

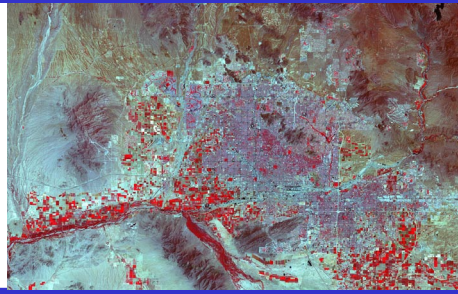
## Overarching Research Questions

- How does urban development alter ecological conditions?
- How do ecological conditions affect urban development?

To study this urban ecosystem set in the Sonoran Desert, ASU researchers in the social, physical, and biological sciences are focusing on five primary study areas:

- land-use change and human feedbacks to ecosystem processes
- nutrients and materials storage, transport, and transformation
- hierarchical patch dynamics modeling integrated with GIS and remote sensing
- primary production and plant water use
- insect and bird populations and communities

Here we present graphics and key results from some of these initial studies.



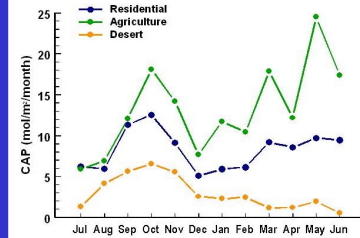
## Project Co-Directors

**Nancy B. Grimm**  
**Charles L. Redman**

Poster contributions: R. Bolin, D. Brewer, S. Carroll, P. Christensen, A. Coppola, S. Faeth, W. Fagan, C. Gries, E. Hackett, D. Hope, L. Kuby, M. Luck, C. Martin, E. Matranga, N. McIntyre, A. Nelson, D. Pijawka, M. Ramsey, J. Rango, J. Roach, E. Sadalla, B. Shears, D. Sicotte, L. Stabler, W. Stefanov, W. Zhu

## Gas Exchange Characteristics of Urban Vegetation

C.A. Martin and L.B. Stabler



Gas exchange characteristics were studied during 1998 and 1999 in urban landscapes of Phoenix. Carbon Acquisition Potential (CAP) of woody vegetation in residential landscapes was modeled and contrasted with similar predictions of vegetation at nearby remnant desert and agricultural sites. Predicted value of CAP in residential landscapes was intermediate compared to a higher value at agricultural sites and a lower value at remnant desert sites.

Monthly predicted carbon acquisition potential (CAP) of urban residential, agricultural, and desert vegetation from July 1998 to June 1999.

## Survey 200: Preliminary Results

C. Gries, W. Zhu, D. Hope, and S. Carroll



This project is intended to monitor long-term ecological trends over time and space. Ecologically relevant parameters were sampled at 200 randomly selected sites (see map at right) in spring 2000, and sampling will be repeated every 3 to 5 years. Data below from 1999 pilot study.

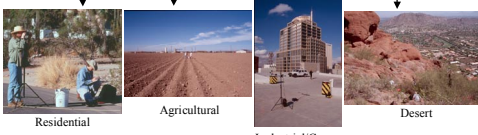
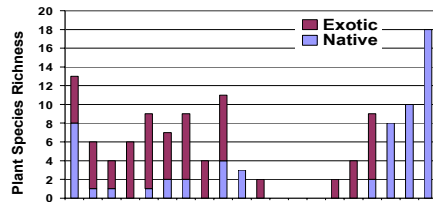
### Integrated Inventory

Measured variables include: vegetation species, plant canopy dimension, built structures, surface cover types, soil physical and chemical properties, bird counts, and photos.

### Preliminary Findings

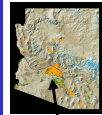
- The percentage of non-native plant species in residential yards in Phoenix appear to be higher than in temperate European cities.

- Shrub biomass per unit area is higher in the desert than in residential yards, while tree biomass is higher in residential yards.



Photos by Tim Trumble/ASU Insight

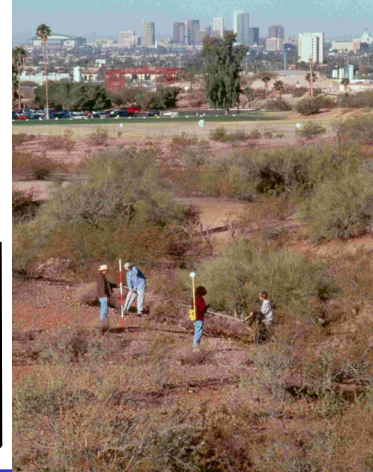
## Central Arizona-Phoenix Ecosystem



Arid nature: precipitation  
180 mm/y  
study area= 5,000 km<sup>2</sup>  
Rapidly growing human  
population:  
1950: 50,000  
2000: 2.8 million



GIS Lab  
Arizona State University



## Effects of Habitat Type on Arthropod Community Structure in a Heterogeneous Urban Environment

N. McIntyre, J. Rango, W. Fagan, and S. Faeth

Richness and abundance of ground arthropods were systematically monitored for 1 year at 16 sites equally distributed among four urban land-use types (residential, industrial, agricultural, and desert remnant) in the CAP LTER study area. Significant differences in arthropod diversity were observed among the land-use types, with the most taxa found at agricultural sites and the fewest taxa found at industrial sites.



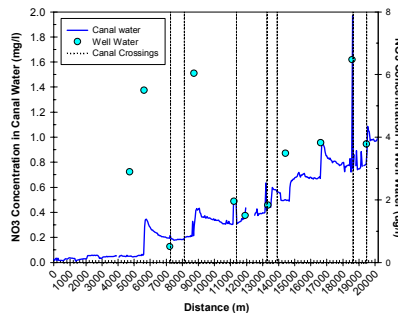
Among the 88 taxa of ground arthropods collected were ladybird beetles (Coleoptera:Coccinellidae). These beneficial insects are commonly encountered in agricultural fields where they prey upon pest insects.

Photo by N. McIntyre

## Nutrient Dynamics in Arid Urban Fluvial Systems: Canals and Streams

W.J. Roach, A. Coppola, and N. Grimm

This study is investigating how urbanization affects nutrient dynamics in the fluvial systems of the CAP ecosystem. Work has focused on two contrasting systems: the Tempe-Southern canal and Indian Bend Wash, a flood control project in Scottsdale.



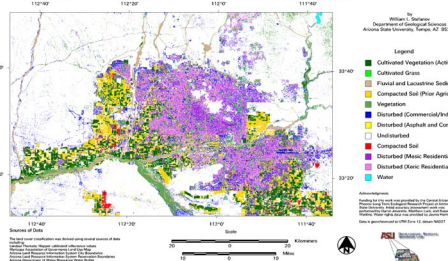
Sampling along the Tempe-Southern canal as it flows into Phoenix shows a dramatic overall increase in nitrate-N concentration, with spikes occurring at nearly regular intervals at sites where groundwater is pumped into the canal. Conversely, phosphorus concentrations remain low throughout the canal, suggesting potential phosphorus limitation.

## Monitoring Urban Land Cover Change: An Expert System Approach to Land Cover Classification of the Phoenix Metropolitan Area

W. Stefanov, M.S. Ramsey and P.R. Christensen

An expert system has been developed for use with remotely sensed data to derive land cover classifications for the CAP LTER site. The technique integrates measured surficial properties with ancillary GIS data to obtain high classification accuracy. Research applications include both historical assessment and monitoring of land cover change.

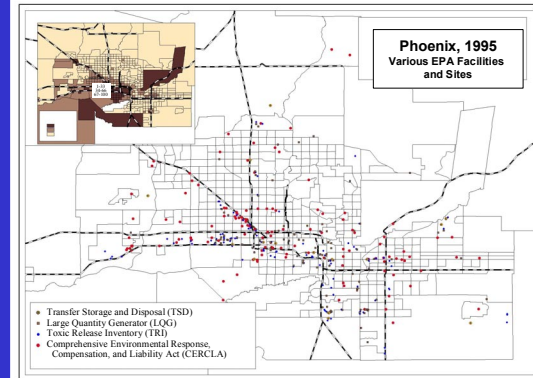
### 1998 Land Cover Map of the Phoenix, Arizona Metropolitan Area



A land cover classification was produced by recoding an initial maximum likelihood classification of Landsat Thematic Mapper data using expert decision rules and ancillary datasets. Use of the expert system also enabled the addition of four new land cover classes to the initial classification (Cultivated Vegetation, Cultivated Grass, Compacted Soil-Prior Agricultural Use, and Fluvial and Lacustrine Sediments/Canals). Overall classification accuracy is 85%.

## The Ecology of Risk in a Sunbelt City: A Multi-Hazard Spatial Analysis

R. Bolin, E. Hackett, D. Pijawka, E. Sadalla, D. Brewer, E. Matranga, A. Nelson, and D. Sicotte



To investigate issues of Environmental Justice, CAP LTER researchers mapped locations of various federally regulated facilities. Concentrations of hazardous sites were assessed for relationships with neighborhood socio-economic status by examining census data.

Weak but statistically significant relationships were found for all types of facilities. Concentrations were found in minority and lower income neighborhoods, primarily in the core of this rapidly expanding metro location.