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

Sixth Annual Poster Symposium

February 23, 2004
Carson Ballroom, Old Main
Arizona State University

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

Sixth Annual Poster Symposium
Agenda
February 23, 2004
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1:00-1:15	Welcome and Introductions *Charles Redman and Nancy Grimm*
1:15-2:15	Keynote Address – **O. J. Reichman** ***The Nature of Synthesis and Collaboration: Research Tools for Urban Ecology***
2:15-3:15	Poster Session #1
3:15-3:30	Social with refreshments
3:30-4:30	Poster Session #2

O. J. Reichman

O. J. Reichman is Director of the National Center for Ecological Analysis and Synthesis and Professor in the Department of Ecology, Evolution, and Marine Biology at the University of California, Santa Barbara. He is currently the Chair of the Publications Committee for the Ecological Society of America (ESA) and serves on the ESA Visions Committee. He has been an editor for two ESA journals, as well as past President of the American Society of Mammalogists and Chair of the Board of Directors of the BIOSIS Corporation (Biological Abstracts). He has served on a number of National Science Foundation (NSF) panels, as Director of the Ecology Program at NSF, as Associate Vice Provost for Research and Director of Konza Prairie Research Natural Area at Kansas State University, and as Assistant Director for Research of the National Biological Service (Department of Interior). Reichman received a Ph.D. from Northern Arizona University in 1974 and worked as a postdoctoral associate at the University of Utah in 1975. Reichman's research focuses on the influence of the spatial patterns of animal disturbances on the restoration of plant communities and natural landscapes. A second area of research involves an analysis of long-term food storage strategies by animals that cache food during periods when it is unavailable or costly to secure.

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DeLap, J., S. Dooling, K. Yocom, G. Simon, and W.C. Webb. ***The history of urban park development in Seattle 1900-2000: An emergent phenomenon?***

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Bolin, Bob, and Sara Grineski. ***South Phoenix and the geography of exclusion: Past and present.***

Cook, William, David Casagrande, Diane Hope, Chris Martin, and Jean Stutz. ***The North Desert Village "Suburbosphere": An experiment in urban ecology.***

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Berda, Chryste. ***Most frequently found arthropods at Pendergast School.***

Bills, Robert, Sean Whitcomb, Jamaica Cousins, and Jean Stutz. ***Differences in arbuscular mycorrhizal fungal community structure at residential and desert land use types within the CAP LTER.***

Celestian, Sarah B., and Chris A. Martin. ***Leaf physiology of four landscape trees in response to commercial parking lot location.***

Gries, Corinna, Diane Hope, Brooke L. Stabler, Arthur Stiles, Chris A. Martin, and John M. Briggs. ***The manmade plant communities in the CAP LTER area.***

Mahkee, Darin K., and Chris A. Martin. ***Growth of two landscape shrubs following severe pruning: Evidence of a hysteretic effect of former irrigation and pruning practices.***

Mahkee, Darin K., and Chris A. Martin. ***Leaf morphological plasticity of two landscape shrub taxa in response to a change in shrub pruning practices.***

Marussich, Wendy A. and Stanley H. Faeth. ***Understanding trophic dynamics in urban and desert ecosystems using arthropod communities on brittlebush (*****Encelia farinosa*****).***

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Stutz, Jean C., Sean Whitcomb, and Jamaica Cousins. ***Local arbuscular mycorrhizal fungal diversity is strongly coupled to regional diversity in an urban ecosystem.***

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Hedquist, Brent, and Anthony Brazel. ***Urban heat island (UHI) measures for the S.E. metropolitan area of CAP LTER: Transects versus fixed stations.***

Hope, Diane, Weixing Zhu, Corinna Gries, Jason Kaye, Jacob Oleson, Nancy B. Grimm , Darrel Jenerette, and Larry Baker. ***Spatial variation in inorganic soil nitrogen concentrations across an arid urban ecosystem.***

Jenerette, G. Darrel, and Jianguo Wu. ***Soil heterogeneity in six patches of the Phoenix, AZ metropolitan region: Implications for scaling.***

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Singer, C. K., Chris A. Martin, Linda B. Stabler, and Darin K. Mahkee. ***Influences of drip irrigation rate and pruning on electrical conductivity of soil surrounding two landscape shrubs.***

Sisart, Shannon, Joseph Dean, and Shannon Johnson. ***The diazotroph community of biological soil crusts.***

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ABSTRACTS

All abstracts are listed alphabetically by first author.

Andrews,[1] T., L. Duman[1], M. Robinson[1], G. Scrivener[1], N. Settles[1], I. Taylor[1], and K. Kyle[2]. [1]Awakening Seed School, 6630 S. 40th St, Phoenix, AZ 85040; and [2]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Pond chemistry at Awakening Seed School.***

Fourth and fifth graders at Awakening Seed School undertook a semester-long study of pond chemistry in their school's native habitat area during the spring of 2003. Data from this pond was collected and compared with data collected at selected CAP LTER sites.

Bagley, A., P. Burnett, M. Koneya, M. Roberts, R. Walton, and D. Worley. Maricopa Association of Governments, 1820 W. Washington, Phoenix, AZ 85007. ***Understanding current and future job centers: An analysis of the Maricopa region.***

The Maricopa Association of Governments (MAG) projects population and employment for Traffic Analysis Zones (TAZ) in Maricopa County, Arizona, primarily for regional transportation planning. There are many databases created for that process, including a Major Employer Database that contains 70% of all wage and salary jobs in the county, and estimates of total jobs by TAZ. Additionally, MAG compiles a "regional composite" of local general plans.

Over the past few years, MAG has applied many of these databases to economic development in the region. MAG planning and economic development directors identified their community job centers. As a result, MAG has compiled a "regional composite" of job centers in the region.

This poster depicts the methods utilized in identifying and analyzing existing and future job centers in the MAG region. The Major Employer Database was geocoded and stratified by employment type and number of employees. An analysis of future employment at build out was also conducted using the MAG Sub-area Allocation Model (SAM-IM). A neighborhood grid analysis depicting employment averaged across a one-mile radius is shown here. The job centers were analyzed utilizing the land use data at MAG (existing land use, general plans, and known future developments) and the travel times to job centers were derived from the transportation models.

Banzhaf, E.[1,2] [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]UFZ - Centre for Environmental Research Leipzig-Halle, POB 2, D-04301 Leipzig, Germany. ***Detecting brownfields by means of remote sensing and GIS data.***

The international urban environmental partnerships focus on brownfields redevelopment, smart growth, sustainable transportation and land use, urban watershed management, green buildings, and solid waste recycling (U.S. Environmental Protection Agency [EPA]). This international exchange meets well with the global Urban Environmental Monitoring (UEM) program of the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) instrument where a dedicated observation strategy for urban environmental monitoring around the world is provided.

The emphasis of this project enriches these overall goals by providing additional detail on one specific land use, i.e. brownfields, and by expanding upon object-oriented classification methods. When focusing on the local level brownfields sites in their certain urban environment can be described as a specifically defined class consisting of diverse objects that need to be characterized by their form, their position and their spatial context. As they may consist of different objects such as buildings, roads and vegetation any multispectral classification scheme will fail to detect this object class. The detection of impervious surfaces on such a site will improve the overall classification scheme by applying a texture analysis.

The first brownfields site being worked on is Baltimore City, Maryland. Three of many more reasons are: First, the City of Baltimore acquired high-resolution imagery for the whole city which is a data set that can be used for this specific issue. Second, EPA selected Baltimore as 1 of 16 federal Brownfields Showcase Communities. Third, apart from CAP LTER, the Baltimore Ecosystem Study (BES) also concentrates on urban development so there is a common interest and good data exchange possible.

Becht, L. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Landscape-level influences of urbanization on reptile communities in the Phoenix metropolitan area.***

This proposed research focuses on the effects of landscape fragmentation of habitat and increased patch isolation on populations of lizards in Phoenix and the surrounding urban area. The goal is to produce a spatially realistic GIS model that investigates the influences of the structure and composition of the surrounding landscape on lizard populations within patches of desert habitat. This landscape level analysis will provide information on the relationships between abiotic and biotic variables and the distribution and abundance of five lizards occurring in the Phoenix Metropolitan area of the Sonoran Desert. Remote sensing data, GIS, ecological modeling, and field surveys will be combined to model habitat degradation and species abundance for five lizard species utilizing habitat along the urban gradient. Model development will include a model building phase followed by field testing of predictions of species distribution. Initially, a habitat model will be developed for each species based on known habitat preferences. Remote sensing imagery will be used in association with GIS coverages of land cover to identify patches of potential habitat. Information on species home range and dispersal patterns will then be incorporated into the model and used to identify potential habitat patches. A sample of the potential patches will then be visited to determine presence/absence and species abundance. The model will then be analyzed for relationships between the structure of the landscape, attributes of the habitat patches, and species abundance.

Berda, C. Fifth Grade Class, Pendergast Elementary School, 3802 N. 91 Ave, Phoenix, AZ 85037. ***Arthropods and their environment at Pendergast School.***

We will be sharing our results from the arthropod protocol that demonstrate the most frequently found arthropods at Pendergast School and the environment in which the arthropods live.

Bills, R.[1], S. Whitcomb[1], J. Cousins[1], and J. Stutz[2]. [1]School of Life Sciences, Graduate Program, PO Box 874601,Arizona State University, Tempe, AZ 85287-4601; and [2]Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212. ***Differences in arbuscular mycorrhizal fungal community structure at residential and desert land use types within the CAP LTER.***

Preliminary results from the Survey 200 Pilot Study indicated that land-use type, land-use history and vegetation type may impact arbuscular mycorrhizal (AM) fungal community structure. Spore densities were found to be lower at residential sites in comparison to desert sites, but it was difficult to detect any other differences in AM fungal community structure because of the small number of sites in the Pilot Study. We are presenting the first part of an investigation comparing AM fungi at additional Survey 200 sites. Soil was collected from exotic plants at 10 sites classified as residential land-use and from native plants at 10 sites classified as desert land-use as part of Survey 200 and used to start pot cultures in the greenhouse to obtain AM fungal spores for identification. Spores were collected by wet-sieving and decanting, followed by sucrose gradient centrifugation. Identification was based on spore morphology observed using the dissecting and light microscope. By looking at a greater number of sites, we could detect differences in AM fungal community structure between these two land-use types. Almost twice as many AM fungal species were detected in the desert in comparison to residential sites. There was also a greater mean number of AM fungal species per woody plant sampled at desert sites in comparison to residential sites. There was a significant overlap in the species composition between desert and residential sites with all species detected in the residential areas also present at desert sites. The most frequently detected AM fungal species were similar in residential and desert sites. Future plans include the identification of AM fungal associations with native plants growing at residential sites.

Bjorn, A. M., A. I. Greve, M. D. Oleyar, and J. C. Withey. Urban Ecology Program, University of Washington, Box 352100, Seattle, WA 98195. ***Evaluating urban forest functionality: A three-dimensional approach.***

Urban development often places a significant amount of pressure on forested green spaces and natural areas. While efforts are often made to protect these spaces, many policies and programs focus on a single, narrow range of goals, rarely considering the multiple functions of forests. Decisions regarding regional plans to conserve these spaces will be most efficient when they are cognizant of these functions, how they tend to change within an area of interest, and if dynamic relationships exist between the functions.

We will investigate three primary functions for which forests in residential areas are protected and managed: economic, ecological, and social. These individual functions could be defined and measured in a multitude of ways, but for the sake of tractability, we use the following general definitions. We define economic functionality of forests in terms of the added monetary value of homes directly attributable to nearby forested areas as derived from a hedonic price model. For ecological functionality we evaluate how closely forested areas resemble 'natural' or presettlement systems with regards to biodiversity using canonical correspondence analysis and existing avian point count data. Finally, we view social functionality of forests in terms of the non-monetary benefits that people gain from forests, such as community cohesion and recreational use, measured via a mailed survey. We use an urban gradient defined by four landscape measures, each of which is calculated for a fixed area around parcel centroids (point count locations for bird data). These metrics are: percent forest cover, distance to nearest forest patch, size of nearest forest patch, and population density. Our study area includes the city of Seattle and surrounding areas in western King County, WA.

We expect that the role forests play in the urban fabric is not constant, but rather varies according to its location on the urban gradient. We attempt to illustrate this point and also explore the ways in which the different functions of urban forests interact, believing that such information would be valuable to community planning and conservation efforts alike.

Bolin, B., and S. Grineski. Department of Sociology, Arizona State University, PO Box 874802, Tempe, AZ 85287-4802. ***South Phoenix and the geography of exclusion: Past and present.***

This poster presents the historical geographical construction of a contaminated community in the heart of one of the largest and fastest growing Sunbelt cities in the US. In "minority" districts of South Phoenix, Arizona, land uses were authorized that were not permitted in white Phoenix, as race and place were discursively and materially woven together. Early conditions in South Phoenix included a railroad and associated warehousing and industries, stockyards, open sewage, dilapidated housing and disease. This area was a stigmatized and underdeveloped zone of racial exclusion and economic marginality in the central city. The core of this exclusionary geography was in place by 1920, increasingly policed and controlled by white Phoenix, producing a geography of "white privilege." This Sunbelt apartheid was subsequently built into zoning, planning, and investment decisions that continue to shape the human ecology of Phoenix today.

Burns, E. K., and E. D. Kenney. Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104. ***Urban fringe expansion measured by water infrastructure development: Phoenix, Arizona, 1950-2000.***

The availability of clean water distributed primarily through centralized infrastructure and management is a driving force in North American urban growth. We provide a decade-by-decade analysis of urban fringe expansion for the City of Phoenix, Arizona, 1950-2000. An unusual dataset, City of Phoenix proprietary data, includes annual water infrastructure information at the scale of individual building parcels. GIS queries and spatial analyses identify the quantity, location, and direction of infrastructure expansion for each decade as physical indicators of population, land use, and employment change. We use map and animated visualizations link expansion of public water infrastructure to local building cycles and the City's expanding boundaries. The City of Phoenix, under permissive Arizona annexation laws, now includes about 530 square miles and a population estimated at 1.1 million persons. Our comparative analyses provide evidence that boom-and-bust cycles of city development have a periodicity closely related to metropolitan building cycles. Annual magnitude of the expansion of this central city expansion decreases as a percentage of metropolitan building activity over the fifty-year period. Patterns of urban fringe infrastructure development reveal significant spatial variations that reflect the development context of each building cycle. We conclude that each expanding fringe is a zone of rural-urban transition. Isolated initial settlement, later leapfrog development and infill of bypassed areas occur. Concentrated areas of initial infrastructure redevelopment exist including the central business district. These spatial differences are evident in the cumulative human settlement pattern in this urban desert landscape.

Buyantuyev, A., and J. Wu. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Estimating vegetation cover of an urban landscape using remote sensing data.***

The ultimate objective of our research is to quantify vegetation structure and investigate how urbanization affects ecosystem primary productivity in the Sonoran Desert where CAP LTER is located. The study combines field survey, remote sensing, GIS, and ecological modeling. As the first step towards our research goal, we used multi-spectral Landsat (30 m pixel) and airborne super-spectral MASTER (9 m pixel) data to derive vegetation indices (NDVI and SAVI) as well as sub-pixel vegetation fractions using the spectral linear unmixing technique. We then attempted to relate remote sensing-based measures to vegetation cover using regression analysis. The results were compared with the CAP LTER 200-survey estimates of vegetation cover and biovolume. Our results showed that the ability of remote sensing data to quantify vegetation parameters is the highest for agricultural plots, relatively poor for desert plots, and the poorest for urban plots. One of the complications for using remote sensing data in estimating ecosystem productivity in the urban environment is that most vegetated urban plots have year-round green vegetation cover while desert areas show distinct seasonal vegetation dynamics. Another significant problem is the extreme subpixel mixing due to spatial heterogeneity and variability in patch size. Similarity of spectral signatures of most desert plants, especially when studied with the moderate spectral resolution instrument, and considerable amount of soil reflectance in deserts impede accurate classification of desert communities. Our results also suggest that, although we originally hypothesized it would, spectral linear unmixing actually did not significantly improve the vegetation cover estimates relative to the results directly obtained using NDVI and SAVI. Future research will focus on building a framework, such as expert system, capable of incorporating both spectral and spatial dimensions of remote sensing temporal data. The goal is to derive ecologically meaningful land cover classification that will allow use classes' characteristics in NPP modeling.

Celestian, S. B., and C. A. Martin. Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212***. Leaf physiology of four landscape trees in response to commercial parking lot location.***

Trees are planted in parking lots to give shade and enhance environmental aesthetics. But elevated thermal microenvironments caused by expansive parking lot surface areas might contribute to the poor performance of many parking lot trees, especially in the desert Southwest. We evaluated effects of parking lot location on leaf physiology of four Southwest landscape tree species. Leaf physiology of four landscape trees, *Brachychiton populneus* (bottle tree), *Fraxinus velutina* (Arizona ash), *Prosopis alba* (mesquite) and *Ulmus parvifolia* (Chinese elm) was studied during spring and summer of 2002. Gas exchange fluxes were lower for bottle tree, Arizona ash, and Chinese elm located within narrow parking lot landscape medians compared with the same-aged trees in large landscape areas on the parking lot perimeters. Leaf gas exchange fluxes of mesquite were not affected by parking lot location. Chlorophyll concentrations within leaves of all landscape median trees were generally lower than in leaves of trees in surrounding perimeter landscapes, even though seasonal patterns of leaf chlorophyll levels were species specific. These studies reveal that mesquite leaf physiology was least affected by parking lot location and may be the best of these four landscape trees for use in desert Southwest parking lot landscape median locations.

Cook, W.[1], D. Casagrande[1], D. Hope[1], C. A. Martin[2], and J. Stutz[2]. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212. ***The North Desert Village "Suburbosphere": An experiment in urban ecology***.

The CAP LTER is initiating an experiment in the North Desert Village family housing development at Arizona State University-East campus, with the general objectives of understand feedbacks between urban landscaping (i.e., radical modification of the pre-existing Sonoran Desert), ecological and micro-climatological parameters, and human behavior. ASU will impose four treatments (plus a control), representative of current trends in Phoenix urban landscaping, on small neighborhoods. Our two overall questions to be addressed with this experiment are:

1) What is the impact of human-induced experimental treatments on ecological processes?
2) How do experimental manipulations influence human perceptions and actions?

Here we provide a brief rationale for the experiment, including some primary advantages (and challenges) we anticipate encountering with this experimental approach, and an overview of its design. A conceptual model depicting the interaction between the primary biophysical and social variables will be outlined. We will also present some of the major a priori hypotheses, and discuss the place of this experiment within the context of the broader CAP LTER.

Crider, D., C. M. Meegan, and S. Swanson. Department of Anthropology, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402. ***Panarchy: Applying the framework to a prehistoric socio-ecological case study.***

Panarchy is a new theoretical framework for investigating the interrelationships of coupled social and ecological systems. Arising from ecology, Panarchy purports to facilitate understanding of complex socio-natural interactions. In this poster, we examine the utility of Panarchy for understanding the drastic changes in Hohokam society from the Preclassic to Classic Period (AD 900-1200) in the Phoenix Basin. During the Preclassic, Hohokam socioeconomic interaction was expressed in a ball-court network that extended for hundreds of kilometers across Arizona, and functioned to redistribute variable natural resources. In the Classic Period, this network was abandoned, economic interaction and territorial extent contracted, and new, more hierarchically organized communities developed along major irrigation canals. Panarchy helps us relate these social changes to variable ecological and climatic conditions.

DeLap, J.[1], S. Dooling[2], K. Yocom[2], G. Simon[3], and W.C. Webb[1]. [1]College of Forest Resources, University of Washington, Box 352100, Seattle, WA 98195-2100; [2]Department of Urban Design and Planning, University of Washington, Seattle, WA 98195; and [3]Department of Geography, University of Washington, Seattle, WA 98195. ***The history of urban park development in Seattle 1900-2000: An Emergent phenomenon?***

There is a long history of park designation and planning in Seattle, beginning with the Olmsted Plan of 1903. Using the analytical framework of emergent theory, we present an argument for the process of park development in Seattle as a nonlinear, unpredictable pattern within an urban landscape from 1900-2000. The first part of our analysis measures the temporal and spatial distribution of park-owned land over 100 years. The second part of our analysis describes more specifically the three distinct eras of park development, by detailing environmental events and social movements, both at the national and local scales, which directly impacted park use, distribution, and acquisition. Changes in the spatial configuration of parks, when observed over a 100-year time frame, demonstrate qualities consistent with emergent phenomenon – that is, they exhibit nonlinear, unpredictable rates and patterns of change. Our research demonstrates the evolution of Seattle's park system is a result of the interactions between economics, politics, culture, and the biophysical factors organized into three distinct eras over time. Additionally, we identify threats to established Seattle parks and recommend strategies for creating and maintaining urban parks while accommodating increases in human population density and urbanization.

Farley Metzger, E.[1], S. Yabiku[2], P. Gober[3], D. Casagrande[4], C. Redman[1,4], N. Grimm[5], and S. Harlan[2]. [1]Department of Anthropology, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402; [2]Department of Sociology, Arizona State University, PO Box 872101, Tempe, AZ 85287-2101; [3]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; [4]Center for Environmental Studies, Arizona State University, PO Box 8732115, Tempe, AZ 85287-3211; and [5]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***North Desert Village landscaping experiment monitoring human-environment interactions.***

CAP LTER researchers will selectively vary the landscaping (using mesic, xeric, native, and oasis landscapes, along with a control) of 30 units in North Desert Village - a group of family residential units at Arizona State University-East. The social science team will study reciprocal relationships between humans and the different types of landscaping regimes. The study will include a structured survey and direct observations intended to elucidate environmental values, landscape preferences, social interaction and behavior patterns before treatment and at continuous periodic intervals after experimental treatment. Results will further scholarly understanding of human interaction with very small scale environments such as backyards and neighborhoods and inform local water managers and policy analysts of human response to landscape treatments with different water requirements. This study will also contribute to our understanding of information feedback between non-human and human components of ecosystems.

Gonzales, D. A.[1], and J. O. Allen[1,2]. [1]Chemical and Materials Engineering, Arizona State University, PO Box 876006, Tempe, AZ 85287-6006; and [2]Civil and Environmental Engineering, Arizona State University, PO Box 875306, Tempe, AZ 85287-5306. ***Aerosol deposition measured by eddy-correlation mass spectrometry.***

Dry deposition is an important mechanism for the removal of aerosol particles from the atmosphere and for the addition of materials to downwind ecosystems. Dry deposition can account for more than half of the total deposition of some chemical species, such as nitrate (NO_{3-}), that are formed in the atmosphere from anthropogenic sources. This may cause a significant perturbation of natural biogeochemical cycles, contributing to eutrophication of water bodies and to nutrient loading of sensitive ecosystems. There is uncertainty in estimates of dry deposition; measured deposition velocity values often differ from predicted values by an order of magnitude.

The well known eddy-correlation technique has been used to quantify the flux of aerosol particles. Aerosol concentrations were measured using an Aerodyne Aerosol Mass Spectrometer (AMS). In the AMS, aerodynamic particle size was measured by particle time-of-flight; chemical composition was determined by flash vaporization of the non-refractory components, which are then ionized by electron impaction and detected using a quadrupole mass spectrometer. Co-located with the AMS inlet was a sonic anemometer to measure wind velocity and direction for eddy-correlation flux calculations. Aerosol deposition velocities for 30-min periods were calculated directly as the covariance of the vertical wind with the AMS signal, divided by the average of the AMS signal. Aerosol flux results from the PROPHET 2001 study are presented. An eddy-correlation mass spectrometry field experiment is planned to measure aerosol deposition to an agricultural field on the Salt River Indian Community.

Gries, C.[1], D. Hope[1], L. B. Stabler[2], A. Stiles[2], C. A. Martin[3], and J. M. Briggs[2]. [1]Center for Environmental Studies, 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-East, 7001 E. Williams Field Rd, Mesa, AZ 85212. ***The manmade plant communities in the CAP LTER area.***

In a stratified tessellation random sampling design perennial plant abundance and richness was measured as percent cover of non-paved area within 30x30 m plots in the Phoenix, Arizona, metropolitan area including surrounding natural desert. Of the 204 total plots that were investigated, 166 plots contained plant cover of a total of 188 unique genera. Average α diversity was 8.4 and β diversity 23 with 95% empty cells and an average total cover per plot of 35%. After eliminating rare taxa and appropriate data standardization, a cluster analysis revealed a clear division between mostly urban and mostly desert plots with only 25% information remaining. Eight urban sites were classified in the desert cluster all of which had original desert vegetation and 10 desert sites were classified as similar to urban sites. Natural desert communities were characterized by dominance of *Larrea, Ambrosia* or *Encelia*. Three of the urban sub-clusters were dominated by the genera *Cynodon/Pinus/Morus, Prosopis,* and *Syagrus*, respectively, while a fourth urban subcluster was highly diverse with no clear indicator genus. The last two urban subclusters were examples of "desert" landscape design while the first subcluster represents an "oasis" landscape design type. The *Prosopis*-dominated and the desert landscape subclusters also contained highly disturbed desert sites that lacked the typical desert genera. A vegetation map has been created based on modeling distributions of the three desert communities for the whole urban area. That is, a pre-urbanization vegetation reconstruction has been attempted.

Grossman-Clarke, S.[1], J. A. Zehnder[2], W. L. Stefanov[3], D. Hope[4], and H. J. S. Fernando[1]. [1]Department of Mechanical and Aerospace Engineering, Arizona State University, PO Box 879809, Tempe, AZ 85287-9809; [2]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; [3]Department of Geological Sciences, Arizona State University, PO Box 876305, Tempe AZ 85287-6305; and [4]Center for Environmental Studies, Arizona State University, PO Box

873211, Tempe, AZ 85287-3211. ***Effects of land cover modifications in mesoscale meteorological and air quality models in the Phoenix metropolitan region.***

Mesoscale meteorological and air quality models such as the Pennsylvania State University/NCAR's MM5 and EPA's Models-3/CMAQ are applied to the Central Arizona – Phoenix LTER study area to improve the understanding of processes related to neighborhood scale climate and air quality, the urban heat island, and mesoscale circulations caused by urban-rural land use differences. Those processes are strongly influenced by the energy, momentum and mass exchange between the atmosphere and the underlying earth surface and hence depend on the urban and rural land use in the considered regions. A new land cover classification and updated 1998 land cover data for the Phoenix metropolitan area were introduced into MM5 allowing to analyze the role of land use changes on the simulated meteorological fields. Furthermore, meteorological conditions influence pollutant conversion and nitrogen deposition. The direct (land use dependent deposition velocities) and indirect effects (meteorological conditions) of urban land cover on nitrogen deposition were investigated by applying the new land use data in the air quality model Models-3/CMAQ. It was shown that urban land use has a significant influence on the simulated near-surface air temperatures and urban air quality.

Harlan, S.[1], A. Brazel[2], D. Jenerette[3], N. Jones[4], L. Larsen[5], L. Prashad[6], and W. Stefanov[6]. [1]Department of Sociology, Arizona State University, PO Box 874802, Tempe, AZ 85287-4802; [2]Department of Geography Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; [3]School of Life Sciences, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601; [4]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [5]School of Natural Resources and Environment, University of Michigan, 430 E. University Drive, Ann Arbor, MI 48109-1115; and [6]Department of Geological Sciences, Arizona State University, PO Box 876305, Tempe, AZ 85287-6305. ***Neighborhood ecosystems: Human-climate interactions in a desert metropolis.***

Urban ecosystems are fragmented in ways that correspond to patterns of organized social life, and the concept "neighborhood ecosystem" anchors both ecological and sociological questions about the causes and consequences of human-environment interactions. In our National Science Foundation-funded biocomplexity project, we are creating a framework and producing evidence that will allow us to model the relationship of social and bioclimatological variables over time and space in urban ecosystems. We will demonstrate that inequalities in "neighborhood capital," comprised of economic, human, social, and natural capital within small areas, determines the relative contribution of different populations to the urban heat island, the exposure of human and biological communities to climate stress, and their vulnerability to the risks of feedback from climate. Initial results of regional-scale and neighborhood-scale comparisons of remotely sensed vegetation and surface temperature patterns indicate strong correlations between population characteristics of neighborhoods (e.g., density, median household income, percent minority, age of housing), vegetation density, and surface temperature. Social surveys show that people correctly perceive that it is growing hotter in Phoenix, and that people in lower-income neighborhoods are exposed to higher outdoor temperatures.

Hedquist, B.[1], and A. Brazel[1,2]. [1]Department of Geography, Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [2]Center for Environmental Studies, PO Box 873211, Arizona State University, Tempe, AZ 85287-3211. ***Urban heat island (UHI) measures for the S.E. metropolitan area of CAP LTER: Transects versus fixed stations.***

Various observations of urban heat islands have been conducted by urban climate researchers and ecologists using mobile surveys (airplanes, autos, bikes, and walks), fixed weather stations, and remote sensing platforms. Each method has advantages, but each has its distinct disadvantages which may account for differing estimates. We use fixed stations versus automobile transects to investigate the degree to which these two methods produce different estimates of the UHI at night for a region stretching from Tempe to Queen Creek in the S.E. Valley region. The advantage of the transect method is that a researcher is able to more fully characterize the "landscape spatial gradient" of temperatures, whereas fixed sites are typically in a station network that is suspect as to accurately representing land cover spatially. The disadvantages lay in the fact that a mobile transect is very difficult to do simultaneously (time sampling problem over large distances) and with great repetitiveness over time (days on end). Fixed sites record continuously. We use an urban (Phoenix Sky Harbor), residential (Alameda PRISMS), and rural (Rittenhouse PRISMS) weather site for fixed stations, and over a 27-day period (spanning July through November) ran post-sundown mobile transects between Tempe and Queen Creek for comparison purposes as to the dimension of the maximum UHI observed along the entire transect. Each transect ran from urban through residential to agricultural/desert rural landscapes. A maximum urban and residential UHI was determined from the fixed sites as ΔT_{U-R} and ΔT_{U-RES} for the period ca. 9-10 pm at night - the same time as each transect was completed. Similarly, we calculated the ΔT_{U-R} and ΔT_{U-RES} as determined from more complete spatial information along the transect route. On average, transects revealed a mean UHI ΔT_{U-R} of 7.3°C and ΔT_{U-RES} of 3.0°C, whereas the fixed site result was 4.8°C and 2.5°C, respectively.

Hope, D.[1], W. Zhu[2], C. Gries[1], J. Kaye[3], J. Oleson[4], N. B. Grimm[3], D. Jenerette[3], and Larry Baker[5]. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [2]Biological Sciences, State University of New York, Binghamton, NY 13902-6000; [3]School of Life Sciences, Arizona State Univer-

sity, PO Box 874501, Tempe, AZ 85287-4501; [4] Department of Math & Statistics, Arizona State University, PO Box 871804, Tempe, AZ 85287-1804; [5]Minnesota Water Resources Center, 173 McNeal Hall, 1985 Buford Ave, St. Paul, MN 55108.
Spatial variation in inorganic soil nitrogen concentrations across an arid urban ecosystem.

Cities provide unique opportunities for integrating humans into ecology, yet most explanations of urban ecological patterns are based on the urban-rural gradient concept, typically defined by various abiotic factors exclusive of economic and social measures. Using data from a probability-based integrated inventory of metropolitan Phoenix, Arizona, we explored the contribution of human-related variables to explaining observed variation in inorganic soil nitrogen (N) concentrations across the city and surrounding desert. Data were examined using spatial statistics on the desert and urban separately, as well as for the entire region.

We found that latitude, land-use history, population density, along with percent cover of impervious surfaces and lawn, best explained the variation observed in for soil nitrate concentrations across the entire region. Regional variations in soil ammonium concentrations were related to only latitude and population density. Within the developed urban area, patterns in both soil nitrate and ammonium were best predicted by elevation, type of irrigation and income level in the surrounding neighborhood. Concentrations of both forms of inorganic N were markedly higher and showed significantly greater spatial heterogeneity between urban sites, compared to the surrounding desert and the spatial autocorrelation of soil nitrate concentrations between desert sites was absent for the urbanized parts of the study area. We suggest that inorganic soil N concentrations become dominated by a number of key human-dominated "local" or "neighborhood" factors in the city, which may be very site-specific and are somewhat different for nitrate compared to ammonium.

Jenerette, G. D., and J. Wu. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 87287-4501. ***Soil heterogeneity in six patches of the Phoenix, AZ metropolitan region: Implications for scaling.***

How does soil heterogeneity vary throughout the CAP LTER region? To address this question we intensively sampled six patches: two agricultural, two mesic yards, and two native desert. At each patch, we used a dual-density spatially stratified design covering an extant of 6400 m^2 and a minimum grain size of 5 m. At each sampling locations we extracted a soil core (10cm depth) and determined its location using laser-based surveying. We analyzed each soil core to determine a suite of physical and biogeochemical variables including: mass of rock material, bulk density, water content, topography, soil organic matter (SOM), total nitrogen and stable isotope nitrogen ratios. We analyzed these data to answer three specific questions. 1) Are the means of each variable different between patches? 2) Are the variances of each variable different between patches? 3) Does the range of spatial dependence for

each variable differ between patches? We discuss our results as they pertain to scaling between individual patches and the Phoenix, AZ, metropolitan region with particular emphasis on explicitly linking these data with the Survey 200 dataset.

Lewis, D. B.[1,2], and N. B. Grimm[2]. [1]Center for Environmental Studies, 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. ***Hierarchical regulation of ecosystem function: material export from urban catchments.***

Hierarchy theory is widely applied to ecosystems. Explicit empirical tests are rare, however, because it is difficult to vary over informative ranges drivers operating at different scales. To overcome this difficulty we employ long-term, comparative ecosystem analysis, and investigate the export of 20 material species from 12 contrasting catchment ecosystems under contrasting storm conditions. Here we show that the load and stoichiometry of material in stormwater runoff is influenced by the interaction between intrinsic features of catchments and attributes of storms. Catchment identity governs the magnitude of among-storm variability in load, the storm attribute with which load is correlated, and the predictability (given storm attributes) of load. Catchment export of materials in stormwater runoff pollutes recipient ecosystems, and is a hot-button issue for regulation of land practices that impair water quality. Our results suggest that even in urban ecosystems, and though material deposition and storm severity are beyond direct control, the amount and variability of material load can be managed via the intrinsic features of catchments.

Machabee, L., and A. Kinzig. Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Investigating the variations in neighborhood parks use and landscape preferences: Preliminary results of a survey-questionnaire.***

The quality of life residents experience in their neighborhoods rests upon several factors: the built and natural features, the housing characteristics, the residents' social ties, the commercial and governmental services, the community organizations, the environmental hazards, etc. These factors vary greatly in quantity and quality from neighborhood to neighborhood. This poster presents preliminary results from a self-administered survey/questionnaire, completed by 639 Phoenix households, concerning some aspects of neighborhood quality of life. In particular, this survey examined the nuances of people's interactions with neighborhood parks. Residents living within one half mile of six parks located in three different socio-economic categories were polled. In addition to the activities they engage in, residents were asked to appraise the features of their park, and to signal their preferences toward different types of landscaping. Comparisons between preferred landscapes for public and private spaces were also made, and questions about neighborhood attributes and allegiances were included in the survey. These questions were designed to explore the relationship between park uses (satisfaction, expectations) and the general neighborhood experience. A final series of questions aimed to delineate the respondent's socio-economic profile. These questions strive to assess the variations in park use (satisfaction, expectations), and landscape preferences with socioeconomic status (sex, age, ethnic origin, education, income). In addition to presenting the research goals and the methodology, this poster introduces preliminary results from a few key questions. First, a portrait is made of the survey respondents. Second, the characteristics of the parks users, the activities they engage in, the time of the day/week they attend, and their overall park satisfaction is described. Finally, the residents' preferences for park and yard landscape are depicted.

Mahkee, D. K., and C. A. Martin. Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212. ***Growth of two landscape shrubs following severe pruning: Evidence of a hysteretic effect of former irrigation and pruning practices.***

In the urban Southwest, many commercial and residential landscape areas are small. Moreover, these landscaped areas are densely planted and heavily irrigated to give a lush and mature appearance soon after installation. Over time, plants arranged and maintained in this manner require frequent pruning to control plant size. Eventually, frequent pruning of plants can lead an accumulation of dead or bare stems, resulting in landscapes that many consider unattractive. To ameliorate this problem, chronically sheared plants are often severely pruned to the ground to rejuvenate plant vigor and enhance plant appearance. However, plant growth rates after severe pruning might be related to previous irrigation and pruning practices because plant growth after severe pruning may be dependent on root storage of carbon and water and nutrient acquisition potential. Our research objective was to determine if former irrigation and pruning practices affect shoot regrowth rates of two regionally common landscape shrubs following severe pruning. From January 2000 to April 2003, *Leucophyllum frutescens* and *Nerium oleander* shrubs were subjected to a factorial matrix of two irrigation rates (high or low) and four pruning frequencies (every six weeks, every six months, once yearly, or unpruned). In April 2003, both shrub taxa were severely pruned to the ground and then allowed to grow until November 2003 without additional pruning. Shoot growth of both taxa following severe pruning was significantly affected by the interaction of former irrigation rate and pruning frequency treatments. For both taxa, the greatest shoot growth occurred for shrubs that had been formerly irrigated at high volume and pruned every 6 months. The least shoot growth occurred for shrubs formerly irrigated at low volume and pruned every 6 weeks. These results give clear evidence of a hysteretic effect of former irrigation and pruning practices.

Mahkee, D. K., and C. A. Martin. Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212***. Leaf morphological plasticity of two landscape shrub taxa in response to a change in shrub pruning practices.***

Leaf morphologies of plants, such as lamina surface area and thickness, can show different levels of plasticity to a change in an environmental condition, which may be related to the plant's adaptation to environmental conditions before the change event. In urban landscapes, pruning strategies of landscape shrubs are sometimes changed suddenly, as in the case of severe renewal pruning (SNP) to rejuvenate shrub vigor and enhance plant appearance. We hypothesized that leaf morphological plasticity to in response to sudden change in shrub pruning practices would be taxon specific. To test this hypothesis, we measured the leaf lamina surface area and thickness of two regionally common landscape shrub taxa (*Leucophyllum frutescens* var. green cloud and *Nerium oleander* 'Sister Agnes') with relatively disparate leaf morphologies before and after SNP. Replicate plantings of both shrub taxa were grown from December 2000 until April 2003 in simulated landscape plots in Phoenix, Arizona, that were treated to a factorial combination of two irrigation rates (high or low) and four pruning frequency (every six weeks, six months, once yearly, or unpruned). In April 2003, all shrubs were severely pruned to ground level then allowed to grow for an additional six months without pruning. For each taxa x factorial treatment combination, 50 leaves were randomly collected six months before and six months after the SNP event. Leaf lamina surface area and dry mass were recorded, and specific leaf mass (SLM) was calculated as the ratio of leaf mass per unit area (mg/cm^2). Before SNP, *Leucophyllum* SLM was affected only by pruning frequency, while *Nerium* SLM was affected by an interaction of irrigation rate and pruning frequency. After SNP, the SLM of both taxa was affected by the interaction of irrigation volume and pruning frequency, but the interactive response was taxon specific. The SLM of *Leucophyllum* was most responsive to SNP, while the SLM of *Nerium* was less responsive suggesting that leaf morphological plasticity of *Leucophyllum* is greater than *Nerium* following SNP.

Manglani, P.[1], and K. D. Pijawka[2]. [1]Heschong Mahone Group, 11626 Fair Oak Blvd Suite 302, Fair Oaks, CA 95628; and [2]Ph.D. Program, College of Architecture and Environmental Design, Arizona State University, PO Box 872005, Tempe, AZ 85287-2005. ***Measuring environmental impacts of sustainable neighbourhood plans.***

This poster examines measures that can be utilized to evaluate sustainability at the neighbourhood planning level. The main aim is to derive quantitative indicators that can be utilized to characterize a neighbourhood plan on its level of sustainability including such measures as energy demand, protection of ecosystem integrity,

water use, heat island effects, and other environmental parameters. The final measures based on a small set of scientifically valid and operational indicators were combined into a single index to compare two neighbourhoods on the levels of sustainability that they had reached. These indicators of sustainability were developed through the scientific literature and applied to two conceptual neighbourhood plans in the Phoenix, Arizona region. Both plans utilize the same 1000 acres of undeveloped suburban desert land and topological features. The first plan is based on the superimposition of a conventionally designed neighbourhood; the second, a plan based on sustainable neighbourhood design principles was a product of a U.S. Environmental Protection Agency sponsored project on sustainability. The research is an example of how to operationally measure the "ecological footprint" at the neighbourhood level in the Phoenix area.

Martin, C. A., L. B. Stabler, K. A. Peterson, S. B. Celestian, D. Mahkee, and C. K. Singer. Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212. ***Residential landscape water use, 1998 to 2003.***

Urban landscape vegetation in the CAP area is normally irrigated because of the great disparity between potential evapotranspiration and rainfall. Residential land use constitutes the majority of land cover type in the Phoenix area. The structure and composition of residential landscape vegetation, being intentionally constructed to enhance environmental aesthetics, may be defined by a system of three locally common landscape design typologies, mesic, oasis and xeric. Extensive vegetative cover including grass lawns and broadleaf trees and shrubs dominates mesic landscapes. In contrast, desert adapted trees and shrubs, decomposing granite surface mulch and no grass lawns typify xeric landscapes. Oasis landscapes are an intermediate design type and generally have a mixture of elements found in both mesic and xeric design motifs. To understand the relationship between homeowner irrigation practices and landscape design type, we installed totalizing water meters on the supply lines of residential irrigation systems in 1998 and 1999 to measure the volume of water applied by homeowners to their landscape vegetation. Landscape surface areas were also measured for each the yards enabling us to express the amounts of irrigation water applied on a landscape surface areas basis, called the specific irrigation volume. From 1998 to 2003, specific irrigation volumes applied to landscape vegetation by homeowners were greatest for yards landscaped with a mesic design motif and least for yards landscaped with an oasis design motif. In addition, specific irrigation application volumes for mesic and oasis yards fluctuated seasonally in a pattern that followed potential evapotranspiration. In contrast, specific irrigation rates for xeric yards showed little seasonal variation and were generally the greatest of the three landscape design types during the winter months.

Marussich, W. A., and S. H. Faeth. School of Life Sciences, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601. ***Understanding trophic dynamics in urban and desert ecosystems using arthropod communities on brittlebush (*****Encelia farinosa*****).***

Do trophic dynamics differ in urban vs. "natural" systems? Is trophic structure controlled by "top-down" (natural enemies) or "bottom-up" (limiting nutrients) forces in these systems? To address these questions, we established long-term arthropod monitoring experiments on brittlebush (*Encelia farinosa*) at two permanent urban CAP LTER study sites (President's House and Desert Botanical Gardens) and one desert preserve (Usery Mountain Park). Brittlebush was selected because it is a common native desert perennial often used in urban landscaping. Experimental treatments include: bird exclosures (cages), ground predator exclosures (rings), and supplemental watering. We sample the arthropod community and plant damage once per month, apply a water treatment every two weeks, and measure plant volume and biomass accumulation four times per year. Arthropods are identified to family and feeding-guild. Family richness is higher at the urban sites than at the desert site. While approximately 50% of the families found are herbivorous, most individuals (<90%) found are herbivorous. Predator and parasite family diversity is also high (>40%), but their abundance is low (<10%). Bird exclosures appear to create enemy-free space at the urban sites, as herbivores are more abundant on plants with cages, and predators are more abundant on plants without cages. At the desert site, however, cages did not have appreciable effects, suggesting that birds are important top predators in urban but not desert areas. The ring treatment caused a decrease in the abundance of arthropods at Desert Botanical Gardens, but an increase at President's House and Usery Preserve. This suggests that ground predators have facilitative effects on arthropod communities in the urban desert remnant and detrimental effects elsewhere. At the urban sites, supplemental water decreased arthropod abundance, while at the desert site, water increased arthropod abundance. This suggests that water exerts stronger bottom-up forces in desert vs. urban areas. Although these results are preliminary, they indicate that both habitat type and trophic dynamics have strong effects on arthropod communities living on brittlebush on the Phoenix area.

Moeller, M. Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211. ***Analysis of long-term remote sensing imagery for the detection of changes in the CAP LTER site.***

The AgTrans project (Agriculture in Transition) deals with the analysis of long-term changes in areas where agricultural use dominates. At least six sites, well distributed over the US and representing different land use/land cover types belong to this project. Each site is also a partner site of the Long-Term Ecological Research project (LTER). The research in the AgTrans project starts with a focus on the regional CAP LTER and first results will be presented in this paper/poster. For the last three decades, beginning in July 1972, permanently recorded satellite imagery is available for most parts of the Earth surface. The images are system corrected and rectified, geocorrected and projected to the UTM cartographic system, which makes their usage in a GIS or image analysis software environment comfortable.

At least two platforms, consisting of four different sensor types should be mentioned. Landsat's payload consists of three different sensor types, the early Multi Spectral Scanner (MSS, 80-m geometric resolution, scenes from 1973 and 1979 were used for the CAP site), Thematic Mapper (TM, 30-m geometric resolution, scenes from 1985, 1990, 1995 for CAP) and Landsat Enhanced Thematic Mapper (ETM, 30-m geometric resolution [ms] and15-m [pan], one scene from 2000 for CAP). The recently developed ASTER sensor provides remotely sensed imagery with a up to 15m resolution (scenes from 2000 and 2003 for CAP).

For a standardized satellite image analysis a multi level classification scheme has been developed by Anderson et al. (1976). This classification scheme has been well proofed for remote sensing imagery of different geometric resolutions in a number of scientific investigations. It has also been used for an US-wide mapping of land cover/land use based on TM imagery recorded between 1990 and 1992. The results of this investigation can be found in the National Land Cover Data Set 2000 (NLCD 2000).

The Anderson classification scheme was also used with some adoptions for the satellite image analysis of the CAP site in this analysis. For the interpretation of Landsat MSS imagery (1973 & 1979) “Anderson level I” was chosen and on the Landsat TM data (1985) the “Anderson classification level II” was applied successfully.

Anderson, J. R.,E. E. Hardy, J. T. Roach and R. E.Witmer. 1976. A land use and land cover classification system for use with remote sensor data. Geological Survey Professional Paper 964. US Government Printing Office, Washington.

NLCD (2000) can be seen on the web at
http://landcover.usgs.gov/natllandcover.asp

Morehouse, N. School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501***. Local buggers: An inquiry-based introduction to local insect populations.***

Insects are the most abundant and diverse taxa in the animal kingdom, and thus present a potentially rich and meaningful opportunity for students to connect with local flora and fauna. Here we present a series of inquiry-based activities that introduce students to the diversity of local insect populations through the construction of a class insect collection. Using the resulting collection, students create and defend their own classification scheme and subsequently compare it to more established classification systems such as the Linnaean system. In addition, students explore the relationship between insect distribution and habitat type using their collected specimens and topographic maps of the nearby area. Lastly, students investigate morphological differences between insects in their collections. During this activity, they are asked to link differences in body structure to patterns of spatial distribution and habitat type discovered in the previous activity and to form hypotheses about the function of specific insect structures. Students will be assessed based on their ability to construct their own classification scheme, to describe patterns in insect spatial distribution and insect morphology, and to form hypotheses about the function of insect structures. This series of activities is appropriate for grades 5-8, and corresponds to specific National and State Standards in Inquiry, Life Sciences and Geography. In addition, this unit represents an excellent companion to protocols and activities developed by the Ecology Explorers program. More specifically, issues of arthropod diversity and spatial/landscape distribution addressed by the Ecology Explorers program correspond well with material contained in the lessons presented here. Access to this unit and supporting materials is free through the following website: http://gk12.asu.edu and will be included in the teacher resources section of Ecology Explorers.

Morrow, M. 1542 N. Sterling, Mesa, AZ 85207. ***Identification of cyanobacterial isolets from the biological soil crusts of Organ Pipe Cactus National Monument, Ajo, Arizona.***

Molecular methods will be more effective in obtaining the species of cyanobacterial isolets than based on morphological characteristics. Cyanobacteria are photosynthetic organisms. The strains in this experiment originate from the desert soil crusts in southern Arizona. The soil crusts are an intricate biosystem which is held together by the organisms that inhabit it. In the crusts the cyanobacteria prevent erosion that would otherwise be caused by the lack of plants. Six different strains have been isolated and are to be worked with. The first step is to culture enough cells to work with. The cyanobacteria will be grown on BG11 noble agar and allowed to photosynthesize under a fluorescent light. When sufficient material exists, the genetic material will be extracted using the MoBio Plant DNA Extraction Kit. The next process is to increase the amount of DNA through Polymearase Chain Reaction in a thermocyclyer. The process results with the duplication of approximately 700 base pairs of the 16s. Electrophoresis is done using all of the product in a 1% agarouse gel and the DNA bands are cut for purification. Next, the DNA will be purified using the MoBio DNA purification kit. Finally, the DNA will be sequenced in the Arizona State University DNA sequencing lab allowing for the order of the nucleic acids to be recorded. This experiment will allow the desert soil crust cyanobacteria to be compared on a genetic level. Also, morphological comparisons will be made to classify the isolets.

Neil, K. School of Life Sciences, Arizona State University, P.O. Box 874601, Tempe, Arizona 85287-4601. ***Dynamic nature of scientific knowledge***.

Usually when the concept that scientific knowledge evolves and grows over time is addressed in class, it is mentioned in the first weeks and rarely mentioned again. In this lesson, students develop an understanding and abilities of scientific inquiry through historical exploration of an unresolved research question that culminates with them contributing to current scientific knowledge. The lesson demonstrates the importance of repeatedly testing hypotheses and of using knowledge of related topics to investigate current questions. The question addressed is: Why do *Daphnia*, a.k.a water fleas, develop enlarged helmets and tail spines during some seasons of the year? As the scientific community has studied this question for more than a century, two alternative hypotheses have evolved: there is a chemical cue that triggers the morphological response that (a) originates from the predator or (b) originates from eaten prey. Students design their own experiments to explore these hypotheses and, upon completing their experiments, present their contributions at a classroom "conference." *Daphnia* were chosen because they are readily available to instructors, the experiments run approximately a week and are relatively simple to conduct, and the question has not been "answered." Therefore, students have the opportunity to participate in the scientific debate. In addition to their experiment proposals and presentations, students are evaluated based on writing down and discussing what questions still remain (due to insufficient and/or weak data) and a theoretical experiment they would perform next to help address those questions. By exploring how the questions and knowledge of a current research topic have evolved through time and then participating in the debate themselves, the students can experience the dynamic nature of science. This lesson can be modified for use in grades 7 through college and accessed at: http://gk12.asu.edu.

Netzband, M.[1], and W. L. Stefanov[2]. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]Department of Geological Sciences, Arizona State University, PO Box 876305, Tempe, AZ 85287-6305. ***Remote sensing and landscape metrics for global urban ecological monitoring.***

Data from the NASA Earth Observing System (EOS) sensors (such as ASTER and MODIS) promises to increase our understanding of global urban ecological processes and improve city and land planning capabilities. The ongoing Urban Environmental Monitoring (UEM) project at Arizona State University uses EOS data to characterize past and present urban and peri-urban ecological change. The primary goal of the project is to develop an understanding of urban evolutionary trajectories. If distinct trajectory "types" can be identified and modeled, we may then predict responses of urban/peri-urban systems to future environmental stressors. A subset of 8 "high priority" cities (Chiang Mai, Berlin, Canberra, Delhi, Lima, Manila, Mexico City, and Phoenix) has been selected for intensive study of regional development history. These cities have been selected to represent a range of geological, geographic, climatological, and social factors.

While characterization and monitoring of urban center land cover/land use change is important in establishing baseline information, it is only of limited use in understanding the development pathways of cities and their resilience to potential outside stressors. As an exemplar of the UEM project approach, we present an analysis of ASTER and MODIS data for Phoenix, AZ, USA to explore the hypothesis that landscape structure directly affects biogeophysical parameters at relatively small spatial scales (1 km). The methodology includes development of a new expert system land cover classification model for ASTER data, landscape structure analysis of the resulting land cover dataset using spatial metrics (class area, mean patch size, edge density, and interspersion/juxtaposition), and comparison with several measured biogeophysical parameters from MODIS (albedo, day/night surface temperature, fPAR, LAI, and NDVI). Our results indicate that urban landscape structure is in general poorly correlated with all of the examined MODIS variables. We explore several potential explanations for this observed lack of correlation.

Prashad, L.[1], W. L. Stefanov[1], A. Brazel[2], and S. Harlan[3] .[1]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe AZ 85287-1404; [2]Department of Geography Arizona State University, PO Box 870104, Tempe, AZ 85287-0104; and [3]Department of Sociology, Arizona State University, PO Box 872101, Tempe, AZ 85287-2101. ***Defining temperature and vegetation connections at neighborhood and regional scales in Phoenix, Arizona using remotely sensed and ground-based measurements.***

Neighborhoods (1 km^2 areas) in Phoenix, Arizona, USA have significant relationships between remotely sensed vegetation abundance (SAVI) and surface temperatures. Significant differences were also found between SAVI and surface temperatures of low socioeconomic status (SES) neighborhoods and neighborhoods with high SES. Low SES neighborhoods have significantly higher temperatures and lower SAVI values. A second study was conducted on the regional relationship between SAVI and surface temperatures in Phoenix. It was hypothesized that these remotely sensed variables would be significantly related to ground-measured relative humidity values and air temperatures. Remotely sensed SAVI and surface temperature values were collected for five dates, representing different seasons, along with weather station data taken at the time and date of the remote sensing scenes. Linear regression analysis showed that SAVI and surface temperature do have a statistically strong relationship for the majority of the scenes. The analysis found no link between SAVI and relative humidity or surface temperature and air temperature. Since past studies have shown connections, although complex, between these variables it is likely that there is an error in the study. Possible reasons for this error are that the weather station sites do not accurately represent the land types of the region, wind effects may be influencing the station measurements, or that the

differential heating of north and south facing slopes with the same SAVI values may be making the regression invalid.

Redman, C. L.[1], G. Gammage[2], N. Jones[1], E. Corley[3], J. Holway[4], J. Keane[5], S. Megdal[6], and R. Quay[7]. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [2]Morrison Institute for Public Policy, Arizona State University, PO Box 874405, Tempe, AZ 85287-4405; [3]School of Public Affairs, Arizona State University, PO Box 870603, Tempe, AZ 85287-0603; [4]Arizona Department of Water Resources, 500 N. 3rd St, Phoenix, AZ 85004; [5]Salt River Project, PO Box 52025, Phoenix, AZ 85072-2025; [6]Water Resources Research Center, University of Arizona, 350 N. Campbell Ave, Tucson, AZ 85721; and [7]Department of Water Services, City of Phoenix, 200 W. Washington St, Phoenix, AZ 85003. ***Water supply in Greater Phoenix: Improving regional decision making through university partnerships.***

The future water supply of the Greater Phoenix region is dependent on a fragmented water management infrastructure comprised of several state and local agencies and private corporations. During the next 50 years, it is possible that growth and increased demand for water will reach the limit of our water resources. How water is managed will determine when the region reaches this point. The Consortium for the Study of Rapidly Urbanizing Regions (CSRUR) hosted a dialogue to identify water policy information and research needs and to begin to build linkages between water policy decision makers and research agendas between Arizona State University, the University of Arizona, and state and local agencies. Participants included greater than 50 individuals representing a broad base of decision makers and academics whose focus is water supply in Arizona. This event resulted in identifying several unmet research needs and forming new partnerships. Currently, CSRUR is coordinating the development of a shared water-data network that will provide decision makers access to datasets that were previously unavailable outside of a single agency. This effort will improve the knowledge that any single agency has, resulting in more accurate information and an improved forecasting ability.

Redman, C. L.[1], A. P. Kinzig[2], D. R. Foster[3], M. P. Gutmann[4], P. M. Kareiva[5], L. H. Kuby[1]. [1]Center for Environmental Studies, 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]Harvard Forest LTER, PO Box 68, 324 N. Main St, Petersham, MA 01366; [4]Institute for Social Research, University of Michigan, PO Box 1248, Ann Arbor, MI 48106-1248; and [5]The Nature Conservancy of Washington; 217 Pine St, Ste 1100, Seattle, WA 98101. ***Agrarian landscapes in transition: A cross-scale approach.***

This interdisciplinary, cross-site project is tracing the effects of the introduction, spread, and abandonment of agriculture at six LTER sites. Many conceptualizations of agrarian transformations assume a simple linear model—change driven by present-day economic, demographic, and technological conditions. This project incorporates a more integrated and long-term view: land-use change affecting landscapes, altered landscapes affecting ecological processes, and both influencing the ways humans monitor and respond to their surroundings, engendering further cycles of change. This study will identify and quantify the ways in which these integrated cycles differ across cultures, biogeographic regions, and time. Analytical approaches include structural-equation modeling, analysis of spatial and causal effects, and cross-site comparisons of case studies. As a practical test, project approaches and insights will be examined in the context of conservation planning at The Nature Conservancy.

This investigation will demonstrate the importance of social-science information and approaches in ecosystem investigations. Second, this project will develop general theories on how socio-ecological legacies, and lags in the recognition of and response to change, vary across space and time. Third, the project expects to show that humans act not only to disturb ecosystems, but also to monitor ecosystem values and maintain stability. Fourth, project results will provide information of use to policy makers by using an approach that explicitly relates socio-ecological processes to varying levels of political organization. Fifth, cross-scale data collection and analyses are expected to demonstrate that some patterns of human-ecological interactions are surprisingly long term, vary across space and time, and are nonlinear.

As a first step in the project, each site is formulating a narrative of agricultural histories in their region; here we present some of the analyses from the Phoenix narrative.

Roach, W. J.[1,2], R.Arrowmisth[3], C. Eisinger[2,3], N. B. Grimm[1,4], J. B. Heffernan[1], and T. Rychener[1]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; [2]IGERT in Urban Ecology, Arizona State University, PO Box 8713211, Tempe, AZ 85287-3211; [3]Department of Geological Sciences, Arizona State University, PO Box 871404, Tempe, AZ 85287-1404; and [4]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211.
Anthropogenic modifications influence the interactions between the geomorphology and biogeochemistry of an urban desert stream.

We used historic aerial photography to document geomorphic changes resulting from the development of Indian Bend Wash, Scottsdale, AZ. Catchment land use shifted from prehistoric agriculture (14th century) to desert and again to agricultural fields in the early 20th century. Beginning in 1955, suburban development has expanded from the mouth to headwaters of the wash, followed by greenway creation. This development has produced a shift in vegetation from desert scrub and mesquite bosques to a community dominated by low grasses and widely spaced trees. The geomorphic modifications of the floodplain interact with catchment-wide land use changes to alter sediment transport and deposition, spatial and temporal patterns of nitrogen storage, and vegetative community dynamics.

Saltz, C.[1], C. Hill[2], and M. Elser[1]. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]Life Sciences Visualization Center, School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Ecology Explorers: Land-use prediction game.***

Explore the exciting new predication game on land-use change developed for the Ecology Explorers website. This dynamic game combines photographs and flash animation to introduce students to interpreting aerial photography and then challenges them to predict changes in land-use in Phoenix.

Schaafsma, H., and J. Briggs. School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601. ***The Sonoran Desert: A palimpsest of prehistoric human activities.***

Anthropogenic disturbances often alter local patch-dynamics and successional processes. These patches may be difficult to determine in areas with species with longevities measured in hundreds and thousands of years as seen in some desert plants. Recent research has shown that prehistoric (~750 years BP) farming has produced measurable legacies in modern Sonoran Desert plant communities. The study area is a five-mile reach of Cave Creek in Arizona that encompassed the first terrace with a total area of 124 ha; prehistoric fields make up 9% of the area. The differences between the fields and the remainder of the first terrace show that almost 1/10th of the area has been modified by humans and retains legacies of these changes up to 800 years after abandonment. Legacy effects have been measured on the fields in the woody, cacti and herbaceous communities. Changing 9% of the landscape has consequences for the patch dynamics of the system as a whole by altering plant communities as well as producing differences in habitat. These results show that archaeology coupled with plant biology may provide a way to assess processes of disturbance, succession, and patch dynamics in plant communities with extreme longevity. The results also have serious implications regarding past human interaction with the landscape; the wide distribution of archaeological sites suggests that large areas of the Sonoran Desert have contained numerous anthropogenic patches for at least the last two thousand years. Discovering the scale at which these patches create significant alterations is an on-going aspect of this work.

Schmieding, S. J., Department of History, Arizona State University, PO Box 872501, Tempe, AZ 85287-2501. ***From purgatorial wasteland to reclaimed garden: Hydrological development, water politics, and social engineering in pre-statehood central Arizona.***

Framed by the Spanish/Mexican eras and American entrada, this project analyzes the evolution between 1863 and 1912 of physical and ideational systems in Salt and Gila River Valleys concerning development of water resources, illustrating the historical synthesis of political, economic and ecological forces in creating a baseline for later agrarian and urban developments.

Between the Hohokam collapse and Arizona's incorporation into the United States, human sedentary settlement of central Arizona's alluvial lowlands was largely limited to Pima and Maricopa settlements in Gila River Valley. Euro-Americans initially classified Arizona's deserts as wastelands to be survived en route to California, with water engineering limited to wells and tanks on migration routes. Perceptions changed as economic and social needs propelled non-Indian settlers to Arizona. Initially drawn by gold strikes on the Gila River and Central Highlands, depletion of placer deposits and need for foodstuffs attracted settlers and investors to Salt and Gila River Valleys. Viewing present and past indigenous agricultural practices, non-Indian farming was initially based on mimicry and excavation of Hohokam canals. Euro-American population increased, technology and economic systems improved, the Indian wars gradually ended, irrigation infrastructure became more complex, and farmed acreage increased dramatically. Ruled by "prior appropriation" doctrine where senior claimants had primary legal rights, resource-competition dynamics produced political, economic and ecological crises in Euro-American and Indian societies that were not mitigated until private-federal cooperation exemplified by the Salt River Project enabled development of complex water storage and delivery systems, and the legal mess emanating from prior appropriation practice was clarified after the 1910 Kent Decree. The Salt River project and Gila River's hydrological limitations ensured Salt River Valley's ascension as the state's economic and political center, while Native American exclusion from political power ensured non-Indian hegemony over water resources.

Schoeninger, R.[1], P. McCartney[1], C. Gries[1], C. Saltz[1], E. Ortiz-Barney[2], T. Craig[3], S. Scheiner[4], M. Elser[1]. [1]Center for Environmental Studies, 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 Biology, University of Minnesota-Duluth, Duluth, MN 55812; and [4]National Science Foundation, 4201 Wilson Blvd, Arlington, VA 22230. ***Ecology Explorers online data analysis.***

Ecology Explorers is a CAP LTER educational program for Kindergarten through 12th grade students. Protocols developed by CAP scientist are employed by the students for data collection in their schools. One goal of this project was to provide appropriate data analysis tools that allow students and teachers access to their data while

providing tools to teach required concepts using graphs and statistics in an online environment. The second goal of this project was to accomplish this by using background technology developed for scientific data access applications and a design that provides extensibility to the use of scientific datasets collected by CAP researchers for their research.

The application lets the students develop hypotheses, questions and predictions based on the available data. Simple statistical procedures and two types of graphs are offered to test the hypothesis. A bar graph and a dot-plot/box and whisker series along with concepts of central tendency, median, mean and quartile were chosen to comply with 6th grade Arizona Department of Education Math standard requirements.

The technology for this web application is based on a standardized internet messaging system through which the front-end user interface (the web pages that the user sees) sends requests to a background system for querying, analyzing and graphing data (a series of data processing services that the user doesn't see). This decoupled design enables us to use the same back end technology for advanced data access applications as well as this guided inquiry. More datasets will be added to the Ecology Explorers Online Data Analysis through configuration files without needing to change either the interface or the back-end services. These files contain the text prompts for the web pages and define the connection between the science questions and data queries need to address them.

Sheibley, R. W.[1], N. B. Grimm[1], C. L. Crenshaw[2], C. Dahm[2], L. H. Zeglin[2], H. van Vleck[1], and A. D. Pershall[2]. [1]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501; and [2]Department of Biology, University of New Mexico, Albuquerque, NM. ***Methods of measuring nutrient spiraling in urban streams.***

Urban development in the USA has led to major alterations to our streams and there is a need to examine nutrient retention in these systems. Twelve streams in Phoenix, AZ, and Albuquerque, NM, were sampled to determine uptake lengths for nitrate using 3 different methods (1) natural changes in background concentration, (2) short-term nutrient additions and (3) 15N tracer additions. Results from this urban study were compared to data from similar experiments in pristine desert streams. In general, background nitrate was higher in urban streams, often exceeding 1 mg N/L. Declines in background nitrate in the urban streams were often not measurable. From short-term injections, uptake lengths were 300 to 1200 meters long and were much higher than those measured in pristine streams. Bromide responses downstream showed very little transient storage owing to the high level of channel modification. Uptake lengths from 15N tracer experiments were similar to those determined from the nutrient additions indicating that streams were close to saturation with respect to nitrate. Overall, urban streams were less retentive than their pristine counterparts. This comparison demonstrated that nutrient spiraling of nitrate in urban streams can be adequately measured using short-term injections as a result of high nitrate loading.

Shen, W.[1,2], J. Wu[1], J. F. Reynolds[3], and N. B. Grimm[1]. [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, P. R. China; and [3]Department of Botany and Nicholas School of the Environment & Earth Science, Duke University, Durham, NC 27708-0340. ***Simulating the primary productivity of a Sonoran ecosystem: Model parameterization and validation.***

Modeling has played an important role in understanding the structure, functioning, and dynamics of complex ecosystems in the past several decades. However, ecosystem modeling for desert systems has received relatively little attention. We have adapted and reparameterized the PALS-FT model, originally developed for the Chihuahuan Desert, to simulate the aboveground net primary productivity (ANPP) of a creosotebush (*Larrea tridentata*) and bursage (*Ambrosia deltoidea*) co-dominated Sonoran desert ecosystem in the Phoenix metropolitan area, which is home to the Central Arizona – Phoenix Long-Term Ecological Research Project (CAP LTER). Model predictions were validated using field observations from an independent test site in the San Simon Valley of the southeastern Arizona. The results showed that PALS-FT was able to simulate ANPP of this typical Sonoran Desert ecosystem reasonably well, with a relative error of -8.8% at the ecosystem level and generally <25% at

the functional type level. We then used the model to simulate ANPP and its seasonal and inter-annual dynamics of a similar ecosystem within the CAP LTER study area. The model predicted average annual ANPP of the Sonoran ecosystem was 72.3 g $m^{-2}y^{-1}$, ranging from 11.3 g $m^{-2}y^{-1}$ to 229.6 g $m^{-2}y^{-1}$ in a 15-year simulation. The simulated average ANPP of the Sonoran ecosystem is close to field observations in other areas of the Sonoran Desert, and the simulated ANPP range is within the range of ANPP for arid and semiarid ecosystems suggested by other researchers. The dynamics of ecosystem ANPP in response to fluctuations in annual precipitation simulated by the model seemed to agree well with the known relationship between ANPP and precipitation in arid and semiarid systems. An closer examination of this relationship at the level of plant functional types further revealed that the seasonal distribution of rainfall significantly affected ANPP. Our future research goals include using the (partly) validated model to investigate how native desert ecosystems respond to changes in multiple environmental factors induced by urbanization, such as rising air temperature, elevated atmospheric CO_2 concentration, and increasing nitrogen deposition.

Shochat, Eyal[1,2], M. Katti[1], and S. Lerman[1]. [1]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; and [2]Sutton Avian Research Center, University of Oklahoma, PO Box 2007, Bartlesville, OK 74005. ***Differences in bird foraging behaviour between Sonoran Desert and urban habitats in central Arizona.***

Urban bird communities exhibit high population densities and low species diversity, yet the mechanisms behind these patterns remain largely untested. We present results from an experimental study of behavioral mechanisms underlying these urban patterns and provide a test of foraging theory applied to urban bird communities. We measured foraging decisions at artificial food patches to assess how urban habitat differs from more natural ones in predation risk, missed-opportunity cost (MOC), competition, and metabolic cost. We manipulated seed trays and compared the leftover amount of seed (giving up density - GUD) in urban vs. desert habitats in Arizona. Desert habitat exhibited higher predation risk than urban. Increasing the MOC caused desert birds, but not urban birds, to quit patches earlier.

House Finch and House Sparrow coexist by trading off travel cost against foraging efficiency. Exclusion experiments revealed that urban doves were more efficient foragers than passerines. Providing water decreased the digestive costs only in the desert. We suggest that at the population level reduced predation and higher resource abundance drive the increased densities in cities, whereas at the community level the decline in diversity may involve exclusion of native species by highly efficient urban specialists. Competitive interactions, therefore, play a significant role in structuring urban bird communities. Our results indicate the importance and potential of the mechanistic approach for future studies on urban bird communities.

Singer, C. K. C.A. Martin, L. B. Stabler, and D. K. Mahkee. Department of Applied Biological Sciences, Arizona State University-East, 7001 E. Williams Field Rd, Mesa, AZ 85212. ***Influences of drip irrigation rate and pruning on electrical conductivity of soil surrounding two landscape shrubs.***

Drip irrigation of landscape plants is a common water conservation practice in Southwest desert cities. However, soluble salts in drip irrigation water derived from relatively saline sources might exacerbate long-term accrual of salts in urban soils. Saline soils can detrimentally impact landscape plant performance, but the effects of horticultural practices on patterns of salt accrual in soil surrounding drip irrigated landscape plants are poorly understood. We measured electrical conductivity (EC) of soil surrounding *Nerium oleander* 'Sister Agnes' and *Leucophyllum frutescens* var. green cloud shrubs that had been previously subjected for four years to a factorial arrangement of two drip irrigation rates (high and low, irrigation water EC=0.614 dS/m) and two pruning regimes (pruned every 6 weeks and unpruned). EC of eight soil cores at two contiguous depths (0-20 and 20-40 cm) and four distances (0, 0.5, 1.0 and 1.5-m) away from the base of each shrub was measured using the saturated paste method. Overall, soil EC was positively related to drip irrigation rate. When drip irrigated at the high rate, soil surrounding unpruned shrubs had higher EC than soil surrounding shrubs pruned every 6 weeks. But when drip irrigated at the low rate, soil surrounding unpruned shrubs had lower EC than soil surrounding shrubs pruned every 6 weeks. Patterns of soil EC surrounding *Leucophyllum* or *Nerium* were similar, did not vary with sampling depth, and were generally highest 0.5 m away from the base of each shrub. These results show that higher drip irrigation rates can exacerbate salt accrual, but that pruning practices ameliorate salt accrual under these conditions possibly by the frequent removal of salt sequestered in shoot tissues.

Sisart, S.[1], J. Dean[2], and Shannon Johnson[3]. [1]Desert Vista High School, 16440 S. 32 St, Phoenix, AZ 85048; [2]Mesa High School, 1630 E Southern Ave, Mesa, AZ 85204; and [3]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***The diazotroph community of biological soil crusts.***

Deserts have long been considered limited in nitrogen. In a desert, large influxes of nitrogen are traditionally considered due to nitrogen fixing cyanobacteria that reside in biological soil crusts. These biological soil crusts cover large areas of the deserts and are vital in maintaining the ecological system. Previous research has shown that cyanobacteria can only survive and therefore fix nitrogen at the photic zone of the soil crusts. However, nitrogenase activity can be measured below the photic zone suggesting diazotrophic microbes. In our experiment, we looked at soil crusts at two different maturity stages from the Colorado Plateau. We enumerated nitrogen-fixing bacteria concentrations in the first centimeter of the soil crusts, which we divided into six vertical horizons. For every horizon, we used an MPN (most probable number) culturing technique in order to determine the concentration of the nitrogen-fixers in the soil profile. The plates contain a nitrogen-free media as a selective agent. From these micro-well plates, we chose a few interesting bacterial colonies. We obtained three morphologically distinct isolates. Our MPN data shows that most of the nitrogen-fixers existed at the top few millimeters of the soil crusts. This is true for both crust types, however it appears there are greater concentration variations in the less developed soil crust. Overall, mean values were approximately 6¥105 cells g-1, with values peaking near 1¥106 cells g-1 in the third horizon (2-3 mm deep) in the immature soil crusts, and in the second horizon (1-2 mm deep) of the mature crust.

Stabler, L. B., and C. A. Martin. Department of Applied Biological Sciences, Arizona State University East, 7001 E. Williams Field Road, Mesa, AZ 85212. ***Effects of drip irrigation rate on above ground net primary productivity of a mixed landscape.***

Municipalities within the CAP LTER study area encourage homeowners to install low water use landscapes and drip irrigation systems because of concerns about availability of long-term fresh water resources. However, there is significant variation in irrigation practices by homeowners who drip irrigate their low water use landscape plantings. Since above-ground net primary productivity (ANPP) is coupled to water availability in arid systems, our objective was to determine the effects of drip irrigation rate on ANPP and water use efficiency (WUE = ANPP/drip irrigation volume) of low water use landscape plantings. Two drip irrigation treatment rates (low or high), based on preliminary residential landscape water use data in the Phoenix area, were applied to 15 plants in each of fourteen 100-m^2 landscape plots for three years using 3.8 L/hr pressure compensating drip emitters. Irrigation volumes applied to each plot were recorded by totalizing water meters. Average low and high irrigation treatment rates were 814 L m^{-2} yr^{-1} and 1954 L $m^{-2}yr^{-1}$, respectively. Each plot contained one of two tree taxa, *Eucalyptus microtheca* 'Blue Ghost' and *Quercus virginiana*, and six of two shrub taxa, *Leucophyllum frutescens* var. green cloud, *Nerium oleander* 'Sister Agnes', and one *Rosmarinus officinalis* 'Prostratus'. Drip irrigation treatment rate did affect plot ANPP and WUE. For three years, ANPP of trees and shrubs drip irrigated at the high or low rate was 98.7 and 52.4 Kg per plot, respectively. Mean WUE of plants drip irrigated at the high or low rate was 0.61 and 0.79, respectively. This research shows that urban landscape water conservation is not realized solely by design and use of low water use plants, but must also include reductions in landscape water use.

Stutz, J. C., S. Whitcomb, and J. Cousins. Department of Applied Biological Sciences, Arizona State University-East,7001 E. Williams Field Rd, Mesa, AZ 85212.

Local arbuscular mycorrhizal fungal diversity is strongly coupled to regional diversity in an urban ecosystem.

Local diversity of arbuscular mycorrhizal (AM) fungi was compared to regional diversity in the Central Arizona – Phoenix LTER. Data on local diversity was collected from two replicated landscape plots located at the Desert Botanical Garden where 50 soil samples were collected for analysis of AM fungal species composition. Data on regional diversity was collected from 36 residential land-use Survey 200 sites. Three soil samples were collected from each Survey 200 site for analysis. AM fungal species in each soil sample were identified from trap cultures, and the relative frequency of each species was calculated. Twelve AM fungal species were detected at the landscape plots located at the Desert Botanical Garden and 19 species were detected in the regional survey. There was a strong overlap in species composition between the local and regional community with ten of the species detected in the local community also detected in samples from the regional survey. The most frequently detected species in the regional survey are also the most common at the local site. Species rarely encountered in at the Survey 200 sites were also rare at the local site. These results indicate a strong coupling between the local AM fungal community and the regional metacommunity. Because wind serves as an effective dispersal agent for AM fungal propagules in arid areas, in-migration of species into the local community is likely.

Swanson, S., and Rebecca Calonico. Department of Anthropology, Arizona State University, PO Box 872402, Tempe, AZ 85287-2404. ***Legacy effects of prehistoric farming: Isotopic analysis of maize grown in sediments from Hohokam fields.***

Maize was a staple crop in the prehistoric southwest US. While prehistoric farmers practice diverse agricultural techniques, fertilization was not practiced, and over time nutrient depletion in fields may have caused reduced agricultural productivity. Remains of maize are ubiquitous in archaeological contexts, and may retain clues to the fertility of the fields in which they were grown. We conducted two maize grow-outs using sediments collected from four different Hohokam prehistoric agricultural field types along Cave Creek north of Phoenix, Arizona. This paper reports the results of the grow outs as well as elemental and isotopic analyses of the agricultural sediments and indigenous varieties of maize grown in them.

Walker, J., and J. Briggs. School of Life Sciences, Graduate Programs, Arizona State University, PO Box 874601, Tempe, AZ 85287-4601. ***Remote sensing of Phoenix's urban forest with high-resolution aerial photography.***

In order to adequately model ecosystems services of the urban environment, it is necessary to accurately inventory urban vegetation and abundance and spatial distribution. This is a methodological design for estimating urban forest structure using remote-sensing techniques on high-resolution aerial photography. Color imagery is able to be analyzed and classified spectrally, albeit limited relative to multispectral imagery. The advantage of analyzing color is typically a much higher resolution is commercially available for entire metropolitan regions, whereas multispectral imagery is generally collected at more coarse resolutions and broad regions. Vegetation is controlled at the local scale within the urban environment, composed of discrete hetergeneous patches, it is necessary to quantify landscape pattern at this scale. Identification of land cover was conducted in the field and georeferenced in order to construct a spectral library based on pixel signatures. Analysis of individual pixel values of the landscape was then conducted utilizing a supervised classification. Classified pixels were then homogenized into distinct patches by using an object-oriented segmentation algorithm that transposes imagery into distinct polygons by incorporating a combination of spectral properties and neighborhood characteristics. This methodology is in the process of being analyzed for accuracy to create a technique to allow for regular monitoring of vegetation change at broad scale with fine resolution in the Phoenix basin.

Warren, P. S.[1,2], D. Hope[2], S. Harlan[3], A. Kirby[4], D. Casagrande[2], N. Jones[2], and A. Kinzig[5]. [1]Biology Department, 2119 Derring Hall, Blacksburg, VA 24061; [2]Center for Environmental Studies, Arizona State University, PO Box 873211, Tempe, AZ 85287-3211; [3]Department of Sociology, Arizona State University, PO Box 872101, Tempe, AZ 85287-2101; [4]Department of Social and Behavioral Sciences, Arizona State University-West, 4701 W. Thunderbird Rd, PO Box 37100, Phoenix, AZ 85069-7100; and [5]School of Life Sciences, Arizona State University, PO Box 874501, Tempe, AZ 85287-4501. ***Correlated ecological and social variation in the urban landscape: exploring potential causes and consequences.***

Humans are the primary drivers of ecological patterns in cities, particularly so for the distribution and abundance of plants and animals. This variation in environmental quality might or might not be valued, or even perceived by the human residents of cities. This recursive question of how humans affect environmental change and how environmental change feeds back to affect human social systems can only be addressed with large-scale empirical research. Results from three concurrent studies at CAP LTER, the Survey200, Parks Project, and Phoenix Areas Social Survey (PASS), indicate that bird diversity, plant diversity, and human perceptions of the environment all vary with income level across the Phoenix metropolitan area. We discuss some of the potential causes and consequences of this set of correlations. In particular, we explore the possibility that much of the variation in the distributions of plants and animals in the city is driven by forces above the level of the individual homeowners, e.g., decisions made by developers or municipal governments. Regardless of mechanism, however, one important outcome is that lower income residents often have access to fewer ecological amenities than do higher income residents.

Warren, P. S.[1,2], M. Katti[3], and M. Ermann[4]. [1]Biology Department, Virginia Polytechnic Institute & State University, 2119 Derring Hall, Blacksburg, VA 24061; [2]Center for Environmental Studies, 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; and [4]Department of Architecture, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061. ***Urban bioacoustics: It's not just noise.***

The acoustic environment plays a major role in shaping animal communication systems. Humans, particularly in cities, profoundly alter the acoustic structure of their environment. Several recent articles have identified effects of noise on animal communication and behaviour. These studies, however, serve to highlight the surprising dearth of research on the behavioural responses of animals to altered acoustic environments. We argue that noise level is not the only aspect of urban bioacoustics that researchers should explore. In addition to elevated noise levels, urban areas are characterized by a predominance of linear rather than point sources of noise, many vertical reflective surfaces, and, predictable diurnal variation in noise levels and sound transmission. All of these characteristics have parallels in natural environments. This suggests that cities are a fruitful area for future research on the evolution of animal communication systems, with implications for conservation in human-altered environments more generally. We present and illustrate a conceptual overview of the acoustic properties of urban areas as well as pilot data from studies conducted at CAP LTER.