“Mesquite Wood and Ancient Rainfall: The TxDOT EDXA Project”

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EDXA and Mesquite: and Introduction
I am exploring the effects of modern rainfall on mesquite (Prosopis glandulosa) wood anatomy across Texas through Ecologically Diagnostic Xyloanalysis (EDXA). EDXA is based on the principle that environmental moisture where a mesquite plant grows directly affects the anatomical structure of its wood.

Materials and Methods
Plants parts are delicate compared to most archeological remnants, and aside from exceptional sites (e.g., dry rock shelters) evidence of past plant use is often in the form of charcoal. Plant preservation in open sites requires exposure to 250 - 300°C (482 - 572°F) temperatures with minimal oxygen, resulting in carbonization and rendering them resistant to biological deterioration. A specialist can often identify charcoal fragments to at least the genus level.

Some tree species exhibit predictable variation in size (diameter and number (density) of water transport vessels (pores) in their wood depending on local rainfall. Within species, vessel diameter tends to be higher and vessel density lower in high rainfall regions. Conversely, in arid regions vessels tend to be smaller and more numerous (Carlgren 1977). Biological and ecological forces that drive adaptation of mesquite wood to its surrounding environment have potential as a proxy indicator for interpreting paleoenvironmental conditions from archeological remains.

Vulnerability index:
Vessel measurements were obtained from 23 samples along a transect spanning 16 counties from El Paso, along the I-10 corridor, across the Hill Country and Edwards Plateau, and west to Colorado County (Figure 10, Table 1). Two additional outsourcing samples from Molina and Bridgeview Counties were also included. Results indicate a lack of correlation between broad scale shifts in rainfall and vessel patterns among the widely spaced, individual samples along the gradient (Table 1). However, samples from the opposite extremes are distinctly dissimilar (Figure 4). Sample 53 (Palo Pinto County) clearly has more vessels than Sample 57 (Colorado County); mean pore diameter and vessel diameter are relatively similar between the two, but the respective vulnerability indices are consistent with EDXA expectations (lower in the drier west, higher in the wetter east).

Discussion
In spite of the challenges, the distinct vessel patterning between the El Paso and Colorado County samples examined in the pilot study along with the results of this study, 2004, indicate major vessel patterns in the present study remain intriguing. Dering (2002) and other researchers have found the following stages to further develop the method:

1. Establish a large modern reference database from each major precipitation regime in Texas, including samples from most landforms in the region.
2. Subject the data set to statistical analysis to establish the variability of mesquite wood anatomy within each precipitation regime.
3. In all possible scenarios the xylem analysis of a piece of wood charcoal with AMS dates to provide an accurate temporal context.

The TxDOT EDXA project is presently executing stage one and the overall results of the pilot study emphasize the need to pursue stage two. Rigorous exploration of multiple landforms in the region is essential for their support of the TxDOT EDXA project.

Conclusion
Precipitation fills streams, provides potable water, and regulates the abundance and distribution of plant and animal resources on which past peoples depended. In some parts of Texas sufficient and well-timed rainfall made farming a viable alternative to hunting and gathering. Reconstructing past regional rainfall patterns is vital for understanding prehistoric human adaptations. As this project progresses and the data is collected, its application to radiocarbon-dated archaeological specimens would potentially help clarify past precipitation conditions across time and space.

Request for Contributions
Mesquite wood contributions are welcome for this ongoing study. Samples are notably absent from northwestern Texas, but additional samples from regions already covered will only enhance the data. Obtain proper permission to collect samples from private landowners.

Guidelines:
- Samples should be at least three inches long, and between 1.5 and 3 inches in diameter (Figure 12);
- either fresh or dead wood is acceptable, but source location is critical;
- GPS coordinate of source location;
- photograph tree and setting, if possible;
- email to: Kevin Hanselka Texas Department of Transportation Environmental Affairs Division 125 E. 11th Street Austin, TX 78701
- email notes, GPS points, photos to: Kevin.Hanselka@tdot.gov;

The author wishes to thank Dr. Scott Peeples and the TxDOT EDXA Archeological Studies Branch Staff Dr. Phil Dering, and numerous sample contributors for their support of the TxDOT EDXA project.

Table 1. Results of the pilot study (from east to west).

Pilot Study: East to West
Mean annual precipitation generally decreases from about 56 inches in the forests of east Texas to about eight inches in the desert west (Figure 9). Since the precipitation gradient one could hypothesize the following changes in mesquite anatomy from east to west:

- decreasing vulnerability indices
- increasing vessel sizes
- increasing vessel densities

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