Actualistic Experiments in Archaeology: Farming and Storing Maize in Range Creek Canyon, Utah

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PROJECT BACKGROUND

Range Creek Canyon (RCC) is located in the West Tavaputs Plateau of East Central Utah. The canyon protects over 500 Fremont farmer/forager archaeological sites dating between 900-1200 AD. After years of working in, living in, and observing the challenging environment surrounding the Range Creek Field Station (RCFS) the scope of our archaeological work was expanded beyond basic archaeological survey, excavation, and paleoenvironmental reconstruction to include actualistic experiments.

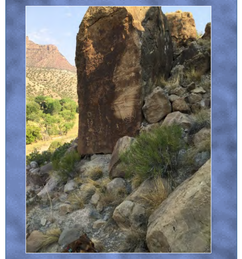
Actualistic experiments test hypotheses about past behavior and processes by conducting activities ourselves, the way they might have taken place, using authentic materials under the same environmental conditions (Outram 2008). The key to conducting meaningful actualistic experiments is through repetition, tracking changes through time, and locating experiments within a relevant proximity to the archaeological record for which we are ultimately interested in. The RCFS considers these long-term studies a priority.

Aspects of maize agriculture are well documented in ethnographic and modern studies, but empirical data on the costs and benefits of farming activities in our specific research area, using only technology available 1,000 years ago, did not exist. We needed first hand data from conducting and analyzing farming activities ourselves, using techniques the Fremont might have used, to better understand the trade-offs they faced in RCC.

We have been repeating our experiments and environmental data collection each year to document long-term variability. Using an actualistic approach has been invaluable.

We are able to integrate:

- The learning curve associated with various activities
- Passing down information as student and staff participants change
- Difficulties and insights that the previous year reveals
- How variability in the environment year to year and season to season affects our experiments.



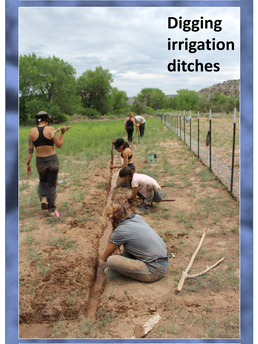
MAIZE FARMING EXPERIMENTS

Starting in 2013, the staff and students planted heirloom varieties of maize each year in two experiments (Boomgarden 2015, Boomgarden et al. 2019) designed to gather empirical data on:

- The costs and benefits of simple surface irrigation using only tools/materials available to the Fremont farmers 1,000 years ago.
  - Fenced half acre field, heirloom maize planted in basins spaced 1-2 meters apart
  - Costs (time spent) of farming activities recorded including: field prep, planting, gathering materials, excavating ditches with replica tools, damming with only natural materials, irrigating, and harvesting maize.
- The amount of water necessary for maize farming to be productive in RCC under changing environmental conditions
  - Between 4-6 fenced plots of heirloom varieties of maize were planted (12 basins per plot, 1-2 m apart, 5 seeds per basin)
  - Water added at planting to ensure germination. Then supplemental water was added at different amounts for each plot ranging from no water (precipitation only) to watering every day.

In both farming experiments:

- Plots and basins photographed through-out growing season
- Plants described periodically (height, growth stage, visible evidence of stress, pest damage, etc.)
- Maize harvested at full maturity, labeled by basin and plot number.
- Cob morphology analyzed (length, diameter, ear weight, row number, weight of dried kernels only, and evidence of stress).
- Weather data recorded: manual rain gauges and automated weather station
- Soil moisture sensors added in 2015



FOOD STORAGE EXPERIMENTS

Of the nearly 500 prehistoric and historic archaeological sites, documented in RCC:

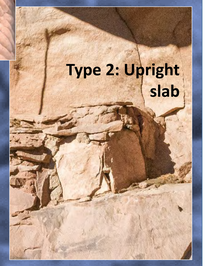
- Approximately 25% of these sites are storage sites or have a storage component.
- The storage strategies are not unique but variability in density, distribution, size, construction techniques, and visibility of the granaries stands out (Arnold 2008).
- Defensive: The majority of the granaries are placed in sheltered locations on extremely difficult to access ledges and cliff faces, well above the valley floor.
- After analyzing over 100 granary structures, we developed some assumptions and set out to test them.
- Assumptions:
  - Some construction techniques might be costlier than others (i.e. amount of mud vs stone)
  - Amount of time invested (cost) should reflect food storage efficacy of different granary styles (benefit).

Our goal in building our own granaries is to document the relationship between time spent in granary construction and the ability of the granary to protect stored resources from non-human competitors and environmental factors (Boomgarden et al. 2018).

Building granaries:

- Students recorded time spent in various construction activities (size, shape, number of constructed walls, amount of mud or stone, wood framing, etc. for small scale (35 x 35 cm) granaries.
- 3 types of Fremont granaries
- Costs associated with building activities are becoming clear with repetition.
- Benefits have been unclear! No experimental granaries could keep rodents out longer than 1 month!
- Modified the timing for when granaries were filled and successfully stored corn in student granaries over winter in 2019.

Fremont Granaries



Student Granaries

UNEXPECTED LESSONS LEARNED

MAIZE FARMING EXPERIMENTS

- Planting
  - Plant spacing
  - Root development
  - Basins vs hills
  - Planting depth
- Maize variety selected
  - Onaveño vs Tohono O'odham
  - Elevation-Growing season length
- Flooding
  - More water ≠ better for maize
  - Dam building investment
- Pests-each year a different attacker at varying intensity, and different time in the growing season
  - Timing is everything!
  - Fencing and netting
  - Rodents
  - Racoons
  - ***Grasshoppers!***

FOOD STORAGE EXPERIMENTS

- Student participation
  - Motivation-need competition
  - Group effort-some work harder than others
  - Learning curve-each student needs to build multiple granaries
  - Granary size-enforce consistency
  - Communication/documentation
- Building location
  - Shelter-is it as dry as you think?
  - Attaching mud to natural walls-is it as sticky as you think?
- Timing of construction vs timing of storing food
  - Drying and repair
  - Filling before fall = increased rodent pressure
  - Filling in late fall = no rodent pressure

ONGOING PROJECTS INFORMED BY ACTUALISTIC EXPERIMENTS

- Soil moisture tracking
- Stream flow tracking
- Experimental grasshopper collection methods
- Isotopic analysis
- Excavation of historic irrigation features
- Cherry Meadows backhoe trench
- Soil sampling from arable land hotspots
- Variability in maize root depth
- Maize starch variability with amount of water
- Maize phytolith variability with amount of water

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