Tending the Utah Bottoms
Exploring Human-Ecosystem Interactions at Rio Mesa Center
Phase 1-Capturing the Site

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Background

This is the first phase, of a larger proposed research project exploring human-ecosystem interactions at the Utah Bottoms. In short, aspects of this research include establishing experimental plots or gardens of traditionally important plants, and studying the costs and benefits associated with collecting, processing, and managing (irrigating, burning, weeding, etc.) these resources. The particular plants of interest are geophytes (roots and tubers), wild grasses, and corn. All three plants were economically important throughout human history at the Utah Bottoms. Archaeological reconnaissance and survey indicate that the bottomlands and surrounding areas have been occupied, at least intermittently, for the last 4,000-5,000 years. Over this time period, lifeways oscillated between hunting and gathering and agriculture. Four distinct periods of human occupation at the Utah Bottoms are indicated: Period 1) early hunter-gatherers (roughly 5,000-2,000 BP); Period 2) prehistoric farmers (roughly 2,000-1,000 BP); Period 3) late hunter-gatherers (roughly 1,000 BP-200 BP); Period 4) historic agriculturalists (150 BP-present). Over the last 4,000-5,000 years, available evidence suggests that corn/maize, wild grasses, and geophytes played important, though varying roles in the lives of human occupants of the Utah Bottom. Archaeological, ethnographic and historical evidence also indicate that all three plants were likely managed or cultivated prehistorically and historically at the Utah Bottoms as well. The factors influencing variation and shifts in the use and management of these plant resources remain poorly understood.

We expect differences in the use of these plants to have been determined primarily by economic considerations. In other words, inhabitants of the Utah Bottoms assessed the nutritional/economic value and labor costs associated with collecting, processing, and managing these different plants, and favored those that yielded the highest net-return rates. Granted, other factors also affected people's choices, but from an archaeological perspective evaluating theses expectations seems to be a reasonable place to begin research. Establishing experimental garden plots of corn, wild grass, and geophytes, and collecting data on their energetic returns relative to collecting, processing and managing costs would allow us to formally assess this proposition. Similar studies have proven useful in addressing questions related to human-ecosystem interactions and long-term patterns of human subsistence, settlement, and socio-political change. Furthermore, although infrequently conducted, studies of the effects of traditional management practices (particularly burning) on local plant communities are increasingly recognized as key to accurately reconstructing pre-Columbian North American landscapes.

Description

<u>Phase 1-Capturing the Site from Invasive Plants.</u> Phase 1 entails establishing experimental garden/weed treatment plots in the fallow agricultural fields at Jones Ranch. Currently, the area is dominated by exotic weeds, namely Russian Knapweed (*Acroptilon repens*) and cheatgrass (*Bromus tectorum)*. The difficulty of re-establishing native vegetation or planting crops in areas infested by these weeds is well documented, and there is much disagreement on the specifics of how this can best be done. However, integrating a number of tactics into a management program has been

shown to be more effective than using a single tactic alone. Available evidence suggests that weed prevention via early detection and containment are the best management tools, as small infestations require few resources to eliminate. Large infestations are difficult to manage and the application of a single control strategy (such as mowing or herbicide use) is rarely sufficient to control established stands. In addition to containment, the best management plan for old, dense infestations is the use of a combination of cultural, mechanical and chemical control techniques applied with diligence and persistence over a number of years. While the use of chemical herbicides appears unavoidable (particularly with respect to controlling Russian knapweed), the use of herbicides should be considered a transitional tool to suppress weeds and replace them with desirable, competitive vegetation. Because repeated application of chemical herbicides presents environmental concerns, it is worthwhile to explore different methods of controlling noxious weeds that minimize the use of these chemicals. Among the promising approaches is capturing sites from weeds with mono-cropping an aggressive perennial grass, followed by interseeding and assisting the succession of other desirable native plants. The following is a working plan to explore methods of controlling weeds and restoring native vegetation at Utah Bottoms. Information is intended to serve as basis for the development of long-term vegetation management plan at the Rio Mesa Center.

Objectives
Successful restoration of native vegetation and weed control at the Utah Bottoms will require development of a multi-tactic, monitoring-based, and prevention-oriented management system. The objectives of Phase 1 are to establish monitoring program, explore a combination of treatment methods, and identify the most effective, least-toxic management method. Components of Phase 1 include:

- conducting weed inventories
- conducting weed control and native plant restoration experiments
- assessing vegetation management programs

Location
Proposed location of Phase 1 work is the eastern end of Utah Bottoms, in and around the fallow agricultural fields at the Jones Ranch. Weed inventories, if feasible given time and budget constraints, should be conducted throughout the entire Utah Bottoms.

Scope
Phase 1 scope of work consists of following tasks:

- Field Investigation
- Field Preparation and Seeding Native Plants
- Report and Graphics Development

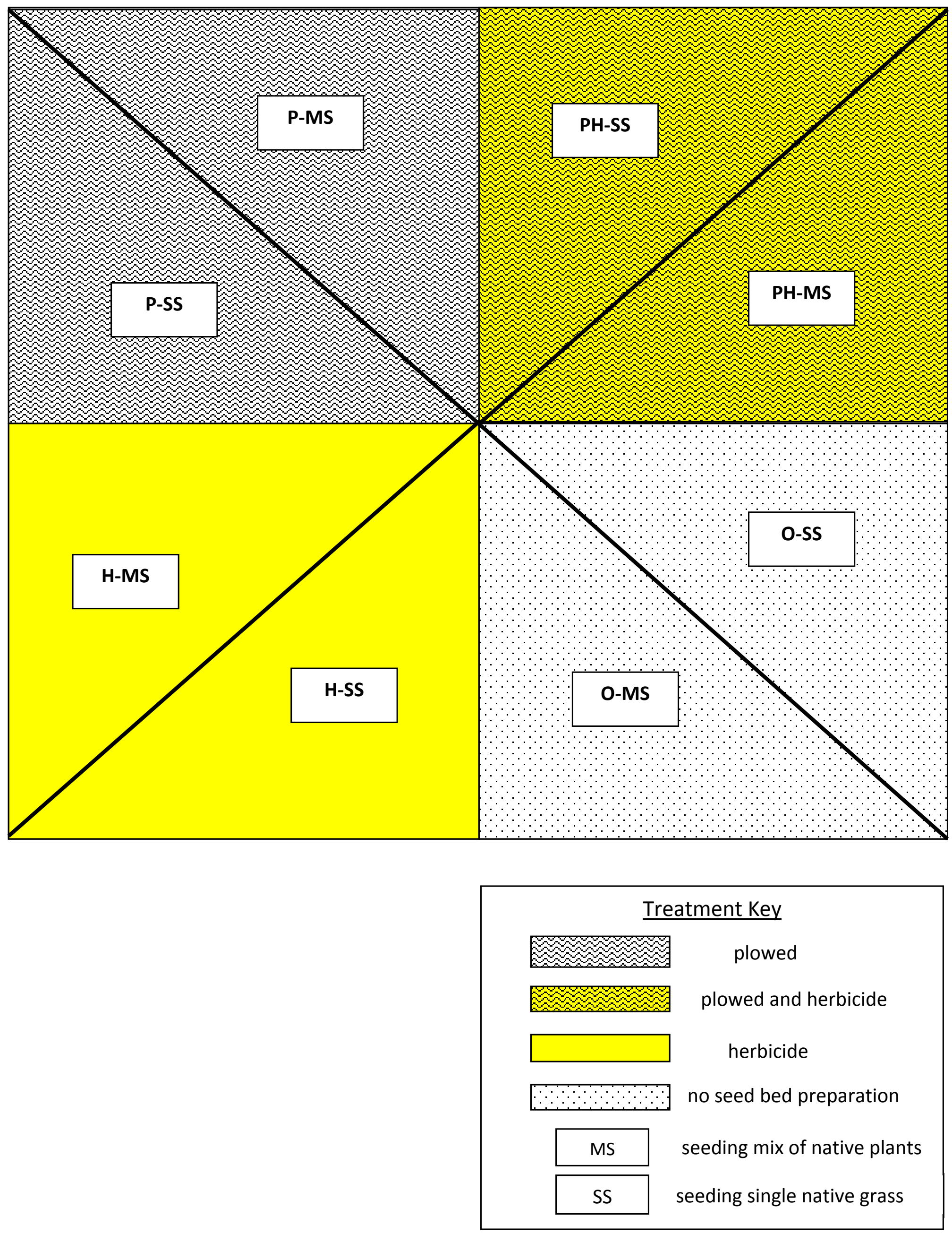
The following describes the proposed tasks:

- <u>Field Investigation</u>
  This task includes: 1) conducting initial weed inventories, and 2) post-treatment monitoring experimental plots. Weed inventories entail mapping and collecting data on the distribution, size, and density of weed infestations at Jones Ranch. Data collected in the field will conform to standards established by NAWMA (North American Weed Management Association 2002; Attachment 1). Mapping will be conducted using Trimble XT Handheld GPS. Inventory data will identify and help prioritize infested areas to be treated first, aid in the development of site specific treatment plans and

budget estimates, and provide background information to help assess effectiveness of weed control and native plant restoration efforts. The second component of field investigation is post-treatment monitoring of experimental plots (discussed below). Post-treatment monitoring will follow the same protocol used for initial weed inventories. After seeding, monitoring surveys will be conducted in the spring and fall to collect data on emergence and survival rates of plants. It is recommended that monitoring surveys be completed each year after initial treatment or until cover stabilizes or the habitat reaches desired plant community. Proposed time of initial weed survey is late summer or fall, 2010.

- <u>Field Preparation</u>
  This task includes: 1) setting up experimental plot, and 2) application of treatment methods. The proposed experimental plot is a four acre parcel evenly subdivided into four one acre sub-plots (Figure 1). Each one acre sub-plot will receive a different combination of weed control treatments. Treatments variables include plowing (P), chemical herbicides (H), aggressive seeding of single native grass (SS) or a mix of native plants (MS). Experimental treatments include: 1) plowing and seeding mix of native plants [P-MS] ; 2) plowing and seeding with a single native grass [P-SS]; 3) plowing, chemical herbicides, and seeding mix of native plants [PH-MS]; 4) plowing, chemical herbicides, seeding single native grass [PH-SS]; 5) chemical herbicides and seeding mix of native plants (H-MS); 6) chemical herbicides and seeding single native grass [H-SS]; 7) seeding mix of native plants without seed bed preparation or application of chemical herbicides [O-SM]; and 8) seeding single grass species without seed bed preparation or application of chemical herbicides [O-SS].

Figure 1. Schematic of Experimental Plot and Treatment Methods



Proposed time of chemical herbicide treatment is during October-November, as evidence indicates that weeds, particularly Russian knapweed are susceptible to herbicides shortly before or after the first major killing frost in the fall. Determining which particular chemical herbicide to use and its application are perhaps best outsourced to train professionals. However, the herbicide Curtail applied at 2 qt/acre has been shown to be effective against knapweed. Tilling or plowing after initial killing is recommended, followed by seeding in late winter and early spring depending on plant species seeded.

Proposed species to be seeded are listed in Table 1. All or some combination of the forbs and grasses listed in Table 1 will be used in plots receiving the mixed seeding treatment (MS). For plots receiving the single species seeding treatment (SS), a hardy and aggressive native wheatgrass, perhaps western wheatgrass (*Pascopyrum smithii)* is recommended.

- Report and Graphic Development
  This task includes data analysis, producing maps and graphics and writing a report on methods, results, and recommendations for future work.

Table 1. List of Plants for Seeding Experimental Plots

Scientific Name	*Common Name*
Forbs	
Erigeron pumilus	*Shaggy fleabane*
Eriogonum umbellatum	*Sulphur-flower buckwheat*
Eurybia (Aster) glauca	*Gray aster*
Hedysarum boreale	*Utah sweetvetch*
Sphaeralcea coccinea	*Scarlet globemallow*
Eriogonum flavum	*Alpine golden buckwheat*
Heterotheca villosa	*Hairy false goldenaster*
Lupinus sericeus	*Silky lupine*
Penstemon cyanocaulis	*Bluestem beardtongue*
Senecio multilobatus	*Lobeleaf groundsel*
Castilleja angustifolia var. dubia	*Northwestern Indian paintbrush*
Petradoria pumila	*Rock goldenrod*
Tetraneuris (Hymenoxys) acaulis	*Stemless four-nerve daisy*
Grasses	
Achnatherum hymenoides	*Indian ricegrass*
Hesperostipa comata	*Needle and thread*
Leymus salinua ssp. salina	*Saline wildrye*
Pleuraphis (Hilaria) jamesii	*James' galleta*
Elymus elymoides	*Squirreltail*
Koeleria macrantha	*Prairie Junegrass*
Poa fendleriana	*Muttongrass*
Sporobolus cryptandrus	*Sand dropseed*
Elymus trachycaulus	*Slender wheatgrass*
Leymus cinereus	*Basin wildrye*
Pascopyrum smithii	*Western wheatgrass*
Poa secunda	*Sandberg bluegrass*

Phase 2-Exploring Traditional Management Techniques

After capturing the site from the weeds.

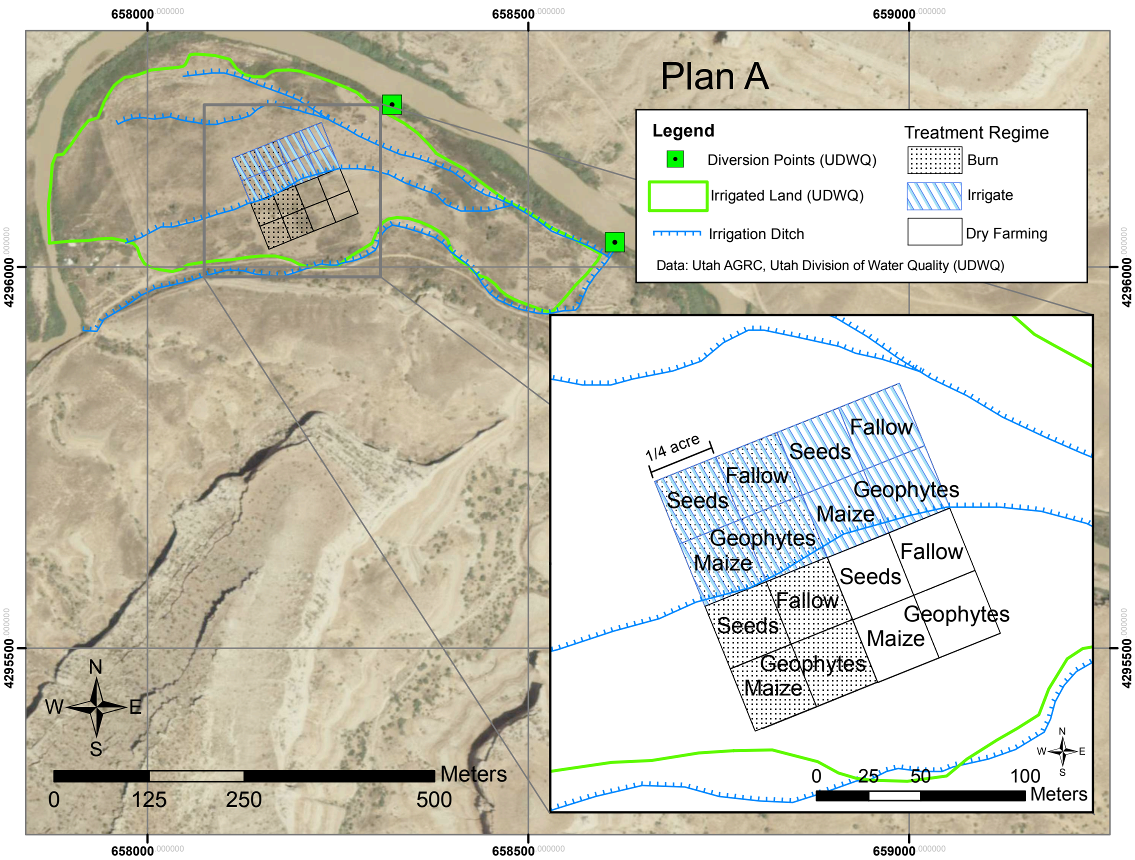
Phase 2 entails establishing corn, wild grasses, and geophytes in the experimental plot, and investigating the influence of traditional management techniques on the economic characteristics (namely quantity) of these plants. In Phase 2, the traditional management techniques we wish to investigate are burning and irrigating. After garden plots are well established, we will conduct timed collecting/harvesting and processing experiments to provide data on return rates, as well as the costs associated with exploiting these different plants. Harvesting the garden plots will also provide data on the effect of human exploitation on these resources. Evidence suggests that some plants, particularly geophytes benefit from repeated digging and human disturbance. Based on previous research, ethnographic analogy, and theoretical considerations, we expect:

- Burning will be the most economical management technique.
- Cultivating/managing wild geophytes via burning will yield the highest net-returns, followed by grasses and corn.
- Burning and irrigating corn, due to the relatively high costs of irrigation, will yield the lowest net-returns.

Research Design

The four acre experimental plot will be evenly subdivided into one acre sub-plots, and each sub-plot will receive a different management regime (Figure 2). Management regimes are: 1) irrigating, 2) burning, 3) irrigating and burning, and 4) "dry farming", or simply seeding plants and letting them grow without any management as control plot. Each of the one acre sub-plots will be further subdivided into ¼ acre parcels and planted with either corn, wild grass, geophytes or left fallow as control plot. Data will be collected on time allocation associated with each management regime, and their influence on the productivity of the plants. Conducting timed collecting and processing exercises in the experimental plots will likely require waiting a year-or-two to allow plants to increase enough so that they can be sustainably harvested.

Figure 2



Plan A
Legend
Diversion Points (UDWQ)
Irrigated Land (UDWQ)
Irrigation Ditch
Treatment Regime
Burn
Irrigate
Dry Farming
Data: Utah AGRC, Utah Division of Water Quality (UDWQ)
658000
658500
659000
4296000
4295500
1/4 acre
Fallow
Seeds
Geophytes
Maize
N
S
E
W
0
125
250
500
Meters
0
25
50
100
Meters