Valles Caldera National Preserve

# Landscape Restoration and Management Plan

**Purpose and Need – Proposed Action**

VALLES CALDERA TRUST

State of New Mexico

Sandoval and Rio Arriba Counties

P.O. Box 359

Jemez Springs, NM 87025

(505) 661-3333

comments@vallescaldera.gov

## *Purpose and Need/Proposed Action*

The Valles Caldera Trust (Trust) is proposing to implement a 10-year strategy for the restoration and management of the forest, grassland, shrubland, and riparian ecosystems of the Valles Caldera National Preserve (Preserve).

## Purpose and Need

The purpose of the proposed Landscape Restoration and Management Plan (LRMP) is to:

- Move the structure and composition as well as function and processes of the Preserve's ecosystems towards the reference condition.
- Reduce the potential for uncharacteristic wildfire.
- Increase the resiliency of the Preserve's ecosystems in the event of disturbances including fire, insects, disease and climatic events or changing climate.
- Enhance objectives on surrounding National Forest System Lands
- Provide opportunities and benefits in surrounding communities and businesses

The LRMP is needed to meet the purposes and goals from the:

- Valles Caldera Preservation Act (U.S.C. 2000)
- Ecological goals for the Preserve adopted by the Trust (Valles Caldera Trust 2009)
- Federal Wildland Fire Management Policy and federal guidance for implementing the policy (NWCG 2009)
- Southwestern Jemez Mountains Landscape Restoration Strategy (Valles Caldera Trust, Santa Fe National Forest 2010)

Based on quantitative assessments of the existing condition of the Preserve's forests, nearly all (>95%) of the Preserve's forests are outside the reference condition with regard to structure and composition, adversely impacting forest function and processes including succession, carbon sequestration, capturing and storing water, and seasonal water discharge.

The ecological condition of the Preserve's grassland and riparian systems is moderately departed based on stand measures of rangeland health, water quality, and riparian function. Departed characteristics include water quality, stream condition and species composition.

In its current condition the Preserve does not support the attainment of the purposes and goals for which is was established. Active restoration at the landscape scale is needed to sustain current native ecological systems and reduce future hazard to native diversity.

## Proposed Action

To move the existing condition of the Preserves ecosystems towards the reference condition (defined as: ***"…the composition of landscape vegetation and disturbance attributes that, to the best of our collective expert knowledge, can sustain current native ecological systems and reduce future hazard to native diversity"*** (USDA - Forest Service - Interagency Fuels Group 2008)), the Trust is proposing to implement the following integrated set of actions: Mechanical Treatment; Wildland Fire Management; Prevention, Control and Eradication of Noxious Weeds; Road Closure, Decommissioning and Maintenance; Wetland and Riparian Restoration.

### Mechanical Treatments

Mechanical treatments include cutting or masticating standing trees and removing, burning or otherwise disposing of the associated biomass. Mechanical treatments are being proposed to improve forest structure and reduce the potential for uncharacteristic wildland fire (fire burning with intensity, severity, or at a scale that is uncharacteristic for the natural fire regime[1].)

The vegetation type, degree of ecological departure, soil, slope, and access were all considered in identifying areas suitable for mechanical treatments. Size class and species selected for cutting and the intensity of thinning treatments would be based on vegetation type, forest inventory, as well as soil type, slope and access. In general the parameters would seek to create more open forest structure and, over time, increase the presence of large, mature trees and old growth characteristics. Trees primarily 7-16 in d.b.h. would be targeted for removal.

A two-tiered system was used to propose priorities for mechanical treatment; forest stand characteristics and landscape areas. Ponderosa pine and dry mixed conifer forests are proposed as the first priority. These forest types have evolved under a frequent fire regime and are the least resilient forests in the event of uncharacteristic wildfire. In addition the use of wildland fire in these forest types is generally only effective at reducing wildland fire hazard and increasing resiliency; mechanical treatment is needed to modify structure (change S-Class). All other forest and grassland types are proposed as the second priority for treatment.

For the purpose of proposing treatment priorities by area, the Preserve has been delineated into three areas named for major landmark features (see Figure 1): Redondo, Valle Grande, and San Antonio. These landscape areas follow 6th level watershed boundaries.

The Redondo landscape area is proposed as the highest priority treatment area. The southwesterly aspect is aligned with wind and topography which would contribute to the spread of wildland fire and it is adjacent to an area of the Santa Fe National Forest, popular for dispersed recreation which has a high incidence of fire occurrence as shown in Figure 2. The Valle Grande area is proposed as the second priority for treatment. The historic cabins on the north end of the Valle Grande are extremely vulnerable to fire. Moving the forests surrounding the Valle Grande to a more open S-Class would improve the hydrologic system of the Valle Grande as well as protecting the iconic view from the impacts of uncharacteristic wildland fire.

---

[1] Fire regime means the frequency, intensity, and scale or extent of fire that occurred naturally during the reference period.

**Mechanical treatment of the forests surrounding the Valle San Antonio would be the third priority. These priorities are general. Lower priorities may be treated along with higher priorities for efficiency or based on funding and area specific environmental conditions.**

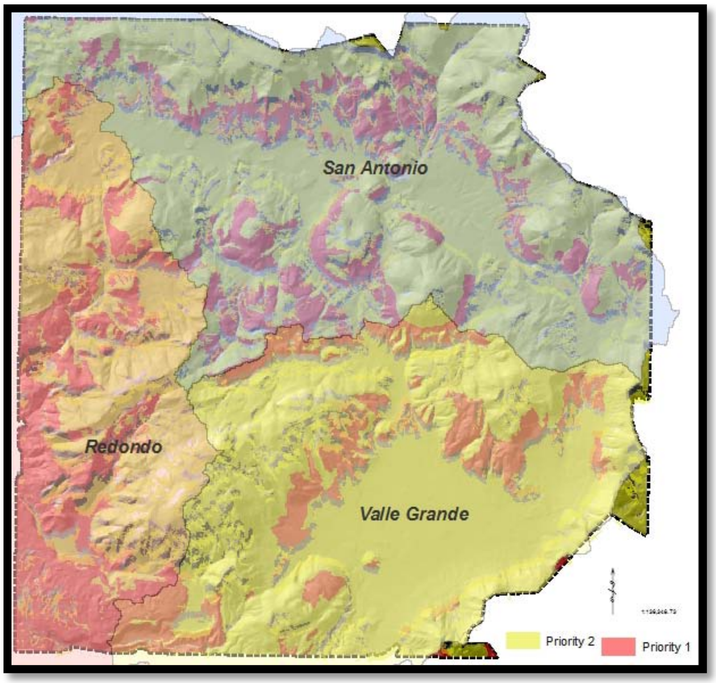


Figure 1 – Priorities by forest stand characteristics within landscape treatment areas.

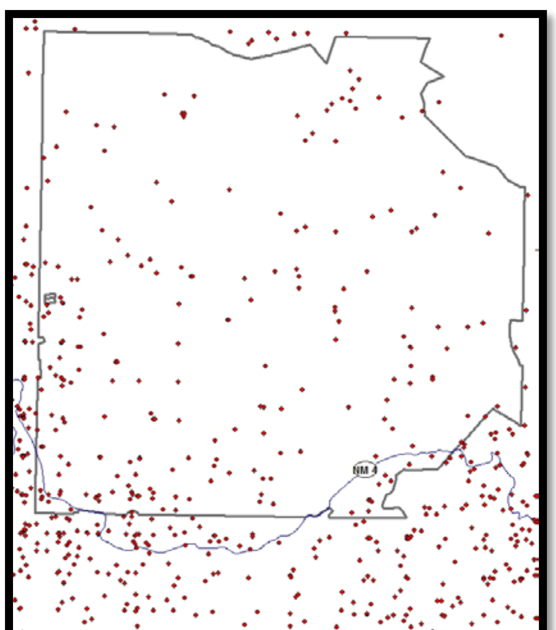


Figure 2 – Fire occurrence since 1909

## Wildland Fire Management

**Prescribed fire as well as the management of natural fire is being proposed to reduce forest densities, restore fire adapted species and processes, and reduce the potential for uncharacteristic wildland fire. The reintroduction of wildland fire would be consistent with, but not necessarily imitative of, the fire regimes that have influenced the structure, composition and function of the Preserve's ecosystems prehistorically.**

**Wildland fire use would be limited initially but could be expanded as more of the forests were treated and the risk of uncharacteristic fire was reduced. The proposed timing and frequency of prescribed fire (and wildland fire use) would also consider current climate trends, wildfire risks, the impacts of wildland fire on other activities on the Preserve, and the social tolerance for wildland fire including the amount and duration of smoke impacts in surrounding communities consistent with guidance for implementation of the Federal Wildland Fire Management Policy, Reviewed and Updated in 2009 (NWCG 2009)**

## Prevention, Control and Eradication of Noxious Weeds

**The Trust is proposing to continue current efforts to eradicate Canada (*Cirsium arvense*), musk (*Carduus Nutans*), bull thistle (*Cirsium vulgare*), and oxeye daisy *(Leucanthemum vulgare)* populations. This includes continuing to mechanically treat (cut, hoe and bag seed heads) musk thistle in combination with the application of the herbicide, clopyralid to treat Canada and bull thistle and oxeye daisy. The Trust is also proposing to use glyphosate (Roundup), Imazipic (Plateau), or the combination of both (Journey) to control cheatgrass *(Bromus tectorum)* primarily in road cuts and other disturbed areas.**

**The Trust is also proposing to implement performance requirements to reduce the risk of introducing new noxious weed species or further spread of existing species as well as a system to identify and eradicate any noxious weeds introduced in the future. Two species with the potential to occur on the Preserve are Dalmatian toadflax *(Linaria genistifolia spp. dalmatica)* and yellow toadflax *(Linaria vulgaris)*.**

## Road Closures, Rehabilitation and Maintenance

**The Trust is proposing to move the current road density (see Figure 3) from an average of 9 mi/mi$^2$ (miles of road per square mile of land) to 1.5 mi/mi$^2$. Meeting this objective would require closing and/or decommissioning about 1000 miles of road over 10 years. Based on soils and hydrology, road closure and decommissioning would include approximately 150 miles of physical decommissioning and rehabilitation with the remainder achieved through administrative closure and natural rehabilitation.**

**Approximately 52 miles of roads to be maintained for use are in need of deferred maintenance to restore hydrology or halt ongoing erosion. Deferred maintenance activities include reshaping and resizing the existing road prism, altering grades, and constructing lead-outs, or installing or replacing culverts to improve drainage.**


Figure 3 – Preserve historic logging road network. Most major roads (thicker lines) were built during 1935-1962 to facilitate harvest of accessible forest stands near the valles. Most minor roads (thinner lines) were built during 1963-1972 to facilitate clearcutting.

## Riparian and Wetland Restoration

In combination with road management actions as described above, the Trust is also proposing to restore wetland and riparian areas throughout the Preserve. The wetland and wet meadow systems containing the Preserve's riparian areas and streams comprise just over 6,800 acres, mostly within the open valle systems. Restoration activities would include stream bank and channel restoration, placement of log and fabric dams, gully plugs, or rock bowl techniques (Figure 4) to protect and restore wetlands, and removal of road and water control features to restore wetlands. Willow plantings would play a key role in restoration actions. Placement of sod plugs may also among techniques proposed for improving stream bank integrity. Temporary mid-term to long term exclosures would be used to protect riparian vegetation from impacts by elk or cattle.

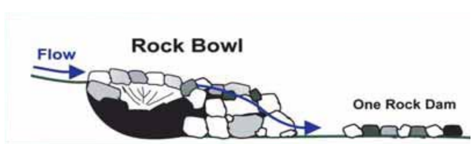


Figure 4 – Diagram of a rock bowl and one rock dam combination to remediate a head cut

## Adaptive Management

Adaptive management is defined as "*…adjusting stewardship actions or strategic guidance based on knowledge gained from new information, experience, experimentation, and monitoring results, and is the preferred method for managing complex natural systems.*" (Federal Register 2003). The Trust implements adaptive management by adopting goals and identifying objectives and monitored outcomes in order to measure goal attainment. The process is illustrated in Figure 5.

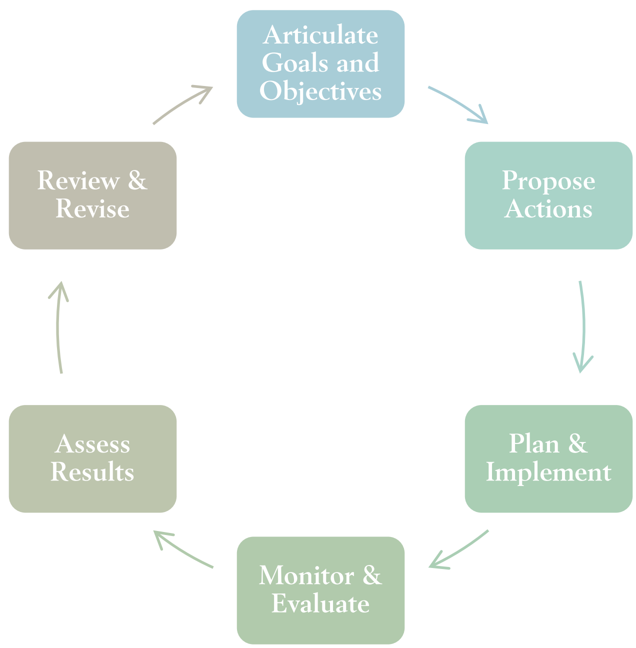


Figure 5 – Process diagram illustrating adaptive management

## Goals

Goals describe a desirable condition as sought by the Trust (Federal Register 2003). A goal is both qualitative and quantifiable, but is not quantified. Goals stretch and challenge us, but they are realistic and achievable and flexible enough to persist over time.

Based on a review of the *State of the Preserve* (Valles Caldera Trust 2007) and in pursuit of the central goal for management put forward in the Framework and Strategic Guidance for the Comprehensive Management of the Preserve prepared by the Trust Board of Trustees (Valles Caldera Trust 2004), the Trust adopted the following goal for the ecological condition of the Preserve: *"The ecological condition of the Preserve would be moving toward the composition of landscape vegetation and disturbance attributes that, to the best of our collective expert knowledge, can sustain current native ecological systems and reduce future risk to native diversity"* (Valles Caldera Trust 2009).

This goal is synonymous with collaboratively developed goal for the Southwestern Jemez Mountains Landscape: *Improve the resilience of ecosystems to recover from wildfires and other*

***natural disturbance events in order to sustain healthy forests and watersheds for future generations.***

## Objectives

"Objective" means the desired outcome that can be meaningfully evaluated by location and timing within the Preserve. Measurable objectives are used to evaluate the progress towards goal attainment. The objectives proposed for assessing goal attainment are listed in Table 1.

Table 1 – Proposed objectives and desired outcomes

| Objective | Desired Outcome |
|---|---|
| Restore Forest Structure | Move the structure and composition of the Preserve's ecosystems towards the reference condition. Improve the resilience[2] of the ecosystem. |
| Restore Forest Function | Improve water capture, storage and yield, carbon sequestration, and succession. |
| Reduce Uncharacteristic Wildfire Potential | To reduce the likelihood of disturbances (especially fire, but also including insects and disease) occurring with uncharacteristic intensity, severity, frequency and/or at an uncharacteristic scale. |
| Reduce Crown Fire Potential | Reduce the likelihood and extent of crown fire potential. |
| Reintroduce Wildland Fire | Restore fire as a critical process in fire adapted ecosystems. |
| Reduce Road Density | Reduce road densities and associated erosion and water quality impacts. |
| Improve Water Quality | Move the water quality of the Preserve towards meeting all designated uses as identified by the New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB). |
| Restore Stream Function | Move all stream condition to a fully functioning condition. |
| Restore Wetlands | Restore historic wetlands extent |
| Protect Native Species | Eradicate noxious weeds; maintain and increase native species and diversity. |
| Improve Wildlife and Fisheries Habitats | Improve and maintain the quality and diversity of wildlife and fisheries habitats. |
| Improve local socioeconomic outlook | Reducing wildfire hazards; create opportunities for local employment |

## Monitored Outcomes

"Monitored Outcome" means, "*…the result or consequence of a stewardship action that can be meaningfully evaluated by location and time of occurrence*" (Federal Register 2003). Meaningful evaluation of outcomes ensures that progress is being made towards achieving plan goals and objectives. Such evaluations are used as the basis for adjusting management actions in a timely manner to ensure continued progress. Table 2 identifies those outcomes selected for monitoring and evaluation.

[2] "Resilience" refers to the ability for an ecosystem to follow its natural successional path following a disturbance.

Table 2 - Monitored outcomes

| Objective | Monitored Outcomes | Frequency |
|---|---|---|
| Restore Forest Structure Stand Level | Tree size, species, and canopy density | 1-5 years following treatment |
| Restore Forest Structure Landscape Level | S-Class Distribution | Summarized Every 5-years |
| Restore Forest Function | Carbon flux, water capture storage and yield | Continuously, summarized every 5-years |
| Reduce Crown Fire Potential | Crown base height, crown bulk density or canopy closure. | 1-5 years following treatment |
| Reduce Road Density | Miles of road, closed, rehabilitated, and maintained | Every 5 years |
| Improve Water Quality | Temperature, turbidity, dissolved oxygen, pollutants | Continuously during frost free seasons; summarized every 5-years. |
| Restore Stream Condition | Depth to width ratio, vegetative cover | 1-3 years following treatments |
| Restore Wetlands | Acres of wetland | 3-5 years following treatment |
| Protect Native Species | Presence of noxious weeds, vegetative cover/diversity, cover /diversity of native species. | 1-3 years following treatments, summarized every five years and. |
| Improve Wildlife and Fisheries Habitats | Key characteristics related to forest structure, water quality, and stream condition | Evaluated every 5-years |
| Improve Local Socioeconomic Outlook | Utilization of wood products | Acres 1-3 years after treatment, summarized every 5-years |

## Scope of the Analysis

The analysis will consider the expected short-term (1-3 yr), mid-term (3-10 yr), and long-term (>10 yr) direct, indirect, and cumulative environmental consequences that are expected to result from taking no action at all, implementing the proposed action, or any action alternative. This analysis is being documented in Environmental Impact Statement (EIS) consistent with the National Environmental Policy Act (NEPA) procedures developed for the management of the VCNP (Federal Register 2003).

"The survival of man in a world in which decency and dignity are possible, is the basic reason for bringing man's impact on his environment under informed and responsible control"

*-Senator Henry Jackson, upon introducing Senate Bill 1075 (ultimately NEPA)*

## Decision to be Made

The Preserve Manager is the Responsible Official who will oversee planning and implementation of the proposed LRMP. Based on the environmental analysis presented in this EIS, the Responsible Official will decide whether or not to select and implement one of the action alternatives as the long-term LRMP for the VCNP or to take no action at this time. The decision will be documented in a Record of Decision (ROD).

## *Background – Physical, Cultural and Socioeconomic Setting*

### Introduction

**The Preserve, located in north-central New Mexico (Figure 6), is primarily in Sandoval County. The land was acquired by the federal government in 2000 through Public Law 106-248. While designated as a unit of National Forest System (NFS) land, it is managed by the Trust a wholly owned government corporation created by the enabling legislation. The Trust is governed by a nine member Board of Trustees, seven of which are presidentially appointed and two ex-officio appointments: the Superintendant of Bandelier National Monument and the Santa Fe National Forest Supervisor.**

**Purposes for acquisition of the Preserve (U.S.C. 2000)included:**

(1) ***to authorize Federal acquisition of the Baca ranch;***
(2) ***to protect and Preserve for future generations the scientific, scenic, historic, and natural values of the Baca ranch, including rivers and ecosystems and archaeological, geological, and cultural resources;***
(3) ***to provide opportunities for public recreation;***
(4) ***to establish a demonstration area for an experimental management regime adapted to this unique property which incorporates elements of public and private administration in order to promote long term financial sustainability consistent with the other purposes enumerated in this subsection; and***
(5) ***to provide for sustained yield management of Baca ranch for timber production and domesticated livestock grazing insofar as is consistent with the other purposes stated herein.***

**Management goals put forward by the act (U.S.C. 2000)included:**

(1) ***operation of the Preserve as a working ranch, consistent with paragraphs (2) through (4);***
(2) ***the protection and preservation of the scientific, scenic, geologic, watershed, fish, wildlife, historic, cultural and recreational values of the Preserve;***
(3) ***multiple use and sustained yield of renewable resources within the Preserve;***
(4) ***public use of and access to the Preserve for recreation;***
(5) ***renewable resource utilization and management alternatives that, to the extent practicable—***
    A. ***benefit local communities and small businesses;***
    B. ***enhance coordination of management objectives with those on surrounding National Forest System land; and***
    C. ***provide cost savings to the Trust through the exchange of services, including but not limited to labor and maintenance of facilities, for resources or services provided by the Trust; and***
(6) ***optimizing the generation of income based on existing market conditions, to the extent that it does not unreasonably diminish the long-term scenic and natural values of the area, or the multiple use and sustained yield capability of the land.***

## Location

**The Valles Caldera National Preserve is located in north central New Mexico atop the Jemez Mountains, part of the southern extent of the Rocky Mountain range, and is at the southern most point of the Southern Rocky Mountains Level III Ecoregion[3] of the United States (Griffith, et al. n.d.). As shown in Figure 6, it is surrounded by NFS land managed by the Santa Fe National Forest (SFNF) and abuts the boundaries of Santa Clara Pueblo's tribal land to the northeast and Bandelier National Monument (BNM) to the southeast.**


Figure 6– Vicinity Map of the Preserve

[3] Southern Rockies Level III Ecoregion - The Southern Rockies are composed of high elevation, steep, rugged mountains. Although coniferous forests cover much of the region, as in most of the mountainous regions in the western United States, vegetation, as well as soil and land use, follows a pattern of elevational banding. The lowest elevations are generally grass or shrub covered and heavily grazed. Low to middle elevations are also grazed and covered by a variety of vegetation types including juniper-oak woodlands, ponderosa pine, aspen, and Douglas-fir. Middle to high elevations are largely covered by coniferous forests and have little grazing activity. The highest elevations have alpine characteristics. Numerous perennial mountain streams with deciduous riparian vegetation support coldwater fisheries and serve as wildlife corridors. (Griffith, et al. n.d.)

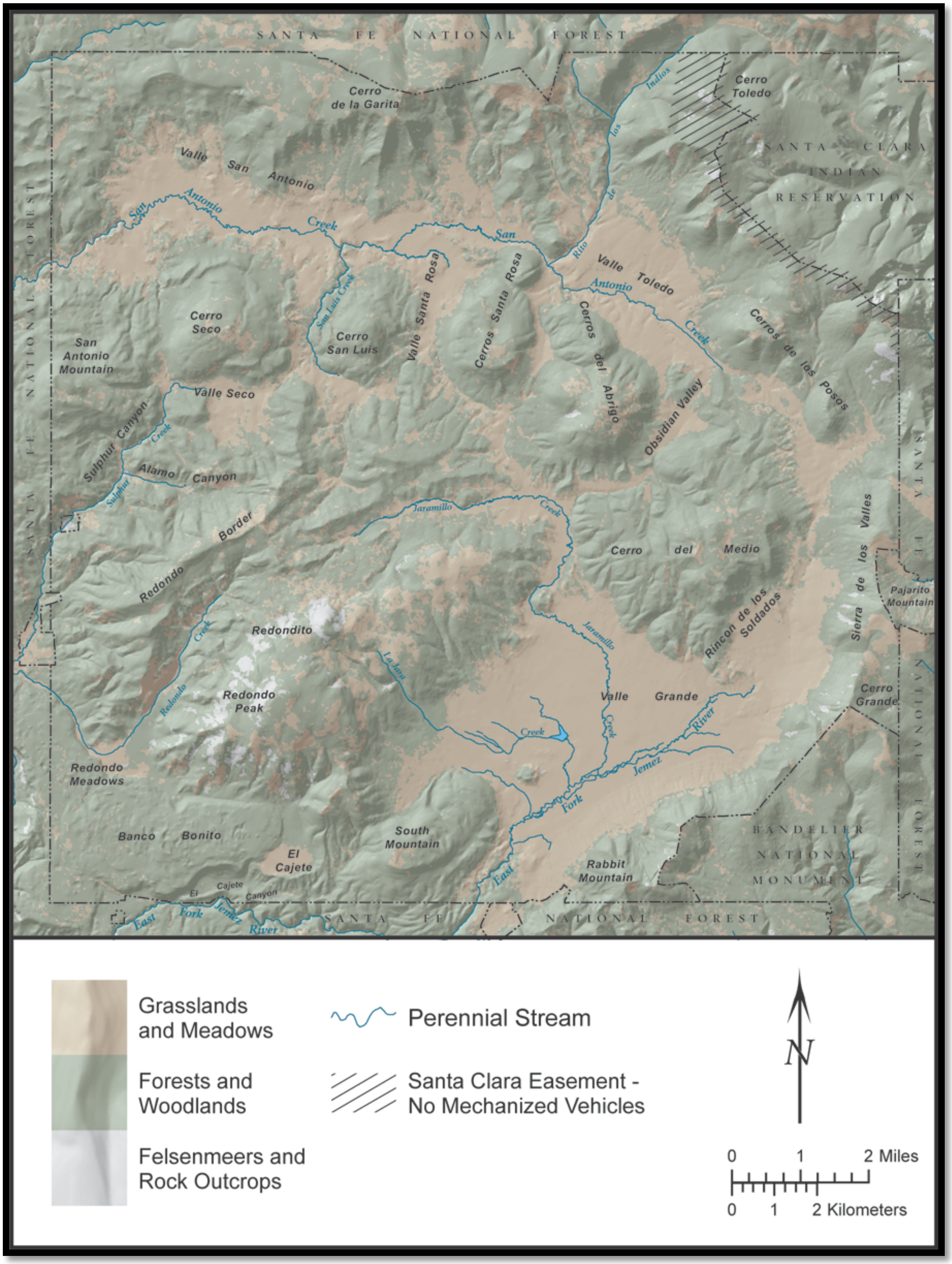


Figure 7– Landscape features of the Valles Caldera National Preserve

## Geology

About 1.25 million years ago, a spectacular eruption created the 13-mile wide crater-shaped landscape now known as the Valles Caldera. The eruption tapped a vast magma chamber that exploded catastrophically, depleting the magma chamber and creating a void into which the surface landscape collapsed. The enclosed caldera filled with water forming a large freshwater lake. The subsurface remained in turmoil as new magma refilled the collapsed chamber, and within 50,000 years Redondo Peak rose up through the lake bottom. Following the resurgence of Redondo, the first of many eruptive flows from ring fractures in the caldera formed the dome at Cerro del Medio, followed by Cerro del Abrigo. This continued counter clockwise around the ring fracture creating the domes in the northern half of the caldera.

By about 500,000 years BP, the southwestern rim of the caldera had breached, emptying the caldera of water and sediments and forming San Diego Canyon to the southwest, visible from space as shown in Figure 8. Additional flows and dome-formation on the south and west periodically prevented the drainage of water, forming lakes in what are now known as the Valle Grande and Valle San Antonio. Approximately 50,000 years ago, an explosive eruption occurred in the southwest corner creating the crater known as El Cajete. The resulting pyroclastic flow produced the striking landmark known as Battleship Rock where the waters from the Valle San Antonio meet the East Fork of the Jemez River; both rivers originate in the Preserve. The final gasp of this eruption produced the broad sloping landform in the southwest corner known as the Banco Bonito; "pretty bench" in Spanish. The Valles Caldera, while not the largest, is one of the most intact calderas in the world, making it ideal for studying the complex geology of caldera formation (Kempter and Huelster 2007).

Figure 8 – The Valles Caldera in a 2003 photo taken from space. Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center, http://eol.jsc.nasa.gov

## Climate

The regional climate is semi-arid continental. Cyclonic storms associated with the polar jet stream bring snow in the winter and rain in the spring and fall. April through June is usually dry. Half or more of the precipitation comes in the summer months in the form of convectional "monsoon" storms when the Bermuda high-pressure system drives moist oceanic air into the Southwest. Periodic El Niño events bring increased winter and spring precipitation to the Southwest, while interspersed La Niña events cause droughts. El Niño events affect stream flows, wildfire activity, and plant productivity (Allen 2004).

The climate scenario is modified by the high elevations and topographical variability of the Preserve. The average precipitation reported for Los Alamos is 18.93 inches and over 35 inches at the caldera rim (Allen 1989). The annual average precipitation at the Valle Grande weather station (2003-2007) was 24.4 inches. Snow accumulation, while minimal at Los Alamos, can be significant on the Preserve. The temperatures at the highest elevations of the Preserve may be 25-35°F colder than Los Alamos; the valles are 10-15°F colder still. The effect of the cold air drainage into the valle bottoms may drive temperatures down even further (Muldavin E. 2006); the low temperature recorded at the Valle Grande (2003-2007) was -16.6ºF.

Conditions on the Preserve are confounded by several trends. Weather records dating back to 1914 show a general increase of warmer temperatures and drier conditions over the past century. Figure 9 shows the mean annual temperature while Figure 10 displays only the mean temperature for the month of July, indicating that summer time temperatures increased to a greater degree.


Figure 9 – Mean annual temperature, Jemez Springs, New Mexico 1914-2005

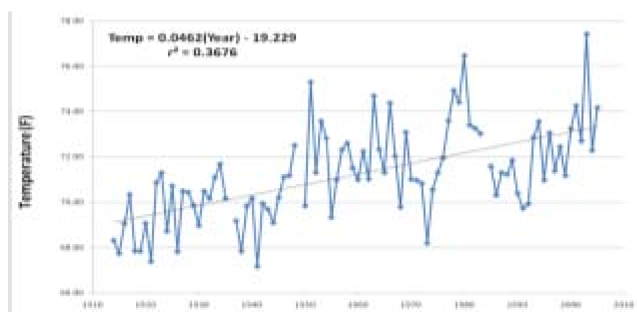


Figure 10 – Mean July temperature, Jemez Springs, New Mexico, 1914-2005

A simple linear regression of weather data indicates a decline in precipitation of .03 inches annually as depicted in Figure 11. However, fitting a 4th order polynomial shows the correlation with the Pacific Decadal Oscillation (PDO)[4] with distinct wet and dry periods of about 20 years. This correlation is depicted in Figure 12; note the trend of lower values in the troughs and peaks. Also note the extreme variability in year to year climate displayed. In the 1950's, one year measured 6 inches of precipitation with the following year measuring over 25 inches; a fourfold difference.

---

[4] The PDO is detected as warm or cool surface waters in the Pacific Ocean, north of 20° N. During a "warm", or "positive", phase, the west Pacific becomes cool and part of the eastern ocean warms; during a "cool" or "negative" phase, the opposite pattern occurs.

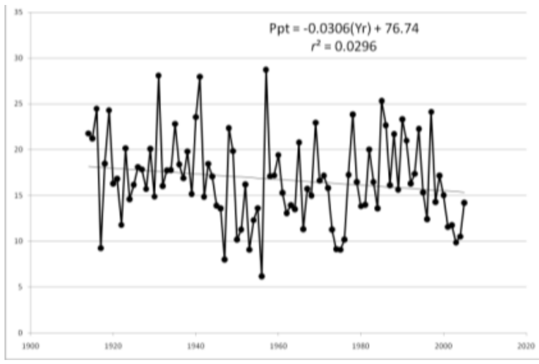


Figure 11 – Annual precipitation, Jemez Springs New Mexico 1914-2005

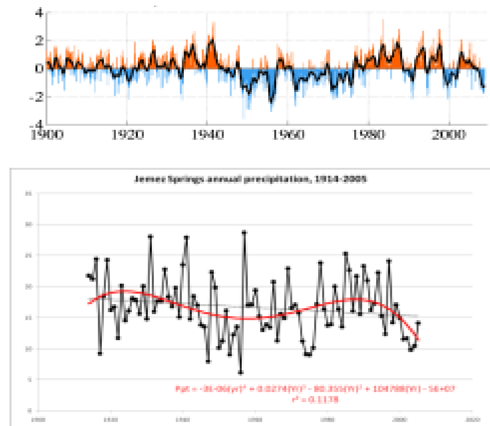


Figure 12 – Annual precipitation, Jemez Springs, New Mexico 1914-2005 (bottom) relative to the PDO index 1900-2008 (top)

## Soils

The soils of the Preserve mirror its geology. Scientists from the Natural Resources Conservation Service, Sandoval County Soil Survey, mapped nearly 80 soil series that fall into forest and grassland groups. Forest soils are primarily mountain soils (Andisols, Alfisol and Inceptisol soil orders) derived from volcanic rocks and gravel (rhyolites and andesites, with some dacites and latites, tuffs and pumices) along with windblown deposition. Forest soils tend to be rocky with loamy textures in the matrix. Grassland soils are mostly Mollisols that developed in the volcanic alluvium of the alluvial fans and piedmonts or in recent water-deposited sediments of the valle bottoms. They are deep with rich organic material and fine textures in the top layers and few rocks (Muldavin and Tonne 2003).

## Water

Nearly 75 miles of perennial stream originate in the forests and meander through the valles of the Preserve. The headwaters of the East Fork of the Jemez River and the Rio San Antonio originate within its boundaries. These tributaries converge below Battleship Rock in San Diego Canyon to form the Jemez River, a tributary to the Rio Grande. The Preserve was established based on watershed boundaries. At the time of acquisition, the lands comprising the headwaters of the Santa Clara watershed were acquired by Santa Clara Pueblo and the lands comprising the headwaters of Frijoles watershed went to Bandelier National Monument. Ninety eight percent of the Preserve lies within the Jemez River watershed with its waters draining into that river.

## Air

The Preserve is within the 5000-square mile Albuquerque-Mid Rio Grande Intrastate Air Quality Control Region (AQCR) 152. Natural factors affecting air quality in the AQCR include spring dust storms and frequent winter inversions. Air quality on the Preserve can be assessed in the smaller air shed defined by the fire weather zone 102 in north central New Mexico shown in Figure 13. Figure 14 shows ventilation data from zone 102 for 2008. Spring and summer show the greatest number of days with good to excellent ventilation with autumn and winter showing the greatest number of poor ventilation days caused by the characteristic inversions. While the actual number of days where ventilation is excellent versus very good or poor versus fair varies annually, the seasonal distribution of conditions is fairly constant. The topography of the Preserve contained within a caldera, greatly influence sight specific dispersal conditions.

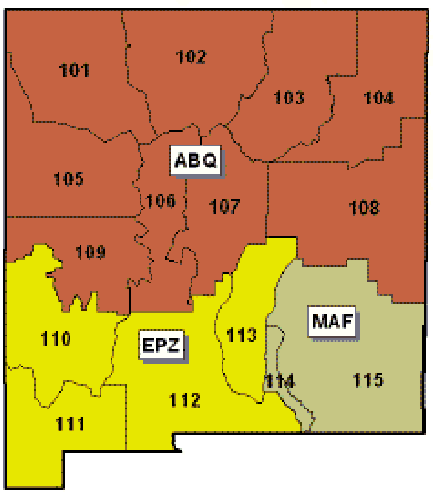


Figure 13– Fire weather zones for New Mexico; the Preserve is within zone 102 (courtesy of the National Weather Service.)

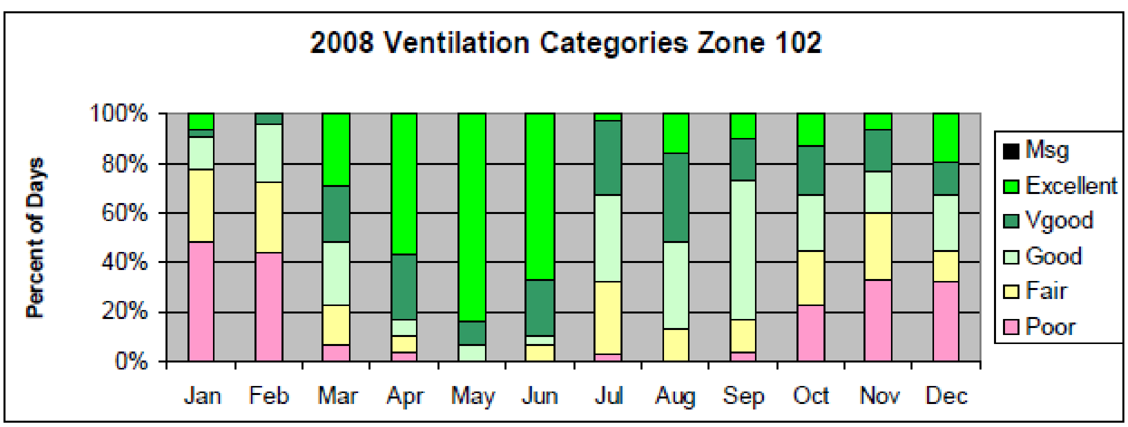


Figure 14 – Actual ventilation data for weather zone 102 (courtesy of Jeanne Hoadley, USDA – Forest Service.)

## Vegetation

The vegetation of the Preserve follows elevational banding and is influenced by soils, climate, and topography. The predominate vegetation types are forests and grasslands with smaller components of woodland and riparian shrubs and rocky outcrops. Compared to other high elevation sites in the southern Rocky Mountains and Colorado Plateau, the vegetative communities of the Preserve are quite diverse and harbor many plant communities that are unique to the landscape of the Valles Caldera (Valles Caldera Trust 2005). The New Mexico Natural Heritage Program has documented 65 plant associations within the Preserve encompassing high elevation sub-alpine forests, mixed conifer and pine woodlands, high montane grasslands, and valley floor wetlands (Muldavin and Tonne 2003).

The extensive montane grassland and wetland communities found on the Preserve are also relatively scarce anywhere in the southern Rocky Mountains. Surveys of the plant life of the Preserve have identified over 550 species, with roughly another 100 species expected to be present. Some of these species are rare within the region, lying about one hundred miles from the nearest known populations. Among these plants, *Delphinium sapellonis*, or Sapello Canyon larkspur (a New Mexico endemic found only in the Jemez, Sangre de Cristo and Sandia Mountains), is the only sensitive plant species recorded in the Preserve. Bog birch (*Betula glandulosa*), another species of note, is somewhat common at higher latitudes of the U.S. and Canada but is found nowhere else in New Mexico except on the Preserve. The highly localized occurrence of distinct plant associations and individual species found on the Preserve makes it one the most diverse sites in the Southern Rocky Mountains Eco-region (Muldavin and Tonne 2003) representing an uncommon nexus of western North American biomes. Table 3 lists the dominant cover types found and Figure 15 displays their distribution.

Table 3– Dominant vegetation and area covered (Muldavin E. 2006) listed in order of dominance.

| Cover | Acres | % |
|---|---|---|
| Mixed conifer forest and woodland | 36,566 | 40.4 |
| Montane grasslands | 19,858 | 22.4 |
| Ponderosa pine forest | 9,241 | 10.4 |
| Spruce-fir forest | 7,005 | 7.9 |
| Wetlands and wet meadows | 6,853 | 7.7 |
| Aspen forest and woodland | 5,103 | 5.8 |
| Roads-disturbed ground | 1,536 | 1.7 |
| Gambel oak-mixed montane shrubland | 1,443 | 1.6 |
| Felsenmeer rock field | 915 | 1.0 |
| Sparsely vegetated rock outcrop | 159 | 0.2 |
| Open water | 56 | <0.1 |
| Post-fire bare ground | 17 | <0.1 |
| Montane riparian shrubland | 14 | <0.1 |
| Total | 88,765 | 100.0 |

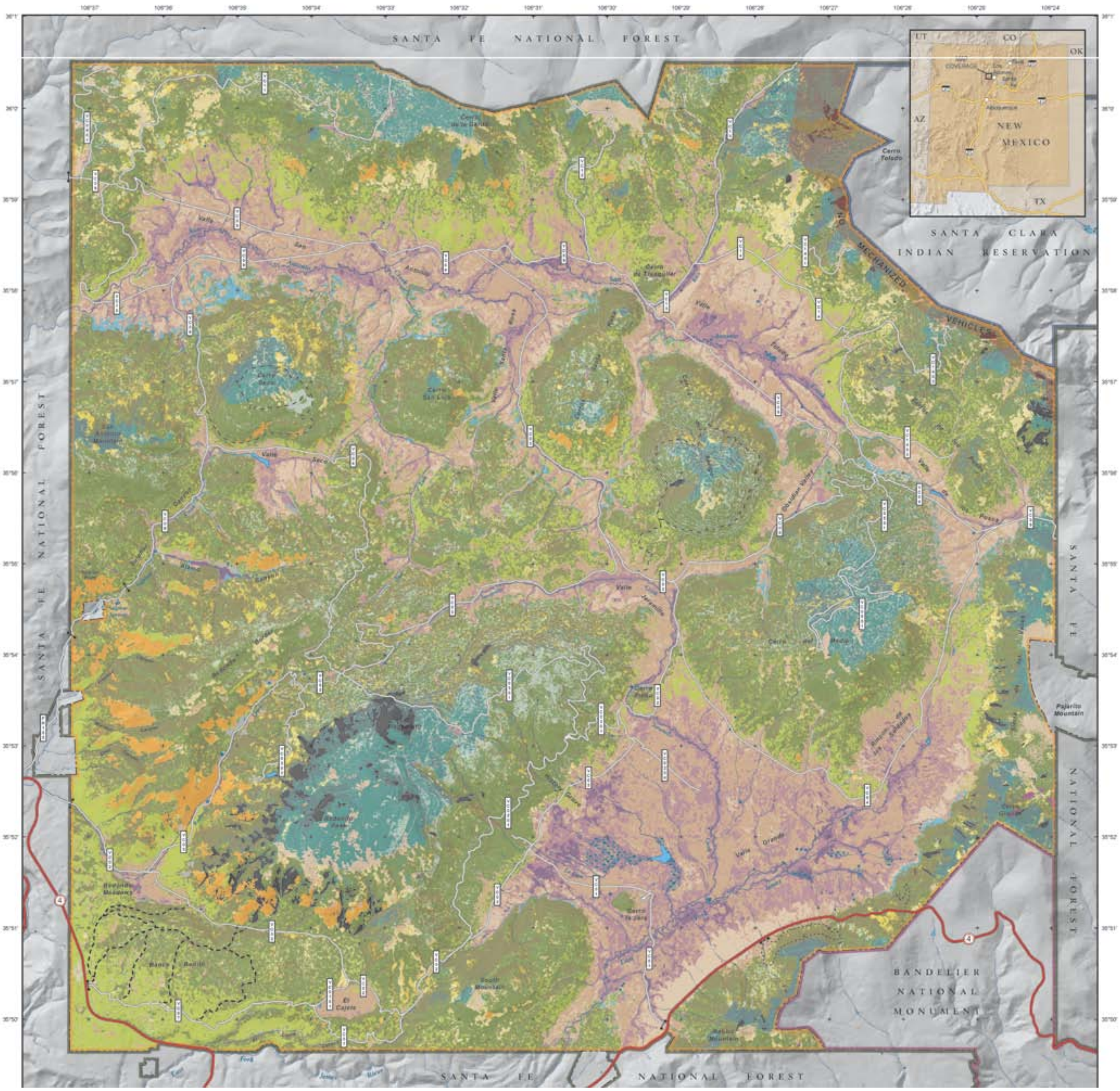


Figure 15 – Major vegetation alliances of the Preserve (Muldavin E. 2006)

## Wildlife

The Preserve supports a great diversity of animals, plants and fungi. Inventories from 2001-2006 identified 69 species of mammals, 102 birds, six reptiles, three amphibians, six fish, 525 plants, 28 lichens, 11 algae and five slime molds. While inventories of insects are ongoing, 134 species of aquatic insects were collected in streams and wetlands in 2003-2004 (Viera and Kondratieff 2004); 54 species of butterflies were identified in surveys in 2001 (Klientjes 2001).

Below elevations of 8,500 feet, animals include elk, mule deer, coyote, bobcat, various squirrels, prairie dog, chipmunks, raccoon, skunk, cottontail, woodrat, mice, weasels, beaver, badger, black bear and mountain lion. Local birds include blue grouse, Merriam's turkey, various hawks and owls, robin, house wren, woodpeckers, nighthawk, hummingbirds, white-throated swift, sparrows, warblers, meadowlarks, chickadee and golden and bald eagles.

Between 8,500 feet and 11,000-12,000 feet, animals include elk, mule deer, black bear, lynx, weasels, squirrels, chipmunks and several mouse species. This life zone also supports the gray fox and various shrews and provides homes for grouse, woodpeckers, hummingbirds, sparrows and warblers. Other bird species include goshawk, Steller's jay, dark-eyed junco, several kinglet species and mountain bluebird.

## Fish

The streams of the Valles Caldera National Preserve (VCNP) contain a variety of native fish as well as introduced rainbow and brown trout. These waters used to contain Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) (Anschuetz and Merlan 2007). Stream and fish surveys of the two major streams/rivers, East Fork Jemez River and San Antonio Creek, of the Valles Caldera have been conducted (2001 and 2002) as well as twice yearly fish sampling at permanent monitoring stations in lower, middle, and upper reaches of each stream (2003-2009). These two streams contain a mixture of the following species:

### *Native Species*

Rio Grande chub (*Gila pandora*), fathead minnow (*Pimephales promelas*), longnose dace (*Rhinicthys cataractae*), and Rio Grande sucker (*Catostomus plebeius*)

### *Non-native Species*

Rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and white sucker (*Catostomus commersoni*) – one individual found

## Socio Economic

The Preserve is located primarily in Sandoval County with a small inclusion in Rio Arriba County. Los Alamos and Santa Fe counties to the east also contribute to the socio economic setting. These counties all have a single urban center and strong rural roots and continued rural influence in their culture. The urban and government employment and economic factors are so dominant in these counties that the agricultural and forest industries are barely measurable, even in the directly related Sandoval and Rio Arriba Counties (Valles Caldera Trust 2009).

However, forest and agriculture are important economic factors in the numerous small towns and villages that comprise the cultural roots of the impact area. The Preserve has been an important feature of the working landscape of the area for many generations (Anschuetz and Merlan 2007).

## Cultural Resources

The complex cultural landscape of the Preserve exists in layers and is deeply entwined with the natural landscape. The abundant high quality obsidian has drawn humans to the Preserve for 10,000 years; evidence of quarries, tool making, and hunting are ubiquitous. The grandeur of the landscape drew humans to the valles and mountains in the past just as it does in the present. Redondo Peak is considered sacred to many; its importance to Native Americans is acknowledged in the Valles Caldera Preservation Act. Jemez Pueblo ancestral sites are located in the Preserve's southwest corner but the higher elevations precluded early farming beyond the Banco Bonito in the southwest corner of the Preserve (Figure 7).

## Historic Land Use

Factors relating to climate and geology have produced a heterogeneous environment capable of supporting sustained land use throughout the human history of the Preserve (Anschuetz and Merlan 2007). The system has remained, to a degree, somewhat resistant and resilient to disturbance over time. However, the existing condition of the Preserve is in part a cumulative effect of the intense extractive uses of the past, including domestic livestock grazing, timber harvest wildlife management and geothermal exploration.

### *Livestock Grazing*

Livestock grazing was the first significant extractive use of the Preserve's resources. Early surveyors and explorers consistently identified the large grassy valles with their perennial waters as ideally suited for grazing. Prior to the 1876 survey and patent to the [Baca] land grant, the Cabeza deBacas and their neighbors were herding small flocks through the tall grasses of the valles, "probably no larger than several hundred animals apiece" (Martin 2003). At that time "…the Baca family heirs permitted members of the Pueblo of Jemez to run sheep and horses in the Valles Caldera's rich grasslands[5]. The Jemez use of these valley ranges for herding was apparently a long-lived tradition that dated back to the early Spanish colonization of New Mexico" (Martin 2003). These numbers increased at the turn of the century under Frank Bond who had *partido*[6] agreements with Hispanic shepherds. Clyde Smith, who was born on a homestead at Battleship Rock in 1899 and worked on the ranch as a young man, estimated that

---

[5] A misunderstanding between G. W. Bond and Brothers Company and Jemez Pueblo led to the arrest of members of three Jemez Pueblo families for illegal grazing around 1920. Even though the court proceedings, which were held in Española, determined in favor of the Indian defendants, Frank Bond ended the unwritten agreement that allowed the Pueblo to pasture their cattle and horses in the Valles Caldera (Anschuetz and Merlan 2007).

[6] Under the *partido* agreement, their own stock served as collateral. Bond collected a fee for range use from the *partidarios*, "usually 300 pounds of wool and 25 lambs per 100 ewes." *Partidarios* also had to outfit themselves from his store, where he charged a flat 10 percent interest rate. With expenses mounting, most *partidarios* were lucky to keep their own sheep at the end of a contract. (Martin 2003).

there were over 100,000 sheep on the Baca Location during the summers of 1917 and 1918 (Anschuetz and Merlan 2007).

In 1939-1940 with the decline of wool prices Frank Bond added cattle to the Baca Location's ranching operations (Anschuetz and Merlan 2007). In the early 1950s, the Baca Location supported some 30,000 sheep and 5,000 cattle (Martin 2003). By the late 1950s, ranchers ran as many as 12,000 cattle on the ranch (Martin 2003).

In 1963 James Patrick Dunigan purchased the Baca Location from the Bond Estate. After allowing existing grazing permits to expire, Dunigan started running his own cattle in 1965, running about 7,000 yearlings from mid-April through mid-November (Anschuetz and Merlan 2007). To expand the areas of the ranch suitable for grazing and implement a rotational grazing system, Dunigan built fences and constructed earthen tanks. In an attempt to reduce damage from grazing, lengthen the grazing season, and accelerate the reclamation of the vast network of logging roads, Dunigan working established plots of cool season, non-native grasses (Anschuetz and Merlan 2007). These European grasses are now well established and considered naturalized.

The Trust began an "interim grazing" program two years after acquisition, grazing conservative numbers of cattle under a variety of administrative programs while acquiring the necessary information on production and utilization to develop an ecologically and economically sustainable grazing program. Inventories and assessments found that while Dunigan grazed conservatively relative to historic use, the average number of cattle he grazed (7,000) was ten-fold the capacity of the Preserve when forage was allocated appropriately to elk and ecosystem services (TEAMS Enterprise Unit 2007). In 2009 the Trust moved from the interim program to a long-term program for livestock grazing managed under a comprehensive program for the multiple use and sustained yield of forage resources. The program includes annual programs for domestic livestock grazing consistent with goals and objectives for ecological restoration and using monitored outcomes to prescribe annual operations under a program of adaptive management (Valles Caldera Trust 2009).

### *Timber Harvest*

In the 2004 technical report, "Assessment of Timber Resources and Logging History on the Valles Caldera National Preserve", Jeff Balmat and John Kupfer succinctly described three distinct eras of timber harvest in defining the logging history of the Preserve. Each era was characterized by methods and approaches that reflected the technological, political, and economic context of the period.

Pre-1935 - Small timber firms began commercial logging operations in the Jemez Mountains in the late 1800s (Martin 2003). Limited by access, these operations easily reached ponderosa pine stands around the village of Ponderosa, in the Cañon de San Diego Grant, south of the Baca (Glover 1989). Harvesting within the Preserve, if there was any, was relatively insignificant.

1935-1962 - The New Mexico Timber and Lumber Company later named the New Mexico Timber Company (NMT) bought the timber rights to the Baca from the Redondo Development Company in 1935, commenced logging, and oversaw logging operations from then until 1972.

From 1935 to 1962, the ponderosa pine stands of the Baca were "high-graded", with the best ponderosa pine sawlogs greater than twelve inches in diameter being harvested from the lower elevations, save for a few seed trees per acre (Martin 2003). Approximately 38 percent of the Preserve's forests (25,600 ac) were harvested using light to heavy selection cutting in the southwest corner on the Banco Bonito lava flow, the northern and eastern rims (Garita and north of Valle Toledo), and around the base of Cerro del Medio, Cerros del Abrigo, and Cerros de Trasquilar (Balmat and Kupfer 2004). Before chainsaw technology became pervasive, crosscut saws were used to fall timber. Logs were skidded by horses to decks where trucks waited to haul the logs to the mill. Toward the end of the era, middle elevation mixed conifer stands were harvested as roads and technology improved.

<u>1963-1972</u> - Improved technology and roads enabled clear-cutting of all species and sizes on approximately 16 percent (10,590 ac) of the Preserve's forests from 1963 to 1972 (Balmat and Kupfer 2004). During this era, NMT employed jammer logging, a cable logging system where a mechanical cable winch hauled logs directly from the stump to roadside collection points. The trees were then were taken to the mill by truck and large slash piles were left in place of trees (Martin 2003). Regulatory changes and a new pulpwood mill in Arizona further aided intensive harvesting during this period. Legal action halted NMT and its intensive logging methods in 1972 (Martin 2003). Figure 16 - Redondito in 1963 (top left), 1972 (top right), and 2000 (bottom) below shows a forested volcanic dome of the Preserve (Redondito) prior to and following clear cutting and road building.

Figure 16 - Redondito in 1963 (top left), 1972 (top right), and 2000 (bottom)

Jammer logging was supported by a dense network of thousands of kilometers of new, contour-paralleling roads, sometimes less than 300 ft apart, spiraling up the forested domes of the Baca (Balmat and Kupfer 2004). The roads permitted logging of steep and high elevation slopes and contributed to fragmentation of the remaining forest areas. Lack of conservation practices caused severe soil and water quality damage as well as aesthetic depreciation of the landscape. These unsustainable practices still affect the biological, economic, and aesthetic qualities of today's forests.

<u>1980-2000</u> - From 1980 until the sale of the Baca to the US government in 2000, logging proceeded at a more conservative pace under the guidance of the New Mexico State Forestry Office. Approximately 1100 ha (2,739 ac, 4% of forested area) were harvested between 1980 and 1992 (Balmat and Kupfer 2004). Most harvests employed selection cutting and were guided

by conservation-minded guidelines established by the State (New Mexico State Forestry 1990). Selection cutting harvests a portion of mature trees, usually the largest and highest quality individuals of the most valuable species. The proportion of trees harvested varied widely. Some patch cutting took place (a patch is a small clear-cut). Logging was carried out in many areas of the Baca including the Cerros del Abrigo, Cerro del Medio (much of which had been previously harvested), and the Sierra de los Valles on the eastern caldera rim (Balmat and Kupfer 2004). South Mountain and the old growth surrounding the historic ranch headquarters was also selectively logged during this period (Keller 2010)

### *Wildlife Management*

In the late 19th century as the population in the Jemez area increased so did subsistence hunting. During this same period the increased availability of modern rifles gave rise to more recreational hunting. This combination of increasing pressures soon decimated populations of mule deer and wild turkey in the area. The popularity of elk hunting was so great that elk were eradicated across the state of New Mexico by 1910 (Anschuetz and Merlan 2007).

At the same time, a change in management policies adversely affected several other native and introduced animal populations that had become a traditional part of the Valles Caldera's ecology. Ranchers and federal agents placed poisoned grain at black-tailed prairie dog towns to rid pastures of these pests in the 1920s (Anschuetz and Merlan 2007) (citing Pickens 1979, in Scurlock 1981:148). Ranchers and government officials also regarded feral burros and horses as nuisances because they competed with cattle and sheep for pasturage. In a concerted effort to rid the Jemez Mountains of such unnecessary competition to livestock industry, U.S. Forest Service personnel rounded up 1,500 burros and horses from the greater Jemez district area, including the Baca Location (Anschuetz and Merlan 2007) (citing Tucker and Fitzpatrick 1972:81).

With the depletion of elk, mule deer, turkey, horse, and prairie dog populations in the Jemez Mountains, gray wolves, mountain lions, and coyotes killed increasing numbers of sheep and cattle around the Valles Caldera (Anschuetz and Merlan 2007) (citing Winter 1981:178). In 1916 the United States Forest Service initiated a new predator control program (Anschuetz and Merlan 2007) (citing Scurlock 1981:144). The U.S. Biological Service (now known as the Fish and Wildlife Service) sent trappers into the Jemez Mountains, including the Valles Caldera, to exterminate gray wolves and mountain lions. As recalled by Homer Pickens (1979), a long-time trapper and wildlife specialist, John Davenport, who once served as one of Frank Bond's Baca Location ranch managers, killed the last New Mexican gray wolf in the Valle Grande in 1932 (Anschuetz and Merlan 2007) (citing Scurlock 1981).

In 1947 New Mexico Game and Fish released 47 head of elk imported from the Yellowstone, Wyoming area into the Río de las Vacas valley west of the Baca Location (Martin 2003) (citing Allen 1997). Although the Jemez Mountains grasslands provided favorable habitat, the introduced elk herd increased at a slow rate, with the population reaching only an estimated 200 animals in 1961. The New Mexico Department of Game and Fish introduced another 58 elk from Jackson Hole, Wyoming between 1964 and 1965. The populations continued their slow increase in the Valles Caldera over the next decade (Martin 2003) (citing Allen 1997). Dramatic ecological change that had both an immediate and great impact on local elk demography

**occurred in 1977: In June of that year, the 25,000-acre [10,000-ha] La Mesa fire burned in the ponderosa pine forests on the Pajarito Plateau at Bandelier National Monument. The fire converted the forest into grassland and opened up considerable winter habitat for the Jemez elk population. With favorable climatic conditions, the elk herd expanded to about 7,000 in 1989. In 2001 it was estimated that between 4,000 and 6,000 elk used the Baca Ranch for summer range. (Martin 2003) (citing Allen 1997).**

### *Fisheries*

**The stocking of non-native trout in the late 1800's and early-1900's was probably the main cause of the extirpation of RGCT from the streams of the Valles Caldera.**

**From the 2002 East Fork Jemez River stream inventory report: A cultural report from 1892 states that the mountain streams fed "Los Valles" (Preserve) and that the streams "teem with mountain trout". This report pre-dates fish stocking in the Jemez Mountains. The first recorded stocking in New Mexico occurred in 1896 (Sublette, Hatch and Sublette 1990). The mountain trout that this report talks about is likely Rio Grande cutthroat trout. During 1936, a creel census was conducted throughout the state in USDA-Forest Service waters. Included in this report is a stocking history for the East Branch [Fork] Jemez River. During the years 1932-1936, 88,300 rainbow trout and 13,500 Yellowstone cutthroats were stocked. During 1936 the creel census recorded that 30% of the fish caught were rainbow, 50% were Yellowstone cutthroat, and 20% were brown trout. No RGCT were caught in the East Fork Jemez River. However, this report does not say where the creel census was conducted or where the fish were caught or stocked. One can conclude that brown trout were stocked prior to 1932 (USDA-Forest Service 2002).**

**From the 2003 San Antonio Creek stream inventory report: RGCT has been extirpated from San Antonio Creek since the 1950's by exotic trout introductions through competition, hybridization and predation (Sublette, Hatch and Sublette 1990).**

### *Geothermal Exploration*

**The following account of geothermal resources and exploration was taken from Goff (2008 in press). Valles Caldera contains hot springs and fumaroles with characteristics similar to those at electricity-producing geothermal systems: 1) acid, sulfate-rich hot springs and hydrogen sulfiderich fumaroles at the top of the system (Sulphur Springs) and 2) neutral, chloride-rich hot springs at the sides (Soda Dam). The first well in the caldera was an oil test completed in 1959 along Alamo Creek on the west side of Redondo Peak. The exploration team might have thought that the resurgent dome was a structural trap for oil and gas. The well struck superheated steam at several thousand feet.**

**Patrick Dunigan drilled three wells (Baca-1, 2, and 3) northeast of Sulphur Springs. Each well had water temperatures at or near 400°F, but none could sustain flow adequate for power production. Dunigan contracted with Union Oil of California (UNOCAL), the leading geothermal developer in the U.S., to explore the geothermal resources on the property. Around 1968, UNOCAL drilled Baca-4 in the Redondo Canyon west of Redondo Peak. The well was a "boomer," about 560°F with sustainable flow. During the next 10 years, UNOCAL drilled**

several more wells. Some were drilled near Baca-4 to determine if the geothermal reservoir was large enough for an electric power plant (Baca-5, 6, 9). Two wells were "step-outs" drilled in other canyons to see if the reservoir was large (Baca-7, 8). The step-out wells were hot, but neither had sustainable flow.

In 1978, UNOCAL signed a joint agreement with the U.S. Department of Energy and Public Service Co. of New Mexico (PNM) to cost share development of the Valles geothermal system. The UNOCAL claimed that 400 MW of electric power could be produced (1 MW is enough power for 1,000 people). The PNM bought two 25 MW geothermal turbines and a pad was constructed for the first 50 MW power plant in Redondo Canyon. The joint project was terminated in 1983 because UNOCAL only proved about 20 MW of power. Only five or six of the 25 wells drilled was commercial. By 1984 the geothermal wells were plugged and abandoned. The UNOCAL left and PNM sold their turbines to the Mexican government.

Three wells were drilled for scientific purposes in 1984, 1986 and 1988 (VC-1, 2a and 2b) funded by the Continental Scientific Drilling Program (CSDP). These wells explored the configuration and roots of the geothermal system, the structure of the caldera and potential fossil ore deposits. The CSDP wells provided a continuous core (complete section of rock from top to bottom).20 At the time, VC-2b was the deepest and hottest "core hole" in the U.S. (5,760 feet, 560°F) and penetrated a complete section of volcanic rocks in the caldera as well as several hundred feet of the Precambrian basement. The CSDP wells VC-2a and VC-2b encountered veins with ore minerals deposited from co-existing hydrothermal fluids. No wells have been drilled in Valles Caldera intending to intersect geothermal fluids since 1988.

When the Baca Ranch was purchased in 2000, the federal government was able to negotiate a mutually acceptable price for the purchase of only 87.5 percent of the mineral rights to the land. Concerned that the owners of the remaining 12.5 percent of the mineral rights might seek to build a geothermal power plant on the Preserve, the U.S. Forest Service condemned these mineral rights in 2006. However, that action required that the owners of the interests be compensated, but the parties were unable to establish a fair compensation price. In January of 2010 U.S. District Court Judge, Robert Brack, ruled $3.8 million plus court fees as compensation and the mineral rights were withdrawn.

## Sensory Resources

Sensory resources include the sights, sounds, smells, and overall sense of place one experiences on a landscape. A view or vista can be somewhat measured; in fact land managers have developed tools to establish and evaluate measurable objectives for visual quality. However, the sight of golden grass moving in the breeze against a backdrop of a deep blue sky is a moment that one experiences with all their senses and

Figure 17 – Participant in a sensory workshop

is much more difficult to quantify (Figure 17).

The expansive grasslands provide the foundation for the total sensory experience on the Preserve. Whether one is standing in the middle of a valle with the grassland extending out in all directions, climbing upward through the forest to turn and view the grasslands from above, rounding the corner of a forested road when the view of the expansive grasslands appears suddenly, the focal point is the grasslands.

The forests connect to the grasslands in a way that appeal to human nature. Visitors will consistently walk through the remnant old growth forest near the historic headquarters area of the Preserve and stop at its edge to view the grassland. It is as though a forgotten instinct returns to remind them they cannot be easily seen by predators or enemies if they stay within the canopy's shade.

The juxtaposition of golden aspen against blue sky or evergreen forests draws out the camera but the photo does not capture the rustling leaves, the sounds of the raven's wings, or the smell of leaves turning to soil.

Through recreation programs that limit the number of people in a place at any one time, the Trust is protecting and interpreting the sights, sounds, and sense of place on the Preserve while it considers options for long-term management of public access and use.

## Current Land Use

Current land management activities on the Preserve include natural resource management, multiple use and sustained yield of forage, facilities maintenance and repair, road maintenance, and public access and use,

### Natural Resource Management

While the proposed LRMP proposes restoration at the landscape level meaning that restoration is considered as a cumulative outcome of multiple activities at multiple temporal and spatial scales. Currently the Trust is implementing restoration and management activities at a project level meaning that actions and outcomes are considered at the site of implementation.

#### *Forest Management*

Forest management actions that are completed or active include mechanical treatments (thinning and mastication) along NM 4 at the southwest corner, surrounding the historic buildings in the Valle Grande, and in Redondo Canyon. The purpose and need for these forest management activities has been to reduce the current wildland fire hazard presented by the dense forest (Valles Caldera Trust 2003, reviewed 2010); (Valles Caldera Trust 2009). All of these projects have included research components to contribute to the development of the proposed LRMP.

#### *Wildland Fire Management*

Consistent with the Federal Wildland Fire Management Policy (NWCG 2005) the Trust developed a Wildland Fire Management Plan (Valles Caldera Trust 2008) for the Preserve. This plan requires the suppression of all unplanned ignitions (lighting and human caused) and permits prescribed burning under NEPA compliant plans. A prescribed fire was completed in montane grasslands in order to gather information on the effects and effectiveness of the use of wildland fire in the grasslands to achieve resource objectives (Valles Caldera Trust 2005).

Other prescribed fire projects are associated with forest management project described above and include research components on the behavior and effects of prescribed fire in masticated material and the effects of thinning and prescribed fire on Merriam's turkey habitat and forest soils.

### *Noxious Weed Control and Eradication*

The Trust maintains an annual program to control and eradicate Canada, bull, and musk thistle; and oxeye daisy (Valles Caldera Trust 2003, Reviewed 2008, 2010). Canada and bull thistle as well as oxeye daisy are being treated annually with an herbicide, Clopyralid, trade name Transline. Musk thistle is primarily treated by digging up the plant and removing the seed heads. Canada and Musk thistle is eradicated in half the known locations and reduced 80-90 percent in other treated locations. However new locations have been discovered; likely spread through gophers and road maintenance activities. All locations of bull thistle have been reduced in size and density however the difficulty remains in preventing all plants from seeding. Though normally biennial, the thistle appears to be adapting to local precipitation patterns and reproducing both as an annual or biennial.

### *Riparian and Wetland Restoration*

The trust has completed inventories and initiated several restoration and maintenance activities to restore riparian and wetland areas in San Antonio and Sulphur Creek 6$^{th}$ level watersheds (San Antonio, Indios, Sulphur, and Redondo Creeks), and on Jaramillo Creek and the Eastfork of the Jemez River. These restoration activities have been associated with the road maintenance projects previously identified or have involved site specific actions along the stream (Valles Caldera Trust 2009).

Projects have been, or are being, implemented through grants and collaboration with partners including Los Amigos de los Valles Caldera, New Mexico Environment Department, WildEarth Guardians, and New Mexico Gas Company.

## Road Closure, Decommissioning and Maintenance

The Trust has focused on completing the deferred maintenance on the existing road network. These road maintenance activities have resulted in reduced erosion, sediment transportation and the restoration of historic flows and wetlands (Valles Caldera Trust 2004,2006,2009) and provided for safe access onto and through the Preserve (Valles Caldera Trust 2006).

The extensive network of historic logging roads has been inventoried; use has been minimal and primarily non-motorized.

## Multiple Use and Sustained Yield of Forage

From 2003 – 2008 the Trust operated annual programs for domestic livestock grazing under an interim grazing program. This program initially offered grazing to local producers during drought years then moved into testing a variety of programs in order to develop a long-term program that could prove to be economically and ecologically sustainable (Valles Caldera Trust 2002,2004,2005). In 2009 the Trust moved into management of a comprehensive program for the Multiple Use and Sustained Yield of Forage Resources (Valles Caldera Trust 2009). Under this program the Trust allocates annual forage production for ecosystem services, consumption by wildlife, and use by the Trust for domestic livestock grazing or other purposes. The program permits annual programs that return revenues equal to or greater than operational costs and can be adjusted annually based on environmental conditions or in support of other programs and activities on the Preserve.

## Public Access and Use

Public access and use to the Preserve is provided for recreation, education, scientific research, and other purposes. Access is also provided to contractors, state and federal agency personnel, or others to perform work. Prior to federal acquisition an estimated 200-300 people visited the Preserve annually. In 2009 15,584 people accessed the Preserve for recreational activities (Valles Caldera Trust 2009).

Programs include hiking, fishing, wildlife viewing, hunting, mountain bike riding, and horseback riding. There are daily tours to learn about history, botany, wildlife, archaeology, and geology. Special events include endurance horseback rides, marathons, mountain biking events, and many outdoor education events for youth groups and schools (Figure 12).

Figure 18 – Youth from the Pajarito Environmental Education Center learn about fish monitoring

In 2010 the Trust opened a Science and Education Center (SEC) in Jemez Springs that includes laboratory, classroom and dormitory facilities. The SEC is expected to greatly expand access and use of the Preserve by students and educators.

## *List of Preparers*

Marie Rodriguez Valles Caldera Trust Project Lead

## *List of Tables*



## *List of Figures*

## *Works Cited*


Allen, C. D. *Changes in the landscape of the Jemez Mountains, New Mexico.* Berkeley: University of California, 1989.

Allen, C. D. "Ecological patterns and environmental change in the Bandelier landscape." In *Archaeology of Bandelier National Monumnet: Village formation on the Parajito Plateau, New Mexico*, by T. A. Kohler, 19-68. Albuquerque: University of New Mexico Press, 2004.

Anschuetz, K., and T. Merlan. *More Than a Scenic Mountain Landscape: Valles Caldera National Preserve a Land Use History. RMRS-GTR-196. 277p.* Fort Collins, CO: USDA-Forest Service, Rocky Mountain Research Station, 2007.

Anschuetz, Kurt F., and Tom Merlan. *Valles Caldera National Preserve Land Use History.* General Technical Report, Fort Collins: Rocky Mountain Research Station, 2007.

Balmat, Jeff, and John Kupfer. *Assessment of Timber Resources and Logging History of the Valles Caldera National Preserve.* Master's Thesis, Tucson: Department of Geography and Regional Development, University of Arizona, 2004.

Federal Register. "NEPA Procedures of the Valles Caldera Trust for the Valles Caldera National Preserve." *Federal Register / Vol. 68, No. 137 / Thursday, July 17, 2003 / Notices.* Washington D. C., 2003.

Glover, Vernon J. *Jemez Mountains Railroads.* Albuquerque, NM: U.S. Forest Service, Southwestern Region, 1989.

Griffith, G. E., et al. "Ecoregions of New Mexico." *(color poster with map, descriptive text, summary tables, and photographs).* Reston, Virginia: U.S. Geological Survey.

Keller, Archie, interview by VCT Cultural Resources Dr. Anastasia Steffen, Kimberly DeVall, VCT Recreation/Interpretation Supervisor and VCT Natural Resources Marie Rodriguez. *Former Timber Manger, Baca Ranch* (July 14, 2010).

Klientjes, P.K. *Valles Caldera NAtional Preserve Butterfly Report .* Final Report, Eau Claire, WI: University of Wisconsin, Department of Biology, 2001.

Martin, Craig. *Valle Grande: A history of the Baca Location No. 1.* All Season's Publishing, 2003.

Muldavin E., P.Tonne, C. Jackson, and T.Neville. *A Vegetation Map of the Valles Caldera National Preserve, NM.* Final Report fo Cooperative Agreement No. 01CRAG0014, Albuquerque: University of New Mexico, Natural History Museum, 2006.

Muldavin, E., and P. Tonne. *A vegetation survey and preliminary ecological assessment of Valles Caldera National Preserve, New Mexico.* Albuquerque: Univeristy of New Mexico, 2003.

NWCG. *Guidance for Implementation of the Federal Wildland Fire Management Policy.* Washington D.C.: US Department of Agriculture; US Department of Interior, 2009.

NWCG. "Guidance for Implementation of the Federal Wildland Fire Management Policy." 2005.

Sublette, J. E., M. D. Hatch, and M. Sublette. *The Fishes of New Mexico.* Albuquerque, NM: University of New Mexico Press, 1990.

TEAMS Enterprise Unit. *Existing Rangeland Condition Report - Valles Caldera National Preserve, 68p.* Porterville, CA: USDA-Forest Service, Region 7, Unpublished In-Service Report, 2007.

U.S.C. *Valles Caldera Preservation Act.* Public Law 106–248—July 25, Washington D.C.: 106th Congress, 2000.

USDA - Forest Service - Interagency Fuels Group. *Interagency Fire Regime Condition Class Guidebook v1.3.0.* Fort Collins, CO: Rocky Mountain Research Station, 2008.

USDA-Forest Service. *East Fork of the Jemez River Stream Inventory Report.* Santa Fe National Forest and Valles Caldera Trust, 2002.

Valles Caldera Trust. "2009 Report to Congress." 2009.

Valles Caldera Trust. "Environmental Assesement, MUSY Forage." Jemez Springs, 2009.

Valles Caldera Trust. *Framework and Strategic Guidance for the Comprehensive Management of the Preserve.* Administrative Direction, Jemez Springs: Unpublished, 2004.

Valles Caldera Trust. "Framework for Strategic Guidance and Comprehensive Management." Los Alamos, NM, 2005.

Valles Caldera Trust. "Interim Grazing Program." Stewardship Register, 2002,2004,2005.

Valles Caldera Trust. "Multiple Use and Sustained Yield - Forage Resources." Environmental Assessment , Jemez Springs, 2009.

Valles Caldera Trust. "Multiple Use and Sustained Yield of Forage Resources." Stewardship Register, 2009.

Valles Caldera Trust. "Redondo Canyon Forest Management Project." Stewardship Register, 2009.

Valles Caldera Trust. "Road Maintenance." Stewardship Register, 2004,2006,2009.

Valles Caldera Trust. "San Antonio Creek Wetland and Riparian Restoration." Stewardship Register, 2009.

Valles Caldera Trust. "State of the Preserve." Cumulative Effects Analysis, Jemez Springs, 2007.

**Valles Caldera Trust. "Valle Grande Entrance Upgrade." Stewardship Register, 2006.**

**Valles Caldera Trust. "Valle Toledo Prescribed Fire." Stewardship Register, 2005.**

**Valles Caldera Trust. "Valles Caldera National Preserve Noxious Weed Erdaication program." Stewardship Register, 2003, Reviewed 2008, 2010.**

**Valles Caldera Trust. "Valles Caldera National Preserve Vegetation Management and Fuel Project." Stewardship Register, 2003, reviewed 2010.**

**Valles Caldera Trust. "Valles Caldera National Preserve Wildland Fire Management Policy." 2008.**

**Valles Caldera Trust, Santa Fe National Forest. "Southwest Jemez Mountains Collaborative Forest Landscape Restoration Strategy." Proposal for Funding, 2010.**

**Viera, K., and B. Kondratieff. *Survey of selected aquatic insect taxa of the Valles Caldera National Preserve, Sandoval County, New Mexico. 74p.* Fort Collins, CO: C.P. Gillette Museum of Arthropod Diversity, Department of Bioagriculture Sciences and Pest Management, Colorado State University, 2004.**