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

Fourth Annual Poster Symposium

January 17, 2002
Arizona Room, Memorial Union
Arizona State University

Sponsored by:
Center for Environmental Studies
Arizona State University

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Agenda
January 17, 2001
Arizona Room, Memorial Union

2:00-2:15	Welcome and Introductions *Charles Redman and Nancy Grimm*
2:15-3:15	Poster Session #1 – Biogeochemical processes; land use and history; climate and water; and modeling posters
3:15-4:15	Keynote Address – **Deborah B. Jensen** ***Conservation in an Urbanizing World***
4:15-4:30	Social with refreshments
4:30-5:30	Poster Session #2 – Education and data management; human dimensions; and plant and animal posters

DEBORAH B. JENSEN

Deborah B. Jensen is a conservation biologist and executive with substantial experience building and leading programs that deliver scientific knowledge to the practice of conservation. She has worked in the non-profit sector, in government and in academia.

As Vice President for Conservation Science for The Nature Conservancy she helped craft a new strategy for ecoregion-based conservation, and established a post-doctoral research program for conservation scientists. Her research interests are in conservation priority setting and adaptation to climate change. She is a senior fellow at the World Resources Institute and the President-elect for the Society for Conservation Biology. Her doctorate is from the Energy and Resources Group at the University of California at Berkeley.

2001 CAP LTER Symposium

Poster Session #1 (22)	Poster Session #2 (23)
Anderson, Moore, Rodriguez, & Xin	Bolin, Brazel, Collins, Grineski, Hackett, & O'Donnell
Berling-Wolff & Wu	Celestian & Martin
Bigler	Cousins, Whitcomb, & Stutz
Brazel & Selover	Doan, Buegge, Buegge, Gilbert, & Landrum
Esparza, Hu, Westerhoff, Sommerfeld, Baker, Dempster, Rodriguez, Dawson, Hintze, Cummings, & Masles	Elser & Saltz
Grossman-Clarke, Hope, Hyde, Stefanov, Fernando, & Grimm	Gilbert, Buegge, McCartney, Gries, & Landrum
Hall, Grimm, Collins, Gade, Hope, Jenerette, Kinzig, Schade, Sponseller, Welter, Wu, Johns, Luck, Erickson, & Kochert	Gries, McCartney, Schoeninger, & Sundermier
Hedquist and Brazel	Harner, Kuby, & Gober
Hu, Sommerfeld, Dempster, Westerhoff, Baker, & Nguyen	Hope, Gries, Carroll, Zhu, Fagan, Redman, Grimm, Nelson, Kinzig, & Martin
Ivanich, Tyburczy, & Arrowsmith	Jenerette, Goldsmith, Marussich, Roach, & Wu
Jenerette & Wu	Katti, Shochat, Stuart, Lemmer, & Rambo
Lewis, Wu, & Grimm	Marussich & Faeth
Lopez, Zoldak, Smith, Fry, & Redman	Nelson, Bolin, Hackett, Smith, & Grineski
Peccia, Dillner, & Borenson	Nelson, Bolin, Smith, O'Donnell, & Hackett
Perry, Anderson, & Buseck	Nelson, Harlan, Sicotte, & Yang
Roach & Grimm	Quay
Stuart	Shochat, Faeth, Fagan, Tseng, Rambo, & Cassalata
Swanson	Shochat, Lerman, Putnam, & Katti
Tomalty & Selover	Sicotte
Wentz, Anderson, Stefanov, & Briggs	Stabler & Martin
Wu, Wu, Stuart, & Harris	Stiles & Scheiner
Zoldak, Lopez, Smith, Fry, & Redman	Warren & Kinzig
	Whitcomb & Stutz

LIST OF POSTERS

POSTER SESSION #1

BIOGEOCHEMICAL AND GEOPHYSICAL PROCESSES

Anderson, James, Gordon Moore, Rudolpho Rodriguez, and Hua Xin. ***Inorganic aerosol generation from freeways in the greater Phoenix area.***

Hall, Sharon J., Nancy B. Grimm, S. L. Collins, Kris Gade, Diane Hope, G. Darrel Jenerette, Ann Kinzig, John D. Schade, R. Sponseller, Jill R. Welter, Wanli Wu, Tracy Johns, Matt Luck, Roy Erickson, and Cathy Kochert. ***N_{ox} emissions and uptake by urban soils.***

Ivanich, Paul A., James A. Tyburczy, and J Ramón Arrowsmith. ***Measuring bedrock topography using gravity to understand subsidence along a portion of the CAP canal in northeast Scottsdale.***

Lewis, David, Wanli Wu, and Nancy Grimm. ***Material transport in storm runoff from urban catchments.***

Peccia, Jordan, Ann M. Dillner, and Justin Borenson. ***Correlating bioaerosols with PM2.5 and PM10 concentrations.***

Perry, Dana, James Anderson, and Peter Buseck. ***Analysis of atmospheric particles deposited onto mesquite leaves in the Central Arizona - Phoenix LTER area.***

Roach, W. John, and Nancy B. Grimm. ***Contrasting diel patterns of water chemistry from three lakes in Indian Bend Wash.***

Wu, Wanli, Jianguo Wu, Diana Stuart, and Jayme Harris. ***Spatial patterns of impervious surface cover in the Cave Creek watershed, Phoenix metropolitan area.***

LAND USE AND HISTORY

Bigler, Wendy. ***Reconstructing prehistoric streamflow in the Salt River: An error analysis.***

Lopez, Santiago, Mike Zoldak, C. Scott Smith, Jana Fry, and Charles Redman. ***Land use trajectories.***

Swanson, Steve. ***Time, space, and stability: Investigating landscape responses to climate variability in the Southwest.***

Wentz, Elizabeth, Sharolyn Anderson, William Stefanov, and John Briggs. ***Desert fire history and effects on the Phoenix, Arizona, metropolitan area.***

Zoldak, Mike, Santiago Lopez, C. Scott Smith, Jana Fry, and Charles Redman. ***Experimental use of Unsupervised Classification Method for examining spatio-temporal landuse patterns.***

CLIMATE AND WATER

Brazel, Anthony, and Nancy Selover. ***The evening transition in Phoenix.***

Esparza, Mario, Qiang Hu, Paul Westerhoff, Milton Sommerfeld, Larry Baker, Tom Dempster, Mari Rodriguez, Samanth Dawson, Kirsten Hintze, Michelle Cummings, and Marisa Masles. ***Occurrence and treatment of algae-related taste and odor metabolites in Arizona reservoirs and urban canals.***

Hu, Qiang, Milton Sommerfeld, Thomas Dempster, Paul Westerhoff, Larry Baker,and My-Linh Nguyen. ***Influence of growth conditions on production and release of the taste and odor compound geosmin by a cyanobacterium isolated from the phoenix water supply system.***

Stuart, Glenn. ***Effects of urbanization on pollen frequency distribution patterns in the Phoenix metropolitan area***.

Tomalty, Roger, and Anthony Brazel. ***Local variability of solar reception in CAP LTER.***

MODELING

Berling-Wolff, Sheryl, and Jianguo Wu. ***Landscape structure of the Phoenix metropolitan region: Evaluation of an urban growth model.***

Grossman-Clarke, Susanne, Diane Hope, Peter Hyde, Will Stefanov, Harindra S. Fernando, and Nancy B. Grimm. ***Assessment of temporal and spatial characteristics of nitrogen dry deposition in the Phoenix metropolitan area.***

Hedquist, Brent, and Anthony Brazel. ***The use of GIS and visualization tools to interpret microclimate change along the Phoenix East Valley urban fringe.***

Jenerette, G. Darrel, and Jianguo Wu. ***Modeling fine scale spatial heterogeneity of carbon and nitrogen dynamics in the Central Arizona Phoenix region.***

POSTER SESSION #2

EDUCATION AND DATA MANAGEMENT

Doan, Shannon, Gretchen Buegge, J. Jeremy Buegge, Edward Gilbert, and Leslie R. Landrum. ***The Arizona State University Herbarium Vascular Plant Image Library online.***

Elser, Monica, and Charlene Saltz. ***Ecology Explorers: Program components***.

Gilbert, Edward, Jeremy Buegge, Peter McCartney, Corinna Gries, and Leslie Landrum. ***Virtual floras.***

Gries, Corinna, Peter McCartney, Robin Schoeninger, and Amy Sundermier. ***EML: Submission and discovery of ecological metadata.***

Harner, John, Michael Kuby, and Patricia Gober. ***Hands-on learning about urban sprawl.***

Quay, Ray. ***Greater Phoenix 2100 Regional Atlas.***

HUMAN DIMENSIONS

Bolin, Bob, Anthony Brazel, Tim Collins, Sara Grineski, Edward Hackett, and Maureen O'Donnell. ***Community-based research: Environmental conditions, human health and the quality of life.***

Hope, Diane, Corinna Gries, Steve Carroll, Weixing Zhu, William F. Fagan, Charles L. Redman, Nancy B. Grimm, Amy Nelson, Ann Kinzig, and Chris Martin. ***Humans structure the ecosystem properties of cities: Findings from the '200 survey.'***

Jenerette, Darrel, Susan Goldsmith, Wendy Marussich, John Roach, and Wanli Wu. ***Contrasting socio-ecological relationships between China and the United States: Water footprints for cities in two distinct cultures.***

Nelson, Amy, Bob Bolin, Edward Hackett, Scott Smith, and Sara Grineski. ***Sunbelt toxics: Industrial polluters in Phoenix, Arizona.***

Nelson, Amy, Bob Bolin, Scott Smith, Maureen O'Donnell, and Edward Hackett. ***The development of environmental injustices in Phoenix, Arizona.***

Nelson, Amy, Sharon Harlan, Diane Sicotte, and Fang Yang. ***Labor market dynamics in a postindustrial city: A spatial and sectoral analysis of employment changes in the Phoenix MSA.***

Sicotte, Diane. ***A hazardous undertaking: The social construction of environmental contamination claims.***

Warren, Paige S., and Ann P. Kinzig. ***Neighborhood socioeconomic status predicts ecological characteristics of small urban parks.***

PLANTS AND ANIMALS

Celestian, Sarah B., and Chris A. Martin. ***Effects of commercial parking lots on size of size landscape trees.***

Cousins, Jamaica, Sean A. Whitcomb, and Jean C. Stutz. ***Arbuscular mycorrhizal fungal species composition, richness, and abundance in the Phoenix metropolitan area.***

Katti, Madhusudan, Eyal Shochat, Diana Stuart, Jomarie Lemmer, and Beverly Rambo. ***Environmental and socioeconomic influences on the Phoenix avifauna.***

Marussich , Wendy A., and Stan H. Faeth. ***Trophic dynamics of urban and desert ecosystems: Arthropod communities on brittlebush (*****Encelia farinosa*****).***

Shochat, Eyal, Stanley Faeth, William Fagan, Maggie Tseng, Jennie Rambo, and Richard Cassalata. ***Seventy-eight years of ground-arthropod sampling in the greater Phoenix area: Results from the first three years.***

Shochat, Eyal, Susannah Lerman, Christopher Putnam, and Madhusudan Katti. ***Differences in bird foraging behaviour between Sonoran Desert and urban habitats: A field experiment with seed trays.***

Stabler, L. Brooke, and Chris A. Martin. ***Irrigation volume and pruning frequency affect water use efficiency of two Southwest landscape shrubs.***

Stiles, Arthur, and Samuel Scheiner. ***Preliminary classification of desert plant communities using Landsat Thematic Mapper (TM) data.***

Whitcomb, Sean, and Jean C. Stutz. ***Pruning effects on root length density, root biomass, and arbuscular mycorrhizal colonization in two shrubs in a simulated xeric landscaped yard.***

ABSTRACTS

All of the following abstracts are listed alphabetically by first author.

Anderson, J. R.[1], G. Moore[2], R. Rodriguez[1], and H. Xin[3]. ***Inorganic aerosol generation from freeways in the greater Phoenix area.*** ***[1]***Department of Mechanical and Aerospace Engineering, Arizona State University, PO Box 876106, Tempe AZ 85287-6106; Department of Chemistry and Biochemistry, Arizona State University, PO Box 871604, Tempe AZ 85287-1604; and [3]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404.

Freeways are significant line-sources of aerosol particles that fall within both PM2.5 and PM10. We have conducted a series of field experiments along Phoenix-area freeways to separate background aerosol from aerosols generated by vehicular traffic. Principal aerosol types included re-entrained mineral dust, Ca-rich silicates from concrete roadway surfaces, Fe-rich particles (probably from engine and tire wear), rubber fragments (from tire wear), soot from combustion, and a group a Na-rich types (perhaps from combustion of Na-bearing fuel additives). During the winter pollution season, freeway-generated PM10 from the best-studied site on Loop 101 in Scottsdale was on the order of 10 to 20 g m^{-3}. However, when mean wind speed fell below a threshold of about 2.5 m/s aerosols were trapped within a turbulence structure produced by passing traffic. At such times of stagnant air, aerosol concentrations quickly rose to values as much as ten times the background PM10 value. Once the mean wind rose above the threshold values, concentrations quickly returned to more normal levels. While not measured, gases such as CO could be expected to be trapped in a similar way during periods of stagnant air. Because stagnant conditions are common in both the winter and summer pollution seasons, freeways and immediately adjacent land can be considered to be special linear micro-environments that are frequently subject to vehicle-generated pollutant levels far above ambient conditions for most of the airshed.

Berling-Wolff, S., and J. Wu. ***Landscape structure of the Phoenix metropolitan region: Evaluation of an urban growth model.*** Department of Plant Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501.

Cellular automatons (CA) are well suited to investigations of complex urban form due to their spatially explicit nature and their ability to generate very complex global forms from simple local rules, utilizing the principles of self-organizational theory. We have developed an urban growth model for the Phoenix region (PHX-HILT) based on a model (HILT) that was originally designed for the San Francisco Bay Area. To better represent Phoenix, PHX-HILT contains a number of modified and new growth rules, and is parameterized with data on land use and a suite of other variables collected within the Phoenix area. As part of the evaluation of PHX-HILT, we compare the shape complexity of land use types between the simulated and empirical maps using fractal dimension and other landscape pattern indices, to determine if the model produces a reasonable representation of the actual urban form. Several class and landscape level metrics were obtained and compared at five different grain sizes: 1 km, 500 m, 250 m, 100 m and 30 m. The fractal indices compared include the Double Log Fractal Dimension (DLFD), the Mean Patch Fractal Dimension (MPFD) and the Area-Weighted Mean Patch Fractal Dimension (MPWFD). Other indices include Patch Density (PD), Landscape Shape Index (LSI), Contagion (CONTAG) and Shannon's Diversity Index (SHDI).

Bigler, W. ***Reconstructing prehistoric streamflow in the Salt River: An error analysis.*** Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104.

The Hohokam built the largest canal network known in prehistoric North America. Understanding the relationship between these people and the river that supported them is a key challenge for archaeologists. Using tree ring data collected on the Mogollon Rim, archaeologists have calculated annual streamflow conditions for the past 1,400 years. These data have also been used to infer presence and absence of flooding. Through this project I analyze calculations and assumptions previously made and show that while tree ring data are useful, they have limited application in retrodicting precise annual streamflow, and by themselves do not indicate presence or absence of flood events.

Bolin,[1] B., A. Brazel[2], T. Collins[2], S. Grineski[1], E. Hackett[1], and M. O'Donnell[1]. ***Community-based research: Environmental conditions, human health, and the quality of life.*** [1]Department of Sociology, Arizona State University, PO Box 872101, Tempe AZ 85287-2101; and [2]Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104.

Residents of the Homedale neighborhood in west Phoenix are concerned about environmental conditions in their neighborhood. They complain of sulfur smells and various health problems. They organized themselves to perform a self-study of environmental conditions, health and the quality of life, and came to Arizona State University to ask for information about environmental conditions an guidance in the research. We are collaborating with community leaders to develop a survey instrument focused on health perceptions, hazard perceptions and quality-of-life indicators. In addition, health information will be obtained from symptom and conditions checklists along with information on workplace and neighborhood exposure to environmental hazards. Chemical hazards, toxicity information, and specific health concerns associated with point-source emitters will be mapped in order to help characterize potential risk factors. Ambient air pollution monitoring and dispersion modeling will also be utilized. This project unites sociological, geographical, and geophysical theories, findings and methods (e.g., organizational behavior, community, social stratification, survey research, spatial analysis, and air-quality measurements and modeling) in a community-based research framework. In this it marries the principles of the science shops, pioneered in the Netherlands, with the ideals of a metropolitan university to understand and serve the local community. This project extends existing Central Arizona - Phoenix Long-Term Ecological Research (CAP LTER) into the new area of environmental health. The survey instrument we develop may be used in future CAP LTER Environmental Risk Group research. We hope the project will be a model for future community-based research efforts in greater Phoenix.

Brazel, A., and N. Selover. ***The evening transition in Phoenix.*** Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104.

Wintertime nighttime air motion in the Valley of the Sun is a case of differential cooling processes across differing landscapes, terrain drainage, and an understanding of the ground roughness and site exposure from place to place. Scientists are paying considerable attention to these processes in order to track air quality and other related ecosystem effects. We had an opportunity to establish a weather site in a drainage channel as part of a synergy project among Arizona State University, the City of Tempe, and McKemy Middle School. In this poster we illustrate what happens on a typical cold night in late winter, when for a diurnal period, several short-term stations were set up to observe wind processes in and above the Indian Bend Wash and Salt River channels and across Tempe Town Lake. The switch from daytime up-valley flow, to stagnation after sunset, to down-valley flow during the evening and early morning hours was observed at four sites around Tempe Town Lake. We also accessed all available wind recording sites in the Valley to observe the regional patterns as well. Results indicate that the Phoenix basin is rather unique in the large lag between daytime up-valley flow and subsequent switch to down-valley flow many hours after sunset. This is ascribed to the broad Valley geography, and length of time to western Valley sites for the drainage flow (i.e., 1-3 mph) to reach those areas. Sometimes the switch is as late as midnight, as occurred on the February 29th period illustrated here.

Celestrian, S. B., and C. A. Martin. ***Effects of commercial parking lots on size of six landscape trees.*** Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

Landscape trees in commercial parking lots provide shade as well as enhance aesthetic value. However, planting location might compromise tree growth and function. We studied the effect of commercial parking lots on the size of established landscape trees (*Brachychiton populneus, Fraxinus velutina, Pinus canariensis, Pinus halapensis, Prosopis chilensis,* and *Ulmus parvafolia*) in Phoenix, Arizona. During Summer 2001, tree canopy volume, height and trunk diameter at breast height (DBH) of trees species were evaluated in parking lot medians surrounded by asphalt, and in adjacent perimeter planter beds in 15 commercial parking lots. For all tree species in medians, mean canopy volume, height, and DBH was 73, 36 and 41%, respectively, compared to trees in adjacent perimeter planter beds. Size of *Pinus halapensis* and *Ulmus parvafolia* was most negatively affected by median planting location, while size of *Brachychiton populneus* and *Prosopis chilensis* was least affected by median planting location. For all trees, an infrared thermometer was used to measure summer mid-day surface temperatures along four (north, east, south, and west) gradient transects (.45, 1.22, 3.05, and 7.62 m) from the tree trunk base. Temperatures of asphalt surfaces around medians were up to 35 °C higher than surface temperatures of vegetated and non-vegetated surfaces in adjacent perimeter planter beds.

Cousins, J. R., S. A. Whitcomb, and J. C. Stutz. ***Arbuscular mycorrhizal fungal species composition, richness, and abundance in the Phoenix metropolitan area.*** Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

Little is known about arbuscular-mycorrhizal fungi (AMF) in urban ecosystems, but with a worldwide increase in urban areas there is a growing need to understand AMF diversity and functioning in these systems. This project sought to characterize AMF species composition, richness, and abundance at twenty sites located in the Phoenix, Arizona, metropolitan area (Survey 200 Pilot Study). Sampling sites were selected to represent four predominant land use types found in the metro area: urban/residential, urban/non-residential, agricultural, and desert. AMF spores were extracted and identified from soil samples and trap cultures that were established from soil collected at each site. Spore abundance in soil samples was low (less than 50 spores/100 cm^3 at over half of the sites), with the lowest numbers of spores collected from residential and desert sites. Species richness ranged from 2 to 9 AMF species detected per site. The greatest number of species was detected at desert and non-residential sites and the least number detected at residential and agricultural sites. Eighteen species of AMF were identified, with 13 from the genus *Glomus*, 4 from *Acaulospora*, and 1 from *Entrophospora*. A Geographic Information

System (GIS) analysis of the relationships between AMF species richness and composition, land use history, and soil properties found no differences in AMF species richness or spore abundance among the land use types or soil taxa sampled.

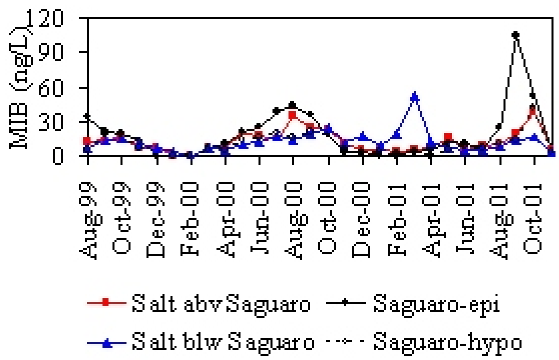
Doan, S., G. Buegge, J. J. Buegge, E. Gilbert, and L. R. Landrum. ***The Arizona State University Herbarium Vascular Plant Image Library on-line.*** Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

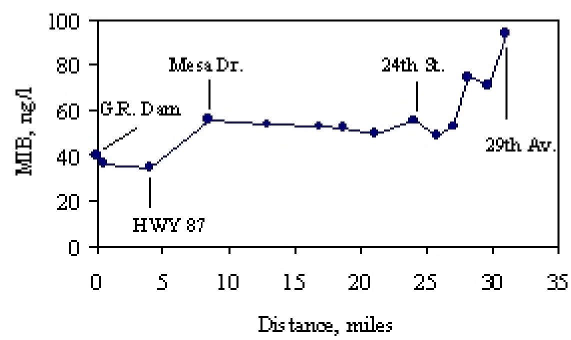
The Arizona State University (ASU) Herbarium comprises over 240,000 collections of dried plants. Herbaria are of enormous value to researchers, who utilize the specimens for studies in myriad fields, including systematics, ecology, anthropology, entomology, geology, geography, homeopathy, cancer research, journalism and scientific illustration. It is a vital resource for the Central Arizona - Phoenix Long-Term Ecological Research (CAP LTER) project by providing an historical record of plants growing in the Phoenix area and serving as a reference for new identifications. The general public also find the Herbarium valuable and often call or visit requesting plant identification or general botanical information. While the Herbarium is open to everyone, many people are unable to physically visit the facility. The ASU Herbarium has recently increased access to its collections by establishing the Vascular Plant Image Library, or "virtual" herbarium on the world wide web. The Library currently includes 1,070 scanned herbarium sheets and 425 photos of living plants. Essentially all the vascular plants growing wild in the Phoenix area are represented. These may be viewed anywhere access to the world wide web is available. Images are life-sized on the screen, and future plans include the ability to magnify selected portions of the plant.

Elser, M., and C. Saltz. ***Ecology Explorers: Program components***. Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

Students from across the Phoenix metropolitan area have been involved in collecting Central Arizona - Phoenix Long-Term Ecological Research (CAP LTER) population data in their schoolyards. The Ecology Explorers program has several components that make this a successful scientist-teacher-student partnership. View the components and the interactive web site in this presentation.

Esparza[1], M., Q. Hu[2], P. Westerhoff[1], M. Sommerfeld[2], L. Baker[3], T. Dempster[2], M. Rodriguez[1], S. Dawson[1], K. Hintze[1], M. Cummings[1], and M. Masles[2]. ***Occurrence and treatment of algae-related taste and odor metabolites in Arizona reservoirs and urban canals.*** [1]Department of Civil and Environmental Engineering, Arizona State University, PO Box 875306, Tempe AZ 85287-5306; [2]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; and [3]Baker Environmental Consulting, 8001 Greenwood Dr, Moundview MN 55112.





Does your tap drinking water smell earthy or musty? It is most likely due to the presence of two naturally occurring algae metabolites (MIB and Geosmin) that are noticeable in drinking water at levels of only 8-10 ng/L. The presence of these taste and odor (T&O) compounds in drinking water represents an interesting feedback between naturally occurring blue-green algae that produce the metabolites and the social perception/acceptance for the safety of drinking water. Water management practices and engineering applications have been shown to reduce blue-green algae populations, and reduce the T&O level in the Phoenix-metro drinking water.

Over the past three years, three reservoirs in the semi-arid region surrounding the City of Phoenix (Bartlett Lake, Saguaro Lake and Lake Pleasant) have been monitored for MIB and Geosmin production.Two long urban canals (Arizona and Central Arizona Project Canal) within metropolitan Phoenix were also monitored. The upper figure shows MIB concentration entering, leaving and within Saguaro Lake. MIB concentrations peaked during the summer months of each monitored year, and remained low the rest of the year. Similar annual seasonal trends in the production of T&O within each reservoir have been clearly identified. Issues related to reservoir limnology and biological processes will be included in the poster.

The lower figure shows the MIB concentration on August 4th 2001 along the Arizona Canal, from Mile 0 at Granite Reef Dam. In-canal production of MIB by periphytic algae showed the same annual trends as in-reservoir production. However, MIB in-canal production was mainly located at two different "hot spots" along the canal, Hwy 87-Mesa Dr. and 24th St.-29th Av. Dissolved nitrate from pumped groundwater has been implicated as one source for the location of these "hot spots," and provides an interesting feedback between ground- and surface-water management strategies. Two different in-canal treatments, copper sulfate addition and mechanical brushing, have been implemented several times during 2000 and 2001. These treatments reduce algae biomass and reduce T&O production.

Gilbert, E.[1,2], J. Buegge[1], P. McCartney[2], C. Gries[2], and L. Landrum[1]. ***Virtual floras.***
[1]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; and Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

At the minimum, a flora presents a checklist of species that have been documented to exist or have existed within the given area. One more complete might contain descriptions, dichotomous keys, illustrations and/or distribution maps. Usually a good part of the data is obtained directly from collection specimens. The growing trend of cataloging biological collection data into a database format is transferring this plethora of valuable data into a more manageable and flexible configurations. These databases integrated with image and character databases through a taxonomic thesaurus can establish a data structure with the same capabilities of a traditional flora though with a much greater flexibility.

The initial components of a web based flora linked to a biological database network has been developed for South Mountain Park in southern Phoenix (http://cochise.asu.edu/bdi/navikey/intro.htm). This site queries an Arizona State University database network to produce a browsable checklist with links to images and collection data for each species. Also available are a set of interactive identification keys in the form of Java Applets. These keys are in a polyclave format allowing the user to reduce the list of possible taxa by selecting traits from a characters list. Once the list is reduced to an individual or a manageable group, an identification can be verified through a brief description and links to various images.

Illustrated in this poster is how these applications along others will be used to mine a biological database network to produce an information resource as informative as a flora though with much greater search and presentation capabilities. A user will have the ability to create floras, checklists, and printed guides that are customized to match any combination of locality, habitat, or plant group definitions. Furthermore, it will be a flora that can always be revised, improved, and built upon.

Gries, C., P. McCartney, R. Schoeninger, and A. Sundermier. ***EML: Submission and discovery of ecological metadata.*** Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

Ecological Metadata Language, or EML, is a working draft of the metadata standards developed by the ASU BDI research project in conjunction with the LTER Metadata Committee and the Knowledge Network for Biocomplexity (KNB) Project at the National Center for Environmental Analysis and Synthesis (NCEAS). It forms the basis for a series of advanced applications that will enhance the management of and access to ecological data. Two examples are described in this poster.

1) Xylographa is a "XML input Wizard" that is being built after the model of tax entry programs. Based on a XML schema it allows the user to enter data into appropriate fields, pulls information out of databases, and converts metadata compiled by certain other programs (e.g. ArcGIS). Help screens guide the user through the input, reverse engineering, and conversion process. The information can then be saved as EML file and loaded into a catalog.

2) The metadata query system "Xanthoria" provides a web-accessible method for querying a number of structurally different, remote metadata storage facilities simultaneously. The system employs the use of SOAP (Simple Object Accessing Protocol) to send query requests and responses in the form of XML messages back and forth between a query application and a number of registered query targets. The system is exceedingly flexible, as it is not restricted by firewalls or differences in programming languages and operating systems.

Grossman-Clarke[1], S. , D. Hope[2], P. Hyde[3], W. Stefanov[4], H. S. Fernando[1], N. B. Grimm[2]. ***Assessment of temporal and spatial characteristics of nitrogen dry deposition in the Phoenix metropolitan area.*** [1]Department of Mechanical and Aerospace Engineering, Arizona State University, PO Box 876106, Tempe AZ 85287-6106; [2]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; [3]Arizona Department of Environmental Quality, 3033 N. Central Ave, Phoenix AZ 85012-2905; and [4]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404.

The aim of our study is to answer the question if nitrogen dry deposition fluxes represent a significant input to the N mass balance of the CAP ecosystem.

In order to determine nitrogen dry deposition fluxes we developed a diagnostic model which includes equations describing the surface energy balance and the ability of the surface to take up matter. Input data are measured airborne pollutant concentrations (NO, NO_2, NO_x) and hourly meteorological variables. Those data are available on a continuous basis over extended time periods from 6 air quality monitoring stations operated by the Arizona Department of Environmental Quality and Maricopa County Air Quality Division. Five sites are located within the urban core area and one site in the surrounding desert. Land use data were obtained from a digitized land use classification derived from LANDSAT TM at a resolution of 30m x 30m, combined with detailed ground survey data on surface cover and vegetation types at 204 sites across the study area. Model simulations were carried out for the whole year of 1998 determining annual NO, NO_2 and NO_x dry deposition fluxes at the six locations.

The simulations show that dry N deposition rates derived from NO_x species alone are significantly elevated above rates of N deposition in non-urban environments, but within the range of fluxes found from similar urban areas such as Los Angeles. NO_x deposition shows a marked seasonal pattern, peaking over the winter months and declining during the summer. This seasonal trend is much less distinct for the predicted NO and NO_2 deposition fluxes. From a sensitivity analyses follows that the most important determinants of N deposition fluxes are the ambient concentration of NO_x species in the atmosphere and the amount of vegetated surface cover.

Hall, S. J.[1], N. B. Grimm[2], S. L. Collins[3], K. Gade[2], D. Hope[4], G. D. Jenerette[3], A. P. Kinzig[2], J. D. Schade[2], R. Sponseller[2], J. R. Welter[2], W. Wu[2,4], T. Johns[2],[4], M. Luck[4], R. Erickson[4], and C. Kochert[2,4]. ***NO_x emissions and uptake by urban soils.***
[1]Environmental Science Program, The Colorado College, Colorado Springs CO 80903; [2]Department of Biology, Arizona State University, PO Box 8731501, Tempe AZ 85287-1501; [3]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; and [4]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

The gaseous oxides of nitrogen, nitric oxide (NO) and nitrogen dioxide (NO_2; NO + NO_2 = NO_x), are common products of fossil fuel combustion in the urban atmosphere that are derived from both industrial (stationary) and transportation (mobile) sources. Anthropogenic NO_x emissions are regulated by law because they play a central role in tropospheric ozone formation. However, little is known about the consequences of anthropogenic NO_x emissions on ecosystem function in the urban environment and surrounding, undeveloped regions. We measured NO_x uptake and emissions from soils in three landscape positions, including managed turf, xeriscape, and unmanaged desert remnants within the Central Arizona – Phoenix LTER site. Desert remnant soils were strong NO_x sinks but became NOx sources immediately following experimental watering. In contrast, NOx fluxes in managed turf and xeriscaped soils were highly variable, ranging from strong sinks to strong sources of NO_x, likely depending on the initial inorganic nitrogen concentration and water-filled pore space of the soil. Although xeric soils are known to be large sources of NO globally, particularly after rainfall, urban soils are strong sinks for anthropogenic NO_2 which dominates the soil-atmosphere exchange of NO_x in the urban ecosystem.

Harner, J.[1], M. Kuby[2], and P. Gober[2]. ***Hands-on learning about urban sprawl.***
[1]Department of Geography, 1420 Austin Bluffs Pkwy, University of Colorado at Colorado Springs, Colorado Springs CO 80933-7150; and [2]Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104.

The traditional emphasis on instructor-centered teaching is being replaced by a focus on student-centered learning. *Human Geography in Action*, a combination textbook-lab manual-CD, comprises 14 hands-on chapters that challenge students to collect, manipulate, display, and interpret geographic information. The chapter on urban sprawl involves an interactive case study of urban growth in Colorado Springs. The activity has three parts. In the first, students run a computerized animation of the growth in Colorado Springs from 1950 to 2000 assessing the relationship between transportation development and the pattern of urban growth. In the second, they use GIS to explore five urban-growth scenarios (infill, urban villages, beltway, growth corridors, and leapfrog) and overlay several different data layers to determine what effect the scenarios have on transportation and sensitive ecological zones. The five scenarios were among those actually considered by city planners in 2000. The third part involves a structured role-playing debate in which students as stakeholders express preferences for a particular form of urban growth and then break into citizen action committees charged with making a single recommendation to the City. The chapter conveys the difficult choices facing 21st Century cities, and the different perspectives people have about these choices.

Hedquist, B., and A. J. Brazel. ***The use of GIS and visualization tools to interpret microclimatic change along the Phoenix East Valley urban fringe.*** Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104.

The objective of this study is to observe gradients of temperature and moisture at the time of maximum urban heat island development in the southeast valley of Phoenix, and to conduct research on the spatial and temporal variance of these gradients and their relation to the built residential, urban, and rural (agricultural and desert) environments. Data has been collected during a five-month period through the use of various field methods. This includes a series of automobile transects (27), collecting one-minute temperature, humidity, and dew-point information, and with the use of six long-term automated weather stations (HOBOS), collecting five-minute weather data at locations corresponding to CAPLTER 200-point survey points along the urban fringe. Results collected thus far indicate a thermal gradient as great as 11 °C between urban to rural areas along the transect route. A proposed interactive, web-based exploratory interface is presented, which allows the user to visualize, spatially and temporally, seasonal heat island differences along the urban fringe.

Hope, D.[1], C. Gries[1], S. Carroll[2], W. Zhu[3], W. F. Fgan[4], C. L. Redman[1], N. B. Grimm[3], A. Nelson[1], A. Kinzig[3], and C. Martin[5]. ***Humans structure the ecosystem properties of cities: Findings from the '200 survey'.*** [1]Arizona State University Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; [2]Department of Statistics, Oregon State University, Corvallis OR 97331-4606; [3]Department of Biological Sciences, Box 6000, Binghamton University – SUNY, Binghamton NY 13902-6000; [4]Department of Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501; and [5]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

At the Central Arizona - Phoenix (CAP) LTER study site, we undertook an extensive integrated inventory to answer the question: "To what extent do human variables contribute to explaining spatial variation in the basic ecological properties of an urban ecosystem?" We used a dual-density randomized tessellation stratified design, with a sampling density inside:outside the developed urban core of 3:1. Data from a synoptic integrated field inventory were supplemented with geographic and socioeconomic variables from existing CAP databases and from the US Census data. Plant diversity, and soil NO_3-N content were modeled using the 12 independent variables, representing the main geophysical, geographic and human characteristics of the study area. Spatial patterns in soil NO_3-N across the whole site were related to human population density, the proportion of impervious surface cover and land use. Plant diversity was best explained by land use, elevation and median family income. Plant diversity was highest in the desert and urban areas and lowest for agricultural sites. In desert plots, site-to-site variability in both plant diversity and soil nitrate-N was relatively low and spatially auto-correlated. Desert plant diversity was best modeled by including elevation, average age of housing, and distance from urban center. Plant diversity and soil nitrate-N in urban plots showed no spatial autocorrelation and huge between-site variation. Urban soil N was best modeled by human population density and impervious surface cover. Urban plant diversity was best explained by housing age, median family income and whether the site was ever in agriculture. The positive plant diversity-income relationship is particularly interesting – neighborhoods with a median family income level above $50,000 per year had on average 2.3 times the plant diversity of less wealthy areas. Distance from urban center was largely unimportant in explaining system-wide patterns.

Hu, Q.[1], M. Sommerfeld[1], T. Dempster[1], P. Westerhoff[2], L. Baker[3], and M-L. Nguyen[2]. ***Influence of growth conditions on production and release of the taste and odor compound geosmin by a cyanobacterium isolated from the phoenix water supply system.*** [1]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; [2]Department of Civil and Environmental Engineering, Arizona State University, PO Box 875306, Tempe AZ 85287-5306; and [3]Minnesota Water Resources Center, St. Paul MN 55108.

Geosmin is a common component of the off-flavors detected in the drinking water supply sources of metropolitan Phoenix (Arizona). A cyanobacterium, tentatively identified as *Oscillatoria splendida*, was isolated from the Arizona Canal source water during incidents of elevated geosmin production and, using GC/MS analysis, was implicated as a cause of earthy/musty off-flavors in the drinking water supply. Production of geosmin was found to be constitutive in *O. splendida* during all growth phases. Effects of environmental parameters on the growth characteristics, and on production and release of geosmin by *O. splendida*, was studied under laboratory conditions. The specific growth rate and cell-bound geosmin increased with increasing temperature from 12 to 26°C, the range of water temperatures that occur in the drinking water supply. On a per-chlorophyll a basis, however, more geosmin was released from the cells at lower temperatures. An inverse relationship was evident between light intensity and *O. splendida* growth and the release of geosmin. Cell-bound geosmin, however, was higher at higher light intensities. Dark incubation initially stimulated the biosynthesis of geosmin, whereas a prolonged period of darkness (2-3 weeks) resulted in massive release of geosmin into the culture medium from lysis and cellular decomposition. Dissolved nitrogen appeared to be a limiting nutrient for *O. splendida* in the water supply source. When nitrate was added to laboratory cultures, both cyanobacterial growth and geosmin production increased. Laboratory results will be discussed in the context of natural episodes of off-flavors in drinking waters in the Phoenix water supply system.

Ivanich, P. A., J. A. Tyburczy, and J R. Arrowsmith. ***Measuring bedrock topography using gravity to understand subsidence along a portion of the CAP canal in northeast Scottsdale.*** Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404.

Subsidence is a major problem in the Phoenix basin and can be especially harmful when not planned for or expected. This study focuses on an area in northeast Scottsdale where the Central Arizona Project (CAP) canal, which carries Colorado River water as far as Tucson, has subsided approximately 0.5 meters (1.5 feet) in the last 10 years. Remote sensing InSAR (Interferometric Synthetic Aperture Radar) data show a large subsidence bowl, approximately 4 km by 2 km in this area. Subsidence is caused by excessive groundwater withdrawal, which causes

pores in the alluvium once held open by water to collapse due to the loss of pore pressure. This pore volume loss results in a lowering of the ground surface, or subsidence. We are undertaking geophysical studies to investigate possible subsurface controls on this subsidence. We use high sensitivity relative gravity methods, including elevation control using differential GPS, to measure slight variations in the earth's gravitational field caused by density contrasts between bedrock and alluvium. These density contrasts are used to determine the bedrock topography beneath the canal area. We have collected raw data from 540 gravity stations located in an approximately 20 square kilometer area around the canal. We will use these data to understand the shape of the observed subsidence bowl and the relation to bedrock topography.

This work is being performed in conjunction with the Arizona Department of Water Resources (ADWR), specifically Maurice Tatlow, the Central Arizona Project (CAP), specifically Alex Richards, and the Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) project.

Jenerette, D.[1], S. Goldsmith[2], W. Marussich[3], J. Roach[3], and W. Wu[1,4]. ***Contrasting socio-ecological relationships between China and the United States: Water footprints for cities in two distinct cultures.*** [1]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; [2]College of Architecture and Environmental Design, Arizona State University, PO Box 871905, Tempe AZ 85287-1905; [3]Department of Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501; and [4]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

Understanding the feedbacks between ecological and social systems is a current challenge spanning many disciplines, including ecology, economics, geography, geology, sociology, engineering, and others. The purpose of this study is to examine the differences in linkage in two distinct social settings, the cities of China and the United States. We applied a water usage urban ecological footprint to investigate social and environmental differences between the acquisition of this ecosystem service in these two nations. We identified 15 cities stratified by population size and geographic location. Initially water-use data for residential, industrial and commercial, and total consumption were obtained. City social data including population and area and some indicators of economic activity were also obtained. These data were geo-referenced to a spatially explicit map of annual available water run-off. Based on these maps, spatially heterogeneous ecological footprints were delineated. Differences between China and U.S. footprints and urban variables were identified. These differences describe how socio-ecological relationships can vary between differing cultures.

Jenerette, G. D., and J. Wu. ***Modeling fine scale spatial heterogeneity of carbon and nitrogen dynamics in the Central Arizona Phoenix region***. Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

Understanding the determinants of spatial heterogeneity can provide extensive knowledge on the controls of system variability. Here, we describe a spatially explicit model of carbon and nitrogen dynamics, ECO-SPACE, that is being used to explore how spatial heterogeneity develops and is maintained in ecosystems of contrasting human management. This model integrates the essential features of nutrient cycling with alternative material redistribution vectors and vegetation dynamics. Currently, we are examining the interactive effects of material accumulation into islands of fertility and material transport through hydrologic vectors on spatial heterogeneity in terrestrial ecosystems. The information obtained from this study will be used to develop detailed predictions about spatial patterns in real systems as a consequence of distinct hypothetical controls, for example hydrological or vegetation island accumulation, to ecosystem functioning.

Jensen, D. ***Conservation in an urbanizing world.*** World Resources Institute, 10 G Street, NE (Suite 800), Washington DC 20002

Parks and protected areas are necessary but insufficient to conserve the world's biodiversity. Trends in conservation in the last decades have identified three new strategies: getting the scale right, creating green markets, and seeking integrated landscape management. However, global change has not yet been incorporated into the conservation strategies of most places or institutions. Examples of new approaches will be presented as will speculations about the future.

Katti, M., E. Shochat, D. Stuart, J. Lemmer, and B. Rambo. ***Environmental and socioeconomic influences on the Phoenix avifauna.*** Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

Bird communities in urban areas are strongly influenced by environmental changes due to human activities. While studies of urban bird communities have addressed the effects of habitat modification by humans, they rarely incorporate underlying socio-economic factors. We combine data on habitat structure and human socioeconomic structure in the Phoenix metro area to ask: To what extent do the habitat factors typically measured in bird studies explain community patterns in an urban area? Do human socioeconomic factors have detectable effects on bird communities? We censused birds 4 times during 2000-2001 at 40 of the 200-survey sites. We examined bird species richness and abundance in a General Linear

Modeling framework using habitat (vegetation composition and structure) data from the 200-survey, socioeconomic data from the 1990 census at the block level, remote-sensed (GIS) data for landcover, landuse, biomass (NDVI), and spatial measures. We found no seasonality in species richness or total abundance, although species composition varies seasonally. Bird species richness increases significantly with greater total biovolume, NDVI, proximity to river, median family income (MFI), human population density (HPD), latitude (west to east), and decreasing median housing age (MHA). MFI, HPD and MHA remain strongly significant factors within 18 residential sites. Abundance is influenced by MFI, HPD, MHA, landuse (higher in residential than desert or agriculture), area of impervious surface, and number of plant genera. We thus find that human socioeconomic factors leave a strong imprint on bird communities, and enhance the explanatory power of traditional habitat measures.

Lopez, S.[1], M. Zoldak[1], C. S. Smith[2], J. Fry[2], and C. Redman[3]. ***Land use trajectories.*** [1]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; [2]Information Technology, Arizona State University, PO Box 870101, Tempe AZ 85287-0101; and [3]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

Exploration of spatio-temporal land use information demands creative ways of displaying data. Effective visualization can shed light on subtle patterns captured within complex spatio-temporal data that may not be apparent in formal or statistical data analysis. The map presented here shows different land use trajectories and urban growth in the metropolitan Phoenix area for a time period between 1934 and 2000. Land use transition information was obtained from the interpretation of aerial photographs for square mile sections of land. Land use classes where summarized into coarser categories (i.e., residential, recreational, commercial, industrial, institutional, vacant, underdevelopment, rural, and agricultural) and represented in a choropleth map for each year. The land use trajectory is shown not only as a map, but also as a transition flowchart using the same colors of the map and the same intervals of time. The result is an innovative time-series representation combining maps and flowcharts to visualize land use change over time. The flowcharts help to understand and visualize the complexity of the transitions (i.e., the more complex a flowchart is, the more complex the land use change for that area is).

Lewis, D.[1,2], W. Wu[1,2], and N. B. Grimm[1]. ***Material transport in storm runoff from urban catchments.*** [1]Department of Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501; and [2]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

We study the mechanisms of transport, retention, and transformation of nutrients and materials in urban catchments. Such research benefits an understanding of ecosystem function, as cities present novel laboratories with potentially novel biogeochemical processes. Additionally, these studies may provide relevant information for parties concerned with the fate, such as on-site retention vs. off-site transport, of nutrients.

We focus on storm runoff, which transports materials that accumulate on the landscape during dry periods. Storms also trigger biogeochemical processes that retain and transform nutrients. These processes may be exacerbated in arid cities with long accumulation periods and with a large portion of impervious surface. We are currently mapping flowpaths within sub-basins of the broader Cave Creek catchment. These sub-basins comprise a range of land cover types, such as urban, dense residential, suburban, and desert. Along flowpaths, we will investigate what processes transport, retain, and transform materials. For instance, retention of material may derive from physical obstructions that inhibit the flow of water or that remove material from flow. Biotic processes, such as plant uptake or microbial respiration, may also retain materials as they move along hydrologic flowpaths. Here, we present the initial stages of our efforts to identify flowpaths and to quantify material transport in storm runoff in cities.

Marussich , W. A., and S. H. Faeth. ***Trophic dynamics of urban and desert ecosystems: Arthropod communities on brittlebush (*Encelia farinosa*).*** Department of Biology, Arizona State University, PO Box 871501, Tempe, AZ 85287-1501.

Do trophic dynamics differ in urban vs. 'natural' systems? Is trophic structure controlled by 'top-down' (predators) or 'bottom-up' (limiting nutrients) forces in these systems? To address these questions, we are currently establishing long-term experiments at two permanent study sites (President's House and Desert Botanical Gardens). After surmounting several land accessibility hurdles, we have planted 40 brittlebush (*Encelia farinosa*) plants at each site. In addition, we will also manipulate existing brittlebush plants at two additional sites (Community Services Building and McDowell Mountain Park). Brittlebush was selected because it is a common native desert perennial that is often used in urban landscaping. As soon as the plants are well established (January-February 2002), we will manipulate water availability and access of predators (both birds and ground arthropods) using a water addition treatment and bird- and/or ant-exclosures in a 4 x 2 x 4 x 5 (4 sites x 2 water treatments x 4 exclosures treatments x 5 replicates) factorial design. We will sample the arthropod community and plant damage once per month. Arthropods will be identified to family and feeding-guild, and plant damage will be quantified and traced to herbivore type. By using LTER permanent sites, we will link these experiments to other LTER core areas by quantifying changes in ecosystem function (e.g., productivity, P/R ratios, organic matter accumulation) as functions of trophic complexity and patch type. Ultimately, we will combine our experimental results with a patch dynamic model to better understand how inter-patch differences in tropho-dynamics impact regional fluctuations in plants, herbivores, and predators.

Nelson, A.[1], B. Bolin[2], E. Hackett[2], S. Smith[3], and S. Grineski[2]. ***Sunbelt toxics: Industrial polluters in Phoenix, Arizona.*** [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; [2]Department of Sociology, Arizona State University, PO B0x 872101, Tempe AZ 85287-2101; and [3]School of Planning and Landscape Architecture, Arizona State University, PO Box 872005, Tempe AZ 85287-2005.

We examine the spatial distributions of industrial facilities emitting toxic substances in the Phoenix, Arizona, metropolitan region. The analysis relies on a geographic information system (GIS) mapping of hazardous facilities listed in the Environmental Protection Agency's Toxic Release Inventory (TRI) for 1999. We assess the spatial distribution of polluting industries in relation to the demographic composition of proximal neighborhoods. We utilize two different methodologies to determine patterns of environmental injustices in the metropolitan area. We first examine patterns of inequities in the location of TRI facilities based on the volume of atmospheric releases and on the toxicity of those releases for census tracts that host such facilities. Next we statistically compare the sociodemographic characteristics of host/non-host tracts to determine if there are inequalities by race and class in the emissions of hazardous industries. We then develop a spatial methodology that allocates hazards based on one kilometer radius circles around each point-source polluter. This technique, the Hazard Density Index (HDI), provides a spatially sensitive technique that allocates potential risks to portions of all tracts within 1 km of the polluting facility, and not just those that host the facility. Using the HDI methodology for both volume and toxicity of releases, we analyze the sociodemographic characteristics of census tracts. Findings on patterns environmental injustice for volumes and toxicities of atmospheric releases using the two alternative methodologies are compared.

Nelson, A.[1], B. Bolin[2], S. Smith[3], M. O'Donnell[2], and E. Hackett[2]. ***The development of environmental injustices in Phoenix, Arizona***. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; [2]Department of Sociology, Arizona State University, PO Box 872101, Tempe AZ 85287-2101; and [3]School of Planning and Landscape Architecture, Arizona State University, PO Box 872005, Tempe AZ, 85287-2005.

This paper examines the development of environmental inequalities in the Phoenix, Arizona, metropolitan area. Four hazard types are utilized in order to identify environmental inequities. These are: Toxic Release Inventory facilities, Large Quantity Generators of hazardous waste, Treatment, Storage and Disposal Facilities, and toxic contamination sites identified by the Environmental Protection Agency. A spatial methodology that provides a cumulative hazard density index is employed to quantify proximity-based risk burdens for each census tract in the metropolitan region. After identifying tracts that exhibit the highest concentrations of hazards, case studies of four neighborhoods are developed in order to characterize the selected tracts and adjacent areas. The focus is on identifying historical-geographic changes in land uses, demographic composition of neighborhoods and the siting/abandonment of hazardous industrial facilities that have resulted in pronounced environmental inequities in the metropolitan area. We identify key factors that, over time, have produced distributional inequities in the locations of point-source hazards in the metropolitan area. We also develop a methodology that contextualizes micro-level case studies with meso-level statistical analyses of selected census tracts across the metropolitan area. Three general developmental trajectories are described that appear associated with the disproportionately high hazard concentrations in specific areas of the city. We conclude with a discussion of the planning implications for these different "toxic trajectories" that produce environmental inequities.

Nelson, A.[1], S. Harlan[2], D. Sicotte[2], and F. Yang[2]. ***Labor market dynamics in a postindustrial city: A spatial and sectoral analysis of employment changes in the Phoenix MSA.*** [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; and [2]Department of Sociology, Arizona State University, PO Box 872101, Tempe AZ 85287-2101.

This poster presents a survey of changes between 1983 and 1998 in the industrial and occupational structure of the Phoenix metropolitan area. Phoenix exemplifies the Sunbelt in it's reliance on the New Economy, which is defined by an emphasis on technology, flexible capital, and information. To date, most labor market research has focused on consequences of deindustrialization of the East and Midwest U.S. for their cities and residents. We fill this gap by examining whether the current economic prosperity brought by the New Economy is shared equitably by all segments of society. We employ data from three federal agencies to develop

area economic profiles, including the location and gender/racial composition of occupations in individual firms (Equal Employment Opportunity Commission), wages for occupations in each area (Bureau of Labor Statistics), and social indicators on urban neighborhoods where employers are located (Census). A more detailed investigation separates industrial activity into high- and low-technology classifications. We then examine the distribution of "good" and "bad" jobs, as defined by average wages and skill level requirements among race/ethnic and gender categories and compare this with demographic changes for these subpopulations. With this information, we assess the employment condition of each of these groups. Results indicate that Phoenix experienced job growth across all industrial sectors from 1983 to 1998 and that, unlike cities of the East and Midwest, the central city retained its job base. Phoenix continues to be dominated by manufacturing and producer services, but these industries have lost market shares due to growth in other services. Within these categories, high-technology activities are concentrated into a few industries while low-technology activities are more diverse. White women made advances in professional/managerial (high quality) jobs while Hispanic men gained market share of employment in laborer/operative (low quality) jobs. Finally, sex segregation decreased (net of changes in the occupational structure) across occupations from 1983 to 1998.

Peccia, J., A. M. Dillner, and J. Borenson. ***Correlating bioaerosols with PM2.5 and PM10 concentrations.*** Department of Civil and Environmental Engineering, Arizona State University, PO Box 875306, Tempe AZ 85287-5306.

Recent air analysis in the Phoenix metropolitan region has shown that particulate matter mass concentrations in urban areas are 3 to 7 times higher than in nearby rural areas. This increase coincides with a dramatic increase in the number of reported *Coccidioides immitis* infections (Valley Fever) in Arizona and provides a rationale for investigating the microbial fraction of particulate matter.

The goal of this research is to develop and test methodology to quantitatively correlate the mass or number concentration of airborne fungal spores to the total mass of airborne particles. The development of these protocols and pilot data will be used to build a broad based research effort to correlate exposure of airborne biological agents with commonly monitored (and regulated) PM10 and PM2.5, and investigate relationships between outdoor particulate matter and indoor particulate matter. Specific research objectives within this pilot investigation include the following: (i) measure the outdoor airborne fungal concentration (total and culturable) and total particle mass concentration in rural areas during seasons of high risk (Jun-Jul, Oct-Nov) in Arizona, (ii) measure the same ratio at urban areas high in particulate matter (on-going construction sites, highways, etc.) and, (iii) use rDNA gene-based technology to detect and identify the fungal spore *C. immitis* in airborne samples.

Perry, D.[1], J. Anderson[2], and P. Buseck[1,3]. ***Analysis of atmospheric particles deposited onto mesquite leaves in the Central Arizona - Phoenix LTER area.*** [1]Department of Chemistry and Biochemistry, Arizona State University, PO Box 871604, Tempe AZ 85287-1604; [2]Department of Mechanical and Aerospace Engineering, Arizona State University, PO Box 876106, Tempe AZ 85287-6106; and [3]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404.

Atmospheric particles deposited onto leaf surfaces were analyzed using scanning electron microscopy, and the spatial distributions of the particle types were mapped. Mesquite leaves were collected and analyzed from fifteen sites throughout the Phoenix metropolitan area on two days during the summer of 2001. The sites were chosen to represent each of five land-use categories: undisturbed (natural desert), soil (prior agriculture, gravel), vegetation (agriculture, grass), residential, and commercial. Individual particles on the mesquite leaflets were analyzed for their sizes, shapes, and chemical compositions using an electron microprobe. Preliminary results show that aluminosilicates and calcium silicates are the most abundant particle types. The aluminosilicates are most abundant at sites in the southern region of the sampling domain, while the calcium silicates are most abundant at a site in the northern portion of the sampling region. Although their concentrations are relatively low, sulfur-rich particles are significant in the location of their maximum concentration in the eastern part of the sampling region; previous experiments have observed sulfur-rich particles in this area. The results show that individual particles deposited onto leaf surfaces can be analyzed with scanning electron microscopy and that particle types vary spatially throughout the sampling domain. These results suggest that particle deposition on leaves can be used to measure the spatial resolution at which particle types change along a gradient from the urban core to the natural desert.

Quay, R. ***Greater Phoenix 2100 Regional Atlas***. GP2100, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

Greater Phoenix 2100 is a joint university / community project that hopes to bridge the gap between university research and community policy making. GP2100 is proposing to prepare a paper and web based regional atlas of environmental and urban data for the greater Phoenix Arizona region. This will include all of Maricopa County and parts of Pinal and Yavapai County. Target date for publication is mid 2002.

Roach, W. J., and N. B. Grimm. ***Contrasting diel patterns of water chemistry from three lakes in Indian Bend Wash***. Department of Biology, Arizona State University, PO Box 871501, Tempe, AZ 85287-1501.

Intense solar radiation and dramatic temperature fluctuations characterize Sonoran Desert summers. During the summer, air temperatures frequently fluctuate by more than 10 °C over the course of a day. In part because of the warm temperatures and abundant sunshine, many desert aquatic ecosystems are extremely productive, and this productivity has important consequences for water chemistry. We quantified diel fluctuations in water temperature and water chemistry in three urban lakes in Indian Bend Wash during July 2001. Depth-stratified samples were collected from each lake six times between approximately 5:30 AM and 9:00 PM. We then compared vertical profiles of water temperature, dissolved oxygen, nitrate, ammonium and soluble reactive phosphorus for each time step. In all three lakes surface water warmed more rapidly than deeper water. Oxygen concentrations increased while ammonium concentrations declined over the course of the day. In some lakes, nitrate was also consumed, but this pattern was not consistent. Diel variations in dissolved oxygen and nitrate concentrations were most striking in the shallowest lake and were more modest in the deepest lake. We hypothesize that the increases in oxygen concentrations and declines in nitrogen result from primary production and that differences between lakes are due in part to differences in morphometry and in part to differences in the dominant relative importance of macrophytes versus phytoplankton.

Shochat, E.[1], S. Faeth[2], W. Fagan[2], M. Tseng[2], J. Rambo[2], and R. Cassalata[1]. ***Seventy-eight years of ground-arthropod sampling in the greater Phoenix area: Results from the first three years.*** [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; and [2]Department of Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501.

We sampled ground arthropods in 24 sites of six different land-use types (habitats): agricultural, desert parks, urban desert remnants, industrial, mesic urban yards and xeric urban yards. Pitfall traps were set for 3 days each month from the spring of 1998 to the spring of 2001. We compared total abundance, species richness, and species diversity between habitats and years.

The total arthropod abundance dramatically decreased between the first two years, and leveled off during the third year. Taxa richness continuously decreased each year of the study. We used Fisher's Alpha index to assess the meaning of combined declines in abundance and richness in terms of species diversity. We found no differences in taxa diversity between the years, probably due to insufficient sample size. Though there were dramatic fluctuations in diversity within habitat, these were not consistent. The simultaneous decreases in abundance and richness may distort a possible trend in species diversity between years and should not be the only criteria in determining trends in community dynamics.

We found significant differences in taxa diversity between habitats, with the highest diversity in urban desert remnants and the lowest in mesic urban yards. All three habitats with Sonoran desert vegetation (desert park, desert remnants and xeric yards) had the highest diversity, indicating the importance of native plants for sustaining high species diversity. The differences in arthropod species diversity in time and space emphasizes the importance of a long-term monitoring program of biological populations for future management and conservation strategies in the greater Phoenix area.

Shochat, E., S. Lerman, C. Putnam and M. Katti. ***Differences in bird foraging behaviour between Sonoran Desert and urban habitats: A field experiment with seed trays.*** Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

We used artificial food patches (millet seed trays) to compare bird foraging behaviour in urban and Sonoran Desert habitats in Arizona. We hypothesized that birds will exploit more seeds in the urban habitat due to higher population densities and lower predation risks. Seed trays were placed in each habitat for 24 hours and the leftover amount of seed (giving up density - GUD) was measured. Maximum ambient temperature during the experiment served as a covariate. Except for House Finch (HOFI), GUDs measured in the urban habitat were much lower than in the desert. In several urban locations GUDs were extremely low year round, suggesting that although resource abundance may be high, the per capita harvest is lower in the urban habitat. The opposite trend for HOFI indicates a possible mechanism of coexistence with House Sparrow (HOSP). GUDs on trays where only HOFI foraged were significantly higher than GUDs on trays where HOSP were also present. Experiments with supplemental water in the dry season in the desert demonstrated that water is a major factor influencing bird foraging capability. In the urban habitat there was no water effect on GUDs, suggesting that the high water availability in cities may in turn be a crucial factor in supporting high bird populations. However, in the desert water effect on GUD was species dependent, with Black-throated Sparrow, a highly granivorous species, being most affected. Our results indicate that high abundance of both water and food in cities may be the primary factors underlying the observed pattern of much higher bird densities in cities throughout the world.

Sicotte, D. ***A hazardous undertaking: The social construction of environmental contamination claims.***Department of Sociology, Arizona State University, PO Box 872101, Tempe AZ 85287-2101.

This poster presents my dissertation research, a multiple case-study focusing on the social construction of environmental claims in three very different communities in Central Arizona. In each of these communities, a hazardous facility has been sited, and in each residents have claimed that pollution by industrial waste has contaminated the area, damaging the environment and the health of residents. The three cases are: South Central Phoenix (the urban site of a geographic cluster of hazardous waste treatment, storage and disposal facilities); Queen Creek (the suburban site of a factory using hazardous materials); and Hayden (the rural site of copper mining, smelting and production). I am investigating how the racial/ethnic and class composition of each area, the amount of scientific data from health studies, and other political and economic factors affect the process of claims-making. Preliminary results indicate that the way in which the contamination claim was presented by the claims makers and the degree of political response to the contamination claim are not driven by the amount, quality, or soundness of epidemiological data, but by other factors. Political factors, such as the degree to which the issue can be characterized as racial discrimination, the degree to which the controversy is seen by the media as newsworthy, and conflicts between state and city government over land uses have been shown to be more important factors than scientific data in the success or failure of the claim. Economic factors, such as the community’s place in the relations of production, and the economic importance of the industrial facility in the region are also primary determinants of the success of claims. The demographic history of each area, the history of labor relations, and the history of environmental contamination controversies taking place in Arizona in the past also played an important role in the social construction of each claim.

Stabler, L. B., and C. A. Martin. ***Irrigation volume and pruning frequency affect water use efficiency of two southwest landscape shrubs.*** Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

Water use efficiency (WUE) of two field-grown southwest landscape shrubs, *Nerium oleander* (oleander) and *Leucophyllum frutescens* (Texas sage), was determined in response to a two-by-three factorial treatment combination of irrigation volume (high or low) and pruning frequency (frequently, every 6 weeks, infrequently, every 6 months, or unpruned control). WUE was defined as the ratio of shoot mass produced to volume of irrigation water applied for one year. Measurements of total shoot volume, pruned biomass, and total shoot biomass of control plants harvested after one year were used to develop allometric relationships between shoot volume and standing biomass. After one year, interaction of irrigation and pruning elicited reduced shoot biomass production of oleander plants given high volume irrigations if frequently pruned and for both pruning treatments if given low volume irrigations. Main effects on Texas sage produced greatest total shoot biomass in plants given high irrigation volumes or left unpruned. Interactive effects on WUE of oleander and Texas sage elicited highest WUE in low irrigation volumes and unpruned controls. In contrast, WUE was lowest for both landscape shrubs if given high irrigation volumes and frequently pruned. These data show the importance of drip irrigation scheduling and pruning practices in controlling WUE of landscape shrubs in arid climates.

Stiles, A.[1], and S. Scheiner[2]. ***Preliminary classification of desert plant communities using Landsat Thematic Mapper (TM) data.*** [1]Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; and [2]Division of Environmental Biology, National Science Foundation, 4201 Wilson Blvd, Arlington VA 22230.

Remote sensing is a valuable means by which to collect and subsequently generate spatially explicit information. Landsat Thematic Mapper (TM) is a versatile and well-utilized platform from which to gather spatial data. In concert with image processing software, the user is able to analyze larger expanses than would be possible with ground sampling alone. This effort is concerned with the creation of a map depicting Sonoran Desert community distribution, based on woody species (shrubs, trees, and cacti), across the Central Arizona - Phoenix Long-Term Ecological Research (CAP LTER) study area centered on the Phoenix metropolitan area, Arizona. Using species data from desert areas collected in the 200-sites survey of Spring 2000 and Stiles' data in remnant patches, a community classification was created using TWINSPAN. A supervised classification of TM imagery was performed using the community classification as a guide for the delineation of training groups. It was found that conventional image classification techniques were inadequate for the creation of a sufficiently accurate community distribution. Some gross-scale patterns were faithful to know distributions on the ground, but this was not true for all large-scale patterns and per-pixel accuracy assessment fell below acceptable levels. Better results are possible using some modifications to the strategy. Proposed solutions are discussed.

Stuart, G. ***Effects of urbanization on pollen frequency distribution patterns in the Phoenix metropolitan area***. Department of Anthropology, Arizona State University, PO Box 872402, Tempe AZ 85287-2402.

Inspection of pollen frequency data for surface pollen assemblages derived from the 200-point LTER survey reveals the effects that urbanization and agriculture have had on pollen frequency distribution patterns in the Phoenix metropolitan

area. Some of these effects are intuitively obvious – greater amounts of tree pollen in urban areas over that of the surrounding deserts, for example – others were something of a surprise. Pollen curves of selected taxa are presented, with special emphasis on those that display readily observable change over different depositional contexts. These include pine (*Pinus*) pollen, which displays an apparently strong relationship with urban locations, palo verde (*Parkinsonia*) pollen, which appears to increase in frequency at higher elevations, creosote (*Larrea*) which displays a strong correlation with desert settings, and the broad group of Chenopodiaceae and Amaranthaceae pollen types which display an apparently strong correlation with agriculture.

Swanson, S. ***Time, space and stability: Investigating landscape responses to climate variability in the Southwest.*** Department of Anthropology, Arizona State University, PO Box 872402, Tempe AZ 85287-2402.

Landscape stability and resilience can be conceived as the ability of landscape elements to resist and recover from externally induced change. Remote sensing and climate data sets are a useful source of information for investigating landscape-scale spatiotemporal variability in landscape parameters, a necessary first step for understanding the stability and resilience of vegetation communities across a landscape. This study demonstrates that such landscape parameters can have long temporal persistence (more than 1000 years) by examining correlations between the distribution of prehistoric human settlements and landscape stability estimates generated from modern remote sensing data. When coupled with climatic data, spatiotemporal data on vegetation productivity permit investigation of the spatial and temporal scales at which change occurs, and the spatial and temporal lags between climatic variability and ecosystem response. These spatial and temporal lags are important factors for modeling human perceptions of and responses to climate and ecosystem change.

Tomalty, R., and A. Brazel. ***Local variability of solar reception in CAP LTER.*** Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104.

The atmosphere over rural and urbanized areas differs in many ways in relation to terrain influences and human-induced variations (e.g., heat, humidity, wind, and pollution). The sun's energy penetrates through the atmosphere to reach the variable surface of the region. From the top of the atmosphere to the surface, there are controls on amounts of solar energy that are accumulated at any given time. These controls range from exterrestrial, to regional, to local in scale. In the urbanized/rural landscape of the Central Arizona - Phoenix Long-Term Ecological

Research (CAP LTER) project, a question arises as to the local variability of the amount of the sun's energy across the region. Previous information on Phoenix indicates that particulates and other pollutants may induce over a 15% urban/rural contrast. The implications for this amount of variability cascade into plant productivity, solar energy technology, and urban climate processes, in general. This poster illustrates the impact of local factors (e.g., elevation, land use, pollution) on solar reception, utilizing a mobile transect method in concert with less dense fixed point monitoring sites. The mobile sampling method is designed to sample the horizontal and vertical domain (e.g., across the city and up and down South Mountain). Fixed points are available from the Arizona Meteorological network (AZMET), an agricultural weather monitoring system in southern Arizona, with several sites in Phoenix and its surroundings. Results confirm large spatial and vertical gradients to solar reception in winter.

Warren, P. S.[1,2], and A. P. Kinzig[2]. ***Neighborhood socioeconomic status predicts ecological characteristics of small urban parks.*** [1]Biology Department, 2119 Derring Hall, VPI&SU, Blacksburg VA 24061; and [2]Department of Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501.

Humans actively construct biological communities in our gardens, yards and neighborhood parks. Different human communities and societal institutions are likely to construct different landscapes. There can be both intentional and unintentional consequences of these different constructions for ecosystem function. Yet, few studies have directly examined which sociocultural characteristics predict variation in ecological characteristics such as biodiversity. We studied bird species diversity and vegetation structure in 15 small neighborhood parks in the city of Phoenix, Arizona, classifying parks as high, medium, and low socioeconomic status using market cluster data. Market cluster analysis, a tool commonly used in sociological studies, provides a rank-ordered classification of human communities from the most urban-affluent to the most rural-impoverished. We conducted point count censuses for birds in and around each park and took a variety of measures of vegetation structure. Bird species diversity was higher in parks in higher income areas than in lower income areas. Neighborhood socioeconomic status was a better predictor of bird diversity than either tree species diversity or tree abundance, though tree abundance also varied with socioeconomic status. Thus, we have identified a potential human imprint on urban patterns of biodiversity.

Wentz, E.[1], S. Anderson[1], W. Stefanov[2], and J. Briggs[3]. ***Desert fire history and effects on the Phoenix, Arizona, metropolitan area.*** [1]Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104; [2]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404; and [3]Department of Plant Biology, Arizona State University, PO Box 871501, Tempe AZ 85287-1501.

The goal of the present research is to utilize remote-sensing tools to reconstruct the extent and impact of fires in a desert-urban environment. Our results indicate that simple band stretches and albedo data successfully discriminated burned versus unburned regions. Variations in reflectance values between burned and unburned regions can be related to density of vegetation in these areas.

Whitcomb, S. A., and J. C. Stutz. ***Pruning effects on root length density, root biomass, and arbuscular mycorrhizal colonization in two shrubs in a simulated xeric landscaped yard***. Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601.

Although shoot pruning is a common landscape practice, little research has focused on its effects on the roots and mycorrhizal associations of woody landscape plants. In this study, we examine the effects of shoot pruning on root length density, root biomass, and arbuscular mycorrhizal (AM) colonization of two woody shrubs commonly used in xeriscape™ landscapes in the Phoenix metropolitan area, *Nerium oleander* and *Leucophyllum frutescens*. Seven experimental plots were established using landscape practices typical of arid, urban environments, including drip irrigation and decomposed granite mulch, and three pruning treatments were initiated (2 plots per treatment + 1 unpruned control plot). These treatments included 1) shearing every 6 weeks, 2) heading back every 6 months and 3) rejuvenation pruning (cutting back to 0.5 m) every year. Roots were sampled at the base of three plants of each species by soil coring to a depth of 20 cm. The first root sampling occurred in the late winter, after the shearing and heading treatments had been imposed, but prior to the first rejuvenation pruning. A second root sampling occurred during active growth in the late spring. A trend towards stimulation of AM colonization in *Nerium* was apparent, but this result was not quite significant. Colonization was lower in both species in May than in February due entirely to seasonal effects. *Leucophyllum* root growth was suppressed by pruning, but there was no significant impact of pruning on *Nerium* root growth.

Wu, W.[1], J. Wu[2], D. Stuart[1], and J. Harris[3]. ***Spatial patterns of impervious surface cover in the Cave Creek watershed, Phoenix metropolitan region.***
[1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211; [2] Department of Plant Biology, Arizona State University, PO Box 871601, Tempe AZ 85287-1601; and [3] Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404.

Urbanization results in a dramatic increase in impervious surface cover (ISC), which can significantly alter stream structures and hydrological regimes in urban areas. Such alterations often lead to increased stream temperature and pollutant loadings, changed stream biogeochemistry, and even malfunctions of the whole watershed ecosystem. The total amount of impervious surface cover (TISC) has been used as an important indicator for urban planning and ecological research. A threshold of severe ecological effects was usually assumed as the TISC reaches 30% of a watershed. However, directly measuring TISC is difficult, and often needs to be done on a fine scale.Spatial configuration of ISC and its association with ecological processes have not been well studied. To understand mechanistic linkages between urbanization and stream ecology, it is necessary to analyze the spatial pattern of ISC at multiple scales, and take an account of landscape heterogeneity. In this study, we address the following questions: (1) How to measure ISC at the landscape scale? (2) Does any continuous gradient of ISC exist within an urban watershed? To answer these questions, we use high-resolution (3 m) digital imagery (Landiscor,1999) and image analysis techniques to extract ISC data, and examine the spatial pattern of ISC in the Cave Creek watershed as a case study. A longitudinal ISC gradient of the watershed along an urban-rural transect has been analyzed for TISC and its relation with topography, stream flowpath, and urban development. Lateral ISC gradients are explored in the Lower Cave Creek sub-watershed by buffering the stream channels, and dividing the sub-watershed into transect sections across the stream. Results from the spatial analysis of the 3 m resolution images are aggregated up to 9 m and 28.5 m resolutions for multiscale comparison. The characteristics of the spatial pattern of ISC and its ecological implications are discussed.

Zoldak, M.[1], S. Lopez[1], C. S. Smith[2], J. Fry[2], and C. Redman[3]. ***Experimental use of Unsupervised Classification Method for examining spatio-temporal landuse patterns.*** [1]Department of Geography, Arizona State University, PO Box 870104, Tempe AZ 85287-0104; [2]Information Technology, Arizona State University, PO Box 870101, Tempe AZ 85287-0101; and [3]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe AZ 85287-3211.

The Central Arizona - Phoenix Long-Term Ecological Research (CAP LTER) historical land use database for greater Phoenix, Arizona, has both spatial and temporal components. In the geographic information systems (GIS) database, individual square mile areas surrounding a stratified random sample of more than

200 study sites are composed of many different land use polygons. In addition, there are different GIS map layers representing land use at particular moments in time. The historical data were derived from air photos and historical records. Within each layer, change within the square mile can be described and analyzed, and, at any given location, change through time can be described and analyzed. The challenge is to do both simultaneously. The work presented here is a first, experimental, attempt to use an image analysis technique, unsupervised classification, to simultaneously describe both spatial and temporal changes. The polygon data were rasterized, and each layer was joined to create a multi-band image. Multiple realizations of the unsupervised classification were examined to find the one that showed the most distinct spatial and temporal patterns. The final output contains 12 spatially and temporally distinct clusters of land use change that are further classified into 3 temporal trajectories of similar changes.