

Messages from the past: How modern landscapes reveal prehistoric land use patterns

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Human activities can create changes to landscapes that are perpetuated through time as ecological legacies thereby creating a palimpsest effect in modern plant communities and soils. In the course of the Landscape Legacies Project at Agua Fria National Monument, we have documented anthropogenic landscape patches on small scale agricultural terraces (~1-50m) and larger scale areas surrounding pueblo sites created by a variety of human activities (~50-500m). The primary mechanism creating these legacies appears to be the relocation of stones within the landscape for building, land clearing and agricultural activities. We show that anthropogenic legacies differ between types and intensities of prehistoric land use through quantification of localized plant communities, soil analysis and analysis of aerial photography. We propose ways that these legacies can be interpreted to infer past land use intensities, and from this we can gain a greater understanding of human settlement pattern and land use change through time.

Anthropogenic landscapes have been well documented from a variety of landscapes and are generally well reported within the ecological literature

It is well established that legacies last hundreds to thousands of years

Examples:

> Central France 2000 year-old legacy of Roman villa, animal pens and fields: Dupouey, J. L., E. Dambrine, J. D. Laffite, and C. Moares. 2002. Irreversible Impact of Past Land Use on Forest Soils and Biodiversity. *Ecology* 83:2978-2984

> Amazon 500-800+ year old legacy of farming and villages: How "Virgin" Is Virgin Rainforest? 2004 K. J. Willis, L. Gillson, T. M. Brnic *Science* 16 April 2004: Vol. 304, no. 5669, pp. 402 – 403

> Eastern deciduous forest 400 year old legacy of forest management: Black, B. A., and M. D. Abrams. 2001. Influences of Native Americans and Surveyor Biases on Metes and Bounds Witness-tree Distribution. *Ecology* 82:2574-2586.

> Southeastern US 1,000 year-old legacy of corn farming on aquatic life: Peacock, E., W. R. Haag, and M. L. Warren. 2005. Prehistoric Decline in Freshwater Mussels Coincident with the Advent of Maize Agriculture. *Conservation Biology* 19:547-551

> Southwestern US 800 year-old legacy of corn and cotton farming in Sonoran Desert: Schaafsma, H. 2003. Modern Sonoran Plant Communities: Reflections of Prehistoric Agriculture. MS thesis. Arizona State University, Tempe

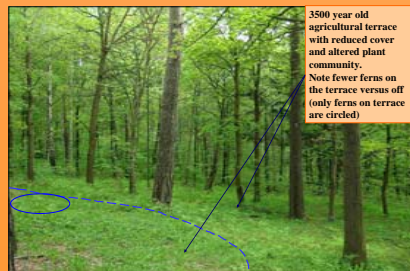
These and many other studies provide evidence that humans are a dominant driver of ecological functions.

See below:

Herbaceous growth in prehistoric trash area
Cholla growing in rubble of fallen walls
Area free of trees surrounding ruin



Pueblo Colorado near Galisteo, New Mexico. Abandoned 500 years ago. Photo shows effects of changed soil on modern plant community



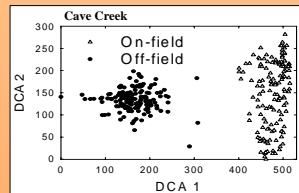
Bronze Age field in central Sweden. Abandoned ca 3500 years ago, outlined by blue line. Less vegetation cover on the old field

Closer examination of the apparent patterns on the landscapes shows quantifiable legacies resulting from human actions

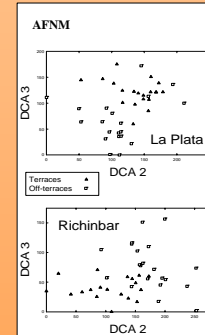
Legacies are present in both modern plant communities and the soils

Legacies in the plant communities:

The primary difference we have found in our study sites is significant differences in community composition between farmed and unfarmed areas



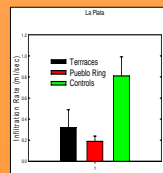
Scatter plots of Axis 1 and 2 (Cave Creek) and axis 2 and 3 (AFNM) from Detrended Correspondence Analysis (DCA) of the terrace and adjacent off-terrace sites from Cave Creek top and La Plata (top right) and Richinbar (bottom right). These plots indicate that although the numbers of species is similar on and off terraces the community compositions are different. This suggests that prehistoric agricultural practices are still impacting the modern plant community.



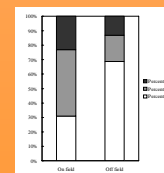
Legacies in soil properties:

AFNM: soil compaction was greater on fields and close to village ruin

Cave Creek: N and C contents differ on and off the fields and soil textures are significantly altered



The average infiltration rate for around La Plata ruin at AFNM show that soil compaction was a legacy of human actions. We found that less impacted areas had the highest infiltration rate, the pueblo ring the lowest and the terraces in between.



Legacies farming from Cave Creek in the percentages of sand, silt and clay from on and off-field samples:
On-field: 31 percent sand, 45 percent silt, and 23 percent clay.
Off-field: 69 percent sand, 18 percent silt, and 13 percent clay.

What can we learn about human behavior by "reading" legacies?

We postulate that different human activities will leave different types or intensities of legacies on the landscape

Working backwards from modern ecological data we may be able to interpret the types, intensity, or durations of human activities that may have produced the visible legacy

A current question in the archaeology of AFNM regards the use of the fortified sites and non-fortified sites on the mesa; were the forts occupied for an extended period of time and used for warfare and guarding the non-fortified sites during the 12 and 1300s? Or is it possible that the fortified sites were manifestations of a very short period of time during which violence was extensive and may have been the cause of abandonment of the area?

Without archaeological excavations there is little actual evidence either way. However, the modern landscape may offer insights.

In the photos below are views of two ruins on AFNM with areas of apparent anthropogenic impact outlined. The top two are the same pueblo ruin shown in a dry spring (2004) and a wet spring (2005). Note that impact areas are large around the pueblo and extend out in all directions. Also the impacts are visible in wet and dry years.

The lower photo shows a similar sized, but fortified site built within a wall and up against a cliff. The visible legacy occupies a very small fraction of the area surrounding the buildings proper and is within the walled area only.



We propose that the smaller legacy visible in the lower photo is due to lower human impact during the time of occupation and since the pueblos are close in size we propose that this fortified site was occupied for a much shorter period of time.

This has implications for interpreting human actions while living on this mesa.

Ongoing studies at AFNM may be able to confirm these initial conclusions and provide a way for ecology to help interpret human behaviors in the past