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## *An overview of the Valles Caldera National Preserve: The natural and cultural resources*

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# AN OVERVIEW OF THE VALLES CALDERA NATIONAL PRESERVE: THE NATURAL AND CULTURAL RESOURCES

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**ABSTRACT** — The Valles Caldera National Preserve is one of New Mexico's natural wonders and a popular area for public recreation, sustainable natural resource production, and scientific research and education. Here, we provide a concise overview of the natural and cultural history of the Preserve, including descriptions of the ecosystems, flora and fauna. We note that, at the landscape scale, the Valles caldera appears to be spectacularly pristine; however, humans have extracted resources from the Preserve area for many centuries, resulting in localized impacts to forests, grasslands and watersheds. The Valles Caldera Trust is now charged with managing the Preserve and providing public access, while preserving and restoring these valuable public resources.

## INTRODUCTION

The Valles Caldera Preservation Act (Public Law 106-248), passed by Congress in 2000, provided for the acquisition of the Baca Ranch located in the Jemez Mountains of New Mexico (Fig. 1). The Act designated the acquired lands to be the Valles Caldera National Preserve and created the Valles Caldera Trust to manage the 88,900 acre tract. The Preserve was established to protect and preserve the scientific, scenic, geologic, watershed, fish, wildlife, historic, heritage, and recreational values of the Preserve, and to provide for multiple use and sustained yield of renewable resources within the Preserve. Congress also mandated that the Trust become financially self-sustaining within 15 years, indicating that public use fees and renewable resource revenues would eventually provide sufficient income to operate the Preserve without Federal appropriations.

During the past several years, the Trust has been establishing recreation programs, operating interim programs for livestock grazing, and undertaking the daunting task of inventorying and monitoring the natural and cultural resources on the Preserve. Current public access programs include recreational hiking, horseback riding, cross-country skiing, fishing, elk and turkey hunting, and a wide variety of special events, such as night-sky programs, weekend photography workshops, geology and nature tours, horse-drawn wagon and sleigh rides, and public school educational activities. Scientific inventories for flora, fauna, soils, geology, and watershed condition, together with cultural resource surveys, are still under way to provide resource data for science-based adaptive management planning. In addition, numerous scientists from a wide variety of agencies and universities are using the Preserve as an outdoor laboratory for research and education.

## NATURAL RESOURCES

The Valles Caldera National Preserve (VCNP) lies at the center of the Jemez Mountains of northern New Mexico (Fig. 2). The VCNP is a collapsed magma chamber approximately 25 km (15.5 mi) in diameter, and incorporates multiple resurgent lava domes that rose following the chamber's collapse ca. 1.25 million years ago. The VCNP is characterized by forested domes and grassland

*valles*. Elevation ranges from 2,440 m (7,930 ft) at the outflow of the Jemez River's East Fork, to 3,430 m (11,254 ft) on Redondo Peak, the highest dome in the caldera. The VCNP forms a single watershed unit draining out a breach in the caldera wall to the Jemez River's San Diego Canyon, southwest of the VCNP.

The Jemez Mountains flora and ecology is typical of the southern Rocky Mountains. Ponderosa pine (*Pinus ponderosa*) is the major tree species below 2,740 m (9,000 ft) that rings the valles, except on some north-facing slopes where blue spruce (*Picea pungens*) has recently gained importance (Hogan and Allen, 1999; Muldavin and Tonne, 2003; Muldavin et al., 2006). Ponderosa forests grade into mixed-conifer forests with higher elevation. These stands occur below ~3,050 m (10,000 ft) and contain combinations of ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), quaking aspen (*Populus tremuloides*), and limber pine (*Pinus flexilis*). Spruce-fir forests dominated by Engelmann spruce (*Picea engelmannii*) and corkbark fir (*A. lasiocarpa* var. *arizonica*) are found at the highest elevations above 2,740 m (9,000 ft). Aspen (*P. tremuloides*) stands occur throughout the forested landscape. Soil characteristics, cold air drainage, hydrology, fire, and grazing contribute to the maintenance of the grasslands that span the valles in the enclosed caldera (Allen, 1989; Coop and Givnish, 2007a, b). On the VCNP, 20 habitat mapping units, including specific vegetation associations and their characteristic flora (Fig. 3), have been identified and described by Muldavin et al. (2006). In addition, soils mapping by scientists with the U.S. Forest Service and National Resource Conservation Service have yielded 20 soil series within 19 soil mapping units on the Preserve.

The VCNP supports a great diversity of animals, plants and fungi. Species inventoried during 2001-2007 include 48 species of mammals, 113 breeding birds, 6 reptiles, 3 amphibians, 6 fish, 525 plants, 28 lichens, 11 algae and 5 slime molds. Ongoing inventories of insects have resulted in hundreds of species identified, including 131 species of aquatic insects from VCNP streams and wetlands.

Wildfire, herbivory, and logging have been the principal disturbances influencing vegetation pattern and process in the VCNP (Balmat and Kupfer 2004). Fire has been a principal force shaping local vegetation patterns. Most Jemez Mountains ecosystems experienced a history of frequent, widespread, lightning-ignited



FIGURE 1. The Valles Caldera National Preserve [Photos by Don Usner (DU), Esteban Muldavin (EM), Robert Parmenter (RP) and Kimber Barber (KB)]. Clockwise from upper left: view of San Antonio Creek in Valle San Antonio (DU); north rim of the Valles Caldera (EM); aerial view of Valle Toledo following a prescribed fire in November, 2005 (RP); livestock grazing in the Valle Grande (DU); bull elk bugling (KB); “bachelor herd” of bull elk (DU). See Plate 1 on page 131 for color version of this figure.



FIGURE 2. View of the Valle Grande (looking east) from the slope of Redondo Peak (Photo, R. Parmenter).

fires prior to the late 1800s, when intensive livestock grazing and subsequent active fire suppression greatly reduced fire frequencies (Allen 1989, 2002; Touchan et al., 1996; Morino et al., 1998). Herbivory by livestock (sheep and cattle) has also directly altered vegetation structure and composition. Largely as a result of the often intertwined effects of grazing histories and fire suppression, most local vegetation types have undergone major changes in the past century (Allen, 1989), similar to those generally described for New Mexico and the Southwest (Dick-Peddie, 1994). Vegetation changes in the VCNP include (1) extensive invasion of montane grasslands and meadows by trees; (2) extreme increases in tree density in many mixed conifer and ponderosa pine forests, with associated increased potentials for unnaturally intense fires, like the 1977 La Mesa Fire in Bandelier National Monument, the 1996 Dome Fire, and the 2000 Cerro Grande Fire; and (3) the spread of numerous exotic species, which presently account for approximately 10% of VCNP's vascular flora.

High levels of historic grazing activities by domesticated livestock and increasing elk populations also have had associated impacts on VCNP watersheds, streams and water quality (Fig. 4). Breakdown of stream banks and trampling of riparian vegetation have altered the geomorphology of stream channels by "scaloping" the stream banks, creating streams that were wider and shallower than would be expected in a more natural situation. However, with the recent 80-90% reduction in cattle stocking rates by the managers of the Valles Caldera Trust since Preserve acquisition in 2000, streams are recovering and have increased substantially in their "proper functioning condition" classifications (McWilliams et al., 2000; McWilliams, 2006).

Historic logging activities also led to extensive disturbance to the ecosystems of the VCNP. Logging began in 1935, and continued at varying levels until the Preserve was acquired by Congress in 2000. The most intensive logging occurred in the 1960s and early 1970s by the New Mexico Timber Company, which owned the timber rights to the Preserve's forests (Fig. 5). Clear-cutting and jammer logging were utilized to harvest the large-diameter trees, and over 1,100 miles of logging roads were bulldozed through the forests (Fig. 6). Since that time, the forests have regrown in dense,

"dog hair" thickets of small trees, creating areas of high risk for catastrophic fire. One of the Trust's major management priorities is to thin these forests to reduce fire hazard, and return the forests to a more natural, sustainable condition (Fig. 7).

## CULTURAL RESOURCES

The rich animal, botanical, and mineral resources of the Valles caldera have provided materials and food for human use throughout prehistory. The earliest occupation of the Southwest began during the Paleoindian period, dated from more than 10,000 years ago to about 7500 years ago (5500 BC). Evidence for these earliest inhabitants is tantalizingly ephemeral; only a handful of possible Paleoindian camp sites have been discovered in the Jemez Mountains and none are within the caldera. Rather, the presence of these early hunter-gatherers is suggested by tentative obsidian hydration dating (Russell, 1981; Anschuetz, 2006), by obsidian points found in the Preserve that appear similar to the early types, or by geochemical sourcing of obsidian artifacts found at Paleoindian sites outside the Jemez Mountains back to the geological deposits found at Cerro del Medio. These early sites can be difficult to find because deposits in which they occur are buried or eroded over time, or because artifacts from the period are mixed in with those from subsequent human use at the same locations.

During the Archaic period (5500 BC through AD 500), the subsistence base for these human groups witnessed a shift from wide-ranging hunting of large game animals and gathering of botanical resources toward a focus on harvesting and processing of region-specific plant resources such as seeds and nuts. For the first time, artifact assemblages commonly include ground stone artifacts, believed to be used in processing of vegetal resources. Flaked stone artifacts often were made only of locally available materials and distinctive tool types include a variety of dart points. Some sites on the Preserve are dated to the Middle and Late Archaic, suggesting to archaeologists that human use of the Preserve progressively increased throughout the Archaic. In fact, excavations in the 1980s and 1990s associated with geothermal and power line projects within the caldera (Acklen et al., 1993, 1997; Baker and Winter, 1981; Winter, 1983) contributed substantially to the sum of what is known about the Archaic period in the Jemez Mountains. The numerous large and small scatters of obsidian tools and debris found throughout the caldera represent a wide range of types of use, from locations used briefly to make stone tools or prepare specific resources such as game or fish, to small seasonal camp sites, to expansive habitation sites that were occupied repeatedly over centuries.

While domesticated maize entered the Southwest as early as the Late Archaic in the Jemez Mountains (Vierra and Ford, 2006), dependence on cultivated plants and horticultural practices did not occur until the Ancestral Puebloan period (AD 500-1650). Pottery first appears during this period, initially as plain ceramics and then in a diverse range of decorated types including the black-on-white ceramics common all over the Jemez Mountains. Small flaked stone points suitable for use as arrows also first appear. The characteristic round subsurface "pithouses" distinctive to the period before AD 1000 are not known within the Preserve. After

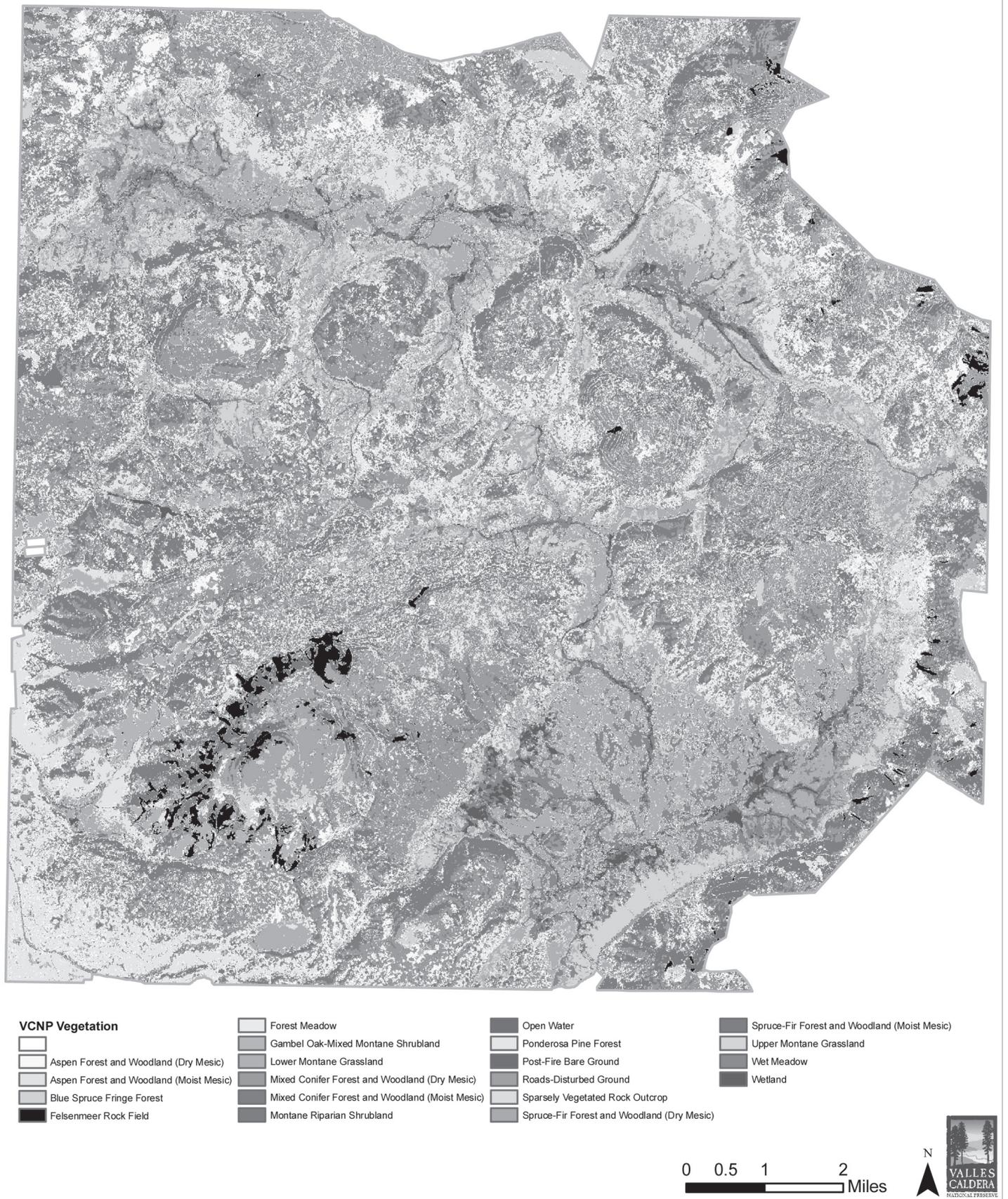


FIGURE 3. Vegetation map of the Valles Caldera National Preserve.



FIGURE 4. Repeat photographs of Jaramillo Creek in the Valle Grande. Left, mid-1930s during periods of extensive sheep grazing. Right, same location in 2001 (Photo, S. Tharnstrom). Note how riparian vegetation has stabilized the streambanks, creating a narrower, deeper channel. This improved stream geomorphology reduces both erosion and temperature levels.

AD 1000, a shift to above-ground habitation structures appears to coincide with the beginning of agricultural intensification and increased permanence in settlement that continued throughout the period and characterizes the historic pueblos across the Southwest. However on the Preserve, small one- and two-room masonry structures called “fieldhouses”, ubiquitous in the Jemez area and on the Pajarito Plateau, appear to occur only on Banco Bonito in the southwestern part of the Preserve. It is likely that the south-facing gently sloping landforms on Banco Bonito (below 2500 m in elevation) offer the only conditions within the Preserve suitable for maize agriculture. This also is why there are no pueblos within the caldera. Plant foods may have been cultivated or encouraged at other locations within the caldera, but the types of plants would have been quite different than those that supported Puebloan populations who relied on maize-beans-squash horticulture.

The absence or restricted distribution of fieldhouses and large settlements does not indicate diminishing use of the caldera by

Puebloan people. Rather, the sedentary agricultural people in late prehistory probably used the caldera much as it is used today, as an area without large or permanent habitation but visited or occupied briefly by all the people of the region. Thus, while ceramic sherds compose only a small fraction of the total artifacts present on the Preserve, the decorated sherds that have been recovered are broadly diverse and represent the distinctive ceramic types characteristic of the numerous cultural groups in the surrounding region. Undoubtedly, the rich obsidian-bearing geological deposits in and around the caldera were an important draw for prehistoric peoples from PaleoIndian through Ancestral Puebloan times (Fig. 8).

One of the challenges in understanding the archaeological record in the Preserve is interpreting the function and age of the numerous obsidian artifact scatters found everywhere in the caldera. The artifact assemblages at these sites were created while knapping obsidian collected at primary and secondary geological deposits located at Cerro del Medio, San Antonio Creek,

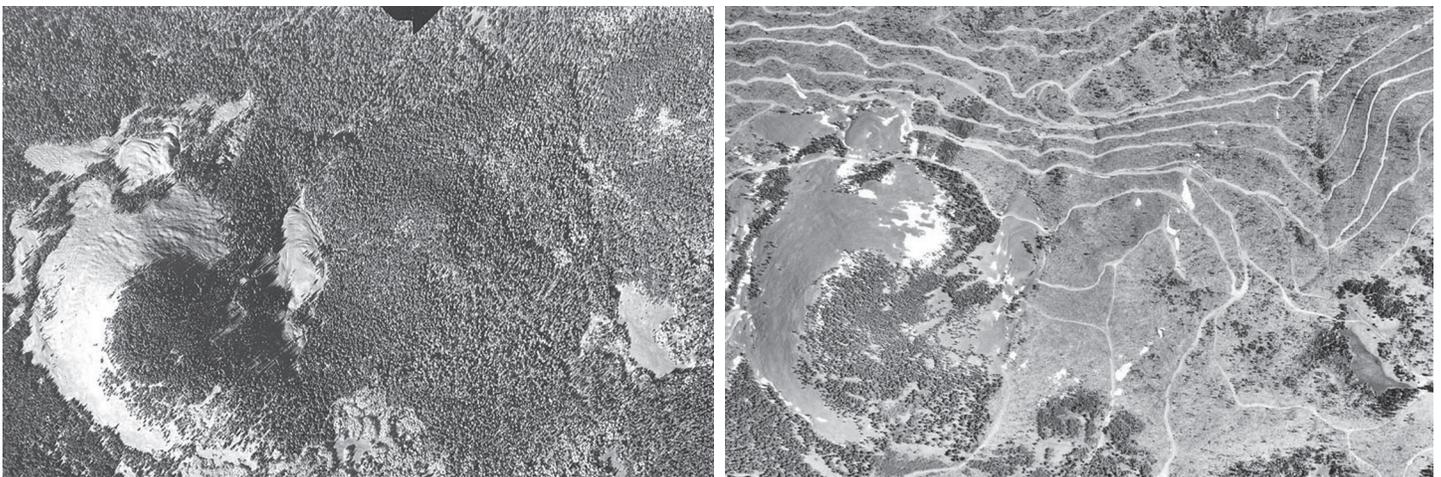


FIGURE 5. Repeat aerial photographs of Redondito Peak area. Left, prelogging period (1963). Right, postlogging period (1975). Note logging roads and loss of all forest, except on the steeper slopes of Redondito (lower left).



FIGURE 6. Map of roads on the Valles Caldera National Preserve in 1981, highlighting old logging roads from the clearcutting and jammer logging period by the New Mexico Timber Company during 1963-1972. More than 1,100 miles of logging roads were bulldozed and abandoned, creating large-scale erosion problems that still exist today (source: Allen, 1989).

and Rabbit Mountain (Boyer and Robinson, 1956; Newman and Nielsen, 1985; Bough and Nielsen, 1987; LeTourneau et al., 1997; Glascock et al., 1999; Shackley, 2005). The abundance, high-quality, and large nodule size of the volcanic glass at these sources was valued and exploited by people throughout prehistory. Determining the function of the sites can be difficult because they could represent complex habitation activities or simpler specialized or brief activities. While obsidian scatter sites can be associated with any or all cultural groups, they often do not contain the artifacts that are distinctive to one or another of the cultural periods.

Modern communities that surround the Preserve, including numerous Pueblos and Tribes as well as local Hispanic and Anglo communities, have deep historic and cultural connections to the

caldera, as expressed through ongoing traditional activities as well as rich oral histories and sacred traditions. Today, members of Pueblo communities that surround the Preserve, such as Cochiti, Jemez, San Ildefonso, San Juan, Santa Ana, Santa Clara, Santo Domingo, Tesuque, and Zia, continue to visit the Preserve to collect medicinal and ceremonial plants and to visit shrines and ancestral sites. More distant groups such as the Hopi, Navajo, Ute, and Zuni also maintain a connection with the caldera.

Historic use of the area is best documented after the arrival of the Spanish over 400 years ago, initiating the use of the area for livestock grazing (see historic overviews by Anschuetz and Merlan, 2004; and Martin, 2003). The Baca Location No. 1 was an indirect Spanish land grant, granted in 1860 to the heirs of Luis Maria Cabeza de Vaca as settlement of a land dispute. However,

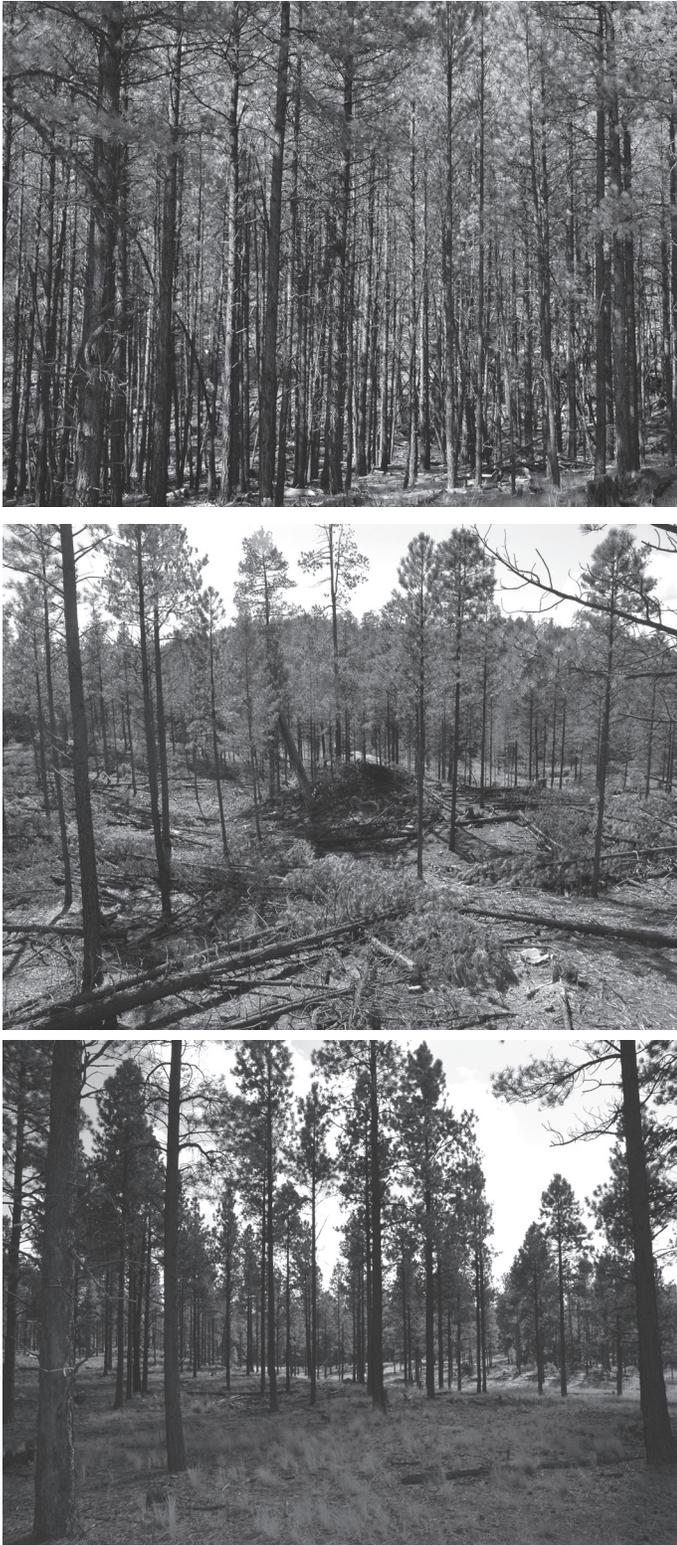


FIGURE 7. Forest thinning on the Valles Caldera National Preserve is under way to reduce forest fire risk and restore second-growth forests to a more natural, sustainable condition. Top: example of second-growth, “dog hair” thicket of Ponderosa pine. Middle: thinning project underway. Bottom: thinned forest two years following treatment. Total forest restoration will take many decades of tree re-growth. (Photos, R. Parmenter).



FIGURE 8. Top: obsidian artifacts at a prehistoric quarry on Cerro del Medio. Bottom: collection of different weapons and tools from Valles Caldera National Preserve. (Photos, T. Seaman; R. Soto).



FIGURE 9. Historic loggers cabin in Redondo Border area (Photo, K. Croll)

the large tract passed quickly out of the grantees hands and was acquired in 1899 by the Valles Land Company. Grazing, logging/milling, and mining activities increased in the region throughout the late 1800s and early 1900s as the railroad and timber industry brought Euro-Americans to expanded settlements in the Jemez Valley (Fig. 9). In 1918, Frank Bond leased the ranch lands from the Redondo Development Company, then purchased Baca Location No. 1 in 1926. Logging operations expanded in the Jemez Valley in the 1920s as rail lines were developed to carry timber to the major railroads in Bernalillo. The New Mexico Timber Company began logging operations in the Baca Location No. 1 in 1935. Most of Bond's employees were Hispanic, and today traditional Spanish families in the surrounding communities cherish the stories from their parents and grandparents detailing working on the ranch in the sheep, cattle, and timber industries.

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