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4,500 Years of Biotic Change in Range Creek Canyon

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I. Introduction

Packrats (Genus *Neotoma*) live up to their namesake and collect almost anything, but especially vegetation from their area. Their collections (middens) are also preserved very well due to the crystallization of packrat urine that seals them like time capsules. This behavior allows the preserved middens to give excellent insight into the environment in which they were formed. Once the middens are processed and the vegetation from the middens is extracted and analyzed, it can be compared to present-day vegetation growing in Range Creek Canyon. From this comparison, we can see how climate has changed over the past few thousand years due to different plant tolerances for particular environmental conditions. The importance of understanding past climates and its impacts on local vegetation of the time can help us understand how past conditions may have impacted the ancient inhabitants of Range Creek Canyon.

The Fremont peoples were likely only present in the Range Creek area for a brief time (Metcalfe, 2008). Current midden samples collected from Range Creek span a timeframe of 4,500 years ago to present. Analysis of these middens can give insight into environmental conditions before, during, and after Fremont settlement. Understanding the nuances of environmental shifts using data from packrat middens will provide a clearer narrative regarding climate and its impact on the Fremont peoples of Range Creek.

II. Methods

Middens were processed by me in the University of Utah Records of Environments and Disturbance (RED) Lab. Processing involved soaking them to remove the uriniferous matrix and sorting the vegetative contents.

Sorting the contents of middens involves the removal of each unique macrofossil, which includes seeds, twigs, leaves, and any other artifact of vegetation. Macrofossils are then identified by comparing the minutia of detail present in the sample against previously identified samples from other middens. Finally, the presence of a macrofossil is ranked on a scale of one to three and recorded for each midden.

III. Results

Identification of macrofossils to species requires a niche understanding of botany. Small variances in the braiding of twigs or the ridges in needles can help identify to which species of tree the macrofossils may belong.

Colorado pinyon (*Pinus edulis*) can be identified by its needles, which come in pairs of two with a ridge in the center of the two needles forming a hallow cone shape.

Differentiating between Rocky Mountain Juniper (*Juniperus scopulorum*) and Utah Juniper (*J. osteosperma*) can be challenging, given their similarities. The main differences are in the end points of the leaves and how closely they interweave. Besides appearance, the two species prefer different environmental conditions. Utah juniper grows best in Range Creek in dry conditions at

elevations between 5,300 ft. and 6,500 ft. Rocky Mountain juniper prefers a more mesic environment and above 6,600 ft. in Range Creek, it is the dominant Juniper species.
Dates from previous Range Creek midden analyses indicate an expansion of Colorado pinyon onto the Colorado Plateau in the late Holocene. Radiocarbon dating of middens showed an absence of pinyon at 4,575 years before present (BP) and its appearance 3,520 BP.
The adaptation of these plants to specific niches indicates environmental conditions in Range Creek Canyon by their absence or presence. This logic, coupled with radiocarbon dates of middens, provides a timeline of changing climatic conditions at Range Creek.

IV. Conclusions

Packrats and their propensity to justify their nomenclature provide a unique opportunity to reconstruct biotic change in Range Creek Canyon. The eight middens I processed during my UROP will add to this effort once the middens are radiocarbon dated.