PROJECT SUMMARY

Pollen Analysis

Source: S. Mensing, University of Nevada-Reno

Introduction and Background

In 2007, the University of Nevada-Reno conducted an analysis of sediment core samples extracted from Sand Creek Massacre National Historic Site (NHS). Pollen from each core sample was analyzed to reconstruct the site's historic vegetation. Sediment radiometric date analyses were conducted on some samples. Information obtained from this project will be used to determine the site's historic environment and to support management of the area for its vegetative conditions at the time of the 1864 massacre, part of the site's purpose.

Methods

Multiple core samples were taken the bottom of the Big Sandy Creek bed and a nearby spring-fed pool. Corers were pushed or pounded into the sediment and three samples were analyzed for chronology, sediment, and pollen. The sediment of each core was analyzed for percentage of water and organic and inorganic material. Pollen samples were taken from above and below the gravelly layers since sands and gravel do not hold pollen. Terrestrial pollen grains were counted and pollen concentration was calculated. Pollen was identified at the lowest possible taxonomic level.

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NPS

A National Park Service employee conducts core sampling.

Chronology of a core from the Big Sandy Creek bed was determined with Pb-210 radiometric dating (lead 210). Pb-210 radiometric dating is used to determine the accumulation rate of sediments in lakes and other bodies of water over a 100-200 year period since radiocarbon dating is unreliable within the last 200 years. Dates were assigned to depths and pollen samples were taken from approximately 1850 or 30 cm (12 inches) and 1925 or 28 cm (11 inches).

Results

Big Sandy Creek bed

A series of silt and gravel deposits from the Big Sandy Creek bed indicated the occurrence of periodic flood events. Sediments consisted of 1-3% organic silt and fine sand between 105 and 90 cm (41 to 35 inches). A coarse sand and gravel layer was documented at 32- 90 cm (13- 35 inches), which is likely a flood deposit over a small pool similar to the spring-fed pool that was sampled. It is possible the deposit is the result of multiple flooding events. Sands and gravels were not present in the upper 30 cm (12 inches) or deposits since 1850, which indicates sediment-depositing floods did not occur during this period. Organic content steadily increased to 10-11% at the surface.

Pollen analysis showed the vegetation from 1864 to be dominated by the goosefoot family, Chenopodiaceae, especially

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goosefoot or lambsquarters (*Chenopodium* spp.) and pigweed or amaranth (*Amaranthus* spp.), though further study is needed to support this analysis. Pollen from this family comprised approximately 64% of terrestrial pollen in prehistoric sediments, 50% around 1900, and 32% of present sediments. It is not clear if species were native or non-native. Sagebrush (*Artemesia* spp.) pollen increased from 2-4% prehistorically through around 1900 to approximately 10% at the present. The decline of the goosefoot family and increase in sagebrush pollen may be in response to changes in changes in fire frequency or agricultural disturbances. Grass (*Poaceae* spp.) pollen also increased since the prehistoric period and appears to have been fairly abundant in the mid-1800s.

Significant riparian tree pollen was not documented in the Sand Creek Massacre NHS. There is no evidence that willows (*Salix* spp.) were ever an important part of the ecosystem at the site and their current absence is consistent with the 1864 environment. Cottonwood (*Populus* sp.) was also absent from the core samples, though cottonwood pollen is not frequently preserved at sites dominated by cottonwoods. Little alder (*Alnus* spp.) pollen was found in samples from the 1900s and the low abundance suggests it is from a distant source and was transported fluvially (i.e., by stream or river) or by wind. Cattail (*Typha* spp.) pollen, a wetland species, appears after 1950, though the sedge family (Cyperaceae) was present in all levels, which suggests the continuous presence of at least moist soil.

Spring-fed pool

Samples from the spring-fed pool were not analyzed for radiometric dates, though the cores appear to have similar patterns and sedimentation rates to the Big Sandy Creek bed. Though gravel and sand layers were not present, large amounts of sand were documented suggesting depositions were caused by wind or formed in place. The percent of organic matter averaged 6% with a maximum of 11.6% and is comparable to the creek bed site. Pollen trends were similar to the Big Sandy Creek bed, though the decrease of *Chenopodium* spp. and *Amaranthus* spp. pollen towards the present was not as strong. *Chenopodium* spp. pollen was more common in the lower core and Amaranthus spp. pollen increased towards the surface. Sagebrush pollen also increased towards the surface, though grass pollen did not. Cattail pollen was rare and occurred near the surface, though sedges were present at all depths similar to the creek bed site.

Discussion and Conclusions

A thick layer of gravel and course sand occurs below the 1864 layer and may be associated with flooding deposition. The establishment of cottonwoods along the creek bed may also be associated with this flooding event. Bare gravel deposited by floods in the late 1800s collected organic material and gradually resulted in the current wetland vegetation.

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Poison milkweed (*Asclepias subverticillata*).

The vegetative history constructed from the pollen record supports park efforts to maintain grasslands associated with shrubs. Terrestrial pollen present in the cores suggests that the vegetation growing beyond the riparian zone has changed little over time, though further study is needed. The pollen record indicates the region was relatively barren and drier than current drought conditions. Some pine and juniper pollen was present though pine pollen is known to travel long distances and is likely from the Rocky Mountains--further study is needed to support this information. Since 1864, vegetation composition has shifted, which may be related to introduced species, changes in fire frequency, or agricultural disturbances.

Further research is needed to determine the desired future conditions of Sand Creek Massacre NHS and the use of this study as a guide for management should be limited.

Literature Cited

Mensing, S. 2007. Pollen analysis of sediment cores recovered from the Sand Creek Massacre National Historic Site. Report. Reno, NV: University of Nevada-Reno.

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