

Effects of Fire on Cultural Resources¹

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Abstract.—Over the past 10 years, considerable information has been gathered on the effects of fire and fire suppression activities on cultural resources in the Southwest. A review of this information is presented, and recommendations are offered on how damage to cultural resources can be minimized through integration of cultural resource considerations into fire management activities.

Fire managers today are involved in developing programs to accomplish objectives far more complex and difficult than ever before. In meeting these objectives they must also ensure the protection of many very significant resource values. One important challenge and obligation for fire managers, particularly in the Southwest, is to identify, understand, and protect cultural resources. This paper is intended to organize for the fire manager much of the current information on the importance of cultural resources and how fire affects them. Based on this, management considerations and recommendations are offered on how to protect these irreplaceable values.

CULTURAL RESOURCES AND WHY WE PROTECT THEM

In the broadest sense, cultural resources are the surviving traces of past peoples and cultures. Cultural resources include artifacts, such as spear points and pieces of pottery, as

well as the remains of pit houses, cliff dwellings and log cabins. Other evidence includes rock art, fire hearths, stone quarries, trash deposits, and remnants of fields or canal systems. All of these remains hold clues to past ways of life. Over time their study will help us better understand the course of human events and perhaps why societies succeed or fail.

Well over 95% of the story of human life in the Southwest took place before the arrival of Europeans. This immense span of time, before the advent of written records, is called prehistory. It encompasses more than ten thousand years of cultural adaptation and change, from the PaleoIndian mammoth hunters of the closing Ice Age, to the beginnings of agriculture and settled life, to the architectural wonders of Chaco Canyon. All we can hope to learn about these prehistoric people and their struggle to survive is contained in the archeological record they left behind.

With the arrival of Coronado in 1540, the historic period begins. Cultural resources from this period document the settlement and development of the Southwest under Spanish, Mexican, and finally American rule. Remains include missions, ranches, forts, homesteads, mines and logging camps. Also included are historic period pueblos and other Native American sites. Cultural resources of the historic period can provide a wealth of information on local history and daily life, informa-

tion not always recorded in the books and journals of the day.

There is little doubt that the Southwest contains the nation's most spectacular and best preserved record of the past. Many sites, for example fortifications and large pueblo ruins, are easy to recognize. Others, like pit house depressions and artifact scatters are harder to detect. The importance of cultural resources lies not just in the artifacts they contain, but in the relationships between the artifacts and features present at a site, both above and below the ground. It is through the study of these relationships that archeologists can determine the sequence of events at a site and the activities and ways of life represented. In addition to scientific values, cultural resources may hold special social or religious significance for living people, for example Native American ancestral sites and shrines. Finally, cultural resources have educational and interpretive value because they are the tangible core of the nation's cultural heritage. More and more Americans are becoming interested in the past and are seeking opportunities to visit and learn about archeological and historic sites.

Although many cultural resources in the Southwest have survived for hundreds or thousands of years, they can be wiped out in a moment by heavy equipment and construction activities. In that sense, cultural resources are extremely fragile. They

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are also non-renewable. Once a site is destroyed, the information it contained is lost forever. Each time this happens, our chances of eventually understanding a particular culture or time period are diminished.

Because of concern over the loss of cultural resources due to development activities and looting, Congress has passed a number of laws to protect sites on public lands. The Antiquities Act of 1906 and the much stronger Archaeological Resources Protection Act of 1979 prohibit the unauthorized excavation or removal of archeological resources from Federal lands. The National Historic Preservation Act, passed in 1966, directs Federal agencies to inventory, evaluate, and protect cultural resources under their jurisdiction. It also directs agencies to take into account the effects of their activities on cultural resources in order to ensure that important sites are not inadvertently destroyed. Today, consideration of cultural resources, including field surveys when information is inadequate, has become a routine part of the project planning process in agencies like the Forest Service, Park Service, and the Bureau of Land Management. Steps have also been taken to begin integrating cultural resource considerations into fire management activities.

EFFECTS OF FIRE AND FIRE MANAGEMENT ACTIVITIES ON CULTURAL RESOURCES

Only within the past 10 years or so has serious consideration been given to assessing the effects of fire on cultural resources in the Southwest. Most of our current information is derived from observations and studies carried out in the aftermath of wildfires. Although plans have been developed to test the effects of fire on various types of cultural remains (Kelly and Mayberry 1979; Jones and Euler 1986), little has been published on the results of such experiments.

The fires in the Southwest for which cultural resource information is available include the following:

1. **Little Moccasin Canyon Fire, Mesa Verde National Park, 1972.** This fire burned 1,080 acres within the Park. Pinyon, juniper, and oak brush were the primary fuels. Following the fire, a cursory inspection of several sites revealed considerable damage to masonry pueblos and surface ceramics (Switzer 1974).
 2. **Dutton Point Fire, Grand Canyon National Park, 1976.** This fire burned 321 acres. The vegetation type was primarily ponderosa pine and Gambel oak with a sage understory. An intensive survey following the fire documented effects on eight small masonry sites (Jones and Euler 1986).
 3. **La Mesa Fire, Bandelier National Monument, 1977.** This fire burned over 15,000 acres within Bandelier National Monument, the Santa Fe National Forest, and Department of Energy lands. The area is characterized by long finger-like mesas and steep canyons, with ponderosa pine and pinyon-juniper as the dominant vegetation types. This was the first fire in which archeologists were called in to help crews avoid cultural resources during fire line construction. Following the fire a survey was conducted of all hand lines, dozer lines, heliports, and other areas of disturbance (Traylor et al. 1979). One hundred sites, mostly small, masonry pueblos, were recorded; of these, 58 were burned to some degree. Test excavations were also conducted at four sites to assess the effects of the fire on sub-surface materials. This is the most comprehensive study available on the effects of fire on cultural resources.
 4. **Radio Fire, Coconino National Forest, 1977.** A total of 4,600 acres were burned on the slopes and summit of Mt. Elden. A variety of vegetation types were involved including ponderosa pine, ponderosa pine-chaparral, and pinyon-juniper. Following the fire, archeologists surveyed the entire burn area. Sixty-five sites were recorded, primarily small masonry pueblos (Pilles 1984). In addition, four sites were tested.
 5. **Jacket Fire, Coconino National Forest, 1977.** Approximately 290 acres of pinyon-juniper woodland were burned. A portion of the burned area was surveyed, and eight small masonry pueblos and four artifact scatters were recorded (Pilles 1984).
 6. **Wallace Fire, Coconino National Forest, 1979.** A total of 645 acres of dense ponderosa thickets were burned. Subsequent survey identified 10 small masonry pueblos, 2 pit houses sites, and two artifact scatters (Pilles 1984).
- Two major types of damage to cultural resources have been identified in these studies: damage caused by the direct and indirect effects of fire itself; and damage caused by fire suppression and related activities.

Effects of Fire on Cultural Resources

Anywhere from 67% to 90% of the cultural resources within the above

fires were burned to some extent. Three major factors are thought to be involved in determining the nature and extent of fire damage to cultural resources (Traylor et al. 1979:130): 1) fire intensity; 2) duration of heat; and 3) heat penetration into the soil. While many variables, including wind, humidity, and topography, influence a fire's intensity, fuel load is thought to be the most important determinant. Due to years of fire



Figure 1—Wooden structures, like this administrative site no longer in use, are highly susceptible to destruction by wildfire.



Figure 2—Prehistoric ruins, including masonry architecture, can be damaged by fire as well as by fire suppression activities.

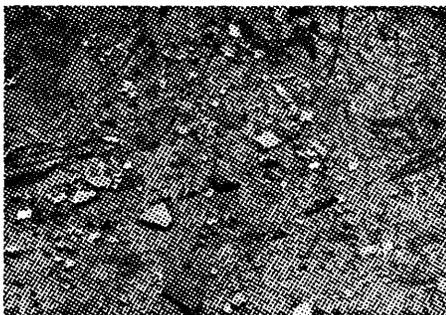


Figure 3—Artifacts on the surface, like this ceramic sherd scatter, can be damaged by fire if temperatures are hot enough.

suppression, fuel loads in many areas of the Southwest are probably much heavier than ever before. Likewise, the potential threat to cultural resources may be far greater than in the past.

In the La Mesa Fire, the severity of burning at a site seemed to correspond closely to the density of the fuel load adjacent to and on the site (Traylor et al. 1979:131,134). Although temperatures were not recorded, it was estimated that temperatures of 100-300 degrees Celsius probably characterized lightly-burned grassy areas. Temperatures in the 300-500° range were estimated for fires in the pinyon-juniper vegetation type, and temperatures of 800°C or more may have been reached in ponderosa pine stands.

Direct Effects

The following summarizes what we now know about how fires directly affect various types of cultural materials. Because temperature and pre-fire data are not available for the fires discussed above, comparisons and generalizations must remain fairly limited.

Wood.—Obviously, wooden structures such as frame building and log cabins (fig. 1) can be destroyed by fire. Exposed wooden beams in pueblo ruins are also susceptible to damage or destruction. In both the La Mesa and Radio Fires, remains of historic buildings were destroyed.

Building stones and grinding stones.—Stone masonry (fig. 2) can be damaged by fire. Discoloration, severe cracking, spalling, and disintegration of sandstone building stones occurred in the Little Moccasin Canyon Fire at Mesa Verde. The same was true of tuff masonry in the La Mesa Fire at Bandelier. Effects undoubtedly vary with the condition and type of material. On the Jacket Fire, sandstone grinding stones were frequently cracked, whereas those

made of basalt were only fire blackened (Pilles:1984:11). Subsurface masonry in the La Mesa Fire was generally unaffected.

Lithic artifacts and raw materials.—While breaking and spalling of chert and obsidian artifacts can occur, effects have generally been limited to discoloration and development of a dull, dark patina. In areas of intense heat on the Radio Fire, some obsidian artifacts were partially melted. In areas where obsidian sources are present, thermal fracturing can obscure evidence of prehistoric quarrying activity (Pilles 1984:11).

Ceramics.—Ceramic remains (fig. 3) can be either carbonized or oxidized by fire resulting in smoke discoloration and changes in paste characteristics. In the La Mesa Fire, surface designs were burned off or obliterated in some cases, making identification impossible. In the Little Moccasin Canyon Fire, spalling and separation along coil lines were observed. Presence of a shiny black residue, possibly pine pitch, has been noted in several fires.

Bone, plant remains.—Organic materials, like bone, seeds, fibers, etc., can be charred or destroyed, even at fairly low temperatures.

Pollen.—Surface pollen can be destroyed at temperatures above 300°C (Traylor et al. 1979:155).

Samples for dating.—Analysis from test excavations following the La Mesa Fire indicated that fire can affect thermoluminescence and obsidian hydration dates obtained from surface artifacts. Results of carbon-14 tests were inconclusive. If wooden beams are destroyed, opportunities for obtaining tree ring dates will be lost.

Rock art.—Although no rock art sites were present in the fires studied thus far, petroglyphs and pictographs would be especially vulnerable to damage by scorching or spalling.

Indirect Effects

Cultural resources also can be damaged by the indirect effects of fire. Factors that have been identified include:

Erosion.—Erosion often occurs in the aftermath of fires due to destruction of vegetation cover and loss of organic material in the soil. On the Radio Fire, run-off following the fire cut gullies up to 10 feet deep in some places (Pilles 1984:11).

Falling trees.—Trees killed by fire eventually are uprooted. This may result in structural damage and artifact displacement.

In summary, available information indicates that wood and other organic materials are most susceptible to destruction by fire, although other remains on the surface may be severely damaged. The general opinion is that relatively cool fires, below 300 degrees Celsius, probably will not cause permanent damage to most inorganic materials. Also, excavation data currently indicate that buried cultural materials in deposits 5 centimeters or more below the surface will not be harmed by most fires (Traylor et al. 1979:148, Pilles 1984:12). One exception would be burning roots, where temperatures as high as 1500 degrees Celsius may occur (Traylor et al. 1979:132)

Effects of Fire Management Activities on Cultural Resources

In most of the fires discussed above, the most severe impacts to cultural resources occurred, not as a result of the fire itself, but as a result of fire suppression and rehabilitation activities. Three major types of damage have been identified (Traylor et al. 1979:111): 1) destruction of architecture and associated information; 2) displacement of artifacts; and 3) destruction of artifacts. Much of the following information is derived from observations on the La Mesa Fire and other fires in the Southwest.

Direct Effects

Fire line and helispot construction.—Fire suppression activities that involve use of heavy equipment pose the greatest threat to cultural resources. Dozer blades and tracks can cause severe damage in and around sites by cutting deep into soils, destroying architecture, and displacing surface materials. On the La Mesa Fire, only two sites were impacted by initial dozer line construction which was monitored by archeologists; however, when these lines were later widened, 15 sites previously avoided were severely damaged. Ten sites were damaged by dozer line construction on the Radio Fire. Hand line and helispot construction, especially at night, can result in exposure of subsurface deposits and may potentially affect structural sites by loading them with discarded vegetation.

Fire retardants.—Some damage to exposed walls resulting from retardant drops by air tankers and helicopters has been observed. Corrosive effects on cultural materials have yet to be analyzed.

Mop-up activities.—During mop-up, damage may result from any of the following activities: engines and other vehicles moving around inside the burn; moving hose; digging roots and stumps in or around a site; and snag felling operations.

Rehabilitation activities.—Activities associated with fire rehabilitation such as water bar construction and installation, berm leveling, equipment used for reseeding, planting, salvage logging and fuelwood collection could have damaging consequences to sites and materials.

Indirect Effects

Surface collecting by fire personnel has occurred on a number of fires; however, once informed of the importance of leaving artifacts in place, crews have been very coopera-

tive. Wildfires can present management with follow-up resource protection problems due to the effects of exposing previously unknown or inaccessible cultural sites and materials to theft or vandalism.

Prescribed Fires

In the case of prescribed fire activities, many similar effects can occur. Managers must be aware that burn plot preparation work such as line construction, porta-tank and hoselay setup, snag felling, pre-treatment of fuels with chemicals, mechanical fuel reduction, vehicle and/or packstock movement in and around the area, and mop-up and patrol operations can affect cultural sites or materials.

MANAGEMENT IMPLICATIONS AND RECOMMENDATIONS

Training on the nature and protection of cultural resources has been included in interagency fire management training programs for a number of years, and general awareness of the need to consider cultural resource values has increased significantly. Integration of cultural resource considerations into fire management policies and plans probably varies by agency. National Park Service fire policies (NPS-18) address the need to reintroduce fire back into many largely fire-dependent ecosystems, consistent with the protection of the religious rights of Native Americans where applicable, and cultural sites with associated materials. Especially in Southwestern parks, fire management plans must contain guidelines and constraints on fire suppression and fire use, along with procedures to conduct post-fire salvage of artifacts as part of rehabilitation.

In the Southwestern Region of the Forest Service, cultural resource considerations are addressed in some,

but not all, National Forest fire management action plans. Archeologists or other personnel with cultural resources training are usually involved in monitoring use of heavy equipment on fires. Cultural resources are given routine consideration in prescribed fire planning and in rehabilitation activities.

The following recommendations are intended to provide the manager with a checklist of considerations in developing and/or improving their overall program.

Planning and Preparation

1. Obtain baseline cultural resource inventory information, the product being a thematic map or overlay. (Note: Site location information is protected under the Archaeological Resources Protection Act; therefore, managers need to provide for security of this data.)
2. Consult with the archeologist or historian on the relative significance of cultural resources involved (for example, National Register status or potential).
3. Identify and map cultural values at risk in consultation with the archeologist or historian.
4. List how fire affects the cultural materials listed.
5. Consider ways to reduce the risks to highly vulnerable sites by reducing fuel loads, constructing fire breaks, etc.
6. Outline any Native American concerns in consultation (to determine times, seasons to restrict burning, etc.).
7. Identify and present training in cultural site identification,

protection measures, etc. to fire personnel.

8. Train and fire-qualify local archeologist(s) to line locator, dozer supervisor, resource advisor, or other jobs as needed by the manager.
9. Identify and classify fire management zones or units based on objectives, fuel type, and values at risk.
10. In consultation with archeologists, prepare a section on cultural resource protection steps in the area fire management plan.
11. Prepare or update the Line Officer's Briefing Statement with a section on specific constraints for the incoming Incident Commander. Preassign a qualified archeologist to present this section to the incident management team briefing.

Minimizing Impacts of Wildfires

1. Include consideration of cultural resources in determining appropriate suppression response, i.e. confinement, containment, or control strategy.
2. Consider restricting the use of heavy equipment in culturally sensitive areas.
3. If heavy equipment is used, assign one or more fire-qualified archeologists to flag sites and other cultural features during suppression through mop-up and rehabilitation. (Identify a standard color and method for site marking and assure that all personnel know how cultural resources will be marked.)

4. Make available a cultural resource specialist to assist with shift briefings for overhead, especially crew and felling supervisors, strike team leaders (dozer, engine and crew), and field observers.
5. Plans for all operational periods should contain clear and specific written instructions regarding line construction and other suppression activities as necessary around cultural values.

Considerations in Prescribed Fires

1. Prescribed burn plans should be designed with a section for cultural clearances, including a signature line for the area archeologist as appropriate.
2. Obtain an on-site inspection and clearance of the burn area.
3. Become familiar with temperatures and durations of the flaming front; know the type and loading of the fuels complex and how they may affect specific cultural materials.
4. Consider the use of chemical foam applications on sites; consult the area archeologist and manufacturer for details and effects.
5. Consider physical removal or reduction of fuels in and around sites.
6. Thoroughly brief all burn personnel on identification and proper protection of cultural features.
7. Consider using archeologist(s) to physically remove

and document artifactual materials from a burn site; this is recommended as a last resort.

8. Include a section on cultural resource protection and clearances in natural prescribed fire plans.

Documentation in Cultural Resource Records

1. Consider incorporating information on fuel build-up and fire vulnerability in cultural resource site record forms or data bases.
2. Following a fire, update site records to document the occurrence of the fire and observed effects on cultural materials.

Research Needs

Far more research is needed on the effects of fire on cultural resources and on effective techniques to avoid or mitigate damage due to fire.

CONCLUSIONS

This paper has attempted to summarize for the manager the nature of cultural resources in the Southwest and how fires might affect them. The effects of fire management activities, including suppression and related activities, have also been addressed, and some ways in which the manager can minimize damage have been presented. The authors hope this information represents just the beginning of a progressively more heightened awareness and commitment to protect these priceless cultural resources.

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