In the Shadow of Ghost Trees: Applying Forest Ecology to Archaeological Interpretations

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Abstract

Forest boundaries shift both gradually and abruptly over time as a result of such varied forces as fire, climate, pestilence, grazing, and human land use. Small scale shifts in timberline or forest boundaries can be hard to discern from the paleoecological record, yet humans, like other mammals, likely exploited the ecological diversity along forest edges. Understanding the interplay between the forest and human adaptive strategies is a critical tool for interpreting past human lifeways. As part of the Greybull River Sustainable Ecology project (GRSLE) in northwestern Wyoming, students from Colorado State University located the remnants of a lodge-pole pine forest and recorded the spatial and observable characteristics of those "ghost trees." This information, combined with local dendrochronological data, fire history, and regional paleoclimatic fluctuations was overlayed with geospatial data and orthographic photographs to provide a visual representation of a changing prehistoric environment. These depictions of past forest landscapes, when incorporated into the archaeological record, offer insights into not only how humans interacted with their woody neighbors but also how climate more generally may have influenced mobility and foraging patterns prehistorically.

Figures 1 & 2: Tree scars chronicle historic land use at the Jack Creek Cow Camp (top). Natural or anthropogenic? Downed timber patterns sometimes provide perplexing clues about ecological and human activity (bottom).

Figure 3: A shadow of its former self: the imprint of a ghost tree remains on the landscape long after the tree has fallen.

Figure 4: A portion of the ghost tree study area.

Introduction

The present-day landscape of the Upper Greybull watershed in the area surrounding Jack Creek is typified by alpine meadows, patches of coniferous forests, ephemeral ponds, hummocky spring sources, and basalt cliffs that drop vertically into the Jack Creek river valley. Paleoecological studies as well as research during the 2005 field season hint at the complex climatological and ecological history of the region. The preponderance of archaeological lithic scatter across both landscape and time eludes to an equally complex relationship between human activity over at least the last 13,000 years in this montane environment. The reconstruction of paleoforests is critical for interpreting past human lifeways and artifact occurrence in relation

Methods

•Using a Trimble GeoXT GPS unit, physical characteristics of ghost trees were recorded, including spatial location (UTM coordinates), diameter, height (stumps), length ("downtrees"), and presence of charcoal. As a GIS shapefile, orientation was implicit in the collection of the polyline data associated with downed trees. The following standards were observed:

–Stumps or fallen trees whose roots were no longer imbedded in the ground surface were not considered in situ and therefore not recorded.

–When an observable match could be made between a broken stump and a nearby fallen tree (approximately within 2 meters), the stump and the fallen tree were considered one polyline with demarcated vertices.

– The length of a fallen tree included the "shadow" of the original fallen tree, i.e. a prominent linear impression left by an eroded trunk or visible tree detritus in a discernible line upon the ground.

•Ghost tree characteristics and spatial distribution were then compared to GIS data on artifact location, elevation, land cover, slope, and aspect.

•A charcoal sample was collected for radiocarbon analysis from the charred exterior of a standing-dead ghost tree in the study area.

•A second tree sample was collected for dendrochronology from a tree stump in the historic Jack Creek Creek Cow Camp

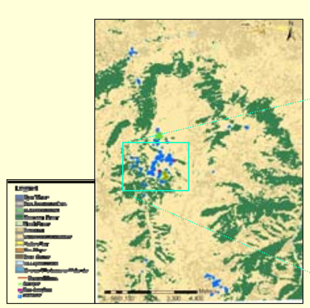

Figure 5: The land cover database from the US Geological Survey showing the distribution and primacy of evergreen forests in the study area.

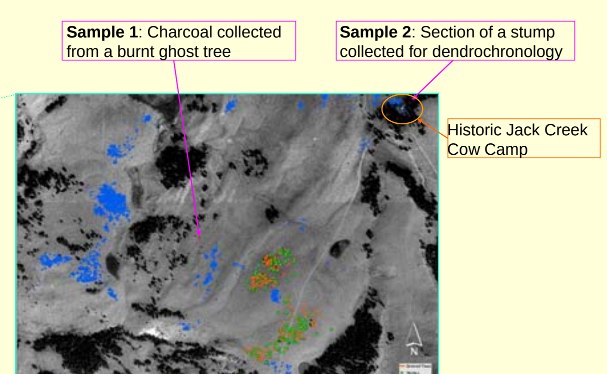

Figure 6: Ghost trees and tree samples shown in relation to archaeological sites in the Jack Creek area.

Results

Landscape Taphonomy and Artifact Association

Recording the remains of an ancient forest offers tangible insight into shifting forest boundaries on a centennial and even decadal scale. Radiocarbon dating and dendrochronology can further enhance this story of past forest morphology. By mapping artifacts and ghost tree distribution with modern-day forest boundaries (Figure 7), a more complex pattern emerges. This pattern, however, may be more indicative of landscape taphonomy than of long-term vegetation change. In particular, the overwhelming majority of artifacts in the study area are located outside of both the modern-day forest and ghost tree boundaries, suggesting a possible link between artifact discovery and forested landscape. Alternatively, when slope is considered as a possible geomorphological influence on artifact location, no immediate relationship appears (Figure 8). Rather, a gentle southeastern incline is observed across the artifact/ghost tree study area. Taken as a whole, artifacts and ancient forests represent related but discontinuous landscape attributes, each contributing to an understanding of paleoecological conditions.

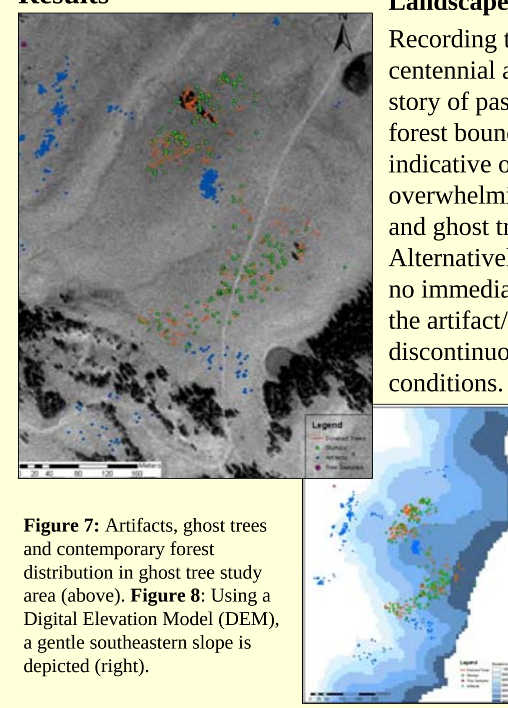

Figure 7: Artifacts, ghost trees and contemporary forest distribution in ghost tree study area (above). **Figure 8**: Using a Digital Elevation Model (DEM), a gentle southeastern slope is depicted (right).

Tree Sample Results

• A charcoal sample collected within the ghost tree study area (Figure 6) yielded a radiocarbon age of 330±50 BP (Beta-20904 64), providing a likely tree death in the 1700's and sprout initiation in the 1300's (Figure 9).

•A cross-section of a tree stump was collected from the Jack Creek Cow Camp. The dendrochronological record indicates that the tree was 229 years old (± 5 years, human error) establishing the origin of the tree to around 1776.

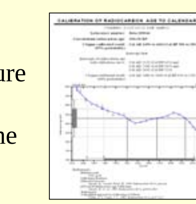

Figure 9: The radiocarbon age report for Tree Sample 1.

Conclusions

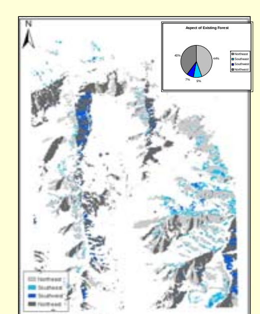

Figure 10: When forest cover and aspect are compared, a strong correlation is observed between forests and north-facing slopes

Forest edges, or ecotones, have been described as optimal places for both humans and mammals to make use of two distinct ecological communities. Patch size, especially near forest boundaries, may have also played an important role in past human land use (Kornfeld 2003). Variability in forest patchiness has been linked to global and regional oscillations in seasonal isolation, ice sheet extent, atmospheric carbon dioxide levels, topography (Figure 10), disturbance, and resource availability (Kornfeld 2003; Gillespie et al. 2004; Baker and Kipfmueller 2001). Lending credence to this argument, major shifts in biome position and area have been documented between 14,000 and 9,000 BP (Gillespie et al. 2004). More tantalizing yet for the paleoforest puzzle, packrat middens have recently yielded evidence that Ponderosa pine--ubiquitous in the Jack Creek area today--were found only in southern Arizona 12,000 years ago, quickly spread northward, replacing limber pine in dominance and reaching Wyoming just 2,000 years ago (Norris, Jackson & Betancourt, in publication). Such findings support a complex story of paleoecological flux since the last glacial period. Evidence of human activity in the Jack Creek study area extends back at least 13,000 years and coincides with dramatic and possibly anomalous changes in the forested environment, reinforcing the need for archaeologists to consider how such ecosystems may have influenced past human lifeways.

References: Baker, William L. and K. F. Kipfmueller
2001 Spatial Ecology of Pre-Euro-American Fires in a Southern Rocky Mountain Subalpine Forest Landscape. In *Professional Geographer*, 53(2):248-262.
Gillespie, S.C and B.F. Atwater
2004 The Quarternary Period in the United States. Elsevier B.V., Amersterdam, The Netherlands
Kornfeld, Marcel
2003 Islands on the Plains : ecological, social, and ritual use of landscapes, edited by Marcel Kornfeld and Alan J. Osborn, 4-11. University of Utah Pres, Salt Lake City
Norris, Jackson and Betancourt
2005 Cited in lecture F311 Forest Ecology, Colorado State University.

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