

## **Middle Bear Canyon Erosion Investigation, Catalina Mountains, Tucson Arizona.**

Carried out by LTRR students spring semester, 2000.

Middle Bear Canyon, located at an elevation of around 1820 meters in the Santa Catalina Mountains near Tucson, Arizona, is a popular picnicking and camping destination. Tucsonans wishing to escape the heat of the desert can reach Middle Bear Canyon in less than an hour and enjoy the shade provided by tall ponderosa pines. However, recreational use in the area may be contributing to increased erosion on adjacent slopes, a problem also encountered at nearby Rose Canyon Lake (Danzer 1996).

Hypothesis: Bank and slope erosion occurred following expanded recreational use of the campground area due to foot traffic and other human activity.

Alternative hypothesis: Bank and slope erosion is occurring continually in this area and the campground use is not an important factor.

### **METHODS**

Because no direct measurements of slope erosion have been made for the Middle Bear Canyon area, we used dendrogeomorphological methods to estimate approximate dates of large erosional events as well as to infer the amount of erosion that has occurred in the area since the establishment of the sampled trees (LaMarche 1968). At least 2 cores were taken from approximately 30 trees, many of which were leaning and about half of which were rooted directly on the slopes affected by erosion. Modified skeleton plots (Schroder 1976) were created in order to show where suppression or release, numerous resin ducts, and other tree reactions occurred during the life history of the tree. The skeleton plots were compiled and dates of reaction that -were common among many trees were noted.

Normally, tree roots are underground. Under conditions of rapid or persistent soil erosion, roots can become exposed. The trunks and root diameters were measured, as well as the distance from the top of the root to the present soil surface. Measurements were also taken of the distance between the trees and the streambed, as well as the height of the tree location above the present stream channel. Measurements and observations of each tree were recorded on separate cards. The site was then mapped to approximate scale. Large exposed roots were cored from the top, while dead exposed roots were cut with a saw.

Several fire scarred stumps were sampled in the vicinity as well in order to determine fire frequency and history for the site.

### **Observations**

Stumps beyond the stream had been cut with an ax and were quite weathered. Exposed roots were noted on both young and old trees.

## Preliminary results

Changes in growth were noted around 1890, the 1920s, the 1940s, and ca. 1960. A tree by the creek had a wound late in the 1914 ring possibly the result of summer flooding. Many of the older trees had a wound in 1879 (a fire date).

The group of twisted trees near profile "E" probably began growth on the high bank which was undercut and slumped in the 1850s - resulting in the twisted forms as the trees re-oriented to vertical. These trees began growing in the 1830s or 40s (age estimated when correcting for coring height). Tree size and tree age were not well related as these trees proved similar in age to much larger individuals above and below that had not been affected by the bank slump.

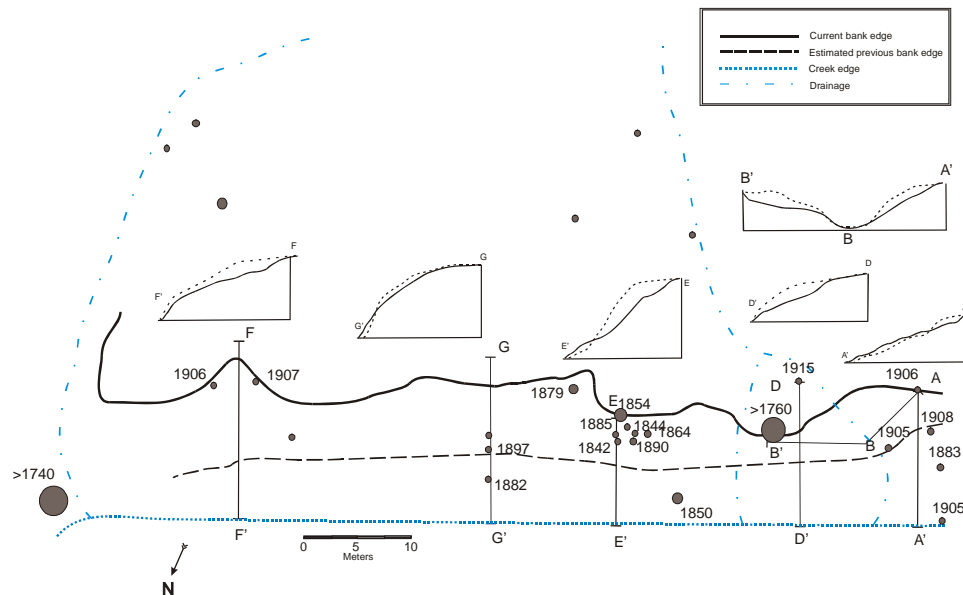
The large tree with the massive expose roots provided evidence of erosion prior to 1850. A large root was wounded on its upper surface by fire in 1819. By 1851 enough erosion had occurred to expose the bottom and it was scarred by a fire in 1851 on its lower surface.

The creek channel has not been cutting the bank as older trees grow at the foot of the toe slope. Some soil has been deposited along the base of the toe slope burying the tree bases.

One of the ax cut trees was felled in the 1880s.

So, we concluded that the erosion process is episodic and a persistent feature of the area. While the current human use probably has some effect, erosion in this area did not begin recently. The erosion is due to overland flow and washing of the slope material. Additionally, the area has been used for a long time, perhaps for centuries, as the location is pleasant and water is seasonally available.

### ***Middle Bear Canyon erosion study***



Map of MBC site with pith dates of trees, bank features, and section profiles.



Profile "E" with twisted trees on fallen bank section.



Tree pith >1760

Root, wounded on top: 1819  
scarred on bottom: 1851

Danzer, S.R. 1996. Rates of slope erosion determined from exposed roots of ponderosa pine at Rose Canyon Lake, Arizona

LaMarche, V.C. 1968. Rates of slope degradation as determined from botanical evidence, White Mountains, California. U.S.G.S. Professional Paper 352-I

Schroder, J.F. 1976. Dendrogeomorphological analysis of mass movement on table cliffs plateau, Utah. Quaternary Research 9:170-174

