ECOSYSTEMS OF THE PAJARITO PLATEAU AND EAST JEMEZ MOUNTAINS: LINKING LAND AND PEOPLE

by

Teralene S. Foxx

LA-UR-02-7156

For the Cultural Resources Management Plan

November 2002

CONTENTS

List of Figures

List of Tables

ECOSYSTEMS OF THE PAJARITO PLATEAU AND EAST JEMEZ MOUNTAINS: LINKING LAND AND PEOPLE

Teralene Foxx, ecologist

I. INTRODUCTION

After the volcanic eruptions in the Jemez Mountains over a million years ago, development of vegetation on the ash-hewn plateau and the remnant mountains was influenced by relief and climate and, in the last 10,000 years, human interaction. The volcanism and erosion influenced the soil development through soil-forming factors of climate, vegetation, topography, and time. Geofloras were influenced by drying climate and mountain building. In the reverse, the developing soils influenced vegetation through chemical make-up, texture, and water availability (Dick-Peddie 1993). As the environment of the Pajarito Plateau and Jemez Mountains underwent geologic change, various plant communities became established (Figure 1) with woodlands at lower, drier elevations and forests at higher, cooler sites. The erosive power of water developed watercourses that carved canyons into the plateau. Riparian zones developed in canyon bottoms, dominated by water-loving species that grew within the area mediated by water flowing permanently or ephemerally through the canyons. Throughout the centuries, before human populations entered the area, a dynamic process of change took place. Fire, windfalls, floods, and changing weather patterns influenced ecosystems—sometimes within a microhabitat or within the vast landscape. Approximately 10,000 years ago the first humans entered into the ecosystem. With them came change. At first the change was small, but as larger aggregations of people began to use the land, modifications to the landscape were made and the area was no longer pristine.

This document describes the ways prehistoric and historic humans used the environment of the Pajarito Plateau and east Jemez Mountains. Reliance upon past studies, ethnobotany, ethnozoology, excavations, and modern studies enabled this examination of the influence of human activities on the ecology of the area.

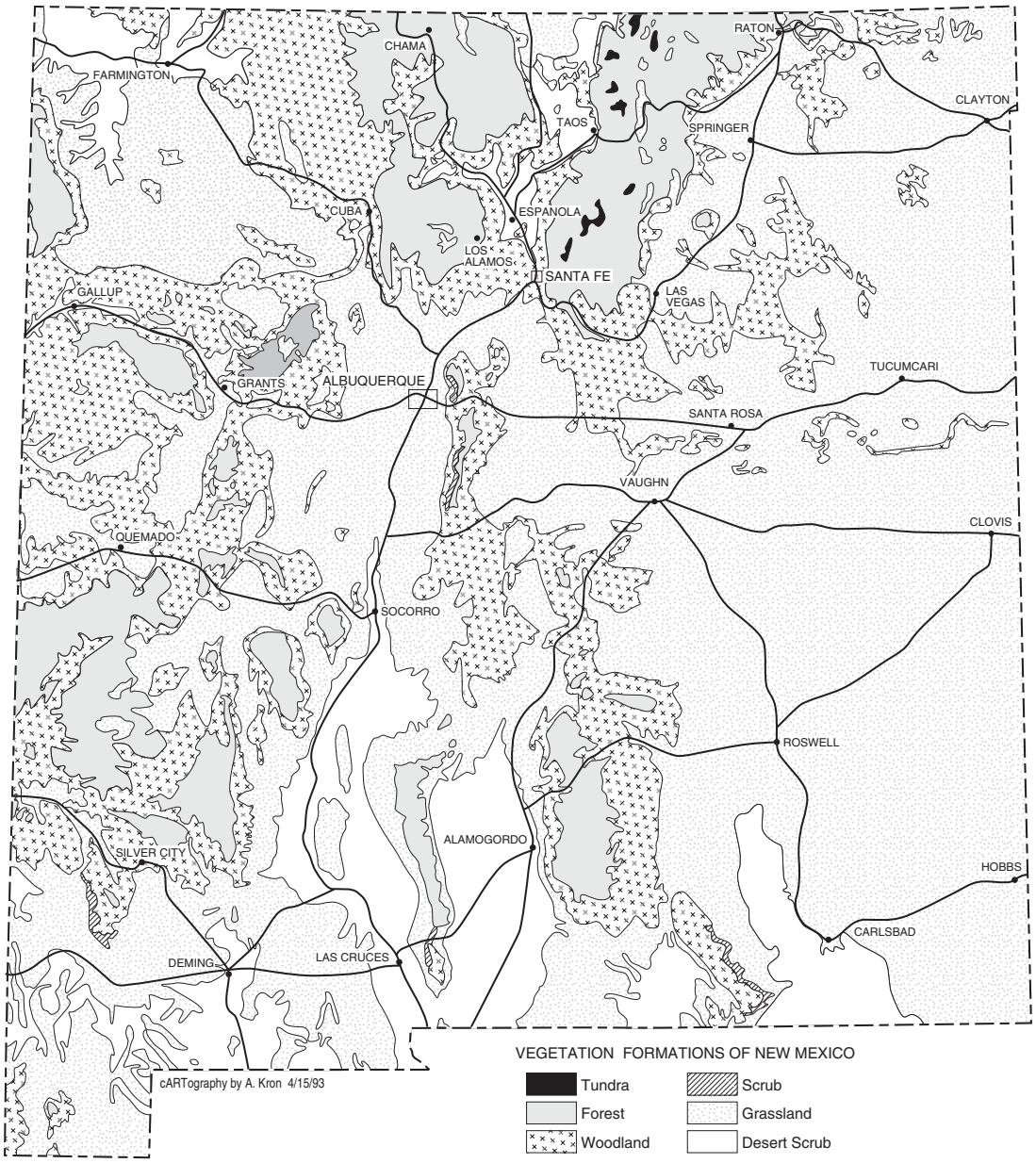


Figure 1. Established vegetation types of the Los Alamos area in relation to the rest of New Mexico.

II. PLANT COMMUNITIES ON THE PAJARITO PLATEAU AND EAST JEMEZ MOUNTAINS

Prehistoric and historic human activities on the Pajarito Plateau varied with topography and plant communities. Middle elevations were used for habitation, while upper and lower sites were used for hunting, foraging, grazing, primitive agriculture, and historic recreational activities.

Mapping and classification of the Jemez Mountains have been done by the US Forest Service for the Santa Fe National Forest (Moir and Ludwig 1979), by Allen (1984, 1989) for Bandelier National Monument, by Potter and Foxx (1981) for the Cerro Grande, by Barnes (1983) for the piñon-juniper woodlands, and by Balice et al. (1997) for Los Alamos National Laboratory and adjacent areas. In the late 1990s, Koch et al. (1996) and Balice et al. (1997) developed a land cover map for the Pajarito Plateau and adjacent east Jemez Mountains. The classification included 10 categories ranging from open water to spruce-fir forests. These classes correspond to the cover types for the land classification map presented in Appendix I (Koch et al. 1996, Balice et at. 1997).

The major cover types were defined by dominant tree species and structural characteristics as follows: juniper savanna, piñon-juniper woodland, ponderosa pine forest, mixed conifer forest, and spruce-fir forest. The relationship between these cover types and elevation is show in Figure 2 (Foxx and Hoard 1984). The other cover types—grassland, shrub land, open water, and unvegetated land are not influenced by topography. Appendix I provides a pictorial description for each of the elements discussed in Balice et al. (1997). Specific information concerning plant species that occur in these cover types can be obtained from Foxx and Hoard (1984), Foxx et al. (1998), Foxx and Tierney (1980), and Jacobs (1989).

The plant communities represent the environment that prehistoric and historic peoples used and lived in. In the past 20 years there have been some major fires that changed the nature of some of the landscape substantially from before 1977:

- The La Mesa fire (1977) burned primarily ponderosa pine forest and some piñon-juniper woodland in Bandelier National Monument, Santa Fe National Forest, and Los Alamos National Laboratory. On the 1997 map, areas severely burned are now mostly grassland or shrub land. These severely burned areas were historically ponderosa pine.
- The Dome fire (1996) burned higher elevation ponderosa pine and mixed conifer forests in Bandelier National Monument and the Santa Fe National Forest.
- The Oso fire (1997) burned areas within Santa Clara Pueblo land and in the Santa Fe National Forest.

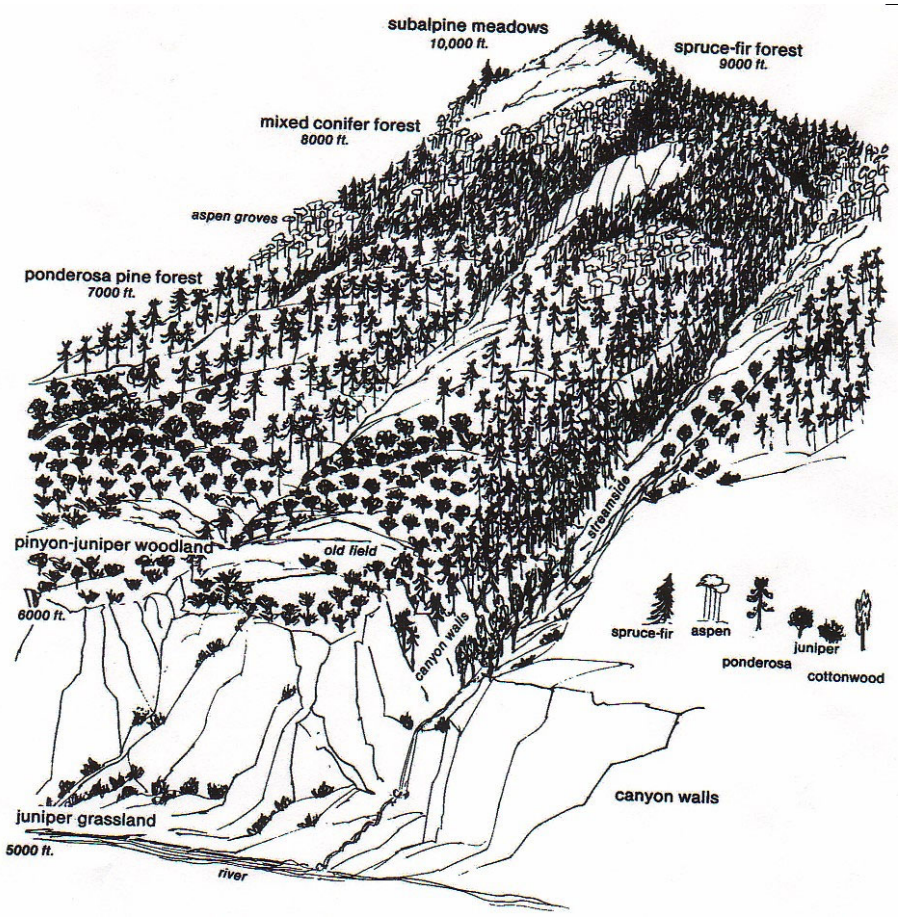


Figure 2. Cover types by elevation.

- The Cerro Grande fire (2000) burned much of the ponderosa pine and mixed conifer in the Santa Fe National Forest above 8,000 ft behind the town of Los Alamos and primarily Santa Clara Pueblo land. It also burned within Los Alamos National Laboratory below 8,000 ft to approximately 7,000 ft and within the community of Los Alamos. Much of the area was burned by a high-intensity fire, which changed the overstory from ponderosa pine and mixed conifer to shrub land and aspen stands.

Since we are discussing past history and land use, the maps that show the extent of the Cerro Grande fire have not been included. Later in this document we will discuss the importance of fire in land use and land management as related to use by those who inhabited the plateau. The discussion in this document will follow the periods listed in Table 1 after Hill and Trierweiler (1986) and Vierra et al. (2002).

Table 1. The Cultural History of the Pajarito Plateau

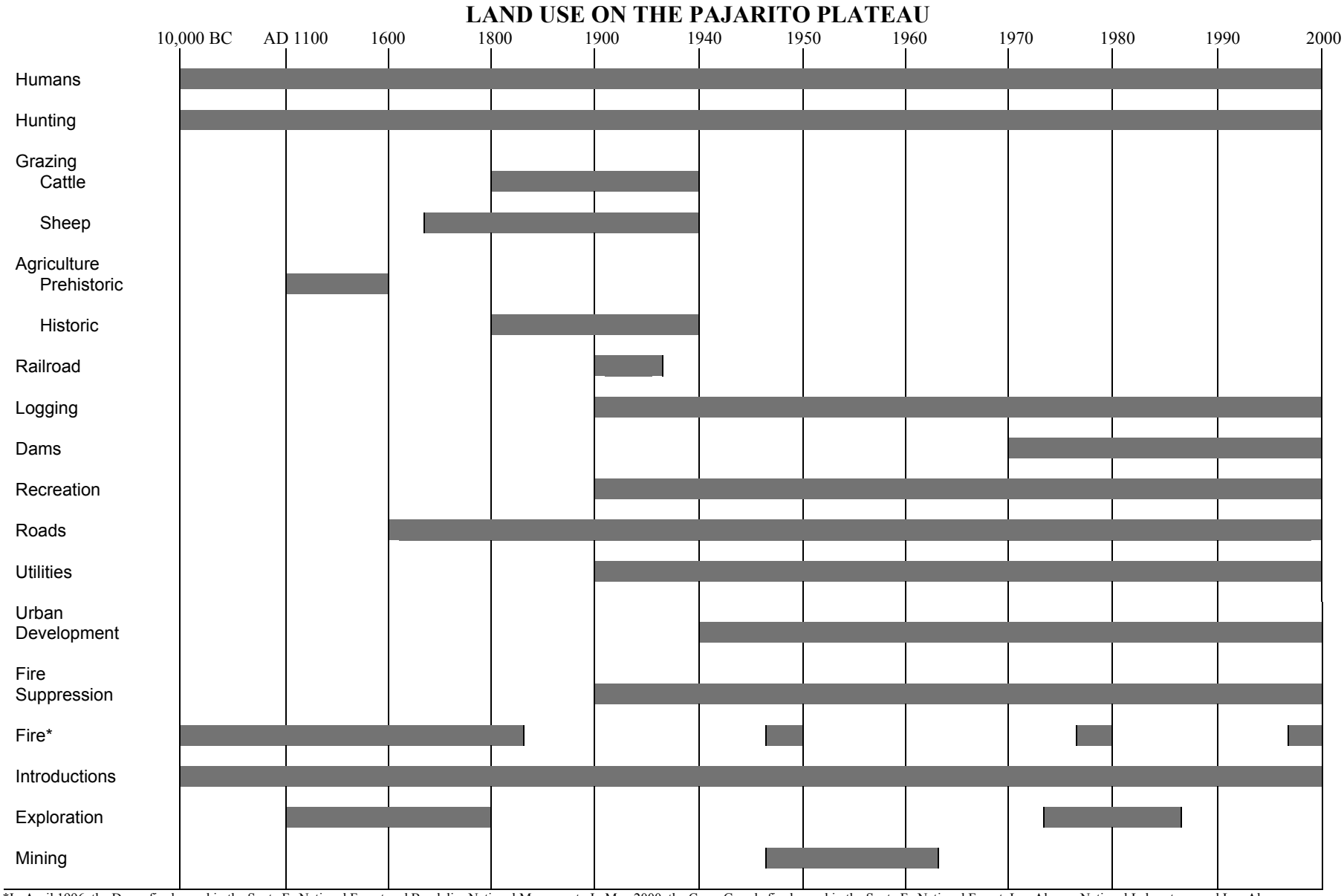
Prehistoric Period	**Time Periods**
Paleoindian Period	9500 to 5500 BC
Archaic Period	5500 BC to AD 600
Development Period	AD 600 to 1150
Coalition Period	AD 1150 to 1325
Classic Period	AD 1325 to 1600
Historic Period	
Hispanic Period	AD 1600 to 1821
North American Influence	AD 1821 to 1912
Statehood to the Manhattan Project	1912 to 1940
Manhattan Project to End of the 20th	1940 to 1999
The 21st Centruy	2000 to 2002

III. PLANTS AND ANIMALS AS INDICATORS OF PAST LAND USE AND CHANGE

A. Plants as Indicators

The Pajarito Plateau has a long history of use by different groups of peoples. Evidence of prehistoric ruins and gardens show disturbance by humans as early as 10,000 years ago (Steen 1977). The plateau has been logged, grazed, and dry-land farmed since the 18th century. More recent disturbance includes burned areas, disposal sites, roads, and other structures (Figure 3). Patterns of plant succession after disturbance are generally as follows: weedy annuals, replacement of annuals with perennial forbs and grass, and invasion of woody species. Plants known as colonizers are usually the first to grow on disturbed sites. These species out-compete the natural species of the original community after the area is disturbed by tilling, fire, or other processes (Clements 1928, Foxx et al. 1998).

Prehistoric and historic dwellings, agricultural areas, and the surrounding landscape can provide information about past use and activities (Foxx et al. 1998, Foxx and Tierney 1982, 1999). The remains of vegetal and faunal material within the hearths of a site can provide information about possible plant and animal uses. Also, the dwellings themselves and the immediate surroundings can provide information about past use and activities. Habitats that had natural or human disturbance are atypical of the surrounding, undisturbed area. These areas of disturbance often have an abundance of plants that were introduced by human activity (Yarnell 1958, Housely 1974). Various



*In April 1996, the Dome fire burned in the Santa Fe National Forest and Bandelier National Monument. In May 2000, the Cerro Grande fire burned in the Santa Fe National Forest, Los Alamos National Laboratory, and Los Alamos County, including portions of the town site.

Figure 3. Land use on the Pajarito Plateau.

categories of these colonizing plants are useful in determining changes in the environment. There are three categories of species often found in association with natural or human disturbance: invasive weeds (often called pioneer plants), noxious weeds, and camp followers.

Invasive Weeds (Pioneer Plants). Invasive weeds can be defined as plants that favor an open habitat and thrive in any disturbed area, ancient or contemporary (Tierney 1973, Lee 1999). Many of these plants are pioneer plants because they are the first arrivals on sites that have been disturbed by human habitation or types of disturbed soils. Most of these species have been introduced from outside the area (e.g., Europe, Africa, or other places within North America) since the time of the European entry into the Southwest and are not native to the landscape. Some species were purposely brought as medicinal or food plants, but others were accidental introductions by seeds clinging to animals or clothing or in goods. Some more recent introductions were used as ornamentals (iris [*Iris missourriensis*]), for repairing spoiled land (crested wheatgrass [*Agropyron cristatum*]), and landscaping (Russian olive [*Elaeagnus angustifolia*]). Many have become naturalized, or a common part of the flora of the area, that are seen in disturbed sites such as ruins, along roadsides, and within floodplains.

Noxious Weeds. For the definition of noxious weeds we are using the Cooperative Extension Service definition: "a plant that has a negative impact on the environment or the economy" (Lee 1999). These plants are further classified into three classes (A, B, and C). These plants have a high probability of affecting the ecology and economics of an area. Noxious weeds displace native vegetation, increase soil erosion, and reduce opportunities for land use. In recent years, areas denuded by vegetation after catastrophic wildfires are sites for noxious weeds such as Canada thistle (*Cirsium arvense*). These weeds are often recent introductions to an ecosystem, and eliminating infestations have the highest priority (Lee 1999).

The difference between noxious weeds and invasive weeds is a fine line. As the plant becomes common in the environment it may change in its classification. Species such as Russian thistle (*Salsola kali*) have become a common part of the landscape and, although widespread on disturbed soil, is not included in the list of weeds that are noxious in New Mexico. In a Santa Fe New Mexican article dated September 16, 1897,

Russian thistle was first reported in the Santa Fe valley and called a noxious weed. Today Russian thistle can be found in abundance on some ruins such as Otowi, along roadsides, and in other disturbed sites**.** Certain weeds may indicate recent disturbance such as excavation (Yarnell 1958). Since Otowi was excavated in the early part of the last century, the excavation is relatively recent. Unexcavated ruins usually do not have plants like Russian thistle in abundance.

Camp Followers. Camp followers are tolerant of disturbed areas surrounding human activity and, in turn, are tolerated or even encouraged by humans because of their economic or aesthetic value (Tierney 1973). Camp followers have proven to be useful indicators of human activity (Tierney 1973, Yarnell 1958, Housely 1974). They are generally non-native species that were brought along for a utilitarian use such as food, medicine, or ceremony (e.g., wolfberry [*Lycium pallidum*] and sacred datura [*Datura meteloides*]). Indicator species may be native or non-native species that thrive in the disturbance of habitation sites (e.g., walkingstick cactus [*Opuntia imbricata*], four-wing saltbush [*Atriplex canescans*], and lambs quarters [*Chenopodium* spp.]). Prehistoric agricultural areas can often be located by rock alignments and sometimes by an anomaly in the existing vegetation, even after 400 years of abandonment. Thus, marks of earlier activities as evidenced by existing vegetation are a legacy of the past.

Floral introductions have occurred since people entered into these environments. The presence of introduced species (invasive weeds [pioneer plants], noxious weeds, and camp followers) indicates use, changing environments, or accidental introductions. The earliest introductions were probably camp followers brought as people migrated to the plateau. Later introductions may have been purposeful or accidental. Scurlock (1998) listed plants introduced since the entry of the Spanish into the middle Rio Grande Valley with approximate dates. Using Scurlock's list as a starting point, we compared that list of introduced plants with "The Annotated Checklist of Plants of the Jemez Mountains" (Foxx et al. 1998). Those plants that were found in the Jemez were noted. The list of introduced plants for the Jemez was further extended by other references, including Martin and Hutchins (1980), Crockett (1977), Lee (1999), Curtin (1965), Tierney (1973), Agricultural Research Service (1971), Phillips Petroleum Company (1957, 1960), Tierney and Hughes (1983), and Stubbendieck et al. (1989). The results are found in

Appendix II. This list includes primarily "wild" species and does not concentrate on domestic species introduced by the Spanish such as wheat, barley, onions, oats, lettuce, watermelon, or fruit trees. Neither does the list address Mexican Indian crops the Spanish introduced, including tomatoes, chiles, cultivated tobacco, and new varieties of corn and beans (Wozniak 1995).

B. Animals as Indicators

Introduction of domestic animals (cows, sheep, goats, pigs, horses, and other species) by the Europeans has had a profound impact on the land and peoples of the Southwest. Migratory societies could move when drought occurred and sedentary groups did not have to depend so much on wild foods. The result was that more trading and raiding was possible. Peace fairs such as those held at Taos in the 18th century between the Pueblo Tribes, the Apache, the Comanche, and the Spanish provided a means to distribute goods (Simmons 1991).

As time passed, some animals were no longer necessary for domestic life. For example, in the mid-20th century burros were no longer needed for the economy as beasts of burden. Many were released and became feral in Bandelier National Monument and the Santa Fe National Forest. In the mid-1970s and early-1980s, the impacts of these animals on the ecosystem and archaeological sites were addressed in Bandelier National Monument. The animals were removed or exterminated. In recent years there has been one feral burro on Los Alamos National Laboratory.

There have been introductions, extirpations, and extinctions of animal species that have changed the nature of the food chains. One example is the introduction of non-native fish, including brown and cutthroat trout. These fish have reduced the numbers of native fish species (Allen 1989) and make it difficult to determine the use of such groups by early peoples. Appendix III, Table 1 (Extinct, Extirpated, Rare, Introduced, and Removed Animals of the Pajarito Plateau and East Jemez Mountains) addresses introductions, extirpations, and extinctions of animals. This information is listed from Los Alamos National Laboratory (1998), Travis (1992), Foxx et al. (1999), Allen (1989), and Findley (1987).

IV. PREHISTORIC LAND USE

The landscape of the Pajarito Plateau and east Jemez Mountains remained untouched by human influence until approximately 10,000 years ago when small groups of Paleoindian hunter-gatherers followed game animals up and down the Rio Grande with trips onto the plateau and into the Jemez Mountains to collect obsidian and other subsistence resources. These people moved often to take advantage of the various resources. As edible plants became available, the consumers would reposition themselves (Tainter and Tainter 1996). This would mean that they might be at low elevations for gathering spring greens and later at higher elevations for summer and fall berries (Tainter and Tainter 1996, Foxx and Vierra 2002).

From those first few people who wandered the mesas and canyons, the use of the area slowly grew. Archaic hunter-gatherer groups (5500 BC to AD 600) relied on small game such as grouse and various plant species. Later, as maize horticulture became established, pit house dwellers (600 to 900 AD) used the area for foraging. As the density of people increased, landscapes were modified. Lands were cleared for agriculture, and every piece of wood within easy walking distance useful for construction, cooking, or heating would have been quickly utilized. The distribution and abundance of native plants and animal species within that area would have been altered in a short time. Vegetation was influenced by plants that were introduced or removed (Tainter and Tainter 1996). The Pajarito Plateau was no longer a pristine wilderness.

Further influence of human occupation came during the period of 1150 to 1325 AD with year-round settlement of the plateau. From this Coalition period through the Classic period, 1325 to 1600 AD, there was increased settlement, development of large pueblos, and agriculture, particularly at the lower elevations within piñon-juniper woodland and juniper savanna. Though abandoned in the mid-1500s because of drought, the plateau continued to be used for foraging and hunting.

A. Plant Resources

The Pueblo cultures used various plants and animals for daily living, including food, clothing, recreation, and ceremony. There are three ways that use can be determined: literature about ethnobotanical or ethnozoological studies, surveys of sites to

determine availability and camp followers, and removal and study of macrobotanical or faunal material from excavations.

Knowledge of early plant and animal uses has been defined by early ethnologists and, more recently, by interviewers of tribal members. During the early 1900s, interviewed persons from the Keres, Tiwa, and Tewa language groups and athabascans, the Apache and Navajo, related folklore about plants and plant usage. Researchers included Castetter (1935), Castetter and Opler (1936), Cook (1930), Jones (1931), Robbins et al. (1916), Stevenson (1912, 1915), Elmore (1943), and Swank (1932). Henderson and Harrington (1914) interviewed tribal members about animal uses. These studies have been a basis for much of the understanding about early plant and animal use. Other means of extrapolating information were through excavations and recovery of plant and animal remains or surveys of sites (Ford 1968; Foxx 1982; Lang 1986; Matthews 1990, 1992; Tierney 1977, 1979; Trierweiler 1990, 1992).

Dunmire and Tierney (1995) summarized much of the ethnographic literature and also conducted personal interviews with tribal members of various pueblos. They identified 304 plants known to have uses for food, medicine, cordage, construction, implements, and tanning within the Pueblo Province. The categories they found and percentages of plants within each use category for the Jemez are found in Table 2.

Using the list compiled by Dunmire and Tierney, we (Vierra and Foxx 2002) identified 215 of the 305 species as being present in the Jemez Mountains flora. Of the 215 species, many had multiple uses. Table 3 shows the species that are most commonly used by various groups. We analyzed the list to determine the plant community where plants used for food and beverages are most likely to occur (Table 4). A more complete and detailed listing is found in Appendix IV, Table 1 (Plant Resources Used by Prehistoric Peoples: Pajarito Plateau and Jemez Mountains).

Additional information has been gleaned from macrobotanical analysis of excavations. We limited our information to two studies: Excavations in the Cochiti flood pool and the Bandelier Archaeological Survey. Foxx (1982) identified macrobotanical material for sites in the Cochiti flood pool study, and Matthews (1990) for the Burnt Mesa Pueblo and Casa del Rito of the Bandelier Archaeological Survey. Both charred and uncharred seeds were recovered from flotation samples. Appendix IV, Table 2

(Macrobotanical Taxa Identified in Archeological Sites) lists macrobiotic species found in these archaeological excavations.

Table 2. Percentage of Plants used for Different Activities*

Food and Beverage	42%
Medicine	59%
Smoking or Chewing	5%
Construction	5%
Coloring, Tanning, Soap, Art, Crafts	12%
Cordage, Fiber, Fine Matting	3%
Implements	11%
Total Number of Identified Plants	**304**

*Calculated from Dunmire and Tierney (1995)

Table 3. Plant Uses and Numbers of Plant Species used from Plant Communities

Activity	Riparian	JS*	PJ	Pipo	MC
Medicinal (n = 148)	18	82	111	73	35
Food (n = 108)	23	41	77	56	30
Implements (n = 28)	4	14	20	15	6
Coloring/Tanning (n = 37)	6	19	24	16	6
Construction (n = 16)	6	7	9	8	4
Smoking (n = 13)	0	8	11	3	9
Cordage (n = 6)	2	3	2	2	1

*JS = Juniper Savannah, PJ = Piñon-juniper, PIPO = ponderosa pine, MC = Mixed Conifer

B. Animal Resources

There is less ethnographic information available on animal use. Much of the present knowledge of potential animal use of specific importance is through zoological remains found through excavations, in mythology and folk story collections, and present ceremonial use.

The Ethnozoology of the Tewa Indians (Henderson and Harrington 1914) was published in the early 20th century. Henderson and Harrington's work provides one of the earliest listings of animals found in the area and the Tewa names for animals. The compilation was made from personal interviews of Native American workers from San Ildefonso and interviews with the Abbotts, then residents of Frijoles Canyon. The purpose of the study was to determine use and presence of various animal species found in or had been present in the area of El Rito de Los Frijoles, the Valle Grande, and Painted Cave in 1910. Their identification of various species provides a glimpse of species that were common in the El Rito de los Frijoles region early in the 20th century,

Table 4. Species of Plants used by Multiple Native American Cultures of New Mexico

Plant	Common Name	Number Groups
Achillea lanulosa	yarrow	3
Alnus tenuifolia	alder	3
Amaranthus graezans	pigweed	3
Amaranthus retroflexus	amaranth	6
Artemisia filifolia	sand sage	4
Artemisia frigida	wormwood	3
Artemisia tridentate	big sagebrush	2
Atriplex canescens	four-wing saltbush	7
Croton texensis	doveweed	5
Fallugia paradoxa	Apache plume	4
Hedeoma nana	false pennyroyal	3
Ipomopsis aggregata	scarlet gilia	3
Juniperus monospera	one-seed juniper	4
Lycium pallidum	wolfberry	4
Mirabilis multiflora	showy four o'clock	3
Monarda menthaefolia	beebalm	4
Cleome serrulata	Rocky Mountain beeplant	8
Pectis angustifolia	lemoncillo	4
Penstemon barbatus	scarlet bugler	3
Pinus edulis	piñon pine	4
Portulaca oleraceae	verdolaga	5
Quercus gambelii	Gambel oak	3
Rhus trilobata	lemonade berry	7
Ribes inebrians	gooseberry	3
Rosa woodsii	wild rose	3
Solanum elaeagnifolium	bullnettle	5
Solanum jamesii	wild potato	4
Yucca spp.	yucca	8

some of which were extirpated or became extinct since the late-1800s (bighorn sheep, elk, wolf). This study was also done to help support identification of various bones taken from excavations in the Frijoles Canyon area: deer, rabbit, fox, coyote, wolf, dog, raccoon, badger, wildcat, beaver, and small birds. Additionally, bones of turkey, eagle, hawk, and owl were noted.

Of the 48 mammals identified, only 15 species were found to have a specific use as food, in ceremony, or within mythology of the Tewa. Of the 46 bird species noted, only 10 species were used as food, in ceremony, or within mythology of the Tewa. No reptiles or amphibians were noted as used for food. Only turtles were used for ceremonial

purposes. Insects had little importance as a food source, but Henderson and Harrington (1914) identify a number of species using Tewa terminology. Appendix III, Table 2 lists the animals and their potential use as identified in Henderson and Harrington (1914). The list was further extended by examination of faunal remains in two major excavation sites: in the Bandelier flood pool (Guthrie 1982a, b) and on Burnt Mesa (Trierweiler 1990, 1992).

Excavations on the Pajarito Plateau have yielded faunal remains. These excavations provide some information, but because of varying processes of deposition, preservation, and archaeological recovery and animal use after abandonment, the presence of bone fragments does not necessarily indicate use by the human inhabitants. However, the information can be used to understand the ecology of the area in which the inhabitants lived. Information about faunal remains can be found in Appendix III, Table 2 (Animal Resources on the Pajarito Plateau and Jemez Mountains).

Extensive excavations for Bandelier within the Cochiti Lake flood pool were conducted in the 1970s. These sites included large multiroom sites, one- and two-room masonry sites, and caves. Guthrie (1982a, b) surveyed the area for present fauna and then identified the various animal remains within the sites. Guthrie determined that many of the faunal remains belong to species that may have used the rocky sites after abandonment by humans and were not used for food or implements. Only a few designated species had charring or knife cuts. Guthrie notes that the bones of other species were a normal part of the fauna of the Rio Grande or were migrants along the river.

During the Bandelier Survey, Trierweiler (1990, 1992) identified the non-human bone assemblages from two sites: Burnt Mesa Pueblo (LA 60372) and Casa del Rito (LA 3852) within Bandelier National Monument. Identity entailed 16 taxa, including 14 mammals and two birds. Trierweiler (1992) noted that although charring might indicate food preparation, edible species such as antelope, bison, prairie dog, blue grouse, porcupine, skunk, and mule deer did not necessarily show charring. He found 10 bone tools primarily made from turkey and mule deer.

More information about animal resources has been summarized by Allen (in press). He tabulated the use of various species in 46 different excavations for the Jemez Mountains (Appendix III, Table 2).

The presence or absence of bone assemblages can indicate many things. One is use of the faunal resources by people. Another is the occupation or use of a site by an animal after abandonment by humans. Even today it is difficult to determine animal patterns, so looking into history is even more uncertain. Although a species might not occur within the faunal assemblage of a particular site or appears in the faunal assemblages but not in the immediate environment, this does not indicate lack of use by humans. Trading of some remains such as pelts, bones, antlers, and horns may account for some discrepancies.

The list, compiled from Henderson and Harrington (1914), and the excavations were compared to a species list created for the Pajarito Plateau by Biggs et al. (1997) and habitat information by Findley (1987). The kit fox (*Vulpes velox*; reported by Trierweiler 1992) has not been reported for the plateau and because of their habitat requirements may not have ever inhabited areas of the plateau or Jemez Mountains. Similarly, jackrabbits are not presently found in the area. Allen (in press) has tabulated the use of various species in 45 different excavations for the Jemez Mountains. Table 5 shows the species found in the various ruins and the numbers of faunal remains in descending order.

Kohler (1990) notes that the faunal assemblage of ruins in the 1989 and 1990 study did not have elk. Allen (1996) compiled ungulate faunal remains from 45 local archeological sites. Of the 218 ungulate individuals (based on a total of 646 bones), he found that other ungulate remains—bighorn, pronghorn, and bison—exceeded elk, indicating low population numbers from 1200 to 1500 AD (Allen 1996). It should be noted that elk do not like densely forested sites and generally are found in open meadows like those of the Valle Grande. The last Merriam elk (*Cervus elaphus merriami*) were noted in the Jemez in the late-1800s. Rocky Moutain elk (*Cervus elaphus nelsoni*) were introduced in 1948 with 28 elk from herds in Jackson Hole, Wyoming. The herds now number into the thousands. The general patterns of movement of elk before the La Mesa fire were different than today and might more closely reflect the migration patterns at the time of prehistoric habitation of the plateau. The elk would summer in the Valle Grande

where calving and nursing took place and in upper mesas such as Burnt Mesa and Escobas Mesa during the winter months (White 1981). The patterns of migration have been changed with successional stages in the La Mesa, Dome, and now Cerro Grande fires (Biggs et al. 1999, Allen 1996).

Table 5. Animal Species Found in 45 Sites and the Numbers of Remains in Descending Order (after Allen, in press)

Animal	Number	Animal	Number	Animal	Number
Turkey	531	Sandhill	33	Elk	3
Cottontail	460	Bighorn	24	Frog	3
Jack rabbit	317	Pronghorn	24	Beaver	2
Mule deer	155	Kangaroo rat	24	Bobcat	2
Prairie dog	81	Toad	10	Pig	2
Sheep/goat	79	Bear	9	Ringtail	2
Cow	75	Horse/burro	8	Dog/coyote	2
Fish	53	Bison	7	Sheep	1
Quail	45	Owl	5	Goat	1
				Burro	1

V. HISTORIC LAND USE

A. European Colonization of the Southwest: The Hispanic Period

Changes in the landscape continued and intensified with increasing numbers of people and their use of the land. The Hispanic introduction of cattle and sheep had far-reaching environmental consequences (Tainter and Tainter 1996). With the arrival of the Europeans to northern New Mexico in the late-16th century, the potential to change the ecosystem was heightened. Now, not only did inhabitants till the soil, small (sometimes large) herds and flocks selectively grazed palatable grasses and forbs.

Introduction of livestock, cutting of forests, development of the railroad, and urbanization have had an influence on the area. Although there is evidence that climatic events have altered the position of the ecotones between plant communities (Allen and Breshears 1998), it has been the activities of the last 400 years that have added or reduced the various elements of the flora of the region. Researchers such as Cooper (1960), Touchan et al. (1996), and Swetnam and Baisan (1996) have found that ponderosa pine forests are denser now than at the time of European settlement. This is not due to climatic change but to fire suppression and livestock grazing. The development of the dense forests has resulted in large, catastrophic fires in recent years. Studies in the piñon-juniper zone by Loftin (1999) have shown a change in the density and health of the lower

elevation forests dominated by piñon and juniper. Grasslands of northern New Mexico have been reduced by the presence of occupation and livestock (Dick-Peddie 1993).

Europeans brought with them plants and animals that were common to their home environments, including domestic iris and mullein (*Verbascum thapsus*). Some were purposely brought, but others were accidental transplants because seeds were attached to clothing or animals. These introductions moved up the *Camino Real* from Mexico to northern New Mexico and became established where people aggregated. Some displaced native species or became invaders in disturbed soils (Appendix II, Table 1 and Table 2).

Since goods came across the *Camino Real* only once every three years, Hispanic herdsmen and farmers lived on a subsistence level. Wild plants and animals supplied some of the food (wild spinach and other plants), clothing (buckskin), and medicine (wild and introduced plants) that supported their lives (Curtin 1965, Simmonds 1991, Ortiz y Pina and Anaya 1972). Appendix V, Table 1 enumerates the native and introduced plants used by the Spanish pioneers.

Although these changes in flora began soon after domestic animals were introduced, the largest changes have taken place in the past 150 years (Dick-Peddie 1993). Early Spanish chronicles, including those of explorers and Jesuit and Franciscan priests, made constant reference to the "sea of grass." Journals and diaries kept by military and religious travelers indicate a changing environment, particularly in places of increasing habitation and livestock. Captain Johnston said of the Santa Fe area in 1846, "*The grass was well eaten out before about the camp and the country around Santa Fe, and today is thinly covered with grama grass and occasional cedar shrubs, betokening the greatest sterility*." He later refers to the plains in 1843, *"from the Rio Grande to Tucson as covered with grama grass, on which animals moderately worked, will fatten in winter...*" Without herdsmen understanding that natural resources are limited, unlimited grazing eventually took a toll on environments of the Southwest. Land deteriorated.

Soon after the arrival of the Spanish into the upper Rio Grande Valley, sheep became the most important and common livestock (Carlson 1969, Grubbs 1958). Because the sheep industry was more profitable than the cattle industry (sheep can be used for both food and clothing) it continued to flourish until the early 1900s, when cattle ranching became more lucrative. The extent to which the plateau was used for grazing by

sheep before the mid-18th century is uncertain. There is some indication that San Ildefonso Indians used part of the area as their grazing commons along with a small seep in Pajarito Canyon as a water source. Goat herds were common around pueblos, and the extensive grazing and firewood removal caused severe erosion (Dorman 1996).

Historically, however, the era of small pastoral herds and subsistence farms began on the Pajarito Plateau in 1742 when Pedro Sanchez was given a Spanish Land Grant (later known as the Ramon Vigil Grant; Figure 4) so that he could provide for his household of 20 persons. For over 100 years, the land remained within the Sanchez family and was primarily used for grazing and not permanent residency. The family flocks were small, but importance of sheep to the economy was illustrated by the sale price of the grant on August 28, 1851. On that date, Antonio Sanchez sold eight shares of the land to Ramon Vigil for a yoke of oxen, 36 ewes, a ram, and $20.00 (Chambers 1974, Chambers and Aldrich 1999).

B. Land Use Changes in the 19th Century: Arrival of the North Americans

Independence, the Santa Fe Trail, and New Citizenship. Land use changes in the 19th century were connected to the political, economic, and social conditions of the time. Before 1821, under Spanish Colonial rule and then the Mexican government, commerce was forbidden between New Mexico and the merchants from the United States. The occasional trade items from Chihuahua City and points further south in Mexico were limited by the distance and isolation of the *Camino Real*. Subsistence farms and a barter economy provided a harsh existence. In 1776, Fray Dominguez wrote about his official trip through New Mexico, including the villa of Santa Fe: *"Lacks everything, its appearance is mournful because not only are the houses of earth, but they are not adorned by any article. A village practicing subsistence agriculture."* In 1790, a census of Santa Fe showed a population of 2,542 with most everyone indicating they were farmers (Dorman 1996). Independence was gained from Spain on September 21, 1821, and immediately beckoned the Yankee traders. With the abandonment of trade restrictions, the first large freight caravan reached Santa Fe in 1824. The assortment of

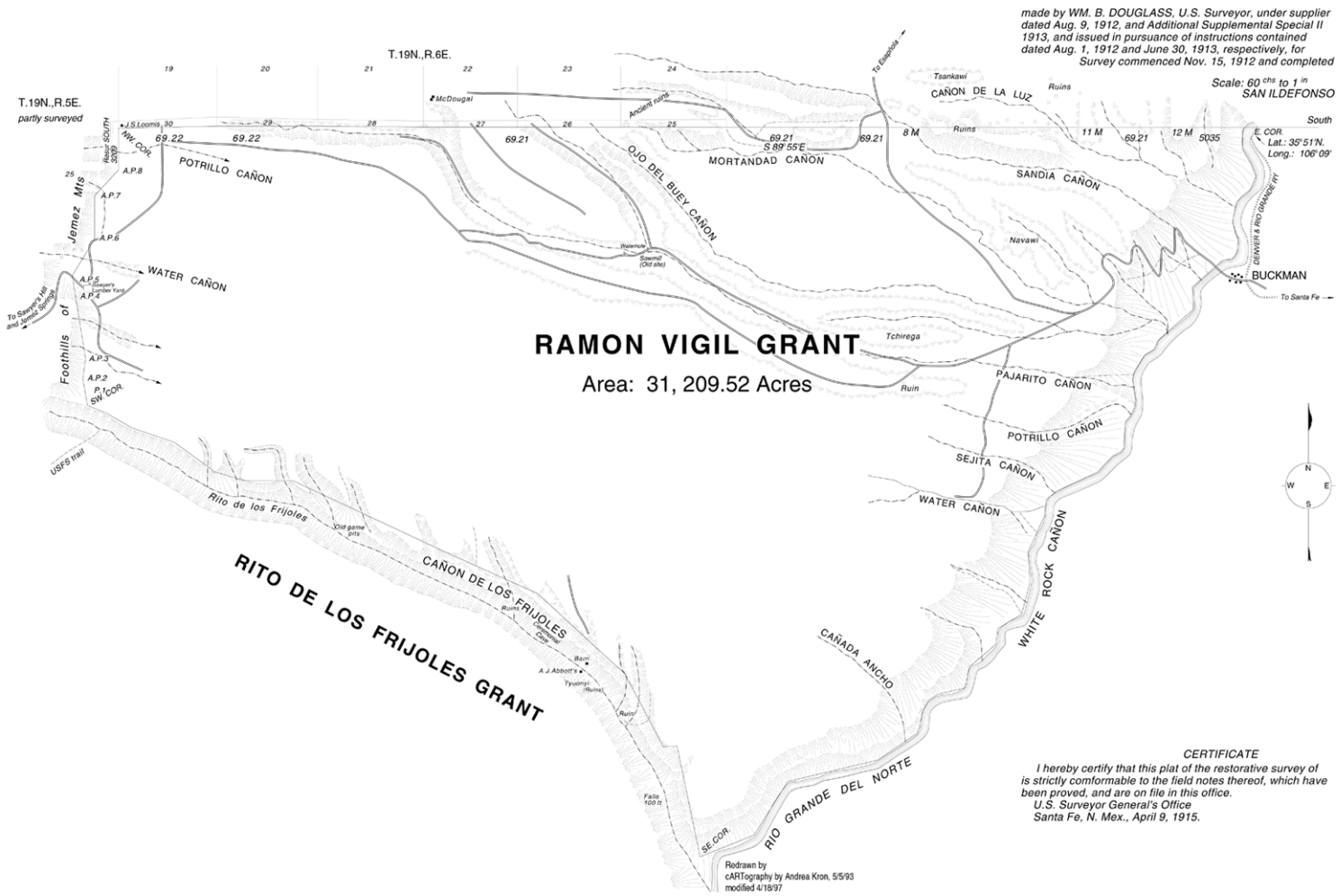


Figure 4. The Ramon Vigil Grant.

merchandise and the profit made brought an influx of Americans into New Mexico and the population of the area began to grow. Soon Santa Fe grew to over 5,000 persons and the population of the region increased (Dorman 1996).

In 1846, war was declared on Mexico by the United States. In an initially bloodless confrontation, New Mexico became a territory of the United States, resulting in further settlement by Americans and Europeans and establishment of military installations like Fort Marcy in Santa Fe. During this period, demands for hay for military animals contributed to the opening of roads across the plateau to a hay camp in the Valle Grande (Chambers 1973, Chambers and Aldrich 1999, Foxx and Tierney 1984). The final major impacts in the 19th century were economic, social, and political conditions in the post-Civil War period that made cattle ranching, mining, and lumbering lucrative businesses. Men of capital, from both eastern and foreign companies, were attracted to the area. The barter economy was replaced by a money economy, and returns on investments became essential.

Twenty-eight years after his purchase of the grant, Ramon Vigil sold it to Thomas Aquinas Hayes, an Irish Priest, for $4,000. Within a month Hayes had sold it for $16,000, later buying it back for the same price. On June 13, 1884, Padre Hayes sold the grant to Winfield Smith and Edward P. Shelton of Cleveland, Ohio, for $100,000. These sales took the land permanently out of Spanish hands, ending an epoch of isolation, years of subsistence farming, and pastoral grazing. Cattle, lumber, homesteading, and recreational development began to make their marks on the landscape.

Oñate introduced cattle into the Rio Grande Valley in 1598. They remained a lesser commodity until the late-1800s. Economic policies and laws passed by the Texas legislature in 1879 and 1883 restricting grazing on depleted Texas ranges were soon to affect the Pajarito Plateau. Texas cattlemen pushed westward into semiarid ranges of the New Mexico Territory. They brought with them poor range practices—too many cattle on too little land. The result was deterioration of the fragile environs.

From approximately 1885 through 1887, the Ramon Vigil Grant was rented to a Texas cattleman, W. C. Bishop, who ran 3,000 head of cattle on 32,000 acres. This was severe overstocking. Today, a liberal estimate of the range stocking for the grant would be 100 acres per cow per year (Foxx and Tierney 1984).

The Railroad: The Super Highway of the 19th and Early-20th Centuries.

Trade and growth flourished with the opening of the Santa Fe Trail, but the opening of the rails across northern New Mexico in 1880 provided a surge in the economy and greater ease of access. As the 20th century dawned, the railroad meant opened markets for products such as cattle, sheep, and other goods as well as greater ease in reaching those markets. Populations increased and new towns such as Buckman and Española emerged. Grazing continued until the early-1940s. In the early part of the 20th century, Frank Bond of Española bought the Ramon Vigil Grant as a pasture and way station for transporting cattle and sheep to and from the Baca Location #1, which he also owned. In Dorman (1996) a statement was made: *"The total number of sheep owned in Española is about 33,000 and according to one informant, Mr. Bond owns 32,000 of these."* The seep in Pajarito Canyon, which had once been used by the inhabitants at Tserige (Hewitt 1906), became an important holding area for animals shipped via the "Chili Line" at the town of Buckman on the Rio Grande (Dorman 1996, Gjevre 1971).

After acquisition of the grant by the US Atomic Energy Commission (US AEC), grazing ceased. Trespass cattle can still be found on the lower portions of the plateau. Though much of the area has been protected for nearly 60 years, evidence of previous overgrazing is still found by the presence of indicator plants such as snakeweed (*Gutierrezia sarothrae*), pinque (*Hymenoxys richardsonii*), and false tarragon (*Artemisia dracunculus*).

The boom in mining, increased population from the westward movement, and development of the railroad created a demand for lumber and other building materials for housing, mining timbers, and railroad ties. Spurs on the rail reached into the isolated forests, and large-scale lumbering became profitable, particularly as the vast Spanish land grants were sold to newcomers and the federal government. It was development of the "Chili Line" that made these lands of the Pajarito Plateau accessible to lumbering.

In 1897, the owners of the Ramon Vigil Grant sold the timber rights to H. S. Buckman, who removed lumber from the area until 1903. He built the town of Buckman on the Rio Grande as a railway station. He constructed a road linking the rail stop to his saw mill, which was probably near what is presently S-Site (thus named because of a very large sawdust pile).

Buckman's contract entitled him to cut all the saw timber standing on the Ramon Vigil Grant, which, when sawed into logs, would measure eight inches in diameter at the small end between the bark. A newspaper article of December 1903 speculated that Buckman cut 36,000,000 board feet on the 32,000-acre grant. There was additional logging after the grant was sold in 1906 to the Ramon Land and Lumber Company. At that time a sawmill, called the Philips Mill, was built in Pajarito Canyon at the present Pajarito Site.

Throughout the early-1900s and into the 1940s, areas adjacent to the Ramon Vigil Grant yielded 17,319,000 board feet of permitted saw-log timber. Most of this was selective logging by local people. There was a considerable amount of trespass logging and cordwood gathering before 1946. From 1923 to 1931, 20% of the timber harvested from the Los Alamos area was used for building the ranch school. After acquisition of the land by the US AEC, the only recorded cutting was salvage logging from a wildfire. Today, nearly decayed stumps and numerous immature pines (60 to 80 years old) are evidence of the extensive logging in the area (Foxx and Tierney 1984).

Homesteading. Another factor in the westward movement, particularly after the Civil War, was the Homestead Act of 1862. This Act granted quarter-sections of land to any bonafide settler who occupied a site for five years. On the Pajarito Plateau west and north of the Ramon Vigil Grant, homesteading was most important after 1894. Homesteads established earlier in the 1800s were used mainly as summer grazing areas. With the Homestead Act, lands needed to be occupied year-round. Later homesteads, such as the Anchor and Brook Ranches, were more extensive and were used for agriculture. At the time the area was condemned for the Manhattan Project, 35 homesteads amounting to 3,600 acres were in private ownership. Most were used for subsistence farming and grazing of small herds of goats, horses, cows, and sheep. Listing of the homesteads at the time of acquisition is located in Appendix VI, Table 1.

Studies done at the Romero Cabin site that was excavated in the early-1980s provide some information about the homestead period. Tierney (1999) interviewed descendents of the early homesteaders and compiled a listing of plant species they used, introduced, or observed. The information is in Appendix V, Table 2.

Foxx et al. (2000) looked at eight fallow historic fields in the ponderosa pine and piñon-juniper cover types to determine species composition and distribution. Part of the purpose was to determine the plant succession since abandonment of the fields in the 1940s. Researchers determined there were 78 different plant species found on these disturbed sites. Of the 78 species, 23 were found to be dominant on one or more of the old fields. There were five species common to all sites. Of particular interest were species in the genus *Artemisia* that seem to be good indicators of previous disturbance to the land (Foxx and Tierney 1997, Tierney and Foxx 1982).

C. Statehood to the Manhattan Project

At the turn of the 20th century, homesteading, grazing of sheep and cattle, and logging were part of the impacts to the lands of the area. This level of activity continued until the early-1900s when recreational development provided new ways to use the landscape. New Mexico became a state in 1912 and people continued to migrate to the area. In the 1940s the political conditions of the world necessitated another change for the plateau and most of the previous activities no longer existed (e.g., homesteading, grazing). The Manhattan Project brought scientists and families to the area to be known as Los Alamos National Laboratory and Los Alamos County, and full-scale urbanization of the area took place.

Recreational Development. Development of the plateau for recreation purposes began in 1914. The beauty and solitude of the area attracted Ashley Pond and some Detroit executives who hoped to establish a recreational ranch, the Pajarito Club. Buildings of the old Phillips Mill in Pajarito Canyon were destroyed or converted into housing. Subsequent drying of the spring and the advent of World War I caused failure of the venture, and the site was again abandoned until Frank Bond used the buildings for a line camp.

The Brook Ranch, situated on Los Alamos Mesa, was purchased by Ashley Pond, who established the Los Alamos Ranch School in 1917. The school curriculum was designed to provide boys with training for outdoor life while they continued their academic studies in a healthy climate. Areas such as Camp May were established as pack

camps, and numerous trails were built for horseback riding. This school remained until 1942 when it was taken over for the Manhattan Project.

At the time the area was condemned for the Manhattan Project, 35 homesteads amounting to 3,600 acres were in private ownership. Since 1940, the population of the plateau has increased (Figure 5). Roads and urbanization have developed much of the land (Figures 6 and 7).

D. The 21st Century

The land use changes that will most profoundly affect the Jemez Mountains and Pajarito Plateau in the 21st century are urbanization and fire. In May 2000, a massive wildfire spread across the east Jemez Mountains burning over 40,000 acres in its path. Over 40% of the area was burned by intense crown fire, reducing portions of the ponderosa pine and mixed conifer to eventual shrub lands and aspen stands. Some of the historic landscape structures such as homestead cabins have been destroyed and some archaeological sites affected.

Activities related to restoration of the landscape, such as reseeding, thinning, and erosion control, have been undertaken by Los Alamos National Laboratory and the County of Los Alamos (BAER Team et al. 2000, Foxx 2001). Land exchanges and new programs at the Laboratory will provide opportunities for future land development (Vierra et al. 2002, Los Alamos National Laboratory 2002). Documentation of past use is essential.

Over the years I have compiled a chronology of dates for the Pajarito Plateau from various sources, including Scurlock (1998), Rothman (1992), various newspaper articles, and Laboratory publications. This compilation is not all inclusive, but is offered as a tool for future studies (Appendix VII A Chronology of Events on the Pajarito Plateau and Jemez Mountains).

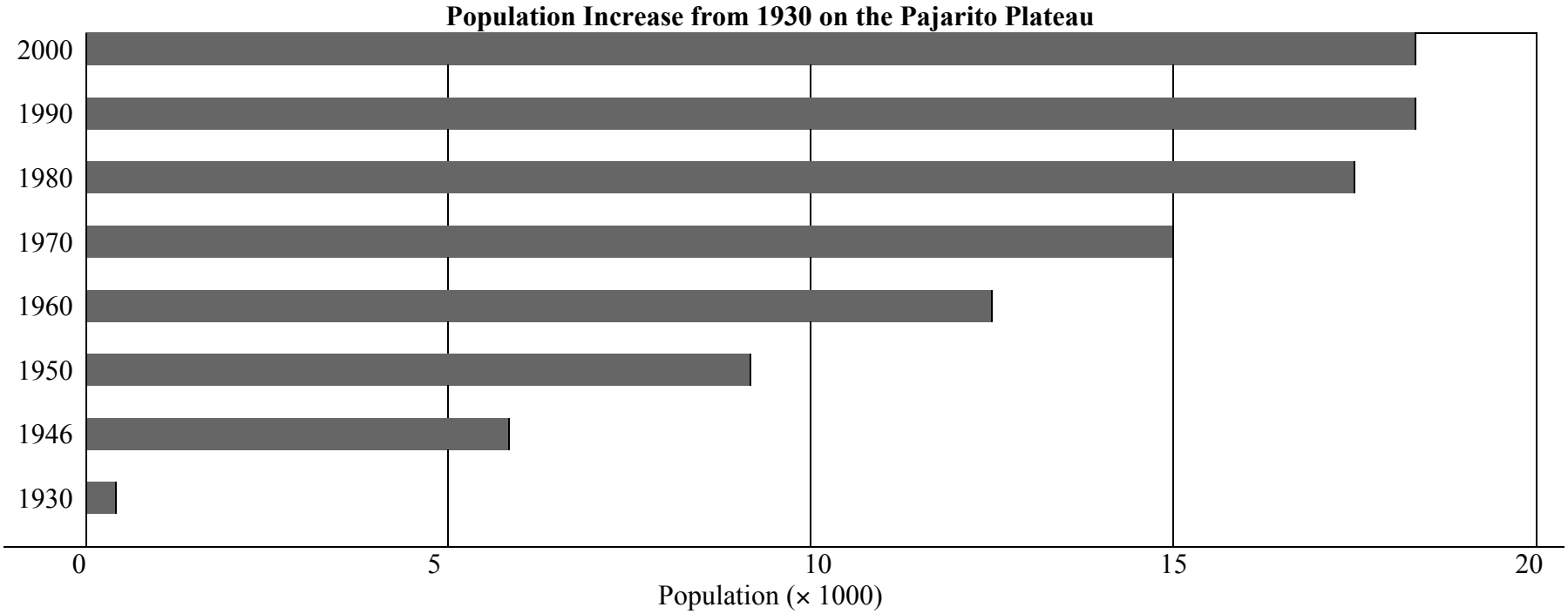


Figure 5. Population increase from 1930 on the Pajarito Plateau.

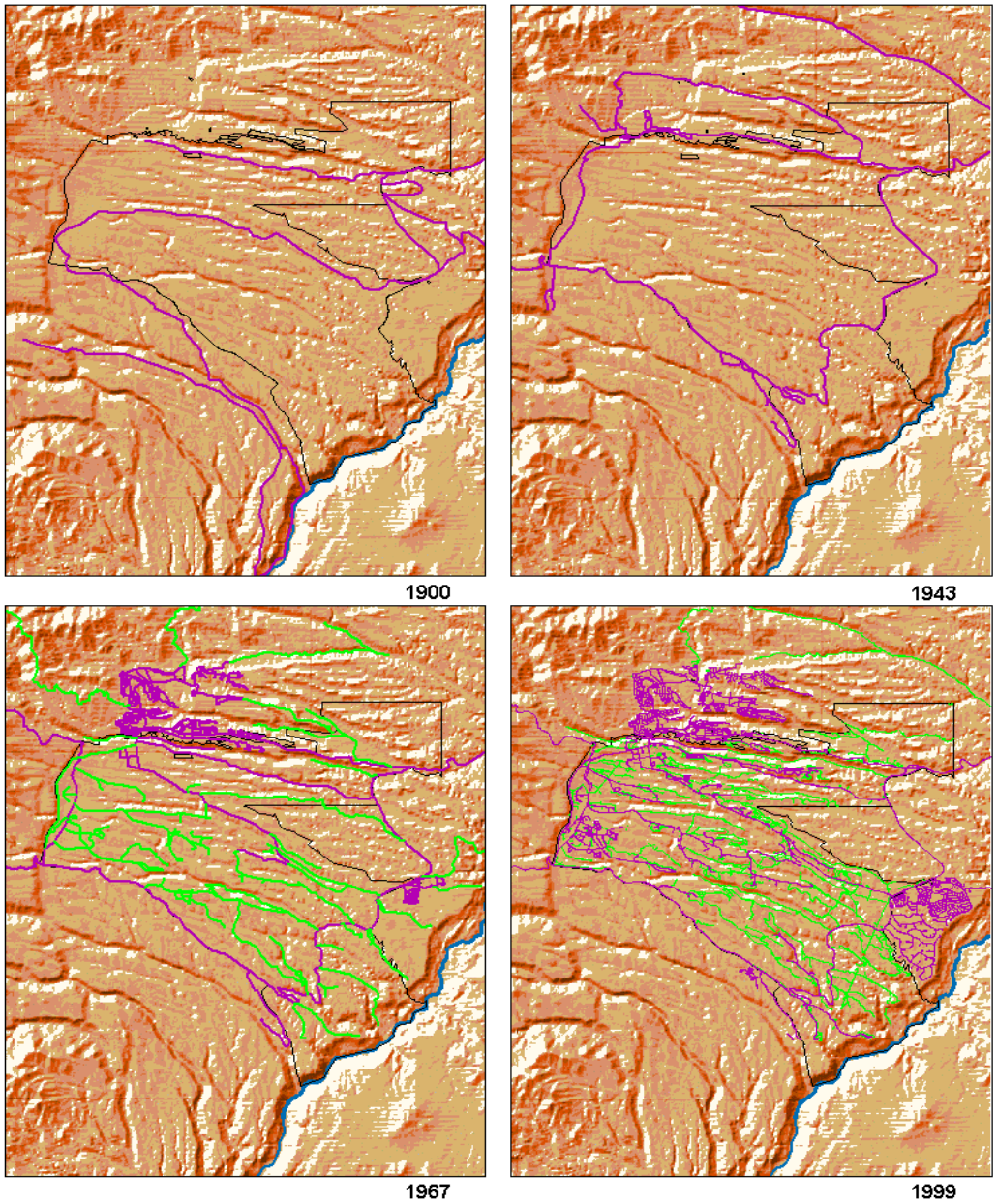


Figure 6. Road development on the Pajarito Plateau from 1900 to 1999.

On a map produced by Hewett in 1900, there was only one road to the Pajarito Plateau—the Buckman Road. That road went from the stop on the Chili Line at the Rio Grande called Buckman, along what is now State Route 4 near White Rock, and up Pajaritio Canyon to the mesa tops and the Buckman set or saw mill in the present S-Site. In the 1920s after the development of the Ranch School, the Totavi road provided new access to the tablelands and a more direct access to the Ranch School. By the 1940s, there were two major roads that reached the plateau, the Buckman Road being abandoned after the closing of the Chili Line. The road known as State Route 502 crossed the Rio Grande and met the road from Española. This unimproved road was 16 to 20 ft wide and very rough. During rains this road was closed to traffic. Curt Sewell, in his "Memories of Los Alamos" described the road to Los Alamos as follows: "This [road] quickly became steep and spectacular. Carved into the side of sheer cliffs, it twisted along, always climbing. On one side was the steep wall of the mesa and on the other, a drop-off as much as several feet before reaching the floor of the canyon." Early homesteaders called the road *Camino del la Culebra* (Snake road). Using a geographic information system, Craig Allen (1989) calculated the road density from the 1935 aerial maps using the following classification: primitive, dirt, improved, and paved. The illustrations here show the change from 1900 to 1999.

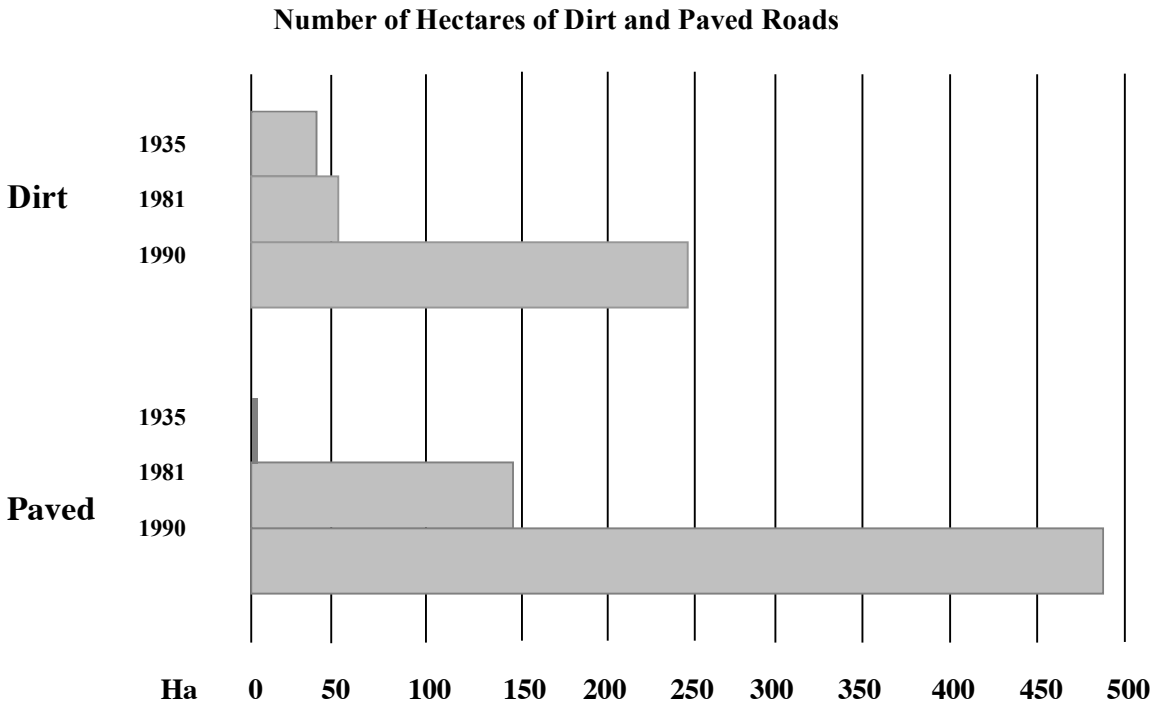


Figure 7. Number of hectares of dirt and paved roads from 1935 to 1990.

VI. ENVIRONMENTAL CONDITIONS AND PEOPLE OF THE PAJARITO PLATEAU

A. Water Resources

Water is one of the most important elements for permanent habitation. The Pajarito Plateau has both permanent and ephemeral streams and some springs. Few of the canyons of the Pajarito Plateau have perennial water. Large settlements are associated with canyons that have perennial water (Frijoles Canyon, Santa Clara Canyon) or springs (Pajarito Canyon). Pajarito Canyon has a perched aquifer where the water emerges to the surface. According to Hewitt these springs provided a water source for Tserige. Throughout the plateau, there are areas where inhabitants also used water collecting devices (Steen 1977).

In addition to the permanent and ephemeral streams on the plateau, there are 27 springs that discharge from formations in White Rock Canyon (Purtymun et al. 1980). These springs are habitats for various obligatory and facultative wetland species (Foxx and Tierney 1980), including a rare orchid: The giant helleborine (*Epipactis gigantea*).

Water resources and riparian zones are important habitats for many plants and animals. Various plant species were important to Pueblo and plains tribes and the Hispanic colonists. Wetland plants were indicators of water, some were used for food and medicine and others such as cattail provided building material (Table 6). Wetland and riparian areas attracted greater quantities of game. Analyses done comparing a dry canyon (Cañada del Buey) to a wet canyon (Pajarito Canyon) showed more species within the wet canyon ecosystem versus the dry canyon.

The upper and middle Rio Grande Valley has been profoundly influenced by human impacts on riparian ecosystems. The biggest impacts have been irrigation agriculture by the Spanish in the 17th century and building of railroads in the 19th and dam building in the 20th centuries by the Anglo-Americans. Cochiti Dam has changed water flow, including flood events, and water levels. Native riparian vegetation has been killed in the flood pool. Other impacts to riparian zones include introductions of plants and animals by the Euro-Americans throughout the last 450 years (Wozniak 1995). These introductions include tamarisk (*Tamarix* spp.) and Russian olive that replace the niche for the native cottonwoods (*Populus* spp.).

B. Climate

Los Alamos has a semiarid, temperate mountain climate. The 30-year mean precipitation for the plateau is 18.7 inches at higher elevations (Los Alamos) and 13.5 inches within the piñon-juniper zone (White Rock). The large-scale atmospheric flows transport moisture from the Gulf of Mexico (in summer monsoons) and from the Pacific Ocean (during winter, spring, and fall). Winter temperatures range from 15 to 25 degrees F at night and 30 to 50 degrees F during the day. Summer temperatures are in the 70s and 80s (Table 7; Bowen 1992). Information for the County of Los Alamos extends back to1910, Española to 1895, and Bandelier National Monument to 1924 (Scurlock 1998; Bowen 1992).

Growing Season. Both Pueblo and Hispanic people were dry-land farmers, good crops depended on the weather conditions. The prehistoric residents used various methods of enhancing water retention of the soil or harvesting water, including floodwater from arroyos or from high to low ground, gravel mulches, and terracing.

Table 6. Wetland Plants used by Pueblo Peoples and Hispanic Colonists

Scientific Name	Common Name	Occurrence	Spring	Summer	Habit	Wetland*
Acer glabrum	Rocky Mountain maple	locally common	x		tree	FACU, FAC
Acer negundo	boxelder maple	locally common	x		tree	FAC, FACW
Alnus tenufolia	alder	locally common	x		tree	FACW
Berula erecta	water parsnip	not common		x	perennial	OBW
Betula occidentalis	western water-birch	locally common		x	tree/shrub	FACW
Cyperus aristatus	flatsedge	locally abundant			Perennial	FACW
Equisetum laevigatum	smooth horsetail	locally common			Perennial	FAC, FACW
Forestiera neomexicana	New Mexico olive	common	x		shrub	FAC+
Iris missouriensis	Rocky Mountain iris	locally common	x		perennial	FACW, OBW
Juncus spp.	rush	locally common		x	perennial	FACW, OBW
Mentha arvensis						FACW
Mimulus glabratus	monkeyflower	not common	x		perennial	OBW
Phragmites communis	common reed	occasional			perennial	OBW
Plantago major						FACW
Populus angustifolia	narrowleaf cottonwood	locally common	x		tree	FACW
Populus fremontii	Fremont cottonwood	locally common	x		tree	FACW
Prunus virginiana	chokecherry	locally common	x		shrub	FAC
Rorippa sinuata	yellow cress	locally common	x		perennial	FACW
Rudbeckia lacinata	coneflower	locally common		x	perennial	FACW
Rumex crispus	wild buckwheat					FACW
Salix sp.	willow	locally common	x		shrub	FACW
Scripus sp.	bulrush				perennial	
Typha latifolia	broadleaf cattail	locally common	x		perennial	OBW
Urtica dioca-procera	nettle					FACW

*OBW = obligate wetland species. Occurs almost always (99%) in wetlands.
FACW = Usually occurs in wetlands (67% to 99% of time) but occasionally found in nonwetlands.
FAC = Equally likely to occur in wetlands or nonwetlands (34% to 66% of the time).

Early Hispanic homesteaders would plant crops and return to the mesas only to weed. They primarily depended on the climatic conditions to produce crops.

From historic data, we know that the growing season can range from 133 to 246 days (Bowen 1992). Bowen (1992) calculated the means and extremes of early- and late-season cold temperature occurrences from historical Los Alamos and White Rock temperature databases based on temperatures of 36 degrees F to 16 degrees F (Tables 8, 9, 10, 11). This information is taken at 4 to 5 feet above the ground and does not necessarily represent the ground microclimate temperature. Bowen notes that at 36 degrees F, low temperature can indicate a light frost because actual ground temperatures

may be 32 degrees F. A 32 degree F low temperature is defined as a freeze, and temperatures below 28 degrees F represent a hard freeze. Crops will differ in their susceptibility to damage. A light freeze may not affect fruit trees but will heavily damage plants on the ground. Another factor in the damage plants sustain is the atmospheric humidity. A moist atmosphere may cause ice and frost to form.

There is a difference in the growing season between White Rock and Los Alamos. White Rock has a growing season 12 to 14 days shorter. This is primarily because of the nighttime winds and flows over the mesas.

The climatic elements such as precipitation, drought, and temperature patterns (e.g., cold winters) have affected the development of the ecology of the plateau and associated human activity. Droughts have caused major movements and interactions of people within the Southwest (Scurlock 1998). Precipitation is important in the formation and maintenance of plant communities, availability of wild foods, and dynamics of wildlife. Patterns of drought affect the forest structure through fire, drought, and die-offs. Swetnam and Baisan (1994) compared fire-scar information and records of burned areas correlated with a Palmer Drought Severity Index. Their data showed an association between severe drought and large fire years and wet periods and small fire years. Droughts in the 1890s, 1950s, and late-1970s contributed to large fires on the Pajarito Plateau. Wet years in the early-1900s contributed to establishment of many ponderosa pine that stock many of the forests of the Pajarito Plateau. Swetnam and Baisan (1994) also found that large fire years in the ponderosa pine were typically preceded by wet conditions in the prior one to three years.

Allen and Breshears (1998, in press) have shown that there was an ecotonal shift between the ponderosa pine and piñon-juniper during the 1950s drought. This was a period of drought years that affected the Southwest, including northern New Mexico. The drought conditions intensified from 1951 through 1956 culminating in 1956 with the driest year of the 20th century. This drought induced vegetation mortality, particularly in the ponderosa pine.

Table 7. Monthly Mean Temperature and Precipitation and Median Precipitation at Los Alamos and White Rock*

Month	Maximum	Minimum	Average	Daily Range	Mean	Median
January	39.5 (41.7)	17.4 (14.6)	28.4 (28.1)	22.1 (27.1)	0.86 (0.57)	0.79 (0.67)
February	43.5 (46.5)	21.1 (19.5)	32.3 (33.0)	22.4 (27.0)	0.80 (0.58)	0.66 (0.48)
March	49.6 (54.9)	26.5 (26.4)	38.0 (40.6)	23.1 (28.5)	1.22 (0.87)	1.07 (0.72)
April	58.4 (63.1)	33.3 (33.1)	45.8 (48.1)	25.1 (30.0)	1.01 (0.68)	0.63 (0.44)
May	67.6 (72.0)	42.0 (41.3)	54.8 (56.6)	25.6 (30.7)	1.17 (0.97)	1.05 (0.96)
June	77.8 (82.7)	51.1 (50.6)	64.5 (66.7)	26.7 (32.1)	1.36 (1.0)	0.91 (0.82)
July	80.6 (85.6)	55.3 (55.9)	68.0 (70.7)	25.3 (29.7)	3.26 (2.23)	3.36 (2.05)
August	77.5 (82.5)	53.5 (54.0)	65.5 (68.3)	24.0 (28.5)	3.52 (2.37)	3.24 (2.21)
September	71.1 (76.0)	47.2 (46.5)	59.1 (61.2)	23.9 (29.5)	2.12 (1.52)	2.01 (1.55)
October	61.5 (65.5)	37.6 (35.2)	49.6 (50.3)	23.9 (30.3)	1.30 (1.13)	1.05 (0.60)
November	48.9 (52.7)	27.1 (24.6)	38.0 (38.7)	21.8 (28.1)	1.02 (0.77)	0.67 (0.56)
December	40.8 (43.0)	19.4 (16.1)	30.1 (29.6)	21.4 (26.9)	1.08 (0.81)	0.74 (0.59)
Average	**59.7 (63.9)**	**36.0 (34.8)**	**47.8 (49.3)**	**23.8 (29.0)**	**18.7 (13.50)**	**19.0 (13.52)**

*White Rock information is in parentheses. Table is from Bowen (1992). This is a summary from 1910 to 1991.

Table 8. Growing Season Data for Los Alamos (1961 to 1990)

	Means		
Temperature (°F)	Latest Spring Date	Earliest Fall Date	No. Days between Dates
36	May 21	October 02	133
32	May 7	October 11	156
28	April 29	October 19	172
24	April 14	November 2	201
20	March 30	November 16	220
16	March 18	November 20	246

From Bowen (1992); Means are based on the period of 1961 to 1990.

Table 9. Extremes in the Growing Season from 1919 to 1990 for Los Alamos

	Spring Date		Fall Date		No. of Days Between	
Temperature (° F)	Earliest	Latest	Earliest	Latest	Least	Most
36	4/26/37	6/11/75	9/03/61	10/31/63	91 (1941)	184 (1963)
32	4/19/56	6/11/75	9/09/41	11/02/51	110 (1941)	185 (1963
28	3/27/54	6/03/19	9/19/71	11/15/78	125 (1983)	220 (1967)
24	3/37/90	5/11/46	9/28/36	12/09/54	158 (1976)	256 (1954)
20	3/06/53	4/27/20	10/08/76	12/11/49	173 (1976)	265 (1954)
16	2/12/86	4/2/20	10/19/76	12/23/39	184 (1976)	291 (1939)

From Bowen (1992)

Table 10. Growing Season Data for White Rock (1961 to 1990)

	Means		
Temperature (° F)	Latest Spring Date	Earliest Fall Date	No. Days between Dates
36	May 22	September 26	124
32	May 11	October 7	148
28	April 30	October 17	169
24	April 14	October 27	195
20	April 3	November 8	218
16	March 16	November 15	243

From Bowen (1992)

Table 11: Extremes in the Growing Season from 1961 to 1990 for White Rock

	Spring Date		Fall Date		No. of Days Between	
Temperature (° F)	Earliest	Latest	Earliest	Latest	Least	Most
36	5/09/70	6/11/75	8/24/68	10/14/80	74 (1968)	148 (1981)
32	4/09/81	5/30/78	9/17/68	10/21/72	121 (1968)	190 (1981)
28	4/01/90	5/21/74	9/20/71	11/07/85	123 (1971)	217 (1990)
24	3/17/90	5/09/65	10/08/76	11/17/78	161 (1970)	240 (1978)
20	3/06/90	5/03/67	10/08/76	11/27/65	173 (1976)	266 (1990)
16	2/09/79	4/09/73	10/18/76	12/10/86	204 (1975)	301 (1986)

From Bowen (1992)

Tree ring records in Arizona and New Mexico indicate a drought in the 1600s that may have also resulted in the death of many conifers growing at lower altitudes (Allen and Breshears, in press). There is a similar pattern in the late-1200s that corresponds to a drought that caused the abandonment of the settlements of the four corners region (Swetnam and Betancourt 1998).

Researchers have found that droughts have been the single most significant "natural" climatic event adversely affecting historic human populations in the Southwest. Historic documentary data, as well as archeological evidence including tree ring data, show that periodic drought of varying magnitudes have impacted past human activity and other environmental components. At least 52 droughts lasting one year or more totaling 238 years occurred in the middle Rio Grande in 448 years. Mean occurrence is 8.6 years and mean length is 4.6 (Table 12). Hill and Trierweiler (1986) estimated the drought years based on tree ring analysis. They found there were a total of 272 years from 1150 to 1600 that were wet enough for dry-land farming and 178 years that did not have adequate precipitation for dry-land farming. Hill and Trierweiler (1986) indicate that only the third year or later in a sequential drought would be a year of food stress because of food stores. Table 13 indicates the years of food stress they have determined from a composite tree ring chronology.

Major climatic events of high and low precipitation can be determined by examining historic chronicles and correlating with tree ring data. From 1430 to the 1800s both drought and cold winters caused hardship for pueblos and Spanish alike.

There is an indication of the droughts of the 1500s (1525 and 1533-35) that probably precipitated the move from the mesa tops of the Pajarito Plateau just before the Spanish arrival. The winter of 1597-98 and the summer of 1598 were dry, followed by

another severe winter, both of which adversely affected the first Spanish colonists. Drought and interrelated famine and raids contributed to the Pueblo Revolt of August 1680.

Exceptionally cold and wet years also influenced the use of land. Nineteen twelve to 1914 was wet. During the early-1900s, the homesteaders indicated they harvested truckloads of beans (Foxx and Tierney 1984, 1999). Ashley Pond set his first venture in Pajarito Canyon where there was a spring. The following years the spring dried and precipitated his move to the mesa top location and the formation of the Los Alamos Ranch School (Foxx and Tierney 1984, 1999; Chambers 1974, 1999).

The winter of 1914-15 was severe in the Jemez Mountains area; sheep ranchers suffered heavy losses. Severe winter weather (1886-1887) destroyed cattle and sheep herds on the Pajarito Plateau and may have contributed to abandonment of the cattle venture by Frank Bond (Rothman 1992). Again in 1915 and 16, a heavy snowpack caused hardship for the cattle industry (Rothman 1992, Scurlock 1998).

C. Fire, an Element of Ecological Change

On the Pajarito Plateau and in the Jemez Mountains, fire is one of the most common natural forces that has shaped the ecology of the area. Although most recently, local fires have been human-caused, most fires of the west are lightning caused. Studies show that fire, primarily lightning caused, was a frequent occurrence before the turn of the 20th century. After the turn of the 20th century, changes resulting from human settlement caused suppression of fire and today many areas have not had fire in over 100 years (Foxx and Potter 1984, Foxx 2001; Figure 8). Studies indicate that the last major fire in the 19th century on the Pajarito Plateau was 1893. Through the ensuing years, without the cleansing of frequent low-intensity fire, forests of the plateau have become overgrown. In the last 23 years over 80,000 acres of forested landscape on the Pajarito Plateau and the east Jemez Mountains have been burned by fire. These high-intensity fires affect archaeological sites and drastically change the vegetation cover.

Table 12. Historic New Mexico Droughts, 1542 to 1989 (Scurlock 1998)

17th Century	18th Century	19th Century	20th Century	21st Century
1542	1700 to 1709 1709	1801 to 1803 1801, 1804 1801	1900 to 1904 1900	2000 to 2002 (2000)
1578 to 1580	1707	1805 to 1813 1806, 1814 1806	1907 to 1910 1907, 1908	
1598 to 1606	1714 to 1717 1715 to 1716	1817 to 1822 1822, 1819	1917 to 1918 1919	
1620 to 1623	1719 summer 1724 to 1725	1824 to 1825 1830, 1833	1920 to1925 1921, 1922	
1625 to 1633	1727	1829 to 1830	1927 to 1928 1927	
1635 to 1640	1729 to 1730 1729	1841 to 1843 1842, 1842	1932 late 1937 1937	
1651 to 1672	1734 to 1739	1845 to 1847 1847, 1847	1939 to 1940 1940	
1675 to 1680	1748 to 1759 1748, 1752, 1763, 1765	1849	1942 to 1948 1941, 1944	
1681 to 1680	1768	1851 to 1853 1851, 1861	1950 to 1956 (1954)	
1689 to 1699	1772 to 1774 1773	1873 to 1877 1870, 1878	1971 (1977)	
	1775 to 1785 1786	1877 to 1883 1879, 1883	1980	
	1787 to 1790	1886 to 1890	1989	
	1793; 1797; 1798	1892 Summer 1896 1893, 1896		
		1898 to 1900 1897	(1996, 1998)	

Explanation: This table represents the drought years outlined in Scurlock (1998). Year numbers in red represent fire scar years on tree ring samples collected by Foxx and Potter (1978, 1984). The year numbers in (green) represent recent large fires in the east Jemez Mountains and Pajarito Plateau that are not represented by tree ring sampling. Year numbers in blue represent the 20 largest fires listed from a regional fire time series developed by Swetnam and Baisan (1996).

Table 13. Years of Severe Food Stress on the Pajarito Plateau AD 1150 to 1600*
(Hill and Trierweiler 1986)

Early Coalition	Late Coalition	Early Classic	Middle Classic	Late Classic
1158	1252	1337	1417	1562
		1338	1418	1563
1188			1419	
1189		1342	1420	1581
				1582
1216		1364	1424	1583
1217				1584
1218		1377	1457	1585
1226			1461	
			1475	
			1524	
			1525	

* Each year listed is the third (or later) sequential year of drought, when food stores would have been exhausted.

Hunter-gatherer populations actively manipulated vegetation to increase production of useable resources (Pyrn 1982). Historically, there is no specific evidence that the native peoples of the upper Rio Grande deliberately set fires for the purposes of attracting game or foraging. There is evidence, however, that fire was used in the Southwest by certain Indian groups. The first Spaniard to enter the region, Cabeza de Vaca, recorded fire practices of the Indians in Texas. Pyne (1982) notes that Bernard DeVoto records that one of the first American columns into the Southwest during the Mexican War found that fire on the mountain was a Southwestern tradition. As their successors learned, it was a fire regime controlled equally by natural and cultural history.

The Apache used broadcast fire as did many tribes living within grasslands. They used smoke signals, burned to cover trails, and burned as an inducement for rain. W. A. Bell noted in 1870 that "*the Apaches also have a very destructive habit…of firing forests of their enemies*." Fire frequencies changed after the Apaches were subdued (Pyne 1982). The specific use of fire by Puebloan peoples has not been recorded. There is some indirect evidence of use of fire through ethnobotanical studies. Lemonadeberry *(Rhus trilobata*) has been used in historic Southwestern Indian basketry (Stevenson 1915). The branches however are not straight switches and thus ethnobotanists were puzzled by their use for basketry. However, ethnobotanist Vorsilla Bohrer observed the shrub in a burned area of the Navajo reservation regenerating with vigorous straight new shoots following

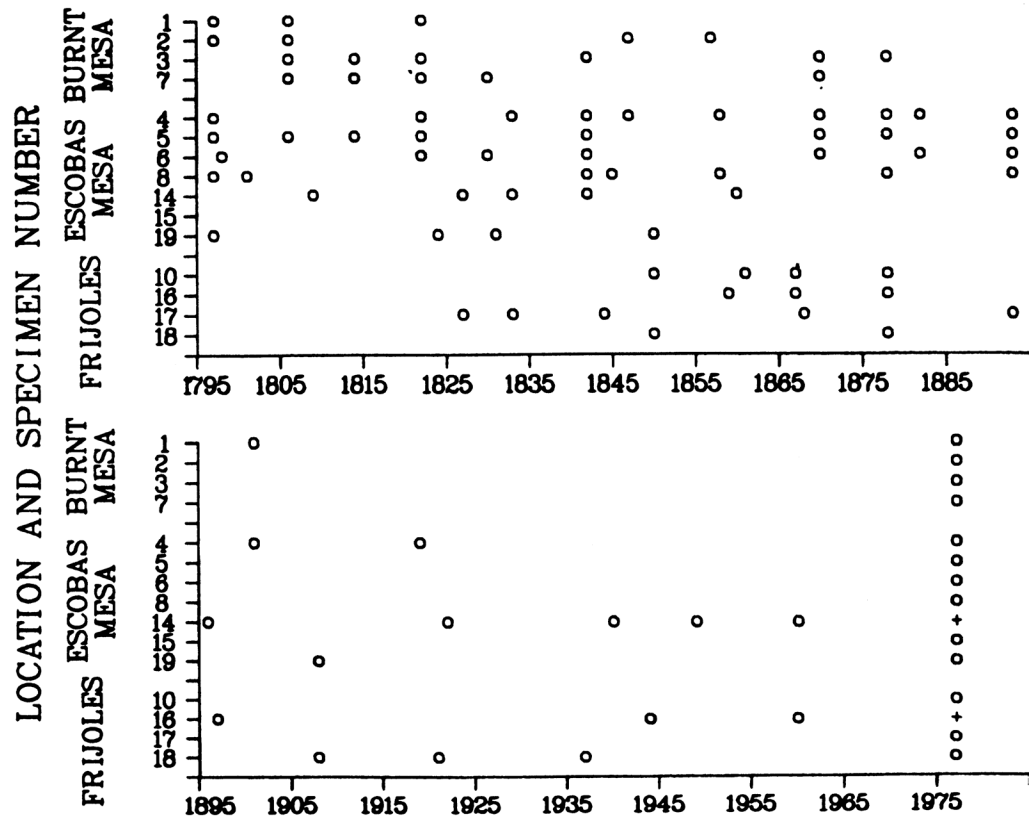


Figure 8. Comparison of frequency of wildfire before and after 1900 calculated from tree ring samples from Bandelier National Monument. In 1977, the La Mesa fire burned at all of these locations.

a fire. She states "*If ancient hunters were in the habit of burning vegetation to secure raw material for their offerings, they may have served themselves in another way. The burned patches of vegetation would foster increased abundance of game and annual plants like sunflower (Helianthus) and bugseed (Corisperumum)…*"

Although there is no evidence that peoples of the area specifically set fire for the purposes of hunting or gathering there is an attitude of understanding the rejuvenating aspects of fire mythology and ritual. At Zuni fire is used in the rabbit hunt; at Cochiti, Nambe, Zuni, and Isleta, fire has taken the form of fostering new life and growth. Bohrer (1983) says "*Although, our knowledge of formalized burning practices among Pueblo agriculturalists has been preserved erratically, an attitude toward fire as a fertile force still persists in ritual contexts*."

Indeed, fire has a regenerating effect. Nearly immediately after fire, shrubs sprout and plant species that have roots or underground stems regenerate quickly. Large game such as elk and deer are attracted to burned areas (personal observations recorded in website Trail Guides 2001, Foxx 2001, Foxx and Potter 1978, Whelan 1995).

From fire scar data, it is shown that small and regional fires are correlated with times of drought. In 1975–1977, Foxx and Potter collected 18 fire scarred ponderosa pine samples and calculated the fire frequency for samples dating from the early-1700s. Additionally, Swetnam and Baisan (1993) have extended fire scarred data for the New Mexico and Arizona region. From 1709 through 1900 all 20 of the large regional fires identified were in drought years (Tables 12 and 14).

Because of the regenerating nature of burned areas, Foxx and Potter (1978) speculated that fire could be a source of food items in subsistence cultures. For example, wild onion, known to be collected for food and medicine by most or all Pueblos (Dunmire and Tierney 1995), generally is found as a single plant throughout forested areas. However, after fire large patches can be found within the ponderosa pine zone (personal observation). Many shrubs are sprouters. That means, young straight shoots would be available (Table 15).

Hill and Trierweiler (1993) discuss food stress and drought (Table 13). Although fire scar data for the most part is only from trees that were 350 years old (Allen et al. 2000), extrapolating from available information, it is conceivable that burned areas may have been a source of some species when food stores were dwindling because of drought. Vierra and Foxx (2001) compared the listing of plants used for food, medicine, and other uses with information gained through succession studies after fire. From fire ecology studies we know that before 1900 there were frequent small fires within the ponderosa pine zone (Foxx and Potter 1979; Table 15). We also know from observations and studies (White 1982) that these burned areas attract large game animals like elk and deer and small game animals such as turkey (personal observation) because of new and nutrient-rich forage. Although it presently cannot be proven, there is evidence of the usefulness burned areas might have been to subsistence peoples.

Table 14. Cross-section from a Representative Tree on Escobas Mesa Sampled after the La Mesa Fire (Dates courtesy of Craig Allen)

Date	Drought Year	One of 20 Highest Fire Years
1637 Center	Yes	
1725	No	Yes
1737	Yes	
1748	Yes	Yes
1757	No	
1763	No	Yes
1773	Yes	Yes
1797 (6)	Yes	
1801 (1)	Yes	Yes
1806 (5)	Yes	Yes
1814 (3)	Year after drought	
1833 (3)	No	
1842 (6)	Yes	Yes
1851	Yes	Yes
1858 (4)	No	
1878 (7)	Yes	
1893 (5)	Yes	
1965	No	
1977	Very early fire season	1977 La Mesa

Explanation: Information is from one tree with fire scars from 1725 through 1977. Numbers in parenthesis () represent the number out of the other 18 fire scar trees sampled by Foxx and Potter (1978) and summarized in Foxx (1984). Column 2 represents those years that correspond to drought years on Table 12. Column 3 represents those years determined by Swetnam and Baisan (1993) to be the largest regional fires in New Mexico and Arizona.

Table 15. Early Succession Plants in Burned Areas that may have been Plant Resources for Early Peoples

			Primary Plant Community*				
Scientific Name	Common Name	Habitat	MC	PIPO	PJ	JS	Uses
Forbs							
Achillea lanulosa	yarrow	perennial	x	x			medicinal
Allium cernuum	wild onion	perennial	x	x			food/medicine
Amaranthus graezans	prostrate pigweed	annual		x	x		food
Chenopodium album	goosefoot	annual		x	x	x	food
Chenopodium leptophyllum	goosefoot	annual		x	x		food
Euphorbia spp.	thymeleaf spurge	annual			x	x	medicine
Physalis foetens	NM groundcherry	annual		x	x		food
Physalis hederaefolia	goundcherry	perennial		x	x		food
Thelesperma spp.	cota, Indian tea	annual			x	x	food/medicine
Sprouting Shrubs							
Amelanchier sp.	serviceberry	shrub	x				food
Archtostaphylos uva-ursi	bearberry	low shrub	x	x			smoking
Berberis fendleri	Colorado barberry	shrub	x	x	x		food
Berberis repens	Oregon grape	low shrub	x	x			food, coloring
Ceanothus fendleri	buckbrush	shrub		x			food
Quercus gambelii	Gambel oak	shrub					food, medicine, implements
Ribes cernuum	wild currant	shrub		x	x		food
Ribes inebrians	wild currant	shrub	x	x			food
Ribes inerme	gooseberry	shrub	x	x			food
Robinia neomexicana	New Mexico locust	shrub	x	x	x		food, implements
Rosa woodsii	wild rose	shrub	x	x	x		medicine
Rubus strigosus	raspberry	shrub	x				food
Rhus trilobata	lemonadeberry	shrub		x	x	x	food, medicine, smoking, coloring, implements
Prunus virginiana	chokecherry	shrub	x				food, medicine
Salix spp.	willow	shrub					medicine, construction, coloring
Yucca baccata	banana yucca	perennial		x	x		food, medicine, coloring, cordage, implements
Yucca glauca	narrowleaf yucca	perennial			x	x	food, medicine, coloring, cordage, implements
Sprouting Trees							
Acer glabrum	Rocky Mountain maple	tree/shrub	x	x			implements
Populus tremuloides	aspen	tree	x				medicine, construction, coloring
*MC = Mixed Conifer, PIPO = Ponderosa Pine, PJ = Piñon-juniper, JS = Juniper Savannah							
Uses from Dunmire and Tierney (1995); Fire species from Foxx and Potter (1978), Foxx (1996); Personal observations in La Mesa, Dome, Oso, and Cerro Grande fires							

REFERENCES

Abert, J. W. *Abert's New Mexico Report,* Horn and Wallace Publishers, Albuquerque, NM (1962).

Adams, E. B., and A. Chavez *The Missions of New Mexico: A Description by Fray Francisco Atanasio Dominguez with other Contemporary Documents,* University of New Mexico Press, Albuquerque, NM (1956).

Agricultural Research Service of the United States Department of Agriculture, *Common Weeds of the United States*, Dover Publications (1971).

Albright 1994 (App VII)

Allen, C. D. "Montane Grasslands in the Landscape of the Jemez Mountains, New Mexico," M. S. Thesis, University of Wisconsin (1984).

Allen, C. D. "Changes in the Landscape of the Jemez Mountains, New Mexico," Dissertation, University of California at Berkeley (1989).

Allen, C. D. "Elk Response to the La Mesa Fire and Current Status in the Jemez Mountains," in: *Fire Effects in Southwestern Forests, Proceedings of the Second La Mesa Fire Symposium*, Rocky Mountain Forest and Range Experiment Station, US Forest Service general technical report RM-GTR-286 (1996).

Allen, C. D. "Ecological Patterns and Environmental Change in the Bandelier Landscape," Chapter 2 in: T. A. Kohler (editor) *Village Formation on the Pajarito Plateau, New Mexico: Archeology of Bandelier National Monument*, University of New Mexico Press, Albuquerque, NM (in review).

Allen, C. D. and D. D. Breshears "Drought, Tree Mortality, and Landscape Change in the Southwestern United States: Historical Dynamics, Plant-Water Relations, and Global Change Applications," in: *The 1950s Drought in the American Southwest: Hydrological, Ecological, and Socioeconomic Impacts*, J. L. Betancourt and H. F. Diaz (editors), University of Arizona Press (in press).

Allen, C. D. and D. D. Breshears "Drought-induced Shift of a Forest-Woodland Ecotone: Rapid Landscape Response to Climate Variation, in: *Proceedings National Academy of Sciences*, Vol. 95 (1998).

Allen, C. D., M. Savage, D. A. Falk, K. F. Suckling, T. W. Swetnam, T. Schulke, P. B. Stacey, P. Morgan, M. Hoffman, and J. T. Klingel, "Ecological Restoration of Southwestern Ponderosa Pine Ecosystems: A Broad Perspective," *Ecological Applications,* In Press.

Allen et al. 2000 (p. 38)

Arnon, N. S., and W. W. Hill "Santa Clara Pueblo," in *Handbook of North American Indians: Southwest,* Volume 9, Alfonso Ortiz (editor), pp 296-307, Smithsonian Institution, Washington, DC (1979).

Ayer, Mrs. E. E. (translator) *The Memorial of Fray Alonso de Benavidez, 1630,* Horn and Wallace Publishers, Albuquerque, NM (1965).

BAER Team, Bureau of Indian Affairs, Department of Energy, City and County of Los Alamos, National Park Service, and US Forest Service, Cerro Grande Fire, Burned Area Emergency Rehabilitation (BAER) Plan Los Alamos, New Mexico, June 9, 2000 (2000).

Bailey, V. *Mammals of the Southwestern United States,* North American Fauna, No. 53, Bureau of Biological Survey, Department of Agriculture, Washington DC. Reprinted by Dover Publications, New York (1971).

Baker R. D., R. S. Maxwell, V. H. Treat, and H. C. Dethloff *Timeless Heritage: A History of the Forest Service,* US Forest Service, Department of Agriculture, Washington, DC (1988).

Balice, R. G., S. G. Ferran, and T. S. Foxx, "Preliminary Vegetation and Land Cover Classification for the Los Alamos Region," Los Alamos National Laboratory report LA-UR-97-4627 (1997).

Bandelier, A. F. *The Valley of the Rio Grande between the Rito de los Frijoles and the Mouth of the Jemez River. Investigations among the Indians of the Southwestern United States Carried on Mainly in the Years from 1880 to 1885, Part 2,* Peabody Museum of American Archaeology and Ethnology, Harvard University Press, Cambridge, MA (1892).

Barker, E. S. *Beatty's Cabin: Adventures in the High Country,* University of New Mexico Press, Albuquerque (1953).

Barker, E. S. *Western Life and Adventures 1889-1970,* Clavin Horn Publisher, Albuquerque, NM (1970).

Barker, E. S. *Ramblings in the Field of Conservation,* Sunstone Press, Santa Fe, NM (1976).

Barnes, W. C. "Stories of the Range," in *Public Lands and Surveys Committee, Senate Hearings before a Subcommittee,* 69th US Senate, 1st Session, 2, pp 1579-1640, Washington DC (1926).

Barnes, F. J. "Habitat Typing in Pinon-Juniper Woodland of the Pajarito Plateau," Final report, National Park Service, Southwest Region (1983).

Bennett, L. E. "Colorado Gray Wolf Recovery: A Biological Feasibility Study, Final Report," US Fish and Wildlife Service, Lakewood, CO (1994).

Biggs, J., K. Bennett, and M. Martinez, "A Checklist of Mammals Found at Los Alamos National Laboratory and Surrounding Areas," Los Alamos National Laboratory report LA-UR-97-4786 (1997).

Biggs, J. R., K. D. Bennett, and P. R. Fresquez, "Resource Use, Activity Patterns, and Disease Analysis of Rocky Mountain Elk (*Cervus elaphus nelsoni*) at the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-13536-MS (1999).

Bohrer, V. L. "New Life from Ashes: The Tale of the Burnt Bush (*Rhus trilobata*)," *Desert Plants* (1983).

Bolton, H. E. (editor) *Spanish Exploration in the Southwest, 1542-1706,* Barnes and Noble, New York (1946).

Bowen, B. M. "Los Alamos Climatology Summary," Los Alamos National Laboratory report LA-12232-MS (1992).

Brown, D. E. *The Wolf in the Southwest: The Making of an Endangered Species,* The University of Arizona Press, Tucson (1983).

Brown, D. E. *The Grizzly in the Southwest: Documentary of an Extinction,* University of Oklahoma Press, Norman (1985).

Burbank, J. C. *Vanishing Lobo: The Mexican Wolf and the Southwest,* Johnson Books, Boulder, CO (1990).

Carlson, A. W. "New Mexico's Sheep Industry, 1850-1900: Its Role in the History of the Territory," *New Mexico Historical Review XLIV* (1969).

Castetter, E. "Uncultivated Native Plants Used as Sources for Food," *Ethnobiological Studies in the American Southwest, No. 1*, University of New Mexico, Albuquerque, NM (1935).

Castetter, E. and M. E. Opler, "Plants Used by the Mescalero and Chiricauhua Apache for Food, Drink, and Narcotics," in: *The Ethnobiology of the Chiricauhua and Mescalero Apache*, University of New Mexico Press, Albuquerque, NM (1936).

Chambers, M. B. "The Battle for Civil Rights or How Los Alamos Became a County," Monograph 3, Los Alamos Historical Society, Los Alamos, NM (1999).

Chambers, M. B. "Technically Sweet Los Alamos, Development of a Federally Sponsored Scientific Community," Unpublished Ph.D. Thesis, University of New Mexico, Albuquerque, NM (1974).

Chambers, M. B. and L. K. Aldrich, "Los Alamos New Mexico, A Survey to 1949," *Monograph 1*, Los Alamos Historical Society, Los Alamos, NM (1999).

Church, F., and P. P. Church *When Los Alamos was a Ranch School,* Los Alamos Historical Society, Los Alamos, NM (1974).

Clark, I. G. *Water in New Mexico: A History of its Management and Use,* University of New Mexico Press, Albuquerque, NM (1987).

Clary, D. A. *Timber and the Forest Service,* University Press of Kansas, Lawrence (1986).

Clements, F. E. *Plant Succession and Indicators,* HW Wilson Company, New York (1928).

Conner, S. V., and J. M. Skaggs *Broadcloth and Britches: The Santa Fe Trade,* Texas A&M University, College Station (1977).

Cook, S. L. "Ethnobotany of the Jemez," Unpublished MA Thesis, University of New Mexico, Albuquerque, NM (1930).

Cooper, C. F. "Changes in Vegetation, Structure, and Growth of Southeastern Pine Forests Since White Settlement*," Ecological Monographs* 30:129–164 (1960).

Coues, E. (editor) *The Expeditions of Zebulon Montgomery Pike,* 2 volumes, Dover Publications, New York (1987).

Crockett, L. J. *Wildly Successful Plants, Handbook of North American Weeds*, Collier Books, New York (1977).

Curtin, L. S. M. *Healing Herbs of the Upper Rio Grand*e, Southwest Museum, Los Angeles, CA (1965).

de Buys, W. *Enchantment and Exploitation: The Life and Hard Times of a New Mexico Mountain Range,* University of New Mexico Press, Albuquerque, NM (1985).

Dick-Peddie, W. A. *New Mexico Vegetation, Past, Present, and Future*. University of New Mexico Press, Albuquerque, NM (1993).

Dickerman, C. "Mid-Nineteenth-Century Botanical Exploration in New Mexico, *New Mexico Historical Review* 60(2):159–171 (1985).

Dorman, R. L. *The Chili Line and Santa Fe the City Different*, R. D. Publications, Inc. Santa Fe, NM (1996).

Dunlap 1984 (App VII)

Dunmire, W. W. and G. D. Tierney, *Wild Plants of the Pueblo Province, Exploring Ancient and Enduring Uses*, Museum of New Mexico Press, Santa Fe, NM (1995).

Ellis, F. H. "The Long Lost City of San Gabriel del Yangue, Second Oldest European Settlement in the United States," in *When Cultures Meet: Remembering San Gabriel del Yangue Owseenge: Papers from the October 20, 1984, Conference held at San Juan Pueblo, New Mexico,* pp 10-38, Sunstone Press, Santa Fe, NM (1987).

Elmore, F. H. "Ethnobotany of the Navajo," *The University of New Mexico Bulletin with the School of American Research, Monograph Series* 1(7) (1943).

Espinosa, G. "First White Visitors to New Mexico found Area a Sportsmen's Paradise," *New Mexico Magazine* 14(7):34, 38 (1936).

Ensign, E. T. "Report on the Forest Conditions of the Rocky Mountains, *US Department of Agriculture Forestry Division Bulletin* No. 2, Washington, DC (1888).

Environmental Journal 9/1976

Findley, J. *The Natural History of New Mexico Mammal*s, University of New Mexico Press, Albuquerque, NM (1987).

Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones *Mammals of New Mexico,* University of New Mexico Press, Albuquerque, NM (1975).

Findley, J., A. H. Harris, D. E. Wilson, and C. Jones, *Mammals of New Mexico*, University of New Mexico Press, Albuquerque, NM (1987).

Flores, D. "An Introduction to the Environmental History of Northern New Mexico," in *A Southwestern Mosaic: Proceedings of the Southwestern Region, New Perspectives University Colloquium,* USDA Forest Service General Technical Report RM 216, Fort Collins, CO (1992).

Ford, R. I. "Floral Remains," in: *The Cochiti Dam Archaeological Salvage Project, Part 1: Report on the 1963 Season*, C. H. Lang (editor), Museum of New Mexico Research Records No. 6, University of New Mexico, Albuquerque, NM (1968).

Foxx, T. S. "Out of the Ashes, A Story of Natural Recovery," Los Alamos National Laboratory publication LALP-01-02 (2001).

Foxx, T. S. "Vegetation Succession after the La Mesa Fire at Bandelier National Monument," in: *Fire Effects in the Southwestern Forests, Proceedings of the Second La Mesa Fire Symposium, Los Alamos, New Mexico*, USDA Forest Service general technical report RM-GTR-286 (1996).

Foxx, T. S. “Nature of the Study Area,” in: *Bandelier Excavations in the Flood Pool of Cochiti Lake, New Mexico*, Lyndi Hubbell and Diane Traylor (editors), Submitted by National Park Service, Southwest Cultural Resources Center, to Interagency Archaeological Services Division, National Park Service, Denver, CO (1982).

Foxx, T. S. “Vegetation Study,” in: *Bandelier Excavations in the Flood Pool of Cochiti Lake, New Mexico*, Lyndi Hubbell and Diane Traylor (editors), Submitted by National Park Service, Southwest Cultural Resources Center, to Interagency Archaeological Services Division, National Park Service, Denver, CO (1982).

Foxx, T. S. “Vegetation Analysis,” in: *Bandelier Excavations in the Flood Pool of Cochiti Lake, New Mexico*, Lyndi Hubbell and Diane Traylor (editors), Submitted by National Park Service, Southwest Cultural Resources Center, to Interagency Archaeological Services Division, National Park Service, Denver, CO (1982).

Foxx, T. S. and B. Blea-Edeskuty, “Wildlife Use of NPDES Outfalls at Los Alamos National Laboratory,” Los Alamos National Laboratory report LA-13009 (1995).

Foxx, T. S., T. K. Haarmann, and D. C. Keller, “Amphibians and Reptiles of Los Alamos County, New Mexico,” Los Alamos National Laboratory report LA-13626-MS (1999).

Foxx, T. S. and D. Hoard, *Flowering Plants of the Southwestern Woodlands, Including Bandelier National Monument*, Otowi Crossing Press, Los Alamos, NM (1995).

Foxx, T. S., L. Pierce, G. D. Tierney, and L. A. Hansen, “Annotated Checklist and Database for Vascular Plants of the Jemez Mountains,” Los Alamos National Laboratory report LA-13408 (1998).

Foxx, T. S. and L. D. Potter, “Fire Ecology at Bandelier National Monument” in: *La Mesa Fire Symposium, Los Alamos, New Mexico*, October 6 and 7, 1981. Compiled by Teralene Foxx, Los Alamos National Laboratory report LA-9236-NERP (1984).

Foxx, T. S. and L. D. Potter “Fire Ecology at Bandelier National Monument,” Final Report, Biology Department, University of New Mexico, Albuquerque, NM (1978).

Foxx, T. S. and G. D. Tierney “Historical Botany of the Romero Cabin: A Family Homestead on the Pajarito Plateau,” Los Alamos National Laboratory report LA-13644-H (1999).

Foxx, T. S., G. D. Tierney, M. Mullen, and M. Salisbury, “Old-Field Plant Succession on the Pajarito Plateau,” Los Alamos National Laboratory report LA-13350 (1997).

Foxx, T. S. and G. D. Tierney, “Status of the Flora of the Los Alamos National Environmental Research Park, Vol. I,” Los Alamos Scientific Laboratory report LA-8050-NERP (1980).

Foxx, T. S. and G. D. Tierney "Status of the Flora of the Los Alamos National Environmental Research Park, A Historical Perspective, Vol. II," Los Alamos National Laboratory report LA-8050-NERP (1984).

Foxx, T., G. Tierney, M. Mullen, and M. Salisbury, "Old-Field Plant Succession on the Pajarito Plateau," Los Alamos National Laboratory report LA-13350 (1997).

Foxx and Vierra 2002 (p. 10)

Freehling, M. D. *Riparian Woodlands in the Middle Rio Grande Valley, New Mexico: A Study of Bird Populations and Vegetation with Special Reference to Russian Olive (*Elaeagnus angustifolia*),* US Fish and Wildlife Service, Albuquerque, NM (1982).

Frome, M. *Whose Woods these Are: The Story of the National Forests,* Doubleday and Company, Garden City, NY (1962).

Gjevre, J. A. *Chili Line: The Narrow Rail Trail to Santa Fe,* Rio Grande Sun Press, Española, NM (1969).

Gjevre, J. A. *Chili Line, the Narrow Trail to Santa Fe*, Rio Grande Sun Press, Española, NM (1971).

Gregg, J. *Commerce of the Prairies,* 2 volumes, Readex Microprint Corporation, New Canaan, CT (1966).

Gregg 1977 (App VII)

Grubbs, F. H. "Frank Bond: Gentleman Sheepherder of Northern New Mexico, 1883-1915," MA Thesis, University of New Mexico, Albuquerque, NM (1958).

Guthrie, D. "Fauna of the Lower Canyons," in: *Bandelier Excavations in the Flood Pool of Cochiti Lake, New Mexico*, Lyndi Hubbell and Diane Traylor (editors), Submitted by National Park Service, Southwest Cultural Resources Center, to Interagency Archaeological Services Division, National Park Service, Denver, CO (1982).

Guthrie, D. "Faunal Remains," in: *Bandelier Excavations in the Flood Pool of Cochiti Lake, New Mexico*, Lyndi Hubbell and Diane Traylor (editors), Submitted by National Park Service, Southwest Cultural Resources Center, to Interagency Archaeological Services Division, National Park Service, Denver, CO (1982).

Gutierrez, R. A. *When Jesus Came the Corn Mothers Went Away: Marriage, Sexuality, and Power in New Mexico, 1500-1846,* Stanford University Press, Palo Alto, CA (1991).

Hafen, L. R. (editor) *Ruxton of the Rockies,* University of Oklahoma Press, Norman (1950).

Hafen, L. R., and A. W. Hafen *Old Spanish Trail: Sante Fe to Los Angeles,* University of Nebraska Press, Lincoln (1993).

Hammond, G. P., and A. Rey (editors and translators) "Don Juan de Oñate, Colonizer of New Mexico," *Coronado Cuarto-Centennial Publications,* Volumes 5 and 6 (1953).

Hammond, G. P., and A. Rey (editors) *The Rediscovery of New Mexico, 1580-1594: The Explorations of Chamuscado, Espejo, Castaño de Sosa, Morlete, and Leyva de Bonilla and Humana,* University of New Mexico Press, Albuquerque (1966).

Hawkins, D., "Manhattan District History, Project Y, The Los Alamos Project, Inception Until 1945," Los Alamos Scientific Laboratory report LA-2532-MS (1945).

Hedke, C. R. "A Report on the Irrigation Development and Water Supply of the Middle Rio Grande Valley, N.M., as it Relates to the Rio Grande Compact," The Rio Grande Valley Survey Commission, State Engineer's Office, Santa Fe, NM (1925).

Henderson, J. and J. P. Harrington, "Ethnozoology of the Tewa Indians," Bureau of American Ethnology Bulletin 56, Smithsonian Institution, Washington, DC (1914).

Hewett, E. L. "Antiquities of the Jemez Plateau, New Mexico," Bureau of American Ethnology Bulletin 32, Smithsonian Institution, Government Printing Office, Washington DC (1906).

Hewett, E. L., and B. P. Dutton (editors) *The Pueblo Indian World: Studies on the Natural History of the Rio Grande Valley in Relation to Pueblo Indian Culture,* University of New Mexico and School of American Research, Albuquerque, NM (1945).

Hewett E. L., J. Henderson, and W. W. Robbins "The Physiography of the Rio Grande Valley, New Mexico, in Relation to Pueblo Culture," *Bureau of American Ethnology Bulletin* 54, Smithsonian Institution, Washington DC (1913).

Hill, J. N. and W. N. Trierweiler, "Prehistoric Response to Food Stress on the Pajarito Plateau, New Mexico: Technical Report and Results of the Pajarito Archaeological Research Project, 1977–1985," Submitted to the National Science Foundation in partial fulfillment of grant BNS-78-08118 (1986).

Hitchcock, A. S. "Manual of Grasses of the United States," USDA Miscellaneous Publication 200, Washington DC (1935).

Hodge F. W., G. P. Hammond, and A. Rey (editors) *Fray Alonzo de Benavides revised Memorial of 1634,* University of New Mexico Press, Albuquerque (1945).

Holecheck, J. L. "Crested Wheatgrass," *Rangelands* 3(4) (1981).

Housley, L. K. "*Opuntia imbricata*, Distribution on Old Jemez Habitation Sites," M. S. Thesis, Claremont College, Claremont, CA (1974)

Hume, E. E. *Ornithologists of the United States Army Medical Corps: Thirty-Six Biographies,* Johns Hopkins Press, Baltimore, MD (1942).

Jacobs 1989 (p. 3)

Jones, V. H. "Ethnobotany of the Isleta Indians," Unpublished MA thesis, University of New Mexico, Albuquerque, NM (1931).

Kessell et al. 1995 (App VII)

Koch, S. W., T. K. Budge, S. G. Ferran, L. F. Sandoval, M. A. Mullen, and K. D. Bennett, "Los Alamos National Laboratory Land Cover Map," Los Alamos National Laboratory report LA-UR-96-3362 (1996).

Koehler, D. A. "The Ecological Impact of Feral Burros on Bandelier," Unpublished report on file at Bandelier National Monument, New Mexico (1974).

Kohler 1990 (p. 15)

Komarek, E. V., Jr. "Fire and Man in the Southwest," *Proceedings of Symposium on Fire Ecology and the Control and Use of fire in Wild Land Management, Arizona Academy of Science* (1969).

Kuykendahl, B. "The Decline of the Rio Grande Cutthroat, Part I," *The Rio Grande Riverkeeper* (spring/summer):2-3 (1994).

Lang, R. W. "Artifacts of Woody Materials from Arroyo Hondo Pueblo," in: *Food, Diet, and Population at Prehistoric Arroyo Hondo, New Mexico*, Wilma Wetterstrom (editor), School of American Research Press, Santa Fe, NM (1986).

Lange, C. H., and C. L. Riley (editors and annotators) *The southwestern Journals of Adolph F. Bandelier, 1880-1882,* University of New Mexico Press, Albuquerque (1966).

Larson, R. W. *New Mexico's Quest for Statehood, 1846-1912,* University of New Mexico Press, Albuquerque (1968).

Lavender 1987 (App VII)

Lee, R. D. "New Mexico's Invasive Weeds," College of Agriculture and Home Economics Cooperative Extension Service (1999).

Ligon, J. S. “Wildlife of New Mexico: Its Conservation and Management. Being a Report on the Game Survey of the State 1926 and 1927,” Department of Game and Fish, State Game Commission, Santa Fe, NM (1927).

Ligon, J. S. *New Mexico Birds and Where to Find Them,* University of New Mexico Press, Albuquerque (1961).

Loftin, S. “Trial by Fire: Restoration of Middle Rio Grande Upland Ecosystems,” in: *Proceeding of the Rio Grande Ecosystems: Linking Land, Water, and People, Toward a Sustainable Future for the Middle Rio Grande Basin*, Rocky Mountain Research Station, Proceedings RMRS-P-7 (1999).

Los Alamos National Laboratory, “Wildfire Hazard Reduction Project Plan,” Los Alamos National Laboratory report LA-UR-02-2017 (2002).

Los Alamos National Laboratory, “Threatened and Endangered Species Habitat Management Plan, Overview,” Los Alamos National Laboratory publication LALP-98-112 (1998).

Lummis, C. F. *Pueblo Indian Folk-Stories*, University of Nebraska Press, Lincoln, NE (1992).

Martin, W. C. and C. H. Hutchins, *A Flora of New Mexico*, J. Cramer, Germany (1980).

Matthews, M. “Macrobotanical Analysis,” in: *Bandelier Archaeological Excavation Project: Summer 1990 Excavations at Burnt Mesa Pueblo and Casa del Rito*, T. A. Kohler and M. J. Root (editors), Washington State University, Department of Anthropology Reports on Investigations 64 (1992).

Matthews, M. “Macrobotanical Analysis” in: *Bandelier Archaeological Excavation Project: Summer 1990 Excavations at Burnt Mesa Pueblo and Casa del Rito*, T. A. Kohler and M. J. Root (editors), Washington State University, Department of Anthropology Reports on Investigations 64 (1990).

Matthiessen 1964 (App VII)

McDonald, C. *Wilderness: A New Mexico Legacy,* Sunstone Press, Santa Fe, NM (1985).

McNitt, F. *Navaho Expedition: Journal of a Military Reconnaissance from Santa Fe, New Mexico, to the Navaho Country Made in 1849 by Lieutenant James H. Simpson,* University of Oklahoma Press, Norman (1964).

Moir, W. H. and J. A. Ludwig, “A Classification of Spruce-fir and Mixed Conifer Habitat Types of Arizona and New Mexico,” USDA Forest Service research paper RM-207, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO (1979).

Muldoon, D. D. “Trappers and the Trail: The Santa Fe Trail from the Trapper’s Perspective,” in *The Santa Fe Trail: New Perspectives,* D. N. Wetzel (editor), pp 67–74, *Essays in Colorado History* No. 6, Colorado Historical Society, Denver (1987).

Murray, R. A. “Las Animas, Huerfano, and Custer: Three Colorado Counties on a Cultural Frontier: A History of the Raton Basin,” *Bureau of Land Management Cultural Resources* No. 6, Colorado State Office, Bureau of Land Management, Denver (1979).

Ortiz y Pino, J., III, and L. Anaya, *The Herbs of Galisteo and Their Powers*, Galisteo Historical Museum (1972).

Phillips Petroleum Company, “Introduced Grasses and Legumes,” Section 6 of a series, *Pasture and Range* (1960).

Phillips Petroleum Company, “Poisonous Grass and Plants,” Section 4 of a series, *Pasture and Range* (1957).

Pickens, H. C. *Tracks Across New Mexico,* Bishop Publishing Company (1980).

Potter, L. D. “Re-evaluation Studies of Grazing Exclosure Plots, Bandelier National Monument,” Unpublished report on file at Bandelier National Monument, New Mexico (1985).

Potter, L. D. and T. S. Foxx “Vegetative Mapping and Fire History of the Cerro Grande Accession, Bandelier National Monument,” Final Report, National Park Service, Southwest Region, Santa Fe, NM (1981).

Purtymun, W. D., R. J. Peters, and J. W. Owens, “Geohydrology of White Rock Canyon of the Rio Grande from Otowi to Frijoles Canyon,” Los Alamos Scientific Laboratory report LA-8635-MS (1980).

Pyne, S. J. *Fire in America,* Princeton University Press, Princeton, NJ (1982).

Pyne, S. J. *Fire in America, A Cultural History of Wildland and Rural Fire,* University of Washington Press (1999).

Riley, C. L. *The Frontier People: The Greater Southwest in the Protohistoric Period,* University of New Mexico Press, Albuquerque (1987).

Robbins, W. W., J. P. Harrington, and B. Freire-Marreco, “Ethnobotany of the Tewa Indians,” Smithsonian Institute, Bureau of American Ethnology, No. 55 (1916).

Robinson, W. J. “Tree-Ring Samples and Dated Fire Scars on Eight Trees from the La Mesa Fire Area,” in “The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument,” *Southwest*

Cultural Resources Center Professional Papers No. 28, Division of Anthropology, National Park Service, Santa Fe, NM (1990).

Rothman 1970 (App VII)

Rothman, H. K. "Cultural and Environmental Change on the Pajarito Plateau," *New Mexico Historical Review* 64(2):185–211 (1989).

Rothman, H. K. *On Rims and Ridges; The Los Alamos Area Since 1880*, University of Nebraska Press, Lincoln, NE (1992).

Santa Fe New Mexican, "Real Russian Thistle," September 16, 1897.

Schroeder, A. H. "Shifting for Survival in the Spanish Southwest," *New Mexico Historical Review* 43(4):291-310 (1968).

Schroeder, A. H. "Rio Grande Ethnohistory," in *New Perspectives on the Pueblos,* A. Ortiz (editor), University of New Mexico Press, Albuquerque (1972).

Scurlock, D. "Land Use History of the Baca Geothermal Transmission Line Corridor," in "An Archaeological Survey of the Baca Geothermal 115 KV Transmission Line," D. C. Eck, pp 15–35, Office of Contract Archaeology, University of New Mexico, Albuquerque (1980).

Scurlock, D. "Euro-American History of the Study Area," in *High Altitude Adaptations along Redondo Creek: The Baca Geothermal Anthropological Project*, C. Baker and J. C. Winter (editors), Office of Contract Archaeology, University of New Mexico, Albuquerque (1981)

Scurlock, D. "From the Rio to the Sierra: An Environmental History of the Middle Rio Grande Basin," USDA Forest Service general technical report RMRS-GTR-5 (1998).

Sherman, J. E., and B. H. Sherman *Ghost Towns and mining Camps of New Mexico,* University of Oklahoma Press, Norman (1975).

Simmons, M. "Settlement Patterns and Village Plans in Colonial New Mexico," *Journal of the West* 8(1):7–21 (1969).

Simmons, M. *Coronado's Land, Essays on Daily Life in Colonial New Mexico*, University of New Mexico Press, Albuquerque, NM (1991).

Steen, C. R. "Pajarito Plateau Archaeological Survey and Excavations," Los Alamos Scientific Laboratory report LASL-77-4 (1977).

Steen, C. R. "Pajarito Plateau Archaeological Surveys and Excavations, II," Los Alamos National Laboratory report LA-8860-NERP (1982).

Stevenson, M. C. “Ethnobotany of San Ildefonso and Santa Clara Pueblos,” Unpublished M.M. 4711, Archives of the Office of Anthropology, Smithsonian Institution, Washington DC (1912).

Stevenson, M. C. “Ethnobotany of the Zuni Indians,” Thirtieth Annual Report of the Burea of American Ethnology, Washington DC (1915).

Stout, J. A. “Cattlemen, Conservationists, and the Taylor Grazing Act,” *New Mexico Historical Review* 55(4) (1970).

Stubbendieck, J., S. L. Hatch, and K. J. Hirsch, *North American Range Plants*, University of Nebraska Press, Lincoln, NE (1989).

Sublette, J., M. D. Hatch, and M. Sublette *The Fishes of New Mexico,* University of New Mexico Press, Albuquerque (1990).

Swank, G. R. “Ethnobotany of the Acoma and Laguna Indians,” Unpublished MA thesis, University of New Mexico, Albuquerque, NM (1932).

Swetnam, T. W. “Fire History and Climate in the Southwestern United States,” in *Proceedings of the Symposium on the Effects of Fire in Management of Southwestern Natural Resources,* J. S. Krammes et al. (technical coordinators), pp 6-17, US Department of Agriculture General Technical Report RM-191, Fort Collins, CO (1990).

Swetnam, T. W. and C. H. Baisan, “Historical Fire Regime Patterns in the Southwestern United States Since AD 1700,” in: *Fire Effects in Southwestern Forests, Proceedings of the Second La Mesa Fire Symposium,* Rocky Mountain Forest and Range Experiment Station, US Forest Service general technical report RM-GTR-286 (1996).

Tainter, J. A. and B. B. Tainter, “Riverine Settlement in the Evolution of Prehistoric Land-use Systems in the Middle Rio Grande Valley, New Mexico, Desired Future Conditions for Southwest Riparian Ecosystems: Bringing Interests and Concerns Together,” United States Department of Agriculture, Rocky Mountain Forest and Range Experiment Station general technical report RM GTR (1996).

Tierney, G. D. *Roadside Plants of Northern New Mexico*, Lightning Tree Press, Santa Fe NM (1983).

Tierney, G. D. “Native Edible Plant Resources Near Cochiti Reservoir, New Mexico,” in: *Archeological Investigations in Cochiti Reservoir, Vol. 4*, Office of Contract Archeology, University of New Mexico, Albuquerque, NM (1979).

Tierney, G. “Plants for the Dye Pot,” *El Palacio* 83(3) (1977).

Tierney, G. D. “A Vegetative Survey of White Rock,” in: *Archeological Investigations in Cochiti Reservoir, Vol. 1*, Office of Contract Archeology, University of New Mexico, Albuquerque, NM (1977).

Tierney, G. “Of Pots and Plants,” *El Palacio* 82(3) (1976).

Tierney, G. D. “Plants and Man in Prehistoric Catron County,” *El Palacio* 79(2) (1973).

Tierney, G. and T. S. Foxx “Floristic Composition and Plant Succession on Near-Surface Radioactvie Waste Disposal Facilities in Los Alamos National Laboratory,” Los Alamos National Laboratory report LA-9219-MS (1982).

Tierney, G. D. and P. Hughes, *Roadside Plants of Northern New Mexico*, Lightning Tree Press, Santa Fe, NM (1983).

Tiller, V. *The Jicarilla Apache Tribe: A History,* University of Nebraska Press, Lincoln (1992).

Touchan, R., C. D. Allen, and T.W. Swetnam “Fire History and Climatic Patterns in Ponderosa Pine and Mixed-Conifer Forests of the Jemez Mountains, Northern New Mexico,” in: *Fire Effects in Southwestern Forests, Proceedings of the Second La Mesa Fire Symposium*, Rocky Mountain Forest and Range Experiment Station, US Forest Service general technical report RM-GTR-286 (1996).

Travis, J. R. “Atlas of Breeding Birds of Los Alamos County,” Los Alamos National Laboratory report LA-12206 (1992).

Trierweiler, W. N. “Faunal Resources and Their Caloric Yields,” in: *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo*, T. A. Kohler and M. J. Root (editors), Washington State University Department of Anthropology Reports on Investigations 64 (1990).

Trierweiler, W. N. “Faunal Analysis” in: *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo*, T. A. Kohler and M. J. Root (editors), Washington State University Department of Anthropology Reports on Investigations 64 (1992).

Truslow, E. C. “Manhattan District History: Nonscientific Aspects of Los Alamos Project Y 1942 through 1946,” Los Alamos Scientific Laboratory report LA-5200 (1973).

Tucker, E. A., and G. Fitzpatrick “Men Who Watched the Mountains: The Forest Service in the Southwest,” Southwestern Region, US Forest Service, Albuquerque, NM (1972).

Twitchell, R. E. *The Leading Facts of New Mexican History,* Volumes 1 and 2, Horn and Wallace Publishers, Albuquerque, NM (1963).

Tyler, H. A. *Pueblo Animals and Myths,* University of Oklahoma Press, Norman (1975).

Udall, S. L. *The Quiet Crisis,* Holt, Rinehart, and Winston, New York (1963).

Ungnade, H. E. *Guide to the New Mexico Mountains,* University of New Mexico Press, Albuquerque (1972).

US AEC Map, US Atomic Energy Commission, Los Alamos Area Office, Real Estate Transaction at Los Alamos County, DWG No. ENG-R1656 (July 1, 1963).

Velarde, P. *Old Father Storyteller,* Clearlight Publications (1989).

Vierra B. J. and T. S. Foxx, "Archaic Upland Resource Use: The View from the Pajarito Plateau, New Mexico," Paper presented in the symposium Papers Honoring the Contributions of Cynthia Irwin-Williams, at the 67th Annual Meeting of the Society for American Archaeology, Denver (March 21–24, 2002).

Vierra, B. J., S. R. Hoagland, J. S. Isaacson, and A. L. Madsen, "Department of Energy Land Conveyance Data Recovery Plan and Research Design for the Excavation of Archaeological Sites Located within Selected Parcels to be Conveyed to the Incorporated County of Los Alamos, New Mexico," Los Alamos National Laboratory report LA-UR-02-1284 (2002).

Wade, J. "U. S. Forest Service Timber Management Plan. Los Alamos Working Circle," Atomic Energy Commission, Los Alamos Area Office, Los Alamos, NM (19??).

Watson, J. R. "Plant Geography of North Central New Mexico," *Contribution from the Hull Botanical Laboratory* 160:194–217 (1912).

Weber, 1965 (App VII)

Weber, D. J. *The Taos Trappers: The Fur Trade in the Far Southwest, 1540–1846,* University of Oklahoma Press, Norman (1971).

Weber, D. J. *The Mexican Frontier, 1821–1846: The American Southwest Under Mexico,* University of New Mexico Press, Albuquerque (1982).

Westphall, V. *The Public Domain in New Mexico, 1854–1891,* University of New Mexico Press, Albuquerque (1965).

Whelan, R. J. *The Ecology of Fire*, Cambridge Studies in Ecology, Cambridge University Press (1995).

White, G. G. "Biotelemetry Studies on Elk," Los Alamos Scientific Laboratory report LA-8529-NERP (1981).

Wooton, E. O. “The Russian Thistle,” *Agricultural Experiment Station Bulletin* 16:1–20 (1895).

Wozniak, F. E. “Human Impacts on Riparian Ecosystems of the Middle Rio Grande Valley during Historic Times, Desired Future Conditions for Southwest Riparian Ecosystems: Bringing Interests and Concerns Together,” United States Department of Agriculture, Rocky Mountain Forest and Range Experiment Station general technical report RM GTR 272 (1995).

Yarnell, R. A. “Implications of Pueblo Ruins as Plant Habitats,” University of New Mexico thesis (unpublished) (1958).

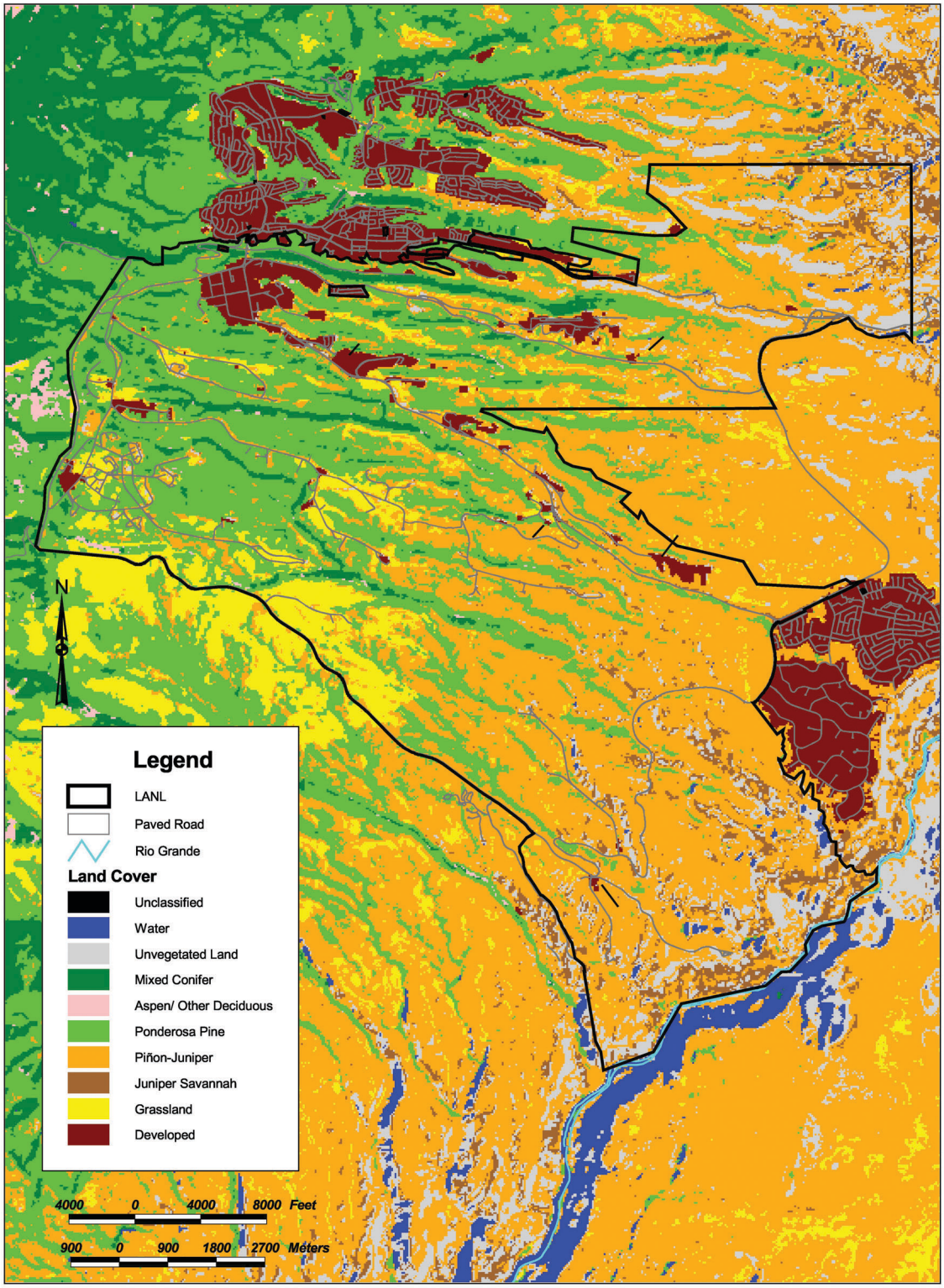
APPENDIX I

Major Cover Types of the Pajarito Plateau and East Jemez Mountains

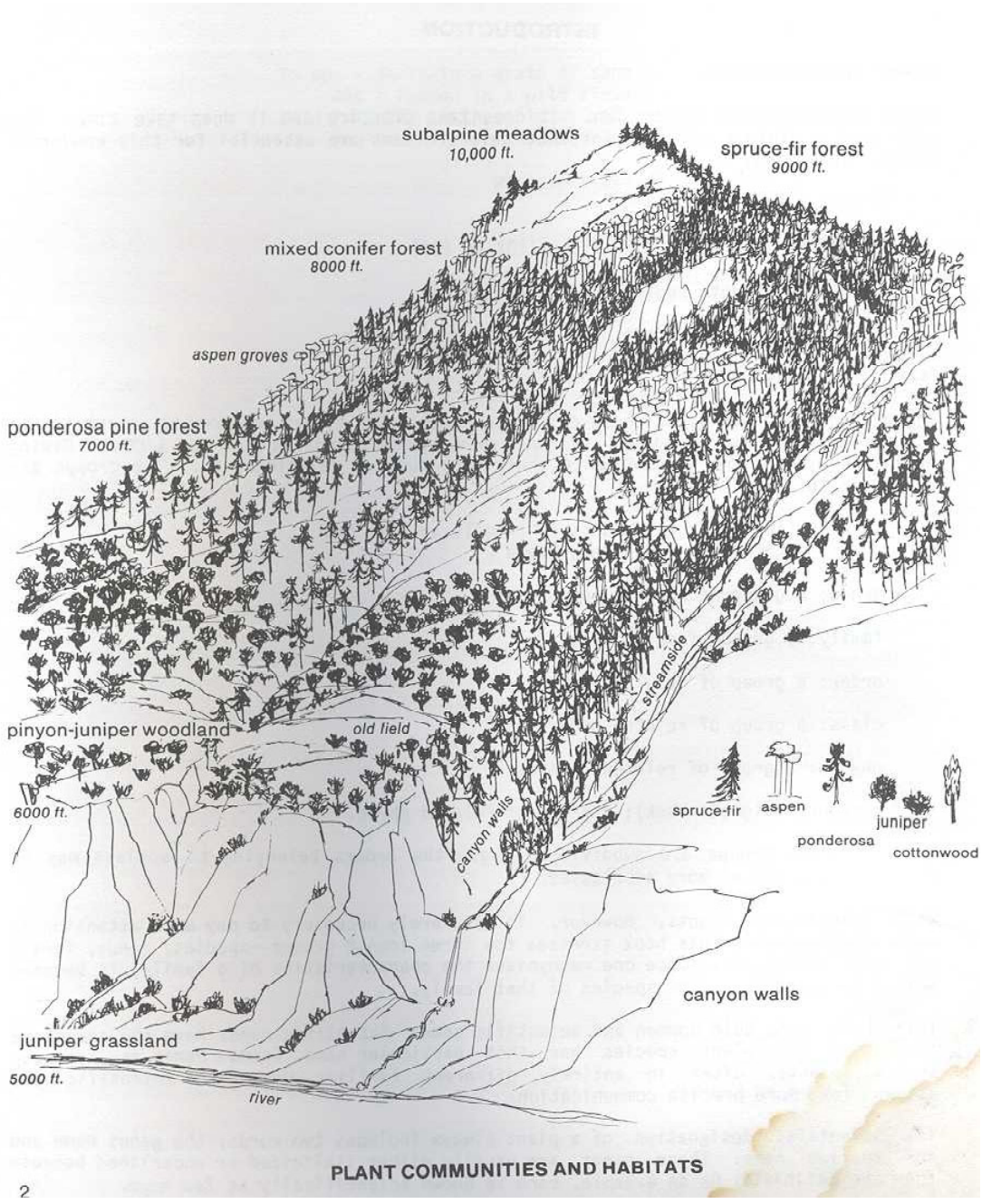
Illustrations and Descriptions

After Balice et al. (1997)

Photos by Teralene S. Foxx



Land cover map for LANL and vicinity before the Cerro Grande fire.



Plant communities as related to the elevational gradiant (Foxx and Hoard 1984).

a. Intermittent stream in lower Ancho Canyon.

b. Pajarito stream below Pajarito springs in White Rock Canyon.

c. Sedge/willow marsh in Pajarito Canyon.

d. Perennial stream below Ancho springs in White Rock Canyon.

e. Riparian vegetation along Frijoles stream in the fall of the year.

Open Water, Wetlands, and Riparian Zones

In the arid Southwest, water is important to survival. On the Pajarito Plateau, springs, perennial and intermitten streams, and the Rio Grande provide life-giving water. This cover type includes all land that is periodically flooded (intermittent streams) or is open water (rivers, perennial streams, and ponds). Wetlands are defined as areas with hydric soil and wetland species that either always require water (obligatory wetland species) or must have water part of the time (facultative wetland species). Cattails (*Carex* spp.) are an example of obligatory wetland species and can be found in marshes. Willow and various sedges are examples of facultative wetland species. These species are found on drier sites, sandbars, and mudflats and grass/sedge meadows. Narrow strips along permanent and intermittent rivers and streams are called riparian zones.

Species within the riparian zones of perennial streams such as Frijoles stream include cottonwood (*Populus* spp.) and boxelder (*Acer negundo*). Along the Rio Grande in the vicinity of Bandelier and LANL, tree species have been flooded but were present before construction of Cochiti Dam. Exotic species such as tamarisk (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*) have increased along the Rio Grande, replacing native cottonwoods.

a. The Rio Grande at the mouth of Ancho Canyon. Ancho rapids is at the left of the picture. Because the area is periodically flooded the river zone is primarily vegetated with weedy species such as Russian thistle (*Salsola kali*).

b. The Rio Grande with native willow along the bank.

Unvegetated Lands

The unvegetated lands within the land cover classification includes tuffaceous cliffs and cliff faces, basal cliffs and basalt talus slopes, and felsenmeers. These sites generally have less than 7 percent vegetation. Even though there is not much vegetation the tuffaceous cliffs and cliff faces were important habitat sites for prehistoric inhabitants. The soft tuff was worked into cavates, and houses and storage areas extended from cliff faces. At lower elevations, the basalt caves provided areas for storage and safekeeping. Many petroglyphs are found on large basalt boulders in White Rock Canyon.

The following pictures show the use of tuffaceous cliffs and talus sites by prehistoric people.

a. Tserige Pueblo included a number of cavates within the tuffaceous cliffs.

b. Petroglyphs and pictographs are found on cliff faces and large boulders.

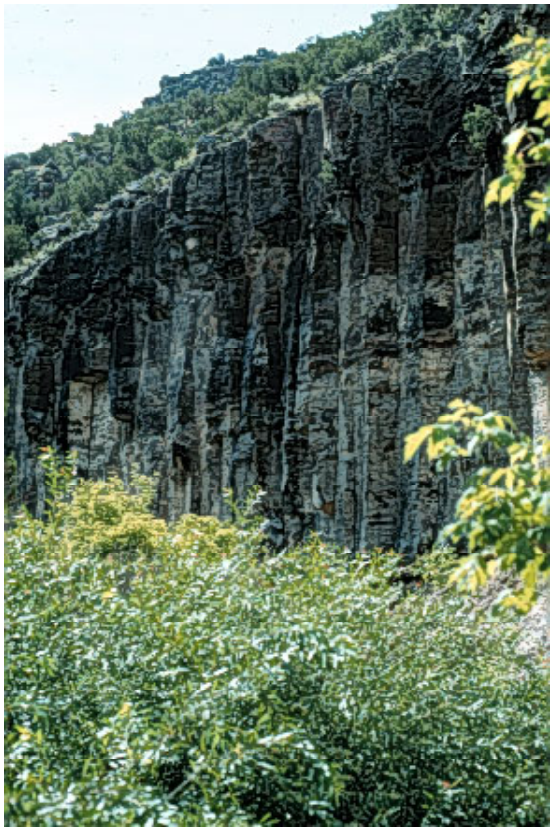
c. Tyuonyi Pueblo and cliffs with cavates, Bandelier National Monument.

Elements of the unvegetated land cover type.

a. Tuffaceous and basaltic cliffs and talus.

b. Tuffaceous cliffs in Ancho Canyon.

c. Basaltic cliffs and talus slopes in White Rock Canyon.



d. Basaltic cliffs in Ancho Canyon.

Juniper Savanna

The juniper savanna land cover type is an open grassland with one-seed juniper (*Juniperus monosperma*) dispersed throughout and has a cover of 10 to 30 percent. Other tree species may be present, but the combined coverage is less than 5 percent. Understory species in this type include sideoats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*), and hairy grama (*B. hirsuta*). The juniper savanna is the primary upland vegetation along the Rio Grande from 1,634 m (5,360 ft) to 1,951 m (6,400 ft) in elevation. There is little evidence of habitation within this type, but within the upland areas of the Rio Grande, evidence of ancient fields and historic animal pens have been found.

a. Juniper grassland within White Rock Canyon.

b. Terrace in Alamo Canyon.

c. Historic animal pen in White Rock Canyon, Bandelier National Momument.

Pinon-Juniper Woodland

The pinon-juniper woodland consists of open or closed low trees. The dominant tree species are one-seed juniper and pinon (*Pinus edulis*). One-seed juniper is more abundant at lower elevations, while pinon is more abundant at higher elevations within the zone. These woodlands are between 1,890 and 2,195 m (6,200 and 7,200 ft) within the canyons. On the mesa tops these species predominate between 1,890 m (6,200 ft) and 2,195 (7,200 ft). Depending on the altitude, the following species can be found in the understory: blue grama, Indian ricegrass (*Oryzopsis hymenoides*), and sand dropseed (*Sporobolus cryptandrus*). At higher elevations, mountain muhly (*Muhlenbergia montanus*) is sometimes present. This cover type is where most of the habitation sites are found on the plateau. At the ecotone between this type and the ponderosa pine cover type many of the homestead sites were also located.

a. Pinon-juniper woodland.

Ponderosa Pine Forests

This type is a closed or open forest. Ponderosa pine (*Pinus ponderosa*) is the dominant species being present with cover greater than 7 percent. One-seed juniper and pinon may be present but make up less than 7 percent of the cover.

These forests can be as low as 1,890 m (6,200 ft) in some protected canyons. In more open canyons, ponderosa pine is generally not found below 1,921 m (6,300 ft). On the mesa tops and lower slopes of the Sierra de los Valles, ponderosa pine forests extend to 2,378 m (7,800 ft) in elevation. Understory species include blue grama, mountain muhly, mutton grass (*Poa fendleriana*), and little bluestem (*Schizachrium scoparium*). Gambel oak is a common shrub species. Within this cover type there were a number of fieldhouses and historic homestead sites. Much of the community of Los Alamos and the upper portions of LANL are within this cover type.

a. Open ponderosa pine forest.

b. Closed ponderosa pine forest.

Mixed Conifer/Spruce Fir

Mixed conifer forests typically appear at higher elevations in the mountains and consist of trees that are at least 5 m (16 ft) tall. Douglas fir *(Pseudotsuga menziesii*) and white fir (*Abies concolor*) are the dominant overstory species, although other species such as ponderosa pine may be present in the overstory or midstory.

Mixed conifer forest intergrades with ponderosa pine communities and as stringers on north aspects of the canyons and on the canyon bottoms above 2,104 m (6,900 ft) in elevation. These communities continue to 2,591 m (8,500 ft) on eastern exposures and on flat areas. Shurbs include ninebark (*Physocarpus monogynous*), wild rose (*Rosa woodsii*), cliffbush (*Jamesia americana*), and dwarf juniper (*Juniperus communis*).

a. Mixed conifer forest with Douglas fir and white fir.

b. Engelmann spruce and white fir dominate high elevations.

Aspen Forest

This cover type occurs in montane and upper montane landscape positions. Trees that are greater than or equal to 5 m (16 ft) tall with coverage greater than or equal to 13 percent are present. Aspen (*Populus tremuloides*) is present in the overstory with at least 20 percent cover. Some combination of Douglas fir, ponderosa pine, white fir, or Engelmann spruce (*Picea engelmanni)* are also present but does not dominate the overstory. Aspen communities are common at mid-elevations in the mountains. They range in elevation from approximately 2,700 to 3,030 m (8,900 to 9,950 ft). Below 2,820 m (9,250 ft) aspen stands occupy north and northeast aspects; whereas, at upper elevations they are found on the southeast- to southwest-facing positions.

a. Aspen groves are found throughout the higher elevations indicating past fire.

Shrublands

Shrublands are identified by the presence of shrub species greater than 0.46 m (1.5 ft) in height with at least 15 percent cover. Trees are generally not present or, if present, make up less than 10 percent of the cover. Shrubs include fourwing saltbush *(Atriplex canescans)* often an indicator of prehistoric dwellings, chamisa *(Chrysothamnus nauseosus*) often found along roadsides and drainages, New Mexico locust (*Robinia neomexicana)* a common species in burned and/or disturbed areas, and Gambel oak common in ponderosa pine forests and burned areas.

a. Sagebrush (*Artemisia tridentata*) shrubland in White Rock Canyon.

b. Oak shrubland and grassland from the La Mesa fire.

Grasslands and Disturbed Areas

Grasslands are dominated by grasses and grass-like plant species. If shrubs or trees are present then the total percent cover is less than 10. Grasslands can be found on hillslopes in White Rock Canyon or other open sites. At the crest of the Sierra de los Valles, subalpine grasslands are conspicuous. They occur at 2,743 m (9,000 ft) on steep southerly and southwesterly slopes. Montane meadows are found in the mixed conifer and spruce-fir zone. Disturbed areas are found throughout and are recognized by the prevalence of weedy species including Russian thistle, summer cypress (*Kochia scoparia*), snakeweed (*Gutierrezia* spp.), and dandelion (*Taraxacum* spp.).

a. Subalpine grasslands on mountain peaks.

b. Low-elevation meadow.

c. Grasslands within the Valle Grande.

APPENDIX II

INTRODUCED PLANTS

Appendix II, Table 1: Introduced Plants of the Pajarito Plateau and the Jemez Mountains

Common Name	*Scientific Name*	Year*	Introduction	Comment
			FORBS	
amaranth, redroot pigweed	*Amaranthus retroflexus*	Post 1598	Spanish; native to tropical America	Seeds used for food.
redroot pigweed	*Amaranthus retroflexus*		Native to tropical America	Seeds used for food.
asparagus	*Asparagus officinalis*	Pre 1851	Introduced from the Old World	Used for food.
beggartick; Spanish needles	*Bidens bipinnata*		From the eastern US	
black mustard	*Brassica nigra*		Naturalized from Eurasia	
marijuana; hemp	*Cannabis sativa*	Pre 1894	From Asia	Curtin reports it in her book.
shepherd's purse	*Capsella-bursa pastoris*		Naturalized and introduced from southern Europe	
hoary cress	*Cardaria draba*		Europe	In New Mexico it is a Class A weed; introduced as a filler in flower arrangements.
musk thistle	*Carduus nutans*	early 1900	Southern Europe	Class B weed in New Mexico.
lambsquarters	*Chenopodium album*	19th century	Naturalized from Eurasia	Used for food.
lambsquarters	*Chenopodium album*		Naturalized from Eurasia	Used for greens.
Mexican tea	*Chenopodium ambrosiodes*		Introduced and naturalized from South America	Used medicinally.
chicory	*Chicorum intybus*		Native of the Mediterranean area	Cultivated in Europe.
Canada thistle	*Cirsium arvense*	late 18th century	Originated in Europe and Asia	Found in Cerro Grande fire area.
bull thistle	*Cirsium vulgare*		From Europe and Asia	Noxious weed.
poison hemlock	*Conium maculatum*		Introduced and naturalized from Eurasia	Poisonous plant.
field bindweed	*Convolvulus arvensis*		Introduced from Europe	Class C weed in New Mexico; seeds remain viable in soil up to 50 yrs.
hedge bindweed	*Convolvulus sepium*		Native of Eurasia	
alfilaria	*Erodium cicutarium*	Post 1598	Spanish; introduced from southern Europe	Good livestock forage.
bedstraw	*Galium aparine*		Introduced from Eurasia	Used for stuffing mattresses and pillows.
black henbane	*Hyoscyamus niger*		Europe, Mediterranean	Considered a Class A weed in New Mexico; poisonous to livestock and humans.
klamathweed, St. John's wort	*Hypericum perforatum*	1793?	From Europe and Asia	
ivy leaf	*Ipomoea hederacea*		Naturalized from tropical America	
summer cypress; fireweed	*Kochia scoparia*		Introduced from Eurasia	
prickly lettuce	*Lactuca serriola*		Introduced from Europe	

Appendix II, Table 1 (cont.)

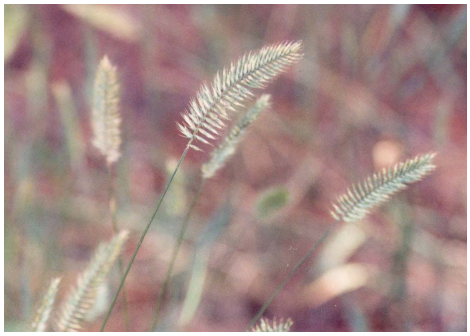
Common Name	*Scientific Name*	Year*	Introduction	Comment
			FORBS (CONT.)	
oxeye daisy	*Leucanthemum vulgare*		Naturalized from Europe	
butter and eggs; yellow toadflax	*Linaria vulgaris*	mid-1800s	Naturalized from Eurasia	Began as a garden plant, ornamental.
mallow	*Malva neglecta*	Pre-1600	Naturalized from Europe	
hoarhound	*Marrubium vulgare*	Pre-1600		Used for tea.
alfalfa	*Medicago sativa*	Before 1821	Spanish	Escaped along roadsides and waste places; East Coast introduced late 1700s; livestock feed.
black medic	*Medigago lupulina*		From Eurasia	
sweetclover	*Melilotus officinalis*	Pre 1915	Introduced from Eurasia	Brought in for bees.
Mint	*Mentha spicata*		Introduced from Europe	Tea and seasoning.
plantain	*Plantago major*		Native of Eurasia	Used medicinally.
prostrate knotweed	*Polygonum aviculare*		Native to US and introduced from Europe	
wild buckwheat	*Polygonum convolvulus*		Naturalized from Europe	
purslane	*Portulaca oleracea*	Pre-1600	Introduced from southern Europe	Used for food.
rough cinquefoil	*Potentilla norvegica*		Introduced and naturalized from Eurasia	
selfheal	*Prunella vulgaris*		Naturalized from Eurasia but also native to US	Used medicinally.
watercress	*Rorippa nasturtium-aquaticum*		Introduced from Europe	Used for food and medicine.
red sheep sorrel	*Rumex acetsosella*	Pre-1600	Naturalized from Eurasia	In Europe blue dyes were made black with plant.
curly dock	*Rumex crispus*		Introduced and naturalized from Europe	
Russian thistle	*Salsola kali*	Post 1890		Came into New Mexico in late 1800s; introduced in US from Russia.
tumblemustard	*Sisymbrium altissimum*		Naturalized from Europe	
sowthistle	*Sonchus asper*		Native of Western Asia, North Africa, Europe	
dandelion	*Taraxacum officinale*	Pre-1600	Introduced and naturalized from Europe	
field pennycress	*Thlaspi arvense*		Naturalized from Eurasia	
salsify	*Tragopogon dubius*	Pre-1800		
goathead	*Tribulus terrestris*		Naturalized from Europe	
alsike clover	*Trifolium hybridum*	1834	Northern Europe	
stinging nettle	*Urtica diocia*		Naturalized from Eurasia	
moth mullein	*Verbascum thapsus*		Naturalized from Eurasia	Used medicinally and as a tobacco.
cocklebur	*Xanthium stumarium*		Native to Eurasia	Used medicinally for snakes.

Appendix II, Table 1 (cont.)

Common Name	*Scientific Name*	Year*	Introduction	Comment
			GRASS	
goat grass	*Aegilops cylindrical*	Pre-1950	Naturalized from Europe	
redtop	*Agrostis alba*	1807	Old World native	Valued for hay, used in pasture mixture.
redtop	*Agrostis gigantea*			
smooth brome	*Bromus inermis*	Post-1884	Introduced from Europe	
Japanese brome	*Bromus japonicus*		Introduced from Europe	
downy chess, cheatgrass	*Bromus tectorum*		Introduced from Europe	Contaminant in straw used in Cerro Grande fire, present in area for many years prior.
Bermuda grass: pata del gato	*Cynodon dactryon*	Post-1880s	Introduced from Africa	
orchard grass	*Dactylis glomerata*	Post-1760	Introduced from Europe and Asia	Spring forage for livestock and wildlife.
barnyard grass	*Echinochloa crus-galli*		Native of Europe	
weeping lovegrass	*Eragrostis curvula*	1927	North Africa	Excellent pasture early spring and fall.
sheep fescue	*Festuca ovina*	1598		Used to seed La Mesa fire.
meadow fescue	*Festuca pratensis*			
Italian ryegrass	*Lolium perenne spsp. multiflorum*	Post-1820		Sometimes used for revegetating areas.
timothy	*Phleum pratensis*	Ca 1747	Europe	Grown alone or with alfalfa and clover; palatable and important tame hay grass.
Kentucy bluegrass	*Poa pratensis*	Post-1579		Good for livestock and wildlife.
green foxtail	*Seteria virdis*		Introduced from Europe	
crested wheatgrass	*Agropyron cristatum(desertorum)*	1898	Introduced from Russia and Siberia	Valuable for regrassing abandoned cropland; drought resistant.
			TREES	
tree of heaven	*Alianthus altissima*	Post-1850		
Russian olive	*Elaeagnus angustifolia*	Pre-1935		
tamarix	*Tamarisk*	Early 1900s	Introduced from Eurasia	Used as an ornamental.
Chinese elm; Siberian elm	*Ulmus pumila*	Post 1919		Used instead of American elm killed by disease.

References for the Table:
Lee, Richard D. "New Mexico's Invasive Weeds" College of Agriculture and Home Economics Cooperative Extension Service, Las Cruces, New Mexico 1999. Curtin, LSM Healing Herbs of the Upper Rio Grande. Southwest Museum, Los Angeles, California, 1965 Tierney, G. D. and P. Hughes Roadside Plants of Northern New Mexico, Lightening Tree Press, Santa Fe (1983) Tierney, G. D. "Plants and Man in Prehistoric Catron County" El Palacio, Vol 79. No. 2 (1973)
News paper article from the Santa Fe New Mexican, September 16, 1897 "Real Russian Thistle" Crockett, L J. Wildly Successful Plants, Handbook of North AmericanWeeds, Collier Books, New York, (1977) Scurlock, D. "From The Rio to the Sierra: An Environmental History of the Middle Rio Grande Basin, USDA Forest Service, General Technical Report, RMRS-GTR-5 (1998) Agricultural Research Service of the United States Department of Agriculture, Common Weeds of the United States, Dover Publications, 1971 Foxx, T. L. Pierce, G. D. Tierney, L. A. Hansen "Annotated Checklist and Database for Vascular Plants of the Jemez Mountains, Los Alamos National Laboratory, LA-13408, (1998) Phillips Petroleum Company, Introduced Grasses and Legumes, Section 6 of a series, Pasture and Range, (1960) Phillips Petroleum Company, Poisonous Grassland Plants Section 4 of a series, Pasture and Range, (1957)

INTRODUCED SPECIES
GRASSES


Desert wheatgrass

Family: POACEAE (Grass)
Common Name: Desert wheatgrass
Scientific Name: *Agropyron desertorum*
Life Span: Perennial
Origin: Introduced from Eurasia
Season: Cool
Habitat: Roadsides, disturbed areas, replanted sites.
Foxx and Hoard (1995): p. 54
Notes: Introduced from Russia to reseed overgrazed ranges of the Great Plains. Resistant to cold and drought tolerant.

Family: POACEAE (Grass)
Common Name: Cheatgrass, downy chess
Scientific Name: *Bromus tectorum* L.
Life Span: Annual
Origin: Introduced from Europe
Season: Cool
Habitat: Found primarily in run-down ranges but also along roadsides and in disturbed areas
Foxx and Hoard (1995): p. 62
Notes: Awns may cause eye injury or jaw abscesses on animals. Believed to have been a contaminant in some of the straw placed on the burned areas of the Cerro Grande Fire.


Slender wheatgrass in La Mesa Fire area.

Family: **POACEAE (Grass)**
Common Name: Slender wheatgrass
Scientific Name: *Elymus trachycaulum* (Link) Malte
Life Span: Perennial
Origin: Introduced to area through reseeding
Habitat: Moist to well drained soils and under open forest canopies
Foxx and Hoard (1995): Scientific name changed from *Agropyron* to *Elymus* p. 57
Notes: Growth starts in mid-spring, seeds mature by August. Reproduces by seeds or tillers. Foxx found in the 1977 La Mesa Fire that the plant disappeared after about 5 to 8 years post seeding.

FAMILY: POACEAE (Grass)
Common Name: Timothy
Scientific Name: *Phleum pratense*
Life Span: Perennial
Origin: Introduced from Eurasia
Season: Cool
Habitat: Fields and roadsides, higher elevations, near Fourth pond
Foxx and Hoard (1995): p. 54
Notes: Produces a palatable hay for cattle and horses and is seeded as a pasture grass. Considered a most valuable forage.


Timothy

Family: POACEAE (Grass)
Common Name: Barley
Scientific Name: *Hordeum vulgare*
Life Span: Annual
Origin: Seeded as part of the rehabilitation efforts on the Cerro Grande
Season:
Habitat: Throughout the burned area, particularly high-intensity burn
Foxx and Hoard (1995): Not included
Notes: Annual barley used as a quick ground cover after the Cerro Grande Fire. This species was the dominant grass cover the first year after the fire. Rarely seen in 2001 surveys.


Ripened barley

Family: POACEAE (Grass)
Common Name: Annual rye
Scientific Name: *Lolium multiflorum*
Life Span: Annual to biennial
Origin: Seeded as part of the rehabilitation efforts on the Cerro Grande
Season:
Habitat: Throughout the burned area, particularly high intensity burn
Foxx and Hoard (1995): Not included, but similar in appearance to *L. perene,* p. 56
Notes: Annual rye was used as a quick ground cover after the Cerro Grande Fire. This species was the dominant grass cover the first and second year post-fire.


Annual ryegrass

Family: POACEAE (Grass)
Common Name: Redtop bend, creeping bent grass, redtop
Scientific Name: *Agrostis alba*
Life Span: Perennial .
Origin: Introduced from Europe
Season: Cool
Habitat: A common plant in moist meadows
Foxx and Hoard (1995): Not included
Notes: Redtop is a very common grass near the Fourth pond.

Open meadow near Fourth pond. The flowers are asters, fleabane daisy, and ox-eye daisy. The reddish tinged grass is redtop.

INTRODUCED FORBS

Family: ASTERACEAE (Aster)
Common Name: Horseweed
Scientific Name: *Conyza canadensis* (L.) Cronq.
Life Span: Annual or biennial
Origin: Introduced from the eastern US[5]
Habitat: Common along roadsides, disturbed areas
Foxx and Hoard (1995): p. 93
Key Characteristics: Flowers greenish-white, flower heads small, innumerable.
Notes: This weed can cause irritation to the nostrils of horses.

Horseweed

Family: ASTERACEAE (Sunflower)
Common Name: Ox-eye daisy, white daisy, white weed, field daisy
Scientific Name: *Chrysanthemum leucanthemum* L.
Life Span: Perennial
Origin: Introduced from Europe
Habitat: Meadows, disturbed sites
Foxx and Hoard (1995): Not included
Key Characteristics: Disc flowers yellow, ray flowers white. About the size of a silver dollar.
Notes: This flower, although an introduction to the US, is the state flower of North Carolina. Found in the meadows adjacent to the Fourth Pond, Santa Clara Canyon.

Ox-eye daisy

Family: ASTERACEAE (Sunflower)
Common Name: Annual sunflower, common sunflower
Scientific Name: *Helianthus annuus* L.
Life Span: Annual
Origin: Introduced from the Great Plains
Habitat: Along roadsides, in moist soils, ditchbanks, and abandoned agricultural areas
Foxx and Hoard (1995): p. 88
Key Characteristics: Tall robust plant with coarse rough stems 3 to 7 ft tall. Large heart-shaped or egg-shaped leaves. Flower heads are large from 2 to 5 in. across. Ray flowers are yellow and disc flowers are reddish brown.
Notes: The prairie sunflower (*Helianthus petiolaris*) is smaller, growing only to 3 ft tall. Flower heads are only 1 to 2 in. across.

Annual sunflower

Family: ASTERACEAE (Sunflower)
Common Name: Dandelion
Scientific Name: *Taraxacum officinale* Weber
Life Span: Perennial
Origin: Introduced from Europe
Habitat: Along roadsides, in moist soils, weedy meadows, ditchbanks, and abandoned agricultural areas
Foxx and Hoard (1995): p. 75
Key Characteristics: Low perennial with a thick taproot. No stems. Plants form a rosette on the ground. Flowers 1-2 inches across, yellow.
Notes: Young leaves can be eaten as spring greens. Readily eaten by all livestock. Nectar plant for insects.

Family: ASTERACEAE (Sunflower)
Common Name: Goatsbeard
Scientific Name: *Tragopogon pratensis*
Life Span: Perennial
Origin: Introduced from Europe
Habitat: Along roadsides, in moist soils, weedy meadows, ditchbanks, and abandoned agricultural areas
Foxx and Hoard (1995): p. 76
Key Characteristics: Low perennial with a thick taproot. No stems. Plants form a rosette on the ground. Flowers 1 to 2 in. across, yellow.
Notes: Young leaves can be eaten as spring greens. Readily eaten by all livestock. Nectar plant for insects.

Goatsbeard, fruit and flower

Goatsbeard flower

Dandelion flower

Family: BRASSICACEAE (Mustard)
Common Name: Shepherd's purse
Scientific Name: *Capsella bursa-pastoris* (L.) Medic
Life Span: Annual
Origin: Introduced from Europe
Habitat: Disturbed soils, roadsides
Foxx and Hoard (1995): p. 133
Key Characteristics: Blooms early with small white flowers. Flat heart-shaped seeds give the plant the name shepherd's purse.
Notes: This is a common plant of disturbed soil.

Family: CHENOPODIACEAE (Goosefoot)
Common Name: Russian thistle, tumbleweed
Scientific Name: *Salsola kali.* var. *tenuifolia* Tausch
Life Span: Annual
Origin: Introduced from Russia
Habitat: Distrubed soils and along roadsides
Foxx and Hoard (1995): p. 109
Key Characteristics: Intricately branched, globular annual with ridged reddish stems.
Notes: This plant was brought to the US from Russia in flaxseed in the late-1800s. It spread rapidly. Plants roll as tumbleweed and scatter the prolific seeds.

Russian thistle

Family: FABACEAE (Pea)
Common Name: Black medic, nonesuch, hop medic
Scientific Name: *Medicago lupulina* L.
Life Span: Annual, biennial, or perennial
Origin: Introduced from Eurasia.
Habitat: Moist soil, roadsides, distrubed soils
Foxx and Hoard (1995): Not included
Key Characteristics: Trailing plant with 4-angled stems. Leaves with three leaflets, central leaflet on a short stalk. Flower yellow with many clustered together. Seeds black when mature resembling a corkscrew.
Notes: Has a high forage value and is found in pastures.

Family: FABACEAE (Pea)
Common Name: Alfalfa
Scientific Name: *Medicago sativa* L.
Life Span: Perennial
Origin: Originated in ancient Media, present-day northwest Iran.
Habitat: Cultivated fields, along roadsides, trails, and disturbed soils.
Foxx and Hoard (1995): p. 147
Key Characteristics: Leaves have three leaflets, flowers are purple.
Notes: Valuable forage plant and a sometimes escape from cultivated fields.

Family: FABACEAE (Pea)
Common Name: Sweetclover
Scientific Name: *Melilotu*s spp.
Life Span: Annual
Origin: Introduced from Eurasia.
Habitat: Common weed of roadsides, ditches, and other disturbed soils
Foxx and Hoard (1995): p. 146-147
Key Characteristics: Tall plant with either small white or yellow flowers.
Notes: There are two species in the area: *Melilotus albus* Desr. (white) and *Melilotus officinalis* (yellow). White sweetclover was first collected in the US in 1739 and has been used as a honey plant since antiquity. These plants reseed readily and withstand heavy grazing.

Family: FABACEAE (Pea)
Common Name: Red clover
Scientific Name: *Trifolium pratensis* L.
Life Span: Perennial
Origin: Introduced from Europe
Habitat: Moist meadows, along streams
Foxx and Hoard (1995): p. 148
Key Characteristics: Leaves with 3 leaflets, flowers in globelike clusters, purple or red.
Notes: Good forage plant.

Family: FABACEAE (Pea)
Common Name: White clover
Scientific Name: *Trifolium repens* L.
Life Span: Perennial
Origin: Introduced from Europe
Habitat: Moist soils of meadows
Foxx and Hoard (1995): p. 148
Key Characteristics: Plants hug the ground and reproduce by creeping stems that root at the joints. Flowers crowded into globelike heads, white.
Notes: Plant has good forage value.

Family: GERANIACEAE (Geranium)
Common Name: Redstem filaree, cranesbill, storksbill, heronsbill, alfilaria
Scientific Name: *Erodium cicutarium* (L.) L'Her
Life Span: Annual or biennial
Origin: Native to Mediterranean Europe and probably introduced by the Spaniards
Habitat: Disturbed soil
Foxx and Hoard (1995): p. 139
Key Characteristics: Small spreading plant with purple flowers. Blooms very early in the spring and throughout the summer and fall. Fruits look like crane's bills.
Notes: Abundant throughout the area and is an imporant range plant early in the spring.


Heron's bill

Family: LAMIACEAE (Mint)
Common Name: Hoarhound
Scientific Name: *Marrubium vulgare* L.
Life Span: Perennial
Origin: A widespread European perennial
Habitat: Weed of disturbed areas and roadsides especially where livestock have been
Foxx and Hoard (1995): p. 143
Key Characteristics: Dense white woolly 4-angled stems. Opposite leaves green above and white woolly below. Flowers white.
Notes: The top of this plant is used medicinally for cough medicines and candy flavoring.

Family: POLYGONACEAE (Buckwheat)
Common Name: Prostrate knotweed, smartweed
Scientific Name: *Polygonum aviculare* L.
Life Span: Annual
Origin: Eurasia
Habitat: Distrubed soils
Foxx and Hoard (1995): p. 162
Key Characteristics: Tough, wiry stemmed, prostrate annual. Bluish-green leaves are alternate. Flowers small white or greenish in small clusters in leaf axils.
Notes: This weed is able to withstand trampling and very dry soils. It is also drought resistant.

Family: ROSACEAE (Rose)
Common Name: Silverweed cinquefoil, silverweed
Scientific Name: *Potentilla anserina* L.
Life Span: Perennial
Origin: Eurasian introduction
Habitat: Range weed on denuded or thinly vegetated moist ground.
Foxx and Hoard (1995): p. 170
Key Characteristics: Low growing perennial reproducing by seeds and runners. Leaves 2 to 10 in. long divided into 5 to 11 pairs of large leaflets. Flowers yellow with five conspicuous bright yellow petals.
Notes:

Silverweed

Family: SCROPHULARIACEAE
Common Name: Common mullein
Scientific Name: *Verbascum thapsus* L.
Life Span: Biennial
Origin: Naturalized weed from Europe brought in by the Spaniards
Habitat: Roadsides, disturbed areas.
Foxx and Hoard (1995): p. 174
Key Characteristics: Erect stout, woolly biennial. Entire plant covered with matted hairs that are forked or starlike. Can grow from 2 to over 6 ft. The first year the plant produces a rosette of leaves. Flowers are yellow, 5-lobed and about 3/4 to 1 in. across.
Notes: After the plant has ripened it stands as a dead brown stalk for some time. These stalks were dipped in tallow and used as lampwicks, thus the common name *candelaria.*

Common mullein

INVASIVE SPECIES

Family: ASTERACEAE (Sunflower)
Common Name: Canada thistle
Scientific Name: *Cirsium arvense* (L.) Scop.
Life Span: Creeping perennial
Origin: Europe and Asia; introduced as a seed contaminant as early as the 18th century.
Habitat: Disturbed areas
Foxx and Hoard (1995): Not reported
Key Characteristics: A creeping perennial forming dense patches. Grows up to 5 ft and is branched at the top, ridged, and hollow. Leaves are alternative and lack petioles. Flower heads are 0.5 in. in diameter surrounded by spineless bracts. Flowers purple to lavender. White flowers are not uncommon. Male and female flowers on separate plants. Reproduce both sexually and asexually.
Notes: Identified at higher elevations in the northern part of the county. Seen within the area burned by the Oso Fire in 1999. This is considered a class A weed by the New Mexico Department of Agriculture. Class A weeds are non-natives that have a limited distribution. Preventing new infestations is a high priorty.

Family: ASTERACEAE (Sunflower)
Common Name: Bull thistle
Scientific Name: *Cirsium vulgare* (Savi) Tenore
Life Span: Biennial
Origin: Europe and Asia; introduced as a seed contaminant.
Habitat: Field, meadows, disturbed sites.
Foxx and Hoard (1995): Not included
Key Characteristics: Grows 2 to 5 ft tall. Short, fleshy taproot. Stems very hairy with dark purple veins. Leaves: First year forms a rosette, second year are double-toothed ending in spine, wavy with prickles on the surface and hairy on the underside. Flower heads dark purple, 1.5 to 2.0 in. wide. Bracts are narrow and spinetipped.
Notes: Probably the least aggressive non-native thistle in the state. Widely distributed at higher elevations. This is a type C weed as identified by the New Mexico Department of Agriculture. These weeds are not native and are widespread throughout the state. Long-term programs of management and suppression are encouraged. Noted in 2001 in the Oso Fire area. Scattered plants.

Family: ELAEAGNACEAE
Common Name: Oleaster, Russian olive
Scientific Name: *Ekaeagnus angustifolia*
Life Span: Tree
Origin: Native of southern Europe and western Asia. (Trees in Kansas, J. C. Mohler, 1928)
Habitat: Field, meadows, disturbed sites.
Foxx and Hoard (1995): p. 25
Key Characteristics: Small tree under 30 ft with a trunk diameter of 8 to 25 cm, erect or twisted and distored, producing an irregular tree. Branches erect or pendulous, spiny.
Notes: A very desirable ornamental tree, on account of its rapid growth, silvery color and fragrant flowers. Has become established along some water ways.

APPENDIX III

EXTINCT, EXTIRPATED, RARE, AND INTRODUCED ANIMALS

ANIMAL RESOURCES USED BY PREHISTORIC PEOPLE ON THE PAJARITO PLATEAU AND JEMEZ MOUNTAINS

Appendix III, Table 1. Extinct, Extirpated, Rare, Introduced, and Removed Animals of the Pajarito Plateau and Jemez Mountains

ORDER	Family	Common Name	Scientific Name	Extinct	Extirpated	Rare	
			AMPHIBIANS				
		Jemez Mountains salamander	*Plethodon neomexicanus*			x	Considered threatened by the Department of New Mexico Game and Fish.
			MAMMALS				
			Carnivora				
	Canidae	gray wolf	*Canis lupus*	x			Became extinct in 1940s in the west; Pickens indicates last wolf shot in Valle Grande.
	Canidae	grizzly bear	*Ursus arctos*	x			Last grizzly bear in New Mexico was killed in 1930s.
	Mustelidae	pine martin	*Martes americana*			x	
	Mustelidae	river otter	*Lutra candensis*			x	Otters need large bodies of water; only preserved specimen in New Mexico found in Gilia in 1954. Early sightings are recorded for the Rio Grande Valley.
		mink	*Mustela vison*		x		
	Felidae	cougar	*Felis concolor*				These species have never been killed out; however, records show the populations were larger; 50 lions were killed in the Jemez between 1931 and 1934. Homer Pickens said he killed 36 mountain lions in 1932 in the Jemez Mountains, 10 from the area above what would be Bandelier National Monument.
			Artiodactyla				
	Cervidae	Rocky Mountain elk	*Cervus elaphus*		x		The Merriam elk was exterminated from the state by 1909. A small herd of Rocky Mountain elk was introduced to the Jemez in the 1940s.
	Bovidae	bighorn sheep	*Ovis canadensis*		x		Bandelier claims to have seen the last sheep on the plateau in the late 1800s.
		pronghorn	*Antilocarpa americana*		x		Thought to be present in historic times but presence has never been confirmed.
		bison	*Bison bison*	x			Bison were essentially gone from New Mexico by 1860. The last kill was 1884. The Taos Indians hunted bison in the eastern plains until 1883.
	Sciuridae	prairie dogs	*Cynomys gunnisoni (Gunnison prairie dog); Cynomys ludovicianus (Black-tailed prairie dog*			x	Praire dog towns are found in the Valle Grande but have not been identified on the plateau. The black-tailed prairie dog has been considered for listing under the Endangered Species Act.

Appendix III, Table 1. (cont.)

ORDER	Family	Common Name	Scientific Name	Extinct	Extirpated	Rare	
			Rodentia				
	Heteromyidae	beaver	*Castor canadensis*			x	Beaver were used for fur in the early exploration of the Rocky Mountains. Beaver at one time made dams in Frijoles Canyon. They are now found along the Rio Grande.
	Zapodidae	Meadow jumping mouse	*Zapus* spp.			x	These mice are considered rare in the area.
			BIRDS				
		Bald eagle	*Haliaeetus leucocephalus*				Once endangered they are now listed under the Endangered Species Act as Threatened.
		American peregrine falcon	*Falco peregrinus anatum*				Once considered endangered but delisted under the Endangered Species Act in 1997.
		Mexican spotted owl	*Strix occidentalis lucida*				Considered threatened under the Endangered Species Act. Henderson and Harrington mention hearing a Mexican spotted owl in Frijoles Canyon in 1910.
		wild turkey	*Meleagris gallopavo*				Travis reports that human disturbance has seriously disrupted the natural life patterns of the turkey resulting in diminished populations.
			INTRODUCTIONS				
			FISH				
		brook trout	*Salvelinus fontinalis*				Brook trout, rainbow trout, and yellow stone cutthroat were planted in Frijoles Creek in 1912 to 1955 and in Alamo Creek and Capulin Creek between 1919 and 1931.
		rainbow trout	*Salmo gairderi*				See above.
		brown trout	*Salmo trutta*				See above.
			AMPHIBIANS				
		bullfrog	*Rana catesbeiana*				Widespread species that may or may not be native to New Mexico.

Appendix III, Table 1. (cont.)

ORDER	Family	Common Name	Scientific Name	Extinct	Extirpated	Rare	
			INTRODUCTIONS (CONT.)				
			BIRDS				
		starling	*Sturnus vulgaris*				First detected in New Mexico in 1935. By 1959-1962 they were summering in Albuquerque. Sightings reported in Los Alamos since 1958.
			MAMMALS				
	Cervidae	elk	*Cervus elaphus*	*Cervus elaphus*			See information above.
		beaver	*Castor canadensis*				In 1964 two beavers were released in Guaje Canyon by the New Mexico Department of Game and Fish. Monitor 7/16/64. Homer Pickens indicates that more beaver will be carried by horseback to Guaje and Los Alamos Canyon. (I don't think they took. tsf).
			REMOVALS				
		mule deer					Between 1961 and 1969 Homer Pickens began a program to trap deer that were over running the area. About half of the more than 500 deer trapped were given to the New Mexico Department of Game and Fish and transplanted to the Pecos Valley and on the reservation. Twenty were used for cesium-137 studies. (Homer Pickens)

Findley, James S. The Natural History of New Mexican Mammals, New Mexico Natural History Series, University of New Mexico Press 1987
Los Alamos National Laboratory, Threatened and Endangered Species Habitat Management Plan, Los Alamos National Laboratory Publication, LA-LP-98-112 (1998).
Allen, Craig "Changes in the Landscape of the Jemez Mountains, New Mexico", DissertationUniversity of California Berkeley, (1989)
Travis, Jim "Atlas of Breeding Birds of Los Alamos County, New Mexico, Pajarito Ornithological SurveyLos Alamos National Laboratory Publication, LA-12206 (1992)
Foxx, T. S., T. K. Haarmann, D. C. Keller "Amphibians and Reptiles of Los Alamos County, New MexicoLos Alamos National Laboratory Publication, LA-13626-MS (1999).
Pickens, Homer *Foot Prints Across New Mexico*

APPENDIX III Table 2: Animal Resources on the Pajarito Plateau and Jemez Mountains

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Fish									
Osteichthyes									
	Teleost sp.							Bones of various fish were found	
Amphibia									
Frog	*Anuran*						Reported; various frog species reported for area	x	
Reptilia									
Garter snake	*Thamnophis*						Reported	Common along Rio Grande	
Gopher snake	*Pituophis melanoleucus*						Reported	Living in ruins	
Lizard							Various lizard species reported for area. Largest is collared lizard.	Species unknown	
Turtles	*Chrysemys picta*								
Western diamondback	*Crotalus anade*			x rattlesnake			Reported	Common along Rio Grande	
Insecta									
Ant				x					
Spider				x					
Mammals									
Artiodactyla									
Bovidae									
Pronghorn	*Antilocapra anadensi*	Once ranged into area		x			Not reported: widespread in grasslands of New Mexico		x
Bighorn or mountain sheep	*Ovis anadensis*	Bandelier reports saw last one in 1880					Extinct in this area of New Mexico		charred specimen

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Mammals (cont.)									
Bison	*Bison bison*			x			Extinct: Grazing animals in open grasslands		
Domestic cow	*Bos taurus*						Introduced by Spanish	Material collected near surface so assumed to be cow not bison; trespass cattle were along river.	
Domestic goat	*Capra hircus*						Introduced by Spanish; extensive grazing in Española Valley in 1800s (Dorman)	x	
Domestic sheep	*Ovis aries*						Introduced by Spanish	Brought in by Spanish; corral was in the area.	
Cervidae									
Elk	*Cervus canadensis*	Elk were extirpated by 1814					Reported; grazer and feeder on grass and in mountain meadows; migrate to lower elevations in winter.	x	

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Mammals (cont.)									
Mule deer	*Odocoileus hemionus*	Deer products were used	x	x		San Ildefonso; Santa Clara; Isleta; Pecos; Zia; San Felipe; Zuni	Reported; browsers that feed on shrubs; seasonal differences result from seasonal availability of shrubs	Early in the 20th century deer was quite uncommon in the Southwest. Deer herds gradually increased after 1924 (Findley 1987). In the 1960s overpopulation of deer resulted in capture and transport of deer to other areas (Pickens)	charred specimen; bone tools
Rodentia									
Mustelidae									
Rocky Mountain marten				x		San Juan	Not reported; eat squirrels, live in forests. Fur was once a commercial item because of softness and thickness		
Beaver	*Castor canadensis*	Hunted and used for food	x				Not reported; seen along Rio Grande	No signs of human use.	
Striped skunk	*Mephitis mephitis*	Skins used for ceremonial purposes.			x		Reported; omnivorous, consuming small insects, small vertebrates, and plant material; solitary animals		Charred specimens

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Mammals (cont.)									
Otter	*Lutra canadensis*	Fragments of skin used					Not reported; mostly in southern NM, some historic reports in Rio Grande Valley		
Geomyidae									
Gopher, Mexican pocket	*Cratogeomys castenops*						Not reported	x	
Gopher, pocket	*Thomomys bottae*						Reported; live in burrows in soils where tunnels can be dug	x	x
Cricetidae									
Mouse, deer	*Peromyscus* sp.			x (mice)			Reported; a common mammal	5 species found: *P. truei, P. maniculatus, P. boylii, P. difficilis,* and *P. leucopis*	
Heteromyidae									
Mouse, pocket	*Perognathus* sp.						Reported; mice live in arid areas, sandy and gravelly soils and found as high as the PJ	x	
Erethizontidae									
Porcupine	*Erethizon dorsatum*						Reported; vegetarians that live in single trees		charred specimen
Geomyidae									
Prairie dog	*Cynomys gunnisoni*						Reported; found in Valle Grande but not on plateau; form colonies		Charred specimens

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Mammals (cont.)									
Sciuridae									
Squirrel, Abert's	*Sciurus aberti*	Used for food					Reported; found in ponderosa pine forests: hunted for food but seldom plentiful enough to make squirrel hunting an important sport in New Mexico	x	x
Squirrel, Golden mantel	*Spermophilus lateralis*						Reported; prefer meadows and forested edges where herbaceous vegetation plentiful		x
Squirrel, ground	*Spermophilus spilosoma*	Flesh eaten, pelts not used					Reported		x
Squirrel, rock	*Spermophilus variegatus*						Reported	Third most common species in collection. Most larger bones broken; few showed evidence of burning.	x
Vole, meadow	*Microtus* spp.						Reported; Open grassy places in montane forests and marshy locations at lower elevation.		
Woodrat	*Neotoma albigula*						Reported; builds nests and accumulates material sometimes called "trade rat;" may have 10 per acre	x	Charred specimens
Felidae									

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Mammals (cont.)									
Rocky Mountain Cougar		Carved figures at Stone Lions shrine			x	San Juan, San Ildfonso, Nambe, Isleta, Laguna, Pecos, Zia, San Felipe, Cochiti	Reported; chief prey is large mammals, range may be up to 25 sq miles		
Carnivora									
Ursidae									
Bear	*Urus americanus*			x			Reported; forested area, solitary foragers, omnivorous, hibernate	x	Charred specimen
Canidae									
Coyote	*Canis*			x		San Juan, San Ildefonso, Tesuque, Jemez, Pecos, Laguna, Zia, San Felipe, Santa Ana, Cochiti, Zuni.	Reported; probably more common than when Europeans came; mainly carnivorous	dog or coyote	Charred specimen; dog or coyote
Fox, gray	*Urocyon cinereoargenteus*						Reported; broken country and woodlands; live in family units; omnivorous; widespread and common	Fox fur used for ornamentation by modern pueblo	
Fox, kit	*Vulpes macrotis*						Not reported; desert foxes that live in open country, deserts, and grasslands primarily in southeast New Mexico		x
Wolf	*Canis lupus*					Isleta, Laguna	Extinct		

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Mammals (cont.)									
Procyonidae									
Raccoon	*Procyon lotor*						Reported; widespread, nocturnal; home ranges 3 km in diameter	x	charred specimen
Ringtail	*Brasariscus astutus*						Reported; inhabit rocky or broken country, widespread, foraging area 140 hectares, dens in rocky areas	Foraging range of species	
Lagomorpha									
Leporidae									
Desert cottontail	*Sylvilagus auduboni*						Reported; found in the PJ woodland, deserts, and grassland; Mountain cottontail (*S. nuttalli*) has been reported from the Jemez		charred specimens
Jack rabbit	*Lepus californicus*					x	Not reported; Common in NM and seen everywhere except high mountains; may be in ponderosa pine but like treeless habitats	bone awl from jackrabbit; larger limb bones broken or burnt, more tubular bones showed signs of cutting	charred specimens
Birds									
Barn owl	*Tyto alba*							Owl feathers have been used for decorative purposes	

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Birds (cont.)									
Blue grouse	*Dendragapus obscurus*								
Canada goose	*Branta canadensis*							Common migrant along Rio Grande	
Cooper's hawk	*Accipiter cooperi*							Common on plateau	
Coot	*Fulica americana*							Common along Rio Grande	
Ducks	*Anas* sp.							Many bones were burnt	
Eared grebe	*Podiceps caspicus*							Common migrant along Rio Grande	
Goldfinch	*Spinus* sp.							x	
Hawks	*Buteo* sp.							Common on plateau	
Magpie, black-billed	*Pica pica*							x	
Mourning dove	*Zenaidura macroura*							x	
Northern flicker	*Colptes auratus*			x (woodpecker)				Many tribes use the red and yellow feathers of the flicker for ornamentation.	
Peregrine falcon	*Falco peregrinus*							Common on plateau	
Pinyon jay	*Cymnorhinus cyanocephalus*							x	
Prairie falcon	*Falco mexicanus*							Common on plateau	
Raven	*Corvus corax*			x (crows)				x	
Scaled quail	*Callipepla squamata*							x	

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Birds (cont.)									
Screech owl	*Otus asio*							x	
Sharp-shinned Hawk	*Accipiter straiatus*							Common on plateau	
Snow goose	*Chen hypeerborea*							Common migrant along Rio Grande	
Thrush	*Hylocichla* sp.							x	
Towhee	*Pipio* sp.							x	
Turkey	*Meleagris gallopavo*					Pecos, Laguna, Acoma, Zia, San Felipe, Santa Ana, Cochiti, Zuni.		Bone tubes and whistle made from turkey LA12119; Many bones charred, long bones showed cutting	awls and burned specimens
Yellowheaded blackbird			x	x					
Dove						Zia, San Felipe, Santa Ana			
Hawk						San Ildefonso			
Bald eagle, golden eagle	*Haliaeetus leucocephalus; Aquila chrysaetos*			x		San Juan, Santa Clara, Tesuque, San Ildefonso, Nambe, Isleta, Jemez, Pecos, Laguna, Acoma, Zia, San Felipe, Santa Ana, Cochiti, Zuni			
Roadrunner	*Geococcyx californianus*					Laguna, Acoma, Zia, San Felipe, Zuni			
Hummingbird						San Felipe			
Magpie, black-billed	*Pica hudsonia*			x					

Appendix III, Table 2 (cont.)

Group	Scientific Name	Use reported in Henderson and Harrington (1)	Food (1)	Mythology and storytelling (1, 2)	Clothing (1)	Clan (1)	Reporting in Recent Checklists (Biggs et al., Foxx et al.)	Guthrie; Bandelier Floodpool Sites (3)	Bandelier Archaeological Survey (4, 5)
Birds (cont.)									
Bluebird	*Sialia spp.*					San Ildefonso			
Crow	*Corvus spp.*					Jemez, Pecos, Zia, San Felipe			

(1) Henderson, J., and J. P. Harrington, Ethnozoology of the Tewa Indians. Bureau of American Ethnology, Bulletin 56, (1914); (2) Lummis, C. L. Pueblo Indian Folk-Stories, University of Nebraska Press, 1992; Edited by Lyndi Hubbell and Diane Traylor, Submitted by National Park Service, Southwest Cultural Resources Center; (3) Guthrie, D. "Faunal Remains" IN Bandelier Excavations in the Flood pool of Cochiti Lake, New Mexico; (4) Trierweiler, W. N. "Faunal Resources and Their Caloric Yields" IN Bandelier Archaeological Project: Archaeological Services Division, National Park Service, Denver, CO, 1982. Summer 1989 Excavations at Burnt Mesa Pueblo, 1990; (5) Trierweiler, W. N. "Faunal Analysis" IN Bandelier Archaeological Project, Summer 1990 Excavations at Burnt Mesa Pueblo and Casa del Rito

APPENDIX IV

PLANT RESOURCES USED BY PREHISTORIC PEOPLES: PAJARITO PLATEAU AND JEMEZ MOUNTAINS

FOOD USE INDICATED BY MACROBOTANICAL REMAINS FROM SELECTED SITES

Appendix IV, Table 1. Plant Resources Used by Prehistoric Peoples: Pajarito Plateau and Jemez Mountains*

Scientific Name	Common Name	Occurrence	Spring	Summer	Fall	Habitat	MC	PIPO	PJ	JS	B	D	W
Euphorbia spp.	thymeleaf spurge	common	spring	summer	fall	annual			x	x	x		
Juniperus communis	dwarf juniper	common	spring			shrub	x	x					
Lepidium sp.	peppergrass	common	spring	summer-mid		annual		x	x				
Mentha arvensis	field mint	common		summer-early	fall	perennial	x	x	x				x
Opuntia sp.	prickly pear cactus	common	spring	summer-early		perennial		x	x	x			
Penstemon barbatus	scarlet penstemon	common		summer-late		perennial		x	x		x		
Poa fendleriana	muttongrass	common	spring	summer-early		perennial	x	x					
Ribes cernuum	wild currant	common	spring			shrub		x	x				
Robinia neomexicana	New Mexico locust	common	spring	summer-early		shrub	x	x	x				
Rubus parviflorus	western thimbleberry	common	spring	summer-mid		shrub	x	x					
Vicia americana	American vetch	common	spring			perennial	x	x	x				
Yucca baccata	banana yucca	common	spring			perennial		x	x				
Pinus ponderosa	ponderosa pine	dominant in pine	spring			tree	x	x					
Monarda menthaefolia	bee-balm	locally		summer-mid	fall	Perennial	x	x	x	x			x
Cyperus aristatus	flatsedge	locally abundant				Perennial		x	x				x
Amaranthus graezans	prostrate pigweed	locally common		summer late	fall	Annual		x	x		x		
Amaranthus retroflexus	green pigweed	locally common		summer late	fall	Annual		x	x				x
Asclepias spp.		locally common	spring			perennial		x	x	x			
Berberis fendleri	Colorado barberry	locally common		summer-early		shrub	x	x			x		
Ceanothus fendleri	buckbrush	locally common		summer-early		shrub		x			x		
Chenopodium album	goosefoot	locally common		summer-mid		annual		x	x	x	x		
Chenopodium leptophyllum	goosefoot	locally common		summer-mid		annual		x	x		x		
Equisetum laevigatum	smooth horsetail	locally common				perennial		x	x	x			x
Fragaria americana	wild strawberry	locally common		summer-early/late		perennial	x	x					x
Machaeranthera spp.	purple aster	locally common		summer-late	fall	annual or biennial		x	x				
Petolostemum candidum	white prairie clover	locally common		summer-late		perennial		x	x	x			
Portulaca oleracea	common purslane	locally common		summer-mid		annual	x	x	x	x			
Prunus americana	wild plum	locally common		summer-mid/late		shrub		x	x				x
Prunus virginiana	chokecherry	locally common	spring			shrub		x	x				x
Ranunculus inamoenus	buttercup	locally common		summer-early		perennial		x	x	x			x
Rubus strigosus	raspberry	locally common	summer-mid			shrub	x	x					
Rumex crispus	curlyleaf dock	locally common	spring			perennial	x	x	x				x
Smilacina racemosa	false solomonseal	locally common	spring			perennial	x	x					
Stipa spp.	needlegrass	locally common		summer-early		perennial		x	x				
Typha latifolia	broadleaf cattail	locally common	spring			perennial		x	x				
Vitus arizonica	canyon grape	locally common	spring			vine		x	x	x			
Amelanchier spp.	service berry	not common		summer early		shrub		x	x				

Appendix IV, Table 1. (cont.)

Scientific Name	Common Name	Occurrence	Spring	Summer	Fall	Habitat	MC	PIPO	PJ	JS	B	D	W
Habenaria sparsiflora	bog orchid	not common		summer-mid		perennial	x	x					
Juniperus scopulorum	Rocky Mountain juniper	not common	spring-early			tree	x	x					
Minulus glabratus	monkeyflower	not common	spring			perennial		x	x	x			x
Parthenocissus inserta	wester five-leaf ivy	not common	spring			vine		x	x				x
Philadelphus microphyllus	mock-orange	not common		summer-late		shrub	x	x	x				
Psoralea lanceolata	lemon scurfpea	not common	spring			perennial		x	x				
Ptelea trifoliata	hoptree	not common	spring			tree/shrub		x	x	x			
Ribes inebrians	wild currant	not common	spring			shrub	x	x					
Ribes inerme	gooseberry	not common	spring			shrub	x	x					
Rumex mexicanus	wild dock	not common		summer-early		perennial		x	x				x
Solanum jamesii	wild potato	not common		summer-mid	fall	perennial		x	x				
Solanum triflorum	cutleaf nightshade	not common		summer-mid		annual		x	x				
Sphaeralcea spp.	globemallow	not common		summer-early/mid		perennial	x	x	x				
Thelypodium wrightii	Wright's mustard	not common		summer-late		perennial		x	x	x			
Achillea lanulosa	yarrow	ubiquitous	summer-fall	summer	fall	perennial	x	x			x		x
Allium cernuum	wild onion	ubiquitous		summer		perennial	x	x			x		
Helianthus annuus	annual sunflower	ubiquitous		summer-early/late		annual	x	x	x				
Pseudocymopterus montanus	mountain parsley	ubiquitous		summer-early		perennial	x	x	x				
Quercus gambellii	Gambel oak	ubiquitous	spring			shrub	x	x	x				
Taraxicum officinale	common dandelion	ubiquitous	spring	summer		perennial	x	x	x				x

* MC = mixed conifer forest, PIPO = ponderosa pine forest, PJ = piñon-juniper woodland, JS = juniper savannah, B = bare ground, D = developed, and W = water

Appendix IV, Table 2. Macrobotanical Taxa Identified in Archaeological Sites

Common Name	***Scientific Name***	**Matthews**	**Foxx**
Pigweed	*Amaranthus*	x	x
Saltbush	*Atriplex canescans*	x	
Cheno-Ams	*Chenopodium/Amaranthus*	x	x
Hedgehog cactus	*Echoncerus*	x	
Spurge	*Euphorbia*	x	
Juniper	*Juniperus* sp.	x	
Wild tobacco	*Nicotiana* cf. *attenuata*	x	
Common bean	*Phaseolus vulgaris*	x	x
Ground cherry	*Physalis*	x	
Pine	*Pinus*		
Pinon	*Pinus edulis*	x	x
Ponderosa pine	*Pinus ponderosa*	x	
Cottonwood/willow	*Populus/Salix*	x	
Purslane	*Portulaca* sp.	x	x
Oak	*Quercus* sp.	x	x
Lemonadeberry	*Rhus trilobata*	x	
Yucca	*Yucca* spp.	x	
Corn	*Zea mays*	x	x
Hackberry	*Celtis reticulata*		x
Walking Stick Cholla	*Opuntia imbricata*		x
Prickly Pear	*Opuntia* sp.		x
Chokecherry?	*Prunus* sp.	x	x
	Astragalus		x
Russian olive	*Eleaegnus angustifolia*		x
Coyote melon	*Cucurbita foetidissima*		x
Wormwood	*Artemisia* sp.	x	
Rocky Mountain beeweed	*Cleome*	x	
Rabbitbrush	*Chrysothamnus* sp.	x	
Dropseed	*Sporobolus*	x	

Matthews, Meredith H. "Macrobotanical Analysis" IN Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo. Edited by Timothy A. Kohler. WSU Department of Anthropology Reports of Investigations 62.

Matthews, Meredith H. "Macrobotanical Analysis" IN Bandelier Archaeological Excavation Project: Summer 1990 Excavations at Burnt Mesa Pueblo and Casa del Rito. Edited by Timothy A. Kohler and Matthew J. Root. WSU Department of Anthropology Reports of Investigations 64.

Foxx, Teralene S. "Vegetative Study" IN Bandelier Excavations in the Flood Pool of Cochiti Lake, New Mexico. Edited by Lyndi Hubbell and Diane Traylor, National Park Service, Southwest Cultural Resources Center, Interagency Archaeological Services Division, National Park Service, Denver, Colorado.

APPENDIX V

PLANT RESOURCES USED BY HISPANIC COLONISTS

AND

PLANTS OF GARDENS AND HOMESTEADS: DESCENDENT INTERVIEWS

Appendix V, Table 1. Native and Introduced Plants Used by Spanish Pioneers

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
Abronia fragrans	sand verbena	lechuguilla		x						
Actaea arguta	baneberry	yerba del peco		x						poisonous plant
Achillea lanulosa	yarrow	plumajillo		x						
Allium cernuum (recurvatum)	wild onion	cebollita del campo	x							
Aulospermum purpureaum	parsley family	chimaja	x	x						
Amaranthus blitoides	pigweed	chile puerco	x					sunburn	x	to fatten pigs
Amaranthus graezans										
*Amaranthus hybridus**										
Amaranthus paniculatus	red cockscomb	alegria		x				x		brought in by the Spanish
Amaranthus powellii	pigweed	quelites yus, quelites colorado yus	spring greens							
Amaranthus retroflexus										
Apocynum cannabinum	dogbane	lechuguilla		x						
Argemone hispida	thistle poppy, prickly poppy	cardo santo		x						
Archtostaphylos uva-ursi	bearberry	corilillo		x				tobacco		
Artemisia filifolia	silver sage	romerillo		x						
Artemisia franseriodes	wormwood	altamisa de la sierra		x						
Artemisia mexicana	wormwood	estafiate		x						
Artemisia redolens	wormwood	anisote		x						
Artemisia tridentata	big sagebrush	chamiso hediondo		x						
Asclepia asperula										
Asclepiodora decumbens	antelope horns	inmortal		x						
Asclepias involucrata (speciosa)	milkweed	lecheros	greens	x						
Atriplex canescens	four-wing saltbush	chamiso							x	
Bahia dissecta										
Baileya multiradiata										
Berberis fendleri (fremontii)	Fremon'ts barberry	palo marillo		x						
Berberis repens	Oregon grape	yerba de la sangre		x						

Appendix V, Table 1. (cont.)

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
Brassica mapestris	yellow field mustard	mostaza		x						
Cannabis sativa	mariguana	marihuana		narcotic						
Capsicum frutescens longum	chili	chile	x	x						from the Aztecs
Carthamus tictorius	saffron	azafran	flavoring	x	dye			x		
Castilleja integra	Indian paintbrush	flor de Santa Rita		x	dye					
Cenchrus pauciflorus	sand bur			x						noxious weed in alfalfa
Cercocarpus montanus	mountain mahogany	palo duro			dye	x				
Chenopodium album	lamb's quarters	quelite salado, quelites salados		greens						
Chenopodium ambrosioides	wormwood	pazote, hipazote, epazote de comer		x						
Chrysothamnus graveolens	rabbitbrush	chamiso cimarron, chamiso blanco		x	dye					
Chrysanthemum parthenium	feverfew	altamisa Mexicana								
Cirsium undulatum	thistle	cardo santo		x						
Cleome serrulata	Rocky Mountain beeweed	guaco	x	x						
Coriandrum sativum	coriander	culantro, cilantro	seasoning	x						from southern Europe
Croton texensis	croton	barbasco		x		x				
Cucurbita foetidissima	coyote melon	calabazilla		x	tanning					
Dalea formosa	dalea	yerba de alonso garcia		x						
Datura metelodes	thorn apple, jimson weed	toloache		narcotic						
Dyssodia papposa	fetid marigold	pague		x						
Echinocerus spp.		pitajaya	x							
Ephedra spp.	Mormon tea	canutilo del campo	tea	x						
Equisetum laevigatum (hiemale)	scouring rush	canutillo del llano		x			scouring pad			children made whistles
Erigeron canadensis	fleabane	pazotillo						x		
Erigeron flagellaris		zarzilla		x						

Appendix V, Table 1. (cont.)

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
Eriogonum racemosum	buckwheat	colita de rata, colita de raton					cleaning teeth			
Erodium cicutarium	alfileria, storksbill	alfilerillo		x					x	introduced from southern Europe
Erysiumum capitatum (elatum)	wallflower	yerba del Apache		x						
Eupatorium herbaceum (arizonicum)	throughwort	mata		x				smoking		
Euphorbia serpyllifolia	spurge	yerba de la golondrina		x						
Fallugia paradoxa	Apache plume	ponil		x						
Fransera speciosa	deer's ears	cebadilla, cebadilla de la sierra		x		x				
Franseria acanthicarpa (tenuifolia)		yerba del sapo		x						
Gaura coccinea	scarlet guara	yerba de la virgen		x						
Geranium caepistosum (atropurpureum)	wild geranium	patita de leon		x						
Gaillardia pinnatifida	blanketflower	yerba del sol		x						
Glycyrrhiza lepidota	wild licorice	amolillo		child-birth						closely related Old World licorice
Grindelia aphanactis	gumweed	yerba del buey		x						
Gutierrezia sarothrae	snakeweed	escoba de la vibora; yerba de la vibora collalle		x						
Hedeoma nana (oblongifolia)	pennyroyal	poleo chino		x						
Helenium hoopseii	sneezeweed	yerba del lobo		x child-birth						
Helianthus annus	annual sunflower	anil, mirasol, girasol	x	x	dyes					known to be used by Canadian Indians (1636); Lewis and Clark found many groups using seed.
Heracleum lanatum	cow parsnip	yerba del oso		x						
Humulus lupulus	wild hop	zarza, zarzaparilla	drink	x						
Hymenoxys richardsonii	bitterweed	pinhue, pinque	chewing							
Juniperus communis	common juniper	sabina macho, pino macho		x						

Appendix V, Table 1. (cont.)

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
Juniperus deppeana										
Juniperus monosperma	one-seed juniper	almaciga de sabina	chewing gum	x						
Juniperus scopulorum										
Juniperus spp.	juniper bark			x						
Lepidium sp.	peppergrass								x med	
Ligusticum porteri		osha		x						
Linum lewsii	wild flax	linasa		x						
Lupinus aduncus	lupine			x						
Lycium pallidum	tomatillo	chico	x							recorded by Fremont (1844)
Kallostroemia brachystylis	caltrop	contrayerba		x						
Malva parviflora	mallow	malva		x						indicator for hard-pan and clay
Marrubium vulgare	horehound	marrubio	tea	x						
Medicago sativa	alfalfa	alfalfa				bedbugs			x	livestock feed
Melilotus alba						bedbugs	sweetens linens		x	
Mentha spp.	pennyroyal	poleo	tea	x						
Mentha arvensis										
Mentha spicata	spearmint	yerbabuena	tea	x						
Mentzelia multiflora		pegagega			adhesive					
Mimulus glabratus										
Mirabilis multiflora	showy four o'clock	maravilla		x						
Monarda menthaefolia	beebalm	oregano, orgeano de la sierra	seasoning	x						
Monarda pectinata	horsemint	oregano del campo	seasoning	x						
Nicotiana attenuata (torreyana)	tobacco	punche		x				smoking		
Opuntia imbricata	cane cholla, walkingstick cactus	entrana		x				canes, hair	x	feed livestock bad years
Opuntia sp.	prickly pear		x	x					x	feed livestock bad years
Oxalis violacea	wood sorrell	socoyol		x						
Oxytropis lambertii	rattleweed	frijolillo								poisonous to livestock

Appendix V, Table 1. (cont.)

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
Pectis angustifolia		limoncillo		x						
Pectis papposa										
Penstemon barbatus										
Penstemon torreyi	scarlet bugler	varas de San Jose, varitas de San Jose		x						
Pericome imarro	pericome	yerba del chivato		x						
Phacelia corrugata										
Phoradendron juniperimum	juniper mistletoe	bellota de imarr	berries	x						
Phragmites communis										
Prunus melanocarpa	chokecherry	capulin	x	x						
Physalis foetens (neomexicana)	ground cherry	tomate del campo		x						
Pinus spp.	Pine	ocote, palo de ocote		x			firewood			
Pinus edulis	piñon pine		x	x			firewood			
Pinus ponderosa	yellow pine	pino real imarron		x			firewood			
Plantago major	common plantain	lanten		x						
Populus angustifolia	narrowleaf cottonwood	imar sauco		x						
Populus fremontii (wislinzi)	valley cottonwood	imar de hoja redonda	x	x			x			used for setting bone fractures
Quercus gambellii	Gambel oak	encinillo		x	dyes				x	fattening hogs
Radicula nasturtium	watercress	berro	x	x						
Rhus trilobata	lemonade berry	lemita		x				hair		
Rhus toxicodendron	poison ivy	yedra								poisonous plant
Rosa woodsii (fendleri)	wild rose	rosa imarron, rosa del campo		x						
Rudbeckia lacinata	cutleaf coneflower	dormilon		x						
Rudbeckia tagetes	coneflower	dormilon		x						
Rumex crispus	dock	lengua de vaca	x	x						
Salvia reflexa		chan	x	x		x				
Sambucus sp.	Elderberry	flor de sauz, capulin silvestre		x						
Sedum spp.	Stonecrop	siempreviva		x						

Appendix V, Table 1. (cont.)

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
Sponaria officinalis	bouncing bet	clavelina, clavellina		x			soap			
Senecio filifolius	groundsel	yerba del caballo		lx						
Smilacina racemosa										
Solanum elaeagnifolum	bull nettle	tomatillo del campo, tomatito pelon	curdling milk	x						
Solanum jamesii	wild potato		x							
Solanum nigrum	black nightshade	tomatito	x							
Solanum triflorum										
Solidago canadensis	godenrod	mariquilla		x	dye					
Sphaeralcea spp.	globe mallow	yerba del negro		x						
Taraxicum officinale	dandelion	chicoria	x	x	dye					
Thalictrum fendleri	meadow rue	ruda de la sierra, ruda cimarron		x						
Thelesperma megapotamicum	wild tea	cota te sivestre	tea	x	dye					
Typha latifolia	cattail	aguapa			baskets					
Verbascum thapsus	mullein	punchon, tobaco cimarron		x						
Verbena macdougalii	verbena	vervena dormilon		x						
Verbena ambrosiafolia	verbena	moradilla		x						
Verbesina encelioides	crownbeard	anil del muerto		x						
Xanthium commune	cocklebur	cadillos		x						troublesome weed; Dodoens (1578) reported use for venomous snakes
Xanthium stumarium										
Yucca spp.	Spanish dagger		x	x	x		needles	hair		
				INTRODUCED PLANTS						
	garlic	ajo	x	x						
	apricot	albaricoque, hueso de	x	x						
	gourd	calabacita	x							both seeds and meat eaten
Allium cepa	onion	cebolla	x	x						
Prunus persica	peach	durazno	x	x						

Appendix V, Table 1. (cont.)

Scientific Name	Common Name	Spanish Name	Food	Med	Weaving	Bug repellant	Household	Personal care	Animals	
				INTRODUCED PLANTS (CONT.)						
Phaseolus vulgaris	pinto beans	frijoles	x	x						
	iris	lirio		x						
Zea mays	corn	maiz	x	x						
Rosa spp.	garden rose	rosa de castilla								introduced by Spanish colonists
Triticum aestivum	wheat	trigo	x							introduced by Spanish colonists

Curtin, L.S.M. Healing Herbs of the Upper Rio Grande. Los Angeles: S. W. Museum (1947)

Appendix V, Table 2. Garden and Field Plants Used by the Homesteader: Descendent Interviews

Evelyn Frey's List of Native Plants in Frijoles Canyon				
piñon	cedar	squawtree	black alder	black walnut
wild grape	gooseberries	currants	oak	cottonwood
datura	strawberries	raspberries		
Evelyn Frey's List of Cultivated Plants in Frijoles Canyon				
wild plums	nectarines	apples	banana apples	sugar pears
weeping willow	English black walnut	irises	mint	cabbage
peaches	lilies	redwood trees		
Montaño-Olivas List of Flowers, Fruits, Vegetables				
roses	baby's breath	violets	gladiolas	asters
tulips	delphiniums	petunias	pansies	hyacinths
calendulas	lilacs	snapdragons	irises	zinnias
daisies	dahlias	flax	marigolds	sweet William
larkspur	bachelor buttons	sweet peas	carnations	tritoma
Oriental poppies	shasta poppies	chrysanthemums	peonies	hollyhocks
cannas	gladiolas	red hot pokers	cherries	carrots
mushrooms	dill	head lettuce	zucchini squash	Swiss chard
popcorn	cabbage	mustard greens	green beans	apricots
cucumber	bell pepper	havas (horse beans)	green squash	celery
okra	leeks	celeriac	broccoli	garlic
strawberries	pumpkins	parsley	pears	turnips
scallopini squash	peas	eggplant	parsnips	English peas
asparagus	cauliflower	spinach	corn	raspberries
rutabagas	red onions	apples	yellow hots	tomatoes
beets	pinto beans	radishes	Brussels sprouts	shallots
leaf lettuce	yellow squash	white onions	chives	gooseberries
green onions	rhubarb			

APPENDIX VI

HOMESTEAD INFORMATION

COMPARISON OF POPULATION CHARACTERISTICS 1980 VS 1990

These lists of the homesteads of the Los Alamos area were copied from patent papers on file with the Bureau of Land Management, Santa Fe, New Mexico.

Appendix VI, Table 1 (Part 1)

Patent Holder	Certificate Number	Application Number	Size of Homestead (ac)	Date Patent was Filed
Juan Lufo Garcia	1793	2727	160	6/13/1892
Benigno Quintana	2090	4050	120	9/11/1894
Juan N. Gonzales	2071	4112	120	9/11/1894
Pedro Gomez y Gonzales	2442	4093	120	10/4/1898
James S. Loomis	1920	--	163.85	5/8/1901
David Romero	2781	4106	160	7/20/1901
Severo Gonzales	1999	--	158.31	2/7/1902
William E. Moses	2559	--	40	6/31/1903
Efmen Gonzales de Duran (widow of Juan Ignacio Duran)	3285	--	160	6/14/1904
Miguel Sanchez	3350	--	160	9/28/1904
Donaciano Gomez	3455	--	160	4/18/1905
William C. White	3459	--	160	4/18/1905

Appendix VI, Table 1 (Part 2)

Patent Holder	Patent Number	Size of Homestead (ac)	Date Patent was Filed
David Quintana	351630	97.5	8/20/1913
David Quintana	351634	52.5	8/20/1913
Harold H. Brook	389938	130	3/6/1914
William M. Hopper	389939	130	3/6/1914
Harold H. Brook	389940	20	3/6/1914
Federico Gonzales	582454	57.5	5/4/1914
Robert G. McDougall	413859	107.5	6/15/1914
Jose Albino Montoya	479145	90	6/21/1915
Estanislado Gonzales	514423	140	2/18/1916
Victor Romero	541208	15	8/4/1916
Elisso M. Vigil	553805	62.5	11/10/1916
Martin Lujan	636672	160	6/17/1918
Francisco Gonzales	706489	22.5	9/15/1919
Roman Martinez	714008	30	10/21/1919
Martha A. Brook	721732	150	11/28/1919
Fermin M. Vigil	762236	60.31	7/16/1920
Andres Martinez	762235	62.25	7/16/1920
Donaciano Gonzales	773942	12.5	9/20/1920
Noberto Roybal	780148	125	11/4/1920
Iocadio Archuleta	--	52.5	4/1/1921
Federico Gonzales	862923	15	5/19/1922
Ramon Duran	876162	10	8/15/1922
A. J. Connel*	1043435	40	1/21/1931
Juan N. Gonzales*	1118944	120	9/6/1944
Jose I. Garcia	876161	35.53	8/15/1922
Hipolita de Archuleta	878099	56.74	12/4/1922
Ezequiel Garcia	889406	42.5	12/4/1922

Appendix VI, Table 1 (Part 2; cont.)

Patent Holder	Patent Number	Size of Homestead (ac)	Date Patent was Filed
Adolfo Garcia	949507	55	12/8/1924
Adolfo Garcia	1065411	4.5	--
Ezequiel Garcia	1095524	14.98	2/11/1938

* A. J. Connel relinquished a tract to the Forest Service "being the owner of a certain tract of land situated and included within the limits of the Santa Fe National Forest." The land was traded for this parcel of record. Juan J. Gonzales was reissued a patent because the original patent contained an inaccurate description.

Appendix VI, Table 2 Population Summary, Los Alamos County

	1980	1990	% Change
Total Population	17,599	18,115	2.9
Age of Persons			
Under 5 years	1,115	1,132	1.5
5 to 17 years	4,466	3,585	-19.7
18 to 64 years	11,296	11,730	3.8
65 years and over	722	1,668	131.0
18 years and over	12,018	13,398	11.5
16 years and over	12,860	13,969	8.6
Median age	33.0	37.8	14.5
Sex of Persons, Male	9,019	9,182	1.8
Female	8,580	8,933	4.1
Race and Ethnicity of Persons, White	16,727	17,064	2.0
Black	73	96	31.5
American Indian, Eskimo, or Aleut	99	126	27.3
Asian or Pacific Islander	191	428	--
Other race	509	401	--
Hispanic	2,022	2,008	-0.7
Non-Hispanic	15,577	16,107	3.4
White	15,151	15,467	2.1
Total Minority	2,448	2,648	8.2
Marital Status, Persons 15 years and older	13,269	14,241	7.3
Never married	2,638	2,579	-2.2
Married	9,376	9,829	4.8
Separated	126	165	31.0
Widowed	348	511	46.8
Divorced	781	1,157	48.1
Household Summary, Persons in households	17,597	18,044	2.5
Persons in group quarters	2	71	3,450
Households	6,283	7,213	14.8
Families	5,000	5,318	6.4
Married-couples families	4,616	4,807	4.1
Families headed by a female, no husband present	269	364	35.3
Families headed by a male, no wife present	115	147	27.8
Nonfamilies	1,283	1,895	47.7
Persons per household	2.8	2.5	-10.7
Persons per family	3.21	2.96	-7.8
Household size, 1 person households	1,129	1,653	46.4
2 person households	2,043	2,749	34.6
3 person households	1,125	1,174	4.4
4 or more person households	1,986	1,637	-17.6

Appendix VI, Table 3. Housing Summary, Los Alamos County

	1980	1990	% Change
Total Housing Units	6,585	7,565	14.9
Housing units, tenure and vacancy			
Occupied	6,283	7,213	14.8
Owner	4,629	5,367	15.9
Renter	1,654	1,846	11.6
Vacant	302	352	16.6
For rent	124	101	-18.5
For sale only	80	42	-47.5
Other	98	209	113.3
Average number of rooms			
Owner-occupied housing units	6.6	6.7	1.6
Renter-occupied housing units	3.9	4.1	5.4
Occupied housing units by persons per room, 1 or less	6,124	7,065	15.4
1.01 to 1.5	73	82	12.3
1.51 or more	86	66	-23.3
Value, Specified owner-occupied units	3,775	4,432	17.4
Less than $15,000	10	4	-60.0
$15,000 to $49,999	345	54	-84.3
$50,000 to $99,999	2,551	1,195	-53.2
$100,000 to $149,999	721	1,704	136.3
$150,000 to $199,999	121	827	583.5
$200,000 or more	27	648	2,300.0
Median value	$77,200	$126,100	63.3
Average value	$84,410	$139,678	65.5
Contract rent, specified renter-occupied units	1,634	1,832	12.1
No cash rent	33	47	42.4
Less than $100	12	3	-75.0
$100 to $199	671	15	-97.8
$200 to $299	653	359	-45.0
$300 to $399	214	497	132.2
$400 to $499	39	450	1,053.8
$500 or more	12	461	3,741.7
Median contract rent	$216	$403	86.6
Average contract rent	$224	$432	93.2
Average rent asked, specified vacant-for-rent units	$222	$333	49.6
Average price asked, specified vacant-for-sale only units	$78,304	$123,819	58.1
Occupied housing units by type of structure, 1, detached	4,000	4,475	11.9
1, attached	218	745	241.7
2 to 4 units	1,075	738	-31.3
5 or more units	799	867	8.5
Mobile home or trailer	191	366	91.6
Other	0	22	--

APPENDIX VII

A CHRONOLOGY OF EVENTS ON THE PAJARITO PLATEAU AND JEMEZ MOUNTAINS

CHRONOLOGY

Date	Event
9500-6000 BC	Paleoindians roamed the Southwest in search of mammoths and are today known as the Clovis people.
500 BC	Cultivation of corn and squash transformed hunter-gatherer societies into agricultural societies.
900 AD	First peoples inhabiting Pajarito Plateau.
1100-1200 AD	Population of the region grew.
1500s	The drought forced some Tewa and Keres pueblos to be abandoned (Schroeder 1972:48). Drought conditions probably forced Jemez Pueblo to move to higher elevations (Schroeder 1968:298).
1591	Espejo's expedition exchanged iron and small bells for corn, tortillas, turkeys, pinoles, and buffalo robes at Cochiti (Riley 1987:238).
1591	(January 8) Castano de Sosa may have been the first European to reach the Santa Fe River. He described the event: "It was bitterly cold and snowing. When we emerged from the sierra we came to a river, frozen so hard that horses crossed on the ice without breaking through" (Hammond and Rey 1966:280).
1591	(early) Wood-burning "ovens" were noted by Castano de Sosa at San Ildefonso (Riley 1987:235).
1598	A Tewa Pueblo village above San Juan was destroyed by the flooding Rio Grande. The villagers moved a few miles south, but their village was once again devastated by flood. Once again they moved south, this time to high ground across the Rio Grande from the pueblo of Yunque, which allowed them to settle the new pueblo name Okeh. A few years later Oñate and his Spanish colonists established the first Spanish town in New Mexico at Yunque, and a few months later the Spaniards moved across the river to construct the new capital of San Gabriel (Ellis 1987:15-16).
1598-1602	Oñate recorded the presence of wild turkeys in the province and listed the following mammals for the regions: "buffalo, goats with hideous horns (bighorn sheep), lions, bears, wolves, tigers (jaguars), penicas, ferrets, porcupines, and other animals" (Bolton 1946:353).
1598	(post) A grass native to Eurasia, sheep fescue (*Festuca ovina*), may have been introduced to New Mexico via the fleece and droppings of domestic sheep brought by Oñate (deBuys 1985:225).
1600s	The Jicarilla Apache believed that the bighorn sheep were driven from their valley habitat into the mountains by guns of the Spaniards (Tiller 1992:22).
1600	Larger pueblos abandoned and pueblo peoples migrated to lower elevations.
1600	By this year, the Pueblo Indians living on the Pajarito Plateau abandoned their villages and fields and moved to lower elevations along the Rio Grande. This movement may have been due in part to the drought and cold snowy winters in the mid to late 15th century (Rothman 1989:191-192).
1600-01	The drought, in part, over these two years caused some of Oñate's colonists to desert San Gabriel and return to Mexico (Hammond and Rey 1953:60-61).
1600-1634	Spanish livestock herds nearly doubled every 15 months (Gutierrez 1991:57).
1610	Villagra, who accompanied Oñate's 1598 expedition, wrote, "The rivers abound with fish, turtles, eels, trout, and sardines. These exist in such quantities that a single Spaniard with a large bare hood was able to catch six arrobas (240 pounds) weight." (Espinosa 1936:34).
1626	(pre) Fray Alonso de Benavides recorded that the Tewa were experiencing famine due to insufficient irrigation water (Hodge et al. 1945:39, 69).

Date	Event
1630	Fray Benavides listed the following fish found in the Rio Grande Basin: bagre (blue catfish, *Ictalurus furcatus*), trucha (trout, *Salmo* spp.), yellow bullhead (*Ictalurus natalis*), anguila (eel, *Anguilla rostrata*), boqueinete (sucker *Moxostoma* sp.), sardina (Chub, *Notropis,* sp.), aguja (gar shovel-nose sturgeon, *Scaphirhynchus playtyrhynchus*), cazon (long-nose gar, Lepisosteus osseus), and matalote (Gila chub, *Gila intermedia*) (Ayer 1965:37, 261-262).
1694	(January) Vargas described Jemez Pueblo as on "a highet" and "in a good location" with "the necessary conveniences of pasture, water, and firewood" (Kessell et al. 1995:558).
1696	A famine impacted the Pueblo and Hispanic settlements. Various wild animals and plants, in the valleys and mountains, were commonly harvested and eaten (Twitchell 1963 v. 1 409).
1730s	(late) (to early 1742) Pedro Sanchez claimed that wolves attacked and bit his shepherds on the Ramon Vigil Grant and caused him to remove his sheep (Albright 1994:229).
1742	Viceroy don Gaspar Domingo de Mendoza granted the Vigil Grant to a former soldier named Pedro Sanchez.
1771-75	The annual crop harvest at San Ildefonso Pueblo was diminished due to infestations of "locusts" (Adams and Chavez 1956:71).
1782	King Charles III of Spain requested eight elk be captured in New Spain and shipped to the royal zoo in Madrid. This task fell on Governor Juan Bautista de Anza in Santa Fe, and the elk were capture in the nearby mountains and brought to pens behind the Governor's Palace, then sent south with the fall caravan to Mexico City. All but one of the eight animals reach Madrid safely (Simmonds 1969:41-44).
1797	Based on tree-ring evidence, a forest fire occurred on the Pajarito Plateau (Robinson 1990:142).
1800s	(early) A Tewa Pueblo Indian reportedly killed two buffalo near Santo Domingo Pueblo (Bailey 1971:13).
1800s	(early to mid) An elderly San Ildefonso man claimed to have hunted pronghorns near Rio Grande Canyon on the Pajarito Plateau (Henderson and Harrington 1914:15).
1800s	(late) All five races of southwestern wolves were extant in the state (Brown 1983:24-25).
1803	Elk, deer, bighorn sheep, buffalo, bears, mountain lions, wolves, foxes, and coyotes were reported as common in the region (Simmons 1991:168).
1807	(March 2) Zebulon Pike (Coues 1987, II:602-603) reported that Father Baptiste Lalande at San Juan Pueblo was "a great naturalist, or rather florist; he had large collections of flowers, plants, etc., and several works of his favorite studies, the margins and bottoms of which were filled with his notes in the Castilian language."
1807	(March) Pike described the Rio Grande in general: "It cannot …be termed a navigable stream, owing to sand-bars," and "In the mountains above Santa Fe it afforded amply sufficient water for canoe navigation, and even more than appeared to be flowing in its bed in the plains. This must be attributed to the numerous canals and dry sandy soil through which the river courses, where much of the water which flows from the mountains must be absorbed and lost" (Coues 1987, II 729-730).
1807	Elk were reported as common by Pike (Coues 1987, II:597).
1815	(fall) A French trapper wrote that the streams of northern New Mexico "abounded with beaver" (Weber 1971:46).
1815	Three Anglo Americans were trapping in the Sangre de Cristo Mountains in southern Colorado (Conner and Skaggs 1977:30).
1820-40	There were few or no fires over much of the regions during this period. This may have been due to generally wetter conditions and intensification of sheep grazing, which reduced fuel (Swetnam 1990:10).
1821	Three parties of Anglo traders came over the Santa Fe Trail, and members of these groups trapped beaver and other fur-bearing animals on the Rio Grande from below Santa Fe and north into the San Luis Valley (Hafen and Hafen 1993:93).
1822	Based on tree-ring data, a forest fire occurred on the Pajarito Plateau (Robinson 1990:142).
1822-24	The first area to be intensively trapped was the southern Sangre de Cristo Mountains between Santa Fe and Taos (deBuys 1985:93).
1822-26	Taos trappers virtually took all the beaver in the Sangre de Cristo and Jemez Mountains (Flores 1992:8).

Date	Event
1824	Some trappers took 1,500 pounds of beaver pelts from New Mexico (Weber 1971:84).
1824	Beaver populations in the Rio Grande and Pecos River basins were rapidly decreasing due to Anglo trapping (Weber 1965:65).
1826	A Santa Fe Trail caravan transported 2,044 pounds of beaver back east (Weber 1971:100).
1827	Anglo and Franco trappers virtually harvested all of the beaver in the Sangre de Cristo Range by this date (Ungnade 1972:48).
1828	Some 1,200 pounds of beaver pelts, valued at over $5,000, were shipped over the Santa Fe Trail (Weber 1971:175).
1830s	Fewer beaver were taken as a result of population reduction due to trapping and falling prices. Taking of buffalo robes increased due to demand and rising prices (Weber 1971:208-210, 215).
1830s	(mid) Hat-making technology improved and techniques to substitute raccoon, rabbit, and nutria for beaver were found back East, resulting in the rapid decrease in beaver pelt prices (Muldoon 1987:70).
1830s	(mid) The popularity of buffalo hides as sleigh lap robes and floor runs was growing in the eastern United States. As a result, the prices of robes increased (Lavender 1987:13).
1830s	Josiah Gregg (1966, II:202) wrote the following about fire's role in maintaining grasslands: "It is unquestionably the prairie conflagration that keeps down the woody growth upon most of the western uplands. The occasional skirts and fringes that have escaped their range have been protected by streams they border. Yet may not the time come when these vast plains will be covered with timber?….Indeed, there are parts of the southwest now thickly set with trees of good size, that, within remembrance of the oldest inhabitants, were as naked as the prairie plains; and the appearance of the timber in many other sections indicates that it has grown up within less than a century. In fact, we are now witnessing the encroachment of timber upon the prairies, wherever the devastating conflagrations have ceased their ravages.
1830s	Wolves were reportedly taking cattle, horses, and sheep in the region (Gregg 1966, I:194).
1830s	Gregg (1966, I:192-195; II:207-210) noted that black bears and grizzly bears were relatively common in the region and the wolf abundant in northern New Mexico. Elk and deer, according to him, did not occur in large numbers. Gregg also mentioned pronghorn, bighorn sheep, prairie dogs, and wild horses.
1830s	(late) Almost all felt for hats was made from furs like raccoon, which were much cheaper than beaver. With a decreased price in the beaver market, large trapping companies went out of business (Murray 1979:32).
1831	About $50,000 worth of beaver pelts and bison robes were shipped east over the Santa Fe Trail. Some $17,500 worth of these were harvested in New Mexico, amounting to 55 to 60 packs of beaver and 200 robes (Weber 1971:206).
1838	A band of French trappers went into the Sangre de Cristo Mountains above Mora, but owing to prior trapping along the streams, caught no beaver (deBuys 1985:159).
1841	The European honey bee had not yet reached New Mexico (Gregg 1977, I, 195)
1842	Based on tree-ring data, a forest fire occurred on the Pajarito Plateau (Robinson 1990:142)
1844	Josiah Gregg (1966, II:149, 212), based on observations made in the early 1830s, also warned that the buffalo might become extinct in the West and decried their slaughter.
1846	(late August-September) Lt. Abert (1962:18, 22-23, 29, 31, 33-35) recorded the following mammals in northern and central New Mexico: grizzly bear, gray wolf, black-tailed deer (mule), white-tailed deer, elk, pronghorn, raccoon, cottontail, rabbit, and prairie dog.
1846	(October 8) Along the road from Santa Fe to Agua Fria, Lt. Abert (1962:65) noted threadleaf groundsel, sagebrush, and several species of cactus. He had to purchase "fodder and wood" for his camp near Agua Fria.
1846	(November 10) Lt. Abert (1962:120-121) noted "cockle burs" (*Xanthium strumarium* var. *canadense*) and "sand burs" (*Cenchurus* sp.) in New Mexico. These were nuisances, as they stick to clothing, blankets, manes of horses, and the tails of mules. Bean mesquite was also recorded.

Date	Event
1846	(fall) (to summer 1847) Agustus Fendler, a Prussian botanist, collected 1,026 plant specimens along the Santa Fe River and the Rio Grande Valley to the west. Two general classes in the saxifrage family were named for him, Fendlera and Fendlerialla (Dickerman 1985:168-169).
1846	Ruxton recorded 75 varieties of grasshoppers and locusts, "lantern bug," and "endless variety" of beetles and tarantulas (Hafen 1950:150).
1846	Three years after cura Antonio Jose Martinez warned that the Anglo-spurred market for buffalo hides would severely reduce, if not exterminate, this animal, New Mexico hunters had to travel over 250 miles east to find only small herds. He also warned that Plains Indians would increase their raiding on New Mexico as their food base, the buffalo dwindled (Weber 1982:98).
1846	(Post) Several plants collected and described by Federick Wislzenus were named in his honor: *Ferocactus wislinzeni*, valley cottonwood (*Populus deltoides* spp. *wislizeni*), and spectacle pod (*Dithryea wislizeni*) (Dickerman 1985:166).
1848	(August 27-September 1) A party of trappers found no grass for their horses and mules from Santa Fe to Abiquiu. They did find "fine grass" on the Chama River above Abiquiu (Hafen and Hafen 1993:344-345).
1849	(August 17) From the mouth of the Santa Fe River to the east back of the Rio Grande across from Cochiti, Lt. James H. Simpson recorded grassland with no trees (McNitt 1964:8).
1849	Rangelands around Santa Fe, perhaps for up to 20 miles, had been denuded by grass by livestock of wagon trains. At nearby Galisteo, erosion cut deep arroyos, and the Galisteo Creek had eroded to a depth of 12 feet. The channel today is about 200 ft wide; in 1849 a plant spanned the creek (deBuys 1985:216-217).
1850-51	The U.S. Assistant Surgeon accompanied Lt. Lorenzo Sitgreaves on his expedition from El Paso to Santa Fe, then west to El Morrow and Zuni area. He was the first scientist to collect birds and mammals in the region. He collected and described, for the first time, grey-headed junco (now lumped with two former species into one), black-capped vireo, Cassin's sparrow, Abert's squirrel, Ord's kangaroo rat, and the coyote (Hume 1942:497-503).
1850-1911	Sandhill cranes were common along the Rio Grande during migration (and probably late fall-winter) (Henderson and Harrington 1914:33).
1851	Antonio Sanchez sold the rights of eight of the eleven heirs to the grant to Jose Ramon Vigil for a yoke of oxen, 36 ewes, one ram, and twenty dollars in cash.
1852	Naturalist S. W. Woodhouse reported that wolves were common across New Mexico (Bailey 1971:310).
1852-55	Army doctor Thomas Charlton Henry described New Mexico's wildlife: "The plains swarm with antelopes; the hills with deer and grizzlies; the rivers with swans, ducks, and wild geese; while among the timber, generally, are found many curious birds, peculiar to the country, some specimens of which are undescribed. There is a great profusion of lizards, salamanders, and chameleons; I should say more than thirty species…" (Hume 1942:210).
1854	Perhaps the last whooping crane in New Mexico, prior to its reintroduction in 1975, was recorded by Henry near Fort Thorn in the Rio Grande Valley (Ligon 1961:106).
1862	Homestead Act passed.
1870s	Ramon Vigil sold his land to Father Tomas Aquinas Hays, Archbishop Jean Baptiste Lamy's priest-in-residence at Santa Clara Pueblo. Hays offered Vigil four thousand dollars.
1870	Based on tree-ring evidence, a forest fire occurred on the Pajarito Plateau (Robinson 1990:142).
1873	Bighorn sheep were common in the Sangre de Cristo Mountains northeast and east of Santa Fe and Taos (Bailey 1971:16-17; Barker 1953:88).
1875	The Right of Way Act provided for a 200-foot right-of-way for railroads and 20 acres for station grounds every 10 miles across public domain (Westphall 1965:93-94).
1877	A military officer with the U. S. Geographical Exploration and Survey reported that elk, once plentiful in the Jemez and Ortiz Mountains, were rarely seen (Henderson and Harrington 1914:2).
1878	Based on tree-ring data, a forest fire occurred on the Pajarito Plateau (Robinson 1990:142).
1878-79	Native Americans (Pueblo?, Jicarrilla Apache?) were burning forests and woodlands in northern New Mexico to drive deer down into canyons were they could be more easily hunted (Cooper 1960:138).

Date	Event
1879	John Wesley Powell believed the sole major problem inhibiting maximum timber production in the western forest was fire (Cooper 1960:137).
1880s	(before) Pajarito Plateau remained open to whoever sought it. Lack of perennial streams and its frequently inhospitable winters largely confined inhabitation to the summer.
1880s	(early) Elk were extirpated in the Jemez Mountains by commercial hunters working for the Chili Line Railroad and local subsistence hunters (Scurlock 1980:31).
1880s	A large fire burned for weeks in the mountains above Santa Fe until it went out on its own (Tucker and Fitzpatrick 1972:49).
1880s	Trout were reported in the Rito del Los Frijoles (Hewett and Dutton 1945:118-119).
1880s	With most of the prey animal populations decimated, wolves became dependent on livestock for sustenance (Brown 1983:31).
1880	The Denver & Rio Grande narrow-gage railway, the Chili Line, reached Antonito, Colorado, to Santa Fe, just to the north of Santa Clara Pueblo, where the line originally ended, a railroad town called Española sprang up "in the midst of hoary old Spanish towns and Indian Pueblos."
1880	(pre) Deer, bighorn sheep, and turkeys were common in Frijoles Canyon (Lange and Riley 1966:167).
1880	(October 25) Bandelier encountered some Cochiti Pueblo men who had been gathering zacate, or popote, grass (*Stipa* sp.) on the Potrero de las Vacas for making into brooms. This area was also utilized for piñon nut gathering (Lange and Riley 1966:170-172).
1880	(October 25) Bandelier observed that most game, including bears, was "abundant" in the Jemez Mountains (Lange and Riley 1966:170-172).
1880	By this year bighorn sheep were extinct in the Jemez Mountains (Hewett and Dutton 1945:105). This species was an important source of meat and figured in ritual ceremonies and mythology (Tyler 1975:118-131).
1880	A resident of Santo Domingo Pueblo related that bighorn sheep "were driven out of the Sierra del Valle, etc., by the Apache" (Lange and Riley 1966:94).
1880	The Territorial Legislature passed a fish and game law that made it a misdemeanor to take fish by use of drugs, explosives, or artificial obstructions. Trout could be taken only by hook and line. Operators of mills or factories could not discharge any waste harmful to trout. Commercial sale of fish was also limited (Clark 1987:32).
1880-85	Bandelier (1892:150) reported that black bears climbed into the top of piñon trees in search of nuts in the Jemez region.
1880	(post) The Chili Line, completed south from Colorado to Española, carried sheep, cattle, hogs, piñon nuts, apples, quartizite, lepidolite, and mica from northern New Mexico (Gjevre 1969:18-19).
1880	(October 23) Bandelier and his guide from Cochiti Pueblo, Juan Jose, reached the south mesa of Frijoles Canyon. He expressed "the grandest thing I ever saw" when he viewed the canyon.
1881-84	The last native elk in the Sangre de Cristo Mountains northeast of Santa Fe were observed or reported (Barker 1953:88). Elk were extirpated in these mountains by settlers, miners, and market hunters (deBuys 1985:280).
1882	A. Bandelier recorded the exotic Alianthus, or tree-of-heaven, growing at the plaza of Ojos Calientes, three miles from Socorro (Lange and Riley 1966:318).
1883	Frank Bond opened a general store in Española.
1883	W.C. Bishop leased the Pajarito Plateau. Bishop headed a large operation with 3,000 head of cattle. Rothman (1929) says "Hispanos later recalled never having seen so many animals in their lives." Bishop set up headquarters in Pajarito Canyon. The 32,000-acre grant could have only really supported 300 head of cattle.
1883	Texas cattleman, W.C. Bishop, concentrated his 3,000 cattle in Pajarito and Water Canyons, which had perennial springs, on the Pajarito Plateau (Rothman 1992:29).
1884	Hayes made a deal with Winfield R. Smith, a wealthy Milwaukee attorney, and Edward P. Shelton, a Cleveland industrialist, and purchased the Ramon Vigil Grant for $100K—more than $3/acre.
1885	Because of land disputes as to the boundary of the Ramon Vigil Grant, Shelton sold his portion to George Fletcher for $44K.

Date	Event
1885	Federal involvement in predator control began when the Department of Agriculture began to study ways of poisoning rodents, pest birds, and predators (Dunlap 1984:143).
1886-87	The harsh winter destroyed Bishop's cattle enterprise, and the plateau returned to historic state. Deep snow blanketed the entire region from October until April, and many of the cattle froze or starved. Alejandro Mones Vijil lost eleven of his eighteen cattle in the winter of 1886-87.
1887	(May-July) The largest recorded fire in the Sangre de Cristo Mountains started in Tesuque Canyon. It burned north to Santa Fe Baldy and east to the Las Vegas Range where it was stopped by a railroad tie-cutting crew (Ungnade 1972:73).
1887	Pajarito Plateau was surveyed for the Ramon Vigil Grant for the General Land Office of the Department of Interior. They said about the western portion of the grant "fine growth of large Pine timber." They also said "grass being of good quality and plentiful," and the two men "saw considerable livestock herd of sheep and cattle grazing in different parts of the tract." They deemed the area was "valuable for its excellent grazing capacity and its large timber supply" (Rothman 1929).
1887	James and Matilda Cox Stevenson, who represented one faction within John Wesley Powell's Bureau of Ethnology, surveyed the ruins at Puye.
1888	Bishop returned to Texas.
1888	About one-fourth to three-eighths of the forest area of Rio Arriba County had burned (Ensign 1888:145, 148).
1890s	Valley residents used the plateau for grazing, cabins sprang up outside the Vigil Grant.
1890s	Widespread forest fires, probably started by railroad operations or ranchers creating meadows burned in the mountains between the lower Chama River and the Colorado border, west of the Rio Grande (McDonald 1985:122).
1890s	(late) Bighorn sheep were exterminated in the Sandia Mountains (Pickens 1980:83).
1890-91	Trout were common in Frijoles Creek, which was described as a "gushing brook, enlivened by trout." The stream also had "many pools," which were nonexistent by 1910 (Henderson and Harrington 1914:54).
1890	Market hunters killed the last elk in northern New Mexico (Barker 1976:107).
1890-1915	Most wolves killed during this period were killed because of the widespread use of bounties (Brown 1983:43).
1891	About 12 million acres of forest burned in the Sangre de Cristo Mountains (Ungnade 1972:48).
1893-1904	Bland produced gold and silver valued at $1,321,582. Eventually shut down because of lack of water.
1893	Based on tree-ring data, a forest fire occurred on the Pajarito Plateau (Robinson 1990:142).
1893	By this year the exotic cheatgrass had spread across much of the state (Frome 1962:253).
1893	The legislature passed the Territorial Bounty Act, authorizing counties to pay bounties on "predatory wolves, big bears [grizzlies], mountain lions, bobcats, and coyotes" (Brown 1983:43).
1893	The New Mexico Territorial Legislature passed a law allowing counties to raise money for paying "wolfers" and other predator hunters for their services (Burbank 1990:98).
1894	Benigno Quintana patented a homestead in the vicinity.
1894	(October) The first confirmed report of Russian thistle in New Mexico was made (Wooton 1895:3).
1895-1924	The mean flow of the Rio Grande at Buckman was 1,444,000 acre-feet (Hedke 1925:37).
1895	By this year virtually every acre of available grassland in the region was stocked with sheep or cattle. Rangelands that should have been stocked with one cow on every 40 acres were stocked with four animals (Barnes 1926:7).
1896	Hewett "tramped every mile" of the plateau, its "stillness and mystery…undisturbed" by modern life.
1896	David Romero who had grazed animals for years on the plateau filed for a homestead.
1896	William Carpenter White settled a parcel adjacent to the Quintana's.

Date	Event
1897	The Organic Act authorized the sale of timber on forest reserves, granted local residents free use of timber and stone on these lands set for broad directives for management of the reserves, and appropriated funds to regulate them (Clary 1986:2, 29).
1898	Hewett surveyed and mapped many of the ruins of the area.
	Antonio Sanchez settled near a muddy pond fed by rainwater.
1898	Smith and Fletcher leased the timber rights to Harry S. Buckman, a lumberman from Oregon living in Tres Piedras. Buckman built a small town, which he named after himself. He established two sawmills on the mesas.
	The original road Harry Buckman built to facilitate his timber cutting wound up White Rock Canyon. It stretched from the town of Buckman on the east side of the Rio Grande in Cañada Ancha to the Buckman sawmills in Water Canyon. Early travelers to Bandelier National Monument followed its course. In 1912 the trail was extended from Water Canyon to the north rim of Frijoles Canyon to accommodate the Selig Movie Company. After the post office in the town of Buckman was closed in the early 1920s, the Los Alamos Ranch School had its own post office, and emphasis shifted away from the trail that Buckman had constructed. The school received an easement from the Forest Service to build a road between the crossing and the school and soon there were two ways to take an automobile to the plateau. The Ranch School road was the antecedent of New Mexico Highway 4, which began in Pojoaque and finished at the school. Yet both roads were unpaved, cumbersome, and rutted and often discouraged travel to the region.
1898	About 19% of New Mexico was forested according to a USGS study (Baker et al. 1988:34).
1898	There were an estimated 70,000 wolves in the Territory (Bennett 1994:200).
1899	Hewett lobbied for protection of the region. Suggestion of a Park on the Pajarito Plateau proposed. The concept was opposed by New Mexicans.
1900s	(pre) Native trout disappeared from El Rito de los Frijoles on the Pajarito Plateau (Hewett et al. 1913:35).
1900s	(early) By this time, grizzly bears, elk, bighorn sheep, wolves, and pine martens had been exterminated by hunters and trappers in the Sangre de Cristo Mountains (deBuys 1985:280).
1900s	(early) Early in 20th century, more than 20 cabins dotted the area north of the Vigil Grant at the base of the Jemez range.
1900	A guest described the plateau: "rich flowers of many hues all around, trees of bright green foliage on every side, birds of tropical plumage flitting from bough to bough; and either side the massive stone walls of the canyon rising up to the rugged edge of the mesa far above."
1900	(pre) An old San Ildefonso man claimed he had hunted antelope on the eastern side of the Pajarito Plateau (Hewett and Dutton 1945:108).
1900	(May) The Lacey Act, ending market hunting for pelts, plumage, eggs, meat, and so forth and outlawing illegal importation of foreign wildlife, was passed by the U.S. Congress (Matthiessen 1964:172).
1900	By this year beaver had been virtually exterminated by trappers and hunters in all of the territory's mountain ranges (Findley 1987:86). Also by this year, elk became extinct in southern New Mexico, primarily as a result of commercial and sport hunting (Findley et al. 1975:328).
1900	A huge swarm of grasshoppers descended on Bland Canyon, drowning in the stream and polluting the water. Reportedly, they were piled over a foot deep along the stream's banks, and residents of Bland were forced to dig out springs for their drinking water (Sherman and Sherman 1975:12).
1900	(post) Piñon-juniper woodlands spread at lower elevation ecotones onto grasslands during this century as a result of fire suppression, livestock grazing, and other factors (Dick-Peddie 1993:91-92).
1902	James Loomis settled what became known as the Anchor Ranch.
1902	The first Yellowstone cutthroat trout were introduced into northern New Mexico (Sublette et al. 1990:56).
1902	The last Rocky Mountain bighorn sheep in the Taos Mountains was shot. This subspecies had been reported as abundant a quarter-century before this event (Bailey 1971:17).

Date	Event
1903	By this year Russian olive had been introduced at Mesilla Park (Freehling 1982:10).
1903	Buckman left the area.
	Buckman's operation required many workers. The building of the road, the operation of the sawmills in Water Canyon, and the transportation of timber to the railway were labor intensive.
	The Vigil Grant, its productivity demolished by Bishop and to a lesser extent by increased American stock outside the Vigil Grant, had more animals competing for less grazing land. Anglo overgrazing extended the impact of earlier, limited overgrazing by Hispanos and Native Americans. Cattle and sheep trails were no longer centralized around water sources. Larger herds also drove game and predators higher into the Jemez Mountains, and the black bears, wild turkeys, and pumas that had characterized the pre-1880 plateau became more scarce below the elevations of 8,000 ft.
1904	The New Mexico Game and Fish Department was created by the Territorial Assembly (Barker 1970:185).
1905	Forest Service was formed; The Jemez National Forest included the plateau.
1905	The Forest Service began to hire trappers to kill wolves on National Forest grazing land (Dunlap 1984:143).
1905	Telephone line was constructed from Pojoaque to the Jemez Mountains.
1905-15	U. S. Forest Service rangers trapped or shot grizzly bears, wolves, and mountain lions to help maintain good relations with local ranchers and to collect bounties (Brown 1985:123-124).
1906	(June 11) Forest Homestead Act opened arable areas that made land more available, and the number of homesteaders in the region increased.
1906	'Cattle barons' were opposed to statehood because free grazing on the public domain would be disallowed, and they would be forced to make rental payments to the state fund. 'Lumber barons' were opposed because large timber holdings were assessed at less than 10% of their value (Larson 1968:243).
1907	Hewett excavated Puye.
1907	The first rainbow trout, an exotic species, were stocked in the Santa Clara Creek and Rio Puerco near Española (Kuykendahl 1994:3).
1907	Judge Abbott and his wife Ida Patton Abbott located where they wanted to live in Frijoles Canyon. He filed a claim on June 11, 1906, for much of the canyon area.
1907	Harold Brook purchased a quarter-section with a pond from the Sanchez family. He founded the Los Alamos Ranch where Fuller Lodge now stands.
1907-1910	Snakeweed (*Gutierrezia* spp.) had invaded the grasslands of the mesa and foothill zones by this time (Watson 1912:202).
1908-1912	Hewett excavated Tyuonyi.
1908	Salt cedar, or tamarisk, was "commonly planted" in Albuquerque as an ornamental plant (Watson 1912:80).
1908	The exotic brook trout was introduced into the Rio Grande at Embudo, Santa Barbara, and Pueblo (Kuykendahl 1994:3).
1908	A $20 bounty was paid for dead bears, and up to $50 was paid for grizzly bear hides. About 271 bobcats were killed in the National Forests, and many more were harvested by trappers or killed by ranchers statewide (Bailey 1971:293; Barker 1953:153).
1909	The New Mexico Territorial Legislature enacted a $15 bounty for wolves (Burbank 1990:98).
1910	(pre) Bighorn sheep were extirpated in the Tewa area (Henderson and Harrington 1914:3).
1910	(August 19) A pair of bald eagles was observed in Frijoles Canyon (Henderson and Harrington 1914:37).
1910	A pair of spotted owls nested along Frijoles Creek in the Jemez Mountains (Henderson and Harrington 1914:37).
1910	Archeologist Neil Judd reported black bears roamed all over the region, and mountain lions were also seen (Rothman 1992).

Date	Event
1910	Mountain lions were declared "fairly abundant" in the Carson National Forest and "very common" in the Jemez Mountains by Forest Service officials (Bailey 1971:286).
1910	Archeologist Neil Judd reported that black bears were common in and around Frijoles Canyon (Rothman 1992:140).
1910	Mountain lions were declared "fairly abundant" in the Carson National Forest and "very common" in the Jemez Mountains by Forest Service officials (Bailey 1971:286).
1910	Judd reported that black bears were common in and around Frijoles Canyon (Rothman 1992:140).
1910-11	Blue grouse and wild turkey were common in the Jemez Mountains. Western bluebirds were also common on mesa tops of the Pajarito Plateau (Henderson and Harringtron 1914:34-35, 37, 45).
1910-11	Blue grouse and wild turkey were common in the Jemez Mountains. Western bluebirds were also common on mesa tops of the Pajarito Plateau (Henderson and Harringtron 1914:34-35, 37, 45).
1912	Buckman Road extended to Water Canyon and to the rim of Frijoles Canyon.
1912	New Mexico admitted to the Union (Pickens 1980:69).
1914	Ashley Pond purchased the Ramon Vigil Grant from four Detroit businessmen.
1914	First auto tours were offered by the Rocky Mountain Camp Company. It took three hours to drive the 27 miles. The tours left Santa Fe before 8AM and climbed Buckman Hill, which was usually in "terrible condition." The car then wound through Pajarito and Ancho Canyons and made its way up the rim of Frijoles Canyon shortly after 11. They then took a footpath into the canyon.
1914	(June 30) The U.S. Congress authorized the Predatory Animal and Rodent Control (PARC) branch of the Biological Survey of the U.S. Department of Agriculture. Congress made this group responsible for experiments and demonstrations in destroying wolves, prairie dogs, and other predators on livestock. Around 300 hunters were employed under this program in 1914-15 (Brown 1983:52, 126-127).
1914	Aldo Leopold, a Forest Service employee, joined J. Stokely Ligon of the New Mexico Game and Fish Department in a program to eradicate the wolf in New Mexico and Arizona. Leopold later reversed his view toward wolves and other predators, which he eloquently explained in *A Sand County Almanac* (Burbank 1990:101, 107-108).
1915	The demand for beef and mutton increased sharply with the start of World War I, and grazing restrictions on the National Forest reserves were relaxed (Brown 1985:129-130).
1915-16	J. Stokely Ligon took charge of predator control in New Mexico-Arizona district. He hired 32 hunters and trappers, including renowned bear hunter Ben Lilly. Nineteen grizzly bears and at least six mountain lions were killed. His staff of wolf hunters also killed 69 wolves in their first year in New Mexico and Arizona. An estimated 300 wolves remained in New Mexico at the end of the year (Brown 1985:127; Burbank 1990:102-103).
1916	The Pajarito Club was abandoned in Pajarito Canyon when the water supply dried up.
1916	(September) Pond forms partnership with Harold Brook; Brook sold to Pond in December 1916.
1916	February 11, 1916, President Woodrow Wilson proclaimed the 22,400-acre Bandelier National Monument.
1916	U. S. Forest Service initiated a predator control program in the Jemez Mountains. The gray wolf, mountain lion, and coyote were targeted for trapping (Barker 1970:113; Scurlock 1981:144).
1916	Congress passed the National Park Act leading to the creation of the National Park Service (Udall 1963:153).
1916-18	When the U.S. joined the allies in World War I, the Forest Service increased the number of permitted livestock on National Forest lands. Conditions caused by previous overgrazing and logging worsened (deBuys 1985:231).
1917	Bond leased the Baca Location No. 1, the Valle Grande, from the Otero Family.

Date	Event
1917	The Pajarito Plateau was a long way from civilization, a trip to Frijoles Canyon remained a strenuous undertaking. Travelers took the old Denver and Rio Grande narrow-gage Chili Line railway from Santa Fe to the Buckman crossing in White Rock Canyon on the Rio Grande. Traversing the river was not an easy task. The bridge across the river regularly washed away in flooding caused by snowmelt from the mountains, and by 1916, the existing structure was in danger of collapse. From Buckman, travelers had two options, horse or foot, to cover the last 15 miles to Frijoles Canyon.
1917	Los Alamos Ranch School established
1917	The grizzly bear population across New Mexico had declined to only 48 animals (Bailey 1971:368, Brown 1985:133).
1918	(April) Bond purchased the Ramon Vigil Grant from Capin and the other Detroit businessmen. One year later he solidified his hold when he purchased the Baca Location.
1918	(January) The Los Alamos Ranch School opened, and the water supply was a problem until a small dam was constructed in a canyon above the school five years later (Church and Church 1974:7).
1919	(pre) San Ildefonso Pueblo lost more land to squatters than any other pueblo. Non-Indian removal of timber for commercial use severely impacted the Rio Grande-Pojoaque River watershed on their land (Arnon and Hill 1979:312).
1920	The Forest Service adopted a policy of no light burning in ponderosa pine forest, based on the belief that fire every two to three years would prevent restocking of the trees (Pyne 1982:522).
1921	School was formed because there were 130 parents on the plateau.
1924	New Mexico's wildlife populations reached their lowest numbers, and more species were threatened with extinction than at any other time. Several species, such as the gray wolf, elk, and grizzly bear were extirpated within a few years (Ligon 1927:15).
1927	Homer Pickens came to New Mexico as a trapper with the U. S. Biological Surveys (which became the U.S. Fish and Wildlife Service in 1935). He described the Valle Grande: ". . . with the exclusion of timber cutting, remained unchanged from the pristine condition as when I first gazed upon the area in 1927."
1927	"On this occasion I was camped in Water Canyon, south of the Los Alamos Ranch School in an area now known as 'S' site project. While I was hunting my dogs had treed a lion on the mesa between Frijoles and Alamo Canyons" (Pickens 1980:71).
1927	"While I was lion hunting in the Jemez Mountains area, the Seven Springs Fish Hatchery was under construction and there were as yet only a few ponds there" (Pickens 1980:67).
1927	In northern New Mexico, Homer Pickens and his brother Andrew succeeded in trapping seven lobos. "As far as I know, these were the last wolves to roam the country. No rancher ever reported losing any more cattle to wolves. Although I fully understood the situation both then and now, to this day I regret that it had to be" (Pickens 1980:11).
1928	Fuller Lodge constructed.
1930	By this year Frank Bond controlled the best grazing lands in the Jemez Mountains. He leased land for grazing his sheep from the Forest Service, and after three years of use, his forest grazing right became permanent (Rothman 1992:129).
1930	Crested wheatgrass was introduced into New Mexico and adjacent mountain states (Hitchcock 1935:48).
1930s	Before the C.C.C. (Civilian Conservation Corps) built a road into what is now Bandelier National Monument, the small hotel in Frijoles Canyon operated by George Frey and his wife could only be reached by saddle mules. Trout were released into the canyon by the Frey's and Pickens (Pickens 1980:78).
1932	"During 1932 I killed 36 mountain lions in the Jemez Mountains, ten of which I took from above the area that would one day be Bandelier National Monument" (Pickens 1980:73).
1933	The mountain lion population in New Mexico was over 300. An adult lion can, and often will, kill one deer per week. Of the 300 lions, if only two-thirds were adults, the annual deer kill would be in the neighborhood of 10,000 (Pickens 1980:63).

Date	Event
1933-1934	John Davenport at one time was part owner of the Baca Location No. 1, a huge tract of land in the Jemez Mountains, killed a lobo wolf between Ojo Caliente and Tres Piedras. His wife, Frances, later gave the mounted wolf to me to donate to the Los Alamos museum, which is housed in the building that formerly was the main lodge for the old Los Alamos Ranch School (Pickens 1980:11).
1933-1940	Emergency conservation funds and C.C.C. performed development on park areas.
1935	By 1935, there were 35 homestead claims on the eastern slope of the mountains.
1941	(August 25) The old Chili Line, an extension of the Denver & Rio Grande narrow gage railroad in Colorado, made its last run from Santa Fe to Antonito, Colorado, via the Rio Grande Gorge, Toas Junction, and Tres Piedras on August 24 (LASL Community News, June 15, 1961, p. 10. "The Chili Line, the narrow gage that died too soon").
1942	(October) Oppenheimer, Dudley, and Edwin McMillan visited Jemez Springs. After rejecting Jemez Springs they drove to Los Alamos Ranch School. (November 16) The government began the process to acquire the lands of the Pajarito Plateau. Appropriated 45,000 acres from various agencies and 9,000 from private individuals.
1943	(January 1, 1943) Letter establishing the University of California to get personnel and procurement for the Manhattan Project (Hawkins 1945:5).
1943	(April 20) Formal contract W7405-ENG-36, with the Manhattan Engineer District of the War Department established the Manhattan Project (Hawkins 1945:5).
1943	(March 15) Oppenheimer and a few members of the staff arrived in Santa Fe (Hawkins 1945:7).
1943	(January) Army contractors began work around the Ranch School. Los Alamos became the home of a secret installation that doubled in size every nine months until the end of the war. By then its population was 3,000.
1943	The Army Corps of Engineers constructed the present road to the "Hill."
1943	First use of Pajarito Canyon by the Laboratory.
1943	8407.50 acres were acquired by Manhattan Engineer District from U. S. Forest Service by Memorandum of Understanding dated May 15, 1943 (Real Estate Transaction Map, Eng 11-16-50).
1943	9,360.06 (May 10, 1943) acres acquired by the Manhattan Engineer District from U. S. Forest Service by Memorandum of Understanding.
1943	(July 1943) 5,550.00 acres previously acquired by the Manhattan Engineer District from U.S. Forest Service by Memorandum of Understanding dated July 1943.
1943	22,703.24 acres acquired by Manhattan Engineer District from U. S. Forest Service by Memorandum of Understanding dated May 15, 1943, withdrawn from appropriation by public land order 230, Dated May 10, 1944.
1943	64,017.40 acres previously acquired by Manhattan Engineer District through condemnation or purchase (Real Estate Transactions At Los Alamos, New Mexico Engineering 11 map 1656).
1944	(August) Following an accident involving plutonium, members of the Health Group and the Chemistry and Metallurgy Division expressed the dissatisfaction which they had felt for some time that the progress of biological studies on plutonium at other projects. Permission was obtained from the Director to undertake a research program at Los Alamos to study the biological problems of special interest to the project (Hawkins 1945:184). A successful method of analyzing urine was developed in January 1945, but was not used as a routine test until after the first human tracer experiment had been performed in April.
1944	The Corps of Engineers cleared a power line right-of-way through the northern tip of Otowi, which came in conflict with the Park Service. The line was later moved.
1945	Los Alamos had 3,000 workers and 1,100 places for them to live.
1946	The first census for the town was conducted and there were 6,524 individuals.
1947	Cargo began charter service September 1 (LASL Community News p. 4 1960).
1947	240 acres acquired by Atomic Energy Commission from U. S. Forest Service by supplement No. 2 Dated October 15, 1947, to original Memorandum of Understanding.
1948	4,505.60 acres acquired by the Atomic Energy Commission from U. S. Forest Service by superseding memorandum dated April 14, 1948.

Date	Event
1948	4,649.60 acres acquired from the U. S. Forest Service by superseding Memorandum dated April 14, 1948.
1948	12,320.60 acres acquired by Atomic Energy Commission from U. S. Forest Service by superseding Memorandum dated April 14, 1948.
1949	(June) Los Alamos County was created.
1949	White Rock began as a construction camp with 325 families living there.
1949-1950	An 8-ich gas line stopped in 1946 and this spurred the transmission of gas through the Jemez. The new gas line was started in 1949 and was completed in 1950 ("Pipeline brings gas to Los Alamos over 168 miles of spectacular scenery, LASL New, October 1962 p. 11).
1950	There were 14,000 people living on the plateau.
1951	(August 20) Los Alamos Canyon bridge was completed. It was 180 ft high, 819.6 ft long, and spanned 426.5 ft. The Atom, April 1964, 1(4):3-5.
1958	"By State Highway 4 between Ancho Canyon site and TA 33 on the road to Bandelier, a pair of deer, oblivious to the bustle of human activity, munch leaves and enjoy the afternoon sunlight filtering through the pines" (Photo caption, LASL Community News, July 30, 1959, 1(15):1, "Los Alamos Pastoral").
1959	"The Pajarito Mountain ski area, six miles west of Los Alamos on Camp May Road, opened last weekend for throngs of enthusiastic skiers. For the beginner, there is Bathtub Row, the short slope adjacent to Rope Tow 2. For the more experienced, there is 4,000-ft long Lumberyard, recently extended 1,800 feet to the top of the mountain. Two feet of snow on the main slope gave promise of a good season for skiing at the Pajarito run" (LASL Community News, November 5, 1959 p. 5 Diagram caption "The Pajarito Mountain").
1959	"Along the eastern rim of the Pajarito Plateau a major portion of the Nation's pumice lies in a king-size bed 20 miles long, five miles wide, and 25 feet thick. The king-size deposit is called the Santa Clara Bed. In 1959, 85% of the high-grade pumice in the United States was mined within a 10-mile radius of Los Alamos. The extent of the deposits was not known until 1948. The University of New Mexico did a survey and this touched off a major new mining effort. Copar Pumice and General Pumice were mining within a stone's throw of Los Alamos. The deposit is on an area known as Guaje Flats. Pumice was in demand for use as an insulation material, as an abrasive, and as a cleanser. It was used in toothpowder. The big use was for construction because it is lightweight and less expensive than concrete, does not conduct heat, and can't burn" (LASL Community News, November 5, 1959, p. 4. "Pajarito Plateau Yields Most U. S. Pumice").
1959	"For the second time there will be a deer hunting season in Los Alamos County Game Refuge. The regular deer hunting season will begin October 15 and end October 25. A two-week season for archers only began September 16 and ends September 30. Either sex may be hunted in the game refuge according to AEC Project Services Branch. This article has a map of areas that are open to hunting" (LASL Community News, September 24, 1959 p. 6 "Second Deer Hunt Season Opens October 15").
1959	Los Alamosans are flocking to harvest what is purported to be the county's number one (and only) agricultural crop. It's a big year for the piñon nut—biggest in the state since 1936, according to the Santa Fe Office of the U.S. Forest Service (LASL Community News, September 24, 1959, p. 3 "Trees Produce Record Nut Crop").
1959	The rope tow to the top of Pajarito Mountain was installed. There was an 1,800-ft upward extension of the old ski run and a rope tow to the top. These improvements make the ski run more than 4,000 ft long with a vertical drop of 1,200 ft. The extension is known as "lumberyard slope." To reach the top the skiers took rope tow 1 and then transferred to the new midway tow. This summer the road to Camp May was egarded and graveled at spots that turn muddy in winter weather. Camp May parking lot about half a mile beyond Pajarito also has been graveled (LASL Community News, August 27, 1959 p. 6 "Work Gets Underway for Better Ski Run").

Date	Event
1959	"For many years Bandelier was accessible only by unimproved dirt roads from Santa Fe. To reach the ruins in Frijoles Canyon, it was necessary to hike down a trail that tumbled down into the canyon from the mesa top in the best Jack and Jill fashion. The only building in the monument was a ranch house built in the early 1900s by a Boston-Santa Fe judge named Abbott. A stone house was partially built from the Indian ruins and features, of all things, hardwood floors. There were no full-scale tourist facilities in the canyon until the 1930s when the C.C.C. (Civilian Conservation Corps) built a trail, a dirt road, the present ranger headquarter-visitor center, Frijoles Canyon lodge. In 1925 Mrs. Frey and her husband George, rode burros down into the canyon, dragging behind them on a sled an upright piano and other belongings. The Frey's only access into the canyon was by the old trail. Everything they wanted was packed down the trail. Besides the piano they brought 75 fruit trees and added them to the orchard begun by Judge Abbott. Eventually the Freys installed a cable cart that ran up 1000 ft of the steepest part of the north cliff making access to the canyon a little easier. The cable was located just east of Longhouse ruins. A trip to Santa Fe was a two-day journey. Mrs. Frey recalled, 'It would take three hours to climb out the canyon and up to the road. Sometimes I would reach the road then turn around and come back home. The trip just wasn't worth the effort.' There was an 18 percent grade in the old road to Santa Fe that went by the way of Water Canyon, according to Mrs. Frey. 'We built a log cabin below the grade so that we could stay overnight there when returning from Santa Fe. One time we came back from Santa Fe and someone had carted the cabin away—except for the fire place.' When interviewed Mrs. Frey said, 'The winters used to be much colder. We were always snowbound, but it was delightful.' She said, 'And, the Rito de los Frijoles is only about half as wide as it used to be. There are hardly any fish left. The river used to swarm with fish that would bite at anything. You didn't feel ethical fishing in those days'" (LASL Community News, August 12, 1959, p. "This Enchanted Land, Bandelier National Monument….its past and future").
1959	Troup 229 marked Los Alamos County principal hiking and riding trails. They worked on Quemazon and Pine Springs and Guage Ridge Trails. The Pine Springs Trail starts at the old Dots Ranch about one mile from the golf course and travels down Rendija Canyon to Cabra Canyon where it swings left up the canyon to Pine Springs. The Guaje Ridge Trail begins on the Los Alamos side of Guaje Canyon and follows west along the ridge to join the Pipeline Road and Quemazon Trail near the top of Cañada Bonita. The Quemezon Trail, which begins behind the Western Area, formerly continued to Camp May but now joins Pipeline Road near the top (LASL Community News, July 30, 1959, p. 3 "Boy Scouts Clear, Mark Hill's Main Hiking Trails").
1960	An "unspectacular but stubborn" fire, which burned a 400-acre wooded area at the Laboratory's K Site, was pronounced "out" Monday after burning four days, but the area still is being watched. The fire actually was a series of blazes touched off by hot metal blasted over a wide area Friday when an experimental device exploded while being routinely burned after a drop test for impact studies. The fire burned an area north of Water Canyon and was confined almost exclusively to brush and fallen timber, according to Roy Reider, LASL safety director. The fire was spotty and did not burn over all the 400 acres. Some 50 Zia Company employees and half of the fire department force had the fire under control by Friday evening and confined, they thought. The fire started up again over the weekend because of wind. At no time were employees or Laboratory facilities endangered by the fires. Firefighters were at the scene immediately. Since brush fires always are anticipated when a drop test is conducted, firemen and equipment always stand by (LASL Community News Vol. 2, No. April 21, 1960).
1960	Royal Crest Trailer Park was established on East Jemez Road (LASL Community News April 7, 1960).

Date	Event
1960	To date, the winter of 1959-60 is the worst recorded in 28 years. By 8 a.m. on February 29, LASL's weather group had measured 77 inches of snow, nearly ten inches more than the heaviest snowfall recorded since 1932 for that period. In the rugged winter of 1940-41, only 67.5 inches had fallen by the end of February; in 1947-48, there were 57.6; in 1957-58, 54.2 were recorded. During the first two days of March this year, another 10.9 inches brought the year's total to 87.9 inches—six inches more than the season total for the oft-discussed Winter of 1947-48. March snowfall has already exceeded the 10.4 average for the month. In 1947-48 there was 81.7 inches but it fell less frequently but harder on site roads that were rough, muddy, and still unpaved. To make matters worse, the town's gas system failed on two bitter cold January days (LASL Community News, March 10, 1960, p. 3 "Weary of Winter Weather? May Get Worse Before It's Better").
1960	The Golf Club swimming pool was started (LASL Community News, March 24, 1960, p. 8 "Contractor Gets Go-Ahead On Golf Club Swim Pool").
1960	Located just east of the Slotin Field baseball diamond on North Mesa, the stable area quarters more than 200 horses and a multitude of other animals in some 107 corrals. The stables were built about 1947 and moved to North Mesa where the Babe Ruth ballpark is. The stables had been in the present location for 8 years. Prior to that time the stables were off Diamond Drive at 35th street (LASL Community News, May 5, 1960, p. 10 "Stables Area Welcomes Newcomers, All's not Horseplay").
1960	A management and conservation program that would put Los Alamos County's renewable natural resources to greater public use has been proposed by the AEC. The program would include opening reservoirs in Los Alamos and Guaje Canyons to fishing; improving streams above the two reservoirs for trout fishing; developing the scenic Los Alamos Reservoir area for general recreation; designing several areas for Christmas tree cutting and evergreen transplanting; logging mature timber, allowing controlled cutting of dead wood; opening grazing lands to domestic livestock; protecting the county's wild turkey flocks and wild herd of horses; thinning out the deer population; and stepping up a variety of soil conservation measures. The proposals are the result of a study of recommendations made by representative of the US Forest Service, the US Soil Conservation Service, and the US Fish and Wildlife Service according to James R. Madding, project conservation officer. The Los Alamos Reservoir will be opened for public use on the first day of the 1961 fishing season. The road to the reservoir will be improved and sanitary facilities built. Guaje Reservoir will not be stocked in 1961. There are native cutthroat in the reservoir that the Fish and Wildlife Service has recommended protected until they become more numerous. Steps have also been taken to protect a herd of 15 to 20 wild horses that winter in Garcia Canyon. "The herd is an example of a rare natural resource which needs protection," Maddy said. "The herd has been wild for generations and the horses are absolutely useless for domestic purposes. There have been cases, however where mares have been shot in attempts to get colts." Protective measures are also planned in Guaje Canyon, the S Site area, and Burnt Mesa, near Frijoles Canyon where rare wild turkey flocks live, according to Maddy. Deer are a common problem. In 1947 there were six accidents involving deer and automobiles with property damage amounting to $200, but in 1959 there were 12 deer-auto accidents with more than $2000 worth of property damage reported. Already in 1960, six such accidents have been reported. (LASL Community News, June 2, 1960, P. 9 "AEC Plan Resources to Get More Public Use").
1960	Air space was opened over Los Alamos. The limited areas then were restricted to the technical areas (LASL Community News, August 25, 1960, p. 3 "Air Space Opens Over Los Alamos").
1960	Pajarito Mountain was being remodeled (series of pictures entitled "Work Parties Remodel Pajarito Slopes" LASL Community News, October 6, 1960, p. 9).

Date	Event
1960	Invitations to bid on long-term leases of two more commercial building sites on DP Road were mailed this week by Zia Company. Leases were executed on November 1 (LASL Community News, November 17, 1960, p. 5 “Bids Asked for Leased Land on DP Road Business Sites”).
1960	Los Alamos people had mixed feeling about paving the road across the Jemez Mountains. The pavement now extending seven miles to the rim of the Valle Grande and soon to stretch another nine, brings all of the first four Forest Service camping and picnic grounds within reach in little over an hour. “State Highway 4 starts over the Sierra de los Valles six miles from the Community Center at the end of West Jemez Road. Six miles further, a road turns left to San Miguel lookout tower on St. Peter’s Dome. Back on State Highway 4, the pavement ends a mile from the San Miguel turnoff. The road gets rough, requiring considerable care if your car is low-slung, but it improves in about a mile. As the road leaves the valley, there is a clutter of sheep pens and a road intersection left. You are now about 16.6 miles from town. Two miles further you pass the tree area (so marked) where Los Alamos folks cut Christmas trees. Then another mile and you are at the first campground, Las Conchas, a little over 19 miles from the community, with two Adirondack shelters and a half dozen camping setups. Half a mile beyond Las Conchas is the House Triple H boy’s ranch. The road leaves the creek here. Fourteen miles from the House ranch, 33 miles from town, a road left leads across the Vallecitos de los Indios to the lumber "town” of Ponderosa and eventually to Jemez Pueblo. The next road left, half a mile farther goes into the second campground on this route at Jemez Falls. The campground is a mile off Highway 4 over an extremely dusty road. Directly across is Banco Bonito campground, four miles by road. Jemez Falls offers 4 camp setups, no good water, and an easy walk to the falls. Highway 4 crosses the east fork of the Jemez for the first time on a new bridge a mile beyond Jemez Falls turnoff. The third campground is here, extending up along the creek with eight setups. You are 34.6 miles from Los Alamos. The last campground in this series is at the end of a mile-long section, which turns off to the left an even mile from East Fork bridge. Like the one across Jemez Falls, the campground isn’t much, but it affords easy access to the lower Jemez for fishing. There are no more campgrounds down Highway 4 (“This Enchanted Land, Camp Sites….paved roads bring them nearer” LASL Community News, June 30, 1960 p. 10).
1960	Permits could be obtained from Zia for collecting downed wood. No cutting of standing trees was permitted. Persons cutting or removing AEC-owned wood without a valid permit or from areas not specifically designated may be apprehended and charged with destruction of Government property. This applies to the cedar and pinon trees in the White Rock area as well (LASL Community News March 10, 1960, p. 8 “Permits for Cutting Wood Required in County by AEC”).
1960	The county will soon have a cemetery. Eight acres of land along the road to the Protective Force pistol range north of the community have been deeded to the county by the AEC for a cemetery. This one has a picture of the area where the cemetery is to be put. It is an open site probably part of an old homestead area (LASL Community News, 2/25/1960, p. 2 “Acreage Deeded for Cemetery”).
1960	One hundred and ninety old laboratory buildings, storage sheds, magazine bunkers, barricades, and other structures dating back to the first days of the Laboratory were burned (LASL Community News, February 11, 1960 p. 3 “Fires Destroy Historic Labs”).
1960	Deer-proof fence was put up around the Los Alamos airstrip. Cargo Air Service demanded a deer barricade after one of the company’s planes and a deer collided on the runway last November, even though deer came out second best. The State Game and Fish Department suggested the fence, a combination of hogwire and barbed wire strands. The fence now under construction will be 12,900 ft long (LASL Community News, January 28, 1960 p. 7. “Deer-Proof Fence Goes Up Around Los Alamos Airstrip’).

Date	Event
1960	Last weekend for the sixth straight year some 2,000 dried and faded Christmas trees were collected by Los Alamos Boy Scouts and placed in nearby arroyos as a soil conservation measure. Arroyos on Horse Mesa and vicinity, at Camp Hamilton in Pueblo Canyon, and at Tsankawi Ruin in Bandelier National Monument receive most of the trees. The project was originated in 1954 by the Los Alamos Chapter of the Izaak Walton League. The December issue of *BOY'S LIFE* carried a full-page article on the project by Mrs. Robert Mitchell of Los Alamos and included a cartoon-page explanation of the ways to use trees in conservation (LASL Community News January 14, 1960 p. 6).
1961	Homer Pickens accepted a job with the Atomic Energy Commission as a conservation specialist.
1961	White Rock began as a residential area.
1961	Some 120 Los Alamos cub scouts and their parent helpers planted some 4,700 ponderosa and Austrian pine seedlings recently in the American Springs area above S site where a forest fire burned about five years ago. About 12 acres of the burned area was planted. The project will be continued next year, according to Casimir Stevens who directed the project (LASL New June 1, 1961, "Cubs Plant Burned Area").
1961	$10,000 was allocated to convert the "controversial and often time smelly Ashley Pond into an attractive park next summer." (LASL New November 2, 1961, p. 4).
1961	Bids were opened on the White Rock Water Distribution System that was to include a pump-house, 2000-gallon storage tank, and a chlorinator room (LASL Community News, November 30, 1961).
1961	Work started on the Barranca Mesa School and an addition was made to Aspen School. The opening of Barranca Mesa School was to be August 1962 (LASL Community News, November 30, 1961, p. 7).
1961	Workmen paving 2.1 miles of Pajarito Road were racing the weather. The road would provide quick travel between White Rock and the Laboratory technical areas (LASL Community News, November 16, 1961 p. 8).
1961	They announced that deer hunting would begin October 14 in Los Alamos County with a 14-day bow hunting only ending October 27. The following day the regular season would begin continuing until November 12. From October 28 to November 9, fork antlered buck may be hunted and November 10 to November 12 either sex. Hunting was allowed around the north and west side of the Laboratory excluding the Pajarito Mountain recreational area. (LASL Community News, October 19, 1961, p. 6 "Hunters Go Out, Deer Head In").
1961	The bag limit for trout was lowered at the Los Alamos Reservoir. Effective October 1, the bag limit was 6 fish. Homer Pickens explained that the reduced bag limit will provide sport fishing for a greater number of people (LASL Community News, October 5, 1961 p. 8 "Daily Bag Limit Lowered in Los Alamos Reservoir").
1961	Construction of the Los Alamos Ski Club's new lodge on Pajarito Mountain was underway. On the slopes, major clearing projects have resulted in extension of the Slalom Hill to the road at the top of Tow No. 1, widening of narrow sections of upper Aspen slope, and the extension of the slope to within 50 yards of the lowest jeep road traverse (LASL Community News, August 10, 1961 p. 8 "Ski Lodge Construction Starts on Pajarito Mountain").
1961	Development begins on Barranca Mesa lots in subdivision 2 (LASL Community News, August 10, 1961, "Development on Barranca Mesa Lots" p. 8).
1961	There were negotiations to open the Buckman road. Sixty acres of land were to be traded for the right-of-way. This was the only remaining obstacle to the sale of 500 parcels of federal land for home sites in the Buckman area (LASL Community News, July 27, 1961, p. 3 "Buckman Road Opening Near").
1961	4.9 miles from the point east of the Valle Grande was to be paved in the next two years. The area had been paved to the Valle Grande in 1959. The area 2.5 miles above Jemez Springs to Battleship Rock was also to be paved. When this project was to be completed 15 miles between the two areas would remain as dirt road (LASL Community News, "Taking the Bumps Out of the Grind, 15 more Miles Paved in the Jemez" June 29, 1961, p. 7).

Date	Event
1961	Trees were cut on Jemez Road for a new high power line to the Laboratory's outlying Ancho Canyon and TA-33 sites east of Bandelier National Monument. The line ran underground from the TA-3 power plant in the main technical area, west to the warehouse area, then above ground on existing power poles to S Site. From S Site, new poles will be installed to carry the power lines to the two sites (LASL Community News, June 29, 1961, p. 5 "Trees Cut in Jemez Road for New High Power Line" p. 5).
1961	Bids were set for Pajarito Road paving job that would open a new route to White Rock (LASL Community News, June 15, 1961, 3(12), "Pajarito Road Bids Set").
1962	Land was leased for the East Park Pool at 111 East Road near the Canyon Road intersection. (LASL Community News, February 15, 1962, p. 11).
1962	The Ski Club voted for the construction of a T-bar ski lift on Pajarito Mountain (LASL Community News, February 15, 1962 p. 9).
1961-1969	"I no sooner got my family settled in Los Alamos than I had a big problem on my hands: deer were absolutely running over the Atomic City, trampling and devouring vegetable gardens, damaging fruit trees and shrubs, and holding up traffic. Members of the local garden club complained to me especially about deer's fondness for roses and new spring tulips. The deer also posed a great traffic hazard. Security personnel patrolling the A.E.C. land collided with 30 or 40 deer each year, and many of these accidents, not to mention those that occurred on public roads, resulted in serious injury to the drivers. Just before I arrived in Los Alamos, a light plane touching down at the city airport had collided with a deer." "To relieve the problems and also preserve the deer, I began a program of live trapping and transplanting that lasted over the next five years." About half of the more than 500 deer trapped during this period were given to the New Mexico Game and Fish Department to be transplanted in the Pecos Valley near Roswell and Ft. Sumner, and also on the Navajo reservation; twenty deer were given to Los Alamos Scientific Laboratory, Health Research Division, for Cesium-137 studies and other testing; and many were transplanted to areas closer to Los Alamos. (Pickens 1980:115-116).
1963	(May) Otowi tract was transferred to DOE and the area between State Route 4 and Frijoles Canyon (Upper Frijoles Area) was transferred to the Park Service (p. 252).
1963	3,925 acres transferred to administrative control of Atomic Energy Commission by Presidential Proclamation No. 3539, Dated May 27, 1963.
1963	After acquiring the area south of State Route 4, Bandelier National Monument repaired a trail into the canyon. They removed some 300 fallen trees, the result of previous years beetle infestation and this spring's high winds."
1963	A track enclosing 6.1 square miles of the Otowi Section of Bandelier National Monument has been transferred to the Atomic Energy Commission from the Department of Interior. The transfer completed a land swap that began in 1959, when the AEC gave Bandelier the 3,600-acre "Burnt Mesa" tract south of Highway 4. Another chunk of 5 square miles along the Upper Frijoles Canyon was turned over to the Monument earlier in 1963 (The Otowi Section, new ground for contention? LASL Community News, July 4, 1963).
1963	The improvement of facilities at Santa Clara Canyon. "By January, there will be 15 adirondack shelters …in Santa Clara Canyon." There was $75,000 in Accelerated Public Work funds spent in the canyon in 1962 and 1963 for development.
1964	Wilderness Act passed.
1964	The Los Alamos County Planning Department estimated that over 2,500 people visited the new facilities at Camp May Community Park this past weekend. Many families took advantage of the new picnic facilities (The Atom, 11(5):24, September and October 1974 "Crowds Visit Camp May").
1964	Cochiti Dam authorized (Rothman 1970), the soil was broken for the "largest construction project in New Mexico's history and the world's tenth largest earth-fill dam. (Environmental Journal, September 1976 p. 9-10). The Dam is 251 feet high and is 5.5 miles long.

Date	Event
1964	(July 21) The razing of TA-01 began (The Atom, September 64, 1(9).
1964	A new 500,000-gallon water storage tank near the junction of Pajarito Raod and State Route 4 was constructed (The Atom, September 1964, 1(9).
1964	Pajarito Road was relocated near TA-46 (The Atom, September 1964, 1(9):5 "Hill Booms as Government Builds").
1964	(June 20) Firemen battle fires and smoke just west of Los Alamos' Western Area (The Atom July 1964, 7:21).
1964	Two beavers were released in Guaje Canyon by the New Mexico Department of Game and Fish. Beaver trapper Lee Cordova is shown releasing the last pair. Monitor 7/16/64 (shows picture). The game department and AEC Conservation Officer Homer Pickens hope that the beavers will build dams to impound a trout pond. More beavers will be carried in by horseback to the upper parts of Guaje and Los Alamos Canyons, Pickens said. (AEC photo).
1964	"Until recently the Jemez section of State Route 4 was sometimes hub-deep in dust or mud and tire-slashing rocks all summer, closed by snow all winter. It was once described by a New York Times travel writer as one of the Southwest's loneliest roads. Over the past two years the road improvement has been made. Los Alamos put its gasoline tax in the early 1950s to improve the stretch to Sawyer's Hill. In the summer of 1959 Bureau of Public Roads paved some miles of the mountain grade. By 1963, the Bureau extended payment across the Valle Grande. Where the road dips into the Valle Grande it follows an ancient route used by Native Americans, Spanish, and loggers. It was the supply route for the American Army to supply a fort in the Valle Grande in the 1860s. "Old timers are wont to deplore the paving of the route, but others acclaim it for the simple reason that the absence of dust has enabled them to see the country side clearly for the first time" (The Atom, August 1964, Vol 1, No. 8. P. 1.).
1964	A 100 space camping area was developed on Frijoles Mesa to replace the camping area in the canyon bottom (The Atom January 1964, Vol 1, No. 1 p. 25).
1964	Christmas trees were used to stabilize various arroyos in Pajarito and Rendija Canyons. Local boy scouts helped Homer Pickens with the project (The Atom, February 1964 Vol. 1 #2, p. 17-1964).
1965	Pajarito Road was widened as it descends into Pajarito Canyon near TA-18; Diamond Drive was also widened (The Atom May 1965, 2(5):24.
1965	St. Peter's Dome Road completed to Fire Overlook (The Atom November 1965 p. 9-11, "St. Peter's Gates Unlocked New Road to Forest Lookout Gives Long Look").
1965	The final paperwork was taken care of on the $50 million Cochiti dam on the Rio Grande. The Governor of Cochiti Pueblo signed an easement making it possible for the Corps of Engineers to build the 251-foot high, 5.5-mile long dam. The ceremony took place before a crowd of 2,000. Work is expected to be finished in 1970 (The Atom, 12(6):24, November and December 1975 "Give a Dam" 10 years ago in Los Alamos).
1966	The Romero Cabin on Pajarito Raod had a reprieve from doom. The actions were decreed by AEC Area Manager Charles Campbell in response to reports that a new hydrogen pipeline would require removal of the homestead cabin near the entrance to Ten Site. Campbell said the pipeline would be re-routed. (The Atom, January-February 1976, 13(1):24, "Saved by the Bell!").
1967	Redondo campground completed in the Jemez (The Atom, October 1967, 4(10):17-19, "Redondo New Camp Ground in the Jemez").
1967	Excavations begin for the Meson Facility (Atom, 4(8):3, 1967, "Excavations Begin for Meson Facility").
1967	Black bear was trapped in North Community and released into Guaje Canyon (The Atom, August 1967, 4(8):3, "Black Bear Trapped in North Community").
1967	Guaje Canyon fire destroys 10 acres. The fire started near Guaje Pines Cemetery, burned out about 10 acres of forest land in Guaje Canyon before it could be contained. Fire took place on May 6 following the driest first four months ever recorded on the Hill to that date (Atom Vol. 4, Number 6, June 1967 p. 21 "Forest Fire Threatened Barranca Homes").

Date	Event
1968	The building of Chamisa School in White Rock and the Instructional Materials Center at the High School ("A Beginning and End" The Atom, 5(4), April 1968).
1968	Boy Scout Troup 229 restored the Romero Cabin. AEC conservation Officer Homer Pickens supervised the operation (The Atom, 5(2), February 1968 pictures with captions).
1972	Wilderness area of 21,110 acres was designated in Bandelier National Monument by agency recommendation, approved 1976.
1972	H-8, Environmental Sciences, was formed from a section in H-6. The first seeds of environmental work were done in the 1960s when Bill Purtymun was hired from the USGS and Homer Pickens was hired by the AEC to work at LASL (Wayne Hansen).
1973	TA-55, Plutonium Facility was completed.
1977	(June 17-21) La Mesa fire began on Mesa del Rito.
1979	Cochiti Dam completed and flooding began.
1980	Tussuck moth infestation left many snags 200 yards each side of Los Alamos Canyon bridge. (Edward Collins, Forest Service to Althaus 1980 Memo).
1983	Eradication of burro population in Bandelier National Monument.
1984	The Romero Cabin was dismantled and moved to the Historical Society. This was done so that the road could be moved (Historical Archives files HS 42K).
1999	Elk Meadows was transferred to the National Park Service Friday. Ninety acres of land, located between Bandelier National Monument and the Baca Location will be added to the Monument. (Los Alamos Monitor, Tuesday, March 30, 1999, 36(62), "Bandelier Takes in Elk Meadows").
1999	The Research Park, 44 acres along East Jemez Road, was dedicated. This was a 55-year lease with DOE (Los Alamos Monitor, Tuesday, March 30, 1999, 36(62), "Dignitaries dedicate Research Park").