

## Project Summary

### Rocky Mountains Cooperative Ecosystem Studies Unit

**Project Title:** Determine water sources through isotope analysis of precipitation, Groundwater, streamflow and riparian vegetation, years 1 and 2

**Discipline:** Natural

**Type of Project:** Research

**Funding Agency:** National Park Service

**Other Partners/Cooperators:** University of Wyoming

**Effective Dates:** 5/1/2004 - 12/30/2006

**Funding Amount:** \$25,000.00

**Investigators and Agency Representative:**

NPS Contact: Brad Shattuck, National Park Service, Natural Resources Program Manager, Chaco Culture National Historical Park - CHCU, PO Box 220, Nageezi, NM 8737, Phone: 505-786-7014 x223, Fax: 7061, brad\_shattuck@nps.gov

Investigator: Elise Pendall, Dept. of Botany, University of Wyoming, Phone: 307-766-6293, Pendall@uwyo.edu

**Project Abstract:**

At Chaco Culture NHP the importance of the alluvial aquifer to the vegetation and also therefore stream stability cannot be overstated. Certain (as yet unidentified) plant species continue to withdraw water from the aquifer, but preliminary research suggests that the water table is close to the maximum rooting depth of the plants. If continued water level decline causes the plants to lose access to the alluvial aquifer they will not be able to tolerate drought and the extent of the riparian community may diminish. This would cause the active channel of Chaco Wash to widen and resume undermining the arroyo banks and nearby archeological structures. Thus the plants act to protect several Great House ruins from erosion, a problem that was very serious prior to the establishment of the floodplain vegetation. The groundwater resource is therefore critical for the direct preservation of the riparian habitat, and indirectly for the stability of archeological structures.

If stream flows were diverted before entering the Park, or if shallow groundwater was pumped before entering the Park, an artificial drought could ensue. An additional concern is the competition that may exist between native vegetation, such as cottonwood (*Populus fremontii*), and the invasive species tamarisk (*Tamarix chinensis*). The riparian cottonwoods are showing signs of deteriorating health in comparison with other riparian shrubs.

This project is two year effort, funded by the Colorado Plateau CESU to have the park work with University of Wyoming researchers to collect data to allow for the development of a groundwater resource management strategy will be developed by Chaco Culture National Historical Park personnel in consultation with USGS and University of Wyoming scientists to optimize protection of cultural resources while at the same time minimizing aquifer drawdown and spread of invasive *Tamarix*. To accomplish this goal, UW researchers will carry out these tasks:

(1) determine the water sources of these specific riparian plant species, and how they may change over the growing season. Competitive interactions among riparian species, including the non-native invasive *Tamarix*, will be evaluated, (2) Complete a study of the shallow alluvial aquifer water used by each species using an isotopic mass balance approach. Field sampling, protocol, and analytical methods will be developed and tested for quality assurance and quality control (QA/QC). Plant specimens, streamflow samples, and precipitation will be collected as permitted by Chaco Culture NHP, (3) a groundwater resource management strategy will be developed by CHCU-NPS personnel in consultation with USGS and UW scientists to optimize protection of cultural resources while at the same time minimizing aquifer drawdown and spread of invasive *Tamarix*, and (4) The PI and graduate student will prepare a final report that will include a recommended resource management strategy. Investigators will also prepare a peer reviewed publication for *Hydrological Processes* or *Water Resources Research*.

**Outcomes with Completion Dates:**

Investigators Annual Reports

Draft Final Report, no later than January 31, 2006

Approved Final Report, no later than March 31, 2006

Presentation to staff of CHCU

**Keywords:** water source, groundwater, streamflow, riparian vegetation, isotope

analysis, water chemistry, Chaco Culture National Historical Park,  
University of Wyoming, Tamarix, water rights

**For Administrative Use Only:**

Date Annual Report Received:

Date Final Report Received:

Publications, etc. on file: