

*Combining archeology and
ecology in the Sonoran desert
and desert grasslands.*

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“WE” =

– Graduate students

- Hoski Schaafsma, Brad Butterfield, Art Stiles, Jason Walker
- Students (both undergraduate and graduate students) and associated faculty members of *Archaeology & Ecology: Legacies on the Landscape* course organized by Kate A. Spielmann

Funding by

- BLM and NPS
- LTER and IGERT Program at ASU
- LTER program at KSU (Blair’s lab)

Goal/Outline of Talk

- Importance of pre-historic agriculture in SW (and US?)
- Present data from two studies
 - Cave Creek (State Trust Land)
 - Aqua Fria National Monument
- **Ecology needs archaeologists:
Archaeology needs ecologists***

* Briggs et al. 2006. Ecology needs archaeologists: Archaeology needs ecologists. *Frontiers in Ecology and the Environment*

- Last five decades, Ecologists and Archaeologists have dismantled two longstanding theoretical constructs.
- Ecologists have rejected the “balance of nature” concept.
- Archaeologists have dispelled the myth that indigenous people were in “harmony with nature”.
- Imperative that ecologists and archaeologists begin working more closely to help advance the fields of archaeology and ecology.

Why is that?

- Humans have impacted systems for a very long time
- Ecologists have “ignored” impact of humans (pristine environments)
- Have historically viewed “impact” as a straightforward product of human land use without addressing the social dynamics that lead humans to alter the landscape in diverse ways

- Archaeologists work with natural scientists to reconstruct the prehistoric environment.
- These reconstructions are usually focused not on ecosystems but on factors that are economically salient for humans.
- Anthropogenic changes are assessed at the scale of human needs rather than in terms of current ecosystem structure and function.

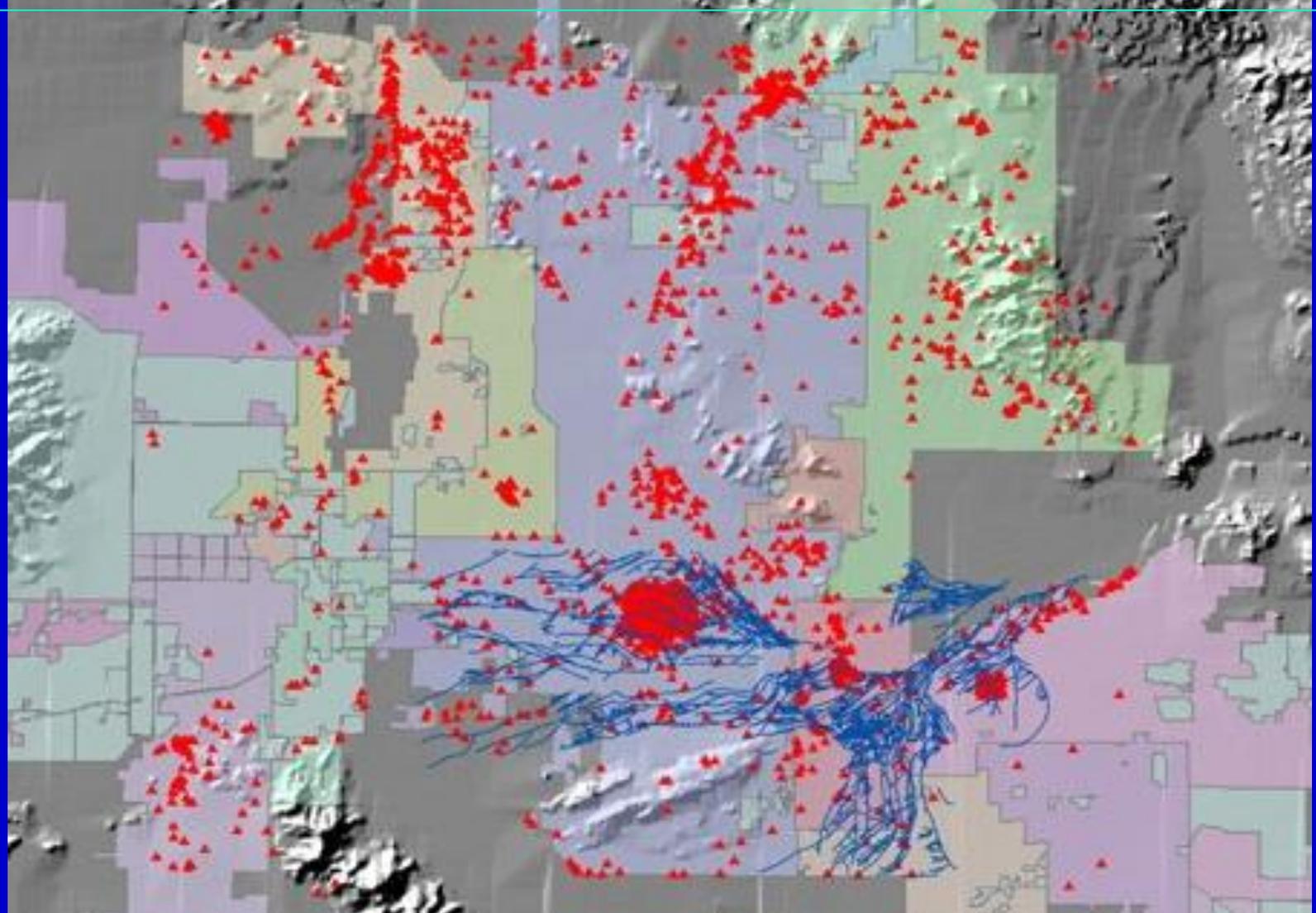
So what are we doing?

- Ecologists and Archaeologist working together at the beginning of study
- Most importantly, getting graduate and undergraduate students involved in all aspects of the project
 - Ecology students working with archeologists and archeology students working with ecologists in the lab and Field

The ancient human footprint

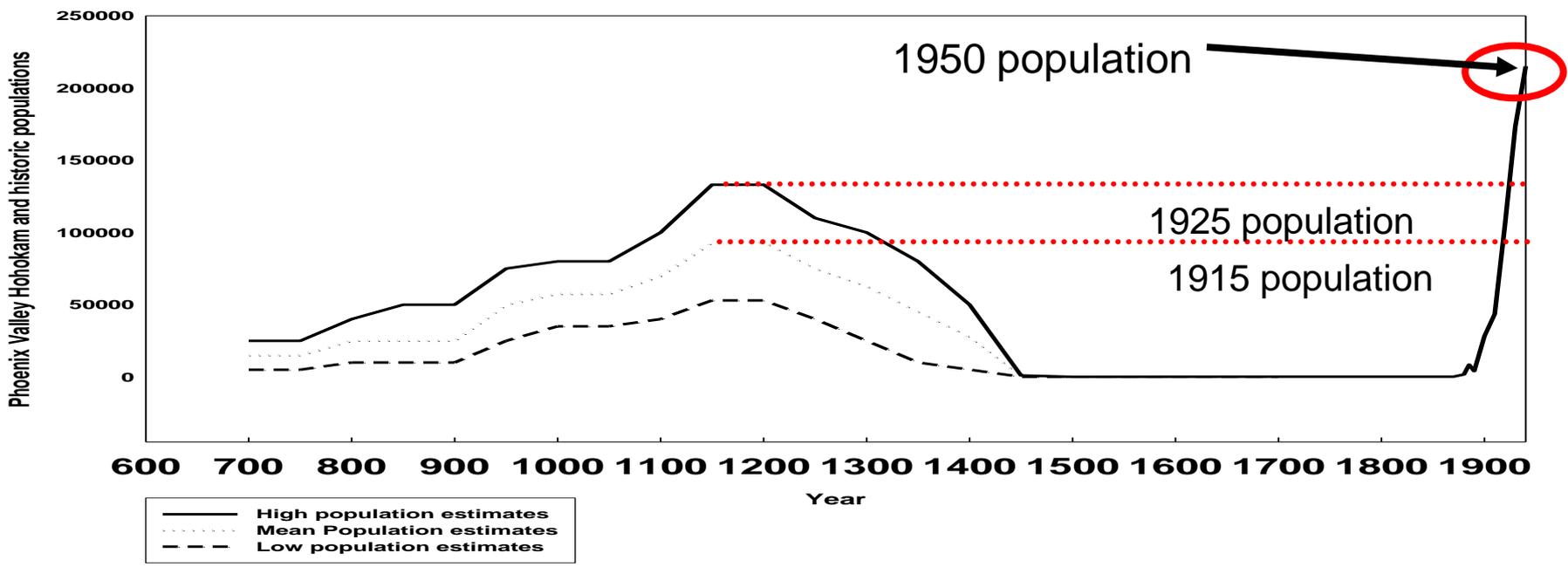
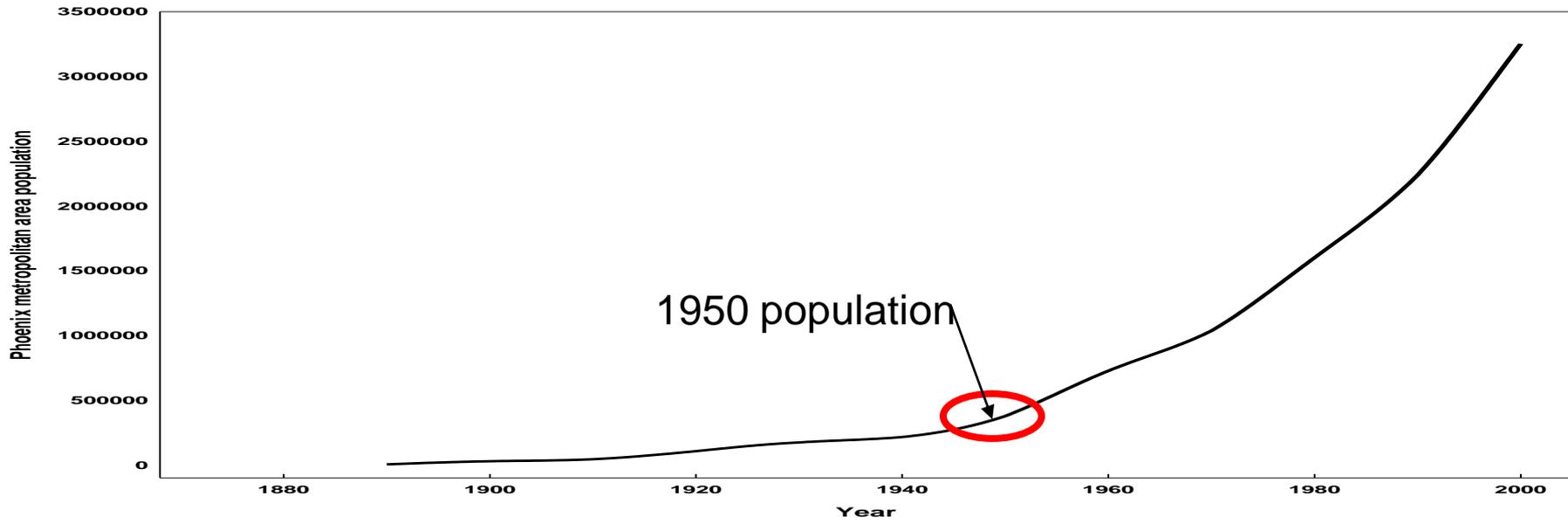
- Hohokam of Southern Arizona represents one of the great cultural traditions of the Southwest
- Present for ~1000 years
- Centerpiece of the Hohokam's was their irrigation system
 - 100's of kilometers of canals; some as long as 30km.

Prehistoric Villages & Modern Municipalities



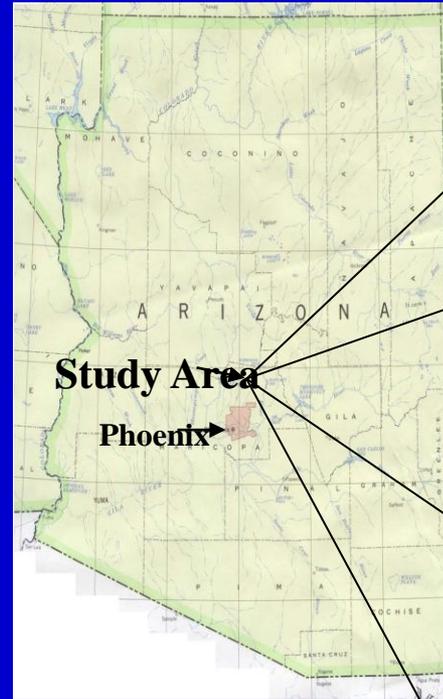
— Canals
▲ Prehistoric villages

Arizona State Historic Preservation Office
Maricopa Association of Governments
US Geologic Survey

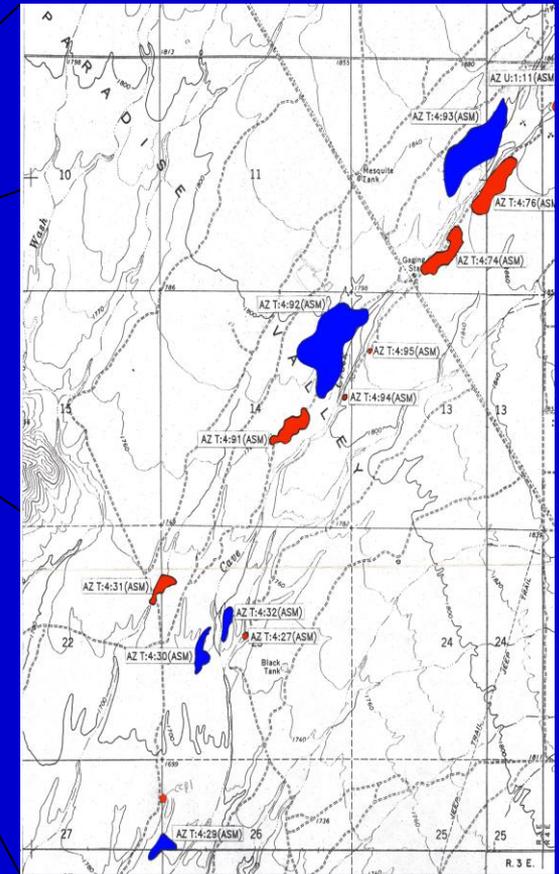


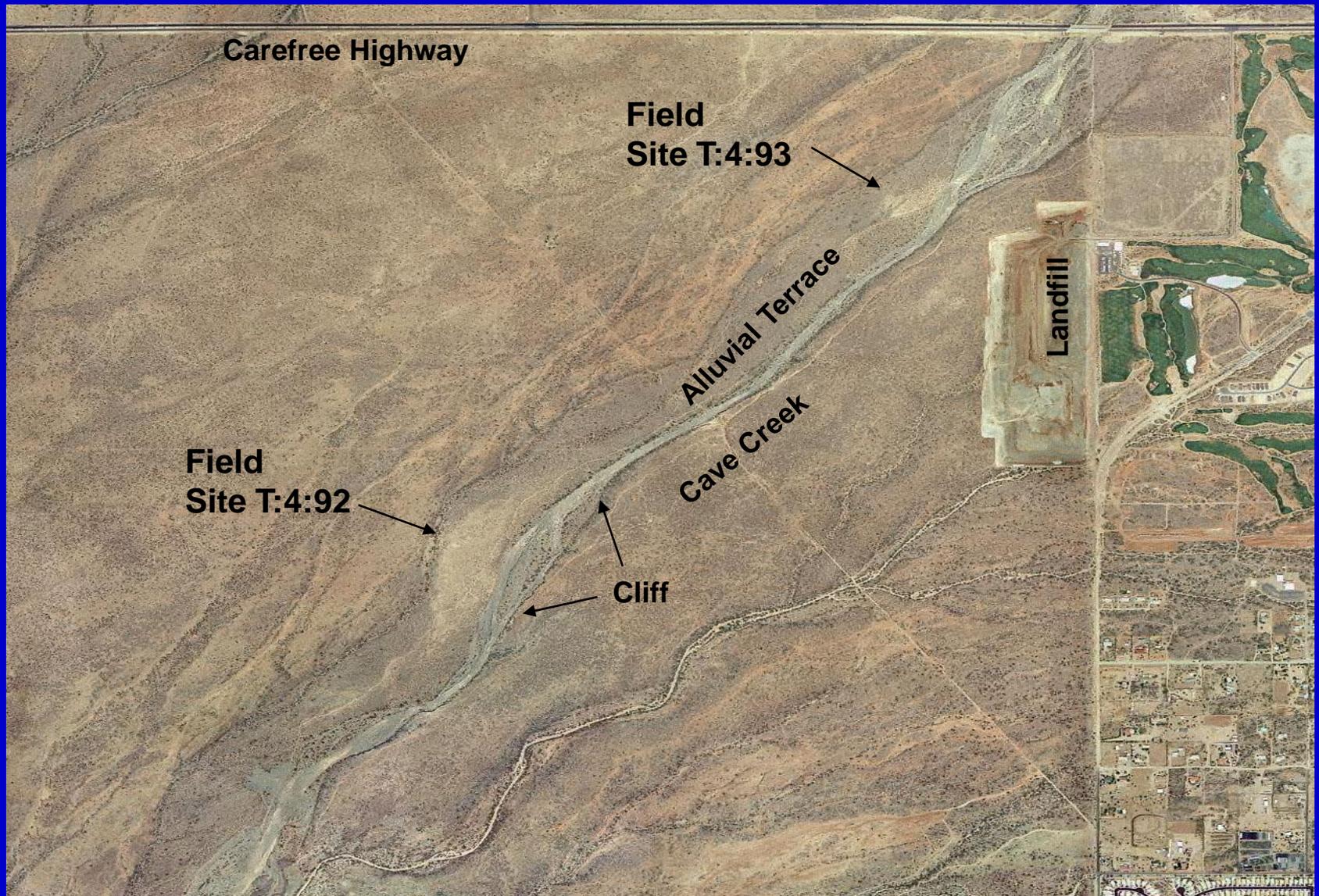
Cave Creek Study Area

- Cave Creek area within the northern Phoenix Basin
- Prehistoric agricultural fields cultivated from ca. AD 800-AD 1200.
- Fields abandoned some time between A.D. 1250 and A.D. 1275
- Uncultivated since but heavily grazed



Arizona





Carefree Highway

Field Site T:4:93

Alluvial Terrace

Cave Creek

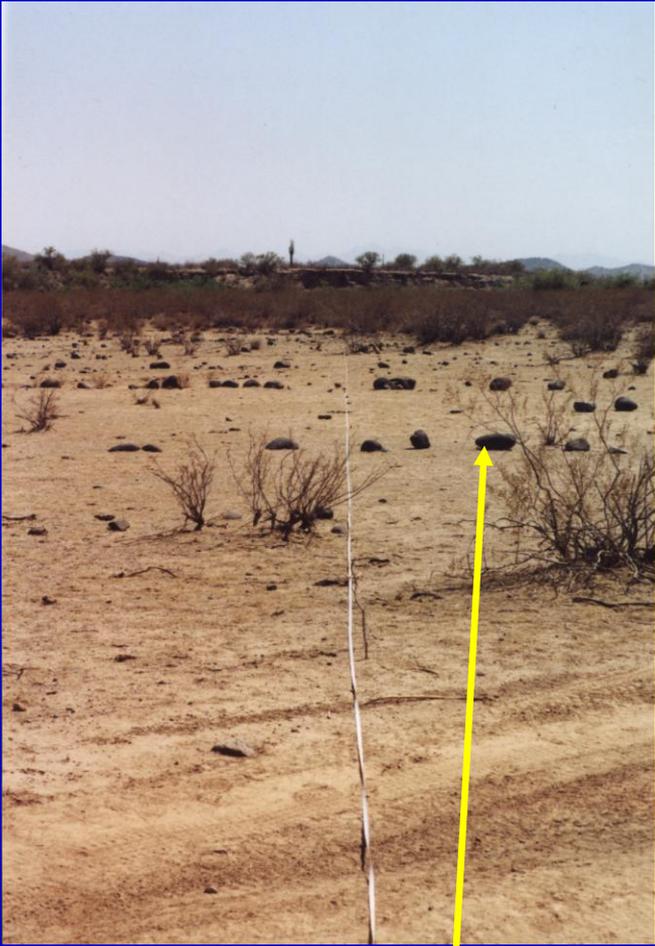
Field Site T:4:92

Cliff

Landfill

One Mile

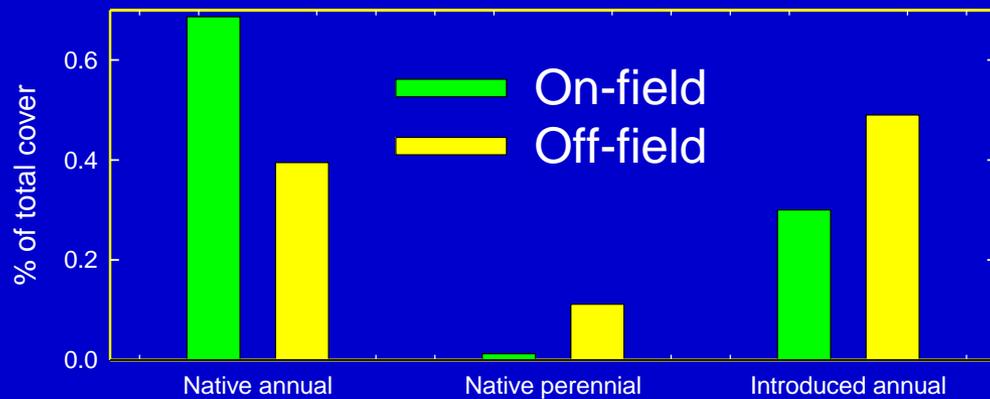
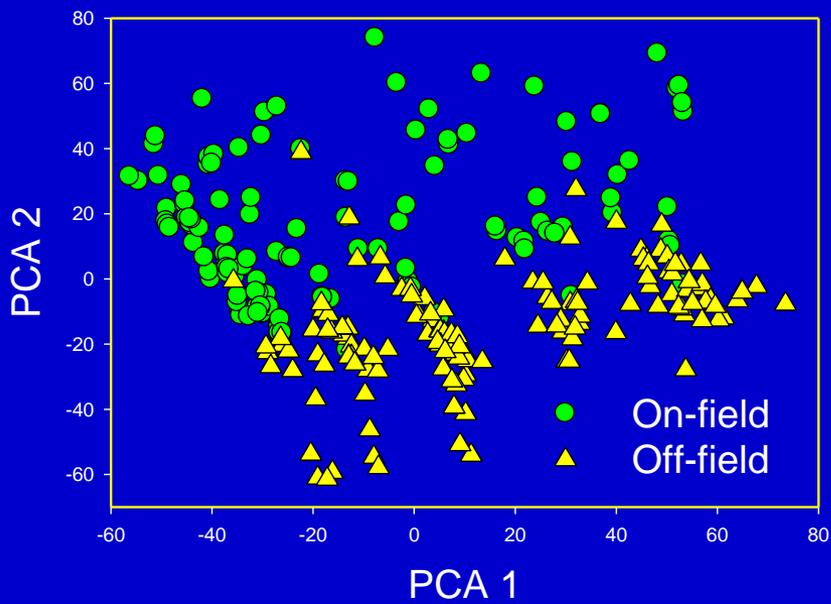
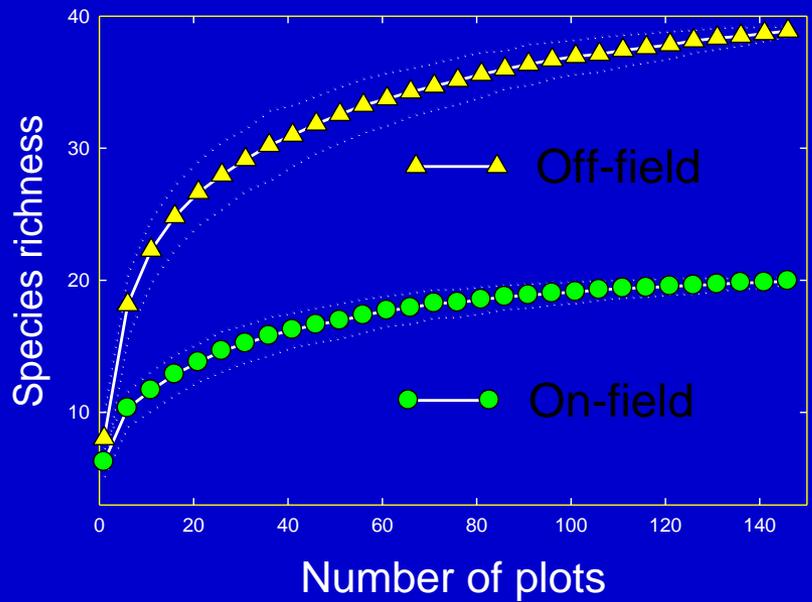
Aerial view of prehistoric fields on Cave Creek, Arizona



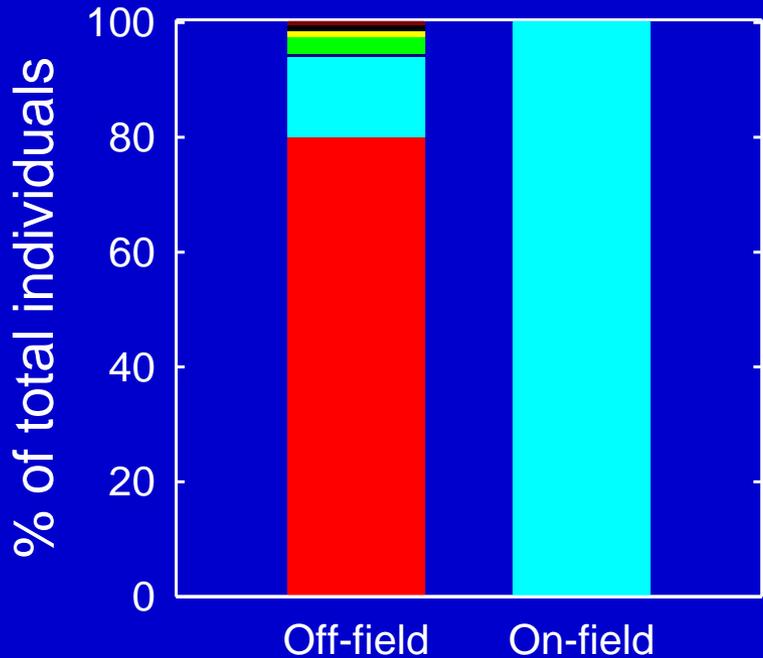
Rocks from pre-historic canals

Methods

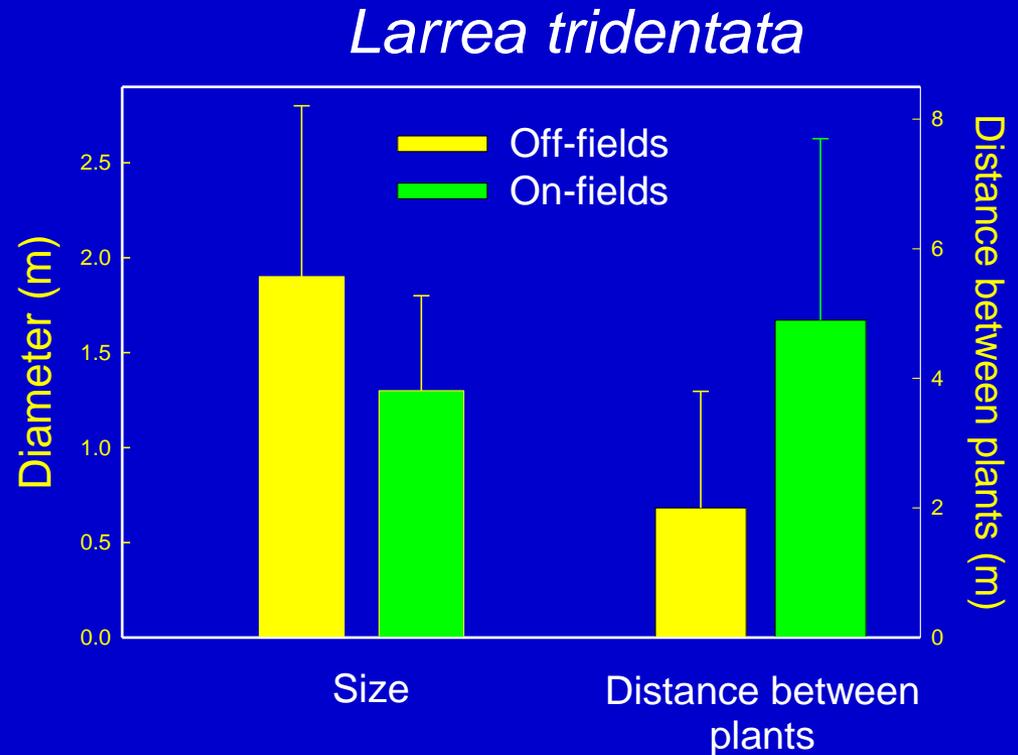
- Vegetation
 - 150 0.25^2 quadrats on 3 prehistoric fields and same number on adjacent areas; Cover of all species estimated in Spring 2005
 - Point-Quarter for woody vegetation and cactus; Size and distance to nearest neighbor of creosote bush (*Larrea tridentata*)
- Soil Samples (Texture, N & C)
- Pollen Samples



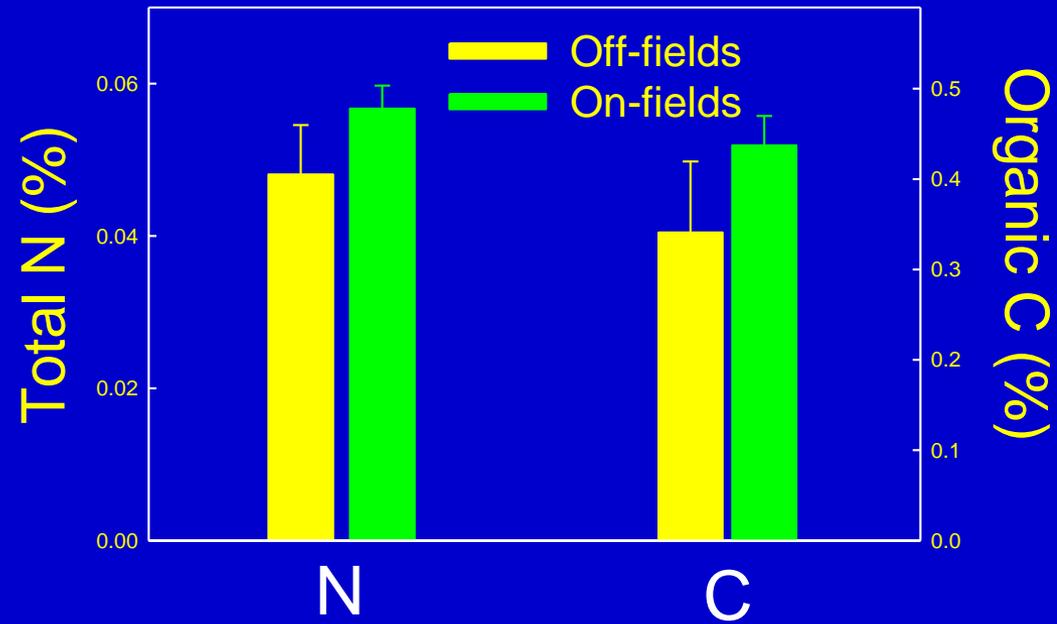
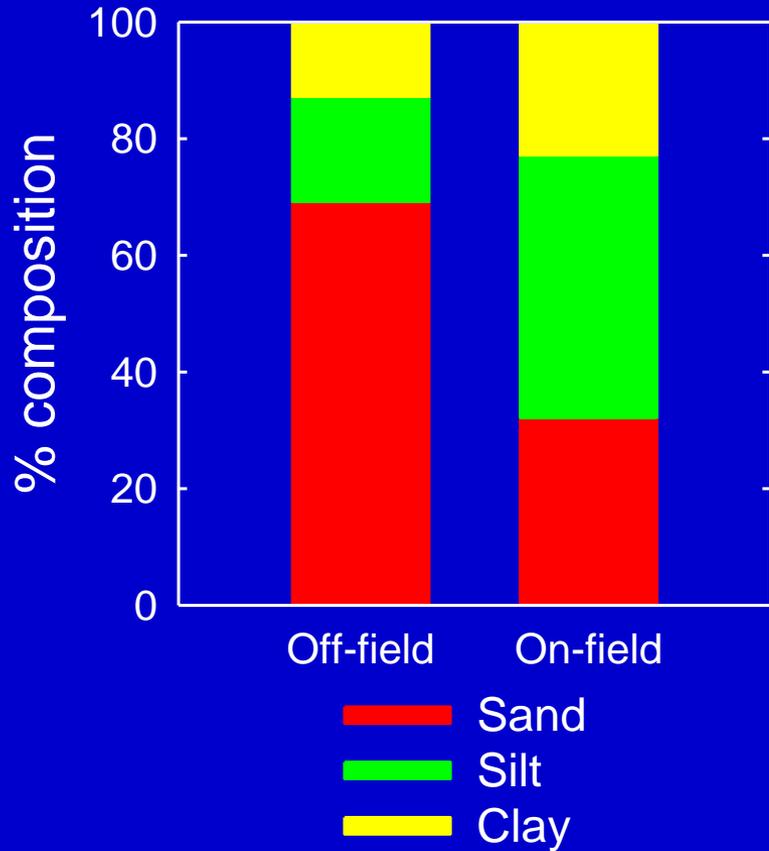
Woody vegetation



- *Ambrosia deltoidea*
- *Laura tridentata*
- *Ziziphus obstusifolia*
- *Opuntia acanthocarpa*
- *Ferocatus wislizenii*
- *Opuntia verisicolor*
- *Mammillaria microcarpa*



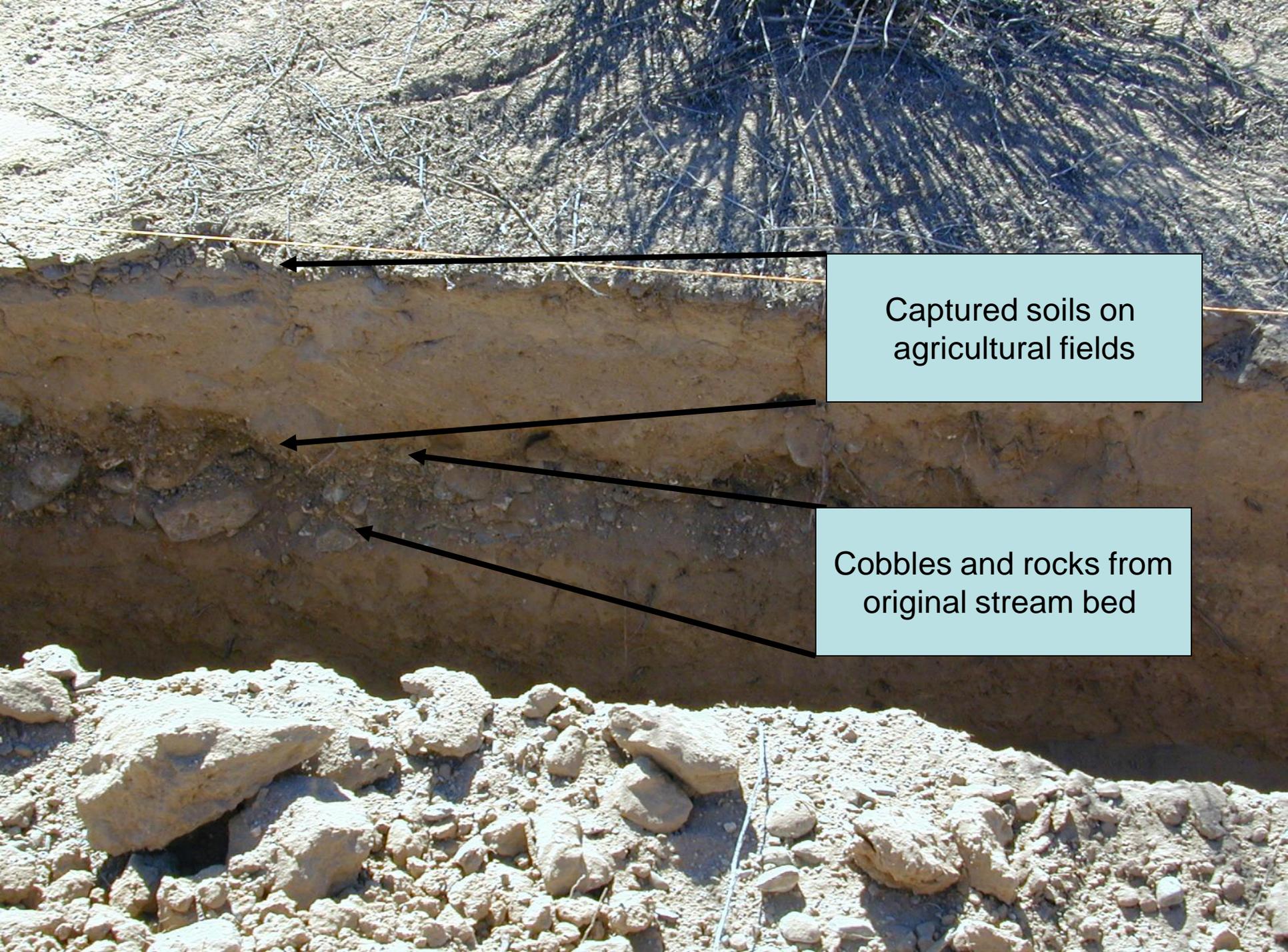
Soils



Pollen Results



- Domesticated crop plants (maize) abundant in field soils.
- Pollen data suggests that *Larrea* was cleared from the fields during cultivation.
- Elevated mesic tree pollen suggest a wetter environment during the time the fields were used.



Captured soils on
agricultural fields

Cobbles and rocks from
original stream bed

Summary of Cave Creek

- A shift in the ecosystem has occurred at Cave Creek due to practices of Hohokam
 - Vegetation
- This shift occurred due to changes in soil properties
 - Silt
- Work underway to determine source of N & C in soil





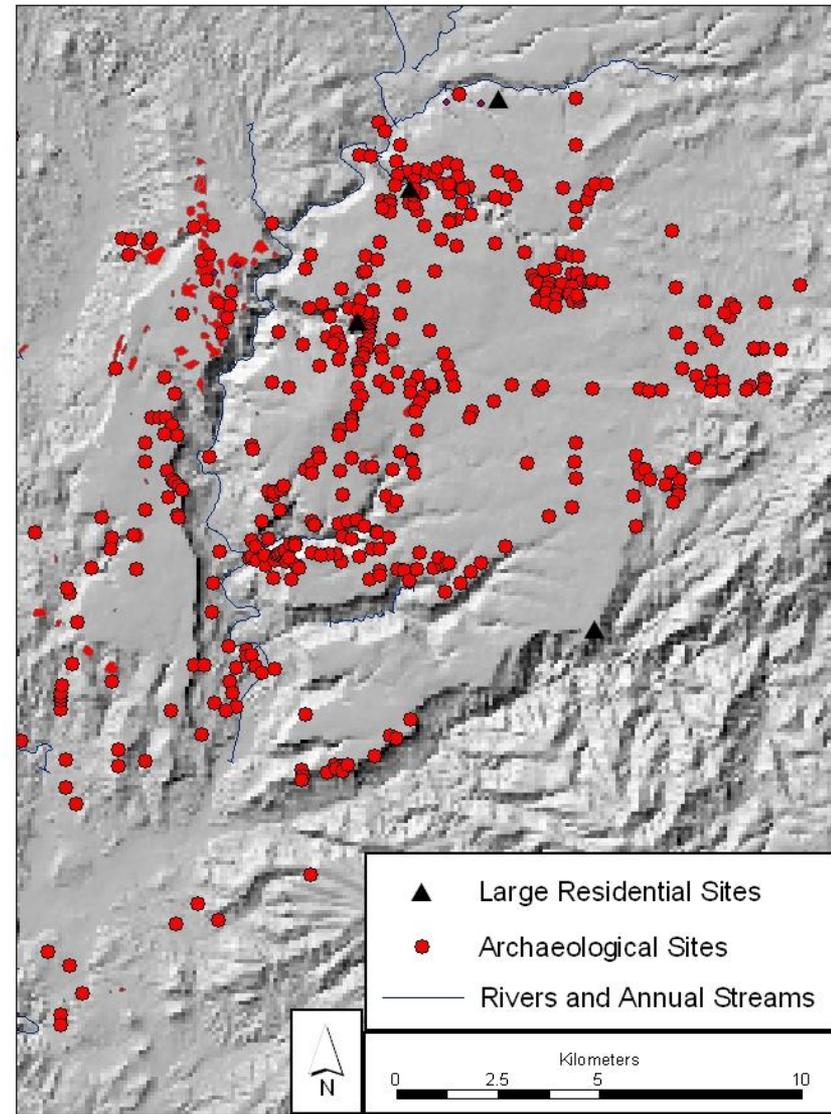
**Agua Fria
National
Monument**

**40 Miles
North of
Phoenix
71,000
acre**

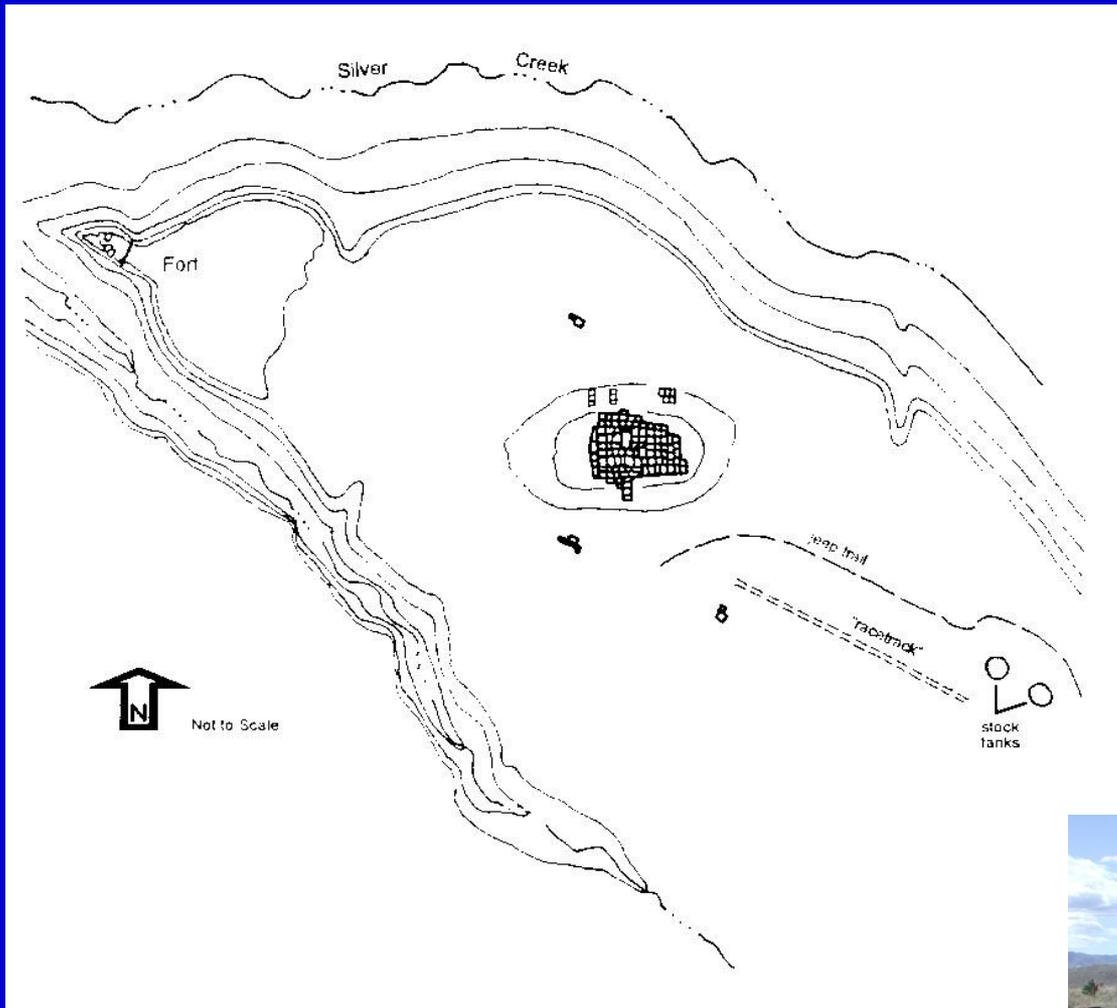


Human impacts on the Agua Fria National Monument

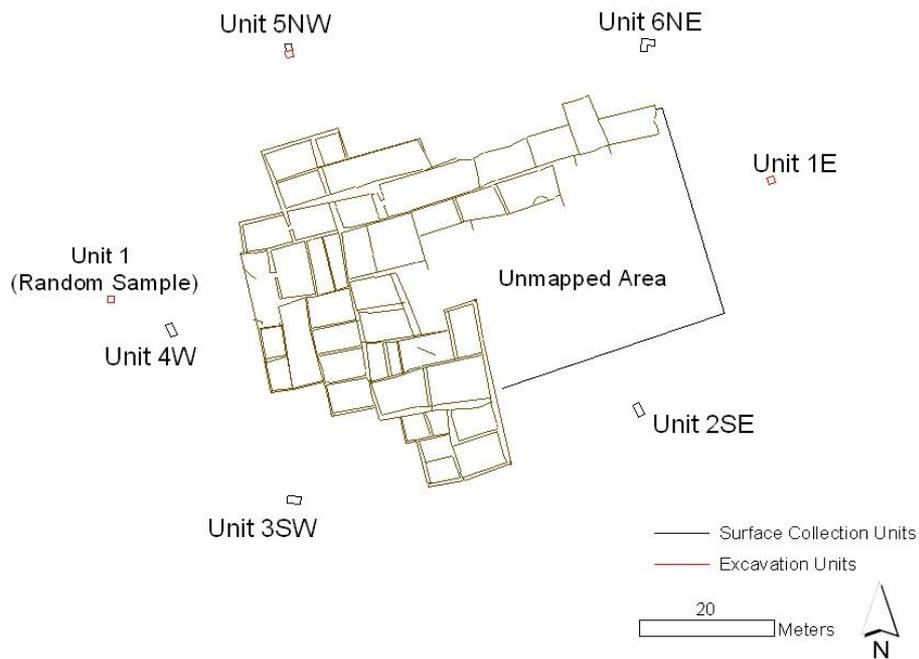
- This desert grassland has experienced two intense pulses of human use in the past 750 years:
 - Sizeable agricultural occupation in the 1300s for ~150 years
 - Livestock grazing since the mid 1800s.



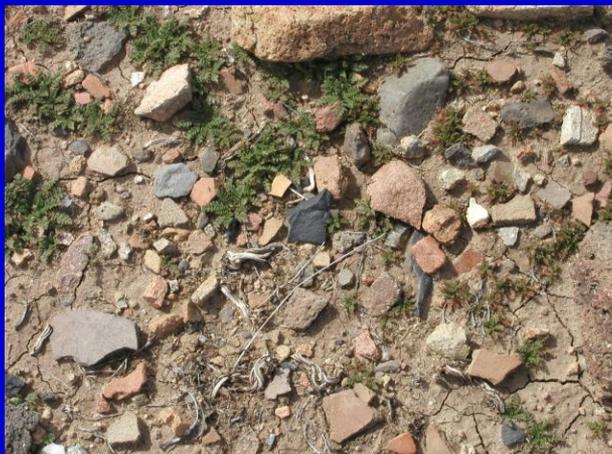
Pueblo La Plata



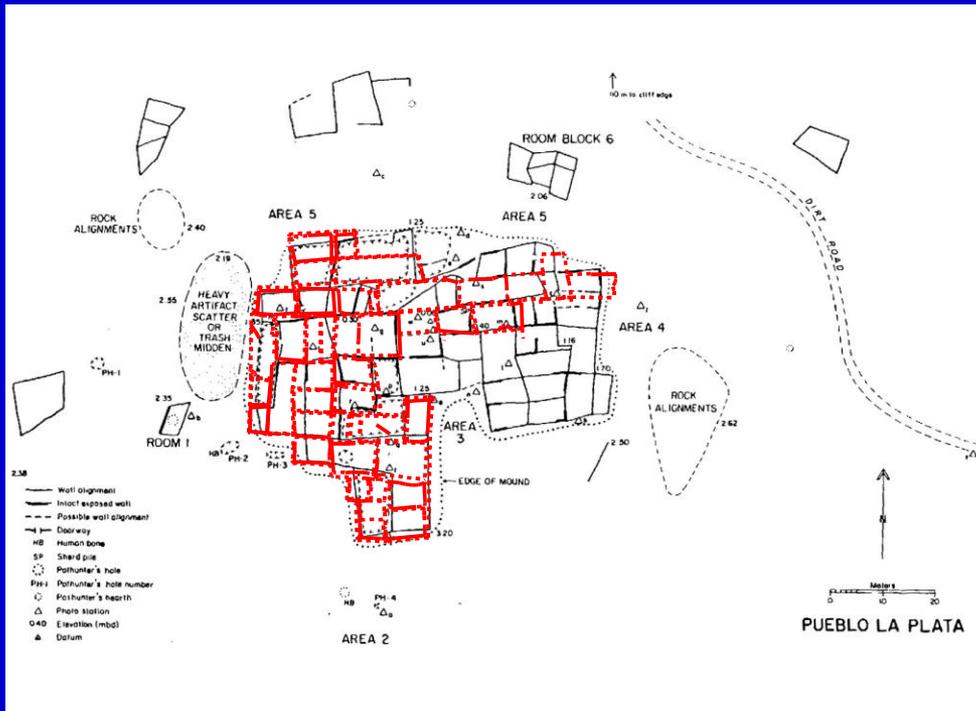
Pueblo LaPlata Excavation and Surface Collection Units



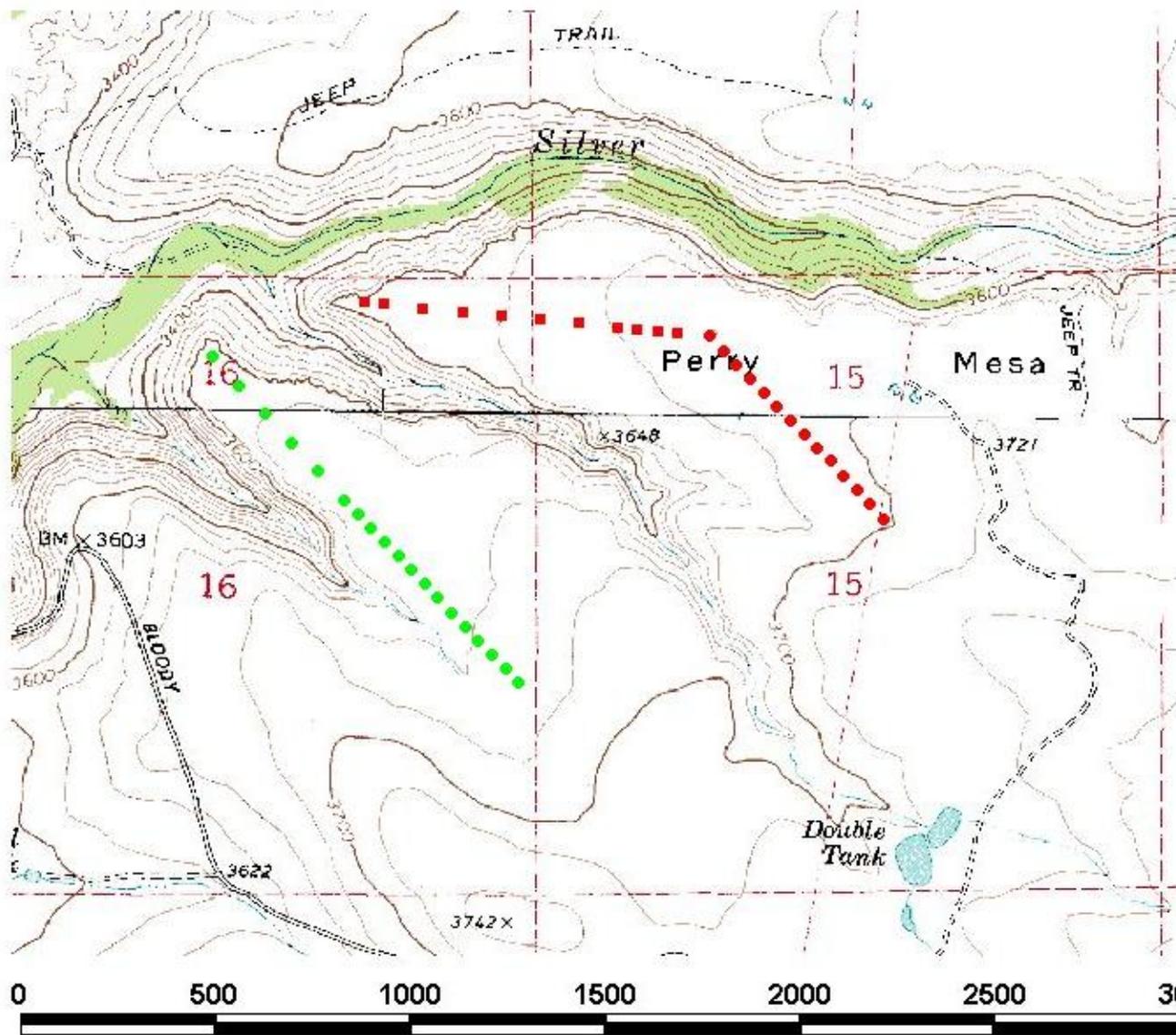
Excavation and Surface Collection



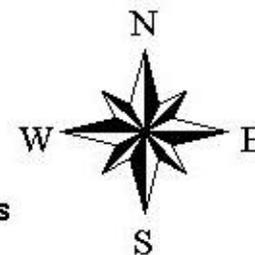
Mapping and architecture studies



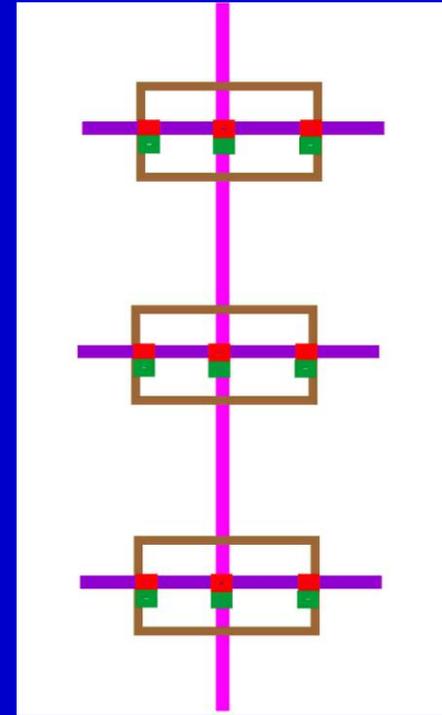
Data collection transects



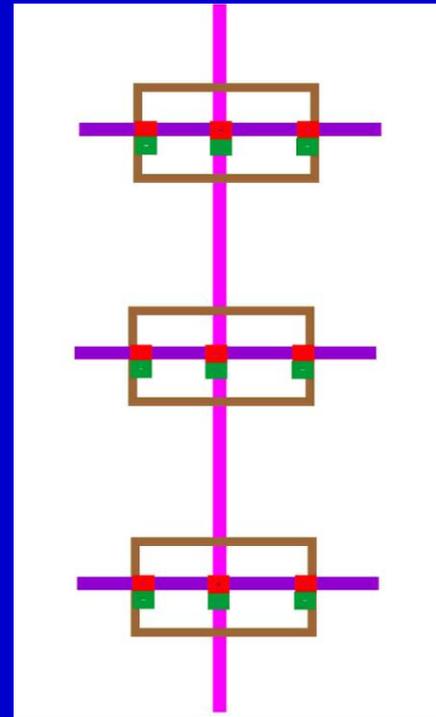
- Fort transect
- La Plata transect
- Control transect



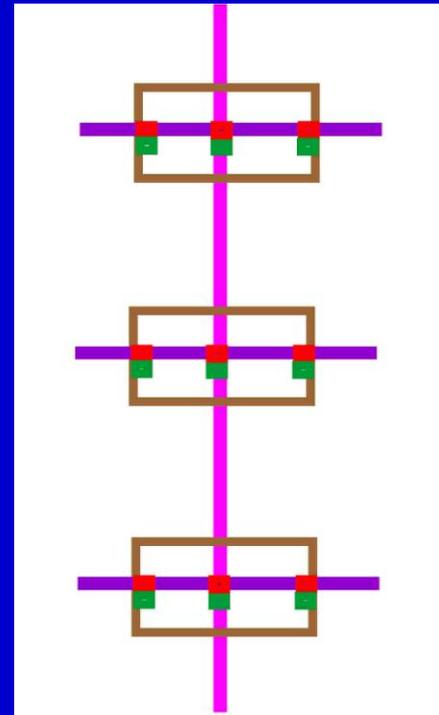
Archaeological survey: Artifacts counted in three 1x1m squares per transect data point



Rockiness survey:
Rock percent cover by size
class recorded in three
1x1m squares per transect
data point



Woody vegetation survey:
Plants recorded in a
30x15m area at each
transect data point



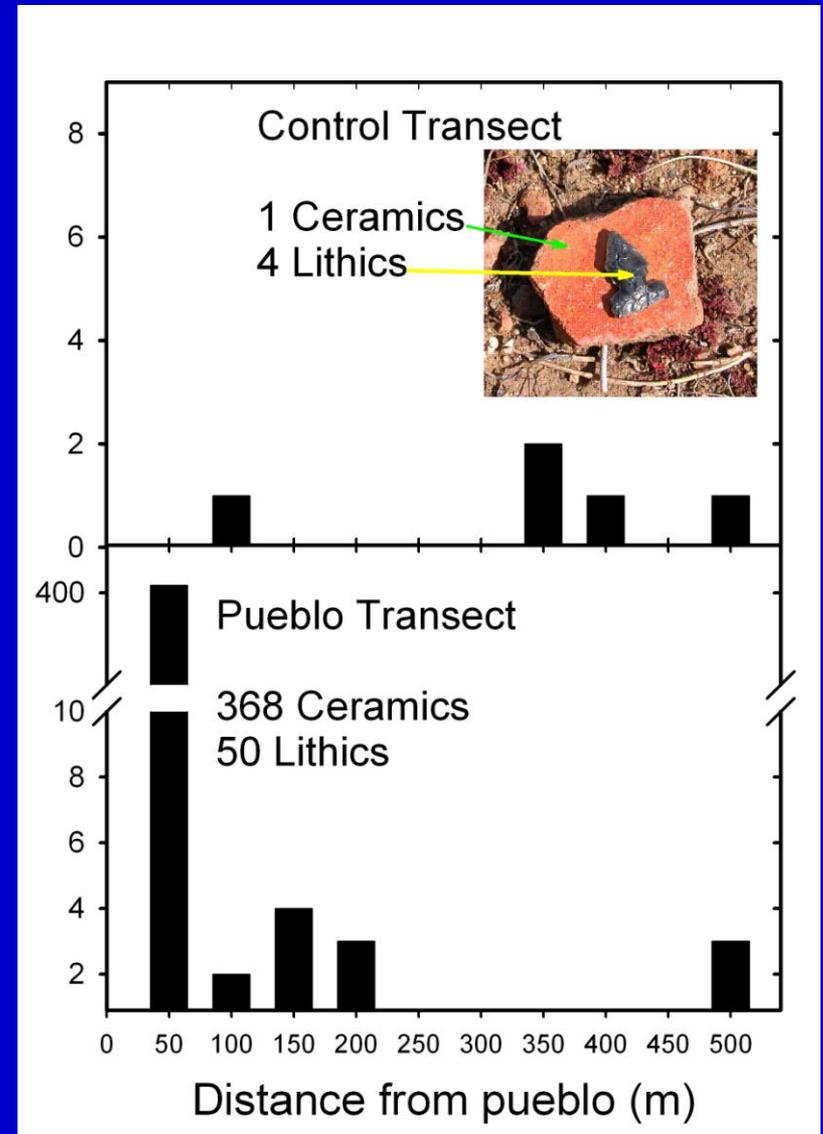
Herbaceous Vegetation Sampling

- 50 0.25^2 quadrats on prehistoric terraces and same number on adjacent areas
- Cover of all species estimated in Spring 2005
- Voucher specimens of all species in ASU herbarium

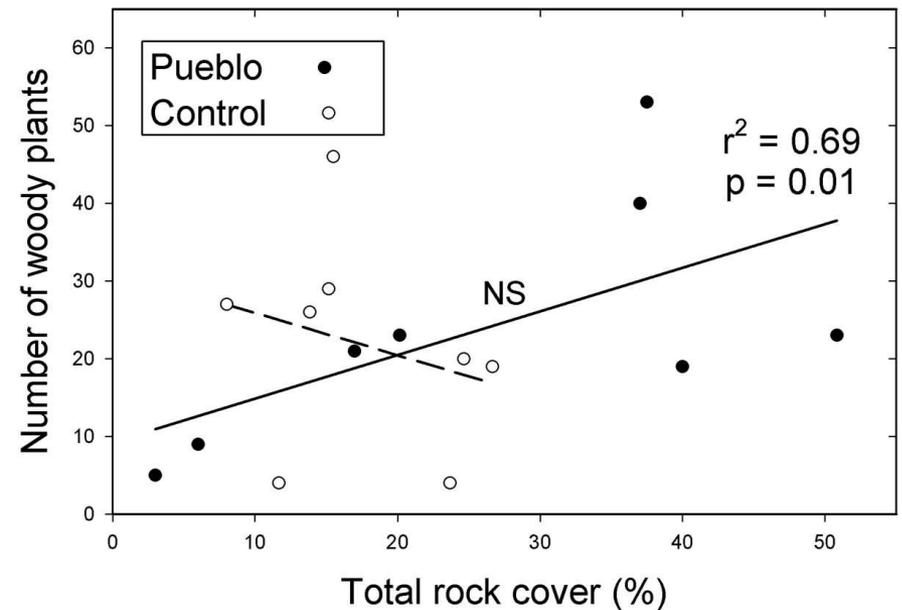
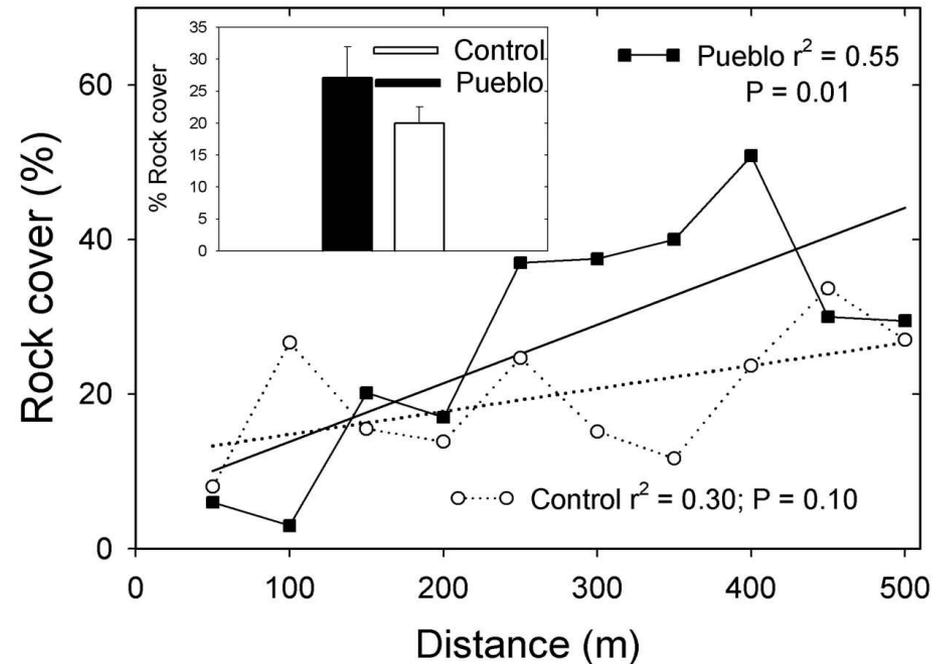


RESULTS

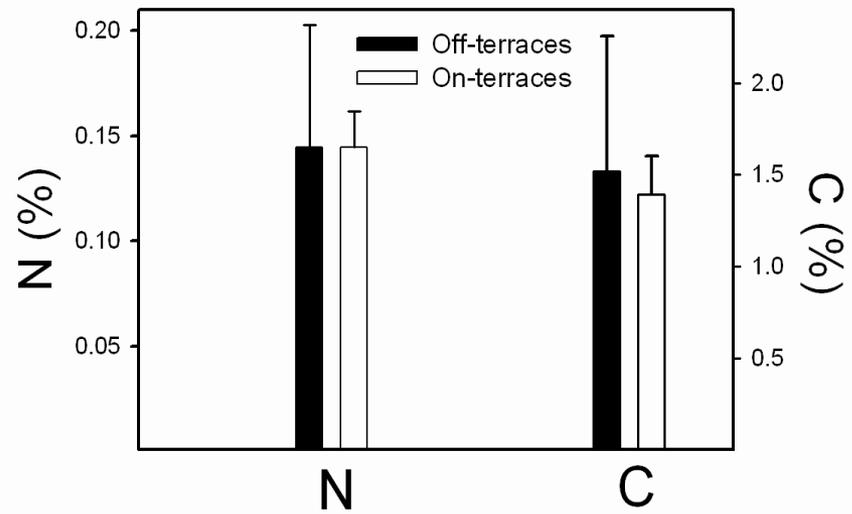
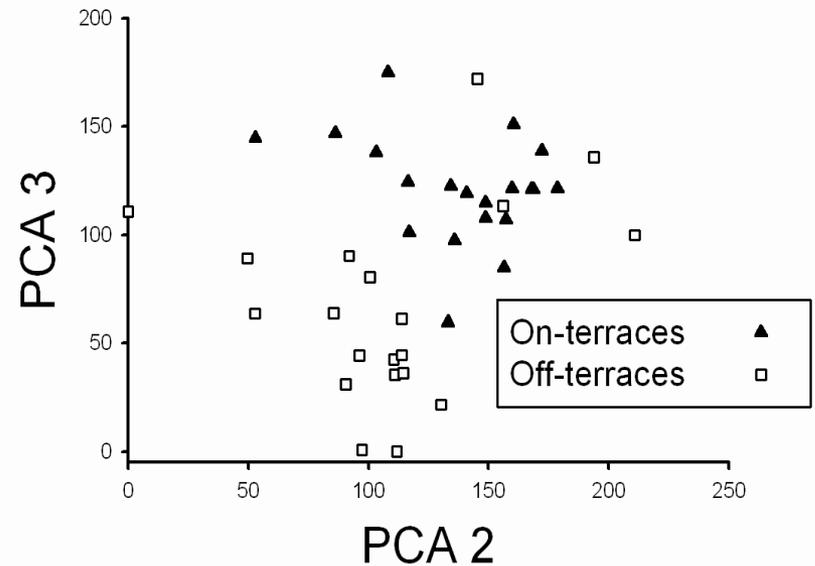
- Pueblo grew from a small core by the periodic addition of 4-6 room units
- As expected, nearly all archaeological artifacts were found on the pueblo transect



- There was a significant relationship between distance from the pueblo and rock cover
- Distribution of rocks had a significant impact on the woody plant cover.
- Prehistoric impact on the present woody vegetation is indirect.



- Community compositions on and off terraced fields were slightly different
- No differences in species richness, growth form (annual vs. perennial) and origin (native vs. introduced species).
- No differences were found between either total N (%) or C (%) of soils



Conclusions—Aqua Fria

- Prehistoric humans at Perry Mesa by moving large amounts of rock around the landscape, have created an ecological legacy around Pueblo La Plata.
- Differences with regard to species composition may be due to differences in the sites and not due to ancient Human footprint
 - ??
 - More samples and sites

Conclusions

- Both studies are examples of secondary succession after agriculture abandonment
 - ~755-1000 Years
- Cave Creek—Fields have legacy effect (like NE)
- Aqua Fria---Fields have minor impact but humans have created a legacy
- These ecosystems have major implications for conservation, restoration and management
- Prehistoric humans with their agriculture practices may be very important
- **Ecologists do need Archaeology**