Legacies on the Landscape:
Integrating Ecology and Archaeology on the Agua Fria National Monument, Arizona.

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Introduction

This project is a collaborative effort between ecologists and archaeologists of the School of Human Evolution and Social Change and the School of Life Sciences at Arizona State University. Researchers are focused on identifying long-term legacies of prehistoric and modern human land use in the desert grassland environment of the Agua Fria National Monument, north of Phoenix, Arizona.
The goal of the project is to build theory about what types of human disturbances leave legacies over different time scales, and gain insights into the ways that today's actions can affect future ecological systems.

Legacies on the Landscape Research Questions

What are the economic, social, and political conditions that influence how prehistoric people articulate with their environment?

Which environmental interactions leave enduring legacies that are detectable on modern landscapes?

What are the ecological conditions that make ecosystems more or less prone to human induced legacies?

How can we integrate knowledge about human induced legacies into modern land management and development of sustainable communities?

Study Area

The Agua Fria National Monument is located north of the Phoenix Basin. This desert grassland and riparian ecosystem has experienced two intense pulses of human use in the past 750 years: a sizeable agricultural occupation in the 1300s and livestock grazing since the mid 1800s. The Legacies project is currently focusing on the 14th century pulse in occupation. Hundreds of archaeological sites are present in the area, including large residential settlements (shown on the map on the right), small hamlet settlements, rock art, and agricultural fields.

Prehistoric Population Dynamics

- The size of the prehistoric population and the length of occupation have implications for the nature of the potential legacy effects. One of the first steps in this research was to reconstruct details about the prehistoric population.
- Through mapping architecture and construction patterns, archaeologists can tell how pueblos were built and estimate how many people might have occupied them during different periods.
- Additional data from excavations, such as radiocarbon dates, also help determine how long a site was occupied.

- Architectural mapping has been completed at two of the larger settlements, Pueblo La Plata (~100 rooms) and Richinbar Ruin (~65 rooms). The corners of the walls were examined and details of visible bonding, abutting, and masonry recorded, which indicate whether rooms were constructed during the same or different episodes.
- Results of mapping Pueblo La Plata (presented on the right) indicate rooms were built in at least 7 construction episodes (Mapes 2005).
- Mapping shows both pueblos grew by accretion rather than simultaneous construction. The growth probably occurred naturally as well as through immigration.
- This suggests temporal changes in population and potentially in levels of human environmental impact.

Prehistoric Manipulation of Agave

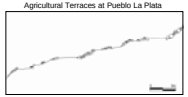
Legacies is working with Wendy Hodgson of the Desert Botanical Garden to record several variables of the agave in the region, such as leaf length, width, and agave location with respect to prehistoric agricultural features.

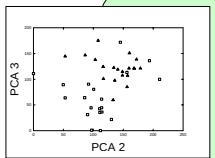
- Results indicate the presence of species of native *Agave chrysantha,* non-native *Agave parryi* as well as several hybrid varieties.
- Some agave in the region probably represent remnants of prehistoric agave fields. The selection of certain agave traits and possible importation of non-native varieties by the prehistoric peoples of the region is still influencing the area's ecology today.

Legacies of Prehistoric Agricultural Fields: Influences on Soil Characteristics and Herbaceous Plant Communities

- Prehistoric agricultural fields have been located and several were selected for additional herbaceous plant surveys, soil analyses, and seed bank studies.
- Agricultural fields are identified by linear piles of stones, or terraces as shown in the photo and map on the right.
- Legacies of small scale prehistoric agriculture have been demonstrated elsewhere in the North American Southwest and our preliminary data is adding to these types of studies.


Agricultural Terraces at Pueblo La Plata


Profile of Agricultural Terraces at Richinbar Ruin

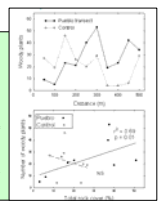


- This scatter plot shows quadrat scores on principal axes 2 and 3 from a principal components analysis of herbaceous vegetation cover by species at Pueblo La Plata. Quadrats on terraced fields are represented by triangles and quadrats off the field by squares.
- The separation of the points suggests that although the numbers of species are similar on and off the terraced fields, the community composition is different.
- No differences were was found in the life form or the origin (native vs. introduced) of the vegetation.

Prehistoric Manipulation of Rock Distribution: Influences on Plant Communities

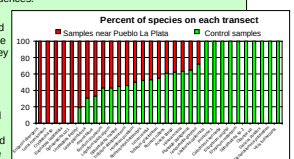
Prehistoric inhabitants altered the distribution of surface rocks while constructing pueblos and agricultural features. We are collecting data to determine whether the manipulation of rock distribution has left enduring legacies on plant communities.

- Data on rock distribution and woody and herbaceous plants was collected along transects near archaeological sites, and "control" transects.
- Numbers of individual woody plants increase with distance from the pueblo.
- There is a positive relationship between number of individual woody plants and total rock cover on the La Plata Pueblo transect (particularly cobble cover, not shown separately here).
- There is no significant relationship between woody plants and rock cover on the "control" transect.



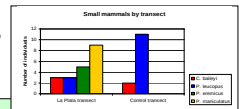
Legacies and Herbaceous Plant Communities: Influences Around Residential Settlements

- Sampling of herbaceous plants was conducted on survey transects near Pueblo La Plata and a "control" transect several km away. This sampling allowed us to determine whether differences in the plant communities existed as a result of more intense prehistoric land use near residences.
- Herbaceous species richness and dominant species are similar on both survey transects.
- Rare herbaceous species differ between transects, with 5 species found only on the Pueblo La Plata transect and 10 found only on the "control" transect.



Legacies and Animal Communities

- Prehistoric land use has many implications for the distribution and densities of fauna. For example, intensive hunting can cause local extinction of certain species, and agricultural practices can open new niches for some small mammal species.
- Archaeological data can be used to identify changes in fauna in prehistory.
- Prehistoric land use can also alter the environment in ways that influence modern animal communities.



- Small mammal traps were set in sample locations near Pueblo La Plata and a "control" location several kilometers from an archaeological site.
- Population density appears higher on the La Plata transect (20 individuals/160 traps, capture rate 12.5%) than the "control" transect (13 individuals/280 traps, capture rate 4.6%)
- Species diversity is higher on the La Plata transect, and includes species preferring a wide range of habitats such as deer mice (*Peromyscus maniculatus*).

Future Directions

The collaborative research between ecologists and archaeologists is ongoing. Currently we are focusing on:

- soil and plant sampling, archaeological studies, and remote sensing analysis of prehistoric agricultural fields
- ceramics studies to examine trade and interaction between the prehistoric settlements
- additional architectural studies

References Cited

Mapes, S. D. 2005. *The Walls Still Stand: Reconstructing Population at Pueblo La Plata.* Unpublished Senior Honors Thesis, Department of Anthropology, Arizona State University, Tempe.

Acknowledgments

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