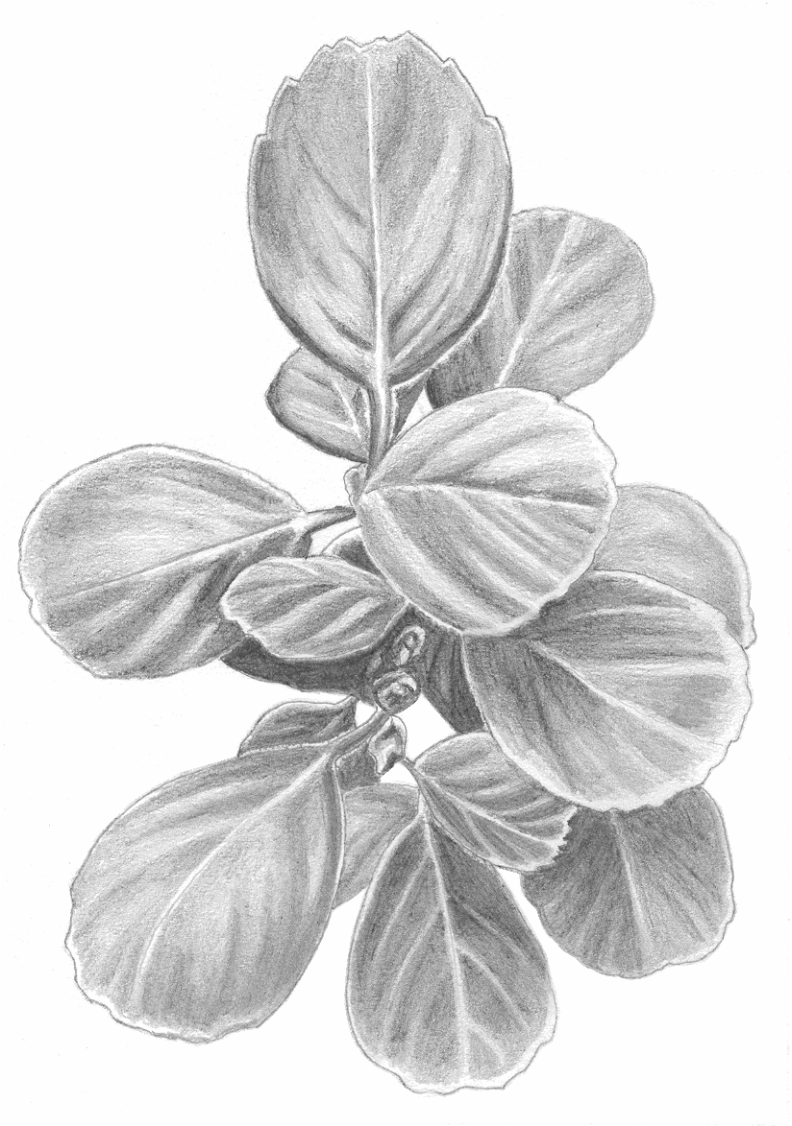
Chapter 1: Purpose of and Need for the Plan



Mountain Mahogany,
Cercocarpus montanus

PURPOSE OF AND NEED FOR THE PLAN

INTRODUCTION

Bandelier National Monument ("Bandelier," "park," or "monument") is proposing to restore approximately 4,000 acres of degraded piñon- juniper woodland (woodland) in the monument (or 40% of the total 10,000- acre woodland area) to a more naturally functioning state. Vegetation has been altered by historic human land uses, and as a result important ecological characteristics such as the rate of soil erosion, and fire intensity and frequency are no longer within the natural rate of variability. Soil erosion also currently threatens over 90% of, or several thousand, archeological sites located within the woodland. Since nearly three- quarters of Bandelier's prehistoric cultural resources are located within the woodland, erosion effectively endangers the majority of the significant resource for which the monument was originally designated.

The monument explores two action alternatives for a restoration plan in this *Draft Ecological Restoration Plan and EIS*, as well as a No Action alternative. Alternative B is the monument's preferred alternative at this time. The plan/EIS is mostly programmatic in nature, which means it provides a framework for taking a range of management actions and a broad- scale discussion of impacts. The monument would decide more site- specific details for treatment each year based on soils, vegetation, cultural resources, and other factors. The plan will cover a 15- 20 year time frame and will determine both a policy direction for management of the park's piñon- juniper woodland, as well as a process for integrating the results of monitoring and research into future management.

PURPOSE OF AND NEED FOR ACTION

The *Purpose* section explains what the plan is intended to accomplish. The *Need for the Plan* section lays out the reasons why action is necessary at this time. Brief summaries of both purpose and need are presented here, but a great deal more information is available in the "Background" section.

Purpose

The purpose of the *Draft 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 for which Bandelier National Monument was established.

Need for the Plan

Historic land use, particularly effects of grazing, in the general area of the monument before it became a unit of the National Park system, have resulted in changes in ecosystem processes that are adversely affecting both natural and cultural resources

inside Bandelier. Most detrimental to fulfilling the congressionally designated purpose of the monument are accelerated rates of soil erosion and the associated losses of archeological resources within the piñon- juniper woodland. Rapid soil loss in 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 are located within piñon-juniper communities, and nearly 90% of these have experienced adverse effects related to erosion (Herhahn 2003; Herhahn, et al. 2006). Without management intervention to actively restore herbaceous understories 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).

The relationship between historic human land use practices and changes in the function, structure, and processes of piñon- juniper woodland at Bandelier is explained in more detail in the *Background* section below. The remainder of this section describes the relevant legal, regulatory, and policy directives that the monument believes indicate that action in the form of an ecological management plan for piñon- juniper woodland is needed.

The National Park Service (NPS) is governed by a series of laws, regulations, and policies. The primary one of these laws is the Organic Act of 1916 (16 USC 1 et seq.) and its 1978 Redwood Amendment. The Organic Act speaks to the conservation and preservation of park resources and values as a high priority of the National Park Service and states that "the fundamental purpose of the said parks, monuments, and reservations . . . is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The NPS has interpreted the Organic Act in its *Management Policies 2006* (NPS 2006a). These policies guide park management of both cultural and natural resources, as well as management of wilderness, visitor use, facilities, etc. Several sections of these policies direct parks to use tools available to them to try and preserve important cultural resources. For example, the policies state that parks must utilize the "most effective concepts, techniques, and equipment to protect cultural resources against . . . deterioration, environmental impacts, and other threats, without compromising the integrity of the resources" and "provide for the long- term preservation of . . . the features, materials, and qualities contributing to the significance of cultural resources." Archeological resources are to be preserved "in a stable condition to prevent degradation and loss" and those resources subject to "erosion, slumping, subsidence or other natural deterioration" are to be stabilized using methods that are not intrusive and that protect natural resources and natural processes. Cultural resources in wilderness may be an integral feature of the wilderness, and are to be "protected and maintained" according to all relevant laws and policies governing cultural resources (Sections 5.3.1, 5.3.5.1.1, 5.3.5.1.2 and 6.3.8).

In addition to the NPS Organic Act and current NPS policy, the enabling legislation for Bandelier National Monument speaks to the importance of the park's unique archeological resources and their preservation for future generations. The 1916 Presidential Proclamation (No. 1322: 39 Stat. 1794) that established Bandelier states: "Whereas, certain prehistoric aboriginal ruins . . . are of unusual ethnologic, scientific, and educational interest, and it appears that the public interests would be promoted by reserving these relics of a vanished people, with as much land as may be necessary for the proper protection thereof, as a National Monument."

With respect to natural resources, NPS *Management Policies 2006* (NPS 2006a) direct parks to intervene in natural biological or physical processes only "to restore natural ecosystem functioning that has been disrupted by past or ongoing human activities." This is true in wilderness as well, where most of the treatment of piñon- juniper woodland at Bandelier would take place if either of the action alternatives described in this environmental impact statement were implemented. Parks may manage wilderness ". . . to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries." The policies instruct park units to "seek to return human- disturbed areas to the natural conditions and processes characteristic of the ecological zone in which [they] are situated." Natural conditions are described as "the condition of resources that would occur in the absence of human dominance over the landscape." Further, landscapes may be manipulated to restore "natural processes and conditions to areas disturbed by human activities such as fire suppression." The policies specifically direct parks to prevent the "unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources" and to prevent or minimize "adverse, potentially irretrievable impacts to soils" (Sections 4.1, 4.1.5, 4.4.2.4, 4.8.2.4, and 6.3.7).

The monument has also previously developed plans and policies which speak to the need to restore more natural ecological conditions, including its *Strategic Plan* (NPS 2000a) and *Fire Management Plan* (NPS 2005a). The relevant pieces of each are discussed in more detail in the *Background* and *Related Laws, Policies, and Plans* sections below.

The imbalance in the monument's resource conditions and the laws, policies, and plans that dictate their return to a more natural state are the reasons why action by the monument to re- establish sustainable vegetative conditions within the piñon-juniper woodland is needed. Doing so would both meet the requirements for natural resource management and help fulfill the obligation to protect the monument's unique cultural resources by slowing the soil erosion that threatens them.

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 this plan:

1. 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.
2. Create conditions within degraded portions of the piñon- juniper woodland that will support a surface fire regime within the natural range of variability (for example, sufficient to maintain restored grass- dominated communities).
3. Manage degraded portions of the piñon- juniper community using information gained through an active program of research and monitoring.
4. Build support for, and actively share information about, restoration actions and related research and monitoring efforts with government agencies, pueblos, and communities.

Desired Future Conditions for Piñon-juniper woodland

In addition to overall objectives for the plan, the monument has defined what it believes to be the functional state and ecological processes that would have characterized the now degraded portions of the piñon- juniper woodland. These are addressed in the "desired future conditions" (DFCs) of each subtype of piñon-juniper woodland in the park, and serve as specific and concrete objectives the monument will try to achieve in implementing the *Ecological Restoration Plan*.

Because European settlement has altered most of the forests of the western United States, DFCs are largely based on inferences from historic accounts, including oral and written histories, photographic records, and recent research (Allen 1989; Allen 2004; Swetnam, et al. 1999). Tree ring age class data can also provide additional information about the past structure of forests. Defining precise structural targets for vegetative communities in the monument is not appropriate because substantial spatial and temporal variability is inherent in plant communities (Allen, et al. 2002). Instead, process oriented, functional definitions for target conditions (historic fire frequency and fire behavior) are used, which provides a generalized DFC vegetation structure, since this acknowledges the inherent variability in natural systems (Allen, et al. 2002) and provides more realistic management goals.

PIÑON-JUNIPER WOODLAND

The piñon- juniper woodland is characterized by the presence of one- seed juniper at lower elevations, and until recent drought mortality, by increasing dominance of Colorado piñon pine at higher elevations. Historic grazing and associated loss of fire disturbance are thought to have allowed the expansion of piñon and juniper into former ponderosa pine savanna, and grass- or shrub- dominated communities.

The generally sparse herbaceous understory (<10% cover) is currently comprised principally of native, warm season grasses, including little bluestem, blue grama, and mountain muhly; these species are typically found in intercanopy spaces. Cool season grasses, including muttongrass, June grass, and littleseed ricegrass, are often found beneath the protective canopy of trees. A distinctive cool season grass of the intercanopy, Galleta was probably more common before grazing and woodland

expansion. A great variety of perennial forbs, as well as annual and biennial forbs, can be found depending on local site conditions and weather patterns. Common shrubs include oak, rabbitbush, and sumac, with sub- shrubs such as wormwood, snakeweed, and pinque. Several genera of cacti are also present, with species of prickly pear dominating.

Desired future conditions in the piñon- juniper woodland in Bandelier would include a matrix of plant communities and structures, from more open grass or shrublands to pine savannas and including some dense patches of woodland. Understory species composition would include a mixture of native, perennial, warm and cool season grasses as noted above, largely reflecting what was present onsite or nearby prior to treatment; the major change would be increases of two- to four- fold in basal and canopy cover of grasses over pre- treatment conditions. Understory cover would be relatively greater on more productive sites, i.e., those with deeper soils, and total tree cover would generally increase with elevation (and precipitation). Recovery of a significant piñon component above 6,500' can be expected given current levels of seedlings remaining in woodland understories and subsequent production of seed crop by mature trees in 25- 50 years. The only exotic species of concern within the project area is cheat grass and experience suggests restoration treatment does not promote establishment of this species; rather treatment promotes recovery of a native herbaceous plant cover which can restrict invasion by exotic species. On the more productive sites, understory ground cover would be sufficient to stabilize soils and to carry low intensity surface fires at intervals of 15–30 years. Where older and denser patches of woodland occur, (typically on less productive, shallow or rocky substrates) surface fire disturbance would be uncommon, and fire would occur as patchy crown fires at intervals exceeding 250 years. Periodic drought and associated beetle mortality would occasionally thin existing woodland stands and, in addition to fire disturbance, restrict local woodland occurrence to rocky, shallow substrate sites.

General descriptions and desired future conditions for sub- components of the piñon- woodland are as follows:

JUNIPER-SHRUB GRASSLANDS

Juniper- shrub grasslands are currently characterized by the presence of a one- seed juniper overstory (not infrequently as a result of tree invasion since 1880) with an understory of various shrubs, grasses, and forbs as noted above. This type is found on the lower mesas and canyon slopes and on elevated benches along the Rio Grande corridor. In addition to relict juniper savanna communities, this type includes former shrub and grassland communities recently invaded by juniper.

Desired future conditions for this type include grass, forb, and shrub dominated communities with scattered mature trees (<5% cover) and herbaceous ground cover sufficient to stabilize soils and carry surface fire (at intervals of 5- 15 years). Isolated patches of juniper- dominated woodland (canopy cover >30%) may occur on shallow soil or rocky substrate sites (see piñon- juniper woodland DFC).

PIÑON-JUNIPER SAVANNA AND WOODLAND

This community is located at a higher elevation than juniper- shrub grasslands, but at a lower elevation than ponderosa pine forests, and is distinguished from the former by increased tree canopy cover and the presence of piñon pine. The overstory of piñon- juniper savanna and woodland types is comprised of Colorado piñon pine and/or one- seed juniper (and remnant living or dead Ponderosa pine components). The understory is characterized by a diverse array of shrubs, grasses, and forbs as noted above. Older growth woodlands are generally found on rocky, shallow soils, while younger savanna- like communities usually occur on deeper, more productive soils. Alligator juniper becomes an important component of woodland on steep rocky slopes in the southwestern portion of the monument, but these woodland types are not within the scope of the current proposal and constitute only a small percentage of total woodland area.

Desired future conditions for piñon- juniper savanna envision a community that maximizes a diverse shrub and grass- forb understory, with patches of piñon and juniper in varying proportions depending on local site conditions. Mature tree canopy coverage would average less than 15%, with herbaceous and/or shrub ground cover sufficient to stabilize soils and carry fire (at intervals of 15- 30 years). Piñon-juniper savanna would typically be located on deeper and more productive soil sites, where sufficient herbaceous cover can sustain frequent surface fire of intensity necessary to maintain open, or patchy, stand structure.

Desired future conditions for the piñon- juniper woodland envisions a community with canopy coverage generally exceeding 30%; herbaceous cover is generally sparse either due to shallow, rocky soils, or because canopy cover suppresses understory growth. Fire disturbance is uncommon, characterized by a patchy crown fire type behavior, and with intervals typically exceeding 250 years. Piñon- juniper woodland would typically be located on rocky, shallow soil sites which limit herbaceous productivity and potential for surface fires, thus promoting woody plant dominance and an infrequent, patchy crown fire regime.

PROJECT LOCATION

Bandelier National Monument is a unit of federal land administered by the National Park Service located on the southern portion of the Pajarito Plateau in the Jemez Mountains in north- central New Mexico. It is approximately 10 miles southwest of Los Alamos and 50 miles northwest of Santa Fe (Figure 1). Bandelier lies within the jurisdiction of Los Alamos, Sandoval, and Santa Fe counties, New Mexico. It is comprised of approximately 33,727 acres, of which 23,267 acres are designated wilderness.

Bandelier spans an elevational gradient from the Rio Grande at 5,300 feet (1,615 meters) to the summit of Cerro Grande at 10,199 feet (3,109 meters), an altitudinal range of 4,899 feet (1,493 meters). The monument's northern boundary is situated on the rim of a large volcano (now the Valles Caldera National Preserve) that collapsed

approximately one million years ago after its enormous eruption. The area is now composed of volcanic ash and lava flows that have been eroded into deep canyons separated by narrow mesas. Modern drainages trend southeast on their way to the

Rio Grande. Modern tributary canyons within the monument, from north to south, include: Frijoles, Lummis, Alamo, Hondo, Capulin, Medio, and Sanchez.

The woodland across the Pajarito Plateau is characterized by cool, dry winters and warm, wet summers. Mean monthly temperatures range from 28° Fahrenheit (F) in January to 71.5° F in June. Mean minimum temperatures in January are around 12° F and mean maximum temperatures are around 89.7° F in June. Precipitation generally increases with elevation with considerable spatial and temporal variation (Hastings, et al. 2005). Mean annual precipitation (MAP) is about 16 inches (ranging from 15 to 16.5 inches depending on the 30- year period of record), and mean annual temperature (MAT) is about 50° F.

Normally a snow pack is formed during the winter months at the higher elevations, which yields peak base stream flows in most major canyons during the spring snow melt. Winter precipitation is generally followed by a distinct seasonal hot and dry period during the months of May and June. This dry period is defined as much by increased potential evapo- transpiration that accompanies increased day length, solar radiation, and temperatures, as by decreased precipitation. As a result, May and June are often the months of greatest fire potential given sufficient fuels and ignition; fire behavior during this time period can also be enhanced by strong wind patterns.

In late June/early July a monsoon pattern typically delivers 50- 60 percent of the annual precipitation between June and September. During this time, high intensity thunderstorms can account for large year- to- year variability in annual rainfall between localities (Hastings, et al. 2005). Over longer time scales, there are prolonged wet and dry cycles, lasting several years or more, which can have far reaching consequences in terms of plant mortality, establishment, and distribution.

The monument contains approximately 2,900 recorded archeological sites that span in time from the Paleoindian period (10,000 years ago) to the historic period (from 1600 to present). The monument also includes ancient hunting camps, “cavate” structures (rooms that have been carved into the soft tuff bedrock), 300- room pueblos, small farming hamlets, and the remains of historic corrals and log cabins as well as other cultural resources.

The elevational range, topographic aspects, climates, and soils mean the park has a variety of both plant and animal life. Bandelier contains moist canyon bottoms, juniper grassland communities, piñon- juniper woodland, ponderosa pine forests, mixed conifer forests, and mountain meadows and is home to 750 taxa of vascular plants, including many sensitive species. Associated wildlife includes elk, mule deer, black bear, mountain lion, and numerous bird and reptile species.

BACKGROUND

The purpose of this section is to describe in detail both the resource rationale for action and the administrative or legal reasons for action.

Historic and Prehistoric Land Use

This project focuses on the upland portions of the piñon- juniper woodland within Bandelier National Monument; this area comprises approximately one- third of the monuments' land area and can be generally circumscribed as mesa top settings between 6,000'- 7,000' elevation. Within this general setting, over three- quarters of Bandelier's prehistoric cultural resources are found. As noted above, desired future conditions of plant communities within the piñon- juniper woodland are based on inferences about the nature and status of these plant communities following prehistoric land use activities (ending around ca. 1600) and prior to historical land use patterns (beginning around 1880).

Aboriginal occupation of the Bandelier area for nearly 500 years (until ca. 1600) yielded a landscape strongly influenced by the needs of a pre- industrial civilization. In particular, fire frequency, tree density, and ungulate populations may have been significantly affected by prehistoric land use (in addition to the effects of prevailing climate). After abandonment in 1600, the system would have begun to adjust to the loss of the disturbance regime associated with a resident human population.

The vegetation of Bandelier was still recovering from the effects of prehistoric land use when historic land use activities began around 1800. Around 1880, these activities (i.e., fuel- wooding, grazing, and hunting) intensified and began to noticeably affect plant communities.

Fence posts and fuel wood were extracted from accessible woodland, animals were hunted (often to the point of local extirpation), herbaceous vegetation was intensively grazed by domestic livestock, and fires were indirectly suppressed by grazing activities. Beginning around 1916 when the monument was created, many of these consumptive activities ceased, although grazing continued through 1932 and a substantial population of feral burros was present in the monument until the mid-1980s.

Local plant communities were and continue to be strongly influenced by these historic land- use activities. Grazing removed herbaceous understory vegetation, and in combination with suppressing fires that normally removed piñon and juniper saplings from much of the landscape, gave way to increased tree dominance. Age class information from piñon- juniper study sites in Bandelier suggests an exponential increase in piñon- juniper stem densities in former pine savanna areas beginning around 1850 (Allen, personal communications, 2005.; Davenport, et al. 1996; Gottfried, et al. 1995; Julius 1999). Piñon and juniper also expanded their local distributions, invading upslope into ponderosa pine dominated forests and downslope into former shrub and grassland communities (Gottfried, et al. 1995).

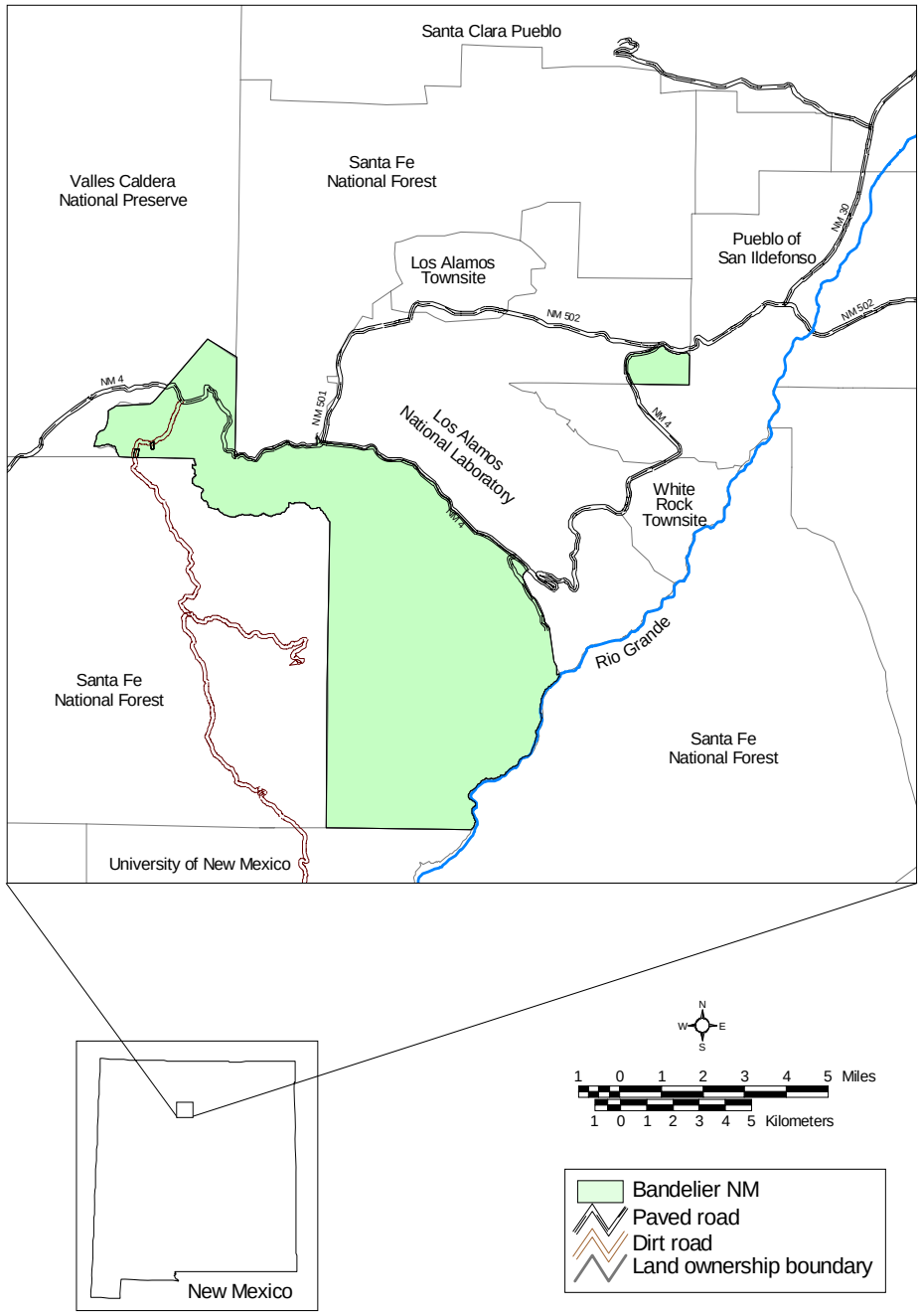


Figure 1. Locational Map of Bandelier National Monument.

Erosion

Changes in the degree and extent of woodland covering the landscape altered the balance of moisture shared by trees and understory herbaceous vegetation. Particularly under drought conditions, the increasingly sparse herbaceous vegetation that remained was unable to compete for limited soil moisture. Interspaces between

woodland trees became increasingly characterized by little or no herbaceous cover (<10%) and the loss of the protective cover and fine roots necessary to capture runoff and hold soils.

Lacking an effective ground cover, many degraded piñon- juniper systems were unable to retain limited soil and water resources. These degraded communities began to yield unsustainable amounts of runoff and sediment, particularly from bare ground interspaces during high intensity summer thunderstorms (Wilcox, et al. 1996a,b). In addition, freeze- thaw action on exposed soils facilitated erosion, both by inhibiting new plants through root shear from becoming established and by creating light textured crusts vulnerable to the forces of wind and rain. Without sufficient water, or the nutrients these topsoils would normally provide, new herbaceous plants could not become established and degraded sites became increasingly desertified. These processes continue today in the piñon- juniper woodland of Bandelier and rapid soil erosion across much of the woodland has resulted. Degraded piñon- juniper woodland communities have grown to occupy thousands of hectares (ha) within the piñon- juniper woodland of Bandelier National Monument.

Active soil erosion on degraded piñon- juniper sites during the last fifty years is clearly evidenced by exposed soils and bedrock, soil pedestals, lobes of active sediment, and sediment accumulation behind fallen logs (Davenport, 1997). On the basis of sediment catchment data collected from 1995 to 2005 at multiple spatial scales, soil loss within degraded piñon- juniper communities at Bandelier at the scale of a hillslope can be can be conservatively estimated at approximately four millimeters (mm) per decade (Davenport, et al. 1996; Davenport, 1997; Davenport, et al. 1998; Wilcox, et al. 1996; Hastings, et al. 2004; Allen, et al. - - unpublished data). Higher rates have been measured in many individual years, on individual sites and certain time windows since 1995. Piñon- juniper woodland soils in Bandelier are at least tens of thousands of years old. Scientists know this because in these semiarid conditions it takes at least that long to develop the argillic (clay- rich) B- horizons found in most of these soils. This means that essentially the background or natural rate of net soil erosion for the Bandelier soil system has been zero for many thousands of years. Otherwise, the soils that the monument has today could not have formed and persisted (McFadden, personal communication 2002). Thus the current measured rates of soil erosion at Bandelier are extremely high, are unsustainable and reflect substantial degradation of soil resources. Although soil is now eroding in the piñon- juniper at a higher rate in some locations than others, assuming a range of soil depths from 15- 75 cm, an average four mm/decade erosion rate means that all soil would be lost in as little as 375 years or as many as 1875 years. Given their shallow depth (generally less than 25 centimeters on upland, non- pumice mesa areas), soils in the piñon- juniper woodland at Bandelier would be certain to be lost across the landscape in 625 years, and much sooner in some individual site locations.

As stated in the *Need for the Plan* section, rapid soil loss in 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 herbaceous understories 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).

RESEARCH AT BANDELIER

Natural Resources Research, Monitoring and Surveys

Staff at Bandelier National Monument have been conducting research and small-scale pilot treatments in piñon- juniper woodland for more than a decade. These experiments have included controls, and options such as plots protected from grazing by herbivore exclosures, seeding, girdling and herbicides, as well as thinning and slash treatment (Chong 1992; Potter 1985; Sydoriak, et al. 2001). To date, this research has found that cutting smaller piñon and juniper trees, and lopping and scattering the branches across the bare spaces between trees can increase both herbaceous ground cover and soil stability (Chong 1994; Jacobs and Gatewood 1999; Loftin 1999; Jacobs, et al. 2000). Studies at the monument also found that the highest potential for a successful response is on areas with deeper and more productive soils, which still support or have the capacity to support native understory communities that can carry periodic surface fires. These sites are also where it is most likely that former grassland, shrubland, or pine savanna occurred. These studies and other related research are described in more detail below.

Research in piñon- juniper woodland in Bandelier began in 1990, when a series of 300- meter vegetation line transects were established to quantify baseline conditions. While these transects are not a random or representative sample of woodland at Bandelier, they have been measured every couple years and provide meaningful monitoring data for park management. Associated with the vegetation line transects are a series of arthropod and mammal arrays, as well as photo points at different spatial scales; preliminary results of arthropod monitoring show large seasonal and annual fluctuations tracking temperature and moisture patterns, but without any apparent trends prior to onset of drought conditions in 2000 (Lightfoot, et al. 2000; Oertel 2004).

Transect data were useful in documenting changes in baseline conditions in piñon-juniper woodland that resulted from a recent regional drought. They indicated that tree canopy, litter, bare soil, and herbaceous plant basal coverage (coverage of the ground at the base of a plant) were fairly stable between 1990 and 2000, although there were often large fluctuations in aerial herbaceous plant cover (canopy cover of a plant) in response to annual precipitation patterns. With onset of drought conditions beginning around 2000, tree overstory patterns began to change

dramatically; by 2004 there was a >90% decrease in live piñon canopy above 6,300 feet. Total tree cover was reduced from 35- 40% cover to around 15- 20%, and dominated by one- seed juniper. In addition, basal cover of some perennial grasses, like big blue stem, also declined dramatically. Subsequent to piñon mortality, and with sufficient growing season moisture, there were associated temporal increases in annual and biennial cover on and around piñon canopy litter mounds.

In 1993, a one hectare study area was established to characterize water and sediment budgets in degraded woodland at Bandelier. This intensive site has been monitored continuously, with an automated rain station, runoff flumes, and sediment catchments at meter, 0.1 hectare, and 1.0 hectare scales. Recent infrastructure additions include equipment designed to quantify wind erosion and suspended sediment. In addition, intensive mapping of soils and vegetation (with a complete census of trees) has been conducted. Several professional publications have resulted from data collected and these provide unique insights into the hydrologic dynamics of a degraded piñon- juniper woodland hillslope at multiple temporal and spatial scales (Allen, et al. in prep; Wilcox, et. al. 1996a,b; 2003).

A series of small- scale (i.e., less than several acres in size) efforts to develop and test restoration methodologies compatible with natural, cultural and wilderness values were initiated in 1991 (Chong 1993, 1994) and 1994 (Jacobs and Gatewood 1999). Based on promising results from these small- scale studies, paired watershed level studies were initiated in 1996, both to validate treatment response for a greater range of site conditions and across multiple biotic and abiotic parameters at functional ecosystem scales, as well as to educate the public about degraded systems and restoration options. Tree thinning and distribution of slash mulch onto bare soil surfaces stimulated herbaceous plant growth and reduced the erosional effects of summer monsoonal rainfall events. Results after three to five years post- treatment were highly significant with two- to seven- fold increases in total herbaceous cover relative to both control and pre- treatment conditions and reductions in sediment production (i.e., soil erosion) by several orders of magnitude (Jacobs, et al. 2002b). Due to funding constraints, only partial data have been collected since 2000; however, most of the paired watershed infrastructure is still intact and able to support future monitoring efforts with renewed support.

In addition to the core restoration treatment study, a number of related and supporting research and monitoring efforts were conducted within the scope of the watershed restoration study site. These are briefly summarized below:

- A first order soil survey, conducted in 1997 delineated 12 soil types units within the two watersheds and immediately adjacent area (Davenport 1997); this classification was simplified to four soil types using presence/absence of surficial pumice and an underlying argillic horizon (Julius 1999).
- An analysis of woodland age structure and understory composition across the three major soil types was conducted within the treated portion of the watershed study area (Julius 1999).

- Butterfly response to watershed restoration treatment, recorded as species abundance and diversity along established vegetation transects in each of two watersheds over three separate years, was recently published as a separate report (Kleintjes, et al. 2004).
- Avian response to watershed restoration, based on data from representative point counts in each of two watersheds across four sample years, is in preparation (Fettig 2006a).
- Sediment production data in response to watershed restoration treatment, measured in six sediment dams per watershed and analyzed as a function of soil type and rain event intensity, has also been recently published in a separate report (Hastings, et al. 2002).
- Surface runoff and suspended sediment production were documented for two 0.3 ha sites (one in each of the treatment and control watersheds) across a range of precipitation events, in partnership with the USGS- WRD (Myers 2004). This three year study was initiated in 2002, during the recent drought, and results were limited by a shortage of significant precipitation events.
- The use of fire as a tool for long- term maintenance of mechanically restored woodland savanna systems was also recently evaluated (Jacobs and Gatewood 2002).

Historical perspectives on woodland systems and the central roles of favorable moisture for plant establishment and periodic disturbances (i.e., fire and drought) in shaping these communities has been documented in the literature, including in several USGS –Biological Resources Division sponsored studies (Allen and Breshears 1998; Allen, personal communication, 2005). Two intensive woodland demography plots document episodes of pulsed establishment and mortality, with tree ring records extending back to ca. 1550. Several packrat middens dated at 3000 years ago suggest piñon- juniper woodland areas have been present at Bandelier for thousands of years (Betancourt, personal communication 1993) although these midden data are most representative of plant communities within foraging distance of the rocky cliff habitat where the middens are located.

Finally, the National Park Service Inventory and Monitoring program has recently completed a soil survey and a vegetation map of the monument, which includes coverage of the woodland . The vegetation map was based on two sets of aerial imagery taken both before and after the recent drought event, and provides high resolution documentation of changes in woodland canopy cover.

Cultural Resources Research, Monitoring and Surveys

Although Bandelier has a long history of archeological research and excavation, systematic survey and monitoring of sites located in the piñon- juniper woodland are more recent phenomena.

The Bandelier Archeological Survey (BAS), an inventory of cultural resources on 42% of park lands (13,986 acres), was conducted from 1987 to 1991 (Powers and Orcutt 1999). A total of 1,959 archeological sites were recorded by the project. An additional

61 sites were recorded in 1992 using the same procedures. As noted above under the Erosion, the background of natural rate of net soil erosion in Bandelier has been zero for many thousands of years. (McFadden, personal communication 2002). This means that under undegraded conditions, the cultural resources in the monument would have persisted indefinitely, or until weather and other factors resulted in the loss of their integrity. The data collected from 1988 to 1992, which included recording information regarding erosion impacts to sites, shows that 90% of sites in the piñon-juniper woodland are affected by erosion.

Following the BAS, a number of surveys to prepare for prescribed burns were carried out, but sites were not recorded beyond their location and general site type. Slightly more information was gathered via a survey in 1992 in the southwest corner of the monument. Good site documentation accompanied surveys conducted after the 1996 Dome Fire. Overall from 1992 to 1999, survey coverage increased by 6,320 acres and identified approximately 500 sites, but with varying degrees of documentation of sites discovered.

Starting in 2001, Bandelier began a systematic program to complete the archeological inventory of its lands with detailed documentation including detailed and accurate mapping, detailed in- field artifact analysis, and current condition information including impacts and threats from both natural and human forces. Since 2001, an additional 3,900 acres (approximately) have been inventoried and approximately 400 sites documented. As of August 2005, 72% of the monument is surveyed (24,209 acres), and the current site database stands at 2,909 recorded sites. Of newly recorded sites in the piñon- juniper woodland, approximately 90% show evidence of erosion.

In 2002, Bandelier received funding to assess the condition of 470 previously recorded archeological sites located on mesa tops within the piñon- juniper woodland (a 28% random sample), and to monitor a subset of these over the next two years. The assessment included systematic recording of erosion impacts to different aspects of each site, repeat photography, and estimation of herbaceous and tree cover on each site. These data also showed that 90% of sites revisited were impacted by erosion (Herhahn 2003). Thirty- two sites out of these 470 sites were selected for longer- term monitoring that includes repeat photography and estimation of herbaceous and tree cover on each site, as well as measuring the surface profile of the site along a transect over each site. These data are still being collected and analyzed.

Another related study indicates that water erosion has resulted in the loss of thousands of artifacts in relatively small areas of the monument, a trend expected to continue without management intervention (Maher, Hogan and Allen 2001). Exposed soil surfaces often exceed 80% cover in woodland intercanopy areas. These large expanses of exposed soil can generate considerable sediment yields during runoff events (Allen, unpublished data; Hastings, et. al. 2002;Wilcox, et al. 1993, 2003). The stabilization of vegetation and soils in the piñon- juniper areas will mitigate many of the current conditions contributing to the loss of archeological resources. Such actions are believed to have the potential to stabilize/protect a large percent of the

vulnerable archeological sites in the monument's piñon- juniper areas (see soils and cultural resource discussions in Affected Environment for more detail on erosion and its effects to archeological resources).

Administrative History

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. Ethnographic resources are defined as any "site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 2006a). Bandelier National Monument contains approximately 2,900 recorded archeological sites, ranging in date from the Paleoindian period (10,000 years ago) to the historic period. The monument includes ancient hunting camps, "cavate" structures (unique to Bandelier), 20 to 300+- room pueblos, small farming hamlets, and the remains of historic corrals and log cabins. Bandelier is also home to one of the largest collections of buildings from the Civilian Conservation Corps (CCC) era. Between 1933 and 1940, the Civilian Conservation Corps (CCC) operated a work camp in Frijoles Canyon at Bandelier and built almost every historic structure that currently exists. Because of its significance, the Frijoles area was designated a national historic landmark in 1987 commemorating the accomplishments of the CCC and its contributions to the history of the National Park Service.

The importance of "ethnographic, scientific and educational" values at Bandelier was further defined and articulated in the 1977 Bandelier *Master Plan* (NPS 1977). This plan is a policy document which governs management of resources and values across the monument. It called for the protection and interpretation of ruins in the monument, and the preservation of the park's natural setting. These twin goals were identified as the purposes of the monument.

The *Master Plan* was updated via a *Statement for Management* in 1990, a guide which includes both general and specific policies (NPS 1990). Stated objectives in the *Statement for Management* include the need for managing cultural and natural resources, providing for management- oriented scientific study of issues related to soils erosion on vegetation, and documenting changes resulting from human activities.

In 2000, the monument produced its *Strategic Plan* for governing the park for the next five years (2000- 2005) (NPS 2000a). In it, the purpose and significance of the monument was elaborated upon, and the mission statement and mission goals were identified. The pieces of the Strategic Plan relevant to this *ecological restoration effort* include the following:

The purpose of the monument is:

- To preserve, protect and manage cultural and natural resources to promote self-sustaining environmental conditions, and the information they represent, as existed prior to modern human influence (that is prior to landscape level livestock grazing and wildlife suppression and following Ancestral Puebloan occupation of the area).
- To provide the means and opportunity to study, understand and enjoy the resources of the monument without unduly compromising the resources or ethnographic values.

The primary significance of the monument relevant to this plan can be summarized as:

- A high concentration and wide variety of well- preserved archeological sites;
- The descendants of this prehistoric culture live in the area today and maintain their cultural and religious ties to the past through the area now encompassed by the park;
- The diverse ecological resources in this relatively small area support intact ecosystems, many vegetation types, associated fauna, and the Bandelier Wilderness, all of which are managed to enable the functioning of natural processes;
- Visitors experience the inspirational qualities of the past and present and the sense of solitude in an environmental rich in archeological sites and wilderness values and in relatively unaltered and scenic landscape;
- Outstanding natural and cultural research opportunities resulting from a relatively high integrity of resources and degree of resource protection.

The *Strategic Plan* also contains mission goals directly relevant to the *Ecological Restoration Plan*. One of these mission goals for Bandelier is to "preserve, protect and manage cultural and natural resources to promote self- sustaining environmental conditions and preserve the information- yielding potential they represent." The *Strategic Plan* goes on to describe accelerated erosion as the identified threat to achieving this goal.

Bandelier recently also 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.

SCOPING PROCESS AND PUBLIC PARTICIPATION

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in an environmental impact statement. Bandelier National Monument has conducted both internal scoping with NPS staff and external scoping with the public and interested and affected groups and agencies.

Internal scoping was conducted by the staff at Bandelier. An interdisciplinary team (IDT) (see *Preparers and Contributors* section of the *Consultation and Coordination* section of this EIS) was formed early in the internal scoping process to define the purpose and need, identify action alternatives to address the purpose and need, determine what the likely issues and impact topics would be, and to identify the relationship, if any, of the proposed alternatives to other planning efforts at the monument.

Internal scoping efforts also included staff meetings with technical experts at both the Natural Resources Program Center and the Intermountain Region of the National Park Service.

External public scoping began with a notice of intent to prepare an environmental impact statement, which was published in the *Federal Register* on April 2, 2003. The monument then conducted four scoping open houses open to the public in Los Alamos and Santa Fe in June 2003 and November 2003. Additional information on public scoping meetings is presented in the *Consultation and Coordination* section of this EIS. The monument also continued ongoing consultation with affected Pueblo communities to ensure that they were fully informed of the proposal and that any suggestions regarding appropriate treatment of cultural sites or resources was fully considered.

ISSUES AND IMPACT TOPICS

Environmental issues are statements of problems or opportunities that might occur if the actions identified in the alternatives were implemented. The degree to which these become problems or advantages is analyzed as a set of impact topics in the *Environment Consequences* section. Issues listed here all have the potential to result in more than negligible changes.

Input from NPS specialists; other federal, state, and local agencies; non-governmental organizations; and the general public resulted in the identification of the following issues and impact topics, which are evaluated in detail in the *Environmental Consequences* section of this environmental impact statement.

Vegetation

Treatments are designed to restructure vegetative communities (by imposing vegetation composition and structure, and ecosystem processes as described above in the *Desired Future Conditions* section) within the woodland and thereby promote more sustainable ecological trajectories. Woodland areas on productive, deep soil sites would resemble savanna- like communities and promote the release of suppressed understory vegetation or remnant plant materials; these understory elements are expected to respond favorably to increased light and moisture conditions between fewer and more widely spaced tree canopies.

Creating camps and crews accessing treatment sites may result in the trampling, damage and/or loss of some vegetation during the treatment period.

Soils

With slash mulch application, and with recovery of a perennial herbaceous understory, soil erosion would be progressively slowed. During treatment, some localized increases in soil disturbance and compaction at the work or camp sites or along access routes would likely occur.

Water Resources and Water Quality

Accelerated erosion in upland settings can potentially lead to increased siltation along some reaches of the monument's perennial streams and river. In addition, woodification within the piñon- juniper has likely altered soil moisture balance dynamics, resulting in desertification of upland sites and increased runoff to lower gradient areas.

Cultural Resources

The NPS defines cultural resources as including archeological resources, historic and prehistoric structures, cultural landscapes, ethnographic resources, and museum collections (NPS 1998). No historic and prehistoric structures, cultural landscapes or museum collections would be affected by any of the alternatives analyzed. However, both archeological and ethnographic cultural resources might be affected in the short and long term by actions in the alternatives. As soils are stabilized, archeological resources would be less threatened with loss. Clearing vegetation away from cultural sites would help ensure their safety should a prescribed or wildland fire burn through the area, but it may also make the resource more visible and subject to damage or theft.

Pueblo Indian groups have a special relationship to Bandelier and treatment may affect elements of this relationship. The presence of crews or use of motorized equipment may temporarily restrict or affect access to ethnographically significant natural resources or places with which these groups are historically associated.

Currently, Bandelier National Monument has a Memorandum of Agreement (MOU) with the six pueblos that are most closely affiliated with Bandelier: Santa Clara, Santo Domingo, San Ildefonso, San Felipe, Zuni, and Cochiti. This MOU requires Bandelier to regularly and actively consult with these pueblos regarding monument activities, sacred materials or places, or other ethnographic resources with which they are historically associated. A Consultation Committee has been established consisting of tribal representatives from the six pueblos and serves to maintain an effective means of communication and consultation between Bandelier and Pueblo Indian communities that are traditionally associated with Bandelier National Monument.

Visitor Use and Experience

The noise associated with treatment (chainsaws, helicopters, etc.) may affect the visitor experience of some backcountry users. Visual changes in the landscape (see below) may also affect some visitors- - some visitors may find the changes in vegetation unattractive or undesirable, as they have become familiar with a more densely wooded landscape. Some visitors may find the cutting of trees offensive, but others may find the more open landscape appealing. There may be changes to visitor use patterns resulting from activity during treatment in certain areas.

Visual Quality

The landscape will look more open following treatment if one of the action alternatives is selected. Vistas that are obscured by trees may be opened. During treatment, visitors may see crews working in wilderness areas.

Wilderness

Most of the areas proposed for treatment are within designated wilderness. The values associated with wilderness include quiet, solitude, and a natural experience. Restoring vegetative communities and associated wildlife to within the natural range of variability would help restore wilderness values, but noise from motorized equipment, the presence of stumps and slash, and the presence of human activity during treatment may affect the wilderness experience for some visitors.

Some visitors may believe any human intervention in wilderness is inappropriate, regardless of the condition of its resources, as it violates the "untrammeled" nature of wilderness. Others believe intervention is warranted in some cases to return ecological or other values or to protect natural or cultural resources.

Wildlife

The alternatives considered in this document have the potential to affect and alter wildlife communities through the modification of wildlife habitat. The manipulation of vegetative communities may alter species composition and abundance and may influence habitat use inside and outside Bandelier's boundaries. Noise from equipment and the presence of humans during treatment may disturb or displace wildlife.

Special Status Species

Actions associated with treatment, including the presence of human activity, use of motorized equipment and/or activities associated with supplying workers may disturb or disrupt special status wildlife. Restoration of ecologically sustainable conditions in piñon- juniper woodland may provide habitat for these or other special status species.

Air Quality

Air quality impacts related to treatment associated with this planning effort include temporary emissions from chainsaws and helicopters that may be used during treatment.

Park Operations

The use of staff or contractor time would be needed to conduct landscape- level treatments. To accomplish treatments, additional money and other resources may be required, or staff may need to be temporarily reassigned.

Health and Safety

Impacts of noise from chainsaws, helicopters and from the use of hand tools on worker's hearing may occur.

Impact Topics Dismissed from Further Analysis

These impact topics were considered by the interdisciplinary team, but dismissed from further analysis because they are either not relevant to the proposal, or impacts to these resources would be negligible; that is, barely detectable.

SOCIOECONOMIC ENVIRONMENT

The socioeconomic environment includes local and regional businesses and residents, the local and regional economy, and concessions at the monument. The economies of the surrounding communities of Los Alamos and White Rock function independently of Bandelier tourism, even though monument visitors often take advantage of local lodging and restaurants.

Implementation of an action alternative (Alternative B or C) may require hiring a small number of temporary contract workers. These workers may be local or regional residents, and they may utilize the surrounding communities in the short term. However, the number of new workers needed to implement action alternatives is expected to have negligible effects on the local and regional economy and monument concessioners. For these reasons, the socioeconomic environment has been dismissed as an impact topic.

ENVIRONMENTAL JUSTICE

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low- income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects if their programs and policies have effects on minority and low- income populations and communities. No disproportionate impacts to minority or low- income populations or communities, as defined in the U.S. Environmental Protection Agency's (EPA) guidelines for environmental justice concerns (EPA 1998) are expected; therefore, environmental justice has been dismissed as an impact topic.

WETLANDS AND FLOODPLAINS

Proposed treatment areas in Bandelier do not include wetlands or floodplains.

PRIME AND UNIQUE FARMLANDS

No prime or unique farmlands exist within Bandelier National Monument, and none would be affected by actions proposed in any of the alternatives.

PUBLIC HEALTH AND SAFETY

The alternatives being considered would primarily be implemented in backcountry areas and not near communities or public facilities. Most activities would be conducted during the off- season months (mid- August through mid- March) in order to minimize effects to visitors and the general public. Under all alternatives only negligible effects are expected to public health and safety; therefore, this topic is not analyzed further in this document.

WILD AND SCENIC RIVERS

The areas identified for treatment in this document do not contain any designated wild or scenic rivers.

INDIAN TRUST RESOURCES

Federal agencies are required to address environmental impacts of their proposed actions on Indian Trust Resources in any environmental document (Secretarial Order 3175 and ECM95- 2). Because no identified Indian Trust Resources exist in the monument, no impact would occur.

SACRED SITES

Sacred sites are defined as specific, discrete, narrowly delineated locations on Federal land identified by an Indian tribe or appropriate authoritative representative, as sacred by virtue of their established religious or ceremonial significance. The managing agency (in this case, the National Park Service) must be provided information on the existence of such sites (Executive Order 13007). Impacts to sacred sites would be avoided through consultation with potentially affected tribes.

CONFLICTS WITH OTHER AGENCY LAND USE PLANS

No land use plans or policies of other agencies (local, state, or Indian tribe) would be affected by actions proposed in any of the alternatives.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Under any alternative, the National Park Service would continue to implement its policies of reducing costs and conserving resources by using energy- efficient and cost- effective technology as required in *Management Policies 2006* (NPS 2006a), and would continue to look for energy- saving opportunities in all aspects of park operations. Consequently, the topic has been dismissed from further consideration in this EIS.

NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

Under any alternative, the National Park Service would continue to strive to minimize short- and long- term environmental impacts of management actions through resource conservation, recycling, waste minimization, and the use of energy-efficient and ecologically responsible materials and techniques as required in *Management Policies 2006* (NPS 2006a). Consequently, the topic has been dismissed from further consideration in this EIS.

URBAN QUALITY, HISTORIC AND CULTURAL RESOURCES, AND DESIGN OF THE BUILT ENVIRONMENT

No alternatives have the potential to affect urban quality, historic and cultural resources (other than those covered in the impact topic "Cultural Resources"), and design of the built environment. Consequently, the topic has been dismissed from further consideration in this EIS.

RELATED LAWS, POLICIES AND PLANS

Laws and Policies

Organic Act and NPS Management Policies. As noted above, by enacting the National Park Service Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of Interior and the NPS to manage units "to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations" (16 USC. § 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC § 1a- 1).

Despite these mandates, the Organic Act and its amendments afford the National Park Service latitude when making resource decisions that balance visitor recreation and resource preservation. By these acts Congress "empowered [the National Park Service] with the authority to determine what uses of park resources are proper and what proportion of the parks resources are available for each use" (*Bicycle Trails Council of Marin v. Babbitt,* 82 F.3d 1445, 1453 [9th Cir. 1996]).

Because conservation remains its predominant mandate, the National Park Service seeks to avoid or to minimize adverse impacts on park resources and values. Yet, the National Park Service has discretion to allow negative impacts when necessary (*Management Policies 2006*, sec. 1.4.3 [NPS 2006a]); however, while some actions and activities cause impacts, the National Park Service cannot allow an adverse impact that constitutes resource impairment (*Management Policies 2006,* sec. 1.4.3 [NPS 2006a]). The Organic Act prohibits actions that permanently impair park resources

unless a law directly and specifically allows for the acts (16 USC 1a- 1). An action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (*Management Policies 2006,* sec. 1.4.4 [NPS 2006a]). To determine impairment, the National Park Service must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (*Management Policies 2006,* sec. 1.4.4 [NPS 2006a]). The *Management Policies* require that these determinations, and

all planning decisions in the Service, be based on current scientific and scholarly understanding of park resources and ecosystems (sec 2.3.1.5).

Park units vary based on their enabling legislation, natural resources, cultural resources, and missions. Management activities appropriate for each unit and for areas within each unit vary as well. An action appropriate in one unit could impair resources in another unit.

As previously mentioned, Bandelier National Monument was established because of its significant "prehistoric aboriginal ruins" and their "unusual ethnologic, scientific and educational" values. An estimated 1,900 cultural resource sites in the monument's backcountry are at risk of damage or loss from accelerated soil erosion related to vegetative changes resulting from historic overgrazing and fire suppression, as described in the *Background* section. In addition to the threat to the monument's cultural resources, allowing existing conditions in these vegetative communities to continue could mean the loss of large areas of the park's vegetative and soil resources, as well as adverse and large- scale effects on native wildlife and wilderness values. This environmental impact statement will analyze the context, duration, and intensity of these impacts, and will be used by the NPS to determine the potential for impairment of park resources and values as required by *Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decision- making* (DO 12)(NPS 2001).

Wilderness Act. As noted in other sections of this document, most of the piñon-juniper in Bandelier that would be treated if this plan were implemented is located in the 23,267- acre designated Bandelier Wilderness. Both the Wilderness Act and the NPS Organic Act require the National Park Service to administer wilderness areas "in such a manner as to leave them unimpaired for future use and enjoyment." While management actions are discouraged in wilderness where ecosystem processes are naturally functioning, they are allowed when needed to correct "past mistakes" or "the impacts of human use" (NPS 2006a, sec. 6.3.7). Section 4(c) of the Wilderness Act discourages motorized equipment in the wilderness to accomplish the tasks of preservation and protection, but does allow it if there is justifiable need and it has been found to be the "minimum requirement needed by management to achieve the purposes of the area as wilderness" (NPS 2006a, sec. 6.3.5). A minimum requirement and minimum tool analysis has been completed for this plan (see Appendix A) and

has found that motorized equipment may be preferable to the use of hand tools because it substantially reduces the overall impact on wilderness resources and values.

Endangered Species Act. The Endangered Species Act of 1973, as amended, states that fish, wildlife and plant species are of esthetic, ecological, educational, historical, recreational, and scientific value to the nation. The Act's purpose is to conserve the ecosystems upon which these species depend, and generally, to increase populations and secure sufficient habitat to recover species to viable levels.

Under section 7(a)(2) of the Act, the National Park Service must ensure that any action that is authorized, funded, or carried out is not likely to jeopardize the continued existence of listed threatened or endangered species or to result in the destruction or adverse modification of designated critical habitat. The National Park Service is required to consult with the U.S. Fish and Wildlife Service (USFWS) if it is determined that an action may adversely affect listed threatened or endangered species or designated critical habitat. The Act also prohibits activities that would constitute an unauthorized "taking" of the protected species.

The National Park Service is required to control access to critical habitat for listed species, and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend. In addition, the *Management Policies 2006* require that all state and locally listed species be considered in planning activities (NPS 2006a, sec. 4.4.2.3).

National Historic Preservation Act. The National Historic Preservation Act of 1966, as amended, (NHPA) (16 U.S.C. 470 et seq.) is the principal legislative authority for the management of cultural resources associated with NPS projects. Section 106 of the Act requires all federal agencies to consider the effects of their actions on cultural resources (historic properties) determined eligible for listing in the National Register of Historic Places (register). In addition, the Act requires that federal agencies take actions to minimize harm to historic properties that would be adversely affected by a federal undertaking. Section 110 of the Act charges federal agencies with the responsibility for establishing preservation programs to identify, evaluate, and nominate historic properties to the register.

National Environmental Policy Act. The National Environmental Policy Act requires that federal decision- makers consider environmental impacts related to proposed actions ((such as implementing actions described in this *Draft Ecological Restoration Plan and EIS*) prior to implementation. This involves analyzing the potential effects and gathering public input as required by the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.). This EIS is being prepared to comply with the requirements of NEPA and the Council on Environmental Quality (CEQ), Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500–1508). In addition, this EIS will comply with NPS *Director's Order 12: Conservation Planning, Environmental Impact Analysis and*

Decision- making (NPS 2001), NPS *Management Policies 20061* (NPS 2006a), and any other NPS procedures or instructions regarding NEPA.

Please refer to the *Environmental Consequences* section for additional resource-specific laws, regulations and policies.

Park Plans

Master Plan. As noted above in the section on *Administrative History* of Bandelier, the purpose of the monument, as stated in the 1916 presidential proclamation establishing the monument, is the preservation and protection of "certain prehistoric aboriginal ruins . . . with as much land as may be necessary for the proper protection thereof." According to the 1977 *Master Plan,* the protection and interpretation of the ruins and the preservation of the natural setting have been and will continue to be the purpose of NPS management of the monument.

Statement for Management. The *Statement for Management* is also detailed above in the section on *Administrative History*. To summarize, this update of the park's *Master Plan* includes both general and specific policies relevant to proposed actions in this document (NPS 1990). Stated objectives include the need for managing cultural and natural resources, providing for management- oriented scientific study of issues related to soils erosion and effects of fire suppression on vegetation, and documenting changes resulting from human activities.

Strategic Plan. The relevant pieces of the Bandelier *Strategic Plan* are summarized above in the *Administrative History* section. Of note, one very specific goal of the *Strategic Plan* is to return 10% of the park to within the natural range of variability (including biologic diversity and processes) trending towards pre- 1880s conditions (NPS 2000a).

Fire Management Plan. The purpose of Bandelier's recently revised and updated *Fire Management Plan* (FMP) is to provide a framework for making fire and fuels management decisions and to describe fire and resource management goals and objectives (NPS 2005a). One goal relevant to this *Draft Ecological Restoration Plan and EIS* that the *Strategic Plan*, the *Resource Management Plan* for the monument, and the FMP (NPS 1995a, 2000a, 2005a) share is to:

> provide the means for staff and the public to preserve, protect, understand, and enjoy the cultural and natural resources of Bandelier National Monument through an integrated program where management activities support naturally functioning ecosystems consistent with cultural resource preservation needs.

The FMP supports this goal by prescribing actions and conditions under which actions would be implemented to achieve specific goals, including resource goals like the one identified above. The actions include fire suppression, prescribed fire, Wildland Fire Use (WFU), and manual and mechanical thinning. Wildland Fire Use is described in the FMP as the "practice of allowing a naturally ignited wildland fire to burn in a predefined geographic area, under specific prescription parameters, to

accomplish fire and resource management goals and objectives" (NPS 2005a:20). In piñon- juniper woodland, the FMP allows the use of these tools, but because no or little herbaceous understory exists to carry wildland or prescribed fire, the need or planning for these activities or for fire suppression is minimal. Although manual and mechanical thinning are allowed, the locations, prescriptions and goals for doing so are different in the FMP than they would be in this plan. In addition, no lop and scattering of branches or attention to soil erosion would be included as part of the FMP activities. Rather, the alternatives in this *Draft Ecological Restoration Plan EIS* are intended to promote future ecological conditions that will enable the use of lightning- caused and prescribed fires managed under the FMP, so that fire becomes the primary ecological mechanism regulating and sustaining vegetative and soil conditions within the piñon- juniper woodland .

Tsankawi Management Plan. Tsankawi does contain areas dominated by piñon-juniper woodland experiencing accelerated soil erosion and in need of restoration treatment; however this section is addressed and managed according to the 2000 *Tsankawi Management Plan Environmental Assessment* (NPS 2000b) and Tsankawi is not part of this planning effort.

Wilderness and Backcountry Management Plans and Policies. Bandelier National Monument does not have an approved wilderness or backcountry management plan; however a substantial draft plan has been completed. In the absence of a more formalized plan, wilderness and backcountry are managed in accordance with the NPS *Management Policies 2006* (NPS 2006a).

Vegetation Management Plan. Bandelier National Monument has a *Vegetation Management Plan* which details routine and ongoing administrative actions relevant to vegetation, where impacts of management can generally be addressed through internal review. The plan outlines treatment options for ongoing vegetation management actions, such as exotic plant control (recently supplemented by an *Exotic Plant Management Plan*, 2006) and hazard tree management. Information from this plan, including descriptions of vegetation communities and complexes, and of desired future conditions for these communities is incorporated by reference and summarized where needed in this *Draft Ecological Restoration Plan and EIS*.