Annual Poster Symposium

January 19, 2006
Carson Ballroom, Old Main
Arizona State University

GLOBAL INSTITUTE of SUSTAINABILITY
ARIZONA STATE UNIVERSITY

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8:00-9:00 AM	Coffee, fruit, bagels, and muffins
9:15-9:30	**Charles Redman**, *Julie Ann Wrigley Director, Global Institute of Sustainability and Co-Director, CAP LTER.* ***Introduction.***
9:30-9:50	**Nancy Grimm**, *School of Life Sciences, Global Institute of Sustainability, and Co-Director, CAP LTER.* ***Ecosystem Responses to Inorganic Nitrogen and Organic Carbon Deposition from the Urban Atmosphere.***
9:50-10:10	**Stanley Faeth**, *School of Life Sciences.* ***Trophic Dynamics in Urban Ecosystems.***
10:10-10:30	**Margaret Nelson**, *School of Human Evolution and Social Change.* ***Long-Term Coupled Socioecological Change in the American Southwest and Northern Mexico.***
10:30-10:50	**Joseph Tainter**, *Global Institute of Sustainability.* ***Water and Agriculture.***
10:50-11:10	**John Anderies**, *School Human Evolution and Social Change.* ***Loss of Resilience, Crisis, and Institutional Change: Lessons from an Intensive Agricultural System in Southeastern Australia.***
11:10-11:30	**Kelli Larson**, *Department of Geography and Global Institute of Sustainability.* ***Geographic, Social Science and Interdisciplinary Perspectives on Urban Ecology: A Developing Research Agenda***
11:30-11:50	**Marcus Janssen**, *School of Human Evolution and Social Change and Department of Computer Science and Engineering.* ***Dynamics of Rules in Commons Dilemmas.***
12:00-1:00	Wrap-up discussion and lunch
1:00-1:15	**Nancy Grimm**, *School of Life Sciences, Global Institute of Sustainability, and Co-Director, CAP LTER.* ***Welcome and Introductions.***
1:15-2:15	**Keynote Speaker, Daniel L. Childers**, *Florida International University and Lead PI of Florida Coastal Everglades LTER.* ***Coupling Human and Natural Interactions in the Dynamic Coastal Landscape of the Florida Coastal Everglades.***
2:15-3:15	Poster Session #1
3:15-3:30	Social with refreshments
3:30-4:30	Poster Session #2
5:00-6:00	Reception with Dr. Childers

DANIEL L. CHILDERS

Daniel L. Childers is a Professor of Biology at Florida International University. He has held a joint appointment in the Biology Department and the Southeast Environmental Research Center since 1994, and has been the Lead PI of the Florida Coastal Everglades LTER Program since its inception in 2000. Dan received BA degrees in Biology and Environmental Studies in 1983 from the University of Virginia, a MS in Marine Science in 1985 from the University of South Carolina, and a Ph.D. in Marine Science in 1989 from the Center for Wetland Resources at Louisiana State University. His research focuses on wetland ecosystem ecology, in particular questions about controls on primary production, biogeochemical cycling, and soil dynamics. He has worked in both forested and herbaceous wetland ecosystems, and in many different freshwater and estuarine settings around the world.

2006 CAP LTER Symposium

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

Poster Session #1	Poster Session #2
Atkinson-Palombo (1)	Buyantuyev, Brazel, & Eisinger (29)
Balling & Goodrich (7)	Buyantuyev & Wu (28)
Brown & Hartnett (2)	Clancy, Kalkstein, Gerrity, & Kuby (30)
Collins, Bolin, Youngs, & Tluczek (8)	Dugan, Fisher, & Lund (44)
Ellis, Garfin, Balling, & Graham (9)	Dugan, Landrum, Gries, Wojciechowski, & Hope (45)
Gonzales & Allen (3)	Faeth, Marussich, Warren, & Shochat (35)
Guhathakurta (10)	Gade & Kinzig (36)
Hartnett & Brown (4)	Gries, Hope, Grimm, Faeth, Martin, Warren, Hutchins, Redman, Stefanov, Moeller, & Edmonds (46)
Hedquist & Comparii (11)	Grossman-Clarke & Zehnder (31)
Kirkwood, Keller, & Jones (12)	Ingram (39)
Lant (19)	Kapoor, Kinzig, & Perrings (47)
Larson & Grimm (5)	Kobayashi (25)
Majumdar, Kaye, Gries, Hope & Grimm (6)	Kruse, Schaafsma, Schollmeyer, Briggs, Horn, Kintigh, Lai, Spielmann, & Wichlacz (41)
McCracken, Harms, & Grimm (13)	Larson, Servis, Casagrande, Farley-Metzger, Harlan, Larsen, Yabiku (40)
McClean, Prapaipong, Zolotova & Shock (14)	Moeller (24)
Murphy & Kinzig (20)	Neff, Chhetri, Hidinger, & Meyer (32)
Prapaipong & Shock (15)	Ruddell, Gustafson, Walker, & Harlan (48)
Peterson, Howe, White, White, & Corley (21)	Saltz, Crocker, Taddy, & Elser (49)
Wentz & Gober (22)	Saltz, Elser, Michel, & Cutts (50)
Wong, Murawski, Szlavecz, Pouyat, Marra, Casey, & Lev (16)	Schaafsma, Johnson, & Briggs (42)

Poster Session #1	Poster Session #2
Wu, Shen, Grimm, & Hope (17)	Singer & Martin (33) (34)
Zhuo, Prapaipong, & Shock (18)	Sprague, Shender, & O'Brien (37)
Zoldak, Lemar, Jensen, & Hutchins (23)	Stinson-Keys, Elser, & Saltz (51)
	Tyrrell & Valdez del Rio (43)
	Walker & Banzhaf (26)
	Walker & Blaschke (27)
	Warren, Tarrant, Adley, Grove, Shochat, & Faeth (38)

LIST OF POSTERS

LAND-USE AND LAND-COVER CHANGES

Alexander Buyantuyev and Jianguo Wu. ***Characterizing Phoenix Urban Growth Patterns with Landscape Metrics Based on Remote Sensing Data: Effects of Thematic Resolutions.***

Yoshihiro Kobayashi. ***3D Downtown Phoenix Modeling.***

Matthias S. Moeller. ***Large-Scale Urban Change Mapping by Remote Sensing.***

Jason Walker and Ellen Banzhaf. ***Urban Tree Cover of Leipzig, Germany.***

Jason Walker and Thomas Blaschke. ***A High-Resolution Urban Landcover Classification Scheme for Phoenix.***

CLIMATE-ECOSYSTEMS INTERACTIONS

Alexander Buyantuyev, Anthony Brazel, and Chris Eisinger. ***Estimating Anthropogenic Heat Discharge and the Urban Heat Island (UHI) of Phoenix with Remote Sensing and Meteorological Data.***

James Clancy, Adam Kalkstein, Daniel Gerrity, and Michael Kuby. ***An Analysis of Air-Mass Effects on the Use of Rail Transit Systems.***

Susanne Grossman-Clarke and Joseph A. Zehnder. ***Testing a Planetary Boundary Layer Scheme in MM5 for the Phoenix Metropolitan Region: Influence of Urbanization on Weather in the Phoenix Metropolitan Region.***

Mark Neff, Netra Chhetri, Lori Hidinger, and Ryan Meyer. ***Science Policy and Research on Climate: Ecosystem Sensitivity Analysis.***

Catherine K. Singer and Chris A. Martin***. Effects of Surface Mulches on Soil Moisture Content and Leaf Relative Water Content of* Atriplex canescens*.***

Catherine K. Singer and Chris A. Martin. ***A Comparison of Inorganic and Organic Surface Mulches on Rates of Soil Respiration.***

FLUXES OF MATERIALS AND SOCIO-ECOSYSTEM RESPONSE

Carol Atkinson-Palombo. ***A Multidisciplinary Approach to Understanding the Relationship Between Vehicle Emissions and Air Pollution.***

Bradley Brown, and Hilairy Hartnett. ***Determination of Bulk Dissolved Organic Carbon Content in the Verde River-Reservoir System*.**

Daniel A. Gonzales and Jonathan O. Allen. ***Dry Deposition of Fine Aerosol Nitrogen to an Agricultural Field Measured by Eddy-Correlation Mass Spectrometry.***

Hilairy Hartnett and Bradley Brown. ***Evolution of Dissolved Organic Carbon Concentrations in Tempe Town Lake: Biogeochemical and Hydrologic Processes.***

Elisabeth K. Larson and Nancy B. Grimm. ***Experimental Assessment of Nitrate Filtration Capacity of Xeriscaped Stormwater Retention Basin Soils.***

Anandamayee Majumdar, Jason Kaye, Corinna Gries, Diane Hope, and Nancy Grimm. ***Does Urbanization Affect the Total N, C and Nutrient Concentrations in the Soil?***

Michelle McCracken, Tamara Harms, and Nancy Grimm. ***The Sky is Falling: Soil Microbial Responses to Deposition from the Urban Atmosphere.***

Brandon McLean, Panjai Prapaipong, Natalya Zolotova, and Everett Shock. ***The Geochemical Response of Rivers to Storm Events as Indicators of Watershed Processes.***

Panjai Prapaipong and Everett Shock. ***Chemical Footprints of Urbanization upon River Compositions.***

Christina P. Wong, Laura Murawski, Katalin Szlavecz, Richard V. Pouyat, Peter Marra, Ryan Casey, and Steve Lev. ***Heavy Metal Variations in Residential Soil Communities along an Urban to Rural Gradient.***

Jianguo Wu, Weijun Shen, Nancy B. Grimm, and Diane Hope. ***Effects of Urbanization-Induced Environmental Changes on Desert Ecosystem Functioning***.

Xiaoding Zhuo, Panjai Prapaipong, and Everett Shock. ***Patterns of Trace Element Distributions in the Urban-Desert System.***

HUMAN CONTROL OF BIODIVERSITY

Stanley H. Faeth, Wendy A. Marussich, Paige S. Warren, and Eyal Shochat. ***Trophic Dynamics in Urban Ecosystems.***

Kris J. Gade and Ann P. Kinzig. ***The Role of Transportation Corridors in Plant Migration in and around Phoenix, Arizona, an Arid Urban Area.***

Scott Sprague, Lisa Shender, and Chantel O'Brien. ***Wildlife Use of Preserved Natural Habitats Within the Greater Phoenix Metropolitan Area.***

Paige S. Warren, Phil Tarrant, Erin Adley, J. Morgan Grove, Eyal Shochat, and Stan Faeth. ***Humans in the Urban Food Web: Emerging Insights from Phoenix and Baltimore.***

HUMAN DIMENSIONS OF ECOLOGICAL RESEARCH

Scott E. Ingram. ***Archaeological Contributions to Contemporary Socioecological Issues.***

Kelli Larson, Rosanne Servis, David Casagrande, Elizabeth Farley-Metzger, Sharon Harlan, Larissa Larson, Scott Yabiku. ***Landscape Preferences in the Arid Southwest: Comparative Results from the Phoenix Area Social Survey and North Desert Village***.

Melissa Kruse, Hoski Schaafsma, Karen Schollmeyer, John Briggs, Kari Horn, Keith Kintigh, Chien Lai, Katherine Spielmann, and Caitlin Wichlacz. ***Legacies on the Landscape: Integrating Ecology and Archaeology on the Agua Fria National Monument, Arizona.***

Hoski Schaafsma, Katie Johnson, and John Briggs. ***Messages from the Past: How Modern Landscapes Reveal Prehistoric Land Use Patterns.***

Timothy Tyrrell and Sacnict Valdez del Rio. **The Nature of Economic Value.**

INFORMATION MANAGEMENT, OUTREACH, AND EDUCATION

Laura Dugan, Laura Fisher, and Bethany Lund. ***Baseline Data for a Burned Area in South Mountain Park in Phoenix, Arizona.***

Laura Dugan, Les Landrum, Corinna Gries, Martin Wojciechowski, and Diane Hope. **A System for Creating, Storing, and Identifying Plant Voucher Specimens from a Large Sampling Area.**

Corinna Gries, Diane Hope, Nancy B. Grimm, Stanley Faeth, Chris Martin, Paige Warren, Jana Hutchins, Charles Redman, Will Stefanov, Matthias Moeller, and Jennifer Edmonds. ***Long-Term Monitoring Data at CAP.***

Maya L. Kapoor, Ann P. Kinzig, and Charles Perrings. ***The CAP LTER Ecosystem Services Assessment: An Interdisciplinary Pilot Study.***

Darren Ruddell, Anne Gustafson, Jason Walker, and Sharon Harlan. ***Plans for the 2006 Phoenix Area Social Survey.***

Charlene Saltz, Nancy Crocker, Danielle Taddy, and Monica Elser. ***Service at Salado, an Urban Environmental Service-Learning Project.***

Charlene Saltz, Monica Elser, Kim Michel, and Bethany Cutts. ***Water Education Provider Survey Results.***

Lynn Stinson-Keys, Monica Elser, and Charlene Saltz. ***Ecology Explorers: K-12 Student Contributions to the CAP LTER Project.***

Robert C. Balling Jr. and Gregg B Goodrich. ***Drought Determinations for the Colorado River Basin.***

Tim Collins, Bob Bolin, Yolonda Youngs, and Melanie Tluczek. ***Peri-urban Growth, Water Conflicts, and Vulnerability in the Verde Watershed.***

Andrew Ellis, Gregg Garfin, Robert Balling, Jr., and Christopher Graham. ***Climate Variability and Change.***

Brent C. Hedquist and Erin Comparri. ***Spatial Expansion of the Greater Phoenix Urban Heat Island (1990-2004).***

Subhro Guhathakurta. ***Impact of Urban Heat Island on Residential Water Use.***

Craig Kirkwood, L. Robin Keller, and Nancy Jones. ***Decision Research in Water Resources Management: A Multiple-Objective, Multiple-Stakeholder Analysis.***

Timothy Lant. ***A System Dynamics Model for Water Supply and Demand in Greater Phoenix.***

John T. Murphy and Ann P. Kinzig. ***The Hohokam Water Management Simulation: Collaborative Modeling of a Complex Coupled Human/Environmental System.***

Arianne Peterson, Peter Howe, Margaret White, Dave White, and Elizabeth Corley. ***Expert Perspectives on Science, Politics, and Water Management in Phoenix.***

Elizabeth Wentz and Patricia Gober. ***Factors Influencing Residential Water Consumption for the City of Phoenix, Arizona.***

Michael Zoldak, Shea Lemar, Ruth Jensen, and Jana Hutchins. ***Workflows: GIS Data to a Visualization Environment.***

ABSTRACTS

All abstracts are listed alphabetically by first author and also include morning speakers' abstracts if available.

Anderies, J. School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402. ***Loss of Resilience, Crisis, and Institutional Change: Lessons from an Intensive Agricultural System in Southeastern Australia.***

Linked social-ecological-systems (SESs) in which surprise and crisis are interspersed with periods of stability and predictability are inherently difficult to manage. This fact, coupled with the legacies of past management actions, typically leaves policy and decision makers few options other than to incrementally adapt and reinforce the current trajectory of the system. Decision making becomes increasingly reactive and incremental as the system moves from one crisis to another. Eventually the system loses its capacity to cope with perturbations and surprise. Using a combination of dynamical-systems modeling and historical analysis, we study such a process that unfolded in the Goulburn Broken Catchment in southeastern Australia over the past 150 years. Using the model to simulate trajectories of the biohydrological system, we correlate the state of the physical system to historical events and management action. We illustrate how sequential management decisions have eroded the resilience of the system (its ability to cope with shocks and surprises) and reduced options for future change. Using the model in a forward-looking mode, we explore future management options and their implications for the resilience of the system.

Atkinson-Palombo, C. Department of Geography and IGERT in Urban Ecology, PO Box 870104, Arizona State University, Tempe, AZ 85287-0104. ***A Multidisciplinary Approach to Understanding the Relationship Between Vehicle Emissions and Air Pollution.***

Vehicle emissions account for an increasing proportion of urban air pollution in developed countries. Policymakers are therefore placing increasing emphasis on trying to understand the complex atmospheric chemical processes related to vehicle emissions. Ozone, in particular, has proven to be particularly tricky to understand, and therefore predict and manage. Given the photochemical nature of ozone production, it is especially problematic in the sunbelt states of California, Nevada, and Arizona, where the combination of sunshine and ongoing rapid auto-centric urbanization has led to critical exceedance of federal air quality standards. However, reducing ozone is not a simple matter of reducing vehicle emissions. In fact, a reduction in vehicle emissions in some places triggers an increase in ozone, something that has been termed "the weekend effect" since it was first identified in the 1970s. There is no clear consensus as to the causes of the weekend effect, but in the meantime, decisions are being made to reduce certain types of emissions that may actually have a negative impact on ozone levels. We discuss the weekend effect, using Maricopa County, Arizona, as a case study. Our findings suggest that calls for alternative transportation and policies focusing on emission reduction need to take more fully into account these complex atmospheric processes.

Balling Jr., R. C., and G. B. Goodrich. Department of Geography, Arizona State University, PO 870104, Tempe, AZ 85287-0104. ***Drought Determinations for the Colorado River Basin.***

Ongoing drought in the Colorado River Basin, unprecedented urban growth in the watershed, and numerical model simulations showing higher temperatures and lower precipitation totals in the future have all increased interest in drought in this region. In this investigation, we used principal components analysis (PCA) to independently assess the influence of various teleconnections on Basin-wide and subregional winter season Palmer Hydrological Drought Index (PHDI) and precipitation variations in the Basin. We found that the Pacific Decadal Oscillation (PDO) explains more variance in PHDI than El Niño - Southern Oscillation (ENSO), the Atlantic Multidecadal Oscillation (AMO), and the planetary temperature combined for the Basin as a whole. When rotated PCA is used to separate the Basin into two regions the lower portion of the Basin is similar to the Basin as a whole, while the upper portion, which contains the high elevation locations important to hydrological yield for the watershed, demonstrates poorly defined relationships with the teleconnections. The PHDI for the two portions of the Basin are shown to have been out of sync for much of the 20th Century. In general, teleconnection indices account for 19% of the variance in PHDI leaving large uncertainties in drought forecasting.

Bills, R.[1], and J. Stutz[2]. [1]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe AZ 85287-4601; and [2]Applied Biological Sciences Department, Arizona State University, 7001 E. Williams Field Road, Mesa AZ 85212. ***Effects of Arbuscular Mycorrhizal Suppression on Productivity of* Encelia farinosa *(Brittlebush) at an Urban and a Desert Site.***

Arbuscular mycorrhizal (AM) fungi are obligate symbionts that are found in roots of roughly 75% of the terrestrial plants around the world. AM fungi have recently been shown to have a pivotal role in plant community ecology by altering plant productivity and diversity. The purpose of this study is to examine the impact of AM fungi on the productivity of *Encelia farinosa* (brittlebush) plants with suppressed and normal colonization levels of AM fungi at an urban and desert site. In general, plants with suppressed mycorrhizal colonization had greater vegetative growth. Suppression of mycorrhizae had no affect on reproductive output. Biomass and reproductive output was higher at the urban site in comparison to the desert site.

Brown, B.[1], and H. Hartnett[1, 2]. [1]Department of Chemistry and Biochemistry, Arizona State University, PO Box 871604, Tempe, AZ 85287-1604; and [2]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe, AZ 85287-1404. ***Determination of Bulk Dissolved Organic Carbon Content in the Verde River-Reservoir System.***

The biogeochemical processes that alter dissolved organic carbon (DOC) in rivers may be different in pristine and human-influenced river reaches. Five sites along the Verde River system have been sampled monthly from Aug 2004 to Dec 2005. The sampling sites consist of two upstream sites (pristine sites) and three downstream sites where the river is influenced by human alterations (i.e., lakes and dams). We made measurements of bulk DOC, conductivity, pH, dissolved oxygen, and temperature. Carbon concentrations are generally highest at the downstream sites. Carbon concentrations are lower, but more variable in the upstream, pristine sites. Conductivity decreased from upstream to downstream suggesting freshwater inputs from

tributaries; there is an inverse correlation between conductivity and DOC. The increase in DOC over the same reaches suggests a source of DOC within the river, perhaps production by phytoplankton. Processes that remove DOC from the river have been examined through laboratory experiments. Approximately 20% of the riverine DOC could be degraded or removed via photo-oxidation after 6 hours of exposure to direct sunlight. These results suggest that there is a complex set of processes that produce and remove DOC in the river. This study provides a better understanding the biogeochemical processes that are controlling the DOC content in the Verde River which is a major source of water and drinking water for the Phoenix area.

Buyantuyev, A.[1], A. Brazel[2], and C. Eisinger[3]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [2]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [3]Mars Space Flight Facility, Department of Geological Sciences, Arizona State University, PO Box 876305, Tempe, AZ 85287-6305. ***Estimating Anthropogenic Heat Discharge and the Urban Heat Island (UHI) of Phoenix with Remote Sensing and Meteorological Data.***

Urban development has profound effects on local and regional climates. The Urban Heat Island (UHI), caused primarily by land use-land cover changes accompanying urbanization, is perhaps the most pervasive and well-known phenomenon of urban climatology. In this study we investigate the spatial structure of heat fluxes in the Greater Phoenix metropolitan area by implementing the heat-balance model to infer anthropogenic heat discharge. This work is implemented using multi-seasonal daytime and nighttime ASTER satellite imagery and local observations from meteorological stations. Short-wave radiation, air temperature, relative humidity, wind speed, and air pressure from three meteorological networks (approx. 70 individual stations) were interpolated on to a grid. Standard ASTER products were then used to derive maps of land cover, surface temperature, spectral emissivity, and albedo. Heat fluxes that contribute to the net radiation, including ground, sensible, and latent heat, were also computed or estimated using known relationships from the literature. Finally, the anthropogenic sensible heat transferred into the atmosphere from artificial surfaces was calculated as the difference between the total sensible heat flux and the heat flux calculated from the radiant heat balance. Our preliminary results show that Phoenix has a clear footprint of increased sensible heat, especially during the night. The contribution of anthropogenic heat discharge is higher in the central urban area and shows a distinct seasonal variation. These findings will enable us to relate the spatial and seasonal structure of the Phoenix UHI to land use and land cover.

Buyantuyev, A., and J. Wu. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Characterizing Phoenix Urban Growth Patterns with Landscape Metrics Based on Remote Sensing Data: Effects of Thematic Resolutions.***

In this study, we investigated (1) land use and land cover change in the Central Arizona – Phoenix (CAP LTER) during the period of 1985-2000, (2) the effects of different levels of land-cover classifications (thematic resolutions) on the behavior of commonly used landscape metrics, (3) the effects of precipitation on land-cover classifications, and (4) scale effects on relationships between biophysical and socioeconomic variables. We used 15-year time series data of land use and land cover for the CAP LTER which were derived from Landsat TM imagery.

Land cover maps with 12 classes were first created for five different years between 1985 and 2000, and then progressively aggregated into 9, 6, 4, and 2 land-cover classes following the same set of criteria. The results showed that during the study period most examined landscape metrics exhibited similar temporal patterns at different levels of classification, although significant differences did occur in some cases. However, the thematic resolution of land-cover maps showed consistent and substantial effects on landscape metrics for a given year (or a particular map). These results were in general agreement with our previous findings of the effects of changing spatial resolution and extent on landscape metrics in that they fall into two general groups: metrics showing consistent patterns of variation and metrics showing unpredictable behavior. Also, most metrics were found to be sensitive to inter-annual variations in precipitation as their temporal pattern resembled that of precipitation and Normalized Difference Vegetation Index (NDVI). Finally, our preliminary investigation suggested that the relationships between ecological and socioeconomic variables may vary considerably with the scale of analysis in terms of both grain and extent. Our results have important implications for studying land use and land cover change in urban landscapes using remote sensing data.

Childers, D. Wetland Ecosystems Ecology Lab, Florida Coastal Everglades LTER, Department of Biological Sciences, Southeast Environmental Research Center, Florida International University, Miami, FL 33199. ***Coupling Human and Natural Interactions in the Dynamic Coastal Landscape of the Florida Coastal Everglades.***

Increasingly, ecologists and environmental scientists are re-thinking conceptual approaches that traditionally have externalized (i.e., ignored) human actions, or have dealt with them as static, non-interacting drivers. A new framework, in which human systems and natural systems are considered within the conceptual umbrella of "the ecosystem," is quickly gathering favor. In the US, over 50% of the human population lives within 80 km of the coast. This demographic suggests that these coasts are among the most human-affected of all ecosystems. The 2004 and 2005 US hurricane seasons clearly demonstrate the vulnerability of these human and natural systems. Eight of 26 sites in the US LTER Network include coastal or marine ecosystem components. As such, the Network is well poised to address the dynamics of human-nature interactions in coastal ecosystems. Furthermore, the future direction of Network science will encourage and expand research into these interactions.

The Florida Coastal Everglades LTER Program (FCE LTER) is located entirely in Everglades National Park, which is immediately adjacent to Miami and to more than two million people. The Everglades is an excellent system to study human-natural interactions. This expansive wetland landscape provides freshwater to 95% of south Florida's six million residents by recharging the shallow Biscayne Aquifer with clean water. Yet this growing human population is so close to the natural system on which it depends that adverse impacts are inevitable (and are increasing). Proximity generates conflicts between human dependence on key ecosystem services and human stresses on purveyance of those services. Everglades Restoration may ease, or remove, these conflicts, but restoration success is not a foregone conclusion and many of these conflicts are coming to light because of restoration efforts. Additionally, the neo-tropical south Florida landscape is dramatically affected by larger-scale human interactions, primarily associated with global climate change. Sea level rise is a persistent "press" disturbance on this very flat landscape. Hurricanes, with their ensuing storm surge, inland flooding, and wind effects, represent a regular "pulse" disturbance that acts in concert with the sea level rise "press." Hemispheric and global climatic systems, including El Niño and the North Atlantic Oscillation, are important drivers of seasonal and interannual precipitation patterns in south Florida. As such, human

effects on large-scale climate systems have important implications for south Florida's human and natural systems.

Clancy, J.[1], A. Kalkstein[2], D. Gerrity[3], and M. Kuby[2]. [1]School of Public Affairs, Arizona State University, PO Box 870603, Tempe, AZ 85287-0603; [2]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [3]Ira A. Fulton School of Engineering, Arizona State University, PO Box 879309, Tempe, AZ 85287-9309. ***An Analysis of Air-Mass Effects on the Use of Rail Transit Systems.***

Transit agencies have long recognized that weather conditions affect human comfort, which in turn affects ridership. Spatial synoptic classification categorizes air masses relative to changes in the air mass and their characteristic content of moisture and temperature. Prior research has shown that air-mass type explains human health responses more effectively than meteorological conditions such as temperature, humidity, or precipitation.

We collected several years worth of daily ridership data for urban transit systems in Newark, Chicago, and the San Francisco Bay Area, as well as daily synoptic air-mass data. Using one-way analysis of variance, we found a highly significant relationship between air-mass classification (the independent variable) and daily ridership (the dependent variable). Prior to the analysis via one-way ANOVA, we took into account the effects on ridership due to local sporting events, holidays, and major public events, as well as weekly, seasonal, and trend time series variation. Quantification of this relationship can help rail planners predict ridership more accurately and design and locate stations better.

Collins, T.[1], B. Bolin[2], Y. Youngs[3], and M. Tluczek[2]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [2]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402; and [3]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-2402. ***Peri-Urban Growth, Water Conflicts, and Vulnerability in the Verde Watershed***.

This research examines regional and local water resource issues and conflicts in rapidly growing areas of the Verde watershed. The study area is a patchwork of water management regimes, municipal centers, uncontrolled rural growth nodes, and variable groundwater resources. Specific groundwater issues include: transfers from the Big Chino aquifer into the Prescott Active Management Area, potential impacts of Prescott groundwater overdraft on Verde River flow, effects of exempt well pumping in the Verde Valley on Salt River Project water rights, and groundwater conflicts between rural areas and municipalities in northern Gila County. Water resource and vulnerability issues are spatially variable and shaped by a variety of local social and geographic conditions. Water management strategies and environmental perceptions of a variety of local interest groups and political actors are examined in reference to these specific issues.

Dugan, L.[1], L. Fisher[2], and B. Lund[2]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]School of Life Sciences, Graduate Programs, PO Box 874601, Tempe, AZ 85278-4601. ***Baseline Data for a Burned Area in South Mountain Park in Phoenix, Arizona.***

There have been many fires in the South Mountain Park throughout its history. Unfortunately, there has been no known detailed documentation (baseline data) of the exact perimeter and area of these burns or of post-fire vegetation changes. This information can be invaluable for future researchers years, decades, and possibly even centuries from now for monitoring how the landscape changes over time in comparison to unburned areas, measuring individual species recovery rates, and making informed fire management and restoration decisions. We collected baseline data of the June 12, 2005 fire in South Mountain Park in Phoenix, Arizona, utilizing a Magellan Meridian Gold Handheld GPS to map the perimeter and a Fujifilm FinePix A340 digital camera to take pictures in four directions (NESW) at every set of coordinates we recorded. The two largest unburned patches within the perimeter were also mapped, but in less detail. We also photographed and recorded coordinates for several points of interest including portions of the Max Delta Trail which runs through the burned area, post-fire new growth, and partially burned dominant species. The information collected will be housed at ASU at <http://caplter.asu.edu/home/photos/photosearch.jsp> (photographs) and <http://caplter.asu.edu/home/projects/projsearch.jsp> (project description), and also at South Mountain Park. This information includes an Excel spreadsheet with picture numbers and associated coordinates, a map plotting the burn, patches, and points of interest created by ARCGIS software, and the entire collection of pictures. The pictures are also currently publicly available online at <http://target.pg.photos.yahoo.com/ph/south_mtn_burn_2005/my_photos>.

Dugan, L.[1], L. Landrum[2], C. Gries[1], M. Wojciechowski[2], and D. Hope[1]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***A System for Creating, Storing, and Identifying Plant Voucher Specimens from a Large Sampling Area***.

A procedure for processing and storing plant voucher specimens was developed during an extensive ecological survey conducted as part of ongoing long-term monitoring of the CAP LTER regional ecosystem. The need to back large plant inventories with voucher specimens has long been recognized. The advantages of specimen collection are that identifications may be verified or changed at a later date, and the material can be subjected to DNA sequencing analysis to provide additional identification support. However, processing and storing a large number of specimens poses logistical challenges, storage space being a particular problem. Therefore in order to streamline the cataloging and storage procedure, we used pre-folded fragment envelopes of ca. 10 X 10.5 cm with preprinted labels and collected plant fragments directly into them instead of the usual processes of collecting, pressing, and mounting full-sized herbarium sheets, and the time consuming act of label printing. A minimum of information (i.e., site ID and date) and field identifications (where known) were written on the label directly in the field. The plant material was then pressed inside the envelope, approximately 5,000 of which can be stored in just over half a herbarium cabinet. Identification was completed in the herbarium after the survey with only a few specimens left unidentifiable because of lack of reproductive structures. This was possible because the local flora is well known. Phylogenetic analysis of DNA sequences from a few unidentified specimens is in the process of being used to help identify the unknown plants to family/genus. Label information was entered into the herbarium's database, after which we were able to bulk upload information on survey sites (localities and plot

descriptions) from the survey database. Overall, this process has proved to be very efficient and provides a permanent record of the 2005 survey.

Ellis, A., G. Garfin, R. Balling, Jr., and C. Graham. Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104. ***A Hydroclimatic Indexing Concept for Monitoring Drought Derived from the Climate of the Southwestern United States.***

As an improvement over current drought indices, a method for indexing the hydroclimate of any location over any period of time is presented. The method was derived from the hydroclimate of the southwestern United States, specifically the approximate area of the Colorado River Basin. The indices are based on the truest representation of a hydroclimate, which is the difference between the natural input of water, or precipitation, and the natural climatic demand for water, or potential evapotranspiration. For time frames of less than 1 year, aggregates of the monthly input and demand were constructed and translated to a historical ranking as a percentile. For 1-year or multiple-year periods, similar aggregates of the hydroclimatic condition were created, but the individual months used to construct the aggregates were weighted depending on their importance to the mean annual hydroclimatology across the region. This places emphasis on the hydroclimatically critical portion of the year for a given location. The hydroclimatic index is directly compared to the popular Palmer Drought Severity Index (PDSI) and the Standardized Precipitation Index (SPI).

For short time frames, the inclusion of the climatic demand for water in the hydroclimatic index significantly differentiates it from the SPI in the warmer portions of the region where climatic demand is greatest. The PDSI is most different from the hydroclimatic index in the coldest and wettest areas in winter and the warmest and driest areas in summer due to its upper and lower limits on soil moisture and the inherent lag in soil moisture. The relationships of the indices on the intermediate and long terms show that the weighted hydroclimatic index most closely resembles precipitation over a 12-month period, but more closely resembles the PDSI when considering multiple years, taking on more of a hydrologic characteristic. Comparison of the indices during recent drought conditions suggests that the hydroclimatic index will respond more quickly to short term hydroclimatic changes than the PDSI while improving upon the SPI by accounting for the effect of temperature in the form of climatic demand for water. For longer time frames, the PDSI was again slow to reflect changes in the hydroclimate compared to the hydroclimatic index as illustrated with runoff on a sample watershed. In reflecting total precipitation across a time frame, the SPI overemphasized wetter years within the drought period even though much of the precipitation fell outside the runoff season, as reflected by low runoff values.

Faeth, S. H.[1], W. A. Marussich[2], P. S. Warren[3], and E. Shochat[4]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe AZ 85287-4501; [2]Department of Ecology and Evolutionary Biology, University of Arizona, PO Box 210088, Tucson, AZ 85721; [3]Department of Natural Resources Conservation, Holdsworth Natural Resources Center, University of Massachusetts, Amherst, MA 01003; and [4]University of Oklahoma, Sutton Avian Research Center, PO Box 2007, Bartlesville, OK 74005. ***Trophic Dynamics in Urban Ecosystems.***

Human activities dramatically change abundances, diversity, and composition of species. However, little is known about how the most intense human activity, urbanization, alters food webs

and trophic structure in biological communities. Long-term studies and experiments in CAP LTER, situated amid the Sonoran Desert, reveal some surprising alterations in control of trophic dynamics. Species composition is radically altered and resource subsidies increase and stabilize productivity. Changes in productivity dampen seasonal and yearly fluctuations in species diversity, elevate abundances, and alter feeding behaviors of some key urban species. In contrast to outlying deserts where limiting resources and environmental stresses dominate, predation by birds becomes the dominant force controlling arthropods on urban plants. Reduced predation risk elevates abundances and alters foraging behavior of birds such that urban birds exert increased top-down effects on arthropods. Shifts in control of food web dynamics are likely common in urban ecosystems, and are influenced by complex human social processes and feedbacks.

Gade, K. J., and A. P. Kinzig. School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe AZ 85287-4601. ***The Role of Transportation Corridors in Plant Migration in and Around Phoenix, Arizona, an Arid Urban Area.***

While the importance of corridors for plant migration has been acknowledged for both native and non-native species, little is known about how corridors actually function in developed and fragmented landscapes. Transportation corridors, such as roads and freeways, provide fairly consistent habitat conditions traversing nearly all human developments and connecting them with undeveloped areas. The combination of the particular conditions along road and freeway verges (the grassy or gravelly areas along the side of the road) and the characteristics of the plants that reach these corridors will ultimately determine which species, native or not, will be able to move within cities and surrounding undeveloped areas. For my study, I selected 20 sites along the four major freeways in the cardinal directions around the Phoenix metropolitan area. Beginning in March 2004, vegetation surveys have been performed seasonally at each site. In addition, seed bank samples and bulk soil samples have been collected at each site. The seed bank samples are being germinated in the greenhouse to determine the seed bank composition. Initial soil chemistry results show that levels of plant-extractable nitrate are significantly increased in the surface soil located directly adjacent to the asphalt (ANOVA using log surface soil concentration; $F=5.556$, $P=0.005$). There were also significant differences between sites located adjacent to different land uses. The urban residential sites had the highest levels, followed by croplands, then lower density "fringe" development, and desert sites had the lowest levels of extractable nitrate (ANOVA using log surface soil concentration, $F=123.67$, $P<0.001$; Fisher's multiple comparison, all combos $P<0.001$). More intensive soil sampling has been conducted at a single site to further quantify the localized deposition of nitrate and total nitrogen.

Gonzales, D. A.[1], and J. O. Allen[1,2]. [1]Department of Chemical and Materials Engineering, Arizona State University, PO Box 876006, Tempe, AZ 85287-6006; and [2]Department of Civil and Environmental Engineering, Arizona State University, Box 875306, Tempe, AZ 85287-5306. ***Dry Deposition of Fine Aerosol Nitrogen to an Agricultural Field Measured by Eddy-Correlation Mass Spectrometry.***

In urban areas high emissions of reactive nitrogen species cause an increase in atmospheric aerosol nitrogen formation and deposition. This nitrogen is eventually removed from the atmosphere by wet or dry deposition, with dry deposition often accounting for more than half of the

total deposition of particulate nitrate. Total N deposition is not adequately characterized, in part because dry deposition is difficult to measure or model. For example measured fine particle deposition to a forest canopy differs from predicted values by an order of magnitude.

The eddy-correlation technique is a micrometeorological method used to directly measure fluxes from measurements made above the surface. Eddy-correlation mass spectrometry (ECMS) has been developed to directly measure aerosol particle deposition velocities from fast response aerosol concentration and wind velocity measurements. Using an Aerodyne Aerosol Mass Spectrometer (AMS), the size and composition of ambient aerosols were measured at 10 Hz. The AMS signal is proportional to non-refractory $PM_{1:0}$ mass. Aerosol deposition fluxes for a given averaging period are then calculated directly as the covariance of the vertical wind velocity with the AMS signal $(F = -\overline{w' S'})$. A field study was conducted to measure aerosol nitrogen dry deposition to an agricultural field immediately downwind of the Phoenix metropolitan area using eddy-correlation mass spectrometry. The study was supplemented with aerosol composition measurements including bulk deposition collectors and filter bank samplers. Here we compare the results of the flux estimates from bulk collection with inferential measurements (filter samples and modeled deposition velocities) and direct micrometeorological measurements (ECMS) in order to improve nitrogen deposition estimates.

Gries, C.[1], D. Hope[1], N. B. Grimm[2], S. Faeth[2], C. Martin[3], P. Warren[4], J. Hutchins[5], C. Redman[1], W. Stefanov[6], M. Moeller[1], and. J. Edmonds[7]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [2]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [3]Department of Applied Biological Sciences, Arizona State University, 7001 E. Williams Field Road Mesa, AZ 85212; [4]Natural Resources Conservation, University of Massachusetts - Amherst, Holdsworth Hall Amherst MA 01003; [5]Institute for Social Science Research, Arizona State University, PO Box 874602, Tempe, AZ 85287-4602; [6]Image Science & Analysis Laboratory, Code KX/JE36-1, Lyndon B. Johnson Space Center, Houston, TX 77058; and [7]Department of Marine Sciences, University of Georgia, Athens, GA 30602-3636. ***Long-Term Monitoring Data at CAP.***

As a Long-Term Ecological Research Site CAP is accumulating several long-term datasets based on active monitoring efforts. These include monitoring of bird and ground arthropod diversity and abundance, water quality in the region's surface water, atmospheric deposition, and net primary productivity. Other long term datasets, based on data mining and mined data analyses, go back in time much further than the active monitoring and include land use, land cover, and climate. Most of the data so far have been analyzed comparing the different land uses. Now we present time series of the available long-term monitoring data at CAP. Most of these time series follow more or less strongly the rainfall pattern. However, different patterns emerge in urban land use where rainfall is expected to have less influence.

Grimm, N. B.[1], J. O. Allen[2], S. J. Hall[1], and J. P. Kaye[3]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [2]Departments of Chemical and Materials and Civil and Environmental Engineering, Arizona State University, PO Box 876006, Tempe, AZ 85287-6006; and [3]Department of Crop and Soil Sciences, Pennsylvania State University, 0416 Ag Sci & Ind Bldg, University Park, PA 16802.

Ecosystem Responses to Inorganic Nitrogen and Organic Carbon Deposition from the Urban Atmosphere.
Urban ecosystems present challenges to biogeochemical theory if patterns and processes of urban biogeochemistry differ fundamentally from those of nonurban ecosystems. Ecosystem theory holds that, on annual time scales in terrestrial ecosystems, the importance of internal N recycling far outweighs external inputs. Theory also holds that C cycles are relatively open, and C fixation by plants fuels most heterotrophic microbial growth. We are studying ecosystem effects of vastly increased deposition rates of N (a byproduct of fossil-fuel combustion in automobile engines) and organic C particles (from cooking and combustion) on desert ecosystem processes. Nitrogen deposition may reach 30 kg ha^{-1} y^{-1} downwind of Phoenix, and we also estimate a potentially significant flux (~10% of net primary production) of organic C to desert ecosystems influenced by the urban atmosphere. We hypothesize that soil microbes are decoupled from plants if organic C is accessible to them, and that under high inorganic N deposition, N supply may increase to the point that P limits plant growth. In this new research project, we will test these hypotheses by studying C utilization by microbes, by measuring total speciated N deposition across a gradient of deposition values, and by initiating a long-term N and P fertilization experiment in sites along that gradient, from upwind sites southwest of Phoenix to core sites and downwind sites in the northeast. A priori, we maintain that whether cities exhibit a distinct urban biogeochemistry depends upon the extent to which high or unique material inputs alter interactions among element cycles.

Grossman-Clarke, S., and J. A. Zehnder. Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Testing a Planetary Boundary Layer Scheme in MM5 for the Phoenix Metropolitan Region: Influence of Urbanization on Weather in the Phoenix Metropolitan Region.***
The fifth-generation PSU/NCAR mesoscale meteorological model MM5 can be used in order to investigate if the increasing extent of the Phoenix metropolitan region affects meteorological processes such as: the development and propagation of summer thunderstorms; how mesoscale circulations due to the variability in urban and rural land use interact with the mesoscale thermal circulations due to complex terrain; and how past and potential future land use changes influence near surface atmospheric state variables and characteristics of the planetary boundary layer. In order to apply MM5 in such process studies with high confidence it needs to be ensured that planetary boundary layer (PBL) processes are represented in the model with high accuracy. Therefore in this study we included simple modifications to the surface energy balance as well as a new version of the Medium Range Forecast (MRF) PBL scheme in MM5 and evaluated the model performance with data from a meteorological field study that was carried out in the Phoenix metropolitan area during a 4-week period in May and June of 1998 to study the convective boundary layer. MM5 simulations were carried out for 1 May 1998 to 12 June 1998 and simulation results were tested against radar wind profiler and radiosonde data from the field campaign. The simulation results show a significantly improved model performance for near-surface meteorological variables, vertical temperature and wind profiles and the evolution of the height of the planetary boundary layer and hence support the application of this version of MM5 in studying the influence of urbanization on weather in the Phoenix metropolitan region.

Guhathakurta, S. School of Planning, Arizona State University, PO Box 872005, Tempe, AZ 85287-2005. ***Impact of Urban Heat Island on Residential Water Use.***
The effect of heat islands in Phoenix has been an increase in summer nighttime temperatures of about 3.9° F while afternoon temperatures have risen 1.1° F. Although microclimatic effects resulting from changes in land use and land cover have caused overall increases in temperatures in all months and all hours of the day, a spatial variation in changes in nighttime temperatures can be observed in localized areas. In this poster we examine whether the spatial variation in summer nighttime temperatures as a result of urban heat island also impact the amount of household water use. In addition, we also analyze the temporal variation in metropolitan water use that can be attributed to changes in summer nighttime temperatures. A cross-sectional analysis of a detailed dataset of water use in June 1998 reveals an increase of 2% water demand for single-family residences for each percent rise in nighttime temperatures. This result suggests a significant impact of rising temperatures on water use in Phoenix.

Hartnett, H.[1, 2], and B. Brown[2]. [1]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe, AZ 85287-1404; and [2]Department of Chemistry and Biochemistry, Arizona State University, PO Box 871604, Tempe, AZ 85287-1604. ***Evolution of Dissolved Organic Carbon Concentrations in Tempe Town Lake: Biogeochemical and Hydrologic Processes.***
Tempe Town Lake in downtown Tempe, AZ, is a man-made lake isolating a short segment of the Salt River channel. Most of the year, the lake is enclosed by two inflatable dams and the Salt River proper has a very low flow rate. In January of 2005, high winter rainfall led to significant water flows in the Salt and Verde Rivers and for the first time since the lake was built, the dams were lowered and the river allowed to flow in a relatively normal fashion. We took advantage of this "natural experiment" to monitor basic water quality parameters (temperature, pH, conductivity, dissolved oxygen) and concentrations of dissolved organic carbon (DOC) in the Salt River as it flowed through Tempe, and to examine how these properties evolved in Tempe Town Lake after the dams were raised. Samples of the river/lake have been collected daily over the last 12 months. In the winter, while the river was flowing, dissolved organic carbon concentrations were relatively high (5-7 mg C/L). After the dams were raised in early March, dissolved organic carbon decreased monotonically to ~3.5 mg C/L over the course of the spring and early summer. Conductivity increased dramatically from ~200 µS to >850 µS as a result of evaporation during this same period. With the onset of the summer monsoon rains, dissolved organic carbon concentrations in the lake increased again and became more variable (3-6 mg C/L). These results suggest that during rainy seasons organic carbon from the land is washed into the river/lake. During dry periods however, biogeochemical process that may include photochemical oxidation, microbial degradation, flocculation and settling decrease the organic carbon concentrations in the lake.

Hedquist, B. C.[1], and E. Comparri[2]. [1]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [2]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Spatial Expansion of the Greater Phoenix Urban Heat Island (1990-2004).***
The urban heat island (UHI) is a well-documented phenomenon and can be especially strong in urbanized desert regions such as Phoenix. Recent studies have shown magnitudes greater

than 11 degrees Celsius during clear and calm atmospheric conditions. Rapid urbanization in Phoenix away from the core of the city has changed the surface land cover characteristics, expanding the UHI toward previously rural areas, which historically had lower minimum temperatures and larger diurnal temperature ranges. This study illustrates spatial expansion of UHI in the last 15 years using a dense network of over 70 weather stations and spatial interpolation in GIS. Ordinary Kriging is used to create 5-year averaged temperature interpolation layers (1990-94, 1995-99, 2000-04), which are then overlaid onto a Digital Elevation Model and compared with land use maps for Phoenix during the respective period. Work in progress involves the creation of an animated time series of temperature change in Phoenix. These maps will illustrate the impact of land cover change and urbanization on the temperature in Greater Phoenix, with the eventual goal of creating evapotranspiration maps to be visualized in 3-D at the Decision Theater. These maps will assist scientists and policy makers to make more informed decisions regarding environmental change, especially ones involved with the Decision Center for a Desert City and CAP LTER. In addition, these maps will aid researchers working to increase the accuracy of mesoscale meteorological models for Greater Phoenix and other rapidly urbanizing desert regions.

Ingram, S. E. School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402. ***Archaeological Contributions to Contemporary Socioecological Issues.***

Climate change, biodiversity, and the sustainability and resilience of socioecological systems are contemporary issues of significant worldwide scientific and popular interest. Insights from the archaeological study of prehistory, it has been argued, can and should contribute to strategies for addressing these contemporary socioecological issues. How, specifically, can archaeologists contribute? This poster identifies several research questions associated with interdisciplinary research on climate change, biodiversity, sustainability, and resilience that can be addressed with archaeological data. Several examples of archaeological research in the U.S. Southwest that can contribute insights to the understanding of these contemporary socioecological issues are also noted. The purpose of this poster is to stimulate further consideration among an interdisciplinary audience of how archaeological data can and should be brought to the study of contemporary socioecological issues.

Janssen, M. School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402. ***Dynamics of Rules in Commons Dilemmas.***

Various social sciences have contributed to understanding how humans make decisions in a given rule set of experimental games, such as social dilemmas. However, the rules of the games are not fixed in real-life settings. I report here on an ongoing National Science Foundation project that studies how humans are able to change the rules in common dilemmas. We study what causes individuals to invest in rule development, and which cognitive processes explain the ability of humans to craft new rules.

We combine laboratory experiments, experiments in the field, and agent-based models. Laboratory experiments are conducted to analyze the effect of the option to change the rules of the game on the level of cooperation. The field experiments are aimed to study the role of experience in the ability to craft rules. We will visit a number of communities in Colombia and Thailand, and will perform a number of role games and field experiments. The communities have

a dominant resource use of fisheries, forest, or irrigation. The results of the experiments are used to compare and test different models of decision making.

Kapoor, M. L.[1], A. P. Kinzig[1], and C. Perrings[2]. [1]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601; and [2]School of Human Evolution and Social Change, Arizona State University, PO Box 2402, Tempe, AZ 85287-2402. ***The CAP LTER Ecosystem Services Assessment: An Interdisciplinary Pilot Study.***

An interdisciplinary team of social and natural scientists is conducting a pilot study to assess the ecosystem services provided within the CAP LTER boundaries. Participants in this study are working in subgroups in order to address three aspects of each ecosystem service. The natural history group is assessing past and projected changes in the function of each ecosystem service. The valuation group is assessing the worth that local residents ascribe to each service. The technology group is identifying the ecosystem services for which there are viable, practicable alternatives. Our main goal is to identify the ecosystem services that are most highly valued; most threatened by human activity; and most irreplaceable through technological substitutes. We expect that this information will provide guidance for policy decisions in the Phoenix metropolitan area. This project will also inform research decisions by highlighting the gaps that exist in our knowledge about the functioning and value of ecosystem services. The basis for our study and our guide in identifying the ecosystem services on which to focus is the Millennium Ecosystem Assessment, which defines these services as "the benefits people obtain from ecosystems." The sources for our assessment are varied and include published literature, professional knowledge, and unpublished data from the city of Phoenix.

Kirkwood, C.[1], L. R. Keller[2], and N. Jones[3]. Department of Supply Chain Management, W.P. Carey School of Business, Arizona State University, PO Box 874706, Tempe, AZ 85287-4706; [2] Paul Merage School of Business, University of California-Irvine, Irvine, CA 92697-3125; and [3]Decision Center for a Desert City, Arizona State University, PO Box 878209, Tempe, AZ 85287-8209. ***Decision Research in Water Resources Management: A Multiple-Objective, Multiple-Stakeholder Analysis***.

We used a multiple-objective decision modeling approach to create a comprehensive catalog of concerns identified by key stakeholders for guiding water resource policy in central Arizona. The model informs stakeholder communications and research activities; highlights special interests of important stakeholders; and helps focus discussion and promote constructive interaction for water policy planning in central Arizona.

Kobayashi, Y. School of Architecture and Landscape Architecture, Arizona State University, PO Box 871605, Tempe, AZ 85287-1605. ***3D Downtown Phoenix Modeling***.

This project is to develop an efficient and effective method for creating 3D city models that will be used with GIS (Geographical Information Systems) data in a VR (Virtual Reality) environment. Here we introduce a modeling process to create a 3D city model from aerial photos, and show the results for the 3D downtown Phoenix model.

The multiple-angle shots of downtown Phoenix were taken at an altitude of 6,000 feet. Two oblique shots with about 30 degree and one vertical shot were used. The 9 x 9 inch films were scanned with 2000 dpi. The building extraction software generated the 3D polygon data for the ground and the buildings using the technology of photogrammetry and 3D vision. The textures for buildings were automatically created from the aerial images at the same time when the height and shapes of buildings were extracted. The model was saved as 3DS formatted file, which is one of the standard formats in 3D CG, and transformed fitting to the geo coordinate using the information of longitude and latitude acquired from Google Earth. Finally, the 3DS file was converted to OSG formatted file to visualize in the VR environment at the ASU Decision Theater.

The model covers about one square mile area in the center of downtown with more than 700 buildings. This was created within 16 hours by one specialist trained for a few months on the modeling method.

Kruse, M.[1], H. Schaafsma[2], K. Schollmeyer[1], J. Briggs[2], K. Horn[2], K. Kintigh[1], C. Lai[2], K. Spielmann[1], and C. Wichlacz[1]. [1]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402; and [2]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Legacies on the Landscape: Integrating Ecology and Archaeology on the Agua Fria National Monument, Arizona.***

Researchers in ecology and archaeology are increasingly aware that ecosystems observed today are the outcomes of long histories of inextricably linked human and ecological processes. Here, we combine approaches from both disciplines to investigate the ecological and social conditions under which human land use results in long-lasting transformations of ecosystem structure and function. We examine the legacy of prehistoric (A.D. 1250-1450) agricultural activities on the present-day Agua Fria National Monument. A strong emphasis on interdisciplinary collaboration in all stages of research combines ecological understandings of desert grassland ecosystem structure and function with archaeology's long-term view of human land use.

Lant, T. Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***A System Dynamics Model for Water Supply and Demand in Greater Phoenix.***

Water requirements in Greater Phoenix are sensitive to population growth, climatic uncertainty, future development, and allocation of natural resources. In turn, these requirements must be supplied by water sources that are subject to complex regulatory and geophysical environments. This study presents a system dynamics model for water supply and demand in Greater Phoenix. The demand for water is generated by population growth, land use, land cover, and climate. Central Arizona Project and Colorado River water, groundwater, watershed sources, and recycled water are presented as sources. The model is presented within a decision support framework designed to inform policy processes.

Larson, E. K.[1], and N. B. Grimm[1,2]. [1]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ, 85287-4601; and [2]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Experimental Assessment of Nitrate Filtration Capacity of Xeriscaped Stormwater Retention Basin Soils.***

Stormwater retention basins are designed to provide the ecosystem services of flood abatement and groundwater recharge. However, studies have shown that stormwater tends to have high nutrient concentrations, which may incur future costs if groundwater is used for drinking water. If retention basins can store or remove nitrate from stormwater as well as mitigating floods, they would provide an additional, valuable ecosystem service to the CAP LTER, which has documented high levels on nitrogen input. Researchers in more mesic climates have found that soils in retention basins effectively remove pollutants within the top few centimeters, but the filtration capacity of basins in arid areas has not been investigated. As a preliminary laboratory evaluation of retention basin soils, we collected replicate cores of approximately 10 cm depth from a nongrassy basin. We then had two treatments groups of pure water and water amended with potassium nitrate. Bulk analyses on all cores were performed and leachates and soil extracts were collected for ion and organic carbon content analysis. Initial treatments indicated an overall flushing of ions in all treatments, although after re-wetting the cores exhibited different behavior. Results from these manipulations will be coupled with future field investigations to assess the filtration capacity of xeriscaped stormwater retention basins, a common feature in the CAP LTER.

Larson, K. Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104. ***Geographic, Social Science and Interdisciplinary Perspectives on Urban Ecology: A Developing Research Agenda***.

In this presentation I will discuss my developing research agenda around three critical elements of human dimensions of environmental systems. First, cognitive aspects relating to human knowledge and understanding of how the world works will be discussed, particularly research on peoples' perceptions of the causes of and solutions to environmental problems. Second, affective elements involving place attachment and attitudinal judgments will be presented along with a conceptual framework for evaluating important dimensions of environmental attitudes. Third, conservation behavior research will be addressed, with particular focus on residential landscaping practices and water use. Throughout this talk, on-going and planned projects discussed include those conducted at CAP-LTER – including the Phoenix Area Social Survey and North Desert Village projects – and the Decision Center for a Desert City (DCDC).

Larson, K.[1], R. Servis[2], Casagrande[2,3], E. Farley-Metzger[4], S. Harlan[5], L. Larsen[6], and S. Yabiku[5]. [1]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; [2]Global Institute of Sustainability, Arizona State University PO Box 873211, Tempe, AZ 85287-3211; [3]Department of Sociology and Anthropology, 403 Morgan Hall, Western Illinois University, Macomb, IL 61455-1390; [4]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402; [5]Department of Sociology, Arizona State University, PO Box 874802, Tempe, AZ 85287-4802; and [6]School of Natural Resources and Environment, Dana

Building - Office 1540, 430 E. University, University of Michigan, Ann Arbor, MI 48109-1115. ***Landscape Preferences in the Arid Southwest: Comparative Results from the Phoenix Area Social Survey and North Desert Village.***

Residential landscape practices consume a significant portion of domestic water use in the Phoenix metropolitan area. Two projects are underway at the Arizona State University's (ASU) Central Arizona–Phoenix Long-Term Ecological Research (CAP LTER) site to address landscape practices and preferences for mesic, oasis, xeric and native yards. First, the Phoenix Area Social Survey (PASS) project is undertaking a second assessment of human-environment interactions in residential neighborhoods of the metropolitan area. Results from the first survey, conducted in 2001, provide information on residents' landscape preferences and behavior for front and back yards as well as reasons underlying preferences. The second project is an experimental site at the North Desert Village residential community of ASU's Polytechnic campus, where biophysical and human factors are being examined before and after installation of landscape treatments that include a control site along with the four landscape types above. A pre-treatment survey was conducted in 2004-2005 and included questions about landscape preferences and practices. Quantitative and qualitative results from these two studies will be compared and contrasted in this poster to further understanding of residential landscape preferences and to facilitate dialogue on these two on-going, collaborative projects.

Majumdar A.[1], J. Kaye[2], C. Gries[3], D. Hope[3], and N. Grimm[3]. [1]School of Physical Sciences, Arizona State University, PO Box 871804, Tempe AZ 85287-1804; [2]School of Biological Sciences, Pennsylvania State University, 416 Agricultural Sciences and Industries Building, University Park, PA 16802; and [3]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe AZ 85287-3211. ***Does Urbanization Affect the Total N, C and Nutrient Concentrations in the Soil?***

We assess the spatial distribution of inorganic and organic carbon, nitrogen and phosphorous concentrations (all together) in various land-use types in the Phoenix metropolitan area, and note how land use and other socioeconomic factors affect the distinct spatial patterns of these variables. The analysis is done using a hierarchical, multivariate spatial statistical model. The use of using all of these variables together in the model, as well as looking at the data spatially, significantly enhances the accuracy of predictions at new points.

McCracken, M., T. Harms, and N. Grimm. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***The Sky is Falling: Soil Microbial Responses to Deposition from the Urban Atmosphere.***

Human activities have resulted in increased nitrogen and carbon deposition, potentially altering microbial activity in soil in human-dominated ecosystems. Desert shrubs such as creosote bush, *Larrea tridentata*, exert positive influences on soil moisture and nutrient availability, creating islands of fertility that show increased microbial biomass and soil respiration relative to plant interspaces. The differences between plant islands and plant interspaces may diminish if atmospheric deposition to plant interspaces supplies additional nitrogen (N) and carbon (C). We measured dry deposition of N and C from the atmosphere at nine desert remnant sites around Phoenix and found no differences among sites upwind, downwind, and within the urban core (deposition rates: 2.2-4.4 mg organic C $m^{-2}d^{-1}$ and 0.2-0.6 mg total N $m^{-2}d^{-1}$). Prior to monsoon rains we found no differences in microbial biomass, soil moisture, and soil respiration between

creosote bush and plant interspaces. During the monsoon, however, microbial biomass was significantly greater in soils beneath creosote bush than in plant interspaces (paired t-test, t=6, $t=5.8_{10}$, $p<0.01$). Soil moisture was also significantly greater under creosote bush than interspaces (paired t-test, $t=2.5_{10}$, $p=0.03$). Microbial biomass and soil moisture were not correlated with measured C or N deposition. The response of soil respiration to precipitation evens was tested through wetting experiments. The increase in CO_2 flux rates following a simulated precipitation event was greater beneath creosote bush (average 0.66 g CO_2 $m^{-2}h^{-1}$ 2 hrs post-precipitation) than in plant interspaces (average 0.20 g CO_2 $m^{-2}h^{-1}$ 2 hrs post-precipitation), but did not differ relative to C or N deposition. These data suggest that at present rates of deposition, precipitation and desert shrubs exert greater positive influence on microbial activity than material C and N deposition from the urban atmosphere.

McLean, B., P. Prapaipong, N. Zolotova, and E. Shock. Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404. ***The Geochemical Response of Rivers to Storm Events as Indicators of Watershed Processes.***

A theme of CAP LTER research is transport of nutrients, trace metals and toxins into and through the Phoenix metropolitan area. The water supply distributed throughout Phoenix is partially derived from the Salt and Verde River watersheds. Understanding the episodic hydrochemical response of each of these watersheds and the effects of mixing will enable predictive modeling of water quality change induced by perturbations to this complex system. Hydrologic perturbations driven by rainfall events produce corresponding geochemical perturbations driven by chemical reactions occurring throughout a watershed. These storms produce measurable fluctuations in surface water composition driven by duration and location of rainfall events and by mixing of these two prominent watersheds. Documenting these fluctuations allows us to categorize cyclical relationships between dissolved solutes in the water. By taking advantage of three anomalously heavy winter storm events in late 2004 and early 2005, which allowed the Salt River to flow through Phoenix, we can begin to visualize transport in the Salt River system. Samples for major ion and trace metal concentrations, taken from January 5, 2005 until October 2005, can be used to resolve watershed processes and river mixing. Preliminary results show that concentration response of trace metals, nutrients and major ions exhibit hysteresis behavior consistent with solute transport being out of phase with fluid transport. Superimposed on this behavior are mixing processes driven by differences in where major rainfall occurred. The dramatic differences in composition between the Verde and Salt Rivers should permit us to resolve these mixing processes. Element response is not simply a function of whether a storm event occurred, but represents a complex integration of surface and subsurface processes within the watershed that are triggered by these storms.

Moeller, M. S. Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Large-Scale Urban Change Mapping by Remote Sensing.***

Permanent monitoring of urban areas is a special challenge for remote-sensing scientists. It has been performed successfully on a medium-scale level since the first optical imagery, recorded by Landsat MSS, became available in 1972. Digitally acquired satellite imagery from space is the only source providing a synoptical view for a large area. Major land-use, land-cover classes

are clearly distinguishable from the imagery and a long-term analysis of the changes of the Phoenix metropolitan area lead to impressive results in terms of growth monitoring.

A rapidly increasing number of newly designed remote-sensing sensors offer improved features. One improved feature is that the spatial resolution has been refined up to 0.61 m in combination with four spectral bands ranging from the visible to the near infrared by the Quickbird satellite. This resolution could be considered a substitute for analogue (and later digitized) aerial photos. The advantages of this imagery from space are quite obvious: the entire digital chain of recording, processing, and analyzing.

Image data of the Quickbird sensor are compared in terms of the appearance of changed urban features in a newly developed area north of Phoenix. Two satellite scenes acquired in 01/2003 and 01/2005 have been analyzed in terms of urban changes by using indices like NDVI (Normalized Differenced Vegetation Index) and PC (Principal Component). The resulting change imagery has been differentiated into several change classes. Samples of the changed objects are compared and the spectral response signal of these changes has been evaluated.

Murphy, J. T.[1,2], and A. P. Kinzig[3,2]. [1]Department of Anthropology, University of Arizona, PO Box 210030, Tucson, AZ 85721-0030; [2]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe AZ 85287-4501. ***The Hohokam Water Management Simulation: Collaborative Modeling of a Complex Coupled Human/Environmental System.***

The Hohokam built an elaborate canal system during their 1500+ years of occupation of the Salt River Valley. Archaeologists have shed much light on the nature of Hohokam society, yet many gaps exist in our knowledge of how the Hohokam built, maintained, and managed such a large system. Of particular interest is the scale of cooperation required, and whether central control of the canal system was necessary or whether self-interested decisions by actors in different positions along the canal system might have promoted the success of the system without a central, directive authority. This question, however, is difficult to address without assembling a large collection of data about the available resources- in particular, the plants available to the Hohokam throughout the year- and the way those sources might have been managed in a real and complex canal system. The problem lends itself to a simulation approach. To meet this need, the Hohokam Water Management (HWM) Simulation has been under construction at CES/IIS/GIoS since 2003. The simulation models water flow through a canal system, tracking nutrient transport and damage to canals, and evaluating plant productivity across the managed landscape. Plant data are assembled in a central database, and water flow is modeled using an algorithm based in engineering studies. Strategies of managing the agricultural system, including dealing with risk and allocating labor to maintain and control the canal system, can be employed by the user or by programmatic agents placed in the landscape. Special data structures allow the creation of alternative histories, which can be used to explore various 'what if' scenarios in the Hohokam trajectory. The simulation is available on the Internet, can be run interactively over the World Wide Web, and includes features that allow sharing of simulation source information, comments, and results.

Neff, M.[1,2], N. Chhetri[2], L. Hidinger[2], and R. Meyer[1,2]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; and [2]Consortium for Science, Policy and Outcomes, Arizona State University, PO Box 874401, Tempe AZ 85287-4401.
Science Policy and Research on Climate: Ecosystem Sensitivity Analysis.
Predicted climate change has been cited as a large, or even the primary, stressor on some ecosystems. This focus on climate might come at the expense of research on other drivers of change, for example land-use and invasive species, regardless of their importance as determinants of future ecosystem conditions. Although it might be a significant stressor on ecosystems, our ability to control climate is limited compared with our ability to influence other stressors. Our project consists of analyzing the sensitivity of two ecosystems to various potential drivers of change by synthesizing available research findings and convening consensus workshops with active researchers. The object of our ecosystem sensitivity analysis is to identify gaps in the current ecology research portfolio. We have selected the Phoenix urban ecosystem as our first study area and are in the process of developing a methodology to rank the potential drivers of change to this ecosystem. Our second study area has not yet been selected, but will be larger in scale and more "pristine," i.e., less dominated by human action. This poster presents our efforts thus far to develop a methodology for our ecosystem sensitivity analysis.

Nelson, M. [1,2], J. Anderies, M. Hegmon[1], K. Kintigh[1], B. Nelson[1], A. Kinzig[3], D. Abbott[1], M. Janssen[1], K. Spielmann[1], C. Redman[4], S. van der Leeuw[1]. [1]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402; [2]The Barrett Honor College, Arizona State University, PO Box 871612, Tempe, AZ 85287-1612; [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; and [4]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Long-Term Coupled Socioecological Change in the American Southwest and Northern Mexico.***
Each generation transforms an inherited social and environmental world and leaves it as a legacy to succeeding generations. Long-term interactions among social and ecological processes give rise to complex dynamics on multiple temporal and spatial scales-cycles of change followed by relative stasis, followed by change. Within the cycles are understandable patterns and irreducible uncertainties; neither stability nor transformation can be taken as the norm. But, what fosters stability or contributes to transformation over long cycles? What vulnerabilities can be tolerated and which tip a system into transformation and at what scale? Resilience theorists have built an understanding of social and ecological vulnerabilities, stability, and transformation based on studies of contemporary socioecological systems. This project will be an interdisciplinary collaboration of archaeologists, mathematical modelers, ecologists, and environmental scientists that questions and examines some of these understandings by applying archaeological and ecological analyses and formal dynamical modeling. Archaeology is attuned to cycles of change over the lifespan of a society-heightened inter-societal interaction, economic intensification, and large-scale anthropogenic environmental change–thus, it extends scientific observation of stability and transformation beyond all social memory. Archaeologically documented case studies in the American Southwest and Northern Mexico provide the information for investigating long-term human-environmental interactions. The empirical investigations provide substantive contexts for models, while the models will foster insight into generalizations that are then examined in empirical contexts. This iterative process leads to insights that could not be derived from any single approach nor can they be derived from the short time span available in contemporary study of social or ecological change.

This project will influence the refinement of theory and understanding of processes of socio-ecological change. First, an intensive collaboration of archaeologists specializing in the American Southwest and Northern Mexico will contribute a new level of understanding of the social and environmental interactions underlying important episodes in human history. Second, through archaeology's deep time perspective, this project will examine the utility of resilience theory as applied to coupled socioecological systems, demonstrate the value of archaeology to ecological theory, and further scientific understanding of current socioecological problems through refinement of concepts and theory. Third, this project will identify the dynamics of transformation and stability as conditioned by cultural and environmental contexts, strategies for coping with uncertainty, and varying constraints of long-term legacies. At the most practical level, this study will promote awareness of some of the human strategies for dealing with uncertainty and change, as well as awareness of how human actions leave legacies of resilience or degradation. In addition, this project will immerse students in an interdisciplinary research community that will spark development of professional skills and encourage them to exchange knowledge about coupled human and environmental systems. Global perspectives and international collaborations will be fostered by engaging students and researchers from the US, Mexico, France, and the many nations represented in the Resilience Alliance.

Peterson, A.[1], P. Howe[1], M. White[2], D. White[3], and E. Corley[4]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [2]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601; [3]Department of Community Resources and Development, Arizona State University, PO Box 874703, Tempe, AZ 85287-4703; and [4]School of Public Affairs, Arizona State University, PO Box 870603, Tempe, AZ 85287-0603.
Expert Perspectives on Science, Politics, and Water Management in Phoenix. The challenges of water resource management in Phoenix require a fine balance of science, politics, and social values in decision making. With the ultimate goal of improving the interface between scientists, managers, policymakers, and citizens, our research seeks to understand expert perspectives on problems and solutions. We conducted semi-structured in-depth interviews with 12 water managers from the greater Phoenix area. Using qualitative analysis, we constructed conceptual maps illustrating water managers' understandings of key themes, including water supply, drought, growth, the role of government, the role of media, uncertainty, science and policy, environment, water ownership, and public perception. The concept maps also illustrate the strength of the relationships between these themes.

Our findings thus far suggest that the greatest variation in expert perspectives is between management organizations rather than between individual positions within those organizations. Most of those interviewed cited growth as a challenge to Arizona's water future, but believed that the Phoenix area was well-equipped to sustain further growth and tolerate potential droughts. Uncertainty factored highly in experts' opinions, with most mentioning incomplete or inaccurate data on environmental variability as a key concern. Our respondents differed in their views of policy, with some calling the political process a hindrance to their work and others who were actively involved in policymaking. Nearly all expressed frustration with the difficulty of conveying comprehensive information to an indifferent public, though few of them mentioned using the media as a public education tool.

Our hope is that by understanding how water managers view these relationships and how their perspectives differ both individually and between their respective organizations, we will be able help Arizona State University's Decision Center for a Desert City promote better relationships between all stakeholders in the Phoenix water arena.

Prapaipong, P.[1], and E. Shock[1,2]. [1]Department of Geological Sciences, PO Box 871404, Tempe AZ 85287-1404; and [2]Department of Chemistry and Biochemistry, Arizona State University, PO Box 871604, Tempe, AZ 85287-1604. ***Chemical Footprints of Urbanization upon River Compositions.***

In 2005, the Salt and Gila Rivers flowed through the Phoenix metropolitan area, and provided a "natural" laboratory to investigate chemical footprints of cities upon rivers and urbanization effects on biogeochemical cycles of metals. In this study, we identify distribution patterns of chemical compositions of the rivers, and attempt to distinguish human and non-human impacts. Water samples were collected monthly from upstream to downstream, and analyzed for major, minor and trace elements with ion chromatography and high resolution inductively coupled plasma mass spectrometry. Preliminary results show increases in most elemental concentrations as the rivers pass through the city. Major ions, Na^+, Mg^{2+}, Ca^{2+}, Cl^-, SO_4^{2-}, are 10-100 times higher downstream. Elevated PO_4^{3-}, NO_3^-, NH_4^+ contents in certain locations seem to correlate with agricultural activities. Increases in concentrations as a result of urbanization are also observed for most trace elements, as revealed by high concentrations of Pb, Zn, Sn, Fe, W, Mn, Ni, Mo, Sb, Cr, and Co in the city and immediately downstream. Among these elements, Pb, Zn, Sn, Ni and Mo show strong signals of industrial activities. At the furthest sampling location, approximately 50 km downstream from the city, Pb, Zn, Sn, Fe, W, Mn, Ni, Mo, Sb contents drop or stay constant, where as Cr and Co concentrations keep rising. Other trace elements: Cu, V, As, U, Cd and Se, exhibit differing systematic patterns that are site specific, which is believed to correlate with water treatment and water-rock interactions. Information on water sources, bedrock types and geologic structures will be incorporated to understand the distribution patterns of the chemical compositions.

Ruddell, D.[1], A. Gustafson[2], J. Walker[3], and S. Harlan[4]. [1]School of Human Evolution and Social Change and Department of Geography, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402; [2]Department of History, Arizona State University, PO Box 874302, Tempe, AZ 87287-4302; [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 87287-4501; [4]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 87287-2402. ***Plans for the 2006 Phoenix Area Social Survey.***

The Phoenix Area Social Survey (PASS) is an interdisciplinary research collaboration among Arizona State University faculty, staff, and graduate students about the relationships between human communities and their environment. After a successful pilot study in 2001-2002, a much larger survey of households has been funded by the National Science Foundation through a supplementary grant to the Central Arizona–Phoenix LTER (CAP LTER) and a substantial contribution from the Decision Center for a Desert City. A second survey will be administered in spring 2006 to 800 respondents in 40 neighborhoods located at CAP LTER's Survey 200 monitoring sites. The survey's content is aligned with CAP LTER's Integrated Project Areas and it has four environmental foci: (1) water supply, quality, and conservation; (2) land use, preservation, and growth management; (3) air quality and transportation; and (4) climate change and the urban heat island. The survey will measure people's perceptions of risk, attitudes, values, knowledge, and behaviors on each of these topics, thereby lending crucial insights about the preferences and actions of people that affect the environment as well as the impact of the socio-physical environment on the quality of human life in the Phoenix metropolitan area. This administration

of PASS is the benchmark for planned long-term social monitoring that will complement ecological monitoring in the study region.

The PASS 2005-2006 Research Team: Carol Atkinson-Palombo, Megha Budruk, Bill Edwards, Pat Gober, Corinna Gries, Nancy Grimm, Anne Gustafson, Ed Hackett, Sharon Harlan (Project Director), Pam Hunter, Larissa Larsen, Kelli Larson, Kitty Lohse, Tom Rex, Darren Ruddell (Graduate Research Assistant), Jason Walker, Paige Warren, Dave White, and Scott Yabiku.

Saltz, C.[1], N. Crocker[2], D. Taddy[3], and M. Elser[1]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [2]University College, Arizona State University, PO Box 873801, Tempe, AZ 85287-3801; and [3]City of Phoenix, 200 W. Washington Street,16th Fl., Phoenix, AZ 85003-1611.

Service at Salado, an Urban Environmental Service-Learning Project.

The overarching goal of the Service at the Salado project is to create after-school clubs that engage children in a local environmental project while performing a valuable community service. Service at the Salado is a partnership between the Global Institute of Sustainability, the University College, and the School of Community Resources and Development. In addition to these internal partnerships, we collaborated with the City of Phoenix, Arizona Audubon Society and Valley View, Greenfield, Sunland, and Lowell Elementary Schools.

Service at Salado engages local schoolchildren in restoring and actively learning about a Sonoran Desert riparian area in the heart of the city. Students participate in The Phoenix Rio Salado Project, a city program that serves to revitalize the Salt River and provide a natural oasis accessible to city dwellers.

Middle-school students participate through after-school clubs in schools close to the Phoenix Rio Salado Project. Arizona State University (ASU) undergraduate and graduate students serve as role models for the middle schoolers. By interacting with college students, the younger students will become more informed about ASU and the opportunities available to them. The poster will display a summary of the projects the students have completed for the City of Phoenix Rio Salado Project.

Saltz, C.[1], M. Elser[1], K. Michel[2], and B. Cutts[2]. [1]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601. ***Water Education Provider Survey Results.***

One objective of the education outreach component of Arizona State University's Decision Center for a Desert City (DCDC) is to determine what role we can play in enhancing the Water Education programs already serving the Greater Phoenix Area. To determine that role, in the summer of 2005 we developed a Water Education Provider Survey to identify water education providers (WEP), and to determine audiences, content, goals, and communication tools used by these local organizations. Survey questions were arranged in four categories: Target Audience, Program Objectives, Communication Tools, and Program Overview. Face-to-face interviewees were asked questions in the same categories as well as questions regarding development and evaluation of their program, collaboration with other educators, and needed areas of improvement within their programs. Our poster will display the results of the survey and the conclusions of a water forum held with the WEPs in December 2005.

Schaafsma, H.[1], K. Johnson[2], and J. Briggs[1].[1]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601; and [2]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402. ***Messages from the Past: How Modern Landscapes Reveal Prehistoric Land Use Patterns.***

Human activities can create changes to landscapes that are perpetuated through time as ecological legacies thereby creating a palimpsest effect in modern plant communities and soils. In the course of the Landscape Legacies Project at Agua Fria National Monument, we have documented anthropogenic landscape patches on small-scale agricultural terraces (~1-50m) and larger-scale areas surrounding pueblo sites created by a variety of human activities (~50-500m). The primarily mechanism creating these legacies appears to be the relocation of stones within the landscape for building, land clearing and agricultural activities. We show that anthropogenic legacies differ between types and intensities of prehistoric land use through quantification of localized plant communities, soil analysis and analysis of aerial photography. We propose ways that these legacies can be interpreted to infer past land-use intensities, and from this we can gain a greater understanding of human settlement pattern and land-use change through time.

Singer, C. K., and C. A. Martin. Department of Applied Biological Sciences, Arizona State University Polytechnic, 7001 E. Williams Field Road, Mesa, AZ 85212. ***Effects of Surface Mulches on Soil Moisture Content and Leaf Relative Water Content of* Atriplex canescens.**

Principles of Xeriscape™, including use of landscape mulches and low-water use plants, promote water conservation and can reduce plant water use by 60% (www.xeriscape.org). Within the CAP LTER area, decomposing granite is commonly used as an inorganic landscape surface mulch. However in recent years, indigenous organic byproducts such as composted pine residue from the Mogollon Rim and shredded urban tree trimmings are increasingly abundant resources. Research is needed to understand how these organic byproducts might be used as surface mulches to conserve soil moisture and improve growth of native plants in Phoenix landscapes. We performed experiments to compare the effects of three landscape surface mulch types (one inorganic and two organic) and bare soil on soil moisture content and evaporative water loss, and on leaf relative water content (RWC) of *Atriplex canescens*. In one experiment during April 2005, soil moisture content at 12 cm depth and early morning RWC of *A. canescens* were assayed in fourteen, 9 x 9 m differentially mulched landscape plots. Of the two *A. canescens* growing in each plot, half received irrigation and half did not. In general, soil moisture content was higher under mulched landscapes, both inorganic and organic, than bare soil, and soil moisture content was highest under shredded urban tree trimmings. Regardless of irrigation application, *A. canescens* growing in organic mulches had the highest RWC. In another experiment during June 2005, cumulative evaporative water loss was greatest from bare soil or soil mulched with decomposing granite and was least from soil mulched with either composted pine residue or shredded urban tree trimming. These results show that organic surface mulches can reduce evaporative water loss from urban desert soils, and improve internal water status of native landscape plants such as *A. canescens*.

Singer, C. K., and C. A. Martin. Department of Applied Biological Sciences, Arizona State University Polytechnic, 7001 E. Williams Field Road, Mesa, AZ, 85212. ***A Comparison of Inorganic and Organic Surface Mulches on Rates of Soil Respiration.***

Landscape soils in the Phoenix area are often covered with mulch materials to moderate soil temperatures and conserve soil moisture. Accordingly, landscape mulches might have an impact on soil respiration (Rs) because Rs flux dynamics are temperature and moisture dependent. In order to determine the effect of surface mulches type on Rs flux dynamics, we applied four mulch treatments (composted pine residue, uncomposted shredded urban tree trimmings, decomposing granite, or bare soil) during winter 2004 to 14 pre-existant drip-irrigated, xeric landscape research plot each containing six *Nerium oleander* shrubs that had been planted in May 1999. In each plot, Rs flux measurements were made in spring, summer, and fall during 2004 and 2005 at two locations, in an open, unshaded location and underneath the canopy of *N. oleander*. Rs measurements were made with a LI-6000 soil respiration chamber attached to a LI-6200 portable photosynthesis system (LI COR Biosciences, Lincoln, NE). Overall, mulch treatment had no affect on Rs flux dynamics in the open, unshaded location, though Rs fluxes were significantly higher in uncomposted landscape tree trimming plots during fall 2005 compared to the other treatments. Mulch treatment did affect Rs flux dynamics under *N. oleander* canopies during the spring of both years and fall 2004. Specifically, soil mulched with landscape tree trimmings had the highest Rs fluxes in spring and fall 2004. Soil mulched with decomposing granite had the highest Rs fluxes in spring 2005 following an abnormally wet winter. Mulch treatment had no affect on Rs fluxes during the hot and dry summer of either year.

Sprague, S., L. Shender, and C. O'Brien. Research Branch, 2221 W. Greenway Rd., Arizona Game and Fish Department, Phoenix AZ 85023. ***Wildlife Use of Preserved Natural Habitats Within the Greater Phoenix Metropolitan Area.***

The objective of our study is to identify habitat and environmental characteristics that contribute to avian and mammalian species diversity and relative abundance in order to establish guidelines for both land development and preservation of natural areas. We have selected representative areas of various types of habitat such as park preserves, river systems, washes, and undeveloped public land. Our initial data collection has been in the Lookout Mountain (LM) and the Phoenix Mountain (PM) Preserves, where we have begun small mammal trapping, camera trapping, recreation counts, incidental observations, quadrat and line-transect vegetation sampling, scent station and track plate investigations, and owl broadcast surveys. Future data collection efforts will include direct observations, GIS analysis, water availability, and light and noise disturbance investigations. Thus far, 420 nights of small mammal trapping have yielded a success rate of 19% (n=81), a recapture rate of 30% (24 recaptures), and established the presence of two rodent species in both study sites (*Neotoma albigula* was present in four of five transects and *Chaetodipus intermedius* in three of five transects). Five days of camera trapping have yielded further observations of *N. albugula*. Incidental observations from 47 visits have identified 49 species (LM=42 species, PM=34 species) representing 31 families of birds, mammals, and reptiles (LM=26 families, PM=25 families). We are in the first year of this study, so we will continue current efforts and refine our observation techniques, in addition to implementing new investigative methods. Ultimately we will use our results to make recommendations to developers and city planners, who are attempting to create a balance between the need for development and preservation of natural areas.

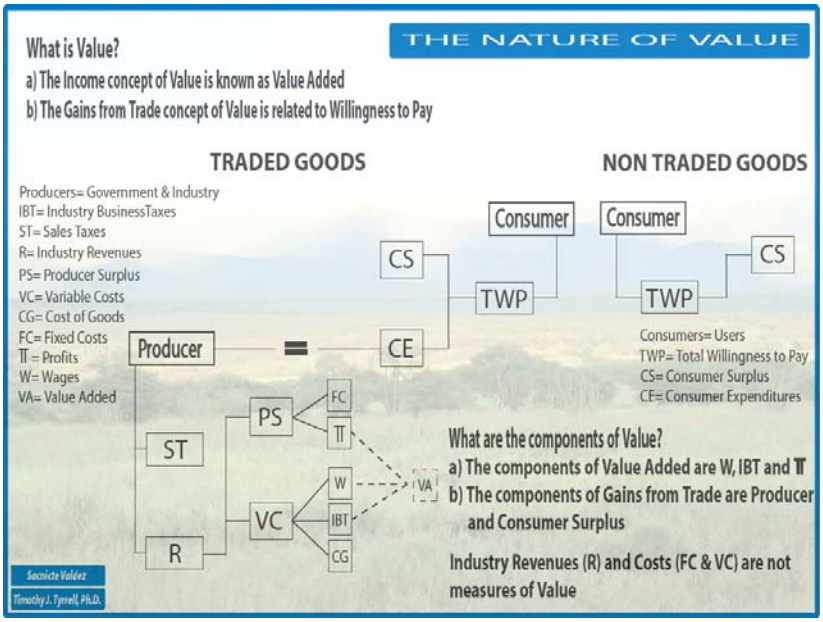
Stinson-Keys, L.[1], M. Elser[2], and C. Saltz[2]. [1]Tempe Preparatory Academy, 1251 E. Southern Ave, Tempe, AZ 85282; and [2]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Ecology Explorers: Student Contributions to the CAP LTER Project.***

Students from across the Phoenix metropolitan area have been involved in collecting population data in their schoolyards. Students from Lynn Stinson-Keys' seventh grade science class at Tempe Preparatory Academy have been collecting and analyzing backyard bird data. The top five posters from the class will be presented.

Tyrrell, T., and S. Valdez del Rio. School of Community Resources and Development, Arizona State University, PO Box 847703, Tempe, AZ 85287-4703. ***The Nature of Economic Value.***

Projects such as the CAP LTER at Arizona State University are charged with the problem of valuing services provided by the regional ecosystem. The identification and quantification of the amounts of services provided is the first task. The second and arguably more difficult task is to assign values to these services. This poster attempts to illustrate the two legitimate concepts of economic value that can be used: the income concept and the gains from trade concept. The components of the income (also called value added) concept are wages, profits and indirect business taxes. The components of the grains from trade concept are consumer and producer surplus. The two concepts overlap and cannot be added. Industry revenues and costs of production are not generally equivalent to either of these concepts and can be used to measure value only in rare cases.

While some ecosystem services can be considered "traded goods," most fall under the category of "non-traded goods." For non-traded goods only the gains from trade concept can be applied (income cannot be computed), but the calculation of consumer surplus (or other more technically correct measures) can be extremely difficult.



Walker, J.[1], and E. Banzhaf[2]. [1]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601; and [2]UFZ Centre for Environmental Research Department of Applied Landscape Ecology, Permoserstr.15, 04318 Leipzig, GERMANY. ***Urban Tree Cover of Leipzig, Germany.***
High-resolution, color-infrared photography was used to extract tree cover through an object-oriented classification procedure, which takes into account intrinsic information (i.e., within-pixel spectra values and object texture) as well as neighborhood characteristics making possible the extraction of real-world object, proper in shape, as the basic units for analysis. The entire image was subdivided into small, relatively homogeneous polygons as defined by a segmentation algorithm, in essence creating patches as the fundamental units for analysis. These objects were then classified based on contextual relationships, such as spectral signatures, texture, and shape metrics in order to produce a binary classification: (1) woody vegetation and (2) all other land-cover types.

Walker, J.[1], and T. Blaschke[2]. [1]School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 852874601; and [2]Universität Salzburg, Zentrum für GeoInformatik (Z_GIS), Schillerstraße 30, A-5020 Salzburg, AUSTRIA. ***A High-Resolution Urban Landcover Classification Scheme for Phoenix.***
An object-oriented approach was utilized in the development of two urban land-cover classification schemes utilizing high-resolution (0.6m), true-color aerial photography. The imagery was segmented into classifiable polygons through a two-tiered segmentation process. A preliminary segmentation level was resegmented based on the spectral similarity of neighboring objects, merging larger objects (e.g., houses and roads), yet retaining the fine-scale segmentation of smaller, more heterogeneous objects (e.g., trees). An initial classification scheme was developed for a sample area within the Phoenix metropolitan area, and was heavily weighted by standard nearest neighbor functions generated by samples from each of the classes, which produced an enhanced accuracy (84%). A second classification was developed from the hierarchical structure of initial classification scheme in which all parameters were transformed into a fuzzy rule set, creating a product transportable to different areas of interest of the same imagery, or for use in similar imagery of different times for landcover change detection. A comprehensive accuracy assessment revealed a slightly lower overall accuracy of 79% for the rule set based classification. We conclude that the transportable classification scheme is satisfactory for general landcover analyses; yet classification accuracy can be enhanced at site-specific venues with the incorporation of nearest neighbor functions using class samples.

Warren, P. S.[1,2], P. Tarrant[2,3], E. Adley[4], J. M. Grove[5], E. Shochat[2,6], and S. Faeth[3]. [1]Department of Natural Resources Conservation, Holdsworth Hall, University of Massachusetts, Amherst, MA 01003; [2]Global Institute of Sustainability, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [4]Purdue University, Smith Hall, 901 W. State Street, West Lafayette, IN 47907-2089; [5]USDA Forest Service, 705 Spear Street, South Burlington, VT 05403; and [6]Sutton Avian Research Center, University of Oklahoma, POB 2007, Bartlesville, OK 74005. ***Humans in the Urban Food Web: Emerging Insights from Phoenix and Baltimore.***

Human activities dramatically change abundances, diversity, and composition of species. Little is known about how the most intense human activity, urbanization, alters food webs and trophic structure in biological communities. Experimental studies at the Central Arizona-Phoenix (CAP) LTER reveal surprising alterations in control of trophic dynamics. Supplemented resources, particularly water, increase and stabilize productivity, setting the stage for altered control of populations. Stan Faeth and colleagues have found that, in contrast to outlying deserts where limiting resources dominate, predation by birds becomes the dominant force controlling arthropods on urban plants. Eyal Shochat and colleagues argue that reduced predation risk on birds elevates elevated abundance and alters foraging behavior such that urban birds exert increased top-down effects on arthropods. However, the nature of human provisioning and alteration of resources and predation varies within cities, according to our research at both CAP and BES LTER. For example, bird feeders appear more common in neighborhoods with moderate income and with more retired people. Perversely, birds show evidence of greater competition for food resources in these same neighborhoods. How do we integrate humans into our models and understanding of urban food webs? The presentation will serve as the start of a conversation on this topic and an invitation for feedback as we develop the next phases of our research.

Wentz, E.[1], and P. Gober[1,2]. [1]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [2]Decision Center for a Desert City, Arizona State University, PO Box 878209, Tempe, AZ 85287-8209. **Factors Influencing Residential Water Consumption for the City of Phoenix, Arizona.**

Continued population growth and the associated process of urbanization in the desert city of Phoenix, Arizona, will require a reliable source of water for its residents. Although the city currently has an inexpensive and abundant supply of water, it is imperative that the city faces the challenge associated with providing continued safe drinking water. To better understand the demand side of this important water issue, we explored the relationship between detached single-family residential water demand and the factors influencing water demand. Determinants of residential water use reflect both indoor and outdoor uses. The factor associated with indoor use was measured by household size, reflecting usage associated with dish washing, laundry, bathing etc. The strongest determinant of outdoor use was the presence of a pool. Other factors were lot size and landscaping style. Two models analyzing these factors were compared. The first model was a global model based on ordinary least squares (OLS). The second model was a local model based on a geographically weighted regression (GWR), which factored in neighborhood relationships as well. Our model parameters can be used to investigate demand under different urban-growth and planning scenarios for policy and decision makers in the city.

Wong, C. P.[1], L. Murawski[2], K. Szlavecz[3], R. V. Pouyat[4], P. Marra[5], R. Casey[6], and S. Lev[6]. [1]Occidental College, Los Angeles, CA, and Institute of Ecosystem Studies, Millbrook, NY 12545; [2]Department of Biology, 75 S. Manheim Blvd, New Paltz, NY 12561-2443 and Institute of Ecosystem Studies, Millbrook, NY 12545; [3]Department of Earth and Planet Sciences, John Hopkins University, Baltimore, MD 21218, and Baltimore Ecosystem Studies, 5200 Westland Blvd, Baltimore, MD 21227; [4]USDA Forest Service and Baltimore Ecosystem Studies, 5200 Westland Blvd, Baltimore, MD 21227; [5]Smithsonian National Zoological Park, 3001 Connecticut Ave NW, Washington, D.C. 20008; [6]Department of Chemistry, Towson University, 8000 York Rd, Towson, MD

21252-0001; and [7]Department of Physics, Astronomy, and Geosciences, Towson University, 8000 York Rd, Towson, MD 21252-0001. ***Heavy Metal Variations in Residential Soil Communities along an Urban to Rural Gradient***.
Densely populated cities, unlike rural communities, are highly impacted by heavy metal pollutants. They possess more pre-1940 (lead-painted) homes, contain congested roadways (source of historic lead gasoline, tire dust and break lining), and receive substantial amounts of atmospheric deposition. This study examined the distribution of heavy metals (Cr, Ni, Cu, Zn, As, Cd and Pb) in residential soils and arthropods: (i) regionally across an urban to rural land-use gradient and (ii) locally within yard patches (front yard, backyard, proximity to road, and home). All residences resided in the Baltimore and Washington D.C. Metropolitan areas as part of the Neighborhood Nestwatch Program. Soil communities varied regionally with inner urban soils containing significantly higher metal concentrations then rural. However, only inner urban soil lead concentrations (248.33±218.24 ppm) were significantly higher then all other land uses; outer urban (62.96±36.71 ppm), suburban (42.06±34.62 ppm) and rural (23.88±24.75 ppm). Isopod heavy metal contents strongly correlated to all soil metal concentrations except for Cu and Cd while earthworms significantly correlated only to Pb. The high accumulation of heavy metals in urban arthropods could significantly affect top trophic level consumers (such as birds).

Wu, J.[1,2], W. Shen[2], N. B. Grimm[1,3], and D. Hope[3]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [2]South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, CHINA; [3]Global Institute of Sustainability, Arizona State University, PO Box 873211,Tempe, AZ 85287-3211. ***Effects of Urbanization-Induced Environmental Changes on Desert Ecosystem Functioning.***
Urban ecosystems being profoundly modified by human activities provide a unique "natural laboratory" to study potential ecosystem responses to environmental changes. Indeed because large cities and their environs are now affected by urban heat islands, carbon domes, and high-level nitrogen deposition, to some extent they resemble the future of the global ecosystem. Urbanization in the metropolitan region of Phoenix, Arizona (USA), has resulted in pronounced changes in air temperature (maximum T_{max} and minimum T_{min}), atmospheric CO_2 concentration, and dry nitrogen deposition (N_{dep}). We used a physiologically based ecosystem model to investigate how the native Sonoran Desert ecosystem dominated by creosote bush (*Larrea tridentata*) responds to the urbanization-induced environmental changes. We found that, at the ecosystem level, aboveground net primary productivity (ANPP) and soil organic matter (SOM) both increased with increasing CO_2 and N_{dep} individually, and with all combinations of changes in T_{air}, CO_2, and N_{dep}. Soil N responded positively to increases in N deposition, but negatively to increases in CO_2 concentration and air temperature. Effects on ANPP and SOM were significantly greater in wet years, whereas changes in soil N were larger in dry years. At the plant functional type (PFT) level, ANPP generally responded positively to elevated CO2 and N deposition, but negatively to increased air temperature. However, significant changes in ANPP at the PFT level were observed, primarily in wet years. C3 winter annuals showed a greater ANPP response at higher CO_2 levels (>420 ppm) than shrubs. Between-plant FT competition for soil water and nutrients stimulated by increased CO2, may be responsible for this response differentiation. Overall, the effects of the three environmental factors were interactive and non-additive, and largely depended on variability in rainfall. These results have intriguing implications for assessing the ecological consequences of the urbanization in this region and arid ecosystems globally.

Zhuo, X.[1], P. Prapaipong[2], and E. Shock[1,2]. [1]Department of Geological Sciences, PO Box 871404, Tempe AZ 85287-1404; and [2]Department of Chemistry and Biochemistry, Arizona State University, PO Box 871604, Tempe, AZ 85287-1604. ***Patterns of Trace Element Distributions in the Urban- Desert System.***

Soil is the largest recipient system in most terrestrial areas, and a major sink and transport medium for various chemicals. Studying the spatial distribution of trace elements in soils can provide constraints on material fluxes in both aquatic and terrestrial systems. In this study, we are generating trace element distributions in the Central Arizona-Phoenix ecosystem by determining concentrations in surface soil samples (top 10 cm) from the 200 point survey in 2005, and developing testable hypotheses about sources and transport mechanisms. We are using a concentrated acid mixture to dissolve soil with microwave digestion, analyzing the trace elements in the samples by inductively coupled plasma mass spectrometry, and plotting the results using a geographical information system. Preliminary results indicate that certain elements such as Pb, Cd, Cu and Ag correlate positively with urbanization, and reach their largest concentrations in the urban center. Other elements including V, Sr and Be show little to no variation that depends on land use, and are randomly distributed over the CAP-LTER area, suggesting sources from the geological background of the desert. Distribution patterns for certain elements, such as As and Cr, are much more complicated. There is a subtle trend of high concentrations over the entire urban area, but no sharp distinction between urban concentrations and geological background concentrations. Land-use history and changes of concentrations with depth in soil profiles will help to determine the sources of those elements still in question.

Zoldak, M., S. Lemar, R. Jensen, and J. Hutchins. GIServices, Institute for Social Science Research, Arizona State University, PO Box 874602,Tempe AZ 85287-4602. ***Workflows: GIS Data to a Visualization Environment.***

The Decision Theater is an advanced visualization environment that will enable policymakers and others to see in detailed three-dimensional representation the consequences of their actions. But those who work with technology realize that things are never as simple as they might seem. This poster presents the methodology utilized to bring a small fraction of the expansive pool of existing GIS data into the Decision Theater model.