National Park Service
U.S. Department of Interior
Bandelier National Monument
New Mexico

BANDELIER
NATIONAL MONUMENT

Draft Ecological Restoration Plan
and
Environmental Impact Statement

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Bandelier National Monument

Los Alamos and Sandoval Counties, New Mexico

Fire has significantly shaped pre- European vegetation in Bandelier National Monument. Historic grazing beginning around 1880, followed by active fire suppression several decades later, effectively removed fire disturbance from many areas. Over one hundred years without fire resulted in major changes to plant communities (expansion of piñon- juniper woodlands at lower elevations; ponderosa pine and mixed conifer forests grew thicker at higher elevations). This increased the potential for crown fires in upper elevation ponderosa and mixed conifer forests and decreased herbaceous understory and fine fuels necessary to carry frequent, low intensity, surface fires in lower elevation ponderosa pine savanna and grasslands. Consequently, fire sensitive piñon and juniper invaded these lower elevation systems, eventually suppressing understory growth and enhancing widespread mortality of the ponderosa overstory during major droughts. The loss of herbaceous understory in these former grasslands and pine savannas created vast expanses of bare soil vulnerable to runoff and erosion throughout much of Bandelier's woodland. Accelerated soil erosion poses a significant threat to prehistoric cultural resources which can be washed away during thunderstorm events. Unchecked, this erosion will compromise the integrity of the unique archeological resources and values for which Bandelier was originally established.

This *Draft Ecological Restoration Plan and Environmental Impact Statement* (DEIS) evaluates two options for reversing the problems identified above, and includes the No Action alternative as a baseline for present management conditions. The specific goals for taking action include: re- establishing healthy, sustainable, grass dominated plant communities within the piñon- juniper woodland, which will help stabilize soils and cultural resources. Alternative B is the monument's preferred alternative. Alternative C also stabilizes soils and cultural resources and would promote healthy sustainable plant communities. Alternative C, however, would take up to 20 years to complete.

The National Park Services will accept comments on the DEIS from the public for 60 days from the date the Environmental Protection Agency publishes the Notice of Availability in the Federal Register. Mail comments to the name and address below or post online at http://parkplanning.nps.gov/. Our practice is to make comments available for public review. Before including your address, phone number, e- mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. Submissions from organizations or

businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will always be made available for public review in their entirety.

Address written comments to: Ecological Restoration DEIS; ATTN: Darlene M. Koontz, Superintendent, Bandelier National Monument, 15 Entrance Road, Los Alamos, NM 87544.

When using the website (http://parkplanning.nps.gov/) for commenting, click on the link for "Plans/Documents Open for Comment," select the title of this document, and follow instructions for submitting electronic comments. Problems with the website should be directed to John Mack, Chief of Resource Management, at 505- 672- 3861, ext. 540.

EXECUTIVE SUMMARY

INTRODUCTION

The Bandelier National Monument *Draft Ecological Restoration Plan and Environmental Impact Statement* (EIS) establishes goals, objectives, and specific implementation actions needed to restore approximately 4,000 acres of degraded piñon- juniper woodland (woodland) to a more naturally functioning state over the next 15- 20 years. This EIS presents two alternatives for the restoration of piñon-juniper woodland, as well as a No Action alternative. Alternative B is the monument's preferred alternative at this time. The plan will determine both a policy direction for management of the park's woodland, as well as a process for integrating the results of monitoring and research into future management.

Restoration actions are expected to mitigate the accelerated soil erosion that threatens over 90% of archeological sites located within the woodland. Mitigating the erosion would also help in restoring understory vegetation and returning a more natural fire cycle to woodland at the monument. Management actions would be focused along mesa tops between 6,000 and 7,000 feet elevation where soil erosion issues are most critical. All 4,000 acres proposed for management actions are located in designated wilderness.

BACKGROUND

Bandelier National Monument (Bandelier, monument, park) is a unit of federal land administered by the National Park Service (NPS) and is located in north- central New Mexico approximately 10 miles southwest of Los Alamos and 50 miles northwest of Santa Fe, New Mexico. Bandelier is comprised of approximately 33,727 acres, of which 23,267 acres are designated wilderness.

In addition to several thousand cultural resources, Bandelier National Monument also contains diverse natural resources. These include a variety of vegetative communities such as juniper grassland communities, piñon- juniper woodland, ponderosa pine forests, mixed conifer forests, and mountain meadows. Associated wildlife includes elk, mule deer, black bear, mountain lion, and numerous bird and reptile species.

Ethnographic, scientific and educational values at Bandelier are articulated in the 1977 Bandelier *Master Plan* (NPS 1977), that also describes management of the monument and the preservation of the park's natural setting. The *Master Plan* was updated in 1990 via a *Statement for Management*, (NPS 1990).

Bandelier recently updated their goal statements for 2005- 2010, some of which address the protection of the monument's natural and cultural resources. Among others, these include:

Reducing soil erosion and promoting vegetative conditions that create a natural fire regime and protect cultural resource integrity within the landscape.

Maintaining prehistoric and historic resources in current or better condition to preserve cultural integrity and information potential.

SIGNIFICANCE OF BANDELIER NATIONAL MONUMENT

Bandelier was designated a National Monument in 1916 by President Wilson (Presidential Proclamation No. 1322: 39 Stat. 1794), largely because of its "tremendous ethnographic, scientific and educational" value. Bandelier National Monument contains approximately 2,900 recorded archeological sites ranging from the Paleoindian period (10,000 years ago) to the historic period. The monument includes ancient hunting camps, "cavate" structures (unique to the Bandelier area), 20 to 300+- room pueblos, small farming hamlets, and the remains of historic corrals and log cabins. In Frijoles Canyon, Bandelier has one of the largest collections of buildings constructed by the Civilian Conservation Corps (CCC) between 1933 and 1940. The Frijoles area was designated a National Historic Landmark in 1987 commemorating the accomplishments of the CCC.

PURPOSE AND NEED FOR ACTION

The purpose of the *Ecological Restoration Plan* is to re- establish healthy, sustainable vegetative conditions within the piñon- juniper woodland and to mitigate accelerated soil erosion that threatens the cultural resources. Protection of these cultural resources is identified in Bandelier National Monument's enabling legislation and this need is further explained below.

Prior to creation of the monument, historic land use, particularly grazing, resulted in changes in ecosystem processes that continue to adversely affect both natural and cultural resources inside Bandelier. The most detrimental of these changes is the accelerated rate of soil erosion and associated loss of archeological resources ongoing within the piñon- juniper woodland.

Continued rapid soil loss in already degraded piñon- juniper communities threatens the integrity of thousands of prehistoric cultural sites, which the monument was specifically set aside to preserve. Over 75% of the known prehistoric sites at Bandelier occur within piñon- juniper communities, and nearly 90% of these have experienced adverse effects related to erosion (Herhahn 2003; Powers and Orcutt 1999, unpublished data). Without management intervention to actively restore the herbaceous understory and stabilize soils in degraded woodland communities, an estimated 1,900 archeological sites are considered at risk of damage or loss from erosion (Herhahn 2003).

Plan Objectives

Objectives are more specific statements of the purpose of the plan, and they must be met to a large degree for the plan to be considered successful in resolving the needs for action identified above. The following are the objectives for Bandelier's *Ecological Restoration Plan*:

- Increase cover of native, perennial, herbaceous plants within degraded portions of the piñon- juniper woodland in order to reduce soil erosion, runoff, and loss of cultural resource integrity.
- Create conditions within degraded portions of the pion- juniper woodland that will support a surface fire regime within the natural range of variability (for example, sufficient to maintain restored grass- dominated communities).
- Manage degraded portions of the piñon- juniper community using information gained through an active program of research and monitoring.
- Build support for, and actively share information about, restoration actions and related research and monitoring efforts with government agencies, pueblos, and communities.

ALTERNATIVES

A combination of research results, internal (NPS) scoping and information obtained through two sets of public scoping sessions was used to create the range of reasonable alternatives. In deciding whether to carry alternatives forward for analysis, the criterion of reasonableness (as defined in the Council on Environmental Quality NEPA regulations, 40 CFR 1500 et seq.) was used as a guide. Reasonableness includes technical and economic feasibility, as well as "common sense." In this case, common sense included the application of research findings from studies and test plots at Bandelier and the scientific literature which have shown that successful treatment of the piñon- juniper woodland can be achieved through the cutting of selected trees and lop and scatter of their branches. Other techniques were either infeasible or would only be possible on a very small scale (Jacobs and Gatewood 1999). Therefore, only the thinning and slash mulch treatment is considered a reasonable approach for Bandelier, and it is the treatment method analyzed in both action alternatives.

Alternative A—No Action

Alternative A (No Action) is a summary of the existing management of resources. The No Action alternative serves as a baseline for comparison of the impacts of Alternatives B and C.

Current management of most resources in the piñon- juniper woodland at Bandelier is limited, with no active management of soils, vegetation, or wildlife beyond current research and monitoring activities. On- going research on soils and vegetation, as well as that for wildlife and special status species would continue in piñon- juniper

woodland under this alternative. Current cultural resources research (e.g., current condition assessments/monitoring, recording of insufficiently documented sites, inventory of unsurveyed areas, resource stabilization, limited data recovery) would continue as funding permitted. Wildland and prescribed fire, as well as fire suppression, are allowed in piñon- juniper woodland though the likelihood of any of these occurring is low due to the sparse fuel conditions. Removal of trees considered threats to the integrity of archeological sites is allowed.

Wilderness would continue to be managed and maintained to provide a primitive and natural experience. Front and backcountry patrols would continue to emphasize visitor and employee safety, resource protection, fire prevention, and minor maintenance of trails.

Actions Common to all Action Alternatives

The action alternatives have several features in common, including:

- **Annual treatment plans**. Although this plan and EIS discuss as many of the site specific variables as are known at this time, they do discuss actions and impacts across the woodland and are considered "programmatic." Therefore, each year the monument staff will prepare a site specific action plan for treating acreage. These annual site- specific treatment plans will be consistent with the Ecological Restoration Plan and EIS, and will flesh out the details of treatment within particular sub- basins to maximize the chances of success, minimize logistical problems, and avoid site specific impacts to cultural and natural resources. A minimum requirements analysis to re- evaluate whether intervention in these particular wilderness sites is needed and if so, to determine the minimum tool for conducting that intervention will be prepared to accompany the annual treatment plan.
- **Seasonal work restrictions**. No restoration work between June and August would occur so that impacts to monument visitors are minimized.
- **Wildlife mitigation (Special Status Species habitat).** Where appropriate, the use of hand tools, use of biological monitors, seasonal restriction for motorized activities, and or buffers would be used to minimize or mitigate impacts to special status wildlife species.
- **Archeological resources**. A variety of measures to protect archeological resources from impacts as a result of restoration activities including camp site location criteria, daily presence of archeologist in work areas, removal of dead trees and some live trees from structural elements of sites, and consultation with affiliated Pueblo tribes regarding sacred sites would be required.
- **Visitor experience**. Visitors would be informed of locations of on- going restoration work so that they can avoid these areas should they choose.
- **Wilderness**. Because all treatment would occur in designated wilderness, management actions in the piñon- juniper woodland would be subject to the minimum requirement analysis concept at the programmatic and project level to determine the appropriateness of intervention and of the use of hand and/or motorized tools and equipment.

- **Research and monitoring**. Controls would be established to assess ongoing erosion potential in other areas of the monument for comparison to treated areas. Following treatment, an area would be monitored annually, and the information used to modify future work as needed. Resources monitored would include soil and water, vegetation, wildlife, and cultural resources.
- **Education and consultation**. Field tours, public presentations of post- treatment response, articles in the park newsletter and local newspapers, annual reports on restoration efforts, and postings on the park and NPS websites are all means the monument anticipates using to educate and consult with interested and affected members of the public.

Alternative B—Operational Priority

Alternative B would maximize the efficiency of treatment and minimize impacts and the time (five years) to implement treatment. Geography and logistics would determine the location and timing of treatment. Crews would complete restoration in a wave- like fashion by working systematically across the monument from one end to the other (southwest to northeast). This alternative would require sequential funding for each season of treatment.

The piñon- juniper woodland would be divided into approximately equal combinations of sub- basins (approximately 800 acres) across the landscape. Field seasons would run generally from September to May. Up to two crews of six to ten personnel would be treating an estimated 50 acres per month, per crew. Locations of up to eight, one- acre backcountry camps would be based on a set of criteria related to proximity to work site and protection of natural/cultural resources. Establishment and supply of some camps would require helicopters or pack strings of four to six mules. Restricting helicopter flight routes and seasons of use would minimize adverse impacts to sensitive species. As work moves closer to monument headquarters, the use of pack strings would be emphasized and helicopter use may be eliminated.

Alternative C—Phased Approach

Alternative C treats sub- basins containing the highest priority cultural resource sites within piñon- juniper woodland. Specific cultural resource criteria which were weighted and averaged to determine a sub- basin's priority for treatment. These criteria included the significance of a cultural resource and the level of threat of its loss (e.g., imminent, permanent loss or less imminent).

One crew of up to six to ten people each would be working at any given time. This alternative treats prioritized sub- basins, many of which may be located far from the next highest sub- basin priority. With a single crew treating approximately 200- 300 acres/year, treatment of the 4,000 acre woodland is estimated to take up to 20 years.

Because of the increased demands caused by moving to prioritized sub- basins, one crew and a September to March field season was assumed for Alternative C for

purposed of analysis. As in Alternative B, camps would be selected based on environmental and logistic criteria.

Environmentally Preferred Alternative

In the Council on Environmental Quality's (CEQ) implementing regulations, agencies are required to evaluate how each analyzed alternative meets certain policy statements set forth in Section 101(b) of the National Environmental Policy Act (NEPA) (40 CFR 1502.2d). The environmentally preferred alternative is defined as the alternative(s) that best meets the these criteria. The CEQ has also indicated in its regulations (1981 Forty Most Asked Questions Concerning CEQ's NEPA regulations) that the environmentally preferred alternative is the one that:

> … causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources.

Using both the CEQ's interpretations of the Section 101 criteria and the alternatives impact information provided in this document, it was determined that Alternative B (Operational Priority) is the environmentally preferred alternative. This is primarily due to its much shorter time frame and much quicker restoration. This means impacts would generally be less severe to cultural and natural resources over the course of treatment at the monument. In addition, the soil erosion that currently threatens vegetation and cultural resources would be slowed and the resources themselves protected to the greatest possible degree.

Preferred Alternative

Alternative B is also the monument's preferred alternative (e.g. the one it is most likely to select for implementation) for the reasons identified above. This option would slow erosion as quickly as possible, thereby preventing loss or degradation of additional cultural resources. Slowing erosion would also help protect and restore important natural resources, including the soils and more natural park vegetation. Eventually, treatment would allow the return of cooler ground fires, which would help in restoring vegetative structure and composition more typical of a sustainable piñon- juniper woodland and grassland.

Alternatives Dismissed From Further Analysis

The following alternatives were considered but not analyzed in detail as they were considered impractical or did not meet the purpose, need and objectives of the plan.

- Use of hand tools only.
- Widespread reseeding of native grasses to jump start regeneration in the piñon-juniper and hand scarifying to establish grasses.
- Reestablishment of beaver populations in Upper Frijoles Canyon.
- Moving the boundary of the park to include Capulin and Alamo watersheds.

- Hand removal of exotic vegetation.
- Allow drought and bark beetles to kill off trees instead of using human intervention.

Use only prescribed fire instead of motorized and hand tools.

ENVIRONMENTAL CONSEQUENCES

The order in which impact topics are addressed in this EIS is intentional, and sets out to progressively illustrate conditions that have led to the need for restoration described above. For example, for readers to understand why cultural resources at stake, they must first know about the human disturbances to vegetation and the resulting soil erosion that occurred. Therefore, vegetation and soils precede the discussion of cultural resources.

Vegetation

In Bandelier National Monument, the piñon- juniper woodland is dominated by one- seed juniper at lower elevations, and until recent drought mortality, by increasing dominance of Colorado piñon pine at higher elevations. Normally, the herbaceous understory is comprised principally of native, warm season grasses, with cool season grasses found beneath the protective canopy of trees.

The piñon- juniper dominated woodland occupies about 10,000 acres of Bandelier National Monument. Of that, about 4,000 acres in the monument are considered degraded and potentially responsive to treatment. Most of the degraded woodlands are found on low gradient, mesa top settings between 6,000 and 7,000 feet in elevation, and are where the soil erosion issues and associated impacts to cultural resources are most critical.

Although piñon and juniper are native to Bandelier, the ecology of the woodland and the distribution of these species have changed during the last century and have become overly abundant, increasing in both profusion and range. Evidence suggests the trees were common on hillsides and rocky slopes, but did not regularly occur in lower gradient, deeper soil settings such as the mesa tops in Bandelier (Albert, et al. 2004). In addition, the extent of the understory of grasses, herbs, and forbs that characterized much of the landscape decades ago has been greatly reduced or eliminated, primarily as a result of intensive historic livestock grazing.

The loss of understory, as well as deliberate fire suppression, has altered the important ecosystem processes of fire frequency and intensity. Frequent lower intensity surface fires at intervals of 15- 30 years generally do not take place in the monument's piñon- juniper woodland. Relatively “cool” lightning fires traditionally had reinvigorated annual and perennial grasses and forbs, while killing back piñon and juniper seedlings and restricting them to more “fireproof” rocky outcrops or shallow soil sites. The closing of the canopy with piñon and juniper trees in areas that had traditionally been more open and savanna- like furthered the loss of herbaceous understory plants and contributed to accelerated soil erosion and runoff.

If current management continues unchanged, as under the No Action alternative, the density and range of woodland tree cover would increase. This longer- term expansion would result in moderate decreases in both cover and diversity of perennial grasses, forbs, and shrubs. These ongoing losses in understory (cover and diversity) and associated negative effects on accelerated soil erosion would continue to yield major, long- term, adverse impacts to grass dominated vegetation communities within the woodland at Bandelier and may increase the potential for severe widespread crown fire, and subsequent weed invasion.

Treating degraded mesa top piñon- juniper under either of the action alternatives is expected to result in major beneficial impacts to the herbaceous understory across this vegetative type. While both action alternatives could potentially treat up to 4,000 acres, the actual number of acres treated under Alternative B would likely be higher than for Alternative C. This is because treatment takes four times as long in Alternative C as Alternative B.

Treatment in either Alternative B or C would increase fuel loading, resulting in moderate, adverse effects in the short term, and fine fuel continuity in the short and long term. This means more frequent, low severity fires would occur, with fewer adverse impacts on herbaceous vegetation and woodland trees than under the No Action alternative. In contrast, it is possible that increased fuel loading and encroachment of woody vegetation under the No Action alternative in combination with piñon die- off could result in increased potential for high severity wildfires over the long term.

Under both Alternatives B and C, the piñon- juniper forests themselves would be thinned, and so long- term, major adverse, effects on some smaller diameter (less than 10 inches) individual live (juniper) would occur. Thinning would also improve conditions for remaining trees by reducing competition for soil moisture.

During the five years of treatment, workers and pack animals would cause localized minor impacts to vegetation from trampling, compaction of soils, transport of weed seeds, and creation of unofficial trails. The more intense time frame of Alternative B means these impacts may be similarly more intense, although in both alternatives they would be considered minor.

Soil and Water Resources

Bare soil surfaces (i.e., without the protective cover of litter, slash, pumice, or vegetation) are subject to heaving by extremes of temperature and humidity, and are extremely vulnerable to erosion from surface runoff and wind. Exposed soil surfaces often exceed 80% in woodland intercanopy areas, and this large expanse of exposed soil can generate high- volume sediment yields during runoff triggered by intense summer thunderstorm events.

Summer precipitation is the dominant pattern throughout the woodland, and high intensity, short duration storm events during the summer can result in an average soil

loss rate of about 3.25 mm/decade. Runoff and soil losses increase and become more focused as the slope gradient increases resulting gully formation.

Under the No Action alternative, runoff and erosion would continue at current accelerated or increased levels, causing long- term, minor adverse effects to water quality. Soil would be removed from some areas and redeposited downgradient during precipitation events. Ultimately this would reinforce woodland desertification processes, where continued soil loss means less effective herbaceous cover. Degradation of soil beyond its ability to recover would occur across a large portion of the woodland resulting in major, long- term adverse effects to Bandelier's soil. .

Treatment under either action alternative is expected to decrease average soil erosion rates across 4,000 acres of degraded woodland by at least two- to four- fold, a moderate to major beneficial effect on soil and water resources. In some locations, runoff and sediment production would fall as much as ten- fold, a moderate to major benefit. Benefits related to treatment may be more for Alternative B because Alternative C would take up to 20 years. It is likely that at least some areas would degrade beyond their ability to recover during this time frame.

Under both action alternatives, small- scale minor adverse effects on soil compaction and erosion caused by project activities (camps, treatment, etc.) would also occur. In addition, short- term, negligible, adverse effects on water quality are expected, associated with impacts created by temporary work camps.

Cultural Resources

A large proportion of the archeological sites in Bandelier relates to the Ancestral Pueblo occupation of the area (approximately A.D. 1175 to A.D. 1550), but earlier and later periods are also represented. About 97% of the project area has been inventoried and a wide array of archeological materials are present. Over half (about 1,600) of the monument's recorded archeological sites fall within the project area.

Currently, erosion (primarily sheetwash) is having a large- scale adverse effect on a majority of archeological resources by reducing their contextual integrity, a critical factor in making accurate inferences regarding ancient human behavior. This loss of context occurs when artifacts are moved out of their original locations by, in this case, overland flow and erosion. Extrapolations from a study in the Frijolito watershed (Maher, Hogan and Allen 2001) suggest that as many as five million artifacts could potentially be moved out of context over the piñon- juniper project area if no changes to current management are made. Erosion can also remove soil from underneath building stones, causing standing walls to topple. While erosion affects both scatters and structural sites, scatters are more mobile and vulnerable to damage.

The No Action alternative would continue current management and would result in the continued erosion and loss of integrity of hundreds of archeological sites. Current management is restricted to ad hoc treatment of individual archeological

sites. While these small- scale actions would have major benefits on individual sites, effects to the overall cultural resource in the woodland would be negligible. The lack of a larger scale plan to mitigate the effects of erosional processes to the monument's cultural resources has the potential to have major adverse impacts on archeological resources throughout the project area. Bandelier's enabling legislation specifically cites the preservation of these unique archeological resources as the monument's purpose and the loss of integrity to these sites could result in impairment of park cultural resources. Impairment is defined as a major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of (park name); (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents.

Current management practices could have negligible to minor adverse effects on ethnographic resources or traditional practices because of the presence and operation of backcountry camps.

Under Alternative B, vegetation treatment within the piñon and juniper woodland would occur over five years (approximately 800 acres/year), maximizing efficiency and minimizing impacts associated with the length of treatment. Treatment would stabilize soils and reduce erosion by a factor of two to ten. Major benefits to the archeological resources on the individual and landscape scales are anticipated as approximately 98% of recorded sites would be stabilized by the end of the five- year treatment period. Minor to major benefits are expected to individual archeological resources as a result of soil stabilization (slash mulching, etc.). Negligible to minor, adverse effects to cultural resources could occur from vegetation treatment methods. Because erosion would continue during treatment, some sites would degrade and lose integrity. Depending on the individual sites and the damage done, these residual impacts could range from minor to major in intensity, but is expected to be no more than minor on a landscape scale. In either action alternative, activities during treatment (use of helicopters, pack strings, camp operations/occupation, monitoring), along with proposed mitigation measures, could have negligible short-term effects to cultural resources.

Because Alternative C would take up to 20 years to complete, more resources are likely to experience erosion and loss of integrity and slightly fewer (approximately 94%) recorded sites would be stabilized. This alternative still produces a major benefit to cultural sites. Other effects to archeological resources under Alternative C are similar to that described for Alternative B with the exception that more sites could be degraded or lost during the 20 year treatment period.

Six New Mexico pueblos—the Pueblos of Santa Clara, Santo Domingo, San Ildefonso, San Felipe, Cochiti and Zuni are traditionally associated with ethnographic resources at Bandelier. Consultation among Bandelier and the six pueblos is guided by a Memorandum of Understanding requiring regular and active discussions regarding park management, fire planning, and operational decisions that affect

subsistence activities, sacred materials or places, or other ethnographic resources. Consultations with the pueblos regarding the need to address the accelerated erosion and degradation of the piñon juniper woodland, as well as the impacts to cultural resources in Bandelier have been ongoing since 1998.

Under the No Action alternative, continued biological, ecological, and archeological research and monitoring and small- scale ad hoc treatment of archeological sites would occur. The lack of vegetation treatment would result in continuing erosion and there would be no associated increase in herbaceous plants that might be important for traditional uses. Negligible to minor, adverse impacts to ethnographic resources are likely for the short and long term under the No Action alternative. Cumulative impacts would be adverse and negligible to minor over the short and long term.

Under Alternatives B and C, short- and long- term, negligible to moderate beneficial impacts to ethnographic resources are expected because of the potential increased availability of culturally important plants and plant material resulting from vegetation treatment. Initial reduction of small diameter trees could result in short- term, negligible adverse impacts to traditional practices which used these resources. Under both action alternatives, most large diameter piñon and juniper trees would be retained, resulting in negligible impacts to potential traditional activities involving large trees (e.g. nut or seed gathering). The locations of backcountry camps and camp activities would result in short- term, negligible effects under Alternative B and potential long- term, major effects under Alternative C (due to its 20 year project period). Alternative C could result in moderate benefits to ethnographic resources in that its long project duration allows extended consultation time with neighboring Pueblos to identify and find protective measures for culturally important places, plants and plant material before treatment activities take place.

Cumulative effects to ethnographic resources under both action alternatives could range from negligible to minor resulting from fire management activities (adverse) and the increase in herbaceous plants/plant parts used in traditional practices (beneficial). The considerably longer project duration (20 years) under Alternative C could result in major adverse effects over time related to disruption in contemporary cultural practices and the potential for reduced ability to pass traditional cultural information to the next generation of practitioners.

Visitor Experience

Bandelier National Monument continues to rate highly with the public in visitor satisfaction and experience. The monument's cultural resources are the primary reason for visitation. Most visits occur during the summer months. The overwhelming majority (over 90 percent) of visits are focused on the frontcountry where visitors enjoy, among other things, a visitor center, two campgrounds, hiking trails associated with cultural resources, and other facilities. The backcountry comprises the majority of the monument's land and the lowest visitation rate (six

percent). Park visitors using this area cite the scenery, peaceful quiet and solitude as reasons for visiting.

Under the No Action alternative, visitor satisfaction ratings and perceptions of their experience at the monument are expected to continue to remain relatively high, at least in the near term. Visitors would not be subject to the adverse effects of restoration activities (e.g., odors, view alterations, disrupted wildlife viewing opportunities), a minor benefit to their experience. Adverse effects to the park's soundscape related to existing noise in the monument would be negligible to minor. However, the park's cultural resource base is at greatest risk under this alternative because this resource is so highly rated with visitors, its degradation over the next few decades would result in long- term, possibly moderate, adverse effects on their experience.

Alternative B would provide the highest degree of stabilization for the cultural resource base, a moderate to major benefit to the visitor experience. At the same time, when compared to other alternatives, treatment activities would result in the most notable adverse effects (negligible to moderate) to the visitor experience (odors, wildlife viewing, view alterations) during and for a period after vegetation treatment. Increased mechanized noise from chainsaws and helicopters would result in negligible to moderate, short- term, adverse effects to the monument's soundscape. It should be noted that most effects would occur in the backcountry, the area with the lowest overall visitation. Negligible to minor benefits to wildlife viewing are possible from increased biological productivity. Ultimately, the accelerated stabilization of the cultural resources under this alternative would result in long- term benefits to the visitor experience when compared to the other two alternatives A or C.

Due to smaller annual vegetation treatment areas proposed under Alternative C, fewer and less intense (negligible to minor) adverse effects to the visitor experience (alteration of views, wildlife viewing opportunities, odors/emission) are expected when compared to Alternative B. Negligible to minor, adverse impacts to the monument's soundscape related to increased mechanized noise (chainsaws/helicopters) are also expected. Similar to alternative B, most effects would occur in the backcountry, the area of the monument with the lowest overall visitation. Negligible to minor benefits to wildlife viewing are possible from increased biological productivity. The increased loss of cultural resources would include minor to moderate, adverse effects to the visitor experience compared to Alternative B, however, stabilizing some cultural resources would result in minor, long- term benefits to the visitor experience when compared to No Action.

Visual Resources

Analysis of impacts to the visual resources of the monument includes issues of scenic quality and the sensitivity of the landscape to visual change. Scenic quality is a measure of the visual appeal of a landscape (e.g., landforms, vegetation, color, water

features, adjacent scenery, etc.). The monument is characterized by a rugged landscape of canyons and mesas ranging in elevation from 5,300 to over 9,000 feet. Vegetation varies significantly throughout the monument from riparian elements (cottonwoods, alders) in canyon bottoms to piñon- juniper woodland along mesa tops where treatment is proposed. Canyon bottoms exhibit a diversity of visual elements, including water features, a variety of vegetation patterns, and interesting landforms. Much of the backcountry use of the park is on trails that follow along the stream courses in canyon bottoms.

Sensitivity is a measure of peoples' concern for the scenic quality of a landscape. It is a function of the numbers and activities of viewers, and locations and distance of the proposed project from sensitive viewing locations. The highest use area within the monument is Frijoles Canyon (Visitor Center and the Main Loop Trail) where views are limited to the canyon bottom and sidewalls. The piñon- juniper woodland proposed for treatment is generally not visible from the popular Frijoles Canyon area.

Under the No Action alternative, the existing, degraded condition of the piñon-juniper woodland would persist resulting in a landscape with little diversity in line, form, color or texture. Without active management, the scenic quality of the piñon-juniper woodland would continue to degrade, resulting in moderate adverse impacts to visual resources.

Proposed activities under Alternative B would result in the largest degree of visual modification. Visual changes in the landscape would depend on variables such as numbers of acres treated at any one time, the pattern of cut areas, etc. Annual treatment areas of approximately 800 acres would vary in their visual quality, with some likely to be perceived as patchy (treated areas interspersed with untreated areas) and some exhibiting very large cut areas, the latter attracting greater viewer attention. In the short term, visual changes in the character of the landscape (minor to moderate adverse impacts) would be more noticeable to viewers under this alternative. In the long term, successful revegetation by native herbaceous vegetation would improve the visual quality of the treated areas over the existing condition of the area, resulting in moderate benefits to visual resources. These benefits are expected to be similar under Alternative C; no such benefits are provided under the No Action alternative.

Under Alternative C the order of areas of treatment would not necessarily be organized by geographic location and could result in treatment of sub- basins quite distant from one another in any given year. Annual treatment areas of approximately 200- 300 acres would minimize the visual contrast between cut and uncut areas when compared to Alternative B. Under Alternative C, short- term visual impacts are considered adverse and minor, while long- term effects would be beneficial and moderate.

Wilderness

The Bandelier Wilderness was designated in 1976 by Congress (PL 94- 567). No language particular to the qualities of Bandelier's wilderness was included in the Act. Simply the number of acres—23,267—and the name "Bandelier Wilderness" were specified.

NPS policies indicate that environmental impact statements should evaluate both wilderness "character" and wilderness "values," including the primeval untrammeled character and influence of the wilderness; the preservation of natural conditions (including the lack of man- made noise); and assurances that there will be outstanding opportunities for solitude and the public will be provided with a primitive and unconfined type of recreational experience.

The Bandelier Wilderness "character" was not pristine when it was designated due to the history of Euro- American land use practices described above, including overgrazing and fire suppression over the past century. As a result, highly "unnatural" conditions, with unsustainable ecological processes, exist today. These unsustainable conditions would continue to desertify the landscape and reduce the park's biological productivity without human intervention. In other words, the requirement of the Wilderness Act to "preserve natural conditions" is unattainable without overt management. The ecological conditions described above have led to the degradation of many of the monument's archeological resources. Both the Organic Act and the Wilderness Act require actions to prevent this continued loss.

Wilderness values are the second component of wilderness. Studies (Hass, et al. 1986; Manning, et al. 1996; Loomis and Walsh, 1992) have found that the general public holds a wide range of values for wilderness, and even places value on the idea of wilderness, whether or not they ever visit (called "existence values"). The greatest values placed on wilderness were for its ability to help in protecting wildlife, water quality and air quality, and its value as a place that will always be available for future generations to enjoy the beauty of nature.

Researchers categorize values toward wilderness as "biocentric" and "anthropocentric". The biocentric includes things like existence of natural, ecologic conditions and protection of habitat, watersheds, and air quality. Anthropocentric values include experiential benefits from things like recreation, educational and scientific values, tourism revenue, aesthetic and spiritual values, and "existence" values.

Other researchers articulate values of a particular group, such as Native Americans or backcountry users. Ranchers, for example, most commonly identify with the "utilitarian" attitude towards the environment (value measured in terms of usefulness), while conservationists may have an "ecological" or "preservationist" view (Kellert 1976).

For many Native Puebloan people affiliated with Bandelier, wilderness is a link to the spiritual world. The wilderness is perceived as part of mother earth and is thought to

be essential to the spiritual, cultural, and physical well- being of native peoples. Administrative or agency boundaries are meaningless. These relationships and beliefs have spanned the centuries, as native Puebloan peoples have lived in harmony with the ecology of the area for hundreds of years (Ortiz 1979).

The "conservation ethic" regarding wilderness restoration varies from being unable to improve upon nature (Turner, et al. 2003) to science- based action in an attempt to return the wild to a more natural state (Sanderson, et al. 2002).

Under the No Action alternative, the piñon- juniper woodland in Bandelier's wilderness would continue to appear "trammeled" and degradation would worsen, with major adverse impacts to the naturalness aspect of wilderness character. However, because visitors may be unaware of the degraded ecological conditions, current management may only have a negligible or minor impact on visitors' perception of the area offering a recreational experience defined by the Wilderness Act.

Those holding biocentric wilderness values would experience moderate or major impacts. Those with anthropocentric values would experience minor adverse to minor beneficial impacts, depending on how they value the recreational aspect of wilderness. For those who believe humans are part of the ecology or that intervention in wilderness is never warranted, the No Action alternative would have no adverse or beneficial impacts.

If either action alternative were implemented, minor to major, short- term, adverse impacts to the wilderness character from noise, the presence of crews and camps, and the unnatural appearance of treated areas would occur during and for a few years following treatment. Major long- term or even permanent benefits to the character of the Bandelier wilderness would result from restoration of the degraded and unnatural state of its piñon- juniper woodland. Although motorized equipment would adversely affect the wilderness character during treatment, better overall protection of wilderness values, cultural resources, soils and vegetation, would offset the short- term, adverse noise impacts. In the long term, restoring natural ecological processes to the piñon- juniper woodlands would have major beneficial impacts to those people with biocentric values and a range from moderate beneficial to moderate and adverse for those with anthropocentric values. For those believing that humans are part of the ecology, or for those believing that intervention is never warranted, minor to major adverse impacts from implementing either action alternative are possible. For the majority of Americans, including those who commented during scoping on this EIS, treatment of Bandelier piñon- juniper woodland would be consistent with the values they place on wilderness, and restoration would have major beneficial impacts.

Wildlife

Bandelier has a wide variety of wildlife that uses its many habitats. Several bird and mammal species occupy piñon- juniper woodland, as well as a few reptiles.

Under the No Action alternative, wildlife may be occasionally disturbed by researchers or cultural resource specialists applying treatment on an ad- hoc basis in the piñon- juniper woodland. No landscape treatment would occur, and the quality and extent of herbaceous habitat in the woodland would continue to decline. Short-term changes in herbaceous growth would be related to precipitation and soil moisture, with species dependent on moisture (invertebrates, for example and the reptiles that feed on them) experiencing temporary population increases. Compared to existing conditions, impacts to wildlife due to habitat change are anticipated to be indirect and negligible.

Treatment in either action alternative would involve the use of chainsaws and helicopters; either may result in temporary disturbance and even displacement of some animals. Animals with exclusively underground life habits would be less affected because of the insulating ability of soil and the less sensitive hearing these species tend to have. Mobile birds, mammals or reptiles that live above ground would likely disperse from the area in the short term, but return once the noise has stopped. Thus, the adverse impacts to wildlife from the use of chainsaws are anticipated to be short- term, direct, and negligible to minor. Although this would be true of both action alternatives, a shorter work season would likely mean fewer animals would be affected each year in Alternative C than if Alternative B were implemented. But the overall duration of impacts would be longer under Alternative C than B (20 years vs. five year treatment duration).

Restoration activities would thin piñon- juniper woodland and may cause changes to wildlife habitat in the project area, which may prove beneficial to some habitat generalist species (cottontails, rock squirrels, mule deer, many bird species) and adverse to more piñon- juniper habitat dependent species (piñon mice, black-throated gray warblers). Effects would be negligible to minor in intensity and range from short- to long- term. Alternative B or C would decrease piñon and junipers, and so may have an indirect adverse impact on black- throated gray warblers at Bandelier through the loss of forest insect prey. Coyote numbers would likely increase with the restoration treatments in response to an overall increase in available small mammal prey species. Impacts to reptiles from habitat changes under either action alternative are likely to be beneficial in both the short and long term.

Special Status Species

Treatment activities may affect the federally threatened Mexican spotted owl and bald eagle and the state threatened peregrine falcon.

Major canyons within Bandelier are thought to have suitable nesting and/or roosting habitat for the Mexican spotted owl and Bandelier has established two spotted owl management designations: suitable nesting areas (SNAs) and nesting/roosting zones (NRZs). Treatment may affect owl SNAs outside the study area through noise (chainsaws, helicopters, etc.) and so they are included as part of the analysis. Annual

surveys for Mexican spotted owls have been conducted in the monument since 1995. No owls have been documented in the monument since 2002.

Bald eagles are only in the Bandelier area from approximately November 1 through February 28. Winter roosting and fishing habitats for bald eagles are located near canyon mouths and along the Rio Grande, respectively. The project area does not include any bald eagle roosting or fishing habitats. Most eagles typically leave these roosts in the Bandelier area as much as an hour before sunrise, and return late in the day near or after sunset. Piñon- juniper mesa tops may be used by bald eagles for occasional foraging during winter months. Winter surveys for bald eagles have been conducted in Bandelier since 1994. Data from 2003 shows approximately 11 eagles observed during winter counts over two consecutive days in January and February.

Four designated suitable nesting areas for peregrine falcons occur in or immediately adjacent to Bandelier. Foraging areas include primarily piñon- juniper woodland and ponderosa pine forests on the mesas of the Pajarito Plateau, with mixed conifer forests extending farther down the canyons from the northwest. The Peregrine Falcon Habitat Management plan (NPS2006c) identifies three management zones that surround suitable nesting ledges and commits to restrictions to prevent impacts particularly to breeding falcons. In northern New Mexico, occupancy of nesting habitat usually starts between March 1 and May 15. Between August 16 and October 15, mechanical activities are no threat to reproduction for the year, but adults will still be present and exhibit courtship behavior and defend the nesting habitat until migration. In most cases, no peregrine falcons will be present from October 16 to February 28. For the purposes of this EIS, chainsaw and helicopter use would be prohibited in zones near nest sites from March 1 to May 16 to prevent indirect impacts from noise to breeding peregrine falcons. The 2006 annual surveys have indicated the presence of an occupied nest in the park

Under Alternative A, sources of noise related to activity in the piñon- juniper woodland would be restricted to those from researchers, occasional treatment of cultural sites, and visitors. Habitat changes would be minimal as well. Impacts to all three special status species would be indirect and negligible.

Under Alternative B, negligible short- term impacts related to the noise of treatment activities may occur to bald eagles and spotted owls; negligible to minor effects of noise are possible to the peregrine falcon. The impacts would be mitigated through certain restrictions placed on treatment operations. For example, if owls are detected within the monument, flights or treatment may be confined to certain areas away from the owls. No helicopters would fly at night when occasional bald eagles may be roosting in trees along access areas to the treatment site. Helicopters would also be routed to avoid impacts from noise to peregrine falcons.

Under Alternative C, there would be no impacts to breeding Mexican spotted owls or peregrines from noise disturbance as the work season would conclude prior to the

start of the breeding season. Impacts to bald eagles would be similar to those described in Alternative B

There may be indirect, short- and long- term, minor beneficial impacts to spotted owls and peregrine falcons due to increased prey availability from habitat changes associated with the treatment under either action alternative.

Air Quality

Recent monitoring data from areas surrounding the monument indicate air quality is generally good and within compliance levels of nearly all monitored pollutants. Several exceedances were due primarily to windblown dust and emissions from a gypsum mine located nearby (Wear 2006). Visibility, monitored at Bandelier National Monument since 1989, is generally very good (approximately 144 kilometers, NPS 2005).

Under the No Action alternative, only very occasional work in the piñon- juniper woodland related to research, treatment at cultural sites, and thinning would occur. These activities would have no detectable (negligible) impact on air quality, and good air quality and visibility within the monument and in the project area are expected to continue.

Under Alternative B, the operation of chainsaws and helicopters for approximately eight months a year over the five- year project would result in minimal emission levels not expected to exceed National Ambient Air Quality Standards (NAAQS). Commercial- grade chainsaw emissions would be low in temperature, occur near ground level and would disperse in the immediate area (negligible, adverse effect). Helicopters, used to transport and supply crews, are expected to release minimal emissions (would not exceed NAAQS) which occur high in the atmosphere and are quickly dispersed (negligible adverse effects). Compared to Alternative C, effects to air quality and visibility under this alternative are similar but occur over a considerably shorter project time period, a benefit to the monument's air quality.

Under Alternative C, the operation of chainsaws and helicopters for approximately six and a half months a year over the 15- 20- year project is expected to result in effects similar to that under Alternative B (negligible, adverse), though over a much longer time period. Despite similar effects to air quality and visibility, Because of the longer project length, slightly increasing negative effects to air quality under Alternative C might be expected compared to Alternative B.

Park Operations

Bandelier National Monument staff levels vary seasonally with approximately 69 permanent staff members and 40 additional seasonal and volunteer staff during summer months. The six divisions and/or programs include Administration; Fire Management; Interpretation and Visitor Services; Facility Management; Visitor and Resource Protection; and Resource Management. With the exception of the Fire

Management division, all division's workloads and/or budgets may be affected by the activities proposed.

Under Alternative A, most divisions would not be affected, but because accelerated soil erosion conditions would require mitigation efforts for affected resources (e.g., cultural resource stabilization), the Resource Management division might incur minor to moderate adverse impacts. This on- going situation would continue to redirect funding and staff duties for the long term, particularly when compared to Alternative B. Under Alternative B, negligible to minor adverse effects are possible to all affected divisions primarily during the five- year treatment period. These effects would result from project- related hiring/personnel management, budget tracking, providing visitor information, pack operations and field camp management, project implementation and monitoring, and human health and safety issues. As many of these impacts would cease once vegetation treatment is complete (5 years), it is expected that Alternative B would, in general, have fewer adverse effects on park operations than would the other two alternatives.

Impacts to park divisions under Alternative C would be, for the most part, similar to those described under Alternative B, though they would continue for 15- 20 years. For the Resource Management division, minor to moderate adverse effects are expected due to the extended project time frame and the demands on division staff. The much longer duration of adverse impacts to most park operations divisions under Alternative C, coupled with its greater intensity of effects to the Resource Management division, would result in slightly increased overall negative effects when compared to Alternative B.

Health and Safety

Health and safety issues addressed in this EIS are related only to park staff and/or contractors and are related to mechanized noise from helicopters, chainsaws and hand tools.

Under the No Action alternative, negligible to minor impacts from activities inside the monument, including car traffic and visitor activities, occur now in the study area. Additional temporary, minor impacts to the natural quiet of the area from aircraft overflights, LANL activities and construction also occur. No impacts related to the No Action alternative would add to these sources of noise.

Under Alternative B, negligible to minor noise impacts from existing activities inside the monument, including car traffic and visitor activities would continue. Minor to moderate adverse effects to workers related to noise exposure could result from the use of hand tools and chainsaws and proximity of workers to helicopters.

Under Alternative C, negligible to minor noise- related impacts from existing activities inside the monument, including car traffic and visitor activities would continue. Adverse effects to workers from noise related to the use of chainsaws and

hand tools and proximity to helicopters are similar to those described under Alternative B (minor to moderate).

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