The CAP LTER Ecosystem Services Assessment: Preliminary Findings and Next Steps

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INTRODUCTION:

An interdisciplinary team of scientists is conducting a pilot study to assess the ecosystem services provided within the CAP LTER boundaries.

- GOAL: To identify the ecosystem services provided by the CAP LTER that are most critical, most threatened, and most difficult to replace through technological substitutes
- Applications: Future policy and research decisions in Phoenix; guidance for future ecosystem assessments
- Data sources: published literature; professional knowledge; unpublished data from the city of Phoenix; U.S. Census Bureau data; PASS survey data
- Based on the Millennium Ecosystem Assessment

PROJECT ORGANIZATION:

Three teams are addressing different aspects of the ecosystem assessment

NATURAL SCIENCE TEAM

Challenge: What are the past and projected changes in the function of each ecosystem service?

Approaches: devised a matrix
worked in subgroups
regrouped at an all-day retreat
categorized land use according to patch type

6 PATCH TYPES:

Agriculture
Desert and desert remnant
Residential
Green space
Riparian
Impervious surface/Transportation

HUMAN VALUATION TEAM

Challenge: What is the worth ascribed to each ecosystem service by the local human population, and how is that valuation changing over time?

Approaches: devised a matrix
worked in subgroups
used direct and indirect methods to calculate ecosystem service valuations:

Valuation Methods:

Revealed preference methods (based on actual expenditures)

Stated preference methods

Substitution of values calculated for ecosystem services elsewhere when necessary

TECHNOLOGY TEAM

Challenge: Which of the ecosystem services would it be technologically and economically feasible to replace with human-engineered substitutes?

Approaches: devised a matrix
worked in subgroups

Results to come…

Brazel, A. Clean water, a provisioning service.

OTHER CHALLENGES:

What is meant by a change in ecosystem service?

- The capacity of an ecological system to provide that service *independent of the human demand for, or pressure on,* that service?
  - e.g., decline in air quality is not in and of itself a demonstration that the *ecological capacity* to provide that service has been degraded
- We didn't evaluate the capacity of the ecosystem to provide the service *relative to the human demand*

ECOSYSTEM SERVICES:

The benefits people obtain from ecosystems

Provisioning
Goods produced or provided by ecosystems

food
fresh water
fuel wood
genetic resources

Regulating
Benefits obtained from regulation of ecosystem processes

climate regulation
disease regulation
flood regulation

Cultural
Non-material benefits from ecosystems

spiritual
recreational
aesthetic
inspirational
educational

Supporting
Services necessary for production of other ecosystem services

Soil formation
Nutrient cycling
Primary production

FINDINGS: In the past 25 years,

- Degradation has occurred mostly in provisioning and regulating services
- Enhancement has occurred mostly in support services and regulating services
- The provisioning of 6 ecosystem services has changed critically in the CAP LTER

Ecosystem Service	Change in Provisioning in Past 25 Years (Natural Science Team)	Change in Valuation in Past 25 Years (Valuation Team)	Availablity of Technologically Feasible Replacements (Technology Team)
Fiber	Significantly Degraded	Decreased	?
Natural hazard (i.e. fire) regulation	Significantly Degraded	Increased	?
Genetic Resources (nonnative)	Significantly Enhanced	Increased	?
Ornamental resources	Significantly Enhanced	Increased	?
Water purification and waste treatment	Significantly Enhanced(?)	Increased	?
Nutrient cycling	Significantly Enhanced	Decreased	?

Trumble, T. Downtown Phoenix.

LESSONS LEARNED:

- Cultural services are extremely hard to quantify from an ecological, economic, or technological perspective (with the possible exception of recreation)
- Some baseline information is necessary for every team (such as changes in land use over time)
- Measuring changes in ecosystem services by patch type is extremely helpful for the natural science team

Phillips, J.C. Example of a regulating service (pollination).

NEXT STEPS:

- Identify the ecosystem services for which there are no technological substitutes
- Address issues around quantifying cultural services in the CAP LTER
- Refine the list of critical ecosystem services in the CAP LTER
- Review/revise the process we used in this interdisciplinary study
- Perform a cross-site comparison with other urban sites