

# Application of integrated inventory to the study of urban ecosystem: an extensive 200-site field survey of the Central Arizona-Phoenix LTER

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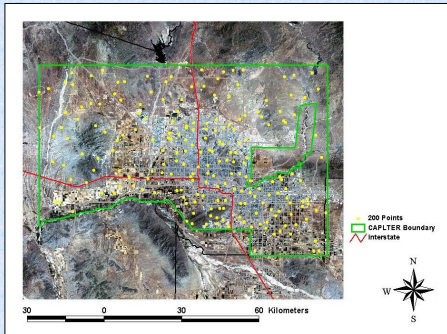
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## Introduction & Methodology

- We asked the question: *'What are the ecological conditions associated with the range of current land uses across metropolitan Phoenix and how do these conditions vary in space and with time?'*
- To answer this question we adopted a whole system approach, using a random sampling design to conduct an extensive field survey and integrated inventory of a number of key variables.
- A tessellation-stratified sampling design consisting of a 4km x 4 km grid was overlaid on the study area (6387 km<sup>2</sup>). One sample point was randomly located in each grid cell within the developed urban core; outside this area every third grid cell was sampled (n=206 sites).
- Field plots were 30m x 30m square and were surveyed exactly where they fell – unless access was not possible (12 such cases) when they were moved to the nearest available point with same characteristics (possible at all but 2 sites), giving a total sample of 204 sites.

## Main variables inventoried:

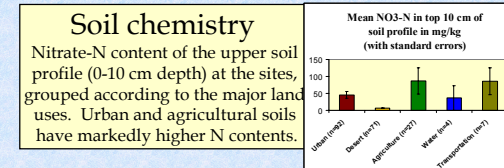
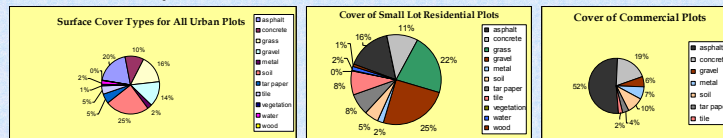
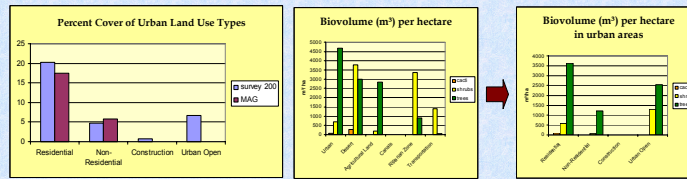
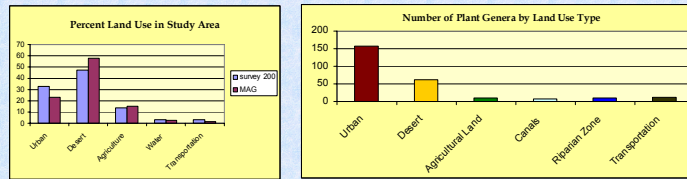
- Land use & surface cover types (e.g. lawn, concrete, asphalt, bare soil, tile roof)
- Vegetation diversity (id to genera), biovolume & condition (see Stiles & Scheiner poster)
- Soil: Soil cores for determination of major nutrient content, pH, bulk density & texture
- Soil fauna/flora: Samples taken for assay of prokaryote, mycorrhizal activity/diversity (see the Cousins & Stutz poster) & pollen id.
- Micro-meteorology: measured while on site.
- Decomposition study (place *Encelia farinosa* litter bags & wood for recovery after 12 months).
- Insect diversity: 3 sweep net samples taken from representative shrubs & trees on the plot (see the Rango et al poster)
- Documentary Photos: From plot center in four cardinal directions and one 'synoptic' view
- Bird survey: Point count of all species for 15 minutes within 3 hours of sunrise, from plot center, 4 times per year. See the Shochat & Katti poster.



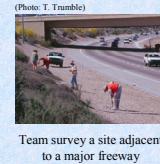
Survey sample points and study area boundary



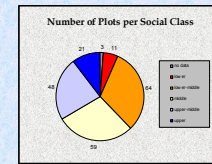
Examples of desert, agricultural, residential, and downtown urban field sites.



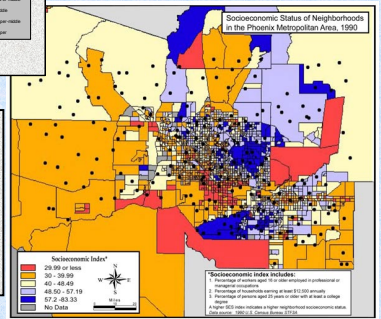
Taking a soil core sample at one of the urban sites.



Team survey a site adjacent to a major freeway



## Example of an interdisciplinary study using the survey data



Outline for the analysis of the relationship between vegetation and socio-demographic indicators.  
Vegetation measures will include:  
- species diversity (native versus exotic)  
- cover of major vegetation types  
- biovolume  
Socio-demographic indicators will include:  
- socio-economic index (see map)  
- race/ethnicity  
- household type indicators

## Development of an 'urban-ness' index

The proposed method uses a number of key components as equal contributors to the index. Another possibility is to create sub-indices that are constructs of

Proposed Components	Variable	Units
1. Human population	Population density	People per km <sup>2</sup>
2. Location in city	Distance from urban center	Kilometers (inverse)
3. Structural modification (horizontal component)	Impervious surface cover	Fraction or 1 or %
4. Structural modification (vertical component)	Height of tallest building	Meters
5. Human activity	Measure of traffic activity (MAG)	Vehicles per hour
6. Recent development activity	Number of housing completions	Number in last 27 years
7. Length of occupation	Time since 1st development	Years
8. Modification of native vegetation	Number of native species (n)	1/n

Component	Rank Score	Rank Score
1. Human population	3	2
2. Location in city	5	2
3. Structural modification (horizontal component)	5	3
4. Structural modification (vertical component)	5	1
5. Human activity	5	2
6. Recent development activity	3	3
7. Length of occupation	5	2
8. Modification of native vegetation	5	3
Average Score:	4.5	2.3
Total Score:	36	18

## Additional Applications of the Survey Data

- In addition to answering our basic question, the survey is also intended to:
- be repeated every 5 years as part of long-term monitoring
- help scale up findings from site-specific studies to the entire study area
- provide a framework of common study sites for multi-investigator studies
- allow comparison of basic site variables between CAP and BES (Baltimore)
- generate ground-truth data with which to calibrate remotely sensed imagery
- produce data for use in whole system modeling

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