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Effects of Prairie Fire On Archeological Artifacts

Editor's Note: How do the caretakers of a "mixed site" (i.e. cultural and natural resources) decide on management techniques that speak in a balanced way to the complex needs of such a site? The following article describes how the stewards of one such NPS area are addressing this delicate and demanding task.

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The Knife River Indian Villages National Historic Site (KNRI) was established to preserve the historical and archeological resources associated with the Mandan/Hidatsa (Plains) Indians and early white exploration of the west. The park harbors evidence of several centuries of human activity. It is noted for its earthlodge village sites (Fig. 1) and evidence of early agricultural development on the northern great plains.

Lewis and Clark and other Euro-American explorers visited the location and recorded important observations on the life of the Plains Indians. Modern cultural resource studies have revealed a wealth of archeological artifacts and historical sites within the 520 ha area.

The park, a linear tract on both sides of the Knife River, is comprised of floodplain with a forest type known as "Missouri River bottomlands," dominated by green ash and boxelder. In addition, higher elevation terrace zones consist of native prairie sites and former cropland.

The park is charged with three major objectives:

(1) to recreate the 1804 historic scene depicting earthlodge villages,

(2) to protect park resources from human and natural impacts, and

(3) to maintain, where compatible, the natural habitat.

Currently, all fires are suppressed. However, historical evidence demonstrates that natural and artificial fires were regular events in the mixed grass prairie, perhaps occurring in 5 to 10-year frequencies. In recent years, fire suppression has resulted in a steady buildup of grassland and riparian fuel loads, colonization of disturbed soils by invading plant species, and natural vegetative growth.

This situation has increased the chances of an uncontrolled wildfire which potentially could endanger the park's cultural resources as well as surrounding private property. However, it was not considered possible to design and implement a fire management plan to achieve the desired ecological benefits without first determining the impacts of grassland fire on significant cultural resources. Although over 20 years of fire ecology research allows ecologists to predict impacts on biotic communities, the possible impacts of prescribed burning on archeological resources are not well known.

Prairie Fire Research

A team of ecologists and archeologists from the University of North Dakota conducted studies in 1988-89 to (1) determine potential impact of prescribed

burns at KNRI on its archeological resources, and (2) develop a recommended burning program for vegetation management at the park.

The impacts of prairie fires on 10 representative archeological materials were evaluated in 4 experimental plots established at the University of North Dakota's Oakville Prairie Natural History Area, a native mixed grass prairie near Grand Forks (Fig. 2). Two separate burns were accomplished in October and November, 1988, and the test artifact materials were collected and analyzed for a variety of changes - in color, weight, structure, and morphology.

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The experiments indicated that fire-related impacts to buried artifacts are negligible, but effects on surface-exposed artifacts will be significant, depending on artifact type and size. Virtually all surface artifacts will be scorched and smoke blackened, and the duration of this effect is unknown. Organic items, such as bone and antler remains, will be substantially altered by blackening and charring. Wood materials will be charred or consumed. Shell will be fractured or disintegrated. Many chipped stone items (flaking debris and tools) will be spalled (splintered or chipped) and pitted/fractured. Pottery will not be damaged structurally, but surface color may be altered. Small lead and glass items will be partially or fully fused or melted (Fig. 3). The structure of larger stone items such as natural rock, flint cobbles, and larger stone artifacts generally is not affected, although localized spalling may rarely occur.

The North Dakota data are unique. The majority of earlier reports on the effects of fire on artifacts have dealt with forested habitats, generally in the American Southwest or California. Few controlled studies have been conducted. The North Dakota study is one of the first to indicate that certain kinds of artifacts will be altered by fire in grassland settings, necessitating careful site management.

Prairie fires probably have little, if any impact on ceramic materials or cobble-sized rocks, a conclusion of significance to archeological interpretation. For example, fire-cracked rock in a grassland setting prob-

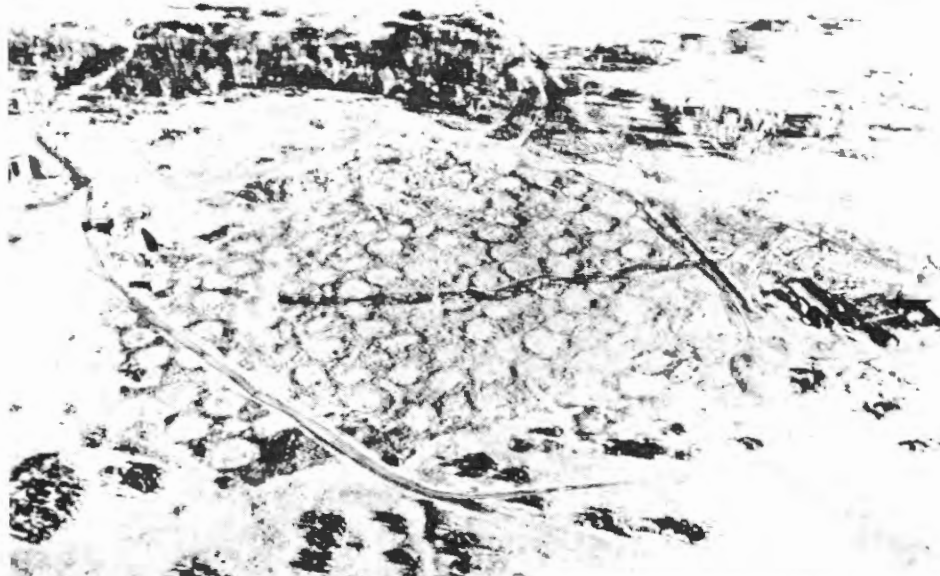


Figure 1. Aerial view of the Big Hidatsa earthlodge village. A light snow cover helps outline the earthlodge depressions and the modern road.

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ably can be interpreted as a product of cultural rather than natural processes.

In addition, while surface deposits of bone and chipped stone can be expected to undergo significant alteration, the degree of alteration in these items is apparently less severe than can be caused by fire-related cultural processes, such as material from an open fire hearth.

These data will help the archeologist interpret the significance of several classes of archeological materials.

Site Management

The KNRI study indicated a potential conflict between the objectives of vegetation management to recreate the original native prairie setting, and protection of surface archeological resources. However, prior surveys demonstrated that artifacts are not randomly distributed on the park, but are concentrated in their highest densities at three major historic period village sites. Consequently, a management plan was developed that provided for differering levels and timing of fire treatment, based on surface artifact density.

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Specific recommendations were that:

(1) Major KNRI village sites not be burned until a

thorough and professional collection of surface-visible artifacts is completed and preserved for future analysis;

(2) Archeological sites at KNRI with moderate artifact densities be surveyed to determine whether surface collection is warranted to mitigate fire damage; and

(3) Burning and other vegetation management programs may begin as soon as feasible on areas and portions of the park that have low artifact densities, archeological sites ineligible for the National Register of Historic Places, or sites not susceptible to fire damage.

In addition to prescribed burns, gradual logging, mowing, site-specific chemical treatment, and even

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grazing may be used to manipulate vegetation in several problem areas at KNRI that cannot easily be burned.

However, some management practices may be difficult to implement on such a small area without creating additional disturbance to natural vegetation (e.g. fence construction, trampling by bison and horses). Consequently the prudent development of a prescribed grassland burning program still remains the most feasible tool to attain the management goals of the park.

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Figure 2. Test burn conducted at the University of North Dakota's Oakville Prairie.

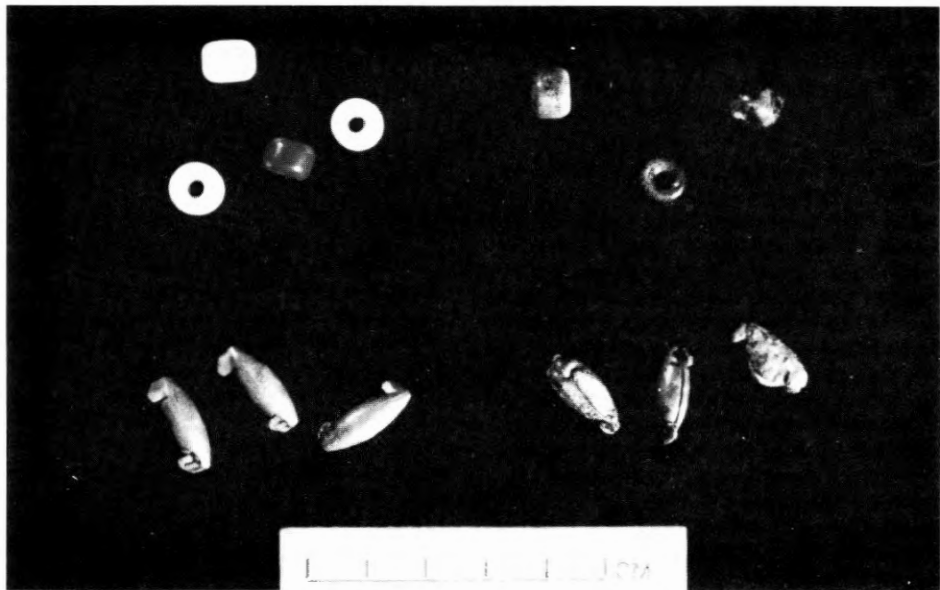


Figure 3. Effects of prairie fire on test artifacts: Unburned glass beads and lead sinkers on left, fire damaged samples are shown on the right.