

3.0 CHAPTER 3 AFFECTED ENVIRONMENT

This chapter describes the current physical, biological, human, and land use environments of the Monument. The description provides a baseline against which to compare the impacts of the alternatives. The baseline described in this chapter represents environmental and social conditions in the Monument at the time the Analysis of the Management Situation (AMS) document was written (2005). In some cases, data have been updated to document changes that have occurred since 2005.

3.1. Resources

This section describes the current physical and biological environments of Monument resources, including air quality and climate, cultural resources, fuels and fire management, geology, paleontological resources, soil resources, terrestrial and aquatic wildlife, vegetation resources, visual resources, and water resources.

3.1.1. Air Quality and Climate

This section discusses the regulatory framework and current condition of the air resource and climate of the Monument. A more detailed description can be found in the AMS (BLM 2005b).

3.1.1.1. Regional Setting and Regulatory Framework

Federal and State governments have established ambient air quality standards for criteria air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), particulate matter (PM) less than or equal to 10 microns in size (PM₁₀), PM less than or equal to 2.5 microns in size (PM_{2.5}), ozone, and lead. Ozone is typically not emitted directly from emission sources, but at ground level it is created by a chemical reaction between ozone precursors, including oxides of nitrogen and volatile organic compounds (VOCs). Therefore, the Environmental Protection Agency (EPA) regulates emissions of VOCs.

With respect to National Ambient Air Quality Standards (NAAQS), the EPA classifies all locations in the United States as either “attainment” (including “unclassified”), “non-attainment,” or “maintenance” areas. These classifications are determined by comparing actual monitored air pollutant concentrations to their applicable Federal standards. Most counties in the Four Corners region are classified as attainment areas for all pollutants (only a small area around the city of Telluride, Colorado, is a PM₁₀ maintenance area).

With respect to visibility, under sections 169 and 401 of the Clean Air Act (CAA), there are several programs in place to protect visibility. These programs include the National Visibility Program, Prevention of Significant Deterioration for the review of potential impacts from new and modified sources, the secondary National Ambient Air Quality Standards for PM₁₀ and PM_{2.5}, and provisions for acid deposition control. In 1987, the Interagency Monitoring of Protected Visual Environments (IMPROVE) visibility network was established as a cooperative effort between the EPA, the NOAA, the NPS, the USFS, the USFWS, the BLM, and State governments to establish current conditions, track progress towards national visibility goals, and to provide information on types and sources of pollutants.

Under the Clean Air Act Amendments of 1977, Congress established a system for the prevention of significant deterioration (PSD) to protect areas that are not classified as non-attainment (i.e., cleaner than the NAAQS). A “PSD increment” classification system was implemented based on the amounts of additional NO₂, PM, and SO₂ degradation that would be allowed above existing baseline levels for various areas. A Class I area would have the greatest limitations, where virtually any degradation would be considered unacceptable. A

Class II area would permit moderate deterioration and controlled growth. National Parks of more than 6,000 acres, and wilderness areas and memorial parks of more than 5,000 acres were defined as Mandatory Federal Class I areas under the 1977 Amendments. All other areas not classified as non-attainment were defined as Class II areas. In addition to more stringent ambient air increments, Class I areas are also protected by the regulation of Air Quality Related Values (AQRVs) by the Federal land managers (FLMs) responsible for the areas. Typically, FLMs are concerned about detectable changes to AQRVs, such as to visibility, flora, fauna, and water and soil chemistry. Currently, the Monument is classified as a Class II area. The mandatory Federal Class I areas closest to the Monument and their approximate distances from the Monument are as follows:

- Mesa Verde National Park, Colorado (25 miles/40 kilometers);
- Weiminuche Wilderness Area, Colorado (70 miles/112 kilometers); and
- Canyonlands National Park, Utah (118 miles/190 kilometers).

The existing air quality of the Monument, as well as future air quality impacts to the Monument, would be based on the pollutants and Class I Area parameters listed in Table 3-1. This table summarizes the NAAQS, Class I and Class II Significant Impact Levels (SILs), PSD allowable increments for Class I and Class II areas, and AQRVs for Class I area.

Under the NEPA, potential air quality impacts due to activities in the Monument must be compared to applicable air quality standards. While comparisons are intended to evaluate a “threshold of concern” for potentially significant direct project impacts, they do not necessarily represent a cumulative analysis. Some regulatory analyses are the responsibility of the State air quality agency (under EPA oversight) and would be conducted during the permitting process.

3.1.1.2. Current Conditions and Trends

Climate and Climate Change

The Monument is in a mountainous, continental region characterized by high mesas and plateaus, and deserts. Dry, sunny days and clear nights with extreme daily temperature changes characterize the climatic region. There are two long-term National Weather Service Cooperative Observer Program monitoring stations near the project area: one east at Cortez, Colorado (6,210 feet in elevation; 1929 through 2004), and one west at Hovenweep National Monument, Utah (5,240 feet in elevation; 1957 through 2004).

In winter, the average daily maximum temperature is nearly 40 degrees Fahrenheit (°F), with the average daily minimum temperature reaching 15 °F. In summer, the average daily maximum temperature reaches 90 to 95 °F, depending on the elevation, and the average daily minimum temperature is nearly 55 °F (WRCC 2005). Precipitation amounts are generally low, and fairly even throughout the year, except during a typically dry period in May and June when the westerly flow of moisture diminishes and summertime southerly flow has yet to be established. Snowfall is possible from mid-October through April, with an average snow depth of 1 inch or more from December through February. Total winter snowfall amounts range from 20 to 35 inches throughout the Monument (depending on the elevation).

Since 1999, the Monument has experienced a period of relatively low precipitation. The annual average precipitation at both monitoring stations has ranged from 49 to 89 percent of normal. In fact, four out of the 10 driest years ever measured at Cortez, Colorado, occurred during this period. Although significant periods of missing data have occurred at Hovenweep National Monument, Utah, a similar distribution may be expected west of the Monument. An extended period of low precipitation constitutes a drought condition. The impacts of the drought on the various resources in the Monument are described in each individual resource section below.

Table 3-1 Air Quality Standards, Increments, Significant Impact Levels (SILs), and Air Quality Related Value (AQRV) Criteria							
Pollutant/AQ RV	Averaging Interval	EPA Class II SIL ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)	Class II PSD Increment ($\mu\text{g}/\text{m}^3$)	EPA Proposed Class I SIL ($\mu\text{g}/\text{m}^3$)	Class I PSD Increment ($\mu\text{g}/\text{m}^3$)	AQRV Threshold
NO ₂	Annual	1	100	25	0.1	2.5	--
SO ₂	3-hour	25	1,300	512	1.0	25	--
	24-hour	5	365	91	0.2	5	--
	Annual	1	80	20	0.1	2	--
PM ₁₀	24-hour	5	150	30	0.3	10	--
	Annual	1	50	17	0.2	5	--
PM _{2.5}	24-hour	--	65	--	--	--	--
	Annual	--	15	--	--	--	--
CO	1-hour	2,000	40,000	--	--	--	--
	8-hour	500	10,000	--	--	--	--
Ozone	8-hour	100 tons per year (tpy) VOC	0.075 ppm	--	--	--	--
Lead	Quarterly	0.1	1.5	--	--	--	--
Visibility (deciviews)	24-hour	--	--	--	--	--	1.0
Nitrogen Deposition (kg/ha-yr)	Annual	--	--	--	--	--	3.0
Sulfur Deposition (kg/ha-yr)	Annual	--	--	--	--	--	5.0

kg/ha-yr = kilograms per hectare per year; ppm = parts per million
 $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter; tpy = tons per year

The State of Colorado has established a 3-hour SO₂ ambient air quality standard of 700 $\mu\text{g}/\text{m}^3$ in addition to a program similar to the Federal PSD increments limiting additional amounts of SO₂ above baseline conditions. The Federal Land Managers Air Quality Related Value Workgroup (FLAG) Guideline (2000) established visibility AQRV thresholds for Class I Areas. The FLAG "just noticeable change" 1.0-deciview threshold is used to assess the significance of potential visibility impacts. The USFS has established cumulative deposition impacts thresholds of concern (Fox et al. 1989).

Wind conditions are not monitored in the Monument; however, in the absence of synoptic winds from the west to southwest, winds are typically influenced by terrain features (upslope during the day and downslope at night). In addition, the strongest winds tend to occur during springtime synoptic systems and are associated with summer thunderstorms. Five Remote Automatic Weather Stations (RAWS) operate at elevations between 6,187 and 8,660 feet and are located outside the Monument (WRCC 2005). At these locations, the winds are calm 5 to 39 percent of the time, and most have speeds less than 8 miles per hour (mph).

On-going scientific research has identified the potential impacts of “greenhouse gas” (GHG) emissions (including carbon dioxide, CO₂; methane; nitrous oxide; water vapor; and several trace gasses) on global climate. Through complex interactions on a regional and global scale, these GHG emissions cause a net warming effect of the atmosphere (making surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO₂ concentrations to increase dramatically, and are likely to contribute to overall climatic changes, typically referred to as global warming. Increasing CO₂ concentrations also lead to preferential fertilization and growth of specific plant species.

Global mean surface temperatures have increased nearly 0.74°C (1.3°F) from 1906 to 2005 (IPCC, 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Regional assessments for the western United States indicate that temperatures have risen 1.7°C (1.8°F) between 1908 and 2007. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions at a scale relevant to local land planning activities, but increasing concentrations of GHG are likely to accelerate the rate of climate change.

In 2007, the IPCC indicated that based on the average of several global climate model predictions, by the year 2100, average surface temperatures in western North America would increase 2.1 to 5.7°C (3.8 to 10.3°F) above the 1980 to 1999 baseline. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures.

Air Quality

The background air quality for the Monument is defined using air quality and AQRV monitoring data. Although there are no air quality monitors operating in the Monument, background air quality conditions in the area can be determined from monitoring data collected at other representative locations throughout the region. All criteria pollutants are monitored in the region by State and local air quality regulatory agencies. AQRV monitoring in Mesa Verde is conducted by the IMPROVE program. Table 3-2 summarizes the background air quality for the criteria pollutants, except lead, and AQRV data that would be used for the air quality analyses for the region. The background data represent the most conservative (highest) values from the monitoring data during the reporting period (derived from the EPA Air Data website [EPA 2004] at <http://www.epa.gov/air/data/info.html>).

The air quality monitoring data from 2001 through 2004 show that for all EPA criteria pollutants, measured values are substantially lower than the applicable NAAQS values. All areas within or near the Monument meet air quality standards.

Atmospheric mercury contamination in the Four Corners area is an emerging issue. The preliminary PSD permit for the new Desert Rock Coal Power Plant and the 2006 listing of a mercury fish advisory at Vallecito Reservoir indicate the need for concern. Additional bodies of water that currently have fish mercury advisories near the Monument, according to the Colorado Department of Public Health and Environment (CDPHE), include Totten, Narraguinnep, and McPhee Reservoirs, and others near Cortez, Colorado. Local atmospheric mercury levels are largely attributed to several regional coal power plants (Source: Environment Colorado: <http://www.environmentcolorado.org/reports/madeintheusa.pdf>). Atmospheric deposition of mercury was identified as a contributing factor in the total maximum daily load (TMDL) measurements developed for McPhee and Narraguinnep reservoirs (CDPHE 2003a).

Information regarding ozone concerns in the Four Corners area is available on the Four Corners Air Quality Task Force website (see 8-hour ozone) (Four Corners Air Quality Task Force 2005) (http://www.nmenv.state.nm.us/aqb/4C/Docs/4CornersOzoneDataGraphs_files/frame.htm).

While the NAAQS for ozone are not exceeded, the ozone concentrations are very high for a rural area. With proposed new oil and gas activity, coupled with new coal power generation, these values could go higher (Four Corners Air Quality Task Force 2005).

Pollutant/AQRV Parameter	Background Data	Monitoring Station
NO ₂ – Annual Concentration (ppb)	9	La Plata, CO
SO ₂ – Annual Concentration (ppb)	2	Farmington, NM
SO ₂ – 24-hr High-2 nd High Concentration (ppb)	8	Farmington, NM
SO ₂ – 3-hr High-2 nd High Concentration (ppb)	26	Farmington, NM
CO – 8-hr High-2 nd High Concentration (ppm)	1.6	Ignacio, CO
CO – 1-hr High-2 nd High Concentration (ppm)	2.0	Ignacio, CO
PM ₁₀ – Annual Concentration (µg/m ³)	21	La Plata, CO
PM ₁₀ – 24-hr High-2 nd High Concentration (µg/m ³)	64	La Plata, CO
PM _{2.5} – Annual Concentration (µg/m ³)	6.9	Farmington, NM
PM _{2.5} – 24-hr High-2 nd High Concentration (µg/m ³)	22.5	Mesa Verde, CO
Ozone – 8-hr Concentration (ppb)	71	Mesa Verde, CO

Pollutant/AQRV Parameter	Background Data	Monitoring Station
Ozone – 1-hr Concentration (ppb)	77	Mesa Verde, CO
Nitrogen Deposition (kg/ha-yr)	2.3	Mesa Verde, CO
Sulfur Deposition (kg/ha-yr)	1.2	Mesa Verde, CO
Mesa Verde Visibility (annual average □eciviews)	23.6	Mesa Verde, CO
<i>ppb = parts per billion</i> <i>hr = hour</i>		

Major sources of pollution that impact local air quality include new and existing coal-fired power plants, increasing populations and mobile sources, and oil and gas development. Results from the Northern San Juan Basin Coal Bed Methane Project EIS (USDA Forest Service 2006), concluded that cumulative air quality impacts (visibility impairment) are expected in Mesa Verde and Weiminuche Class I areas as a result of current and planned oil and gas development in the Four Corners area. The Desert Rock Coal Power Plant Project, as proposed, would result in significant air quality impacts to these Class I areas.

Air quality trends in the Four Corners area and at Mesa Verde are widely acknowledged as moving downward. An interagency task force was recently assembled to try and develop strategies to reverse pollution trends in the area. The role of the Four Corners Air Quality Task Force is to provide interim recommendations for emissions reductions. One such recommendation is that any new or replacement wellhead engines or large compression engines associated with oil and gas development would require the implementation of new emission control measures for oxides of nitrogen (Nox). This is a new requirement for all San Juan Public Land activities and would change the way the Monument has been permitting APDs in the Monument. Until such time that the Four Corners Air Quality Task Force makes final recommendations for emissions control, these interim guidelines are in effect.

3.1.2. Cultural Resources

Cultural resources are the material and physical remains of past human activity, ranging from objects such as artifacts, structures, and features, to natural features and landscapes. Cultural resources are finite and non-renewable resources that embody characteristics and information specific to the cultural group who produced them, and to the time period during which they were created.

The NHPA and the ARPA provide for the protection of cultural resources on Federal lands. Section 106 of the NHPA requires Federal agencies to take into account the effects of their activities on significant historic properties, and specifies the procedures for meeting the statutory responsibilities. The NHPA also established the NRHP, which is a national program that coordinates and supports public and private sectors in the identification, evaluation, and protection of historic and archeological resources. The NRHP offers the official listing of the Nation's historic places deemed worthy of preservation. Section 110 of the NHPA is the legal basis for the historic preservation component of the BLM's cultural program. Section 110 of the

NHPA prescribes the responsibilities of Federal agencies in the identification, evaluation, registration, and protection of significant properties; provides guidelines as a standard of conduct; and directs agencies to ensure that preservation responsibilities are fully integrated into agency operations and management.

Federal agencies are required to identify, evaluate, and nominate historic properties in Federal ownership or control to the NRHP. The NRHP significance of historic properties is determined through evaluation of the property using the guidelines and criteria in 36 CFR 60. The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that:

- are associated with events that have made a significant contribution to the broad patterns of our history;
- are associated with the lives of persons significant in America's past;
- embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction; and/or
- have yielded, or may be likely to yield, information important in prehistory or history.

Significant cultural resources or "historic properties" are defined as those listed on, or that are eligible for listing on, the NRHP.

Prehistoric cultural resources are often evaluated under the criteria of 36 CFR 60.4.d, which pertains to a site's potential to yield scientific information addressing pertinent research questions. Sites most likely to contain important data are those with intact cultural deposits and those where artifacts and features are relatively undisturbed. Features such as hearths, storage or habitation structures, or living structures often yield charcoal for radiocarbon dating; macrobotanical, palynological, and faunal evidence of subsistence practices; and associated datable artifact assemblages. In some cases, prehistoric cultural resources may be significant in terms of the criteria of 36 CFR 60.4. a.-c.

Frequently, historic cultural resources are evaluated in terms of their architectural significance and/or in terms of their association with events of individuals of historical importance (36 CFR 60.4 a.-c.). It is also important to consider historic cultural resources in terms of their value as an archaeological resource. Significant historic archaeological resources are those that are relatively undisturbed, those that can be attributed to a specific theme, and those that retain sufficient artifacts and features to permit further study. The NRHP significance of traditional cultural properties is usually assessed based upon information obtained through consultations with elders and other knowledgeable individuals of a cultural group, as well as through a review of historical documentation.

On a landscape scale, the Monument contains a remarkable diversity and density of cultural resources that represent past lifeways and associated cultures and traditions spanning thousands of years. A site database compiled by the Colorado Historical Society's Office of Archaeology and Historic Preservation (OAHP) for sites within the boundaries of the Monument was used to compile summary site data (see Table 3-3).

Table 3-3 National Register Status of Recorded Cultural Resources, by Component

National Register of Historic Places Status	No. of Prehistoric Sites	No. of Multi-component Sites	No. of Historic Sites	Total ^a	Percent
Listed on NRHP	175 ^b	2	0	177	3.4
Officially eligible ^c	909	16	3	928	18.0
Field eligible ^d	954	47	14	1,015	19.7
Officially need data ^c	230	9	5	244	4.7
Field need data ^d	796	7	11	814	15.8
Officially not eligible ^c	218	4	8	230	4.4
Field not eligible ^d	426	13	33	472	9.2
No NRHP assessment	1,257	13	7	1,277	24.8
TOTAL	4,965	111	81	5,157	100.0

a. Site totals include 92 sites recorded in the Indian Camp Northeast Hazardous Fuel Reduction Project (Fetterman 2004) and 12 sites from the Colorado College Survey of the Painted Hand Environs (Van Dyke et al. 2004) that are not yet entered into the OAHN database. Site totals also include 10 sites on the Anasazi Heritage Center (AHC) administrative site (80 acres) and 28 documented sites on two recently acquired Monument edgeholdings (295 acres) and one in-holding (440 acres).

b. Four sites identified in the OAHN database as being part of the Hovenweep National Register District are not included in this total because it is currently undetermined whether these sites are located on NPS or BLM-administered land. This total includes 167 sites in the Sand Canyon National Register District and 8 individual sites including Lowry Pueblo, which is also a National Historic Landmark. The multi-component sites are not counted in the total as separate sites.

c. Field recommendations for National Register status are based on the site form prepared by the agency/recorder. Sites for which there has been no review and concurrence of determination by the SHPO are listed as field eligible, need data, or not eligible.

d. Official determinations of National Register eligibility are made after the SHPO has reviewed the agency report and site form and has agreed with the agency recommendation.

The Monument contains approximately 5,157 previously recorded cultural resources, representing a wide variety of site types and chronological periods, including cliff dwellings, villages, great kivas, shrines, springs, agricultural fields, check dams, reservoirs, rock art, sweat houses and habitations, historic homesteads and dwellings, camps, corrals, and mines. Individual sites range in size from less than 1 acre to more than 10 acres.

The known cultural resources include 4,965 (96 percent) prehistoric sites, 81 (2 percent) historic sites, and 111 (2 percent) multi-component prehistoric/historic sites. The distribution of known cultural resources is presented on Map 1. An additional three sites of unknown age, as well as 1,101 isolated finds, have been recorded (1,081 prehistoric and 20 historic), for a total of 6,261 documented cultural resources in the Monument.

Portions of the Monument have very high site densities, exceeding 100 sites per square mile. Areas of apparent heaviest site density reflect, to a large degree, areas that have had intensive archaeological surveys conducted. Approximately 18 percent of the Monument has been intensively inventoried for cultural resources. Many of the past inventories were not conducted in a manner that meets current standards. Subsequent reexamination of these areas has determined that earlier site data can be unreliable and/or poorly documented. Based on projections, it is estimated that the total number of sites in the Monument may range from 20,000 to 30,000.

The cultural history of the Monument was summarized in the Presidential Proclamation establishing the Monument, as follows:

“People have lived and labored to survive among these canyons and mesas for thousands of years, from the earliest known hunters crossing the area 10,000 years ago or more, through Ancestral Puebloan farmers, to the Ute, Navajo, and European settlers whose descendants still call this area home. There is scattered evidence that Paleo-Indians used the region on a sporadic basis for hunting and gathering until around 7500 B.C. During the Archaic period, generally covering the next 6,000 years, occupation of the Four Corners area was dominated by hunters and gatherers.

By approximately 1500 B.C., the more sedentary Basketmakers spread over the landscape. Farming began to blossom as Ancestral Northern Puebloan people occupied the area around A.D. 750, and continued through about A.D. 1300, as the area became part of a much larger prehistoric cultural region that included Mesa Verde to the southeast. Year-round villages were established, originally consisting of pit house dwellings, and later evolving to well-recognized cliff dwellings. Many archaeologists now believe that throughout this time, the Ancestral Puebloan people periodically aggregated into larger communities and then dispersed into smaller community units. Specifically, during Pueblo I (from approximately A.D. 700 to A.D. 900), the occupation and site density in the Monument area increased. Dwellings tended to be small, with three or four rooms. Then, during Pueblo II (from approximately A.D. 900 to A.D. 1150), the size and number of settlements diminished and were highly dispersed. Late in Pueblo II and early in Pueblo III, around A.D. 1150, the size and number of settlements again increased and residential clustering began. Later pueblos were larger, multi-storied masonry dwellings with 40 to 50 rooms. For the remainder of Pueblo III (from approximately A.D. 1150 to A.D. 1300), major aggregation occurred in the Monument, typically at large sites situated at the heads of canyons. One of these sites includes the remains of approximately 420 rooms, 90 kivas, a great kiva, and a plaza, covering more than 10 acres in all. These villages wrapped around the upper reaches of canyons and spread down onto talus slopes, enclosed year-round springs and reservoirs, and included low, defensive walls. The changes in architecture and site planning reflected a shift from independent households to a more communal lifestyle.

Farming during the Puebloan period was affected by population growth and by changing climate and precipitation patterns. As the population grew, the Ancestral Pueblos expanded into increasingly marginal areas. As a result, natural resources were increasingly compromised, impacting soil productivity and growing conditions. When dry conditions persisted, Pueblo communities moved south, southwest, and southeast, where descendants of these Ancestral Puebloan people live today.

Soon after the Ancestral Pueblos left the Monument area, the nomadic Ute and Navajo took advantage of the natural diversity found in the variable topography by moving to lower areas, including the Monument's mesas and canyons, during the cooler seasons. A small number of forked-stick hogans, brush shelters, and wickiups are the most obvious remnants of this period of occupation.

Although the Monument was traversed by early Euro-American explorers, Euro-American occupation of the Monument area did not begin until the late nineteenth century, after the Ute had been restricted to reservations outside of the area. Successful homesteads left the public domain and are not included in the Monument boundaries. The primary uses of the Monument in the twentieth and twenty-first centuries have been mineral exploration, livestock grazing, hunting, and cultural resource exploration and looting. These uses are represented in the archaeological record by abandoned homesteads, mining claim markers, corrals, stock ponds, historic rock drawings and inscriptions, camps, and trash disposal sites.” (Proclamation 2000)

3.1.2.1. Regional Setting and Regulatory Framework

The regional cultural setting and regulatory framework are described in the following sections. A more detailed description can be found in the AMS (BLM 2005b).

The cultural history of southwest Colorado is thoroughly described in Colorado Prehistory: A Context for the Southern Colorado River Basin (Lipe et al. 1999). The regional cultural chronology is summarized in Table 3-4.

Dates	Periods	Distinctive Characteristics
A.D. 1776 to present	Euro-American	Homesteads dating from as early as the 1880s, camps, rock art and inscriptions, water control features, animal pens, mining claim markers, and roads.
Undetermined date to present	Ute	A mobile lifestyle based on seasonal rounds of hunting and gathering. Later, there were farms in McElmo Canyon. Early sites were represented by wickiups, rock art, and brown-ware pottery.
A.D. 1300 to present	Navajo	Seasonal use of the area for livestock grazing and resource gathering; hogans, sweat lodges, and distinctive pottery.
A.D. 1150 to A.D. 1300	Pueblo III	Large pueblos and a shift in settlement from mesa tops to canyon rims in some areas with a dispersed pattern in others; high kiva-to-room ratios, cliff dwellings and towers; corrugated gray and elaborate black and white (B/W) pottery, and red or orange pottery (red ware) in some areas. There was a mass migration from the area by A.D. 1300.
A.D. 900 to A.D. 1150	Pueblo II	A Chacoan influence; Great Houses, great kivas, routes, etc., in many, but not all regions; strong differences between Great Houses and surrounding unit pueblos composed of a kiva and small surface masonry room block; corrugated gray and elaborate B/W pottery, and decorated red ware.
A.D. 750 to A.D. 900	Pueblo I	Large villages; unit pueblos of “proto-kiva” plus surface room block of jacal or crude masonry; great kivas; plain and neck-banded gray pottery; and low frequencies of B/W and decorated red ware.

Table 3-4 Cultural Chronology for Southwest Colorado		
Dates	Periods	Distinctive Characteristics
A.D. 500 to A.D. 750	Basketmaker III	Habitation in deep pit houses, plus surface storage pits, cists, or rooms; dispersed settlement with occasional small villages and occasional great kivas; plain gray pottery; and low frequencies of B/W pottery. The bow and arrow replaced the atlatl; and beans were added to the diet.
A.D. 50 to A.D. 500	Basketmaker II (late)	Habitation in shallow pit houses, plus storage pits or cists; dispersed settlement with small low-density villages in some areas; campsites were important as well; gray pottery; atlatl and dart; corn and squash, but no beans; and upland dry farming in addition to floodplain farming.
1500 B.C. to A.D. 50	Basketmaker II (early)	Long-term seasonal use of caves, rock shelters, and alcoves for camping, storage, burial, and rock art; San Juan anthropomorphic style pictographs/petroglyphs; and limited activity sites in open. There were baskets, but infrequent gray pottery; atlatl and dart; corn and squash, but no beans; and cultivation was primarily floodplain or runoff based.
7000 B.C. to 1500 B.C.	Archaic	Subsistence based on hunting and gathering of wild foods; high mobility; low population density; shelters and open sites; atlatl and dart; and use of baskets, but not pottery.
8000 B.C. to 7000 B.C.	Paleo-Indian	Big game hunting and wild food procurement; high mobility; low population density; large, unfluted lanceolate projectile points; and use of baskets, but not pottery.

Source: Adapted from Lipe, et al. 1999.

Important laws, regulations, executive orders, etc., governing cultural resource management in the Monument are discussed in detail in the AMS (BLM 2005b) and summarized in Table 3.5.

Table 3-5 Cultural Resource Mandates and/or Authorities
Laws and Proclamations
Antiquities Act of 1906 (PL 59-209; 34 Stat. 225; 16 USC 431 - 433)
Historic Sites Act of 1935 (PL 74-292; 49 Stat. 666; 16 USC 461)
Reservoir Salvage Act of 1960, as amended by Archaeological and Historic Preservation Act of 1974 (PL 86-523; 74 Stat. 220, 221; 16 USC 469; PL 93-291; 88 Stat. 174; 16 USC 469)
National Historic Preservation Act of 1966 as amended (NHPA) (PL 89-665; 80 Stat. 915; 16 USC 470)
National Environmental Policy Act of 1969 (NEPA) (PL 91-190; 83 Stat. 852; 42 USC 4321)
Archaeological and Historic Preservation Act of 1974 (AHPA) (16 USC 469-469C)
Federal Land Policy and Management Act of 1976 (FLPMA) (PL 94-579; 90 Stat. 2743; 43 USC 1701)
American Indian Religious Freedom Act of 1978 (PL 5-431; 92 Stat. 469; 42 USC 1996)
Archaeological Resources Protection Act of 1979 (ARPA) (PL 96-95; 93 Stat. 721; 16 USC 470aa et seq.) as amended (PL 100-555; PL 100-588)
Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (PL 101-601; 104 Stat. 3048; 25 USC 3001)
Monument Proclamation (Executive Order 2000, Proclamation #7317, establishment of the Canyons of the Ancients National Monument by the President of the United States of America, June 9, 2000; Appendix A)
Regulations
36 CFR Part 7 (Waiver of Federal Agency Responsibilities under Section 110, NRHP)
36 CFR Part 60 (National Register of Historic Places [NRHP])
36 CFR 79 (Curation of Federally Owned and Administered Archaeological Collections)
36 CFR Part 800 (Protection of Historic Properties)
43 CFR Part 3 (Preservation of American Antiquities; implementing regulations for the Antiquities Act)
43 CFR Part 7 (Protection of Archaeological Resources)

Table 3-5 Cultural Resource Mandates and/or Authorities
43 CFR Part 10 (NAGPRA Regulations; Final Rule)
Policy and Interim Guidance
1970 United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Means of Prohibiting and Preventing the Illicit Import and Transfer of Ownership of Cultural Property (implemented in the United States by PL 97-446 in 1983 [19 USC 2601]) (UNESCO 1970)
BLM Colorado State Director's Guidance Regarding Interim Management for Canyons of the Ancients National Monument (BLM 2001c)
BLM Interim Management for all National Monuments (BLM 2001a)
Interim Management Guidance for Oil and Gas Leasing and Development (BLM 2001b)
BLM policy and program guidance for the management of cultural resources, outlined in Manual Sections 8100, 8110, 8120, and 8130 (BLM 2004b)
Departmental Manual Part 411 Museum Property Management
Instruction Memorandum
BLM Instruction Memorandum No. CO-2002-029, Interim Historic Preservation Guidelines and Procedures for Evaluating the Effect of Rangeland Management Activities on Historic Properties (BLM 2002b)
Executive Orders
Executive Order 11593, Protection and Enhancement of the Cultural Environment
Executive Order 13007, Providing for American Indian and Alaska Native Religious Freedom and Sacred Land Protections
Executive Order 13084, Consultation and Coordination with Indian Tribal Governments
Executive Order 13195, Trails for America in the 21st Century
Executive Order 13287, Preserve America
Agreements
State Protocol Agreement between the Colorado State Director of the BLM and the Colorado State Historic Preservation Officer (BLM 1998a) regarding the manner in which the BLM will meet its responsibilities under the National Historic Preservation Act, and the National Programmatic Agreement between the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers

Table 3-5 Cultural Resource Mandates and/or Authorities
Programmatic Agreement between the BLM, the State of Colorado, the national forests in the State of Colorado, the USFS, the State Historic Preservation Office of Colorado, and the Advisory Council on Historic Preservation regarding the management of wildland fire for resource benefits (Agreement No. 1102-002-98-038) (BLM 1998b)
Programmatic Agreement between the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the manner in which the BLM will meet its responsibilities under the National Historic Preservation Act (BLM 1999)
Informational Bulletin No. 2002-101 Cultural Resource Considerations in Resource Management Plans (BLM 2002d)
Memorandum of Understanding (MOU) between the BLM Canyons of the Ancients National Monument and the State of Colorado, Colorado Historical Society, June 19, 2003
Memorandum of Understanding (MOU) between the BLM Canyons of the Ancients National Monument and the United States Fish and Wildlife Service, September 18, 2003

3.1.2.2. Current Conditions and Trends

The condition of cultural resources in the Monument varies according to a number of factors, including terrain, construction, geomorphology, visibility, access, and historic and current land use patterns. Surface and buried cultural resources can be affected by disturbances resulting from natural processes, including wind and water erosion; animal-caused actions, including burrowing and trampling; and ground-disturbing human activities, including vandalism. Cultural resources with standing walls are vulnerable to erosion and impacts from livestock and humans. The most common forms of vandalism include graffiti on rock art panels and unauthorized excavation and looting of sites. Inadvertent damage to sites can result from recreational activities, such as off-road motorized vehicles and bicycles, as well as from increases in public visitation. It is important to recognize that authorized activities at sites, such as scientific information recovery (permitted excavations), can also result in the destruction of portions of sites. Wildfires also cause site deterioration, with the degree of damage being dependent upon the intensity and duration of the fire as well as upon the type of site(s) that are burned. Such damage can include total loss of site elements that are flammable, spalling of rock faces, alteration of dating potential, and post-fire erosion. Even fire suppression tactics, such as fire-line construction and aerial fire retardant drops, can result in damage to sites.

Information on the condition of cultural resource sites in the Monument is extremely variable and generally incomplete, making quantification difficult. This is because a consistent methodology for quantifying and recording site condition data has not been used in the past. It is also due, in some measure, to changes in site recording methods and forms, technology, and advances in knowledge. To collect reliable site condition information, a consistent method for site condition quantification and documentation should be developed and implemented for use in the Monument. In addition, the locations of sites recorded from the 1960s to the early 1990s should be validated, and the site documentation should be updated to current standards.

Carefully collected, standardized data on conditions is needed to obtain more accurate information on the specific types of impacts that are occurring to sites in the Monument. The AMS (BLM 2005b) summarizes the results of a study of the condition of cultural resources in the Monument for seven different disturbance factors, in which chaining was found to have had the greatest impact.

As detailed in the AMS (BLM 2005b), the principal uses of cultural resources in the Monument today are tourism, scientific research, education, interpretation, and cultural heritage values. The BLM Land Use Planning Handbook (BLM 2005a) specifies that cultural resources be allocated according to their potential uses and that the associated appropriate management actions are implemented as follows:

- **Scientific Use:** Sites are preserved until their research potential is realized; appropriate research, including data recovery, would be permitted.
- **Conservation for Future Use:** Sites are preserved until conditions for use are met; protective measures/designations would be proposed.
- **Traditional Use:** Sites are preserved for the long term; information about sites with heritage values for the various individual groups with cultural connections to the Monument area—including both Native American and Euro-Americans—needs to be obtained, so that such sites can be protected and managed. For sacred sites, it would be necessary to develop an approach to site management that does not require tribes to divulge their locations.
- **Public Use:** Sites are managed for long-term preservation and site interpretation; permitted use would be determined.
- **Experimental Use:** Sites are protected until used; the nature of the experiment would be determined.
- **Discharged from Use:** Sites would be removed from protective measures.

As part of the planning process, all previously recorded cultural resources in the Monument would be allocated to use categories. Safeguards against incompatible land and resource uses may be imposed through withdrawals, stipulations on leases and permits, design requirements, and similar measures developed and recommended by an appropriately staffed interdisciplinary (ID) team.

Sites must be documented before they can be assigned to use categories. More than 80 percent of the Monument has not yet been inventoried for cultural resources; thus, a phased approach to the cultural resource inventory would be necessary. Areas in the Monument should be identified and prioritized for future inventory. Criteria for inventory needs could be based upon such factors as the lack of systematic inventory, high public recreation use, high research potential, and previously inventoried areas for which records need field-checking/updating. The Proclamation's requirement to protect objects of scientific or historic interest is the highest requirement.

3.1.3. Fuels and Fire Management

Pinyon-juniper woodlands dominate the Monument landscape, covering approximately 67 percent of the Monument land area. This vegetative community type has a fire regime that ranges from frequent, low-intensity fires to rare, high-intensity, stand-replacing fires. Salt-desert

shrub communities are the second most abundant vegetative type, covering 22 percent of the Monument. This vegetation type typically has infrequent, low intensity fires. Big sagebrush communities, which cover approximately 8 percent of the Monument land area, experience relatively frequent, low-intensity fires. Riparian communities, which cover approximately 1 percent of the Monument, experience infrequent, stand-replacing fires.

Based upon general knowledge of fire ecology in the region and the vegetation structure of the Monument, it is likely that fire has the greatest impact on the ecology of pinyon-juniper woodlands and big sagebrush habitat types. It has a lesser impact on riparian and salt-desert shrub habitats. However, there is little data available regarding the fire regime, including fire frequency, seasonality, intensity, and/or scale for the area. Based on data extrapolated from other areas with similar conditions, it can be predicted that, given the current state of the fuels in the Monument, there is a 90-percent risk of very high to extreme fire danger. Within the past 7 years, there have been five documented fires in the Monument, ranging in size from 1 acre to more than 1,000 acres.

Aerial photographs of the area illustrate an increase in stand density in the pinyon-juniper woodlands over the last 40 years, indicating that fuels in the Monument have increased during this period. In addition, infestations by *Ips* Beetles and drought conditions over the past several years have increased the mortality rates of pinyon trees. In many areas around the Monument, 60 to 90 percent of pinyon trees have died. The degree of mortality has not been as high within the Monument. In addition, the year 2005 saw a major increase in cheatgrass (*Anisantha tectorum*), due in large part to the drought and openings in the woodland floor caused by tree mortality. These conditions have resulted in larger and higher-intensity fires in the Monument and have increased the risk of high-severity crown fires. Detailed descriptions of these communities are found in Sections 3.1.8, Vegetation Resources, and 3.2.6, Livestock grazing.

The National Fire Plan (USDOJ 2000) and the Healthy Forest Restoration Act outline State and national goals and objectives relative to fire and fuels management. However, because most vegetation types in the Monument have high-intensity fire regimes, there is often conflict between attaining healthy ecosystems, protecting cultural resources, and ensuring public safety. In addition, the wildland/urban interface is a major issue influencing fire and fuels management in the Monument.

3.1.3.1. Regional Setting and Regulatory Framework

The fuels and fire regional setting and regulatory framework are described below. A more detailed description can be found in the AMS (BLM 2005b).

The Monument is located on the Colorado Plateau; it is situated in a transition zone between montane and desert communities. Fire season in the Monument generally lasts from June through September, with some drought years extending the season from March through September. Most fires in the area are started naturally (by lightning strikes). Larger fires are typically associated with wind events, since winds are necessary to spread the fire through the canopies of the pinyon-juniper stands. Although lightning is a frequent occurrence in the Monument, conditions necessary to spread fire, including wind, are often absent. However, the increase in pinyon mortality, and the resulting increase in dead fuels and cheatgrass, may cause new fires to spread faster and more easily across the area.

In general, management of the Monument's vegetation resources is guided by the Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (BLM

1997), as well as by livestock management actions in the San Juan/San Miguel RMP ROD (BLM 1985). Additional laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the related resources and land uses in the Monument, are described and listed in Chapter 1, Purpose and Need.

3.1.3.2. Current Conditions and Trends

Current conditions, management practices, and trends are described below.

Community Structure and Fuel Conditions

The Fire Regime Condition Class (FRCC) is a protocol used to ecologically evaluate present-day landscapes within the context of fire and fuels management (Schmidt et al. 2002). FRCCs describe the historical baseline for the composition, structure, and disturbance regime of specific vegetation types. This baseline, or reference condition, is defined as the “historic range of variability” (HRV), which recognizes that ecosystem composition, structure, and disturbance vary over time and space. After the HRV description is developed, vegetation types are assigned to their appropriate Fire Regime Group. Fire Regime Groups range from I to V, with Group I describing frequent low-intensity fires in long-needle pine communities, Group II describing frequent stand-replacing fires in grassland and shrub communities, Group III describing intermittent fires of moderate intensity in dry sagebrush or chaparral communities, Group IV describing intermittent stand-replacing fires in lodgepole pine or aspen habitat, and Group V describing infrequent stand-replacing fires in high-elevation conifer communities.

Pinyon-juniper habitat in the Monument ranges from communities with closed canopies and sparsely vegetated understories to open stands with understories that are densely vegetated with an assortment of shrubs and grasses. Due to this diversity, pinyon-juniper woodlands in the Monument can be classified in Fire Regime Groups I, IV, and V; however, most pinyon-juniper communities in the Monument fall into Group IV. In general, young pinyon-juniper communities in the Monument include trees with high live-fuel moisture and little dead material, representing areas where fire would spread slowly and where fuel loads are light. Older pinyon-juniper communities comprise areas with high tree density, large amounts of dead material, and low live-fuel moisture, representing areas where fire is predicted to spread rapidly and burn with high intensity.

Management practices have undoubtedly contributed to the alteration of pinyon-juniper communities in the Monument. Fire exclusion has had an important influence on the overall structure of these woodlands. Currently, the density of pinyon and juniper trees is extremely high, and many pinyon-juniper habitats in the Monument have lower than expected herbaceous coverage in the understory (BLM 2005b). Livestock grazing in the Monument has also contributed to the deterioration of understory vegetation, as this has allowed non-native weeds (including cheatgrass) and woody species to out-compete native herbaceous species. Cheatgrass can increase fire frequency in pinyon-juniper habitats. This poses a significant threat to both herbaceous and woody vegetation that is not adapted to frequent fire (Section 3.1.3). Extensive chaining (a mechanized vegetation management treatment used on trees prior to reseeding with perennial grasses) in the 1960s and 1970s in the Monument has led to an increase in dead material in several areas, potentially increasing the intensity of future fires. Insect outbreaks, particularly by bark beetles, are widespread, and are occurring in virtually all pinyon-juniper communities in the Monument. Insect infestations increase mortality in pinyon-juniper stands, which then increase fuel loads and create small openings in cover that provide habitat for other plant species.

Big sagebrush communities in the Monument are typically classified in Fire Regime Group III; however, this designation can vary depending on the density of shrubs in the area and the density of herbaceous vegetation in the understory. Fires in sagebrush vegetation are most commonly of high intensity and occur with moderate frequency.

As with pinyon-juniper communities, past and ongoing management practices have greatly altered the historic conditions of big sagebrush vegetation in the Monument. Fire exclusion has contributed to an increase in shrub density and the encroachment of pinyon and juniper trees. Livestock grazing in the Monument has also facilitated the encroachment of pinyon-juniper woodlands into big sagebrush communities. Livestock grazing and other disturbances have led to reductions in native herbaceous cover, which has been followed by the invasion of cheatgrass. Cheatgrass is now present in all of the sagebrush communities in the Monument (BLM 2005b) and presents the potential for more frequent fires in these areas.

Management Practices

Fire management activities consist of fire suppression as well as preventative and proactive vegetation management treatment methods, including prescriptive burning, selective thinning, hydromowing, plowing, and disking. Planning for fire management requires effective communication and coordination of all methods, techniques, and resources.

Most pinyon-juniper woodlands on the Colorado Plateau evolved under infrequent, high-intensity fire regimes. This created mosaics of open and dense stands populated with a mixture of old and young trees. Fire exclusion has allowed stand density to increase and has created a relatively homogenous fuel bed. From an ecological perspective, fuels management practices should aim to create a more heterogeneous landscape, thereby creating variability in stand densities across the landscape and diversity in age classes of individuals within stands. However, in the Monument, fire management practices have been guided by social mandates rather than by ecological necessity. Fire suppression is mandated within most areas of the Monument to protect the high density of cultural resources; however, the preservation of riparian habitat and the prevention of erosion also guide fuels management practices in the Monument.

Fire and fuels management practices in the Monument include hand thinning and mechanical fuels treatment. These methods can be effective in reducing fuel loads and decreasing the intensity and scale of future fires when applied to large areas. The protection of cultural resources has precluded widespread use of prescribed fire and mechanical fuels reduction in the Monument. Protection of cultural resources using fire suppression may be an unattainable goal, since fires that occur near or within cultural sites are predicted to burn with high intensity (BLM 2005b) and thus, may not be controllable.

The San Juan Public Lands 2003 Fire Management Plan (BLM 2003c) outlined specific fire-planning objectives for the Monument and, for planning purposes, categorized certain critical areas in the Monument into nine polygons according to their resource management objectives and constraints (see Map 6). The Category A polygon encompasses Lower Yellow Jacket Canyon, where complete fire suppression is required. Category A polygons are areas where fire is not desired at all. These areas include ecosystems where fire never played a role in the function of the ecosystem, where significant heritage sites exist, and/or where suppression is required to prevent direct threats to life and/or to property. All fires in these areas would be aggressively suppressed.

Category B polygons include the Hovenweep Protection Zone and three additional cultural resources, as well as communications sites operated by the Western Area Power Administration (WAPA) and Shell Oil. Category B polygons are areas where natural fire is not desired under current conditions. These are ecosystems where an unplanned ignition could, without mitigation

measures, have negative effects. Fire control would be emphasized in these areas. “Negative effects” include risks to private lands and urban interfaces, areas with important cultural resources, areas with unnatural fuel buildups, and/or areas where the seed bank does not exist for natural reseeding. Mitigation efforts could include fuels reduction through mechanical means and/or prescribed burns that reduce fuel loading around private land and urban interfaces, creation of agreements that allow fire to cross from public to private lands, cultural resource inventories, and preparation of rehabilitation plans prior to a fire event. Category B areas would be prime areas for identification of hazardous fuel reduction projects designed to mitigate existing hazards. Once mitigation is in place, these areas could move into a C or D category.

The Category C polygon encompasses most of the Monument. Category C polygons are areas where natural fire is desired, but where there may be cultural, social, political, and/or ecological constraints that must be considered. These constraints could include air quality considerations (such as their proximity to Class I air sheds or non-attainment areas), threatened or endangered species considerations (such as the effects of fire on the survival of these species), or habitat considerations (both spatial and temporal). Habitat considerations could be described in terms of maximum burn acreage (e.g., to preserve sage-grouse habitat, no more than 10 percent of the polygon acreage can burn per year), or in terms of time of year (e.g., fall only). Significant prescribed burning would be expected in these areas for public and firefighter safety reasons, as well as to help attain desired resource/ecological conditions. Reseeding is required after fires in Category C polygons.

The 2003 Fire Management Plan (FMP) does not classify any land area in the Monument boundaries as falling within a Category D polygon. Category D polygons are areas where fire is desired and where there are few or no constraints to its use. These areas offer the resource manager the opportunity to take advantage of the full range of options available for fire management. However, given the density of sensitive resources and the mandate to protect them, fire management without constraints is not feasible. A combination of prescribed fire, hand-thinning, and mechanical fuels treatment may be the best option for treating vegetation in the Monument.

3.1.4. Geologic Resources

The geology of the Monument accommodates a variety of recreational activities, including rock climbing on sheer cliffs, hiking on varied topography, mountain biking, horseback riding, and OHV travel (which is only allowed on designated routes). All off-road travel by motorized or mechanized vehicles is prohibited in the Monument. (A more detailed description of these activities is provided in Section 3.2.9, Transportation.) A primary use of geologic resources in the Monument is commercial extraction of minerals. Rock, mineral, and fossil collection is not legal in the Monument.

Another primary use of the geology within the Monument is its aesthetics. The combination of land forms including mesas and canyons creates a visual resource sought by many visitors. These visitors not only occur today but have enjoyed the local geology for centuries. Much of the reason the area has such a rich cultural resource with cliff and hilltop dwellings is the geology.

3.1.4.1. Regional Setting and Regulatory Framework

The Monument includes portions of both the Canyonlands and Navajo sections of the Colorado Plateau physiographic province (Thornbury 1965). In general, the Colorado Plateau is characterized by highly dissected uplands of gently dipping sedimentary rocks, punctuated by localized areas of sharply dipping or folded strata, relatively young volcanic fields, and a few

laccolithic mountain ranges (e.g., Sleeping Ute Mountain, which is a few miles south of the Monument). Except for the isolated mountain ranges, most of the topographic relief in the Colorado Plateau is the result of downcutting of rivers and their tributaries. This is evidenced in the Monument by a series of parallel canyons and intervening ridges created by downcutting of streams flowing generally from northeast to southwest. This pattern is part of the regional drainage from highlands of the southern Rocky Mountains toward the San Juan River.

The flanks of the ridges and broader plateaus show the stair-step pattern typical of the Colorado Plateau, resulting from erosion of alternating hard and soft sedimentary layers. The Monument elevation ranges from approximately 5,000 feet on canyon floors to 7,500 feet atop the highest plateaus, reflects the absence of major streams capable of cutting dramatically deep canyons, as well as the absence of volcanic features and laccolithic mountains. In comparison, Ute Peak, the highest point of Sleeping Ute Mountain, which is a short distance south of the Monument, rises to just under 10,000 feet in elevation.

In the Monument, the Burro Canyon and Dakota formations of the Lower Cretaceous period generally form the more resistant plateau tops, while the canyons are mostly cut into the underlying Morrison Formation of the upper Jurassic Period. The oldest outcrops are of lower Jurassic Entrada Sandstone and underlying Triassic-Jurassic Navajo Sandstone. Quaternary Period alluvium is found on the canyon bottoms and mixed with eolian deposits on the plateaus in the northern part of the Monument. Colluvium is present on the slopes of most canyons, mesas, and ridges.

No specific laws apply to management or use of geologic resources in the Monument, except as they pertain to mineral extraction (including oil and gas) and protection of paleontological resources. Before the area was designated as a National Monument, 43 CFR 3620, Subpart 3622, allowed an individual to remove up to 250 pounds of mineral materials for sampling. This also allowed collection of petrified wood without a permit, except for specimens weighing more than 250 pounds. However, the Proclamation closed Monument lands to all unpermitted collecting. Interim Management for all National Monuments (BLM 2001a) states, "The collection of specimens will not be permitted, except where intended for legitimate scientific uses for which documentation is provided to the satisfaction of the responsible management official."

The BLM's goals and objectives for the management of the Monument's geologic, topographic, and geographic resources include:

- locating, evaluating, and managing significant geologic features or landscapes on public lands;
- facilitating the appropriate scientific, educational, and recreational uses of significant geologic forms;
- facilitating economic-related geologic uses, as consistent with the Proclamation forming the Monument; and
- fostering public awareness and appreciation of geological heritage resources.

3.1.4.2. Current Conditions and Trends

The natural processes of weathering and erosion are gradually changing the topographic and geologic resources of the Monument. However, these changes are occurring over long periods of geologic time and are not to be considered pertinent with respect to this planning document. The only perceptible changes are associated with fluvial processes or localized mass wasting associated with slope failure and rock slides. These issues are addressed by planning

decisions affecting the location of recreational or extractive facilities on steep slopes, areas of rockfall hazards, or active floodplains.

Minor localized degradation of topographic features is expected to occur at a more rapid pace than that resulting from natural causes related to recreational activity. However, the Proclamation prohibits motorized and mechanized off-road vehicles, which greatly reduces the potential severity of such impacts. The present low level of mineral and fossil collection, although prohibited, is expected to continue by individuals either unaware of, or unconcerned about, compliance with this restriction. Similar to recreational use, however, these impacts are not expected to result in significant regional changes in the resource base.

Structural Geology and Seismicity

Two types of structural features can be recognized on the Colorado Plateau: 1) those resulting from tectonic activity that now appear as folded and faulted features composed of sedimentary rocks, and 2) those formed because of igneous intrusion (Patton et al. 1991). The latter laccolithic mountain ranges include the Abajo, Henry, and La Sal Mountains of eastern Utah; Navajo Mountain and the Carrizo Mountains of northeastern Arizona; and the Rico and La Plata Mountains in Colorado, as well as Sleeping Ute Mountain.

The laccolithic ranges are younger than the tectonic structural features of the surrounding area (e.g., the Paradox Fold and Fault Belt to the northeast, the Blanding Basin synclinal trough to the west, the Monument anticlinal upwarp to the west, and the San Juan Basin to the southeast), and appear to have not been influenced by them (Witkind 1964). However, these other structural features have influenced the topography of the region, as reflected in sometimes dramatic folding and faulting of the generally gently sloping layers. Structurally part of the Paradox Basin, the topography of the Monument is influenced by the Blanding Basin synclinal trough to the west, the Dove Creek Anticline to the north, the McElmo Syncline to the east, and the McElmo Dome to the south. The southwest-trending dendritic drainage pattern that characterizes most of the area is related to these underlying structures.

There is one named fault located in the Monument: the House Creek Fault. This fault essentially separates the Dove Creek Anticline and the McElmo Syncline with its southwestern terminus on the southern canyon rim of Yellow Jacket Canyon. The fault extends approximately 19 miles northeast from this point. Many smaller, unnamed faults associated with the Sleeping Ute Mountain laccolith are also present. Most are located on the northwestern and southwestern flanks of Sleeping Ute Mountain, and some of these are associated with uranium prospects.

Earthquake hazard of the Four Corners region, including the Monument, is quite low. Within a 50-year period, an earthquake with a peak ground acceleration (PGA) of 4.27 has a 10-percent probability of occurrence, while the probability of an earthquake with a PGA of 10.76 is only 2 percent. A PGA of approximately 10 is required for damage to occur to older buildings (especially those built before 1965).

Exposed Geologic Units

Based on published geologic maps (Haynes et al. 1972), nine main geologic units representing four different geologic time periods are exposed in the Monument. These units, from youngest to oldest, are listed in Table 3-6.

Period	Unit	
Quaternary	Alluvial, eolian, and colluvial deposits	
Cretaceous	Mancos Shale	
	Undifferentiated Dakota-Burro Canyon	
	Dakota Sandstone	
	Burro Canyon Formation	
Jurassic	Morrison Formation	Brushy Basin Member
		Westwater Canyon Member
		Recapture Member
		Salt Wash Member
	Junction Creek Sandstone	
	Summerville Formation	
	Entrada Sandstone	
Triassic-Jurassic	Navajo Sandstone	

The oldest exposed unit, the Triassic-Jurassic Navajo Sandstone, represents an expanse of windblown sand (dune fields). These were followed by episodic shallow seas (Summerville Formation) and another interval of eolian sand (Junction Creek Sandstone). Near the end of the Jurassic Period, the area was covered by a large, alkaline lake complex (the Morrison Formation) that included episodes with deposition of fine sediments (mudstones and siltstones), coarser sediments (sandstones), and some limestones. The Morrison Formation represents at least two different regimes. The first regime is characterized by high-gradient streams depositing the coarse materials of the Salt Wash Member, and the second regime is characterized by lacustrine (lake) environments resulting in fine-grained silts and clays of the Brushy Basin Member. The Burro Canyon Formation, which was formed at the beginning of the Cretaceous Period, represents the spread of fluvial (stream-transported) clastics, interspersed with lake deposits, which originated from slowly rising highlands in western Utah. By the middle Cretaceous Period, a transgressing (advancing) Western Interior Seaway reached the area. This interval, represented by the Dakota Sandstone, was characterized by a complex mosaic (both temporally and spatially) of fluvial deposits, coastal swamps, and near-shore marine deposits, including both marine sandstones and carbonaceous shales. Continued deposition as

the sea continued to advance is characterized by sediments reflecting deeper marine environments—the Mancos Shale.

Following the deep-water marine environments of the Mancos Shale, there was a regressive period in which the sea became shallower. This led to deposition of near-shore sandstones and interbedded palustral (swamp-derived) coals of the Mesa Verde Group, followed by another transgressive-regressive cycle that included deposition of marine shales of the Lewis Formation, and near-shore sands, shales, and coals of the Fruitland and Kirtland Formations, all of late Cretaceous age. However, these overlying strata, exposed elsewhere in the region (e.g., the cliff-forming sandstones of the Mesa Verde Group) were removed by erosion. Erosion associated with the Laramide Orogeny occurring at the end of the Cretaceous Period some 65 million years ago, led to Tertiary fluvial deposits. More recent erosion is associated with the uplifting of the Colorado Plateau occurring over the last 5 million years. The more recent erosion has led to both the downcutting of the canyons and the deposition of Quaternary sediments, and is continuing through to the present (Holocene time).

The following is a description of geologic units exposed in the Monument, from the youngest surficial deposits to the oldest exposed bedrock units. Abbreviations correspond to U.S. Geological Survey (USGS) convention. A map of exposed geologic units is presented in Map 9.

Alluvial, Eolian, and Colluvial Deposits (Pleistocene and Holocene)

- **Qae, alluvial and eolian deposits:** windblown silt and sand on benches and broad valleys, reworked in part by running water.
- **Qa, alluvial deposits:** silt, sand, and gravel in stream valleys and floodplains; includes soil and, locally, some colluvial and eolian deposits.
- **Qe, eolian deposits:** reddish-brown loess on broad plains, mesas, and large benches; unconsolidated silt and sand banked against cliffs and mantling large areas of broad valleys.
- **Qea:** active eolian sand (Holocene).
- **Qcl, landslide debris:** unsorted material, commonly in large, displaced blocks with characteristic arcuate hummocky surfaces.

Mancos Shale, Km (Upper Cretaceous)

The Mancos Shale consists of gray to dark gray, soft, fissile, sparsely fossil-bearing marine shale. A few thin, distinctive calcareous sandstone and sandy clayey limestone ledges are present in the lower 500 feet. The Mancos Shale is approximately 2,000 to 3,000 feet thick and thickens northeastward.

Dakota Sandstone, Kd (Upper Cretaceous)

The Dakota Sandstone consists of dominantly yellowish-brown to gray, quartzitic sandstone and conglomerate in thick beds with subordinate thin lenticular beds of gray claystone, impure coal, carbonaceous papery shale, and gray friable carbonaceous sandstone. Coarse basal conglomerate is present locally. Depositional environments are of marine origin near the top and of fluvial origin near the base. The Dakota Sandstone intertongues with Mancos Shale. This sandstone ranges from tens of feet thick to 225 feet thick, and averages approximately 100 feet thick.

Burro Canyon Formation, Kbc (Lower Cretaceous)

The Burro Canyon Formation consists of light gray and light brown, fluvial quartzose sandstone and conglomerate in thick beds. Lenticular greenish-gray, locally purplish, commonly non-bentonitic siltstone, shale, and mudstone are also present, and a few thin lenses of gray limestone and chert are present near the top. The formation thickness averages approximately 150 feet, and thins southward to an irregular wedge near the San Juan River, resulting from erosion occurring beneath the basal Dakota Unconformity. Thin, discontinuous mudstone and sandstone lenses are locally mapped within the Brushy Basin Member of the Morrison Formation. A few uranium deposits occur in some thick sandy conglomeratic beds and some beds of gray shale.

The latter two geologic units are often mapped together as Kdb, Dakota and Burro Canyon Formations.

Morrison Formation, Jm (Upper Jurassic)

The Morrison Formation consists of dominantly fluvial, subordinately lacustrine sandstone and mudstone alluvial deposits. Generally, it is approximately 600 feet thick, with its total thickness ranging from 550 to 800 feet. Four members of this formation are found in the Monument:

- **Jmb, Brushy Basin Member:** This is a variegated gray, pale green, red-brown, or purple, bentonitic, lacustrine mudstone with a few lenses of distinctive green and red chert-pebble conglomeratic sandstone, some of which contains uranium-vanadium deposits. The thickness of the Brushy Basin Member ranges from approximately 150 to more than 700 feet. In the San Juan Mountains, as mapped locally, it includes the Burro Canyon Formation.
- **Jmw, Westwater Canyon Member:** The Westwater Canyon Member is mostly yellowish and greenish-gray to pinkish-gray, lenticular, fine- to coarse-grained arkosic sandstone with some interbedded greenish-gray or grayish-red sandy shale and mudstone. This member is approximately 180 feet thick near Bluff, Utah, and thins northeastward to a wedge between Blanding, Utah, and Cortez, Colorado.
- **Jmr, Recapture Member:** This member is a reddish-gray, white, and brown, fine- to medium-grained sandstone characterized by dark- and light-colored grains. It contains interbedded reddish-gray siltstone and mudstone. The Recapture Member is approximately 200 feet thick, and thins, intergrades, and intertongues northeastward with Salt Wash Member. A few uranium deposits are also present.
- **Jms, Salt Wash Member:** This pale gray, grayish-orange, or moderately reddish-brown, fine- to medium-grained fluvial sandstone is present in thick discontinuous beds and interbeds with greenish-gray and reddish-gray mudstone. There are thin beds of limestone locally near the base. In the San Miguel Mountains, the Salt Wash Member may include a thin equivalent of Junction Creek Sandstone at the base. It can be as thick as 550 feet. Thicker, more continuous sandstone beds contain numerous small and large uranium deposits.

Junction Creek Sandstone, Jj (Upper Jurassic)

The Junction Creek Sandstone consists of pink or reddish-orange, fine- to coarse-grained, poorly sorted eolian cross-bedded sandstone. This sandstone forms a rounded "slick rim." Approximately 275 feet thick, the Junction Creek Sandstone merges northward with the upper part of the Summerville Formation. It thins and becomes even-bedded to the east, and is mapped with the Salt Wash Member (Jms) of the Morrison Formation.

Summerville Formation, Js (Upper Jurassic)

The Summerville Formation consists of thin and even-bedded, dark reddish-brown or gray siltstone, shale, and fine-grained sandstone of marine origin. It contains an irregular zone of concretionary chert, with or without limestone nodules, commonly at the top. The Summerville Formation erodes to ledgy cliffs or, where non-calcareous, to a smooth slope. Thickness varies from between 60 to 200 feet.

Entrada Sandstone, Je (Upper Jurassic)

The Entrada Sandstone includes three members, from oldest to youngest they are: 1) the Moab Member, which is a white, medium-grained, cross-bedded or flat-bedded well-sorted sandstone; 2) the Slick Rock Member, a white or reddish or yellowish-orange, thick, massive fine- to medium-grained eolian cross-bedded quartz sandstone that erodes to prominent rounded cliffs; and 3) the Dewey Bridge Member, which consists of reddish brown flat-bedded, locally contorted earthy siltstone and some flat-bedded white sandstone. Together, these units average about 150 feet thick, but can range in thickness from between 70 to 440 feet.

Navajo Sandstone, JTRn (Upper Triassic - Lower Jurassic)

The Navajo Sandstone consists of white, gray, yellowish-gray, or pale orange, fine-grained, well-sorted, conspicuously cross-bedded eolian quartz sandstone. This sandstone commonly erodes to rounded cliffs and domes or, where capped by resistant beds, to vertical or recurved (overhanging) cliffs. The Navajo Sandstone is more than 400 feet thick.

Underlying Geologic Units

Separating the oldest exposed unit (Navajo Sandstone) from the Proterozoic (Precambrian) igneous and metamorphic basement is a thick section of older (Paleozoic and lower Mesozoic) sedimentary rock. These units include sandstones, siltstones, and shales of the Triassic Chinle Formation, Permian Cutler Formation, and Pennsylvanian Hermosa Group. These units are the sources of hydrocarbon (petroleum and natural gas) production in the region. One unit, the Paradox Member of the Hermosa Formation, is the source of carbon dioxide (CO₂) production in the Monument. The Paradox Member represents an expansive, warm, shallow sea or saline lake that resulted in non-clastic layers, such as algal limestones (the source of CO₂ production) and localized deposits of potash and other salts (evaporites). The deepest and oldest sedimentary formation in the area is the Cambrian Ignacio quartzite.

3.1.5. Paleontological Resources

Based on published geologic maps (Haynes et al. 1972), nine main geologic units representing four different geologic time periods are exposed in the Monument. These units are described in Section 3.1.4, Geology. At least four of these units bear documented fossil localities within the boundaries of the Monument. Most of the remaining units are known to contain paleontological resources outside the Monument, and with further investigation these units will likely prove to be fossiliferous in the Monument.

3.1.5.1. Regional Setting and Regulatory Framework

In 1899, Henry Fairfield Osborn through his crew chief, Walter Granger of the American Museum (American Museum of Natural History), conducted the first paleontological work in the area (Brinkman 2005). Scientific investigation has been sporadic since that time, and no comprehensive paleontological investigation of the area has been conducted. Much of the area is remote; thus, paleontologists have relied upon reports of fossil localities by ranchers,

rockhounds, or the public. Unfortunately, by the time some localities are reported, they have already been looted.

No comprehensive study or evaluation of paleontological resources has been conducted in the Monument. Additionally, some locations, as well as the amount of illegal fossil collecting in the Monument, are unknown and undocumented.

Known fossils found in the Monument are Jurassic and Cretaceous in age and include various plants (mostly as petrified wood), invertebrates, and vertebrates (mostly dinosaurs). Of the nine main geologic units, the four formations in the Monument known to have significant fossils are the Junction Creek Sandstone Formation, the Morrison Formation, the Burro Canyon Formation, and the Dakota Sandstone Formation. At least six known paleontological localities occur within the boundaries of the Monument. These formations and their paleontological resources, as well as their potential paleontological resources, are briefly described below. A map of exposed geologic units is presented in Map 9.

Dakota Sandstone Formation (Upper Cretaceous)

The Dakota Sandstone Formation consists of dominantly yellowish-brown to gray, quartzitic sandstone and conglomerate with subordinate thin, lenticular beds of gray claystone, impure coal, carbonaceous papery shale, and gray, friable, carbonaceous sandstone. Depositional environments are of marine origin near the top and of fluvial origin near the base. The Dakota Sandstone and its fossils characterize the beach and near-shore sands associated with the initial stage of the encroaching Cretaceous epicontinental seaway.

In the Monument, Tempskya wood, wood impressions, coals, and invertebrate traces are present in the Dakota Sandstone. Elsewhere, the Dakota Sandstone Formation is well known for its dinosaur tracks.

Burro Canyon Formation (Lower Cretaceous)

The Burro Canyon Formation is composed of light-gray and light-brown, fluvial, quartzose sandstone and conglomerate in thick beds with lenticular, greenish-gray, locally purplish, siltstone, shale, and mudstone. The Burro Canyon Formation is a continuation of the basin fill atop the Morrison Formation, but has sediments derived from Sevier Highlands in central Utah (Aubrey 1992).

Dinosaur bones are the only known fossils of the Burro Canyon Formation in the Monument; however, dinosaur bones and tracks, limonitic wood, seedpod, and leaf impressions are known to be present in other areas in the Four Corners region.

Morrison Formation (Upper Jurassic)

Dominantly fluvial, subordinately lacustrine, sandstone and mudstone alluvial deposits make up the Morrison Formation. The Morrison Formation is a vast shallow-basin deposit that extends across nine western states. In the Four Corners region, the Morrison Formation records the deposition of detritus derived from Jurassic Mongollan highlands of central Arizona. The coarser-grained lower members of the Morrison Formation preserve remains of large river deposits with associated floodplain and shallow ponds and lakes. The Morrison Formation of the western United States is famous for its dinosaur fossils. Gymnosperm fossils are also known to occur, and ongoing research addressing *Hermanophyton* presence in the McElmo Creek area is underway. Of the four members of the Morrison Formation found in the Monument, only the Brushy Basin Member contains fossils. The other members are fossiliferous outside of the Monument.

The Brushy Basin Member consists of variegated, bentonitic lacustrine mudstone with a few lenses of chert-pebble conglomeratic sandstone, some of which contain uranium-vanadium

deposits. Significant fossils include carnivorous dinosaurs, such as *Allosaurus*, sauropod dinosaurs including *Camarasaurus*, gastroliths (stomach stones), and petrified wood, including *Hermanophyton* and *Xenoxylon*. *Auracaria*-like conifers are also known to occur in the Monument.

Elsewhere in the Four Corners region, the Brushy Basin Member and the remaining members of the Morrison Formation (see Table 3-6) generally contain dinosaur bones, petrified wood, and plant fossils.

Junction Creek Sandstone Formation (Upper Jurassic)

The Junction Creek Sandstone Formation consists of pink or reddish-orange, fine- to coarse-grained, poorly sorted, eolian crossbedded sandstone. The Junction Creek Sandstone and the fossils it bears, record the sand dune deposits derived from winds coming off of the retreating Curtis Sea.

Dinosaur tracks have been reported in the Junction Creek Sandstone Formation, along the northern edge of McElmo Canyon.

Potential Paleontological Resources

Almost all rock formations that occur in the Monument contain fossils. These fossil types include invertebrate trace fossils, vertebrate fossils, gastropods, dinosaur bones and tracks, petrified wood, seedpods, and leaf impressions. Of significant note, the Navajo Sandstone is known to produce the most diverse ichnofauna (e.g., protomammal, dinosaur, pterosaur, crocodile, lizard, and invertebrate traces) of any Mesozoic strata of the Colorado Plateau (Rainforth 1997). Additionally, the Navajo Sandstone found elsewhere in the Four Corners region has produced petrified wood, remains of prosauropod and theropod dinosaurs, aetosaur, and therapsid vertebrate fossils. Additionally, the Mancos Shale contains skate or ray teeth, ammonites, pelecypods, scaphites, oysters, gastropods, baculites, and stromatolites.

The Proclamation, BLM policy, and guidance, as given in the BLM H-8270 Manual and Handbook for the Management of Paleontological Resources (BLM 1998d), outline the authorities used for the protection of paleontological resources. Before the area was designated as a National Monument, recreational collecting of common invertebrates and petrified wood on BLM-administered lands was administered according to 43 CFR 3620, Subpart 3622. This also allowed collection of petrified wood without a permit, except for specimens weighing more than 250 pounds. Currently, however, BLM Interim Management for all National Monuments (BLM 2001a) states, "The collection of specimens will not be permitted, except where intended for legitimate scientific uses for which documentation is provided to the satisfaction of the responsible management official."

The BLM's goals and objectives for the management of the Monument's paleontological resources, as stated in BLM H-8270 Manual and Handbook for the Management of Paleontological Resources (BLM 1998d), include:

- evaluating the potential of areas to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils;
- developing management recommendations (including mitigation measures in specific locations) to promote the scientific uses of fossils on Monument lands and to mitigate resource conflicts;
- developing strategies to monitor Monument lands regularly where important paleontological localities have been identified; and
- fostering public awareness and appreciation of paleontological resources.

3.1.5.2. Current Conditions and Trends

Use of the Resource

The principal legal use of the paleontological resource is researching or viewing fossils in their natural surroundings. Collection in the name of scientific research is carried out under permits issued by the Colorado BLM. Recreational use of fossils may include viewing them and noting their differences from other rocks while on outings. Collection of fossils in the Monument is not allowed, except with a Colorado BLM Paleontological Resource Use Permit.

As detailed in the AMS (BLM 2005b), the principal uses of paleontological resources in the Monument today are scientific research and recreational use. The BLM Land Use Planning Handbook (BLM 2005a) specifies that paleontological resources should be allocated according to their potential uses and that the associated appropriate management actions should be implemented.

Before the Canyons of the Ancients was designated as a National Monument, recreational collection of “common invertebrate” fossils in “reasonable quantities,” as well as of up to 250 pounds of petrified wood per person per year per individual was allowed. This activity is now prohibited at the Monument. Illegal collection of fossils has occurred on both a commercial and a casual basis. Continued, illegal collection would impact important fossil deposits. Additional impacts to paleontological resources are being threatened by ground-disturbing activities associated with mineral exploration and extraction and recreational activity, including illegal OHV and mountain bike use off existing or established routes.

The natural processes of weathering and erosion impact paleontological resources in the Monument by continually exposing fossilized material. Lower rates of erosion expose fossils but delay their destruction; whereas, higher rates will expose and more quickly destroy the fossils. This varying rate of erosion also allows a window of time in which a fossil might be discovered, properly identified, and studied.

The protection of paleontological resources may improve through informational and educational programs designed to inform the public about the value of paleontological resources, and how to avoid disturbance of sites. The use of websites, brochures, signage, and exhibits would foster an awareness and appreciation of paleontological resources in the Monument.

Appropriate scientific collecting, by permit, would help build the knowledge base of the scientific aspects of fossils, formations, and geology, both in the Monument and for the surrounding area.

3.1.6. Soil Resources

The entire Monument is described in the Soil Survey of Cortez Area, Colorado, Parts of Dolores and Montezuma Counties, published in 2003. A draft of this document was used in conducting the health assessment of the Monument’s rangelands in 2001. When the soil survey was published in 2003, no changes were made to the soil map units. The survey area is in the Colorado Plateau Semi-Desert Province, Grand Canyon Section (Bailey 1995) and consists principally of a gently southwest-sloping plain, known locally as the Dolores Plateau (Natural Resource Conservation Service [NRCS] 2003). Monument soil units are shown on Map 10.

3.1.6.1. Regional Setting and Regulatory Framework

The primary regulatory tools used in soil management are found in the Clean Water Act (CWA), as described in Section 3.1.10, Water Resources. Sediment resulting from excessive erosion is considered a water quality pollutant and is regulated by State water quality standards. The

Clean Air Act also applies, due to the potential for dust or wind erosion. Other laws relating to soil management include:

- the Taylor Grazing Act;
- the Food Security Act of 1985;
- the Farmland Protection Policy Act of 1984;
- the Soil and Water Resources Conservation Act of 1977; and
- the Healthy Forests Act of 2003.

Of the five BLM Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (Appendix D), one focuses on upland soil, as follows:

Upland soils exhibit infiltration and permeability rates that are appropriate to soil type, climate, landform, and geologic processes. Adequate soil infiltration and permeability allows for the accumulation of soil moisture necessary for optimal plant growth and vigor, and minimizes surface runoff.

Indicators of land health include the following:

- Expression of rills and soil pedestals is minimal.
- Evidence of actively eroding gullies (incised channels) is minimal.
- Canopy and ground cover are appropriate.
- There is litter accumulating in place, and it is not sorted by normal overland water flow.
- There is appropriate organic matter in soil.
- There is diversity of plant species with a variety of root depths.
- Upland swales have vegetative cover or density greater than that of adjacent uplands.
- There are vigorous, desirable plants.

An interdisciplinary (ID) team will determine whether or not soil is meeting Land Health Standard 1, based upon the aforementioned indicators.

3.1.6.2. Current Conditions and Trends

Soil in the Monument is organized into three general soil map units that have similar landform or positions on the landscape, and similar parent material, including:

- soil in canyons and on hills and rock outcrops;
- soil on hills and mesas; and
- soil of floodplains, stream terraces, and alluvial fans.

Most of the soil in the Monument falls within the landform category of soils in canyons and on hills. These soils are formed of colluvium, alluvium, and residuum derived from sandstone and shale. Approximately 66 percent of Federal land in the Monument is correlated with Jurassic-Period geologic stratigraphy. Soil and soil properties are summarized in Table 3-7. Soil map units are presented on Map 10.

Table 3-7 Soil Properties for Soils in Canyons and on Hills, Federal Land Only

Soil Map Unit	Soil Name	Ecological Site	Rangeland Suitability	Available Water Holding Capacity	Runoff Hazard	Water Erosion Hazard	Wind Erosion Hazard	Acres, Proportion of the Monument
109, 110	Romberg-Crosscan Complex (6 to 80% slope)	Pinyon-juniper	Very poor	Low to very low	High to very high	Severe	Slight	80,885 49%
129, 130, 133	Typic Torriorthents, Torriorthents (12 to 100% slope)	Salt desert Breaks	Poor	Very low	Low	Severe	Slight	13,309 8%
22	Claysprings (12 to 65% slope)	Salt desert Breaks	Very poor	Very low	Very high	Severe	Slight	7,463 5%
138	Uzacol, Zwicker, Claysprings Complex 3 to 12% slope	Clayey Salt desert	Very poor	Low	Very high	Moderate	Moderate	3,931 2%
108	Rock outcrop		Unsuitable					3,078 2%

The second largest category of soil is in the landform category of soil on hills and mesas. This soil is formed primarily from eolian material derived from sandstone with some colluvium, residuum, and alluvium derived from sandstone. This soil is, for the most part, correlated with Cretaceous and Quaternary Period geologic stratigraphy. Approximately 31 percent of the Federal land in the Monument is in this category. Table 3-8 presents information about this soil and its properties. Soil map units are presented on Map 10.

Table 3-8 Soil Properties for Soils on Hills and Mesas

Soil Map Unit	Soil Name	Ecological Site	Rangeland Suitability	Available Water Holding Capacity	Runoff Hazard	Water Erosion Hazard	Wind Erosion Hazard	Acres, Proportion of the Monument
42	Gladel-Pulpit Complex (3 to 9% slope)	Pinyon-juniper/loamy foothills	Poor	Very low	Medium	Moderate	Moderate	14,867 9%
105	Rizno-Gapmesa Complex (3 to 9% slope)	Pinyon-juniper/semi-desert loam	Poor	Very low	Medium	Severe	Moderate	11,547 7%
31	Farb, rock outcrop (3 to 12% slope)	Shallow desert	Poor	Very low	Low	Severe	Moderate	5,812 4%
144	Wetherill Loam (3 to 6% slope)	Loamy foothills	Good	High	Medium	Moderate	Moderate	4,235 2%
8, 11	Barx, Barx-Gap Mesa Complex (2 to 6% slope)	Semi-desert loam	Fair	High	Medium	Moderate	Moderate	2,777 2%
70	Mack (0 to 6% slope)	Alkali flat	Fair	High	Medium	Moderate	Moderate	2,640 2%
95, 113, 116, 118	Pulpit Loam, Sharps Loam, Sharps-Cahona,	Loamy foothills	Fair	Low to moderate	High	Severe	Moderate	1,055 1%

Table 3-8 Soil Properties for Soils on Hills and Mesas

Soil Map Unit	Soil Name	Ecological Site	Rangeland Suitability	Available Water Holding Capacity	Runoff Hazard	Water Erosion Hazard	Wind Erosion Hazard	Acres, Proportion of the Monument
	Sharps-Pulpit Complex (6 to 12% slope)							
143	Wetherill Loam (1 to 3% slope)	Loamy foothills	Good	High	Medium	Slight	Moderate	1,050 1%
145	Wetherill Loam (6 to 12% slope)	Loamy foothills	Good	High	High	Severe	Moderate	923 1%
100	Recapture (0 to 6% slope)	Alkali flat	Fair (alkalinity)	Moderate	Low	Slight	Moderate	848 1%
106, 107	Rizno-Ruinpoint Complex, Rizno-Littlenan-Body Complex (1 to 50% slope)	Semi-desert shallow clay, semi-desert loam	Poor	Very low	Medium	Moderate	Moderate	770 <1%
19, 20	Cahona Loam (6 to 12% slope), Cahona-Pulpit, Complex (3 to 12% slope)	Loamy foothills	Good to fair	High	High	Severe	Moderate	746 <1%
9	Barx Loam (6	Semi-desert	Fair	High	High	Severe	Moderate	604

Table 3-8 Soil Properties for Soils on Hills and Mesas

Soil Map Unit	Soil Name	Ecological Site	Rangeland Suitability	Available Water Holding Capacity	Runoff Hazard	Water Erosion Hazard	Wind Erosion Hazard	Acres, Proportion of the Monument
	to 12% slope)	loam						<1%
17, 18, 21	Cahona Loam, Cahona-Sharps-Wetherill Complex (1 to 6% slope)	Loamy foothills	Good	High	Medium	Slight to moderate	Moderate	510 <1%
10	Barx (1 to 4% slope)	Upland loam	Good	High	Low	Moderate	Moderate	466 <1%
114	Sharps loam (6 to 12% slope)	Semi-desert loam	Poor	Low	High	Severe	Moderate	370 <1%
94, 117	Pulpit Loam, Sharps-Pulpit Complex (2 to 6% slope)	Loamy foothills	Fair	Low to moderate	Medium	Moderate	Moderate	179 <1%
115	Sharps-Gapmesa Complex (6 to 12% slope)	Semi-desert loam	Fair	Low	High	Severe	Moderate	113 <1%

The smallest general soil map unit for soil in the Monument is the landform category of soils on floodplains, stream terraces, and alluvial fans. These soils are formed of alluvium derived from sandstone and shale, and occur most often in canyon bottoms. These typically have diverse vegetation, attenuate flood peaks, are sensitive to disturbance, support aquatic species, and filter pollutants. They are, for the most part, correlated with Quaternary-Period geologic stratigraphy. Approximately 3 percent of the Federal land in the Monument is in this category.

Table 3-9 presents information about these soils and soil properties. Soil map units are presented on Map 10.

Table 3-9 Soil Properties on Floodplains, Stream Terraces, and Alluvial Fans, Federal Land Only								
Soil Map Unit	Soil Name	Ecological Site	Rangeland Suitability	Available Water Holding-Capacity	Runoff Hazard	Water Erosion Hazard	Wind Erosion Hazard	Acres, Proportion of the Monument
98	Ramper Loam (0 to 3% slope)	Loamy bottom	Fair	Moderate	Medium	Slight	Moderate	1,608 1%
12	Battlerock Clay Loam (0 to 6% slope)	Alkali bottom	Fair	High	Medium	Moderate	Moderate	1,116 1%
38	Fluvents, Fluvaquents complex (0 to 3% slope)	River bottom	Good	Very low	Very low	Slight	Slight	976 1%
101, 65	Recapture Sandy Loam, Lillings Silt Loam (0 to 6% slope)	Alkali bottom	Poor, excess alkalinity, salts, and sodium	Moderate to high	Medium	Slight to moderate	Moderate	631 <1%
122	Sheppard Fine Sand (1 to 6% slope)	Desert sand	Poor	Low	Very low	Moderate	Severe	527 <1%
135	Ustic Torriorthents (0 to 3% slope)	Loamy bottom	Fair	Low	Low	Slight	Severe	246 <1%
99	Ravola Clay Loam (0 to 3% slope)	Alkali bottom	Poor, excess salts	Low	Medium	Slight	Moderate	238 <1%
1	Ackmen Loam (1 to 3% slope)	Loamy bottom	Fair	High	Low	Slight	Moderate	142 <1%
75	Mikim Loam	Alkali flat	Fair,	High	Medium	Moderate	Moderate	117

Table 3-9 Soil Properties on Floodplains, Stream Terraces, and Alluvial Fans, Federal Land Only								
Soil Map Unit	Soil Name	Ecological Site	Rangeland Suitability	Available Water Holding-Capacity	Runoff Hazard	Water Erosion Hazard	Wind Erosion Hazard	Acres, Proportion of the Monument
	(3 to 6% slope)		excess salinity					<1%
147	Yarts Fine Sandy Loam (1 to 6% slope)	Semi-desert loam	Fair	Moderate	Low	Moderate	Moderate	76 <1%
2, 97	Ackmen Loam, Ramper Clay Loam (0 to 6% slope)	Loamy bottom	Fair	High	Medium	Slight	Moderate	8 <1%

The proportions for only the most restrictive suitability ratings, soil properties, or limitation classes are listed below. Percentages represent the percent of Federal land acreage in the Monument. These restrictive ratings or limitation classes are an indication of where the soil and vegetation resources are most vulnerable, especially when excessive disturbance or environmental stresses are applied.

- Rangeland suitability: Very poor: 58%
- Available water-holding capacity: Very low: 50%
- Runoff hazard: Very high: 58%
- Water erosion hazard: Severe: 75%
- Wind erosion hazard: Severe: <1%
- Sodium, alkalinity, salts: Excess: 1%

Biological Soil Crusts

Biological soil crust communities consisting of varied proportions of cyanobacteria, mosses, and lichens are present throughout most upland environments in the Monument. Where undisturbed, these cyanobacteria crusts may extend up to 1 centimeter in depth and can greatly enhance soil stability. The contributions of biological soil crusts to enhanced soil stability and diminished vulnerability to erosion are well supported by experimental research (Williams et al. 1995a, 1995b; Belnap and Gillette 1998; Eldridge 1998; Issa et al. 2001), and numerous technical reviews (Harper and Marble 1988; Metting 1991; Johansen 1993; Eldridge and Greene 1994; Warren 1995, Warren 2001).

In addition to enhancing soil stability, biological soil crusts are recognized for their importance in several aspects of nutrient cycling, including the ability of some soil crust organisms to acquire and convert atmospheric nitrogen into forms available to higher plants (Evans and Johansen

1999). Through their effects on soil nutrient dynamics, cyanobacteria and some lichens may also enhance the nutritional quality of forage plants used by wildlife (Harper and Pendleton 1993).

Resource Condition

The public land health evaluation process is a two prong assessment. One aspect of it is a qualitative assessment of an ecological site. The evaluation also includes analysis and interpretation of monitoring and inventory data, and draws the conclusion on whether or not standards are achieved or not. Therefore, the evaluation of public land health includes a qualitative assessment that rates current observed conditions in comparison to the potential of ecological sites assessed and to the Colorado Public Land Health Standards. A Rangeland Health Evaluation and Ecological Site Inventory (BLM 2001i) was conducted in the Monument during the summer of 2001. As part of this inventory, the condition of the upland soil and hydrology was assessed.

Eighteen site indicators were used to assess ecological sites relative to a reference site condition for that ecological site. The site indicators are related to three public land health attributes: soil and site stability, hydrologic function, and biotic integrity. Ten of the site indicators apply directly to the soil and site stability attribute, and 12 apply to the hydrologic function attribute. Site indicators included rills, water flow patterns, pedestals and/or terracettes, bare ground, gullies, wind-scoured blowouts and/or deposition areas, litter movement, soil surface resistance to erosion, soil surface loss or degradation, plant community composition and distribution relative to infiltration and runoff, compaction layer, litter amount, and biological crusts. Table 3-10 presents the ratings, by ecological site, for the attributes of soil and site stability; Table 3-11 displays the ratings for hydrologic function.

A slight degree of departure would have slight differences from the site potential. A moderate rating is somewhat analogous to an “at-risk” rating (Pellant et al. 2000). Rangelands that are “at risk” have a reversible loss in productive capability and an increased vulnerability to irreversible degradation, based on an assessment of current conditions (National Resource Council [NRC] 1994). An extreme degree of departure probably has an irreversible loss of site capability.

Upstream irrigation practices are altering the natural hydrologic regime of watercourses on the Monument. Observations have shown an increased flow (in both volume and duration) and an increase in salinity. Mikim Loam soils on Alkoli Flat Ecological Site types shows excess salinity. These sites, however, occur on less than 1% of the total acres in the Monument. The BLM must comply with the Colorado River Salinity Control Act and the State Water Quality Standards for salinity (Regulation 39).

Table 3-10 Public Land Health Assessment Ratings for Soil and Site Stability						
Capable Portions of Ecological Sites, Federal Land Only^a		Degree of Departure from a Reference Site, Percent of Acres Falling Within Each Health Rating for Each Ecological Site				
Ecological Site	Acres Rated	Extreme	Moderate to Extreme	Moderate	Slight to Moderate	Slight
Alkali bottom	2,060	0	53	33	15	0
Alkali flat	3,942	0	6	36	53	5
Clayey salt desert	4,519	0	21	63	16	0
Desert sand	586	0	0	95	5	0
Loamy bottom	2,321	0	23	28	49	0
Loamy foothills	21,403	0	2	46	44	8
Pinyon juniper	56,354	0	9	46	42	3
Salt desert breaks	19,913	0	6	75	19	0
Semi-desert loam	9,033	0	13	71	16	0
Shallow desert	5,641	0	14	36	42	8
Upland loam	1,331	0	0	67	33	0
Semi-desert Shallow loam	848	0	0	73	27	0
TOTAL	127,951	0	9	52	36	3

^a "Capable" refers to land capable of being utilized by livestock.

Capable Portions of Ecological Sites, Federal Land Only¹		Degree of Departure from a Reference Site, Percent of Acres Falling Within Each Health Rating for Each Ecological Site				
Ecological Site	Acres Rated	Extreme	Moderate to Extreme	Moderate	Slight to Moderate	Slight
Alkali bottom	2,060	0	63	28	9	0
Alkali flat	3,942	0	11	37	52	0
Clayey salt desert	4,519	0	20	69	11	0
Desert sand	586	0	0	67	33	0
Loamy bottom	2,321	0	27	25	49	0
Loamy foothills	21,403	0	8	43	48	<1
Pinyon juniper	56,354	<1	20	44	36	0
Salt desert breaks	19,913	0	11	80	9	0
Semi-desert loam	9,033	0	22	68	10	0
Shallow desert	5,641	0	16	25	60	0
Upland Loam	1,331	13	0	55	33	0
Semi-desert shallow loam	848	0	0	73	27	0
TOTAL	127,951	<1	16	51	32	<1

^a "Capable" refers to land capable of being utilized by livestock.

Soil data were collected at all Ecological Site Inventory (ESI) sites. (Methodology and corresponding vegetation communities are described in Section 3.1.8, Vegetation Resources.) Ground cover was measured at each sample point. Table 3-12 summarizes average ground cover ratings for each ESI site. "Bare soil" refers to a soil surface with no cover, such as rock, litter, biological crust, or plant base. "Total litter" refers to all organic litter cover, such as pine needles, old grass material, and small and large wood. "Total rock" refers to the combined sum of the cover for five rock size classes: gravel, cobble, stone, boulder, and bedrock. "Total BioCrust" refers to the sum of the total cover by biological soil crust communities. "Basal vegetation" refers to the amount of soil surface occupied by live vegetation base. Reference sites are shown in bold typeface.

Table 3-12 Average Ground Cover Values (%) for Ecological Sites in the Monument					
Ecological Site	Bare Soil	Total Litter	Total Rock	Total BioCrust	Basal Vegetation
Alkali bottom	36	56	2	6	2
Alkali flat	42	49	1	6	3
Clayey salt desert	43	31	16	9	3
Desert sand	45	52	0	2	2
Loamy bottom	19	72	2	6	4
Loamy foothills, pinyon-juniper	27	50	4	19	2
Loamy foothills, pinyon-juniper reference	28	57	0	12	4
Loamy foothills, sage	35	48	1	14	2
Loamy foothills, sage reference	22	55	0	21	4
Loamy Foothills, chaining	35	48	1	16	2
Loamy foothills, chaining reference	23	66	2	7	4
Pinyon-juniper	28	36	22	14	1
Pinyon-juniper, reference	18	60	13	7	2
Pinyon-juniper, chaining	33	41	13	14	2
Salt desert breaks	33	28	29	9	2
Semi-desert loam	37	37	7	19	2
Semi-desert loam, reference	29	41	4	26	2
Shallow desert	39	31	14	15	2
Upland loam	48	41	1	10	1

Table 3-13 displays average cover values for all sites combined, all reference sites combined, and the highest and lowest cover values sampled in the Monument.

Table 3-13 Average, Highest, and Lowest Ground Cover Values (%) for the Monument

Ecological Site	Bare Soil	Total Litter	Total Rock	Total BioCrust	Basal Vegetation
Monument, all sites combined (356 points)	33	42	11	13	2
Monument, all reference sites (27 points)	23	50	8	13	3
Highest cover value sampled	83	96	79	59	9
Lowest cover value sampled	2	4	0	0	<1

3.1.7. Terrestrial and Aquatic Wildlife

Terrestrial and aquatic wildlife, including sensitive species and their habitats, are described below. Additional information is available in the AMS (BLM 2005b) and in Appendix H.

3.1.7.1. Regional Setting and Regulatory Framework

The Monument is located in a semi-arid transition zone between generally higher elevations to the north, east, and west, and generally lower elevations to the south. Due to its transitional position, large size, and wide range of soil types (from clayey to sandy and rocky), the Monument supports a variety of habitat types. The most extensive habitat type, pinyon-juniper woodland, covers approximately 67 percent of the Monument, while sagebrush and saltbush shrublands and shrub-grass communities cover approximately 22 percent and 8 percent, respectively. As is typical throughout the region, riparian habitats represent only a small portion of the landscape (approximately 5 percent of the Monument), but are of disproportionate importance to wildlife, including to a number of special status species.

Additional habitat types include rocky canyons (some with minor cliff bands) and both perennial and ephemeral/seasonal aquatic habitats. Although limited in area, these types, such as riparian habitats, add to the total biodiversity of the Monument.

Among the variety of fish and wildlife species known, potentially present, or affected by management within the Monument are six species Federally listed as threatened or endangered under the ESA, one candidate for Federal listing, 16 species listed by the BLM as sensitive species in Colorado, one species listed by the CDOW as threatened or endangered at the State level, and eight species that are State-listed as being of special concern in Colorado (Table 3). These special status species are in addition to other species of special ecological, recreational, or economic importance in the region.

Monitoring of terrestrial and aquatic wildlife habitat is guided by the BLM Standard for Public Land Health in Colorado, which focuses on threatened, endangered, sensitive, or other special-status (TES) species. This standard is applicable to both animals and plants; therefore, it directly correlates to the livestock grazing regulations that came into effect on August 21, 1995. Currently, this standard is not being achieved in 12 of the 16 relevant livestock grazing allotments in the Monument, all of which provide potential habitat for special status species. Management for wildlife and wildlife habitat in the Monument is also governed by provisions

specified in the Rangeland Standards and Guidelines for Livestock Grazing in Colorado (BLM 1996a).

Various laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the related resources and land uses in the Monument, are described in other sections of this document. The laws and regulations that are specifically related to the management of wildlife and wildlife habitats on BLM National Monuments and other BLM lands include:

- the Sikes Act of 1960 (as amended);
- the Fish and Wildlife Management Act of 1956;
- the Endangered Species Act;
- the Bald and Golden Eagle Protection Act (16 USC 668-668d);
- the Migratory Bird Treaty Act (as amended);
- the Neotropical Migratory Bird Conservation Act (Public Law [PL] 106-247);
- the Cave Resources Protection Act (16 USC 4301 et seq.);
- the Code of Federal Regulations (CFR), Title 50, Section 402 (50 CFR 401), Interagency Cooperation: Endangered Species Act (ESA);
- the BLM NEPA Handbook (H-1790-1) (BLM 1988b);
- the BLM Land Use Planning Handbook (H-1601-1) (BLM 2001g);
- the BLM Manual 4180 – Rangeland Health Standards (BLM 2001e);
- the BLM regulations contained in 43 CFR 8200;
- Executive Order 12962: Recreational Fisheries (June 7, 1995);
- Executive Order 13186: Conservation of Migratory Birds (January 10, 2001); and
- the Brunot Agreement: Hunting Rights for Ute Mountain Ute (1874).

Current management of terrestrial and aquatic wildlife is summarized in Chapter 2 (Alternatives) and the description of the No Action Alternative in Chapter 4, Environmental Consequences.

3.1.7.2. Current Conditions and Trends

Information on the occurrence, distribution, and habitat use of terrestrial and aquatic wildlife is summarized below. This discussion is organized into three major subsections:

- General Occurrence by Habitat Type
- Special Status Species
- Other Species, Habitats, and Areas of Special Management Importance

Information presented in these subsections is derived from the AMS (BLM 2005b); a search of online databases, including those administered by the CDOW and the Colorado Natural Heritage Program (CNHP 2004 and 2005); and standard ecological references for Colorado, including those related to mammals (Armstrong 1972; Fitzgerald et al. 1994), birds (Andrews and Righter 1992; Kingery 1998), reptiles and amphibians (Hammerson 1999), and fishes

(Woodling 1985), as well as analogous references for adjacent states (Utah, New Mexico, and Arizona).

The AMS (BLM 2005b) also summarizes the current conditions and trends for wildlife and wildlife habitat. This is based on monitoring performed under the BLM Colorado Standard for Public Land Health and Guidelines for Livestock Grazing Management in Colorado (BLM 1997). As noted previously, this pertains primarily to special status species.

General Occurrence by Habitat Type

This subsection describes the occurrence, distribution, and habitat use of terrestrial and aquatic wildlife based on habitat type. Owing to a lack of quantitative or comprehensive qualitative surveys for most species groups, the following descriptions are based on the scientific references cited above, opportunistic observations by the BLM and the USFS, and/or other agency personnel, and the general familiarity of section authors with the fauna of the region.

Pinyon-Juniper Woodlands

Although heterogeneous in tree height, tree density, and type of understory, pinyon-juniper woodlands are relatively consistent in the types of wildlife they support. The trees provide habitat for arboreal (tree-dwelling) species that use the trunks or canopy for nesting, denning, and/or feeding. The understory supports use by non-arboreal (ground-dwelling) species as well as by arboreal species that move out of the trees and onto the ground to feed or hunt. Understory wildlife may include species that are partially dependent on some aspect of the trees (e.g., as cover or a food source [e.g., pinyon nuts and juniper berries]), and species that are associated with a particular type of understory irrespective of the presence of trees.

Of particular importance is the fact that pinyon-juniper habitat supports a number of species that occur infrequently, if at all, in other habitat types and thus may be considered pinyon-juniper "obligates." Among these are the pinyon mouse, the gray flycatcher, the pinyon jay, the juniper titmouse, the gray vireo, and the black-throated gray warbler. Other species strongly associated with pinyon-juniper habitat, but which are also present in other types of habitat, include the ash-throated flycatcher, the western scrub-jay, the bushtit, and the blue-gray gnatcatcher. In winter, nomadic species such as the Clark's nutcracker may move into this habitat from higher-elevation coniferous forests, especially during years of heavy pinyon nut production.

Except for the pinyon mouse, most mammals of the pinyon-juniper woodland are influenced primarily by the type of shrub or grass community in the understory rather than by the presence of trees. Examples include the long-tailed weasel, the coyote, the red fox, the bobcat, mule deer, the black-tailed jackrabbit, the desert cottontail, the rock squirrel, the least chipmunk, and the deer mouse. The Merriam's shrew and the desert shrew may also occur in the understory, and Rocky Mountain elk may also seek the shelter of the trees. Porcupine, a large rodent, may also feed (and/or den) in the trees.

Other mammals using pinyon-juniper habitat, due to the presence of trees, but that are not limited to the trees, include a variety of bats. More common and/or widespread among these in southwestern Colorado are the California myotis, the western small-footed myotis, the long-eared myotis, the long-legged myotis, the little brown bat, the big brown bat, the hoary bat, the silver-haired bat, the western pipistrelle, the pallid bat, and the Brazilian free-tailed bat. Other mammals associated with pinyon-juniper in rocky canyons are described later in this section.

Due to the relative scarcity of other tree communities (i.e., small areas of riparian woodland and montane conifers), several raptors are associated primarily with pinyon-juniper habitat in the Monument. Examples include a variety of raptors that nest in trees, but also feed in nearby shrub-grass communities (including the American kestrel, the golden eagle, the red-tailed hawk,

and the Swainson's hawk), or that nest in trees and hunt within the woodland (including the Cooper's hawk, the sharp-shinned hawk, and the northern pygmy-owl).

Other arboreal birds associated with pinyon-juniper habitat (and other woodland habitats) include the black-chinned hummingbird, the northern flicker, the dusky flycatcher, the western kingbird, the Cassin's kingbird, the black-billed magpie, the American crow, the Bewick's wren, the western bluebird, the mountain bluebird, the northern mockingbird, the loggerhead shrike, the plumbeous vireo, the orange-crowned warbler, the Virginia's warbler, the brown-headed cowbird, and the house finch. In small numbers, the Scott's oriole enters the region from the southwest. Ground-nesting birds present in the understory, and are not tied to the presence of trees, are described in the following subsection on shrubland and shrub-grassland communities.

Presence of reptile species in pinyon-juniper woodland is influenced primarily by the type of understory and/or by the presence of rock outcrops. However, some species (including the western whiptail, the plateau striped whiptail, the tree lizard, and the striped whipsnake) may be more common in pinyon-juniper habitat than in shrubland and shrub-grassland communities.

Saltbush and Sagebrush Shrublands and Shrub-Grasslands

These habitats, while different in terms of plant species composition, are structurally similar to each other due to the presence of shrubs. Shrublands differ from shrub-grasslands primarily in shrub density. Chief among the factors influencing the distribution of these types is substrate, with saltbush generally occurring on sandier soil or drier sites, and sagebrush generally occurring on finer or rockier soil and more moderate sites. Depending on soil and moisture situations, associated shrubs commonly include greasewood and rubber rabbitbrush. Although the following discussion addresses saltbush and sagebrush habitats, some differences in wildlife use are noted.

As with pinyon-juniper habitat, mammal use of saltbush and sagebrush shrubland and shrub-grassland communities is often related more to the type of substrate or herbaceous understory than to the shrubs themselves. Deer and, to a lesser extent, elk may use sagebrush as an important winter browse species. A variety of smaller mammals may den beneath the shrubs and/or use the saltbush fruits as a seasonally important food source, but they are not associated only with the shrubs. For example, these same species may also feed on pinyon nuts or juniper berries that fall to the ground in pinyon-juniper habitats.

Mammals in the shrubland and shrub-grassland include the larger species discussed under pinyon-juniper habitat (including the coyote, the bobcat, the red fox, as well as mule deer, and elk), with all, except for the coyote, probably less common than in areas with trees. However, another carnivore, the American badger, is probably more common in these types of habitats than in pinyon-juniper woodlands. Smaller mammals expected in shrubland and shrub-grassland include the Merriam's and the desert shrews, the desert cottontail, the black-tailed jackrabbit, the white-tailed antelope squirrel, the spotted ground squirrel, the Apache pocket mouse, the Hopi pocket mouse, the Ord's kangaroo rat, the western harvest mouse, the deer mouse, and the Gunnison's prairie dog.

Several of the bird species associated with shrubland and shrub-grassland communities use the woody plants for nesting. Three such species, the sage thrasher, the sage sparrow, and the Brewer's sparrow, approach the status of sagebrush obligates. Other species that make greater use of the shrubs than of the intervening grassy areas include the Say's phoebe, the loggerhead shrike, the green-tailed towhee, the lark sparrow, and the black-throated sparrow. Ground-nesting species not particularly tied to the presence of shrubs include the northern harrier (a raptor), the scaled quail, the mourning dove, the horned lark, the western meadowlark, the

vesper sparrow, and the burrowing owl. A large raptor present in the region only during winter, the rough-legged hawk, is also found in either shrubland or shrub-grassland habitats.

Most of the reptiles found in saltbush and sagebrush habitats are also found in grasslands or open pinyon-juniper habitats with a comparable understory. One species, the sagebrush lizard, is more commonly associated with shrubland than with the other types of habitats. While most wildlife species use a variety of habitat types, those most commonly found in shrubland and shrub-grassland are the short-horned lizard, the western whiptail, the plateau striped whiptail, the bullsnake (the gopher snake), the western rattlesnake, and the longnose leopard lizard.

Riparian Areas, Rocky Canyons, and Wooded Canyons

As described elsewhere in this document, the Monument is traversed by a series of southwest-flowing drainages that occupy distinct and sometimes deep and steep-sided, canyons or arroyos. Although representing a small portion of the total area of the Monument, these are of special importance to a number of wildlife species. This is due to factors such as the presence of water (whether perennial or seasonal), stands of riparian trees or tall shrubs, topographic screening, and/or cliffs or rocky ledges. Taken together or separately, these features attract and sustain a variety of species not present in other habitats. Additionally, they support a disproportionately large richness and density of species in relation to the limited extent of the area.

Many of the mammals described above for pinyon-juniper woodland also occur along the rocky canyons or riparian drainages, including larger species such as the mule deer, the coyote, the red fox, and the bobcat (which is found mostly in rugged terrain). A small carnivore, the gray fox, is more likely to be found in canyons, as are two additional large carnivores, the mountain lion and the black bear. Smaller mammals most often found along canyons include three woodrat or "packrat" species—the Mexican, the bushy-tailed, and the white-throated—as well as the ringtail, the western spotted skunk, the rock squirrel, the Hopi chipmunk, the least chipmunk, the brush mouse, and the canyon mouse.

Riparian habitats that contain persistent water also attract the raccoon and the striped skunk. The only vole species expected to occur in the Monument, the long-tailed vole, prefers areas of lush grasses along drainages.

The availability of riparian trees and tall shrubs for nesting and feeding is especially beneficial to birds. This is due to the increased height and structural complexity, as compared to other habitats. Large trees are suitable for nesting by several raptors (including red-tailed, Swainson's, Cooper's, and sharp-shinned hawks; the great horned owl; the long-eared owl; and the western screech-owl). Trees and tall shrubs on the canyon floors and sideslopes support many of the arboreal species listed previously for pinyon-juniper woodland and may also attract the following: the Lewis' woodpecker, the downy woodpecker, the hairy woodpecker, the western wood-pewee, the cordilleran flycatcher, the ash-throated flycatcher, the violet-green swallow, the black-capped chickadee, the white-breasted nuthatch, the house wren, the American robin, the warbling vireo, the yellow warbler, the MacGillivray's warbler, the yellow-breasted chat, the black-headed grosbeak, the lazuli bunting, the spotted towhee, the song sparrow, the Bullock's oriole, and the American and lesser goldfinches. The western yellow-billed cuckoo, a special status species, is limited to riparian areas with mature cottonwoods. Although the species is potentially present, the absence of large stands of mature or gallery cottonwoods makes its presence unlikely. Where cattail and bulrush occur along a stream or spring discharge area, the habitat may also attract wetland species, such as the red-winged blackbird, the common yellowthroat (a warbler), and the song sparrow, as well as, although less commonly, the yellow-headed blackbird, and, potentially, the marsh wren.

Canyon cliffs and rock ledges provide habitat for rock-dwelling birds, including the white-throated swift, the rock wren, and the canyon wren, as well as the more widely distributed Say's phoebe. Both the barn swallow and the cliff swallow may also nest on canyon walls, as well as beneath bridges, in culverts, or on various other structures. Two other swallows (the northern rough-winged and the bank) may nest in holes or niches on muddy or sandy banks of steep-sided arroyos. Banks along perennial streams that support fish provide nesting habitat for another hole-nesting riparian bird, the belted kingfisher.

A number of raptors may nest on rock ledges or on the generally minor cliff faces of some canyons in the Monument. These include the turkey vulture, the prairie falcon, the peregrine falcon, the American kestrel, the golden eagle, and the red-tailed hawk. Peregrine falcons have been sighted in the Monument.

Rocky canyons are the preferred habitat of species such as the collared lizard, the desert spiny lizard (the fence or plateau lizard), the western rattlesnake, the plateau striped whiptail, and the Mesa Verde night snake. The desert spiny lizard is found primarily in rock outcrops and in sparsely vegetated streambanks along McElmo Creek, Bridge Canyon, and Yellow Jacket Creek. Canyons and arroyos with riparian habitat on their floors provide habitat for additional reptiles, including the common kingsnake, the milk snake, the smooth green snake, and the western terrestrial garter snake.

Aquatic Habitats

Aquatic habitats in the Monument include six perennial streams; several ephemeral streams, some of which have relatively persistent moisture in areas of springs or shallow bedrock; and numerous springs, seasonal pools, and stock ponds.

Areas of permanent or persistent surface water provide a drinking source for a variety of wildlife, particularly the larger, wide-ranging mammal. The associated riparian and wetland vegetation supports nesting, denning, and/or feeding uses by a variety of habitat-specific wildlife (see above). In terms of biodiversity, areas of surface water are especially important in providing habitat for aquatic and amphibious wildlife that are tied directly to the water instead of to adjacent vegetation.

Amphibians that only need seasonal water (seasonal streams, ponds, pools, and marshes) for breeding include two "true toads" (the red-spotted toad and the Woodhouse's toad), one "spadefoot" toad (the New Mexico spadefoot). A second species of spadefoot (the plains spadefoot) is documented a short distance away in Utah, and may occur in Colorado. A second non-arboreal treefrog, the canyon treefrog of extreme western Colorado, occupies habitat such as that found in larger rocky canyons of the Monument and is documented in both Montezuma and Dolores Counties. The only salamander species in the region, the tiger salamander, could breed in either permanent or temporary aquatic habitats and is capable of wandering much farther from water during the non-breeding season than most tailless forms.

Perennial waterways in the Monument (Yellow Jacket, Cross Canyon, Hovenweep Tributary, Sandstone Canyon, Bowdish Canyon, Sand Canyon) host a number of aquatic species, including some of special importance. Native fishes known to occur in the Monument include the speckled dace and the mottled sculpin, as well as two special status species (described later in this section): the flannelmouth sucker and the bluehead sucker. Another special status fish, the roundtail chub, is present in perennial Monument streams. Non-native fishes known to occur include the green sunfish, the common carp, the red shiner, the fathead minnow, and the plains killifish.

From a management perspective, it is important to note that water flows in the three perennial stream reaches in the Monument are sustained to a large degree by return flows from irrigation

of adjacent agricultural lands. Much of this irrigation water is delivered from the Dolores River basin, rather than from the San Juan River basin (to which these on-site streams are tributary); thus, the agricultural irrigation in the area represents an addition to the water balance of the site, rather than a depletion as is more commonly associated with irrigation withdrawals.

Aquatic mammals occurring in the Monument include beaver and muskrats. A few species of waterbirds may also use areas of surface water to nest and/or feed. Species potentially present based on known geographic range, although present in smaller numbers due to the limited habitat, include a large wading bird (the great blue heron), waterfowl (including the mallard and the green-winged teal), two shorebirds (the killdeer and the spotted sandpiper), two rails (the Virginia rail and the sora), and additional, unrelated species (the pied-billed grebe and the American coot). A wider variety of waterbirds may stop during migration, but they probably do not nest on-site.

Special Status Wildlife Species

The following discussions and Table 3-14 present information on special status terrestrial and aquatic wildlife species known to occur, known to have a reasonable potential of occurring, or may be affected by management in the Monument. All Federally listed, proposed, or candidate threatened or endangered species (USFWS 2005) are also listed by the BLM as sensitive species and by the CDOW (2005) as threatened, endangered, or special-concern species at the state level. Other species having special management importance are discussed later in this section.

Species	Listing Agency and Status	Habitat Associations
Fringed myotis	BLM sensitive	Roosts in rocky canyons and wooded areas
Yuma myotis	BLM sensitive	Roosts in rocky canyons and wooded areas
Spotted bat	BLM sensitive	Roosts in rocky canyons and wooded areas
Townsend's big-eared bat	BLM sensitive; CDOW special concern	Roosts in rocky canyons and wooded areas
Allen's (Mexican) big-eared bat	BLM sensitive	Roosts in rocky canyons and wooded areas
Big free-tailed bat	BLM sensitive	Roosts in rocky canyons and wooded areas
Kit fox	CDOW endangered	Occurs in shrublands and shrub-grasslands
Peregrine falcon	BLM Sensitive; CDOW special concern	Nests along cliffs and hunts for waterfowl and upland fowl
Bald eagle	BLM Sensitive; CDOW threatened	Nests or roosts in large trees along rivers and lakes; hunts primarily for fish and waterfowl but may feed on smaller mammals and carrion

Table 3-14 Special Status Wildlife Species Present or Potentially Present		
Species	Listing Agency and Status	Habitat Associations
Ferruginous hawk	BLM sensitive; CDOW special concern	Hunts in dry, open country; may nest in trees or on cliffs/ledges
Mexican spotted owl	USFWS threatened; CDOW threatened	Nests/roosts in ponderosa pine/mixed conifer in canyons, especially with cliffs
Burrowing owl	CDOW threatened	Nests/roosts in abandoned prairie dog burrows in shrub-grassland and grassland habitats
Gunnison sage-grouse	BLM sensitive; CDOW special concern	Nests primarily in sagebrush but also uses grassland and riparian habitats during certain seasons
Western yellow-billed cuckoo	USFWS candidate	Inhabits riparian areas with mature cottonwood forest
Southwestern willow flycatcher	USFWS endangered; CDOW endangered	Nests in riparian habitats with willows and other tall shrubs
Northern leopard frog	BLM sensitive; CDOW special concern	Aquatic habitats and adjacent areas
Longnose leopard lizard	BLM sensitive; CDOW special concern	Found in areas with scattered shrubs or other low plants
Desert spiny lizard	BLM sensitive	Prefers sparsely vegetated banks and outcrops along drainages
Common kingsnake	CDOW special concern	Found in variety of habitats, mostly with trees, shrubs, or rock outcrops
Mesa Verde night snake	None, but named in Presidential Proclamation	Found in rugged terrain with rocky slopes, including pinyon-juniper
Colorado pikeminnow	USFWS endangered; CDOW threatened	Mostly limited to large rivers and major tributaries
Roundtail chub	BLM sensitive; CDOW special concern	Mostly limited to large rivers and major tributaries
Razorback sucker	USFWS endangered; CDOW endangered	Mostly limited to large rivers and major tributaries

Table 3-14 Special Status Wildlife Species Present or Potentially Present		
Species	Listing Agency and Status	Habitat Associations
Flannelmouth sucker	BLM sensitive	Prefers mid- to large-size rivers but may occur in tributaries
Bluehead sucker	BLM sensitive	Prefers mid- to large-size rivers but may occur in tributaries

Federally Listed and Candidate Threatened or Endangered Species

One Federally listed endangered fish species has been located within the Monument (Colorado pike minnow), and two other listed species (the Mexican spotted owl and the SWWF) are potentially present, based on habitats present and known geographic ranges. A candidate species (the yellow-billed cuckoo) is listed for Montezuma County, but habitat for this species in the Monument is lacking. Specific information about the abundance and distribution of these listed species in the Monument and vicinity is lacking. However, based on habitats present on-site, the following general discussion provides some information on potential occurrence and habitat use. This discussion also addresses four other Federally listed species (the Colorado pikeminnow, the bonytail chub, the humpback chub, and the razorback sucker)—big-river fishes listed as endangered and occurring in the Colorado River basin downstream from the site—and a number of other special status species that either occur or are potentially present on-site.

Southwestern Willow Flycatcher – The SWWF, an Endangered species, has not been documented in the Monument. However, suitable willow shrublands along some of the drainages in the Monument and the presence of southwestern flycatchers in the region combine to make them potentially present on-site. The quality of on-site habitat for this subspecies has been compromised by livestock grazing, which often becomes concentrated in areas along streams due to the presence of water, shade, and lush forage. Impacts from livestock grazing include direct or indirect loss of willow habitat due to herbivory and/or trampling. Invasion of riparian corridors by aggressive non-natives (e.g., the Russian-olive and tamarisk [salt-cedar]) further reduces the quality of riparian corridors by out competing willows and other native species.

Mexican Spotted Owl – This Threatened subspecies occurs in the general region (including Mesa Verde), but has not been documented in the Monument. The deeper canyons offer potentially suitable habitat. Potential habitat has been identified on the east side of the Monument. This large owl hunts primarily for small rodents.

Western Yellow-Billed Cuckoo – A candidate species, the western yellow-billed cuckoo is a secretive bird that nests in large groves of mature cottonwood forests along rivers and larger creeks. The Monument offers only limited potentially suitable habitat, along the larger perennial streams. The potential for this species to occur on-site is low.

Colorado River Fishes – Two Endangered non-game fishes associated with major rivers and larger tributaries in the Colorado River drainage basin are known to occur in the San Juan River (a major tributary of the Colorado River) downstream from the Monument. They are the Colorado pikeminnow and the razorback sucker. Razorback suckers have not been documented in Monument streams. However, a pikeminnow was positively identified in 2007 in Yellow Jacket Canyon. These fish could be adversely affected by changes in the flow regime of

the occupied reaches farther downstream. Modification of the historic flow regime, including construction of dams and seasonal withdrawals for agriculture, and its resulting influence on gravel bars, shallows, and other habitats needed for spawning and larval growth, is generally cited as a major contributor to the decline of these species.

Two other listed fishes, the bonytail and humpback chub, are found only within the Colorado River Basin and would not be impacted by activities occurring in the San Juan River Basin.

BLM Sensitive Species

The Monument provides potential habitat for several BLM sensitive species. These include six bat species: the fringed myotis, the Yuma myotis, the spotted bat, the Townsend's big-eared bat, the Allen's (Mexican) big-eared bat, and the big free-tailed bat. All of these species have been captured in Montezuma County by the CDOW. The spotted bat and the big free-tailed bat are rare in Colorado. The Allen's big-eared bat was recorded near the area by the CDOW in 2006, and represents the first recorded in Colorado.

Another BLM sensitive species potentially present on-site is the ferruginous hawk, listed previously in the descriptions of wildlife in pinyon-juniper woodland and rocky canyon habitats. This species, the largest hawk in Colorado, winters in the Monument and feeds in more open terrain, such as semi-desert shrubland, shrub-grassland, or grassland types. Although consuming a wide range of prey, this species may be particularly common in areas with the presence of prairie dogs, which the hawks are large enough to take readily, and which can offer a concentrated and abundant prey source.

The Gunnison sage-grouse was recently recognized as a species separate from the greater sage-grouse. Although it is not known to occur in the Monument, it is present nearby, and the expanse of sagebrush shrubland and sage-grassland are within the historic range of this species. It nests in sagebrush habitats and uses sagebrush as a winter food source. Gunnison sage-grouse use riparian areas and lush grasslands during summer and fall for brood-rearing. Sage grouse management and conservation would follow guidelines established in the Gunnison Sage Grouse Rangewide Plan (April 2005), including but not limited to, habitat improvements and grouse reintroductions. Potentially suitable habitat is found in the northwest portion of the Monument and would be assessed for habitat characteristics prior to any project implementation.

Other BLM sensitive species known to occur in the Monument include the longnose leopard lizard and the desert spiny lizard. These species were discussed previously in descriptions of species occurrence by habitat type.

As described previously, BLM sensitive fish species known to occur include the flannelmouth sucker, the bluehead sucker, and the roundtail chub. Habitat for these and other fish species on-site is limited to the three perennial stream segments (Yellow Jacket Creek, McElmo Creek, and the Cross Canyon tributary) that are sustained by groundwater and spring discharges, as well as by irrigation return flows from adjacent agricultural lands.

State-Listed Threatened or Endangered Species

All of the Federally listed or proposed threatened or endangered species are also State-listed as threatened or endangered by the CDOW. In addition, the CDOW lists some species as threatened or endangered at the State level that do not have a similar Federal status. State-listed species potentially present in or near the Monument are discussed below.

Kit Fox – This small carnivore, State-listed as endangered, occurs in western and southwestern Colorado, as well as in portions of other southwestern and intermountain states. It inhabits drier, more open habitats than the red fox and the gray fox, and feeds primarily on rabbits, small

rodents, and ground-nesting birds. Suitable habitat in the Monument consists of the expanses of saltbush and sagebrush shrubland and shrub-grassland, as well as open stands of pinyon-juniper. There is a record of a kit fox sighting from 1962, from in or near the Monument (Meaney et al. 2006).

Burrowing Owl – State-listed as threatened, this small owl nests in abandoned prairie dog burrows or, less commonly, burrows of large ground squirrels or other ground-dwelling species. Its prey consists primarily of large insects (e.g., grasshoppers) and small vertebrates. In Colorado, the burrowing owl is more common in the eastern plains, where the black-tailed prairie dog is more abundant and widespread than the Gunnison’s prairie dog is in southwestern Colorado. Gunnison’s prairie dogs and burrowing owls are known to occur in the Monument. Suitable habitat in the Monument consists of the expanses of saltbush and sagebrush shrubland and shrub-grassland.

State-Listed Species of Special Concern

The CDOW also lists species that are of special concern in Colorado due to limited or declining habitat, small or localized populations despite ample habitat, and/or due to other reasons. Special concern species potentially present in the Monument and vicinity include most of the species listed as sensitive by the BLM, as well as those Federally listed, proposed, or candidate species not designated as threatened or endangered in Colorado. The only State-listed special concern species potentially present in the Monument, and not included in one of the other special status categories, is the common kingsnake. The common kingsnake is found in a variety of habitats including oniferous forests, woodlands, marshes, grassland, chaparral and desert. It is frequently found near rock outcrops and clumps of vegetation from sea level to 7,000 feet elevation.

Other Species, Habitats, and Areas of Special Management Importance

In addition to the special status wildlife species discussed above, other species, habitats, and areas of special importance in terms of current and/or future management of the Monument are summarized below.

Native Birds Protected by the Migratory Bird Treaty Act

Most native species of birds are protected by the Migratory Bird Treaty Act (MBTA). In addition to protecting the birds from being killed, injured, and/or harassed, the MBTA protects active nests, that is, those nests that contain eggs or young and, if interpreted more broadly, those nests that are being tended to by adults in preparation for nesting.

The MBTA prohibits the unregulated “take” of most native bird species, except for gallinaceous birds (grouse, quail, wild turkey, etc.). This law is understood to cover direct harm to birds, rather than including harm to their habitat. The law does not exempt unintentional take of birds and, as currently interpreted, proposals that appear to risk direct damage to birds and/or live eggs must show diligence in avoiding or reducing this risk. The lead enforcement agency, the USFWS, publishes a list, “Birds of Conservation Concern,” indicating that avoiding harm to the species on this list will contribute substantially to showing diligence to the requirements of the MBTA. Within the Monument, the following birds of conservation concern may be found: the golden eagle, the Swainson’s hawk, the northern harrier, the ferruginous hawk, the Gunnison sage-grouse, the short-eared owl, the peregrine falcon, the prairie falcon, the western burrowing owl, the pinyon jay, the black-throated gray warbler, the gray vireo, and the sage sparrow.

Important Bird Area (IBA)

The Canyons of the Ancients National Monument has been identified by the Audubon Society as an Important Bird Area (IBA). IBAs are sites that provide essential habitat for one or more

important species of birds generally including sites for breeding, wintering, and/or migrating birds. To qualify as an IBA, sites must satisfy at least one of the following criteria:

The site must support species of conservation concern (e.g. threatened and endangered species);

The site must support restricted-ranges species (species vulnerable because they are not widely distributed)

The site must contain rare or unique habitat or an exceptional representative of a natural habitat and support species that are vulnerable because their populations are concentrated in one general habitat type or biome; and/or

The site must support species, or groups of similar species (such as waterfowl or shorebirds), that are vulnerable because they occur at high densities due to their grouping behavior.

The Canyons of the Ancients National Monument was recognized in 2000 as an IBA on the basis that it provides among the best Gray Vireo range in the state of Colorado, supporting a minimum of 500 pairs. It also hosts the best densities of Black-throated Sparrows in the southwest region of the state. The Audubon Society shows the Canyons of the Ancients National Monument meeting all four criteria. Regarding Criteria 1, suitable habitat has been located for the southwestern willow flycatcher and spotted owl, however, neither species has been located. Ferruginous hawks do occur in the Monument. Criteria 2, 3 and 4 species that occur in the Monument include Gray Vireo, Black-throated Gray Warbler, Common Poorwill, Gray Flycatcher, Black-chinned Hummingbird, and the Juniper Titmouse.

The Audubon Society identified minor threats in the Monument as introduced animals and cowbird parasitism and potential threats in the Monument as invasive non-native plants, pollution from nearby coal-fired power plants, habitat conversion, and disturbance to birds and habitats (<http://www.audubon.org/bird/IBA/>).

Amphibians

None of the amphibians (salamanders, frogs, and toads) present, or potentially present, in the Monument are Federally listed as threatened or endangered; however, many species are vulnerable to local extirpation in semi-arid environments due to the need for perennial or predictable seasonal water sources for breeding. Amphibian species present in the Monument have adaptations for arid environments.

While most amphibians are not strictly limited to perennial waters, as are fishes, loss of an occupied water source can have a much more prolonged impact on amphibians than the occasional drying of a stream has on the fish population. This is because fish may quickly recolonize the stream from downstream or upstream reaches when surface flows are reestablished, while recolonization by amphibians can be a very slow process requiring overland dispersal from distant, isolated pools. Additionally, physical disturbances that prevent breeding or that destroy the eggs or tadpoles of a population can negate the entire reproductive effort for that year. Only a few years of failed reproduction can lead to loss of the population, as adults gradually succumb to age without successfully replacing themselves.

Recreationally or Economically Important Game Species

One of the current recreational uses of the Monument is hunting. Hunted species in or near the Monument include the wild turkey, the Gambel's quail, the black bear, the mountain lion, mule deer, and Rocky Mountain elk. Although locals hunt small game, deer and elk are a more major draw, attracting hunters from other areas as well.

As shown on Map 11, most of the Monument area is mapped by the CDOW as supporting a resident population of mule deer. Winter range occurs along some of the northeastern drainages and, along with a small area mapped as a winter concentration area, just north of the northwestern corner. Note that the map depicts only Colorado data; however, similar uses extend across the state line into Utah.

In comparison, elk make more limited use of the Monument, with resident populations mostly along the northeastern boundary and, for winter range, extending generally farther northeast. Severe winter range areas (i.e., habitats used during the severest winters, when other habitats are unavailable due to snow cover) are mapped northeast of U.S. Highway 491. Two migration corridors enter the Monument from winter range and severe winter range: from Yellow Jacket Canyon and from Sandstone Canyon. Elk use within the Monument is a result of constructing McPhee Reservoir. Agricultural practices changed from dryland to irrigated pasture; attracting elk to alfalfa and sunflower fields. Elk were not known to use these lands prior to McPhee's construction.

The Brunot Treaty, ratified by Congress in 1874, withdrew over 5,000 square miles in the mountains of southwestern Colorado from the 1868 Ute Reservation. The Brunot cession area includes 3,857 acres (including 216 acres of private land) in the southeastern corner of the Monument. The agreement, entered into between the United States (as represented by Felix Brunot) and the Ute Indians in Colorado, was passed into law (18 Stat., 36) by the House of Representatives and the Senate of the U.S. Congress on April 29, 1974. Under the "reserved rights doctrine," hunting rights on reservation lands relinquished by the Ute were retained; that is, the tribes retained such rights as part of their status as prior and continuing sovereigns. Article II of the Brunot Agreement specified that "the United States shall permit the Ute Indians to hunt upon said lands so long as the game lasts and the Indians are at peace with the white people." This is considered a valid existing right that, under the terms of the Monument Proclamation that established the Monument, must be honored.

3.1.8. Vegetation Resources

Vegetation resources in the Monument are considered to have intrinsic value, and to provide a setting for the cultural objects, biomass for livestock forage, food and fiber collection, forest products (including Christmas trees), and habitat for wildlife. Following BLM guidance, vegetation resources in the Monument will be discussed with a general distinction made between uplands, comprising primarily woodlands and shrublands, and riparian and wetland areas. Management of special status plant species and significant plant communities, as well as noxious weeds, will also be considered and discussed.

There are approximately 174,100 acres in existing grazing allotments in the Monument, including those contributed by private in-holdings. The condition and trend of vegetation in these allotments, and the associated livestock grazing permits, are discussed in Section 3.2.6, Livestock grazing. Information on Christmas tree permits, fuelwood cutting, and other forest-related products collected in the Monument is located in Section 3.2.3, Special Forest Products. Food and fiber collection in the Monument is generally limited to collection of pinyon and juniper wood for specialty purposes, pinyon nuts, skunkbrush sumac fruits, mushrooms, native tobacco from recent burns, and various shrubs and grasses for basketry, weaving clothes, tools, and ceremonial contexts. Permits for seed collecting for commercial purposes have been issued in the past, but potential impacts from this practice have not been assessed. The use of vegetation resources by wildlife is discussed Section 3.1.7, Terrestrial and Aquatic Wildlife.

3.1.8.1. Regional Setting and Regulatory Framework

The Monument lies within the Colorado Plateau Semi-desert Province (Bailey 1995). This ecoregion barely enters Colorado in the southwestern corner of the state. In this classification system, the defining characteristic of this and other similarly grouped provinces in the Subtropical Steppe of the Dry Domain is the regional aridity. Short-grass grasslands, with locally developed shrub lands and woodlands, characteristically dominate steppe provinces.

Six major vegetation types occur in the Monument, including pinyon-juniper woodlands, salt-desert shrublands, big sagebrush shrublands, and cottonwood-willow-tamarisk woodlands, as well as unvegetated rock outcrops and agriculture/industrial areas. General vegetation types are presented in Table 3-15. Pinyon-juniper woodlands are the most common vegetation type in the Monument; accounting for approximately 67 percent of the total land area (see Map 12). The second most abundant vegetation type, salt-desert shrublands dominated by shadscale or saltbush, represents 22 percent of the Monument area. Big sagebrush shrublands account for almost 8 percent of the Monument area.

In general, the Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (BLM 1997) and livestock management actions in the San Juan/San Miguel Resource Management Plan (BLM 1985) have guided management of the Monument’s vegetation resources. Additional laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the related resources and land uses in the Monument, are described and listed in Chapter 1, Purpose and Need. The laws and regulations specifically related to management of vegetation resources on BLM National Monuments and other BLM lands include:

- the Healthy Forest Act of 2003;
- the Clean Water Act of 1977;
- Executive Order 11990: Protection of Wetlands;
- Executive Order 13112: Control of Invasive Species; and
- 43 CFR 8365.1-5 (vegetation collection).

Table 3-15 General Vegetation Types and Constituent Ecological Sites		
Vegetation Types/Ecological Sites	Acres	Total Area (%)
Pinyon-Juniper Woodlands (total)	(109,169)	67
Pinyon-Juniper	87,766	54
Loamy foothills	21,403	13
Salt-Desert Shrublands (total)	(36,661)	22
Salt-desert breaks	19,913	12
Shallow desert	5,641	3
Clayey salt desert	4,519	3

Table 3-15 General Vegetation Types and Constituent Ecological Sites		
Vegetation Types/Ecological Sites	Acres	Total Area (%)
Alkali flat	3,942	2
Alkali bottom	2,060	1
Desert sand	586	<1
Big Sagebrush Shrublands (total)	(13,533)	8
Semi-desert loam, shallow loam	9,881	6
Loamy bottom	2,321	1
Upland loam	1,331	1
Cottonwood – Willow – Tamarisk Woodlands (total)	(962)	≤1
River bottom	962	≤1
Unvegetated (total)	(2,992)	2
Rock	2,972	2
Water	20	<1
Agricultural/Industrial Areas (total)	(596)	<1
Agriculture/old disturbance	403	<1
Industrial	193	<1
TOTAL	163,913	100

Estimating the acreage of rock cover in the Monument can result in a variety of outcomes depending on the data set used. Figures used in the DRMP/DEIS for rock cover were derived from soil maps and ecological site inventory data. Vegetation type maps and aerial photo interpretation can also be used to determine the amount of area covered by rock. In many cases vegetative cover is located either above the rock or within a defined unit being measured (i.e. polygon, square meter, etc.). In these cases, vegetation is usually measured and rock is not, underestimating rock cover. A more accurate estimate of acres of rock cover based on DRMP/DEIS vegetation types, (excludes newly acquired lands) is as follows:

Table 3-16 Estimated Acres of Surface Rock Cover Within Vegetation Type / Ecological Site Classifications			
Vegetation Types / Ecological Site Classification	Acres	Percent of Rock in Class	Total Acres of Rock Cover
Pinyon-Juniper Woodlands	109,169	6	6550
Salt-Desert Shrublands	36,661	4	1466
Big Sagebrush Shrublands	13,533	4	542
Cottonwood – Willow – Tamarisk Woodlands	962	1	10
Unvegetated	2,992	70	2095
Agricultural / Industrial Areas	596	1	4
Total	163,913		10,667

To portray a more accurate estimate of rock cover than represented in the DRMP/DEIS, the figure used in this PRMP/FEIS for analysis purposes was derived from a combination including vegetative cover map, aerial photo interpretation, and extrapolation from ecological site data. Our best estimate of acres covered by rock, including the newly acquired land described for Alternative VI, is 11,042 acres.

3.1.8.2. Current Conditions and Trends

The condition and trend for vegetation resources has been assessed based on the results of four separate, but related, assessment processes:

- Rangeland trend information has been collected along 40 permanent transects in the Monument since 1981, using permanent transects that are remeasured every 5 years.
- A public land health assessment of the 28 livestock grazing allotments in the Monument, consisting of 174,100 acres, and regulated through 22 permits, was conducted in 2001. This study is a qualitative assessment of a number of site indicators relative to a reference site of the same ecological type. The indicators relate to the three Public Land Health Standards: soil and site stability, hydrologic function, and biotic integrity (Pellant et al. 2000). A summary of these results in terms of biotic integrity and vegetation condition rating is presented in Table 3-17. Complete results are presented in the AMS (BLM 2005b).
- An Ecological Site Inventory (ESI) was conducted simultaneously and co-located with the public land health assessment to generate quantitative data with which to assess the health of vegetation communities. An “ecological site” is an area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. ESI sites were chosen as those most representative of ecological site descriptions, based on

soil types from the Natural Resource Conservation Service (NRCS) Cortez Area Soil Survey (NRCS 2003). Tables 3-7 through 3-9 summarize these results in terms of the extent of the defined plant communities that comprise the general vegetation types described above. Complete results of the ESI are presented in the AMS (BLM 2005b).

- An evaluation of Proper Functioning Condition (PFC) was conducted for riparian areas in the Monument in 2001 and 2002, following the methods described in Prichard (1998 and 1999). A summary of these results is presented in the Riparian and Wetlands Section. Complete results are presented in the AMS (BLM 2005b).

Table 3-17 Public Land Health Evaluation Ratings for Biotic Integrity and Vegetation Condition Ratings										
Capable Portions of Ecological Sites, Federal Land Only^a			Degree of Departure From a Reference Site, Percent of Acres Falling in Each Health Rating for Each Ecological Site				Species Composition, Percent Similar to a Desired Plant Community			
Ecological Site	Acres Rated	Extreme	Moderate to Extreme	Moderate	Slight to Moderate	Slight	0-25% Poor	26-50% Fair	51-75% Good	76-100% Excellent
Pinyon-Juniper Woodlands										
Pinyon-juniper	56,354	0	13	73	11	3	21	32	23	24
Loamy foothills	21,403	0	18	60	21	0	14	45	22	18
Salt-Desert Shrublands										
Salt-desert breaks	19,913	0	31	59	10	0	10	63	27	0
Shallow desert	5,641	0	27	31	42	0	18	49	26	7
Clayey salt-desert	4,519	1	80	19	0	0	14	69	15	2
Alkali flat	3,942	0	54	39	7	0	57	19	24	0
Alkali bottom	2,060	10	81	9	0	0	42	54	3	0
Desert sand	586	0	4	96	0	0	4	45	51	0

Table 3-17 Public Land Health Evaluation Ratings for Biotic Integrity and Vegetation Condition Ratings										
Capable Portions of Ecological Sites, Federal Land Only^a				Degree of Departure From a Reference Site, Percent of Acres Falling in Each Health Rating for Each Ecological Site			Species Composition, Percent Similar to a Desired Plant Community			
Ecological Site	Acres Rated	Extreme	Moderate to Extreme	Moderate	Slight to Moderate	Slight	0-25% Poor	26-50% Fair	51-75% Good	76-100% Excellent
Big Sagebrush Shrublands										
Semi-desert loam	9,033	0	22	69	9	0	15	75	9	1
Semi-desert shallow loam	848	0	33	67	0	--	33	27	39	0
Loamy bottom	2,321	2	64	29	6	0	8	63	29	0
Upland loam	1,331	13	39	14	34	0	19	0	48	33
Cottonwood-Willow-Tamarisk – see Riparian and Wetland text										
TOTAL	127,951	<1	24	61	13	1	19	44	23	14

^a "Capable" refers to land capable of being utilized by livestock.

General Occurrence and Habitat

The four predominant native (excluding agricultural lands) vegetation types (see Map 12) are described below, utilizing the ESI site information for the composite vegetation communities. For detailed descriptions of potential and existing conditions for each of the ESI sites in the Monument, refer to the AMS (BLM 2005b). Results of the general trend monitoring are presented below. Results of the ESI are also presented and summarized in Tables 3-10 and 3-11.

Evaluating the changes in the frequency of the species present on each permanent transect allows for general trend assessments. Thirteen of the 28 larger livestock grazing allotments have one or more transects. The following trends were determined from these transect data:

- **upward trend:** 2 transects;
- **downward trend:** 22 transects;
- **stable trend:** 5 transects;

- **stable-to-downward trend:** 5 transects; and
- **stable degraded condition:** 6 transects.

Uplands, Including Woodlands and Shrublands

Upland areas are described in terms of pinyon-juniper woodlands and salt-desert and big sagebrush shrublands. The biotic integrity and vegetation condition for each ESI community type are summarized in Table 3-16. Communities are referred to by name. Following the first reference, the defining soil types and landscape positions are given. Additional information regarding soil for the ESI sites is found in Section 3.1.6, Soil Resources.

Pinyon-Juniper Woodlands

The pinyon-juniper (Romberg-Crosscan Complex [soil map units 109, 110], Gladel-Pulpit Complex [soil map unit 42] and Rizno-Gapmega Complex [soil map unit 105], canyons and hills) and loamy foothills (Wetherill, Cahona, Sharps, and Pulpit, mesas and hills) ecological sites define the pinyon-juniper woodlands of the Monument. These areas are dominated by pinyon pine (*Pinus edulis*) and Utah juniper (*Sabina osteosperma*) with a diverse understory of limited cover. Principal grasses are muttongrass (*Poa fendleriana*), needle-and-thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), Indian ricegrass (*Achnatherum hymenoides*), and bottlebrush squirreltail (*Elymus elymoides*). Shrubs such as big sagebrush (*Seriphidium tridentatum*), Green's rabbitbrush (*Chrysothamnus Greenei*), bitterbrush (*Purshia tridentata*), and cliffrose (*Purshia stansburiana*) are common. Should these communities decline in health, perennial grasses, especially the large, cool-season bunchgrasses, will decrease. Plant species most likely to invade the site are cheatgrass and weedy annual forbs, such as tansy mustard (*Descurainia* spp.).

Approximately 15,000 acres of pinyon-juniper woodlands (11 percent of the total) were chained in the 1960s. Chaining is a vegetation-manipulation treatment that involves dragging a large chain across the ground surface, which knocks down trees to enhance grass, forb, and shrub production. These sites were typically seeded with crested wheatgrass (*Agropyron cristatum*), although little remains in these areas. The chained sites have returned to a tree canopy of 25 percent cover ranging from 7 to 10 feet in height. The chained sites have a higher cover of annual grasses, weedy annual forbs, and shrubs, probably due to the initial disturbance from the vegetation treatment and because of the open canopy of these sites.

Salt-Desert Shrublands

This shrubland vegetation type consists of six ecological sites, all having similar plant communities, but different soil types. These include salt-desert breaks (Claysprings [soil map unit 22] and Typic Torriorthents [soil map unit 133], hills, knobs, ridges, and canyons on all slopes); shallow desert (Farb [soil map unit 31], mesas, and escarpments), clayey salt-desert (Claysprings, Uzacol, Zwicker and Complex [soil map unit 138], hills, knobs, ridges, and canyons on slopes from 3 to 12 percent for Uzacol and Zwicker and up to 65 percent for Claysprings); alkali flat (Mack [soil map unit 70], Mikim Loam [soil map unit 75], and Recapture [soil map unit 100], mesas, terraces, and alluvial fans on slopes less than 6 percent); alkali bottom (Battlerock Clay Loam [soil map unit 12], Ravola Clay Loam [soil map unit 99], and Recapture Sandy Loam and Lillings Silt Loam [soil map units 101, 65], floodplains, drainageways, and alluvial fans on slopes less than 6 percent), and desert sand (Sheppard Fine Sand [soil map unit 122], dunes, alluvial fans, and terraces on slopes less than 6 percent).

When near their vegetation potential, these areas are a grassland community with scattered stands of four-winged saltbush and shadscale (*Atriplex* spp.). Shrub cover can be as high as 30 to 40 percent. The grassland understory is dominated by galleta (*Hilaria jamesii*), alkali sacaton

(*Sporobolus airoides*), Salina wildrye (*Leymus salina*), bottlebrush squirreltail, needle-and-thread, and Indian ricegrass. Subdominant grasses that may be present are Sandberg bluegrass (*Poa sandbergii*), New Mexico feathergrass (*Hesperostipa neomexicana*), western wheatgrass, and three-awn (*Aristida purpurea*). Subdominant shrubs include winterfat (*Krascheninnikovia lanata*), big sage, bud sage (*Picrothamnus desertorum*), black sage (*Seriphidium novum*), Mormon-tea (*Ephedra viridis*), snakeweed (*Gutierrezia sarothrae*), green molly (*Kochia americana*), spiny hop-sage (*Atriplex spinosa*), and cliff-rose. Utah juniper occurs in small amounts at the higher elevations.

As the ecological condition of the plant community declines, the plant species most likely to invade the site are cheatgrass and annual forbs, such as Russian-thistle (*Salsola australis*) and filaree (*Erodium cicutarium*). Greasewood (*Sarcobatus vermiculatus*) may invade when it is close to its natural habitat. Cool-season bunchgrasses, such as Indian ricegrass, needle-and-thread, and Salina wildrye, as well as the more sensitive shrubs, including winterfat, bud sage, and four-winged saltbush, will drop out of the plant community with overuse. Warm-season grasses may increase initially, but will also decline with continued overuse. Eventually, even shadscale will decline, and a large part of the cover will become annual grasses and forbs.

Big Sagebrush Shrublands

This shrubland vegetation type consists of four ecological sites, all having similar plant communities, but different soil types. These include semi-desert loam (Gap Mesa [soil map units 11, 105], Barx Loam and Barx-Gap Mesa Complex [soil map units 8, 9, 11], Sharps Loam and Sharps-Gap Mesa Complex [soil map units 114, 115], Yarts Fine Sandy Loam [soil map unit 147], mesas and hills); loamy bottom (Ramper Loam [soil map unit 98], Ustic Torriorthents [soil map unit 135], alluvial fans, drainageways, and flood plains on slopes less than three percent) and upland loam (Barx [soil map unit 10], gently sloping benches, mesas, and rolling hills).

At potential, this vegetation type is a mixed grass-shrub community, with big sagebrush as the dominant shrub. The major grasses are galleta, New Mexico feathergrass, blue grama (*Chondrosium gracile*), Indian ricegrass, and bottlebrush squirreltail. In some areas, four-winged saltbush is abundant.

As the plant community declines in condition, plant species most likely to invade the sites are cheatgrass, sixweeks fescue (*Vulpia octoflora*), annual weedy forbs, and snakeweed. Perennial grasses, especially the large, cool-season bunchgrasses, will decrease, and there will be a corresponding increase in basin big sagebrush. In the absence of fire, pinyon and juniper are often invasive on these sites.

Riparian and Wetlands (Including Cottonwood-Willow-Tamarisk Woodlands)

There are 73 miles of perennial and intermittent stream, with 923 acres of associated riparian vegetation on BLM lands in the Monument. There are three primary wetland areas associated with Bluewater Spring, Confluence Spring, and H-O Spring. The total area of wetlands associated with springs is estimated at less than 5 acres.

A Proper Functioning Condition (PFC) assessment was completed in 2001 and 2002 for lentic (i.e., standing water, such as seeps and springs) and lotic (i.e., moving water, such as within river floodplains) riparian areas. An inventory of point-water sources was made during the PFC assessment. A summary of these results follows:

- The results of the point source inventory documented approximately 100 springs and seeps in the Monument. Approximately 45 percent of these springs have perennial surface flow, with the remaining 55 percent flowing only intermittently or not at all.

Springs were selected for PFC assessment based on the presence/absence of flowing water and wetland or riparian vegetation, and based on historic photos and notes. Springs without such vegetation (including contact seeps, fault/joint/fracture springs) were not considered for assessment.

- PFC data were collected for 11 springs in the Monument. Four of these (West Mockingbird, Cannonball Spring, Bluewater Spring, and Hackle Spring) have been developed as water sources for livestock. Of the 11 springs evaluated, three were found to be meeting PFC criteria (Hackle Spring, Cannonball Spring, and Confluence Spring) (Jensen 2003). These results are summarized in Table 3-18.

Allotment	Spring/Seep Name	Date Evaluated	Rating	Causal Indicators for Functional-At-Risk (FAR) or Non-functional (NF) Ratings
Burro Point Community	Hackle Spring	8/26/2003	PFC	
Cahone Mesa	Nice Spring	1/30/2003	FAR - Stable trend	Livestock grazing and compaction associated with the historical homestead site
	Old 160 Spring	1/30/2003	NF	Livestock grazing and upstream watershed conditions on private land
	West Mockingbird Spring	4/2/2003	NF	Livestock grazing and an increase in sediment, attributable to development associated with oil and gas extraction (well pad and routes)
Cannonball	Cannonball Spring	4/9/2003	PFC	
Cross Canyon	Braven Spring	4/2/2003	NF	Increased sediment loading as a result of agricultural development upstream and the input of toxic substances from private land upstream

Table 3-18 Proper Functioning Condition (PFC) Ratings for Evaluated Springs and Seeps				
Allotment	Spring/Seep Name	Date Evaluated	Rating	Causal Indicators for Functional-At-Risk (FAR) or Non-functional (NF) Ratings
	Frothy Spring	4/6/2003	FAR - trend not apparent	Increase in water yield from upstream agricultural development, resulting in mass wasting at the spring and increase in sediment from livestock grazing and an historic route
	H-O Spring	4/2/2003	FAR - downward trend	Increased sediment and water yield from development of an access route through the spring, an increase in sediment and water yield from upstream agricultural fields, and livestock grazing
Hamilton Mesa	Bluewater Spring	1/30/2003	FAR - downward trend	The Blue Water Spring development, water troughs, and fencing that have concentrated livestock, resulting in compaction, decrease in extent of riparian wetland area, and altering flow patterns. The unregulated flow in the tanks is potentially dewatering the spring.
Hovenweep Canyon	Confluence Spring	4/7/2003	PFC	
	Miller Spring	4/7/2003	FAR - static trend	Livestock grazing and compaction around the spring associated with an historic homestead/corral

- PFC data were collected on 73 miles of stream in the Monument. Streams were selected for PFC assessment based on local knowledge of riparian conditions and flow regimes. Perennial streams were given the highest priority for assessment, intermittent streams were given the second-highest priority, and ephemeral streams were not considered. If recent data existed, they were used in the assessment of existing conditions.

- Ten miles of stream were rated as PFC, 18 miles of stream as Non-Functional (NF), and 45 miles of stream as Functional-At-Risk (FAR). Of the 45 miles of FAR-rated streams, 24 miles rated FAR with a downward trend, 1 mile rated FAR with an upward trend, 18 miles rated FAR with a trend not apparent, and 2 miles were rated FAR with the trend assessed as static (Jensen 2003). Causal factors for FAR and NF ratings include livestock grazing and agriculture practices upstream that increase sediment delivery and/or water yield. McElmo Creek is unique in that route encroachment is also a casual factor. These results are summarized in Table 3-19.
- Sixteen livestock grazing allotments that contained riparian areas were evaluated as part of the Monument's Standards for Public Land Health determination process. Of these, two have achieved PFC, one was making progress toward achieving the desired condition, and the remaining 13 had not achieved the desired condition. It has been noted that both tamarisk and Russian-olive are increasing in species composition as a result of either natural or management-related competitive advantage.

Table 3-19 Proper Functioning Condition (PFC) Ratings for Evaluated Lotic Riparian Systems

Stream	Reach	Date Evaluated	Type of Evaluation	Rating
Cahone Creek	From the pasture fence in Section 19, T39N, R18W to its confluence with Cross Canyon; includes photo point CH1	2003	Ground survey	FAR - downward trend
	From the pasture fence in Section 19, T39N, R18W to the Monument boundary; includes photo point CH2	2003	Ground survey	FAR - stable
Cave Spring Canyon	All public reaches; includes photo point CS1	2001	Ground survey	PFC
Cow Canyon	Little Cow Canyon near Lowry Pueblo just below Monument boundary; includes photo point LC2	2003	Ground survey	FAR - downward trend
	Little Cow Canyon, except for segment just below Lowry Pueblo, and Cow Canyon to a point in Section 17, T38N, R19W; includes photo points LC1 and CC1-CC2	2003	Ground survey	FAR - downward trend
Cross Canyon	Below Cow Canyon confluence to the Utah/Colorado border; includes photo points CR1-CR3	2003	Ground survey	PFC

Table 3-19 Proper Functioning Condition (PFC) Ratings for Evaluated Lotic Riparian Systems

Stream	Reach	Date Evaluated	Type of Evaluation	Rating
	Above Cow Canyon confluence to pasture fence in Section 5, T38N, R19W; includes photo points CR4-CR7	2003	Ground survey	NF
	From pasture fence in Section 5, T38N, R19W to a point in Section 27, T39N, R19W; includes photo points CR8-CR11	2003	Ground survey	PFC
	From a point in Section 27, T39N, R19W to Monument boundary; includes photo points CR12-CR14	2003	Ground survey	FAR - trend is not apparent
McElmo Creek	Public reach in Flodine Park allotment; includes photo point ME1	2002	Ground survey	FAR - trend not apparent/possibly stable
	Public reaches in Hamilton Mesa allotment; includes photo points ME2-ME4	2003	Ground survey	NF
	Public reaches in Aztec Canyon allotment; includes photo points ME5-ME8	2003	Ground survey	FAR - upward trend
Papoose Canyon	T38N/T39N survey line to Utah/Colorado border; includes photo point PC1	2001	Ground survey	FAR - downward trend
Sandstone Canyon	All public reaches; includes photo points SS1-SS4	2002	Ground survey	NF
Squaw Canyon	All public reaches; includes photo points SQ1-SQ7	2003	Ground survey	FAR - downward trend
Woods Canyon	From its confluence with Sandstone Canyon to approximately the section line between Section 17 and Section 16, T37N, R18W (includes photo point WD1) and from approximately the section line between Section 16 and Section 15, T37N, R18W to the Monument boundary (includes photo point WD3)	2002	Ground survey	FAR - downward trend

Stream	Reach	Date Evaluated	Type of Evaluation	Rating
	Approximately the portion of Woods Canyon that traverses Section 16, T37N, R18W; includes photo point WD2	2002	Ground survey	NF
Yellow Jacket Canyon	All public reaches, except those in Yellow Jacket allotment; includes photo points YJ6-YJ9	2002	Aerial reconnaissance, ground survey along upper public reach	FAR - trend not apparent/possibly downward
	All public reaches in Yellow Jacket allotment; includes photo points YJ1-YJ5	2003	Ground survey	NF

Special Status Plant Species and Significant Plant Communities

Table 3-20 identifies the status, habitat requirements, potential habitat, and occurrence of special status plant species associated with the Monument.

Special Status Plant Species

No Federally listed plant species are known to occur in the Monument.

Two Federally listed species are known to exist nearby. The Endangered Mancos milk-vetch (*Astragalus humillimus*) and the Threatened Mesa Verde cactus (*Sclerocactus mesae-verdae*) occur in the vicinity of Sleeping Ute Mountain on specific soil types.

Potential habitat for Sleeping Ute milkvetch (*Astragalus tortipes*), a candidate species for Federal listing, may occur in the Monument (USFWS 2008), however surveys have not located any populations.

Two BLM-listed sensitive plant species are known to occur in the Monument (see Map 13). These include Jones blue star (*Amsonia jonesii*) and Naturita milkvetch (*Astragalus naturitensis*). Sensitive plant species are derived from a list approved by the BLM Colorado State Director (BLM Colorado State Office Information Bulletin No. CO-2000-014). BLM policy is that no action should be taken that would contribute to these species becoming listed as candidate species through actions funded, authorized, or implemented by the BLM.

Table 3-20 Federal, BLM, and USFS Sensitive Plant Species Known or Suspected to Occur in the Monument

Species	Status^a	Habitat	Suitable Habitat Present?	Documented Occurrence in the Monument
Jones blue star (<i>Amsonia jonesii</i>)	G4/S1	Dry, open areas with clay, sandy, or gravelly soil, in desert-steppe, rocky gorges, and canyons at 4,500 to 5,000 feet	Yes	One population is present on slopes near the base of Sleeping Ute Mountain.
Cronquist milkvetch (<i>Astragalus cronquistii</i>)	G2/S2 BLM	Low, sandy, or gravelly ridges and sandy washes in blackbrush and salt-desert shrub communities on sandstone or red sandstone of the Cutler and Morrison Formations at 4,000 to 5,000 feet	Yes	No
Naturita milkvetch (<i>Astragalus naturitensis</i>)	G2G3/S2 S3 BLM	Cracks and ledges of sandstone cliffs and flat bedrock areas with some shallow soil development, within pinyon-juniper woodlands at 5,000 to 7,000 feet	Yes	Several large populations exist in the McElmo Canyon area of the Monument.
Sleeping Ute milkvetch (<i>Astragalus tortipes</i>)	G1/S1 Candidate	Scattered colonies on lower slopes of ridges and knolls of Cretaceous Mancos Shale separating mountain foothills from desert badlands (5,600 to 5,750 feet) in mixed desert scrub with <i>Atriplex confertifolia</i> , <i>Chrysothamnus Greenei</i> , <i>Eriogonum clavellatum</i> , <i>Frankenia jamesii</i> , and <i>Gutierrezia sarothrae</i>	Yes	No
Giant helleborine (<i>Epipactis gigantea</i>)	G3G4/S2 FS	Moist areas along stream banks, lake margins, seeps, and springs; a variety of habitats, all having a constant source of water for the roots (4,800 to 8,000 feet)	Yes	No

Table 3-20 Federal, BLM, and USFS Sensitive Plant Species Known or Suspected to Occur in the Monument

Species	Status^a	Habitat	Suitable Habitat Present?	Documented Occurrence in the Monument
Kachina daisy (<i>Erigeron kachinensis</i>)	G2/S1 BLM	Low-elevation seeps and hanging gardens to high-elevation mesic sandstone outcrops in aspen and ponderosa pine communities at 5,000 to 8,000 feet	Yes	No
Comb Wash buckwheat (<i>Eriogonum clavellatum</i>)	G2/SNR, BLM	Sandy to heavy clay washes and slopes, saltbush communities; of conservation concern; 3,900 to 5,500 feet	Yes	No
Eastwood monkey flower (<i>Mimulus eastwoodiae</i>)	G3/S1	Shallow caves and seeps on steep canyon walls at 4,700 to 5,800 feet	Yes	No

The status classifications include:

G1 - Global rank, critically imperiled - at very high risk of extinction due to extreme rarity (5 or fewer) very steep declines, or other factors.

G2 - Global rank, imperiled - at high risk of extinction due to rarity due to very restricted range, very few populations (20 or fewer), steep declines, or other factors.

G3 - Global rank, vulnerable - at moderate risk of extinction due to a restricted range, relatively few populations (80 or fewer), recent or widespread declines, or other factors.

G4 - Global rank, apparently secure - uncommon, but not rare; some cause for long term-concern due to declines or other factors.

S1 - State rank, critically imperiled - due to extreme rarity (5 or fewer) or because of factors such as very steep declines that make it very vulnerable.

S2 - State rank, imperiled - due to rarity due to very restricted range, very few populations (20 or fewer), steep declines, or other factors.

S3 - State rank, vulnerable - due to restricted range, relatively few populations (80 or fewer), recent or widespread declines, or other factors.

SNR - State, not ranked, conservation status not decided

Potential habitat exists for five sensitive plant species that are not currently known to occur in the Monument. These include giant helleborine (*Epipactis gigantea*), kachina daisy (*Erigeron kachinensis*), Eastwood monkey flower (*Mimulus eastwoodiae*), Comb Wash buckwheat (*Eriogonum clavellatum*), and Cronquist milkvetch (*Astragalus cronquistii*) (NatureServe 2005; Spackman et al. 1997; Flora of North America 1993; and Spackman and Anderson 2002).

Significant Plant Communities

Four unusual or significant plant communities occur in the Monument and are discussed below.

Biological Crust Communities

Although not comprising vascular plant species, biological soil crust communities are a unique biological feature throughout much of the upland areas in the Monument. These communities form a crust on the surface of the soil that consists of varying proportions of cyanobacteria, mosses, and lichens. Where undisturbed, these crusts may extend up to 1 centimeter in depth. The contributions of biological soil crusts to enhanced soil stability and diminished vulnerability to erosion are well supported by experimental research (Williams et al. 1995a, b; Belnap and Gillette 1998; Eldridge 1998; Issa et al. 2001), and numerous technical reviews (Harper and Marble 1988; Metting 1991; Johansen 1993; Eldridge and Greene 1994; Warren 1995; 2001).

In addition to enhancing soil stability, biological soil crusts are recognized for their importance in several aspects of nutrient cycling, including the ability of some soil-crust organisms to acquire and convert atmospheric nitrogen into forms available to higher plants (Evans and Johansen 1999). Through their effects on soil nutrient dynamics, cyanobacteria and some lichens may also enhance the nutritional quality of forage plants used by wildlife (Harper and Pendleton 1993).

The status of these communities was assessed in the ESI, which included a parameter for various ground cover types, including total biological crust cover. The primary component of biological soil crusts are the cyanobacteria, with less moss and a relatively small lichen component. Cyanobacteria is the fastest component to return to a disturbed site, with mosses and lichen taking a much longer time to colonize a site. A site was considered to have a key biotic crust community when at least 30 percent of the ground cover consisted of one or more of the following: cyanobacteria ("blue-green algae"), green algae, lichen, moss, microfungi, or other bacteria.

Sand Dunes

Small areas with sand dunes are found in only two locations in the Monument: Yellow Jacket Canyon and the Flodine Park area, which is south of Ismay. These fall within the Desert Sand Ecological site and all consist of Sheppard Fine Sand soil. Sheppard soils are very deep (more than 60 inches). Parent material is eolian material derived from sandstone. There are 586 acres of this ecological site on Federal lands in the Monument. A variety of forbs, grasses and shrubs were found to be unique to this ecological type, including sandhills muhly (*Muhlenbergia pungens*), sanddune skyrocket (*Ipomopsis gunnisonii*), flaxflowered gilia (*Ipomopsis longiflora*), sand sage (*Oligosporus filifolius*), and rush skeleton plant (*Lygodesmia juncea*).

Mature, Undisturbed Pinyon-Juniper Woodlands

Old growth pinyon-juniper woodlands have been characterized as stands of pinyon and juniper with very old trees, and a complex woody structure of dead branches, dead tops, and piles of tangled down wood. The pinyon component often has a higher density in the understory and higher rates of mortality, while juniper has a greater basal area and greater longevity. Canopy gaps occur, most commonly with a bitterbrush understory, while the pinyon-juniper understory is composed of native bunchgrasses with a high foliar cover. Disturbance events, such as insect

and disease outbreaks or individual lightning strikes, create small openings of one to several trees or openings of up to 15 acres (Floyd 2003). The Monument is defining mature undisturbed pinyon-juniper woodlands as having old trees, a tree canopy cover of at least 20 percent, and an undisturbed understory of biological crusts of at least 30 percent cover and/or native perennial bunchgrasses with cover over 20 percent. Under this definition, based on the 2001 ESI, there are 16,360 acres of this type in the Monument, which is about 14 percent of all sites with pinyon-juniper canopy.

Cottonwood Gallery Forests

Less than 1 percent of the Monument has streams or wetlands with riparian vegetation. Of this, a very small proportion is cottonwood overstory. Cottonwood gallery forests should have a diverse age class of cottonwood, and an understory of willow, skunkbrush sumac, silver buffaloberry, rabbitbrush, and water-dependent forbs and graminoids. Currently all cottonwood gallery forests are impacted to some extent by livestock, as well as by the invasive species of tamarisk, smooth brome, Russian-olive, and knapweed. For most areas in the Monument, the age-class distribution of cottonwood is not diverse, and tends toward older, decadent trees with few younger or middle-age class replacements.

Noxious Weeds

An “invasive” species is defined as: 1) non-native (or alien) to the ecosystem under consideration; and 2) one whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health (Executive Order 13112, February 3, 1999).

With respect to the management of noxious weeds, the Monument conforms to the rules promulgated by the Colorado Department of Agriculture. The Colorado Noxious Weed Act, Colorado Revised Statute (CRS) § 35-5.5-101–119 (2003), defines a “noxious weed” as an alien plant, or parts of an alien plant, that has been designated by rule as being noxious or has been declared a noxious weed by a local advisory board, and meets one or more of the following criteria:

- aggressively invades or is detrimental to economic crops or native plant communities;
- is poisonous to livestock; and/or
- is a carrier of detrimental insects, diseases, or parasites.

The direct or indirect effect of the presence of these plants is detrimental to the environmentally sound management of natural or agricultural ecosystems.

In addition, The BLM produces national level strategies for invasive species prevention and management as published in: *Partners Against Weeds; An Action Plan for the Bureau of Land Management* (BLM 1996b) and *Pulling Together: National Strategy for Invasive Plant Management* (BLM 1998e).

The Colorado Department of Agriculture designates three levels of management for noxious weeds in Colorado. List A species must be eradicated before seed development, List B species must be contained pursuant to State noxious weed management plans, and List C species may be designated for control by other local governing bodies (e.g., county weed programs). The BLM has a Participating Agreement with Montezuma County, and under this agreement the County receives funding for noxious weed control along major routes in the Monument. There are no known populations of Colorado Noxious Weed Act List A species in the Monument. Species on the Colorado Noxious Weed Act List B that are known to occur in the Monument are as follows:

- Salt-cedar (*Tamarix chinensis*, *T. parviflora*, and *T. ramosissima*), Russian-olive (*Elaeagnus angustifolia*), Canada thistle (*Cirsium arvense*), and quackgrass (*Elytrigia repens*) are associated with riparian areas, intermittent or ephemeral draws, seeps, and reservoirs.
- Musk thistle (*Carduus nutans*) and Russian knapweed (*Acroptilon repens*) are often present in areas of disturbance, such as roadsides, routes, power line corridors, pipelines, well pads, gravel pits, reservoirs, and corrals, as well as other areas heavily used by livestock. Russian knapweed has also been observed on both public and private land along McElmo Creek, in Flodine Park, as well as in Hovenweep, Cross, Yellow Jacket, and Sandstone Canyons.
- Broad-leaved Dalmatian toadflax (*Linaria dalmatica*), narrow-leaved Dalmatian toadflax, (*Linaria genistifolia*), and perennial pepperweed (*Lepidium latifolium*) are occasionally present in pinyon-juniper areas that have been chained or are otherwise associated with ground-disturbance areas. Small populations of Dalmatian toadflax are known to occur at Goodman Point and in Yellow Jacket Canyon.
- Redstem filaree (*Erodium cicutarium*) is a common noxious weed found in all habitats. This species increases under conditions of disturbance. Along with cheatgrass, it dominates vegetation in many areas of the Monument.

In addition, diffuse knapweed (*Centaurea diffusa*), hoary cress (also called whitetop, *Cardaria draba*), and spotted knapweed (*Centaurea maculosa*) are likely to occur in the Monument.

Species on the Colorado Noxious Weed List Act C that are known to occur in the Monument are as follows:

- Downy brome (also called cheatgrass, *Anisantha tectorum*) is considered to increase under conditions of disturbance and/or fire. It dominates vegetation and is common throughout the Monument.
- Chicory (*Cichorium intybus*), common mullein (*Verbascum thapsus*), field bindweed (*Convolvulus arvensis*), common burdock (*Arctium minus*), jointed goatgrass (*Aegilops cylindrica*), johnsongrass (*Sorghum halepense*), and halogeton (*Halogeton glomeratus*) are occasionally situated in areas of disturbance in the Monument.

In addition, perennial sowthistle (*Sonchus arvensis*) and wild proso millet (*Panicum miliaceum*) are likely to occur in the Monument.

3.1.9. Visual Resources

The Monument is characterized by unique and diverse scenery containing many outstanding features that are visible from numerous key viewing sites. The Monument contains a large number of areas that possess a high degree of scenic quality and a high level of visual sensitivity (representing a measure of public concern for scenic quality and/or changes in that scenic quality), drawing an increasing number of visitors each year who come to recreate and sightsee. High scenic quality is a by-product of the extraordinary topography, geology, and cultural history; scenically diverse vistas and canyons; unusual geological formations; colorful and highly contrasting sandstones; and numerous prehistoric structures and pieces of rock art. Specific areas in the Monument have a high degree of visual sensitivity because of visitor interest and public concern.

Demand for and concern about scenic quality is increasing as development, population, and tourism in the Four Corners Region continues to grow. The economic and lifestyle benefits of

high quality scenery are a primary contribution to the wealth of this region and one of the primary reasons people visit the Monument.

The visual resources of much of the Monument are in a relatively pristine condition. The cultural landscape of the Monument is dependent on healthy and natural appearing scenery. The Monument Proclamation strongly supports the protection of the cultural landscape and appropriate management of the visual resource is closely linked to protection of cultural landscape features.

The Proclamation establishing the Monument states:

The natural resources and spectacular landforms of the Monument help explain why past cultures have chosen to live in the area. The geology of the Monument evokes the very essence of the American Southwest. Structurally part of the Paradox Basin, from a distance the landscape looks deceptively benign. From the McElmo Dome in the southern part of the Monument, the land slopes gently to the north, giving no indication of its true character. Once inside the area, however, the geology becomes more rugged and dissected. Rising sharply to the north of McElmo Creek, the McElmo Dome itself is buttressed by sheer sandstone cliffs; with mesa tops rimmed by caprock, and deeply incised canyons.

The visual resource is an integral component of all Monument settings, and contributes substantially to the quality of the visitor's experience. Additionally, visitors to the Monument readily form judgments and perceptions of the Bureau of Land Management based on the quality and condition of the visual environment of the Monument.

The major areas in the Monument that possess both outstanding scenic quality and high visual sensitivity include, but are not limited to, areas of Hovenweep National Monument within and adjacent to the Monument, Sand Canyon Pueblo, Sand Canyon, Painted Hand Pueblo, Lowry Pueblo, and the three Wilderness Study Areas (Cross Canyon, Cahone Canyon, and Squaw/Papoose Canyon). Visually scenic and sensitive waterways include Yellow Jacket Canyon and Creek; Sandstone, Woods, and Burro Canyons; and McElmo Creek.

Areas of high scenic quality and visual sensitivity that are associated with travel corridors include McElmo Canyon; the Trail of the Ancients Scenic and Historic Byway (County Road 10); key observation points (KOPs) consisting of views from Lowry Pueblo, Sand Canyon Pueblo, Painted Hand Pueblo, and the upper Sand Canyon parking area; and in-holdings of the Hovenweep National Monument. The Monument also contains many miles of jeep, bike, horse, and foot routes that are used to access scenic areas.

3.1.9.1. Regional Setting and Regulatory Framework

In addition to the laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the resources and uses in the Monument, as described in Chapter 1, several others specifically address visual resources:

- **BLM Information Bulletin 98-135:** This restates the BLM policy on the use of Visual Resource Management (VRM) in land-use planning, decision making, and environmental documents. VRM classes are assigned to all public lands as part of the Record Of Decision for an RMP. Visual design considerations are incorporated into all surface-disturbing projects occurring on public lands regardless of the size or potential visual impact of these projects.
- **BLM Information Bulletin 98-164:** This provides additional BLM guidance on the use of VRM when making VRM-related decisions.

- **BLM Information Bulletin 2000-096:** This provides guidance on designating and managing Wilderness Study Areas (WSAs) as VRM Class I areas until Congress designates the areas as wilderness or releases them for other uses.
- **BLM Manual Handbook 8410-1 Visual Resource Inventory (BLM 1986b):** This system analyzes the quality of the view, the sensitivity of the visual resource, and the impacts that development would have at different distances. This comprehensive approach allows resources to be ranked in the context of their surroundings.
- **BLM Manual 8400:** This section describes the overall policy direction for Visual Resource Management (VRM) in the Bureau of Land Management (BLM) which has the objective to manage public lands in a manner which will protect the quality of the scenic (visual) values of these lands.
- **BLM Planning Handbook H-1601-1:** Gives general guidance on incorporating Visual resource values into the planning process.

3.1.9.2. Current Conditions and Trends

Impacts to the landscape are resulting from increases in recreation and tourism, vehicular travel, the number of user-developed routes, and the number of sightseers attracted to the area for its cultural, recreational, and scenic qualities. Additional impacts are resulting from the development of utility corridors, oil and gas exploration and development, seismic exploration, and other land use disturbances. Recreational activities, such as off-road travel, are impacting visual resources most intensely in the areas east of Risely Canyon.

The increasing number of travel routes in the Monument has indirect effects on visual resources. Seldom-seen zones (defined later in this section) are decreasing in the Monument, and an increase in the number of visitors on BLM routes is creating changes in foreground views, middle ground views, and visual sensitivity. The increasing number of user-made routes is expanding surface disturbances that impact visual resources.

An inventory of the current visual landscape was prepared to provide information for this planning process. The inventory process was consistent with BLM Manual Handbook 8410-1. This is outlined below. The inventory map is located in the Plan Project File.

The following steps are involved in the Visual Resource Inventory process: 1) outlining, numerically evaluating and mapping scenic quality; 2) outlining and mapping visual sensitivity levels; 3) delineating and mapping distance zones; and 4) combining the three overlay data sets; and 5) assigning and mapping Visual Resource Inventory classes.

Scenic Quality

The 166,000 acres in the Monument have been broken down into five Scenic Quality Rating Units (SQRUs). The results of the ratings for each unit are presented in Table 3-21.

Unit	Description	Scenic Quality Rating
1	WSAs in the northwestern part of the Monument include Squaw/Papoose Canyon WSA, Cross Canyon WSA, and Cahone Canyon WSA. A citizen coalition has proposed additional areas to be considered for Wilderness designation adjacent to these WSAs.	A
2	Yellow Jacket Canyon area – deep canyon and tablelands	B+
3	Sand Canyon and East Rock Creek Canyon	A
4	Hovenweep Canyon and Cannonball Mesa areas, including the 443-acre McElmo Research Natural Area (RNA)	B+
5	Bowdish/Rincon area in the southwestern portion of the Monument	C

Sensitivity Levels

Sensitivity levels represent a measure of public concern for scenic quality. Public lands are assigned high, medium, or low sensitivity levels by analyzing the various indicators of public concern. The factors to consider in assigning sensitivity levels include:

- type of user;
- amount of use;
- public interest;
- adjacent land use;
- special areas; and
- other factors (indicators of visual sensitivity).

Key Observation Points (KOPs) and sensitivity concerns for the units, as described for scenic quality are:

- **Unit 1:** WSAs and Lowry Pueblo, high public interest in maintenance of visual quality.
- **Unit 2:** Changing land uses from agricultural to residential, County Road P to Cannonball Mesa Road.

- **Unit 3:** Sand Canyon and East Rock Creek Canyon Cultural Resource Management Plan and National Historic Register Districts, Goodman Point (Hovenweep National Monument), and Sand Canyon Pueblo, use by outfitters and guides, and visual concerns by Sand Canyon users.
- **Unit 4:** Large number of users, due to access via Cannonball and Mockingbird Mesas (although behind a locked gate), Bridge Canyon, Painted Hand Pueblo, and Mockingbird Mesa Cultural Resource Management Plan; and adjacent land use concerns for visual quality by Hovenweep National Monument and McElmo Canyon Road users. Trail of the Ancients Scenic and Historic Byway (Colorado, Utah, and Arizona).
- **Unit 5:** Views from Hamilton Mesa.
- **Canyon bottoms:** Locations of dispersed travel through scenic slick rock and cultural landscapes.

Distance Zones

Mapping distance zones, for use in the VRM inventory process, use distances, as listed below, to determine general visibility of the landscape. These distances are measured from primary or secondary routes, heavily used routes, and important vista points, such as from scenic overlooks (KOPs). As a general rule, in the analysis process used to define inventory classes, the closer the landscape to the viewer, the more sensitive it is to visible change.

- **Foreground zone:** The detailed landscape found within 0 to 0.5 mile from the viewer.
- **Middleground zone:** The space between the foreground and background zones, from 0.5 mile to 3 to 5 miles from the viewer.
- **Background zone:** The space from the middleground zone outward to approximately 15 miles (5 to 15 miles).
- **Seldom-Seen zone:** The area not visible within the foreground, middleground, or background zones, and areas beyond 15 miles from any observation points.

Visual Inventory Classes

Upon completion of the steps outlined above, the information is compiled and inventory classes are assigned to the Monument based on the various combinations of quality, distance, and sensitivity. Inventory Classes and their management objectives for maintaining the visual landscape are described below (See Appendix P).

- **Inventory Class I - Preserve the existing character of the landscape:** Under this class, the level of change to the characteristic landscape should be very low and must not attract attention. This class provides for ecological changes; however, it does not preclude very limited management activity.
- **Inventory Class II - Retain the existing character of the landscape:** Under this class, the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

- **Inventory Class III - Partially retain the existing character of the landscape:** Under this class, the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Inventory Class IV - Provide for management activities that require major modification of the existing character of the landscape:** Under this class, the level of change to the characteristic landscape can be high. Management activities may dominate the view and may be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic elements of form, line, color, and texture.

Consideration of the Visual Inventory Classes along with other resource allocations is used to assign Visual Resource Management Class objectives. VRM Class definitions can be found in the glossary. A description of visual resource management for each alternative is located in Table 2-2.

The quality of visual resources in the Monument is directly related to many other resources, such as the quality of passive and active recreational experiences, the preservation of the cultural resources, the level of mineral development, and the quality of air and wildlife habitat.

3.1.10. Water Resources

This section discusses the regulatory framework and current conditions for water resources of the Monument. Water resources in the Monument are shown on Map 14. A more detailed description can be found in the AMS (BLM 2005b).

3.1.10.1. Regional Setting and Regulatory Framework

The surface waters of the Monument are tributary to the San Juan River, which is part of the Colorado River system. The State of Colorado regulates water quality in the Monument. Immediate downstream neighbors include the Navajo Nation, the Ute Mountain Ute Indian Tribe, and the State of Utah.

The Colorado Department of Public Health and Environment (CDPHE) and the Water Quality Control Commission (WQCC) are the administrative agencies responsible for developing specific water quality policy in Colorado, in a manner that implements the broader policies set forth by the legislature in the Colorado Water Quality Control Act. The WQCC adopts water quality classifications and standards for surface and groundwater of the State, as well as various regulations aimed at achieving compliance with all applicable Federal and State requirements (CDPHE 2003b).

The Navajo Nation and the Ute Mountain Ute Indian Tribe have jurisdiction over water quality on their respective lands.

Colorado Water Law

The Colorado water law system governs the allocation of water to various uses, both within the State and in the Monument. Colorado operates on a “prior appropriation” system, which means that the earliest established water rights have the highest priority for water usage. The oldest water rights are given their entire allocation of water before the next-oldest water rights are

given any water. Under this system, water shortages on stream systems are not shared; instead, the limited supply is given to those with the oldest water rights.

Colorado has a system of water courts that continuously receive applications for water rights and they adjudicate them. Federal agencies make applications to the water court when water is needed to fulfill Federal land management purposes. Water rights are awarded for direct diversion from streams and springs, for storage of water in reservoirs, and for underground water. Colorado also awards water rights for maintenance of minimum flow rates in natural streams; however, by State law these water rights may be held only by the Colorado Water Conservation Board. Colorado also requires permits for construction of reservoirs on ephemeral channels and construction of wells; however, the permits do not constitute a water right.

Some unique aspects of Colorado water law apply to the hydrologic situation in the Monument. Parties who import water to a basin from another basin are entitled to use that water “to extinction” if they maintain control of the water. This means that the Dolores Water Conservancy District (DWCD), Montezuma Valley Irrigation Company (MVIC), and other entities that import water to the watersheds in which the Monument is located could use 100 percent of the water they import, rather than allow return flows to move downstream. This means that any long-term effort to manage for and predict flow on the perennial streams in the Monument will require close cooperation with these water users.

State of Colorado Water Quality Standards

The State of Colorado has not identified any water body in the Monument as officially impaired, according to Section 303(d) of the Clean Water Act. None of the Monument streams carry an impaired status; however, there are still localized water quality concerns. The Colorado 2008 Monitoring and Evaluation list identifies all tributaries to McElmo Creek as potentially impaired due to iron. The 2006 303(d) list identifies Narraguinnep Reservoir as not meeting water quality standards for mercury. The 2006 Monitoring and Evaluation List identifies several tributaries with water quality concerns, including Mud Creek for iron, selenium, and nitrates; and Crow Canyon for iron and nitrates. Mud Creek, a tributary of McElmo Creek at the southeastern corner of the Monument, was on Colorado’s 2004 Monitoring and Evaluation List for suspected impairment due to iron, selenium, and nitrate. The Monitoring and Evaluation List identifies water bodies that are suspected of impairment due to sediment, but they cannot be added to the 303(d) list due to a lack of information. McElmo Creek is heavily influenced by irrigation return flows and the saline Mancos Shale that results in high total dissolved solids (US Bureau of Reclamation [BOR] 1977). The water quality of McElmo Creek varies, based on the amount of irrigation return flows present. From 1960 to the present, a variety of water quality parameters and discharge data have been collected by the United States Geological Survey (USGS) for McElmo Creek (USGS 2006).

Colorado Water Quality Standards are based on beneficial use categories, which are assigned numeric standards. Streams or stream segments in the Monument are classified as Recreation 1a, Agriculture, or Aquatic Life Warm 1. Water quality data exist for Yellow Jacket Canyon in the form of “grab” samples collected by the BLM between 1983 and 2001. Grab sample data indicate that the Recreation 1a and Agriculture standards are being fully supported in Yellow Jacket Canyon; however, they also indicate that the Aquatic Life Warm 1 standards are not being fully supported, due to high concentrations of ammonia. Between 1983 and 2001, acute and chronic standards for ammonia were exceeded for all samples. Failure to meet acute and

chronic standards for ammonia is most likely due to irrigation return flows containing fertilizers and, to a lesser extent, livestock in or near the stream.

BLM Standards for Public Land Health in Colorado

There are five BLM Colorado Standards for Public Land Health, one of which focuses on surface water quality. Twenty-eight livestock grazing allotments in the Monument were evaluated for their compliance with BLM Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management. Surface water is not present on 12 of these allotments; therefore, an assessment of water quality was not completed on these allotments. Of the 16 allotments that have completed water quality assessments, ten met water quality standards, and six did not. Causal factors for these determinations consist primarily of land-use activities upstream in the watershed (including agriculture, irrigation, and livestock grazing). This assessment concluded that livestock grazing was a significant factor in all but one of the nine allotments that did not achieve water quality standards. That one allotment had recently changed livestock grazing management, and needs to be monitored to determine the effectiveness of that change.

3.1.10.2. Current Conditions and Trends

Current conditions and trends for surface and ground water are described in the following sections.

Surface Water

Surface water streamflow, along with seeps and springs, in the Monument are characterized below.

Streamflow Characteristics

Discharge is highly variable in canyons throughout the Monument. Generally speaking, water is scarce within the Monument boundaries. Only during very wet years, and immediately following precipitation events, does water flow in most of the canyons. Due to return flows from upstream irrigation, some streams in the Monument have streamflow year-round or for a significant portion of the year. Peak flows occur as the result of late-afternoon thunderstorms during the monsoon season in late summer. This precipitation is carried quickly through drainages and has little chance to percolate into the ground, especially in areas with little ground cover and large areas of exposed bedrock. After precipitation events, standing pools in small depressions are common; however, they tend to evaporate within days or weeks, depending on the aspect of the canyon.

Irrigation return flows create six perennial streams that flow in the Monument. Dolores Water Conservancy District (DWCD) and Montezuma Valley Irrigation Company (MVIC) divert water from the Dolores River to land upstream of the Monument. In an average year, the DWCD delivers 50,000 acre-feet to 28,000 irrigable acres in the Cross Canyon and Yellow Jacket Canyon watersheds. MVIC delivers an average of 153,400 acre-feet to 37,500 irrigable acres primarily south of the community of Yellow Jacket. In addition to irrigation water services provided by DWCD and MVIC, there are numerous independently operated surface diversions on streams that flow through the Monument.

Some of the perennial streams, such as Cross Canyon, have reaches that go dry during drought periods, but otherwise flow while conditions are normal. Since most streams are intermittent or

ephemeral, these perennial streams have very high resource values in the Monument. The perennial streams are listed in Table 3-22.

Table 3-22 Perennial Streams in the Monument		
Stream	Perennial Length (miles)	5th Code Watershed
McElmo Creek	0.7	McElmo Creek
Trail Canyon	2.8	McElmo Creek
Yellow Jacket Canyon	39.2	Yellow Jacket Canyon
Dawson Draw	0.6	Yellow Jacket Canyon
Cross Canyon	6.9	Cross Canyon
Cahone Canyon	4.0	Cross Canyon

The perennial streams in the Monument generally have established riparian areas that help regulate peak flows, maintain base flow, and provide wildlife habitat. Some of the perennial streams, such as Yellow Jacket Canyon, are also important fisheries habitat. Intermittent streams with established riparian areas also have high values in the Monument, because they provide higher stream functions (see perennial discussion above) than do intermittent streams without riparian areas or ephemeral streams. The intermittent streams with established riparian areas are listed in Table 3-23.

Table 3-23 Intermittent Streams With Established Riparian Areas in the Monument		
Stream	Stream Length (miles)	5th Code Watershed
Cave Spring Canyon	1.1	Yellow Jacket Canyon
Sandstone Canyon	17.2	Yellow Jacket Canyon
Squaw Canyon	8.5	Cross Canyon
Woods Canyon	7.8	Yellow Jacket Canyon

Given the lack of historic hydrologic instrumentation and monitoring on Monument land, it is difficult to characterize typical streamflows that are created by the combination of natural hydrology in combination with irrigation return flows. McElmo Creek is the only perennial stream in, or next to, the Monument that has long-term stream-gauging data. Five gauging stations exist along the creek. However, these gauging stations are heavily influenced by return flows from irrigation, and these practices have changed substantially over the life of the gauges. The main conclusion that can be drawn from stream gauging stations is that the watershed's natural hydrology is very flashy, in that rainfall and convective storms can create very high stream flows; flows with the potential for significant erosion and scouring of stream channels.

The BLM has collected hydrologic data on Yellow Jacket Canyon since 2001. These data demonstrate very high, instantaneous peak flows in response to thunderstorm events, sometimes exceeding 250 cubic feet per second (cfs). Typically, flows in Yellow Jacket Canyon are at their lowest during winter, after irrigation return flows have subsided. Flows measured during winter are often between 4 and 6 cfs. Flows gradually increase as the irrigation season proceeds. Average flows are usually highest in late September, as the Monument receives both surface water return flows and return flows from groundwater systems that have been fully charged by irrigation practices. Flows in September typically range from 10 to 25 cfs.

Springs and Seeps

Springs in the Monument are most commonly found on canyon walls at the contact zone between the Dakota Formation and the Morrison Formation. During 2001 and 2002, the BLM conducted a systematic inventory of point water sources in the Monument and documented roughly 100 springs and seeps. Approximately 45 percent of these springs have perennial surface flow, with most springs producing less than 5 gallons per minute (gpm). However, there are isolated perennial springs in the Monument that can produce from 15 to 25 gpm (BLM 2002f and 2003d). The remaining 55 percent of the sources flow only intermittently. Some do not produce surface flow at all, and are only evidenced by a collection of water-dependent vegetation on the land surface. As a group, the springs serve very important functions in the Monument as wildlife water and habitat locations.

Springs were selected for Proper Functioning Condition (PFC) assessment based on the presence or absence of flowing water and/or the presence or absence of riparian vegetation. The method of selection involved looking at historical notes and photos in the water source inventory files at the Dolores Public Lands Office. Springs that had riparian vegetation and flow were given a high priority for PFC assessment. Those that had riparian vegetation and little or no flow were given a moderate priority. Springs that had no riparian vegetation, such as contact seeps, and fault/joint/fracture springs, were not considered for assessment.

PFC data were collected for 11 springs in the Monument. Four of these (West Mockingbird, Cannonball Spring, Bluewater Spring, and Hackle Spring) were developed as water sources for livestock. Of the 11 springs evaluated, three were found to be meeting PFC criteria (Hackle Spring, Cannonball Spring, and Confluence Spring) (Jenson 2003). These results are summarized in Table 3-17 in Section 3.1.8, Vegetation Resources.

Riparian Areas and Floodplains

As described elsewhere in this document, the Monument is traversed by a series of southwest-flowing drainages that occupy distinct, and sometimes deep and steep-sided, canyons or arroyos. Many of these canyons contain riparian areas and floodplains. Floodplains are formed in two ways: by erosion and by aggradation. An erosional floodplain is created as a stream cuts deeper into its channel and laterally into its banks. A stream with a steep gradient will tend to downcut faster than it causes lateral erosion, resulting in a deep, narrow channel with little or no floodplain at all. An aggradational floodplain is created when a stream lays down thick layers of sediment. This occurs when the stream's gradient becomes very slight and its velocity decreases, forcing it to drop sediment brought from higher regions nearer its source. In both cases, this area between the water edge and the high water or flood stage is often composed of water-dependent vegetation and is known as the riparian zone.

These areas are important as wildlife habitat, in acting as a filter in maintaining water quality, and in preventing streambank erosion. Dominant riparian vegetation occurring in the Monument included native trees such as cottonwood and willow in addition to the nonnative tree, tamarisk. Many floodplains, if left dry for extended periods of time will contain upland plant species as

well, such as sagebrush. There are 73 miles of perennial and intermittent streams in the Monument, each having some level of developed riparian vegetation and associated floodplain. The condition of these water-dependent ecosystems is one of several factors measured in determining whether Public Land Health Standards are being met.

There are two executive orders specifically protecting floodplains and wetlands: Executive Order 11988 protects floodplains and Executive Order 11990 protects wetlands.

Groundwater

Localized, shallow groundwater resources in the Monument may be found in alluvial deposits associated with surface water drainages. These shallow aquifers consist of Quaternary Period deposits of alluvial gravel, sand, silt, and clay and/or Quaternary Period deposits of eolian sand and silt (Robson and Banta 1995). These aquifers tend to contain localized, near-surface water and are of limited aerial extent. Traditionally, most stream systems in the Monument were ephemeral or intermittent, but the introduction of irrigation return flows has enhanced the flow of some streams. Irrigation return flow may also contribute to recharge of some shallow groundwater aquifers.

According to Robson and Banta (1995), the principal aquifers under the Monument are part of the Colorado Plateau aquifer system. This aquifer system underlies an area of approximately 110,000 square miles in western Colorado, northwestern New Mexico, northeastern Arizona, and eastern Utah. The aquifers that make up the Colorado Plateau system are composed of permeable sedimentary rocks that vary in thickness, lithology, and hydraulic characteristics. In the Monument, the Dakota-Glen Canyon aquifer system is the uppermost water-yielding unit in the Colorado Plateau aquifer system, and the Coconino-De Chelly aquifer system is the deepest. The aquifers, confining units, and equivalent geologic units that compose these two aquifer systems are listed in Table 3-24.

Table 3-24 Deep Groundwater Aquifers and Associated Stratigraphic Units		
System (age)	System (age)	System (age)
Cretaceous	Mancos Confining Unit	Mancos Shale
	Dakota-Glen Canyon Aquifer System	Dakota Aquifer
Morrison Confining Unit		Jurassic
Morrison Aquifer		
Curtis-Stump Confining Unit		
Entrada Aquifer		
Carmel-Twin Creek Confining Unit		
Glen Canyon		

Table 3-24 Deep Groundwater Aquifers and Associated Stratigraphic Units			
System (age)	System (age)		System (age)
		Aquifer	
Triassic-Permian	Chinle-Moenkopi Confining Unit		Chinle Formation and Moenkopi Formation
Permian	Coconino-De Chelly aquifer system	Coconino-De Chelly Aquifer	Permian
Pennsylvanian, Mississippian, and Devonian	Other, deeper units not considered principal aquifers		Hermosa Formation, Molas Formation, Leadville Limestone, Ouray Limestone, Elbert Formation

Many standard consumption water wells exist in and next to the Monument. The State of Colorado HydroBase data set shows that more than 70 well permits have been issued for domestic and livestock purposes inside the Monument and within 2 miles of its boundary, excluding the highly developed McElmo Canyon valley (Colorado Division of Water Resources [CDWR] 2003).

Typically, domestic and livestock wells are permitted for less than 3 acre-feet of water annually. Only three water well permits listed in the database are used for industrial purposes, with allowable-use quantities ranging from 20 to 56 acre-feet annually. One well permit exists for irrigation, for 35 acre-feet per year. Water wells drilled before 1972 did not need a drilling permit and although several of these older wells likely exist, no official records are available.

3.2. Resource Uses

Section 3.2 describes the current environments of the Monument with regard to resource uses, including education and interpretation, facilities and infrastructure, special forest products, lands and realty, minerals, livestock grazing, recreation, and transportation.

3.2.1. Education and Interpretation

For more than 125 years the cultural resources of the Monument area have been the focus of numerous scientific studies. Consequently, the incredibly dense and well-documented resources make the Monument one of the most intensely studied archaeological cultural landscapes in the world. Twenty-five modern Native American tribes and pueblos claim traditional association with the Monument. For these reasons and others, including historic features, natural environment, and diverse recreational activities, opportunities abound in the Monument for research, education, interpretation, and heritage tourism. It is estimated that Monument visitation averages about 45,000 people each year. To foster understanding, to protect and preserve the resources and, to enhance the public's experience and appreciation, a variety of educational and interpretive programs and opportunities are currently available. Research, education, interpretation, and heritage tourism are critical tools to actively engage the public and to enlist their help in protecting this veritable outdoor museum and ensuring its preservation in perpetuity.

3.2.1.1. Regional Setting and Regulatory Framework

There is no regulatory framework specifically applicable to education and interpretation.

3.2.1.2. Current Conditions and Trends

Research in the Monument has been conducted by many not-for-profit organizations and academic institutions. Recent work has been conducted by the Crow Canyon Archaeological Center, Fort Lewis College, and Colorado College. Developed in partnership with Crow Canyon and funded by the National Science Foundation, Washington State University's nationally acclaimed Village Project utilized Monument data. In addition to the on-the-ground activities, more than 1 million objects collected specifically from the Monument, from a variety of excavations and inventories, are curated as part of the Anasazi Heritage Center (AHC) collection and are actively used and available for research.

Due to the number of extensive studies in the Monument, a large body of information has been published (*Colorado Prehistory: A Context for the Southern Colorado River Basin* [Lipe, et al 1999]) that summarizes much of the research and synthesizes the results. Included in this publication is an extensive bibliography of hundreds of reports and publications. In addition to the scientific work, recent syntheses are also available in popular form, such as the 2006 School of American Research book, *The Mesa Verde World: Explorations in Ancestral Pueblo Archaeology*, which is a collection of articles edited by David Grant Noble (2006).

Even with such extensive scientific studies, public education and interpretation of the resources are critical for protection and long-term preservation. One of the BLM's current strategies is to encourage all visitors to first visit the Anasazi Heritage Center (AHC), which also serves as the headquarters for the Monument. The AHC is a museum for interpreting the history and culture of Canyons of the Ancients National Monument, as well as for the Trail of the Ancients Scenic and Historic Byway and the Four Corners region. The AHC's hands-on discovery area, permanent and special exhibits, and films shown at the center all explore archaeology, local history, and Pueblo, Ute, and Navajo lifeways. The AHC also offers a 10-activity curriculum for school students, a *Junior Explorer-Archaeology* booklet, 12 artifact loan trunks, a 9,000-volume library, and intermittent docent-led interpretive programs. Approximately 4,000 school students visit the AHC each year, in addition to the 25,000 visitors the AHC receives annually.

The Monument's education programs are implemented in partnership with other organizations. The Crow Canyon Archaeological Center offers a unique "Castle Rock Field Days" experience for all fourth graders in Montezuma County, as well as adult education field trips and explorations. The McElmo Canyon Research Institute teaches participants in elderhostel programs, while also performing critical rock art documentation and offering site stabilization assistance. The San Juan Mountains Association instructs participants in site stewardship and route information specialist programs who then, in turn, disseminate both resource and protection information to the public. The Colorado Historical Society's State Historical Fund has generously funded education programs in the Monument, for an approximate total to date of \$500,000. In 2003, the Historical Fund assisted in the publication of *Getting to Know Canyons of the Ancients National Monument* (Cohn 2005) – a book that includes activities for educators. In addition to an archaeological and Native American focus, the book includes interviews with ranchers, farmers, wildlife biologists, artists, geologists, and land managers.

Currently, heritage tourism in the Monument occurs on both an individual and on a group basis. In Section 3.2.8, Recreation, 10 special recreation use permits exist for outfitters and guides in the Monument. Many individuals visit the Monument to experience heritage tourism. Canyons of the Ancients and the AHC are part of the Trail of the Ancients Scenic and Historic Byway, the country's first and only archaeological byway. In addition, information about visiting the

Monument is regularly included in the Mesa Verde Country visitor guide, as well as on various websites and in area guidebooks.

It is critical to inform visitors of the backcountry nature of the Monument, as well as about visitation etiquette and archaeological resource protection laws governing the area. When visitors go to the AHC first before visiting the Monument, front desk staff and volunteers offer one-on-one personalized service to match these visitors, as well as their abilities, interests, and timeframes, with sites appropriate to their needs; they also educate visitors to the needs of site protection. In the Monument, visitors are currently directed to the following areas: Lowry Pueblo, Painted Hand Pueblo, Sand Canyon Pueblo, and to Sand Canyon. A variety of interpretive products for these locations are available, including signs, brochures, and maps. In addition, the AHC offers two alternative forms of access to Lowry Pueblo, including the *People in the Past* and *The Lowry Photo Archives* computer exhibits and the *Ancient Images and Pueblo Perspectives* exhibit about Lowry Pueblo's five painted kivas.

No other sites in the Monument are currently interpreted; however, all public land in the Monument is available to visitors. Managed as an outdoor museum where visitors must earn their experiences through self-discovery, everyone is encouraged to use Leave-No-Trace ethics. Visitors are informed that there are no services, restaurants, gas stations, ranger-guided tours, or developed campgrounds in the Monument. Visitors are also educated regarding private property in-holdings and about the concept of multiple resource management.

Continued research, education, interpretation, and heritage tourism will raise awareness about the values of the Monument's resources and about the sensitivities necessary to protect and preserve the resources. Developing these programs in conjunction with specific site improvements and recreation experiences should increase visitors' sense of value and respect for the Monument and enhance their overall experiences in the Monument.

3.2.2. Facilities and Infrastructure

Facilities and infrastructure support the transportation network, recreational function, oil and gas exploration and development, and public utilities in the Monument. These facilities and infrastructure include the water diversion and conveyance system, and the transportation route network, offering both access to and around the Monument. Paved and natural-surface routes are accessible by private and commercial vehicles. A network of routes accommodates motorized and mechanized use. Infrastructure is in place for motorized travel and non-mechanized uses, such as hiking, camping, horseback riding, hunting, and viewing of wildlife and cultural resources. Additional recreation support facilities and infrastructure include the AHC and Lowry Pueblo, which offer parking areas, picnic tables, and restrooms. Supporting infrastructure for oil and gas exploration and development and public utilities includes temporary roads, rights-of-way (ROW) pipelines, and other associated infrastructure.

3.2.2.1. Regional Setting and Regulatory Framework

Various laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the related resources and land uses in the Monument, are described in other sections of this document. The laws and regulations that are related to management of facilities and infrastructure on BLM National Monuments, as well as on other BLM lands, are described in:

- Section 3.2.4., Lands and Realty;
- Section 3.2.5., Minerals;
- Section 3.2.8., Recreation; and

- Section 3.2.9., Transportation.

3.2.2.2. Current Conditions and Trends

Current conditions and trends related to the facilities and infrastructure of the Monument are described in other sections of this document. The system of routes providing access to the Monument, and their categorical designation, is described in Section 3.2.9, Transportation. The OHV routes, non-motorized route network, and recreation supporting facilities in the Monument are described in Section 3.2.8, Recreation. The supporting infrastructure for oil and gas exploration and development is described in Section 3.2.5, Minerals. The public utilities infrastructure, including communication sites, utility corridors, and ROWs, are described in Section 3.2.4, Lands and Realty.

3.2.3. Special Forest Products

The dominant forest vegetation type in the Monument is the pinyon-juniper woodlands, consisting of pinyon pine and Utah juniper. These woodlands cover approximately 67 percent of the Monument and are the dominant vegetation type on the mesa tops and in the canyon bottoms. The distribution of these woodlands is shown on Map 12. They are described in additional detail in Section 3.1.8, Vegetation Resources, and Section 3.1.3, Fuels and Fire Management. Special Forest Products historically removed from the Monument include fuelwood, fence posts and poles, and Christmas trees. These products have been removed from the Monument both commercially and for personal use.

3.2.3.1. Regional Setting and Regulatory Framework

In general, the Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (BLM 1997) and the livestock management actions described in the San Juan/San Miguel RMP (BLM 1985) have guided management of the Monument's vegetation resources. Additional laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the related resources and land uses in the Monument, are described and listed in Chapter 1, Purpose and Need. Laws and regulations specifically related to management of vegetation resources on BLM National Monuments and other BLM lands include:

- the Healthy Forest Restoration Act of 2003;
- BLM Regulations 43 CFR 5000 *et seq.*; and
- the National Fire Plan.

Interim guidance from the Colorado BLM State Director, which was completed, states the following regarding fuelwood and vegetative use permits:

Commercial forest products sales will not be permitted. Vegetative use areas for private fuelwood and vegetative use permits will be identified by December 1, 2000. These areas will be limited to previously chained areas to remove dead-and-down wood and to reduce fuel load and fire hazards. Vegetative uses are an integral part of traditional tribal subsistence activities.

3.2.3.2. Current Conditions and Trends

Currently in the Monument, forest-related products include fuelwood, Christmas trees, and round wood products, such as poles and fence posts. More traditional forest-related products include bark materials, limb wood, foliar materials, seeds, and nuts.

Following the official designation of the Monument, the Colorado BLM State Director's Guidance required that fuelwood and vegetative use permits be limited to previously chained areas to remove dead wood and to reduce fuel loads and fire hazards. After the completion of a Class 1 cultural resource inventory, all previously chained areas were found to contain a high density of cultural resources. At that time, a recommendation was made to close the Monument to fuelwood gathering and a final decision was deferred until completion of the final RMP/final EIS ROD. In 2003, eight permits were issued for the collection of Christmas trees in the Burro Point area of the Monument.

3.2.4. Lands and Realty

The lands and realty program includes both land tenure adjustments and land use authorizations. Land tenure adjustments focus primarily on land acquisition and disposal, while land use authorizations consist of BLM approvals of ROWs, utility corridors and communication sites, and other leases or permits. Scattered tracts of private lands are present throughout the Monument, complicating the BLM's ability to manage and provide access to public lands. Opportunities exist to increase public benefits by acquiring through purchase or exchange, private lands in areas that would enhance public enjoyment and more efficiently facilitate resource management.

Encroachment is an ongoing concern. There are several examples of Monument lands being incorporated into private land holdings and used for private purposes without authorization. Historic surveys of public land boundaries were not as accurate as current technology allows; and, as a result, uses occurring on neighboring private lands encroached onto public lands. Such activities include plowing of fields, the construction of buildings, the alignment of fences, and other uses. The Monument was established by the President of the United States; therefore, it requires Congressional authorization to change the boundary through the sale or transfer of public Monument property into private ownership. Historic encroachment is different from present day personal use of public lands. For example, the inadvertent clearing of land for private development or for the construction of an unauthorized route or building on public land, given today's clear demarcation of surveyed lands, is a law enforcement violation.

3.2.4.1. Regional Setting and Regulatory Framework

The Monument encompasses approximately 183,298 acres of Federal and privately-owned land. The BLM manages 166,280 acres in the Monument. As part of the Hovenweep National Monument, the NPS manages approximately 400 acres, consisting of four discontinuous tracts. The remaining 16,618 acres are privately owned land within the Monument boundary, consisting of approximately 45 parcels of relatively large, isolated tracts of land under approximately 31 different ownerships. These private land parcels range in size from approximately 30 acres to several thousand acres. The 313-mile Monument perimeter lies adjacent to approximately 250 separate landowners in Montezuma County. There are a number of private landowners adjacent to the Monument boundary in Dolores County as well, although the exact number is not known. All acreage figures presented here were derived from Geographic Information System (GIS) land use data.

Land tenure decisions must conform to the following regulations and policies:

- FLPMA – Acquisitions – Section 205; Exchanges – Section 206; permits for temporary use, such as filming – Section 302; rights-of-ways (ROWs) – Section 501 – ROWs for facilities and systems for the impoundment, storage, transportation, or distribution of water; pipelines for other uses; systems for generation, transmission, and distribution of electric energy; systems for transmission or reception of radio, television, telephone,

telegraph, and other electronic signals; routes; railroads; airways; livestock driveways; etc.

- Federal Land Transaction Facilitation Act (FLTFA) of 2000 – FLTFA amended the FLPMA to allow disposal in land use plans prior to July 25, 2000. The FLTFA currently does not apply to lands identified for disposal after July 25, 2000.
- 43 CFR 2300, land management guidelines regarding withdrawal areas – This regulation affects lands proposed for withdrawal, including existing withdrawals to be continued, modified, or revoked. Requirements describe how the lands would be managed if the withdrawal were relinquished and an opening order issued.
- Section 7 of the Taylor Grazing Act of 1934, as amended (43 USC 315[f]), Land Classifications – The procedures applicable to Section 7 outlined in 43 CFR 2400 must be followed. The following actions require classification: Recreation and Public Purposes Act sales (see 43 CFR 2740) and leases (see 43 CFR 2912), agricultural entries (see 43 CFR 2520, 2530, 2610), and State grants (see 43 CFR 2620). To the extent that the land use planning procedures pursuant to 43 CFR 1600 differ from applicable classification procedures in accordance with 43 CFR 2400, the latter procedures shall be followed and applied. The analysis that supports classification decisions is normally the same analysis utilized in the land use planning/NEPA process to make decisions concerning the disposal or retention of public lands. For any classification decision made through the land use plan, classification decision requirements are initiated (i.e., proposed and initial decisions required under 43 CFR 2400) at the time the decision document is issued for the land use plan.
- 43 CFR 2740, 2912, 2911, and 2920, Land Use Authorizations – These regulations describe where and under what circumstances authorizations for use, occupancy, and development (such as major leases and land use permits) may be granted.

3.2.4.2. Current Conditions and Trends

The Federal lands of the Monument are administered under the multiple-use concept described in the FLPMA. The lands are subject to public-at-large uses, which include hunting, camping, hiking, touring, OHV use, wildlife viewing, and visits to archeological sites. Authorized uses of the land include livestock grazing, commercial outfitting and guiding, oil and gas exploration and extraction, access to private land, and installation of utilities infrastructure.

The private in-holdings are used primarily for livestock grazing, dryland agriculture, temporary lodging, hunting, hiking, and oil and gas extraction. There are two active unpatented mining claims in the Monument (CMC249153 and CMC249154).

Table 3-25 lists the number of BLM authorizations currently active for a variety of ROWs, and the approximate acreages of those permitted uses.

Table 3-25 Active BLM Authorizations for Rights-of-Ways (ROWs)		
Type of ROW	Number of Authorizations	Acres
Road ROW	45	697.2
Power facility	1	1.6
Power transmission line	8	411.8
Communications site	3	4.5
Telephone/telegraph	7	6.1
Water facility	5	13.6
Oil and gas pipeline	6	84.1
TOTAL	75	1,218.9

In 1992, the Western Utility Group prepared the Western Regional Corridor Study for power and other energy-related linear ROWs existing and planned in the western United States. The 230-kilovolt (kV) aerial power line currently traversing the southwestern corner of the Monument, and the buried CO₂ pipeline and infrastructure located in the southeastern area of the Monument, are delineated in the document.

Based on the Proclamation, lands and realty disposition is largely set under law as follows:

- Federal lands will remain in public ownership.
- No leases or sales of land will occur in the Monument. Exchanges of land may be considered, if they will further the purposes of the Monument.
- ROWs that were authorized prior to Monument designation are recognized as valid.
- No new ROWs or ancillary facilities will be processed, except for ROWs authorized pursuant to existing policies and practices, as well as those necessary for access to private land.
- Acquisition of lands in the Monument to protect important cultural or biological values will be considered, from willing sellers.
- While existing withdrawals, reservations, or appropriations are not revoked in the Monument, disposal of Federal lands is prohibited. Conversely, the Federal government may acquire private lands, or interests in private lands, from willing sellers within or adjacent to the Monument boundaries.

Changes in land tenure status are generally not attributable to natural factors. They are more likely to occur due to individual, private decisions to sell or trade land. These decisions may result from external forces that impact the real estate market, such as catastrophic natural events like wildfire, large-scale beetle infestation, drought, and/or flooding. However, they may just as likely stem from personal factors in the lives of the landowners.

3.2.5. Minerals - Fluid

The Monument lies within a geologic region called the Paradox Basin, which covers portions of southwestern Colorado, southeastern Utah, northwestern New Mexico, and northeastern Arizona. The area has high oil, natural gas, and CO₂ potential and is currently producing oil and gas from the Paradox, Leadville, Shinarump, and Pennsylvanian Honaker Trail Formations in the Monument. Fluid and solid mineral resources will be discussed in separate sections below.

3.2.5.1. Regional Setting and Regulatory Framework

The Paradox Basin is typically defined by the existence of evaporite deposits underlain by thick deposits of Devonian and Mississippian Period carbonates, which are unconformably overlain by Pennsylvanian Period strata. The Paradox Basin is a mature oil and gas province, with known oil and gas reservoirs within the Leadville Formation and various carbonate members of the Paradox Formation. The Leadville Formation is the largest CO₂-containing reservoir in the country, and the Desert Creek and Ismay members of the Paradox Formation are the primary reservoirs for oil and natural gas in the Monument.

Oil was first discovered in the Paradox Basin in 1908 near Mexican Hat, Utah, where shallow wells were drilled near an existing oil seep along the San Juan River. Natural gas was first discovered along the southeastern edge of the Paradox Basin in 1921, at the Ute Dome in New Mexico. In the Monument, several old, very mature oil and gas fields exist. The larger fields are the Cache, Flodine Park, McClean Basin (Cutthroat), McElmo Dome, Island Butte, and Papoose Canyon Fields. There are several smaller fields, usually consisting of one or two producing wells. Oil and gas development commenced in 1948 with the discovery of natural gas in the Shinarump Formation.

Oil and natural gas production in the Monument is primarily from algal mounds or oolitic shoals that originated in the shallow shelf environments and are surrounded by low-permeability carbonate muds. As a result, oil and gas production in the Monument depends on localized depositional environments and diagenetic trends in carbonates of the Desert Creek and Ismay members. Although these members extend beneath the entire Monument area, only areas with higher porosity and permeability contain exploitable oil and gas reservoirs, which accounts for the somewhat discontinuous and isolated nature of commercial production. Source rocks for oil and gas are the carbonaceous shales of the Paradox Formation and possibly the Cambrian Bright Angel Shale, both of which underlie the entire Monument. There may also be some future potential for increased production in the Pennsylvanian Honaker Trail Formation and Permian Cutler Formation. The Permian Cutler Formation produces in other areas of the Paradox Basin but is relatively unexplored beneath the Monument.

Additionally, there is also potential for natural gas discoveries in the Pennsylvanian Hovenweep Shale that exist beneath the Monument. The Hovenweep Shale is minimally explored, not a proven reservoir, and therefore speculative at this time. However, current reservoir indicators, advances in horizontal drilling and related fracturing technologies combined with increasing natural gas prices provide merit to mention the possibility of future production. Thus, while the Hovenweep may produce in the future, it is not expected to be developed within the life of the Monument Plan and thus was not considered in the RFD.

In general, management of the Monument's oil and gas resources is guided by the Monument Proclamation and the 1991 Oil and Gas Leasing Amendment to the San Juan/San Miguel RMP (BLM 1985). Additional laws, regulations, and policies that pertain to oil and gas management include the following:

- 43 CFR, Parts 3100 and 3200;
- BLM Onshore Oil and Gas Orders;
- BLM National Notice-to-Lessees;
- the Federal Oil and Gas Royalty Management Act of 1982 (FOGRMA);
- the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA);
- the Federal Oil and Gas Royalty Simplification and Fairness Act of 1996 (FOGRS+FA);
- Energy Policy and Conservation Act of 2000;
- the Unitization Manual 3180 (Exploratory);
- the Unitization Handbook H-3180-1 (Exploratory);
- the 2006 Oil and Gas Surface Operating Standards and Guidelines (Goldbook, 4th edition) (BLM 2006); and
- the integration of BMPs into applications for permit to drill approvals and associated ROWs (WO IM 2007-021).

Interest in the development of geothermal energy sources has risen in recent years. However the Proclamation withdraws CANM from geothermal leasing in the following statement “All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral leasing, other than by exchange that furthers the protective purposes of the monument, and except for oil and gas leasing as prescribed herein” (Appendix A).

3.2.5.2. Current Conditions and Trends

Drilling and Production

According to the Colorado Oil and Gas Conservation Commission, 185 oil, natural gas, and CO₂ wells have been drilled in the Monument since the 1940s. Of these wells, 125 are currently active, and 60 have been plugged and abandoned. Eighty-one active wells are producing from five units in the Monument: Island Butte II, Cutthroat, McElmo Dome, Cache, and Canyon (Shallow). A unit is created when several developers combine operations to maximize production. The remaining 44 wells are producing from Monument land outside of established units. From 1950 through 2003, the average number of wells drilled per year was four. The most wells drilled in a year was 19, and there have been several years of no drilling activity. The overall success rate of all wells is 60 percent, with success rates for CO₂ wells at 65 percent and oil and natural gas wells at 57 percent. Drilling and completion costs are typically in the range of \$700,000 to \$1,500,000 per well.

Current daily production from wells in the Monument is approximately 550 barrels of oil, 3,850 million cubic feet (mcf) of natural gas, and 750,000 mcf of CO₂. Peak production since 1970 was 3,220 barrels of oil per day in 1994, and 9,200 mcf of natural gas per day in 1997. Oil and natural gas production from wells in the Monument has been declining steadily since the mid-1990s. The production of CO₂ from McElmo Dome Unit wells in the Monument has remained relatively constant over the last 10 years, with production ranging from approximately 700,000 to 800,000 mcf/day.

Most oil and natural gas fields in the Monument have produced to near their estimated ultimate recovery and are now considered near depletion, even at current high energy prices. The

estimated reserves from existing fields (both inside and outside the Monument) are 551,125 barrels of oil and 2,953,553 mcf of natural gas, as shown in Table 3-26. Considering fields as a whole, this corresponds to approximately three years of oil production and two years of natural gas production at current daily production rates. With workovers and recompletions occurring in the Pennsylvanian Honaker Trail Formation, production will continue indefinitely.

Table 3-26 Estimated Oil and Gas Reserves of Units Inside and Outside the Monument

Field	Cumulative Production		Estimated Ultimate Recovery		Estimated Remaining Reserves	
	Oil, bbl	Gas, mcf	Oil, bbl	Gas, mcf	Oil, bbl	Gas, mcf
Cutthroat	5,603,914	19,300,181	5,842,632	20,734,357	238,718	1,434,176
Cache	4,570,047	7,606,130	4,703,626	7,900,021	133,579	293,891
Island Butte	2,213,239	5,948,770	2,222,143	5,956,710	8,904	7,940
Flodine Park	2,772,600	16,876,098	2,839,511	17,348,207	66,911	472,109
Papoose Canyon	6,459,776	35,890,976	6,562,572	36,510,415	102,796	619,439
Canyon (Shallow)	7,922	809,647	8,139	935,645	217	125,998
TOTAL	21,627,498	86,431,802	22,178,623	89,385,355	551,125	2,953,553

Bbl = barrels

The most significant mineral resource in the Monument is CO₂ reserves in the McElmo Dome Unit. To date, approximately 4.4 trillion cubic feet (tcf) of CO₂ has been produced, which represents only 29 percent of the projected ultimate recovery of 15.3 tcf. The field has an expected economic life of at least 50 more years from proven, producing reserves. A significant amount of acreage within the Unit, as well as large portions of the Unit that are not currently being produced, is available for future development. Continued high oil prices could increase demand for CO₂ in West Texas tertiary recovery operations, resulting in additional wells and facilities in the McElmo Dome Unit.

At least 54 separate seismic surveys have been approved and completed in the Monument, with three 3-D surveys and 51 2-D surveys. Most individual lines on 2-D surveys were from between 3 to 8 miles long. The highest levels of seismic activity in the Monument are within the Cutthroat and Island Butte II Units.

Leasing

The Monument encompasses 182,876 acres of land, of which approximately 166,000 acres is under Federal surface ownership, managed by the BLM. Of the 182,876 acres, 143,503 acres are leased for oil and gas development under 334 leases; 39,373 acres are not leased. Of the 334 total leases, 31 are private (non-Federal minerals). Table 3-27 shows the breakdown of Federal, private, leased, and unleased mineral estates.

Land/Mineral Status	Total Area (acres)	Leased (acres)	Unleased (acres)
Federal surface/Federal minerals	164,357	132,353	32,004
Federal surface/private minerals	456	279	177
Private surface/private minerals	4,975	0	4,975
Private surface/Federal minerals	13,088	10,871	2,217
TOTAL	182,876	143,503	39,373

Approximately 81 percent (143,503 acres) of the Federal mineral estates in the Monument is leased for oil and gas exploration and development, while 19 percent is currently not leased. Leases entitle the lessee to develop all oil and gas, including natural gas, oil, condensate, and CO₂. The six oil, natural gas, and CO₂ units cover the majority of leased acreage in the Monument. Lease operators are required to exercise due care and diligence to ensure that leasehold operations do not result in undue damage to surface and subsurface resources, or any surface improvements.

Units are typically from 160 acres to several thousand acres in size, and usually consist of several leases. A unit is a “joining of all or substantially all interests in a reservoir or field, rather than a single tract, to provide for efficient development and operation of a common reservoir without regard to separate property interests.” Leases are generally unitized at the convenience of the government or when geologic conditions do not permit the drilling of wells at conventional locations; well sites are selected based on geologic conditions. Unitization provides operators the flexibility to explore, develop, and manage the reservoir properly. As long as there is production within the unit, the individual leases in the unit are held by production and do not expire.

The Monument Proclamation includes guidance as to oil-and-gas management for both existing and potential (new) leases. In terms of existing leases, development will continue, subject to valid and existing rights, provided that the activities do not create new impacts that interfere with the proper care and management of the objects protected by the Proclamation. The 1991 Oil and Gas Leasing Amendment to the San Juan/San Miguel RMP (BLM 1991a) set forth stipulations that apply to all new leases. These relate to surface occupancy, timing of operations, CSU, lease notices, and conditions of approval. In addition, the Proclamation states that “...the Secretary may issue new leases only for the purpose of promoting conservation of oil and gas resources in any common reservoir now being produced under existing leases or to protect against drainage”.

The 1991 Amendment to the San Juan/San Miguel RMP (BLM 1991a) prohibited additional leasing inside the Wilderness Study Areas (WSAs) (Cahone Canyon, Cross Canyon, Squaw/Papoose Canyon) in the Monument. The NSO stipulation currently applies to 59,278 acres, or to approximately 32 percent of the total land area in the Monument. However, none of these stipulations apply to leases issued before 1991. They apply to only 15 of the total 334 leases in the Monument.

Except for oil-and-gas leasing, the Proclamation reserved and appropriated all Federal lands and interests in lands in the Monument and withdrew them from all forms of entry, location, selection, sale, leasing, or other disposition under the public-land laws, including the mineral-leasing and mining laws. Thus, with the exception of oil-and-gas leases, no new Federal mineral leases will be issued in the Monument. Authorization of activities on existing mineral leases will be governed by valid existing rights.

3.2.6. Minerals - Solid

Solid minerals are divided into the classifications of locatable (metallic including uranium) and saleable (industrial). There are also leasable solid minerals, as identified in the 1920 mineral leasing act (i.e. coal, potash, sodium, and oil shale). There are two existing unpatented uranium mining claims (locatable mineral) and one building stone quarry (saleable mineral) located in the Monument.

3.2.6.1. Regional Setting and Regulatory Framework

No metal mining is currently occurring in Montezuma or Dolores Counties, although resources such as uranium, silver, gold, copper, lead, and zinc have been mined in the past. The region produced nearly \$50 million in locatable minerals prior to 1958.

The most readily available saleable minerals in the region are sand, gravel, and building stone. Alluvial deposits containing sand and gravel underlie the Dolores River valley and its main tributary drainages. In addition, the portions of the region are also overlain by eolian (wind-derived) sand. The deposits are used primarily as roadbase and fill material. Eolian sand is a potential source of silica, which is used in industries such as glass and ceramic manufacturing. The Dakota Sandstone is a good source of building stone, and may also be useful for industries requiring high silica content in their manufacturing process.

Laws and regulations that apply to solid mineral leasing and extraction in the Monument include the following:

- The 1872 General Mining Law, which established the general principles of acquiring mining claims. It has been substantially reduced by several subsequent Congressional acts, primarily:
- The Mineral Leasing Act of 1920, as amended, which authorized that deposits of oil, gas, coal, potassium, sodium, phosphate, oil shale, native asphalt, solid and semi-solid bitumen and bituminous rock, and oil-impregnated rock/sand may be acquired through a mineral-leasing system; and
- The Materials Act of July 31, 1947, as amended, which further excluded common varieties of sand, stone, gravel, pumice, cinders, clay, humate, and petrified wood from claims staking.
- Additionally, an operator would be required to comply with BLM stipulations and other restrictions, and pertinent Federal (NHPA, ESA) and State laws.
- The Clean Water Act, which requires that all discharges of pollutants to surface waters (streams, rivers, lakes, bays, and oceans), must be authorized by a permit issued under the National Pollutant Discharge Elimination System (NPDES) program.
- The extraction and sale of aggregate materials, which are generally governed by the Mineral Materials Disposal regulations codified in CFR (43 CFR 3600-3622). However, this use has been withdrawn through The Proclamation.

- The Proclamation including:
 - for mineral activities (including hardrock, oil, gas, and coal), except for oil-and-gas leasing, the Proclamation reserved and appropriated all Federal lands and interests in lands in the Monument and withdrew them from all forms of entry, location, selection, sale, leasing, or other disposition under the public-land laws, including the mineral-leasing and mining laws. Thus, with the exception of oil-and-gas leases, no new Federal mineral leases will be issued in the Monument, and authorization for activities on existing mineral leases will be governed by valid existing rights. Currently, there are no leases or contracts in the Monument for solid minerals and only two existing claims (Federal Register Vol. 65, No. 114 Pg. 37245); and
 - for hardrock minerals, no new mining activity can occur except those on existing claims (claims can be transferred from one owner to another, but the claim itself must both predate the Monument and remain continuously active). Any new activity requires that a BLM mineral exam be conducted to determine that the claim has valid existing rights, prior to notice or plan approval, and any disturbance.

3.2.6.2. Current Conditions and Trends

The two unpatented uranium mining claims in the Monument include CMC 249153, Spider Rock 1 (SW 12-T38N-R20W), and CMC 249154, Spider Rock 2 (SW 12-T38N-R20W). The claimant recorded the claims in 1996; and although they have never produced, they are potentially viable. The Federal government owns the surface and the mineral estate. The claimant filed the mining claims before the Proclamation withdrawal and has kept his claims current (i.e., rental/maintenance fee has been paid), and therefore has the right to develop the minerals. Before he can produce the claims, he would have to submit a plan of operation and a bond. The government could request a validity examination to determine whether or not a prudent operator would develop the claims before approving the plan of operation.

To the extent that these claims contain a valid discovery of a valuable mineral deposit as of the date of the designation, they will be respected as valid existing rights. The exercise of such rights may be regulated to protect the purposes of the Monument, but any regulation must respect such rights. Existing mining claims that lack a valid discovery of a valuable mineral deposit have no valid, existing rights; activities on such claims may be regulated or prohibited to protect the purposes of the Monument. The Proclamation withdrew the area from the 1872 Mining Law; thus, new mining claims are prohibited.

The H&H Quarry 2, a decorative/building stone quarry, is located inside the Monument. No information about current or past production is available. This operation is a split estate, with the BLM controlling the surface and the private sector controlling the subsurface minerals. The location of the pit is NENW, T 39 N, R 18 W, Sec.7.

No information about current or past production is available; therefore, future conditions are difficult to anticipate for H&H Quarry 2.

3.2.7. Livestock grazing

Of all the historic human use activities in the Monument boundaries, livestock grazing has the longest history and covers the largest area. Approximately 98 percent of the 166,000 acres of the Monument is currently used for livestock grazing. A total of 8,492 animal unit months (AUMs) are permitted and active in the Monument (Table 3-28).

Table 3-28 Current Permitted and Calculated Allocation AUMs, by Allotment				
Allotment	Current Permitted AUMs	Average Actual Use AUMs	Calculated Allocation AUMs^a	BLM Acres in Allotment
Adam Lewy	120	118	52	997
Alkali	53	52	49	814
Aztec Canyon	37	78 ^c	37	1,829
Blue Littlewater	23	23	11	255
Burro Point, Community	1,083	350	865	20,960
Burro Point, Individual	11	Not available	8	213
Cahone Mesa	829	777	829	21,925
Cannonball	133	114	97	1,916
Cross Canyon	1,183	937	1,169	30,469
East McElmo Creek	293	330	210	4,478
Flodine Park	211	349	211	4,668
Goodman Gulch	21	Not available	21	940
Goodman Point	150	Not available	133	5,040
Hamilton Mesa ^b	600	346	674	7,761
Hovenweep Canyon ^b	227	143	256	6,110
Lower Aztec Canyon	12	Not available	1	65
Lower McElmo	644	634	644	8,770
McLean	21	Not available	12	644
Papoose Canyon ^b	33	17	50	1,063
Rock Creek	43	15	28	1,832

Table 3-28 Current Permitted and Calculated Allocation AUMs, by Allotment				
Allotment	Current Permitted AUMs	Average Actual Use AUMs	Calculated Allocation AUMs ^a	BLM Acres in Allotment
Sand Canyon East and West	48	Not available	48	3,040
Sandstone	2,206	1,528	662	22,676
Squaw Canyon	160	Not available	150	4,557
Trail Canyon	12	Not available	9	247
Ute Mountain	9	9	6	296
Yellow Jacket	243	300 ^c	243	5,676
Yellow Jacket Canyon	87	77	68	2,455
TOTAL	8,492		6,437	159,696

^aBased on 2001 Rangeland Health Evaluation and Ecological Site Inventory (BLM 2001i)

^bThese allotments are currently permitted below their calculated allocation. However, these allotments do not meet Public Land Health Standards. Once health standards are met, or livestock grazing is determined to not be a factor in public land health, AUMs will be increased to the calculated allocation

^cThese permits were recently adjusted because grazing was determined to be a significant factor in not meeting the Public Land Health Standards.

In general, the Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (Public Land Health Standards) (BLM 1997) and livestock management actions in the San Juan/San Miguel RMP (BLM 1985) have guided management of the Monument's vegetation resources. The Public Land Health Standards were developed in response to livestock-grazing regulations that became effective August 21, 1995, and were approved by the Secretary of the Interior on February 3, 1997. Standards that are monitored include: 1) upland soils; 2) riparian systems; 3) plant and animal communities; 4) special status, threatened, and endangered species; and 5) water quality.

3.2.7.1. Regional Setting and Regulatory Framework

The Monument is located in the semi-arid transition zone between the montane zone of the San Juan Mountains to the north and east, and the arid badlands and deserts of northern New Mexico to the south. At the landscape level, the area slopes gradually from higher elevations in the north and east, to lower elevations in the south and west. At smaller scales, aspects and slopes vary widely due to the numerous gullies and canyons that occur in the area.

Several other resources that interact with livestock grazing are discussed in greater detail in other sections of the document, including Section 3.1.6, Soil Resources; Section 3.1.7, Terrestrial and Aquatic Wildlife (including special status species); Section 3.1.8, Vegetation Resources (including special status species); and Section 3.1.10, Water Resources. All of these features are also discussed in the AMS (BLM 2005b).

In this region, two resources are especially susceptible to the effects of livestock grazing: riparian zones and biological soil crusts. In arid and semi-arid environments, livestock spend a disproportionate amount of their time in riparian vegetation communities and consequently concentrate much of their impacts on these habitat types (Roath and Krueger 1982; Clary and Medin 1990). These impacts affect riparian vegetation, stream morphology, and water quality (Chaney et al. 1990; Fleischner 1993).

Biological soil crusts are easily crushed by livestock or other agents, resulting in a decrease in overall cover of biological crusts and a decrease in the number of crust species present. Untrampled crusts often have four to ten species of soil lichens and/or four to six species of cyanobacteria. In contrast, trampled areas often have no lichens and only one species of cyanobacteria (Belnap 1995). This loss of biological crusts negatively affects soil development, nutrient cycling, and plant germination success, as well as overall soil vigor (Belnap 2003).

Many laws, regulations, and policies pertain to the planning process, and are generally applicable to more than one of the resources/uses in the Monument, are described in other sections of this document. Laws and regulations that are most directly related to management of livestock on BLM lands and/or on National Monuments include:

- the Proclamation;
- the Taylor Grazing Act of 1934;
- the Public Rangelands Improvement Act of 1978 (PL 95-514);
- Executive Order 12548 (1986): Establishment of annual fees for domestic livestock grazing on public rangelands;
- the FLPMA, sections 102, 201, 202, 302, 304, 307, 309, 310, 401, 402, and 403;
- BLM regulations contained in 43 CFR 4100 et seq;
- BLM Manual 4180 – Rangeland Health Standards (BLM 2001e); and
- Interim Management for all National Monuments, which permits livestock grazing in the Monument, pursuant to the terms of existing permits and leases. Appropriate livestock grazing-management practices should be followed to protect rangeland resources and to ensure compliance with BLM Colorado's Standards for Public Land Health and Guidelines for Livestock Grazing. Enforcement actions against trespassers or other violators would continue to be authorized.

These laws range from the most general, such as the Taylor Grazing Act that mandates the overall allotment system, to the more specific regulations that guide local land managers in their day-to-day decisions. Achievement of Public Land Health Standards strongly influences the majority of local decisions concerning stocking levels, times of use, and standards of performance. These standards were developed in response to livestock-grazing regulations that became effective August 21, 1995, and were approved by the Secretary of the Interior on February 3, 1997.

3.2.7.2. Current Conditions and Trends

Current conditions and trends have been assessed by the BLM and have been reported in the AMS (BLM 2005b). This analysis is based on monitoring performed under the BLM Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management. Table 3-29 summarizes the BLM interdisciplinary (ID) team's determinations as to whether or not the allotments are achieving the standards, along with causal factors. Although the determinations are organized by livestock grazing allotments, causal factor(s) are not limited to livestock

grazing. Instead, a variety of multiple-use activities (including recreation and oil and gas development) could be responsible for a determination. Allotments are shown on Map 3.

The standards were developed in response to livestock-grazing regulations that became effective August 21, 1995, and were approved by the Secretary of the Interior on February 3, 1997. Standards that are monitored are: 1) upland soils; 2) riparian systems; 3) plant and animal communities; 4) special status, threatened, and endangered species; and 5) water quality. This section is a brief summary of the more detailed information available in the AMS (BLM 2005b).

Table 3-29 Standards for Public Land Health – BLM Interdisciplinary (ID) Team Determinations						
Standards for Public Land Health						
Allotment	Upland Soils	Riparian Systems	Healthy Plant and Animal Communities	TES Plants and Animals	Water Quality	Grazing a Significant Factor
Adam Lewy	Not achieved	Not achieved	Not achieved	Not achieved	Not achieved	Y
Alkali	Achieved	Not achieved	Achieved	Not achieved	Achieved	N- Livestock mgmt. actions already taken
Aztec Canyon	Achieved	Progress toward achieving	Not achieved	Achieved	Achieved	Ya
Blue Littlewater	Not achieved	Not applicable (NA)	Not achieved	NA	NA	N
Burro Point Community	Not achieved	Achieved	Not achieved	NA	Achieved	Y
Burro Point Individual	Not achieved	NA	Not achieved	NA	NA	N-Utility corridor mgmt.
Cahone Mesa	Not achieved	Not achieved	Not achieved	Achieved	Achieved	Ya
Cannonball	Achieved	Achieved	Not achieved	Achieved	Achieved	N- Livestock mgmt.

Table 3-29 Standards for Public Land Health – BLM Interdisciplinary (ID) Team Determinations						
Standards for Public Land Health						
Allotment	Upland Soils	Riparian Systems	Healthy Plant and Animal Communities	TES Plants and Animals	Water Quality	Grazing a Significant Factor
						actions already taken
Cross Canyon	Not achieved	Not achieved	Not achieved	Not achieved	Achieved	Y
East McElmo Creek	Not achieved	NA	Not achieved	NA	NA	Y
Flodine Park	Not achieved	Not achieved	Not achieved	Not achieved	Achieved	Ya
Goodman Gulch	Not achieved	NA	Not achieved	Achieved	NA	Ya
Goodman Point	Achieved	NA	Achieved	NA	NA	N
Hamilton Mesa	Not achieved	Not achieved	Not achieved	Not achieved	Achieved	Ya
Hovenweep Canyon	Not achieved	Not achieved	Not achieved	NA	Not achieved	N-Wildfire caused
Lower Aztec Canyon	Not achieved	NA	Achieved	NA	NA	Y
Lower McElmo	Not achieved	Not achieved	Not achieved	Not achieved	Not achieved	Ya
McLean	Not achieved	NA	Not achieved	NA	NA	Y
Papoose Canyon	Not achieved	Not achieved	Achieved	Not achieved	Achieved	N-Wildfire caused
Rock Creek	Not	NA	Not achieved	NA	NA	N-Livestock

Table 3-29 Standards for Public Land Health – BLM Interdisciplinary (ID) Team Determinations						
Standards for Public Land Health						
Allotment	Upland Soils	Riparian Systems	Healthy Plant and Animal Communities	TES Plants and Animals	Water Quality	Grazing a Significant Factor
	Achieved					mgmt. actions already taken
Sand Canyon East	Not achieved	NA	Not achieved	Not achieved	NA	Ya
Sand Canyon West	Not achieved	NA	Not achieved	Not achieved	NA	Ya
Sandstone	Not achieved	Not achieved	Not achieved	Not achieved	Not achieved	Y
Squaw Canyon	Achieved	Not achieved	Achieved	Not achieved	Achieved	Y
Trail Canyon	Progress toward achieving	NA	Achieved	NA	NA	N
Ute Mountain	Not achieved	NA	Not achieved	NA	NA	N- Livestock mgmt. actions already taken
Yellow Jacket	Not achieved	Not achieved	Not achieved	Not achieved	Not achieved	Ya
Yellow Jacket Canyon	Not achieved	Not achieved	Not achieved	Not achieved	Not achieved	Y

^a Since the Public Land Health determinations were made, changes to grazing management (i.e., livestock numbers, season of use, and grazing management) have been implemented on these allotments. It is anticipated that these changes will make significant progress toward meeting the Public Land Health Standards.
NA: The standard is not applicable because it is not present in the allotment.

Brief summaries of the information contained in Table 3-28 are presented below. More detailed information on current trends and conditions are found in sections concerning applicable environmental conditions in this document and in the AMS (BLM 2005b). Fourteen of the 28 allotments did achieve one or more of the five standards. Livestock grazing is listed as a significant factor for not achieving standards in 18 of 28 allotments.

The standard for upland soils is not being achieved on 22 of the allotments in the Monument. Progress is being made toward achieving the standard on one allotment (Trail Canyon). Causal factors for these determinations are identified as livestock grazing, historic use of intermingled homestead lands and adjacent private lands, change in historic fire cycle, recent wildfire, and invasion of knapweed.

The standard for riparian systems is not being achieved on 14 of the 16 applicable livestock-grazing allotments in the Monument (the other 12 do not contain riparian areas). Progress is being made toward achieving the standard on one allotment (Aztec Canyon). Causal factors for these determinations are identified as livestock grazing, upstream land uses, historic homestead sites, tamarisk and Russian-olive invasion, route encroachment, augmented flows, recent wildfire, and lack of perennial ground cover.

The standard for healthy, productive plant and animal communities is not being achieved on 22 of the 28 livestock-grazing allotments in the Monument. Causal factors for these determinations are identified as livestock grazing, historic and/or current use of intermingled or adjacent private land, unsuccessful chaining and seeding of pinyon-juniper vegetation in the 1970s, presence of utility corridors, adjacent private land weed source, and the Hovenweep wildfire of 2000 and subsequent invasion of knapweed.

The standard for special status species is not being achieved on 13 of the 17 applicable livestock-grazing allotments in the Monument. This standard does not apply to the remaining 11 allotments because neither special status species, nor their habitats, are present. Moreover, of the 13 allotments not achieving this standard, only two of these determinations are associated with plants; the rest are associated with animals. More specifically, only the Sand Canyon East and West allotments are not achieving this standard, which is a result of *Naturita* milkvetch (*Astragalus naturitensis*), a sensitive plant species. This plant is present in the allotment, but is thought to be at risk due to the increase in unauthorized recreational routes in the Sand Canyon area. The remaining allotments are not achieving the standard on the basis of habitat requirements for an endangered animal species, the SWWF. Habitat for this species is being degraded due to changes in vegetative structure and composition. Causal factors for these 11 determinations are identified as livestock grazing, upstream land uses, lack of perennial ground cover, and route encroachment.

The standard for water quality is not being achieved on 6 of the 16 applicable livestock-grazing allotments in the Monument. Surface water is not present on 12 of these allotments; therefore, an assessment of water quality was not completed for these allotments. Causal factors for these determinations consist primarily of land-use activities upstream in the watershed (including agriculture, irrigation, and livestock grazing). This assessment concluded that grazing was a significant factor in all but one of the nine allotments that did not achieve water quality standards. One allotment (Hovenweep Canyon) recently changed grazing management and needs to be monitored to determine the effectiveness of that change.

3.2.8. Recreation

From the San Juan Mountains to the Dolores River Canyon and with the area's thousands of archaeological sites, the Four Corners region is a land of great geographic and cultural diversity. Public lands in the region attract visitors from across the nation and from around the world.

Recreational opportunities in the Monument offer quality-of-life enrichment for visitors. Steady population growth has placed an increasing recreational demand on adjacent undeveloped public lands. Visitors and nearby residents continue to seek diversity in their recreational opportunities. Prior to the establishment of the Monument, recreation management focused on providing opportunities for all segments of the public, commensurate with demand. Management was open to commercial use opportunities and cross-country vehicle opportunities. Currently the Monument is managed in accordance with the Proclamation and the Interim Management Policy for BLM National Monuments. Recreation management has been primarily custodial, allowing visitors dispersed recreation opportunities and limiting commercial recreation opportunities.

For the past 125 years, scientists and visitors alike have been drawn to this area. The cultural resources alone set this area apart. Colorado's population has grown significantly in the past 10 years (U.S. Census Bureau 2002), and an increasing number of people are living near, or are seeking, undeveloped public land for recreational use. In addition, Colorado remains a popular destination for tourists, especially those seeking experiences in an undeveloped setting. As a result, public lands administered by the BLM are absorbing increasing recreational use. Other factors include:

- changing population demographics (U.S. Census Bureau 2002);
- an increase in dispersed recreation use, both summer and winter;
- an increase in popularity of public lands as a local recreation destination for local communities;
- the amount of adjacent private lands and in-holdings;
- an increase in the economic and social value of recreation and tourism;
- an increase of public interest in, and growing awareness of, the area;
- an increase in the desire of Americans to play a greater role in the management of their public lands;
- technological advances, such as ATVs and mountain bikes, as well as better outdoor equipment and clothing;
- the integration of recreation use with sustainable management of other resources; and
- an increase in educational interest in past cultures.

3.2.8.1. Regional Setting and Regulatory Framework

Current recreation management is based on the Proclamation and the Interim Management Policy and Interim Management Guidance, Canyons of the Ancients National Monument (BLM 2001b). The interim policy addresses a variety of concerns related to commercial use, facilities, recreation opportunities, dispersed camping, and resource protection. It also provides guidelines for future site improvements, maintenance activities, and management decisions.

In addition to the laws, regulations, and policies that pertain to the planning process, or are generally applicable to more than one of the resources/uses in the Monument, as described in Chapter 1, there are others that specifically address recreation. They include:

- The specific terms and conditions authorizing Special Recreation Permits (SRPs) that are issued for commercial or organized events.
- The Brunot Agreement of 1874, which provides limited hunting rights to the Ute Mountain Ute Indian Tribe in the southeastern portion of the Monument. In exercising

their Brunot hunting rights, the Ute Mountain Ute must adhere to regulations established by the Monument designed to protect other resources (i.e. Monument's transportation plan).

- Cooperative agreements between the CDOW and the BLM that provide for enforcement of hunting regulations. CDOW game wardens have primary responsibility for enforcing CDOW regulations and permit conditions.

3.2.8.2. Current Conditions and Trends

Recreational opportunities offered by the land and facilities of the Monument include wildlife viewing, scenic drives, hunting, camping, hiking, mountain biking, horseback riding, visiting archaeological sites, sport climbing, stargazing, and OHV use. People pursue these activities in a full range of settings: some are near urban areas (e.g., Sand Canyon), while others are in remote backcountry locales, such as Wilderness Study Areas (WSAs).

Hunting, fishing, and recreational shooting are important local recreational elements. Elk and mule deer are the principal species hunted on public land in the Monument. Mountain lion hunting occurs in the winter, but is generally not a large part of hunting recreation activity. Recreational shooting is conducted on a limited basis. There are no developed shooting areas.

The Monument offers the opportunity for visitors to experience solitude and challenge in natural settings. Most backcountry recreation occurs in the northwestern portion of the Monument, in the existing WSAs. There are no developed camping areas in the Monument; however, there is a developed campground at Hovenweep National Monument. Dispersed camping is permitted in the Monument. Popular dispersed-camping areas include sites along the Cannonball Mesa route, at Big Point, and near Painted Hand. There are three developed interpretive sites for archaeology: Lowry Pueblo, Sand Canyon Pueblo, and Painted Hand Pueblo. Of the three interpretive sites, Lowry Pueblo is the most developed, offering visitors the opportunity to visit an archaeological site, as well as a parking area, picnic facilities, and vault toilets.

The AHC, located 10 miles north of Cortez and 3 miles west of Dolores, is the headquarters for the Monument. The AHC is a visitor center and a museum.

Other regional recreation providers of developed and dispersed recreation opportunities in the region include:

- the NPS, at Mesa Verde National Park and Hovenweep National Monument;
- the USFS, at the San Juan National Forest and the Grand Mesa-Uncompahgre National Forest;
- the BLM, at the San Juan Public Lands and Uncompahgre Field Office; and
- the Colorado Division of Parks, at Lone Mesa and Mancos State Parks.

Private recreation facilities, such as campgrounds and guest ranches, are found throughout the region.

Commercial opportunities in the Monument fluctuate in the number of outfitters and guides. To date we have outfitters and guides that offer big game and lion hunting, cultural resource tours, horseback riding, and mountain biking. The outfitters are authorized annually under the Special Recreation Permit (SRP) Program. The Proclamation and Interim Guidelines allow historic commercial use to continue, with the provision that modifications can be made to existing permits if risk is posed to the objects of the Monument.

Currently, there is a moratorium in place for issuing new SRPs in the Monument. Prior to the establishment of the Monument, there were 13 active SRPs. Since then, two permittees

decided to cease operations (one lion hunting, one big-game hunting), and one was cancelled by the BLM (big-game hunting). Although no formal documentation has been kept during this moratorium to track new commercial interests, the BLM has documented seven requests for SRPs from June 2000 through September 2002, as follows:

- one for backpacking trips;
- two for horseback rides;
- two for conducting archaeological tours; and
- two for big-game outfitting.

The total commercial client days by outfitter and guide for the years 1999 through 2003 in the Monument are shown in Table 3-30.

Outfitter	1999	2000	2001	2002	2003
Crow Canyon Arch Center	12	12	51	0	0
Dolores River Outfitters	0	0	4	9	6
Far Out Expeditions	40	4	0	0	0
High Country Outfitters	9	18	15	9	21
Kelly Place	146	87	143	85	212
Red Mesa Outfitters	2	2	2	0	2
San Juan Outfitters	0	73	0	20	17
Silver Peak Outfitters	0	0	2	0	0
Western Spirit Cycling	No data	0	0	0	0
Crow Canyon Arch Center	12	12	51	0	0
TOTAL	210	196	217	130	270

Several organized groups tour the Monument, including schools, archaeological organizations, and environmental-education groups. Not-for-profit groups (including public schools, churches, universities, etc.) are sometimes limited by group size; however, they are not charged a fee, and are not required to have an SRP. If schools or universities contact the Monument, they are asked to visit the AHC for information (including information on route conditions and locations to visit) before entering the Monument.

Since 1992, the Monument and the AHC have partnered with the Crow Canyon Archaeological Center to host the Castle Rock Field Days, held in April or May. On this annual occasion, all fourth grade school children in Montezuma County are invited to spend a day in the Castle Rock

area of the Monument to learn about cultural and natural resources. Some 300 students participate each year. Other popular locations for groups include Lowry Pueblo, Sand Canyon Pueblo, and Painted Hand Pueblo. All other types of activities for financial gain (commercial, competitive, special-area use, or organized-group activity) require an SRP.

3.2.9. Transportation

NOTE: For the general purpose of this PRMP/FEIS, the word “road” in the DRMP/DEIS has been changed to “route”. As per BLM Instruction Memorandum No. 2008-014, the definition of a route is “a group or set of roads, trails and primitive roads that represent less than 100% (excludes non-designated routes) of the BLM transportation system”. In general, components of the transportation system are described as “routes”. All designated routes within the Monument are identified on the attached transportation map. Travel off a designated route is considered “cross-country” or “off-road”. County improved routes are still referred to as roads.

This section addresses transportation and access to BLM lands, including recreational off-highway vehicle (OHV) use. The BLM maintains approximately 126 miles of routes in the Monument. Access, whether by foot, motorcycle, horse, or vehicle, is one of many uses the BLM manages for. Reasonable access is made available to persons engaged in valid uses, such as for mining claims, mineral leases, livestock grazing, recreation, and other uses.

Primary access to the Monument is via county roads that originate from State Highway 491 (formerly Highway 666). All access to the Monument is by private or commercial vehicles. No public transport, mass transit, or shuttle services are available. No air service infrastructure exists in the Monument. The Montezuma County Airport, located 3 miles southeast of the Monument, is the closest public air transport facility.

3.2.9.1. Regional Setting and Regulatory Framework

Travel management is aimed at providing adequate access to BLM system lands for visitor use and for administration of those lands while, at the same time regulating travel to protect public safety, prevent damage to resources, and resolve conflicts among users. Current management is based on the Proclamation and Interim Management Policy and Interim Management Guidance, Canyons of the Ancients National Monument (BLM 2001b). The interim policy addresses a variety of concerns related to vehicle use, routes, and resource protection, and provides guidelines for future route improvements, maintenance activities, and management decisions.

Vehicle use in the Canyons of the Ancients National Monument is managed under the direction and authority in 43 CFR Part 8340, “Off-Road Vehicles,” Subpart 8342, “Designation of Roads and Trails.” The OHV regulations apply to use of routes by the general public. Certain other routes may be open to private in-holders, and grazing or other permittees, to meet specific access needs and/or legal rights. All motorized and mechanized vehicle use off-road is prohibited.

All public lands are required to be designated as “open,” “limited,” or “closed” to OHVs (43 CFR 8342.1). In “open” areas, cross-country travel by motorized or mechanized means is not limited. On lands designated as “limited,” cross-country travel is prohibited and travel is limited to specific routes. The network of routes available and the terms and conditions of use on those routes are usually identified on published maps. In “closed” areas, no motorized or vehicle use is permitted. Cross-country travel by foot or by horse is usually permitted in all areas, regardless of OHV designation. Current OHV travel is “limited” to designated routes in the Monument. The Monument is closed to cross-country, off-road travel by motorized and mechanized vehicles, including mountain bikes, to reduce inadvertent damage to cultural

resources. Established routes are open to use, as currently authorized. Monitoring of natural and cultural resources will be initiated in critical locations to determine whether or not resources are being damaged by vehicle use. A final decision on designated routes for vehicular travel, including mountain bikes, will be established through this planning process. Additional regulations and guidelines for transportation management include:

- The Transportation Safety Act of 1974 and subsequent Hazardous Materials Transportation Act amendments of 1976, and 1990 amendments (49 USC 1801 et seq.), and associated regulations (49 CFR 171-173, 177, 383, 392, 395, and 397); and
- Executive Order 11644, "Use of Off-Road Vehicles on Public Lands." The purpose of this order is "to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among various uses of those lands."

3.2.9.2. Current Conditions and Trends

Two routes provide the primary transportation system used for access through the Monument. County Road G (McElmo Creek Road) is a connector linking the Cortez area to destinations in Utah. County Road 10 receives substantial truck traffic and tourists traveling back and forth from Hovenweep National Monument, and is part of the Trail of the Ancients designated loop. The BLM maintains approximately 126 miles of motorized routes. This network includes two-wheel-drive accessible routes, four-wheel-drive "two-track" routes, and All Terrain Vehicle (ATV) routes. All routes in the Monument, except County Road 10 and County Road G (which are chip sealed), have a gravel or natural surface.

BLM routes provide public and administrative (agency and permittee) access to public lands and inholdings of private land within the Monument. Reasonable access is also made available to persons engaged in valid uses that include, but are not limited to the following:

- The movement of equipment and material associated with oil, natural gas, and CO₂ extraction (currently an average of 77 truck trips/day, with an estimated increase to 100 truck trips/day over the next 20 years) (Reasonable Foreseeable Development or RFD), (BLM 2005c). The 2005 RFD estimates the increase in route mileage in the Monument over the next 20 years, resulting from oil and gas exploration and extraction, will be approximately 67 miles. Currently, there are approximately 196 miles of routes for access to oil-and-gas sites.
- Access to inholdings, including:
 - private landowners, who have applied for and received ROW grants for authorized access to their property; and
 - Hovenweep National Monument land parcels within and abutting Monument boundaries, managed by the NPS, which will be considered to ensure "reasonable" access from BLM-administered lands. From the western portion of the Monument, Road 4721 and two small non-system (non-categorized) routes provide access to Hovenweep National Monument. From the eastern portion of the Monument, access occurs on County Road P.
- The movement of livestock into and out of areas permitted for grazing.

- Access for recreation uses, including camping, hunting, wildlife viewing, hiking, mountain biking, equestrian use, OHV use, archaeological site visitation, and general touring. Traffic counts at Lowry Pueblo totaled 974 vehicles from January 2004 through April 2004.

The county roads located on BLM lands in the Monument are listed in Table 3-31. These data were generated from the Monument Travel Routes GIS coverage, dated July 2004. All routes in the Monument have a gravel or natural surface, except for Montezuma County Road 10 and County Road G, which are chip-sealed. Travel system management has focused on maintaining major access routes, which generally receive most of the recreation traffic. Corrective maintenance occurs as problems are identified and as funds permit. Route construction has been limited to improving or upgrading segments of routes to enhance access and/or to alleviate maintenance or environmental problems. Route maintenance and construction has been dealt with by each respective county.

Table 3-31 County Roads Intersecting Canyons of the Ancients National Monument		
Road Name/Number	County	Length on BLM Land (miles)
4	Dolores	2.92
CC	Montezuma	1.87
10	Montezuma	7.16
P	Montezuma	0.75
N	Montezuma	5.38
McElmo Creek/G	Montezuma	0.53
TOTAL		18.61

Table 3-32 lists the routes located within the boundaries of the Monument, as presented in the San Juan/San Miguel RMP (BLM 1985). This table does not include routes that have subsequently been established for the development of oil and gas (i.e., oil, natural gas, and CO₂).

Table 3-32 Route Categories, Specifications, and Lengths Within Canyons of the Ancients National Monument			
Route Classification	Surface	Route Length	
		Feet	Miles
Primary Route Paved	Chip sealed	37,804	7.16

Table 3-32 Route Categories, Specifications, and Lengths Within Canyons of the Ancients National Monument			
Route Classification	Surface	Route Length	
		Feet	Miles
Subtotal		37,804	7.16
Primary Route, Unpaved	Gravel	43,607	8.26
Primary Route, Unpaved	Natural	27,718	5.25
Primary Route, Unpaved	Other	15,606	2.96
Primary Route, Unpaved	Soil	13,361	2.53
Subtotal		100,292	19.00
Secondary Route, Unpaved	Gravel	6,267	1.19
Secondary Route, Unpaved	Natural	17,222	3.26
Secondary Route, Unpaved	Soil	73,205	13.86
Subtotal		96,694	18.31
Tertiary Route, Unpaved	Natural	15,535	2.94
Tertiary Route, Unpaved	Soil	12,993	2.46
Subtotal		28,528	5.40
Single Track	Soil	104	0.02
Subtotal		104	0.02
Reclaiming	Soil	117	0.02
Subtotal		117	0.02
TOTAL		225,735	42.75

Routes were inventoried in the Monument to assist with the development of a transportation plan. This inventory was completed from 2000 to 2002. A comparison of the available data reveals that a far greater number of routes exist on the ground than are indicated in the

transportation plan from the 1985 San Juan/San Miguel RMP. This is the result of user-created routes which when combined with legal access routes totaled 213 miles. A more detailed discussion of access, including a description of the Trail of the Ancients Scenic and Historic Byway, is included in Section 3.3.2, Scenic and Historic Byway.

3.3. Special Designations

The FLPMA directs the BLM to consider and evaluate lands for a number of special designations during the land use planning process. In general, lands are eligible for these designations based on the presence of particular values and qualities through several different types of processes and management frameworks. Current and potential special designations in the Monument include Areas of Critical Environmental Concerns (ACECs), Scenic and Historic Byway, Research Natural Areas (RNAs), Wild and Scenic Rivers (WSRs), and Wilderness Study Areas (WSAs).

The National Landscape Conservation System (NLCS) was created in June 2000 by the BLM to protect the remote and wild character of unique places on BLM-administered lands, including Monuments, Wilderness Areas, National Conservation Areas, WSAs, WSRs, and National Scenic and Historic Byways and Trails (Appendix Q). The Canyons of the Ancients National Monument is part of the NLCS, which emphasizes the protection of entire landscapes of cultural and natural values to maintain their integrity amongst the surroundings that sustain them.

3.3.1. Areas of Critical Environmental Concern (ACECs)

The entire area of the Monument was designated as the Anasazi Culture Multiple Use ACEC in the San Juan/San Miguel RMP (BLM 1985). The ACEC was established to provide elevated levels of protection for the cultural landscape and to preserve opportunities for other identified uses, including recreation, livestock grazing, oil and gas exploration/extraction, and protection of wildlife habitat.

3.3.1.1. Regional Setting and Regulatory Framework

The Anasazi Culture Multiple Use ACEC continues to exist; however, its status is not well defined because no language was included in the Monument's Presidential Proclamation that supersedes the ACEC designation. Therefore, on an administrative level, the entire Monument remains a designated ACEC.

As part of the land use planning process, the FLPMA directs the BLM to "give priority to the designation and protection of areas of critical environmental concern" (Section 202[c][3]). The FLPMA defines ACECs as "areas within public lands where special management attention is required...to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life or safety from natural hazards" (Section 103[a]). BLM Manual 1613, Areas of Critical Environmental Concern (BLM 1988a), outlines the procedures for nominating, evaluating, and determining whether or not special management attention is required for potential ACECs. The BLM is directed to develop ACEC management prescriptions within land use plans (RMPs) with sufficient detail to minimize the need for subsequent ACEC management plans (BLM 1988a, 2005a).

Existing management guidance for the Anasazi Culture Multiple Use ACEC is provided in the following documents:

- the San Juan/San Miguel RMP (BLM 1985); and
- the Anasazi Culture Multiple Use Area of Critical Environmental Concern Plan, Management Guidelines, and Environmental Assessment (BLM 1986a).

The management guidance provided in these documents will be superseded by the Canyons of the Ancients Monument Final RMP.

3.3.1.2. Current Conditions and Trends

The entire Monument remains a designated ACEC. Management of the ACEC would be guided by the Monument Final RMP. There are no proposals to designate tracts of land in the Monument as separate ACECs, except where they overlap with RNAs.

3.3.2. Scenic and Historic Byway

The Trail of the Ancients Scenic and Historic Byway loops through the northern and western portions of the Monument, and consists of portions of County Road CC and County Road 10 (see Map 8).

3.3.2.1. Regional Setting and Regulatory Framework

Scenic and historic byways are a system of primitive routes that pass through public lands with high scenic or public-interest value. The Trail of the Ancients Scenic and Historic Byway was designated by the State of Colorado in 1998.

The byway is managed via a Corridor Management Plan. The Trail of the Ancients Scenic and Historic Byway Amended Corridor Management Plan establishes the vision and goals for preservation and use of the byway (Friends of Trails of the Ancients 2001).

3.3.2.2. Current Conditions and Trends

The Trail of the Ancients Scenic and Historic Byway provides access to a number of examples of Ancestral Puebloan culture and scenic vistas of Colorado Plateau geology and ecology. The byway is located in Colorado, Utah, and Arizona. Efforts are currently underway to include routes in northwestern New Mexico.

The portion of the byway that is situated in the Monument links U.S. Highway 491 with Hovenweep National Monument.

3.3.3. Research Natural Areas (RNAs)

The McElmo Research Natural Area (RNA) is the only RNA designated in the Monument. The RNA consists of approximately 427 acres and is located in Bridge Canyon (see Map 8). The BLM, in cooperation with Fort Lewis College, designated the RNA to provide an area for herpetological research and habitat protection.

3.3.3.1. Regional Setting and Regulatory Framework

RNAs are considered types of ACECs and are thus subject to the same designation process. The McElmo RNA was designated in March 1986 through the San Juan/San Miguel RMP

(1985) and has the dual designation of an Instant Study Area, which is managed, as a Wilderness Study Area.

3.3.3.2. Current Conditions and Trends

The principal use of the RNA is the study of indigenous reptile species (herpetology). A proposal to expand the RNA is being considered as part of this planning process.

3.3.4. Wild and Scenic Rivers (WSRs)

There are no designated Wild and Scenic Rivers (WSRs) in the Monument. The BLM has initiated a review of all waterways in the Monument for possible WSR designations.

3.3.4.1. Regional Setting and Regulatory Framework

Congress enacted the Wild and Scenic Rivers Act (WSRA) in 1968 to preserve a river's free-flowing condition, water quality, and outstandingly remarkable values. The most important provision of WSRA governs protecting rivers from the harmful effects of water resources projects. To protect free-flowing character, the Federal Energy Regulatory Commission (which licenses non-Federal hydropower projects) is not allowed to license construction of dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works on or directly affecting WSRs. Other Federal agencies may not assist by loan, grant, license, or otherwise any water resources project that would have a direct and adverse effect on the values for which a river was designated.

The WSRA also directs that each river in the National Wild and Scenic Rivers System (National System) be administered in a manner that protects and enhances a river's outstanding natural and cultural values. It allows existing uses of a river to continue and future uses to be considered, as long as the existing or proposed uses do not conflict with protecting river values. The WSRA also requires building partnerships among landowners, river users, tribal nations, and all levels of government.

The WSRA requires determinations to be made regarding a river's eligibility, classification, and suitability. Eligibility and classification represent an inventory of existing conditions. Eligibility is an evaluation of whether or not a river is free-flowing and possesses one or more outstandingly remarkable value(s). If found eligible, a river is evaluated regarding its current level of development (water resources projects, shoreline development, and accessibility) and a recommendation is made that it be placed into one or more of three classes: wild, scenic, or recreational.

3.3.4.2. Current Conditions and Trends

Several waterways in the Monument have been analyzed for inclusion in the National System. Table 3-33 summarizes the waterways that have been determined to be eligible for further analysis. None of these rivers, however, were found to be suitable for inclusion in the WSR system (Appendix B).

Table 3-33 Wild and Scenic River (WSR) Eligibility Summary					
Waterway Reviewed	Free Flowing	Outstanding Remarkable Values on Public Lands	Eligible	Tentative Classification	Stream Segment length (miles)
Cross Canyon	Yes	Yes - Cultural	Yes	Scenic	19.9
Hovenweep Tributary	Yes	Yes - Cultural	Yes	Scenic	1.2
Sandstone Canyon	Yes	Yes - Cultural	Yes	Scenic	4.2
Bowdish Canyon	Yes	Yes - Cultural	Yes	Wild	5.3
Sand Canyon	Yes	Yes – Recreation	Yes	Wild	5.2
Yellowjacket Canyon	Yes	Yes-Fishery	Yes	Scenic	28.9

3.3.5. Wilderness Study Area and Citizens' Wilderness Proposal Area

There are no designated Wilderness Areas in the Monument. There are three Wilderness Study Areas (WSAs) in the Monument, plus the RNA, which is also a WSA. Acreages for WSAs described in this document do not include the RNA, which is analyzed separately. WSAs include the Cross Canyon WSA, the Squaw/Papoose Canyon WSA, and Cahone Canyon WSA (see Map 8). The Cahone Canyon WSA is situated entirely within the boundaries of the Monument. The Cross Canyon and Squaw/Papoose Canyon WSAs extend beyond the western boundaries of the Monument into Utah. In addition, there are two Citizens' Wilderness Proposal Areas (CWPA): Mares Tail Canyon and Cross Canyon.

3.3.5.1. Regional Setting and Regulatory Framework

Wilderness provides undeveloped Federal land in a natural condition, without permanent improvements or human habitation, which has outstanding opportunities for solitude or a primitive and/or unconfined-type of recreation. In addition, a wilderness must consist of at least 5,000 acres of land or be of sufficient size to make its preservation and use practical. Wilderness may also contain ecological, geological, or other features of scientific, educational, scenic, and/or historical value. The original wilderness inventory of BLM public lands was performed pursuant to Sections 201 and 603 of FLPMA, beginning in 1978. This process involved evaluating public lands to determine and locate areas containing wilderness characteristics that meet the criteria established in the Wilderness Act.

Areas identified as WSAs are to be managed under the Interim Management Policy until they are designated as Wilderness or until they are released by Congress. Land use plans are given the task of identifying management direction for WSAs, should they be released from Wilderness consideration by Congress (BLM 2005a). The three WSAs in the Monument were determined in 1981 to be suitable for designation as Wilderness Areas by Congress.

Colorado citizens began exploring pristine public wildlands in the late 1950s to map and catalog locations that qualify as potential wilderness areas. With the passage of the Wilderness Act, citizens focused their inventory efforts on documenting wildlands that met the definitions set forth in the Act, such as opportunities for solitude and non-motorized recreation, relatively unnoticeable signs of human work, and features of ecological or scientific value. These inventories included photographs, maps, and records. Colorado citizen groups, now under the umbrella of the Colorado Wilderness Network, continued their field inventory efforts during the 1990s and early 2000s. The Colorado inventory effort utilized the Forest Service’s standard definition of a “road” and applied a formal set of protocols and rigorous data standards. Citizen’s inventories were performed in the field by volunteers and expert professionals using the latest technology: Global Positioning System (GPS) units and Geographic Information Systems (GIS) mapping. This complete and intensive data-collection project has led to a more accurate account of truly roadless areas in Colorado. The inventory of wilderness characteristic areas in the Monument was conducted in 2003-2004. Areas were identified that met wilderness criteria. To date, no decisions have been made regarding these areas.

3.3.5.2. Current Conditions and Trends

Table 3-34 summarizes the WSAs and the Citizens’ Wilderness Proposal Areas (CWPA) in the Monument.

Table 3-34 Existing Wilderness Study Areas (WSAs) and Citizens’ Wilderness Proposal Areas (CWPA)			
Wilderness Study Area	Acreage in Monument	Acreage Outside Monument	Total Acreage
Cahone Canyon	9,156	0	9,156
Squaw/Papoose Canyon	4,681	6,452	11,133
Cross Canyon	11,712	980	12,692
Citizens’ Wilderness Proposal Area	Acreage Outside WSAs in Monument	Acreage Outside WSAs Outside of Monument	Total Acreage
Mares Trail Canyon	157	1	158
Cross Canyon	5,066	1,958	7,024

Public access to WSAs is limited, partly because many of the WSA boundaries are adjacent to private land. However, all three WSAs have at least one access point.

Since 2002, the San Juan Mountain Association (SJMA) has been recruiting, training, and providing volunteers to monitor the Cahone Canyon WSA. In 2003, SJMA also began supporting monitoring efforts of the Cross Canyon WSA. Volunteers visit these two WSAs monthly, from different access points, and record/report activities observed (e.g., type of recreational activity occurring) and also report on the condition of WSA access signs.

The closure (and restoration) of illegal motorized two-tracks that lead into the WSAs is a constant challenge. In fall 2003, volunteers from the Colorado Environmental Coalition assisted with the closure of an illegal two-track that led into the Cross Canyon WSA. Volunteers placed deadfall over the tracks, removed the visual evidence of wheel tracks by raking them out, and installed WSA signs at the boundary. So far, this project has been successful in closing this unauthorized access to motorized and mechanized vehicles.

One of the characteristics examined during the inventory process for establishing WSAs is the opportunity offered for primitive and unconfined recreation in each area. Recreational aspects of WSAs in the Monument provide visitors the opportunity to experience remoteness while, at the same time, preserving the natural setting. The types of recreational uses within the WSAs include hiking, hunting, horseback riding, wildlife viewing, visiting archaeological sites, and dispersed camping.

As visitation to the Monument increases, and subsequently to the WSAs, there may be a need to develop more formal access to them (e.g., parking areas). Such access could be required if resource impacts and/or trespassing onto adjacent private lands increases.

3.4. Social and Economic Conditions

3.4.1. Public Safety and Law Enforcement

Public safety and law enforcement management in the Monument consists of six principal activities: addressing hazardous materials, enforcement of Colorado and Federal codes in the event of criminal actions, enforcement of Colorado codes regarding terrestrial and aquatic wildlife, fire protection, emergency medical response, and search and rescue (SAR). These activities are generally carried out under cooperative agreements among several agencies to ensure that adequate personnel can be placed in the field to cover the large agricultural areas and wildlands that characterize the vicinity of the Monument.

No hazardous waste sites have been identified either within or directly adjacent to the Monument. The principal risks to users of the Monument include collisions with commercial vehicles associated with oil and gas (i.e., oil, natural gas, CO₂), development and exploration and energy extraction, potential inhalation of hydrogen sulfide (H₂S) during oil and gas drilling and production operations, firearm accidents, and getting lost in remote areas.

3.4.1.1. Regional Setting and Regulatory Framework

At any given time, the State of Colorado has approximately eight to ten BLM law enforcement officers, four of whom are typically based within a 90-mile radius of the Canyons of the Ancients National Monument. Officers are usually stationed in Monticello, Utah; Farmington, New Mexico; Durango, Colorado; and Dolores, Colorado. In addition, there are at least four special agents in the State of Colorado, one of which currently operates out of Dolores. These agents oversee and provide assistance on felony or long-term case investigations.

The BLM has entered into Memorandums of Understanding (MOUs) with Hovenweep National Monument, the Rocky Mountain Region of the National Park Service, and the CDOW. These agreements allow Hovenweep National Monument law enforcement officers to take limited action on BLM land if they encounter a violation, and vice versa for BLM law enforcement officers on Hovenweep National Monument NPS land. The MOU with the CDOW designated

BLM law enforcement officers as Special District Wildlife Managers. These agreements allow law enforcement officers to assist with incidents on all BLM land in the San Juan Public Lands area, which includes the Monument, without concerns over jurisdiction issues.

During incidents where additional personnel are required, respondents can be requested from the U.S. Forest Service (USFS), the National Park Service (NPS), the Federal Bureau of Investigation (FBI), Immigration and Customs Enforcement (ICE), the U.S. Marshal Service (USMS), the Colorado State Patrol, the CDOW, and the San Juan County (Utah), and Montezuma County and Dolores County (Colorado) sheriffs' offices.

The CDOW is the government agency responsible for issuing hunting permits and enforcing State codes addressing terrestrial and aquatic wildlife species that inhabit the Monument. All CDOW officers are Level 1 peace officers in Colorado, which allows them to take action on BLM land if they encounter a violation. Under an MOU between the BLM and the CDOW, BLM law enforcement officers in Colorado are granted a Level 2 peace officer commission with the State of Colorado, granting BLM officers the authority to help the CDOW enforce State codes. In accordance with CDOW policy, however, enforcement under this commission is limited to fish and game violations.

Fire protection in the Monument is provided by the combination of resources described in Section 3.1.3, Fuels and Fire Management. In addition, volunteer fire departments are located in each town in the vicinity of the Monument. Response in Shared Responsibility Areas is defined in the series of cooperative agreements laid out in the Interagency Standards for Fire and Aviation Operations 2004 (published annually, USDOJ 2006a) (National Interagency Fire Center 2004). Fire detection for the wildland areas is provided by two seasonal fire lookouts: one located in Mesa Verde National Park and one located on USFS land at the Benchmark site. An additional response team, based out of Mesa Verde National Park, is operated by the Ute Mountain Ute Indian Tribe.

Search and rescue (SAR) operations are ultimately the responsibility of the U.S. Air Force (USAF). However, the USAF has delegated all aspects of search and rescue, with the exception of the use of their aircraft, to the Montezuma County Sheriff's Department. At present, there are two SAR teams composed of volunteers available for response in the Monument. One team is based in Cortez, and the second team, which is a contract canine search and rescue team, is based in Dolores.

The mandates and legal authorities that permit and regulate the policing and protection services that guard public health and safety are:

- CRS 33-1-101 (1), Authority and Mandate for Division of Wildlife;
- the BLM Manual H-9260-1; and
- the BLM Law Enforcement Plan for the Canyons of the Ancients National Monument (draft).

3.4.1.2. Current Conditions and Trends

Changing demographics and increasing local population levels will result in changing requirements for emergency services, principally in areas adjacent to the Monument, but also in the Monument. It is expected that with the combination of a growing local population and awareness of the Monument resulting in an increasing number of visitors, the number of incidents requiring police and emergency response will also increase.

3.4.2. Socioeconomics and Environmental Justice

People have been using Monument resources for at least ten thousand years and resource management strategies have changed over time. Initially, hunters and gatherers subsisted on

wild food sources; later, farmers used both wild and cultivated food sources. Modern society utilizes a variety of Monument resources including wild food (deer, elk, and small game), cultivated food (cattle and sheep grazing), fuel (firewood gathering), industrial resources (oil and gas), recreation (hiking, horseback riding, off-road/on-road 4WD vehicle travel, mountain biking, and primitive camping), and religious/cultural practices (many tribes and pueblos are culturally affiliated with the sites in the Monument and with the Monuments' landscape). In some ways, the Monument may be considered a geographic and cultural center within the socioeconomic study area. Many local and regional residents report that their quality of life is linked to the open space, vistas, cultural resources, wildlife, and recreational opportunities provided by the Monument.

The purpose of this section is to review baseline social and economic conditions in the socioeconomic study area. For this assessment, the following variables are evaluated:

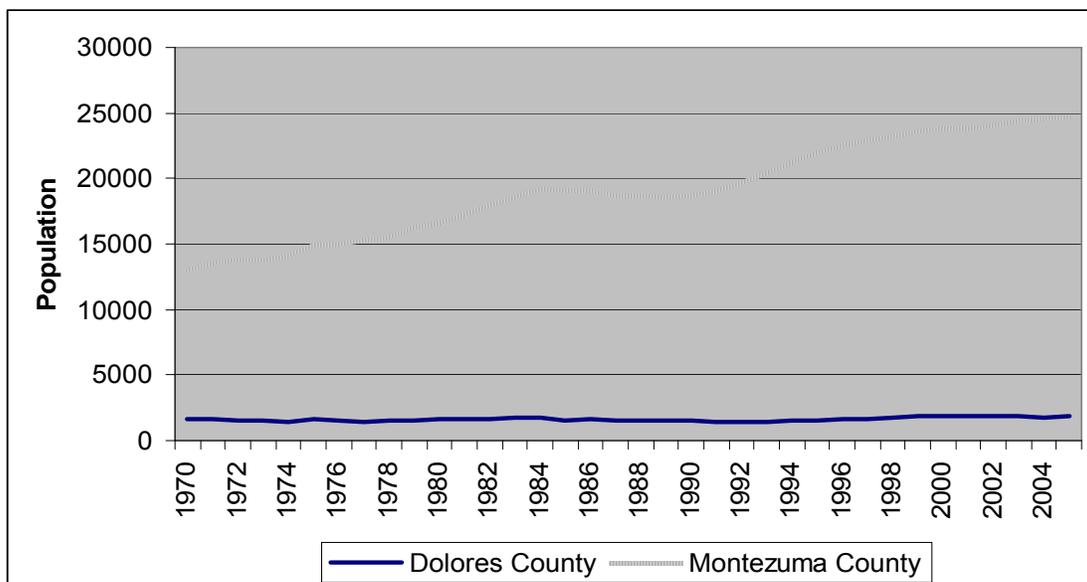
- **economic assessment:** population, employment, and personal income;
- **social assessment:** land use patterns, community resources; and
- **environmental justice:** poverty rates and minority populations.

A baseline scenario is established for each assessment and described in Alternative I (the No-Action Alternative).

3.4.2.1. Population

As defined in the AMS, the socioeconomic study area (study area) consists of Montezuma and Dolores Counties. Montezuma County is located in the southwest corner of Colorado and contains 1.3 million acres. Less than one-third of the land area in Montezuma County is privately owned. Commercial, governmental, and social activities are focused in the city of Cortez. The towns of Dolores and Mancos provide some limited tourist and resident services. Dolores is the closest town to the Anasazi Heritage Center, the primary visitor center for the Monument.

Figure 3-1 Population Trends for Montezuma and Dolores Counties



Population trends for Montezuma and Dolores Counties are illustrated in Figure 3-1 (BEA 2007). Population for municipalities in Montezuma County is shown in Table 3-35. Population growth

in Montezuma County has been faster than that in the U.S. or in the State of Colorado because of the “attractiveness of Western Slope cities to small businesses and telecommuters wanting to get away from large metropolitan areas” (Preston 2005). Preston notes that “‘relative remoteness’ and ‘reserves of natural beauty and cultural diversity’ have proven to be assets that have driven a large share of the migration to Southwest Colorado since 1970” (Preston 2005). The State Demography Office, Preston, and the AMS generally refer to this trend as “amenity migration”.

Table 3-35 Study Area Population			
Community	1990	2000	2005
Dolores County	1500	1840	1850
Dove Creek	710	700	680
Rico	160	210	240
Montezuma County	18670	23830	24860
Cortez		7980	8550
Dolores		860	900
Mancos		1120	1220

(Source: Colorado State Demography office (CSDO) 2006)

As the Montelores name hints, Dolores County is often considered together with Montezuma County. However, Dolores County has some unique challenges and opportunities that are very different from Montezuma County. Most of the residents in Dolores County rely on cities and towns outside of the county for all but the most basic services, which creates close ties with neighboring Montezuma and San Miguel Counties. Dolores County contains 674,000 acres with 42 percent private land and 58 percent State and Federal land, primarily managed by the USFS San Juan National Forest.

Dolores County is split into two distinct physical and human geographic units. The eastern part of the county surrounding the town of Rico has a high mountain character with a hard rock mining heritage. The western part of Dolores County, including Dove Creek and the areas adjacent to the Monument, was settled around dry-land farming. These agricultural roots remain strong, as Dolores County is the only county in the region to experience continued growth in agricultural employment and revenue. Recent domestic water and irrigation projects are changing this pattern. According to the AMS, a primary appeal of western Dolores County is its wide open vistas. Population for Dolores County is shown in Table 3-35.

3.4.2.2. Employment and Income

Trends for total employment and personal income in Montezuma and Dolores Counties are illustrated in Figures 3-2 and 3-3 (Bureau of Economic Analysis [BEA] 2007). Employment, income, and average wages, by sector, for Montezuma County in 2005 are shown in the Table 3-36. The unemployment rate in Montezuma County in 2005 was 5.3 percent, just slightly

higher than the State and National unemployment rates of 5.0 and 5.1 percent, respectively (Comprehensive Economic Development Strategy [CEDS] 2007).

Figure 3-2 Total Employment in Montezuma and Dolores Counties

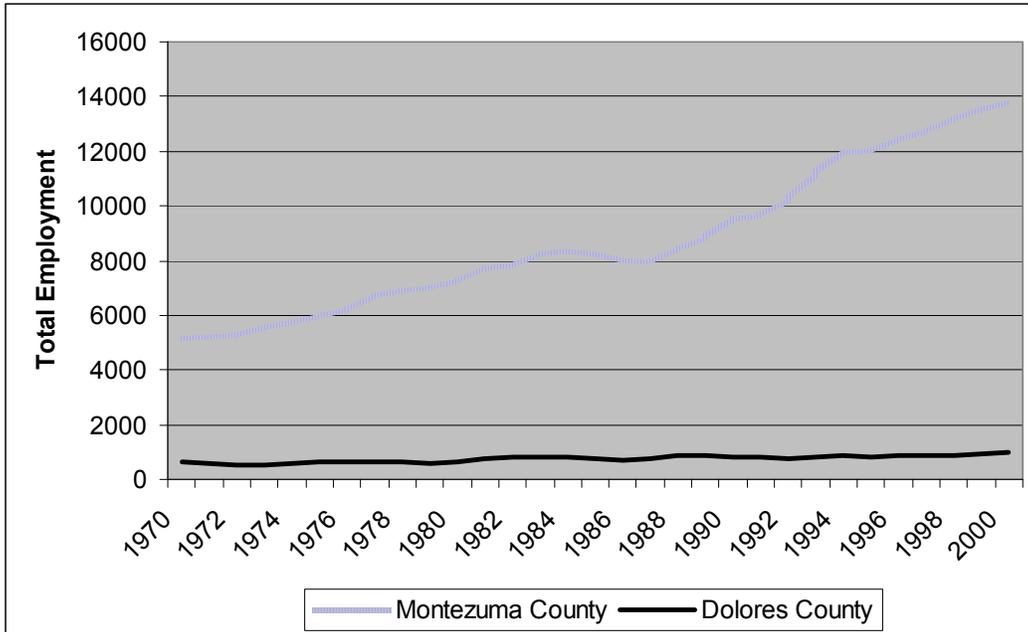


Figure 3-3 Total Personal Income in Montezuma and Dolores Counties

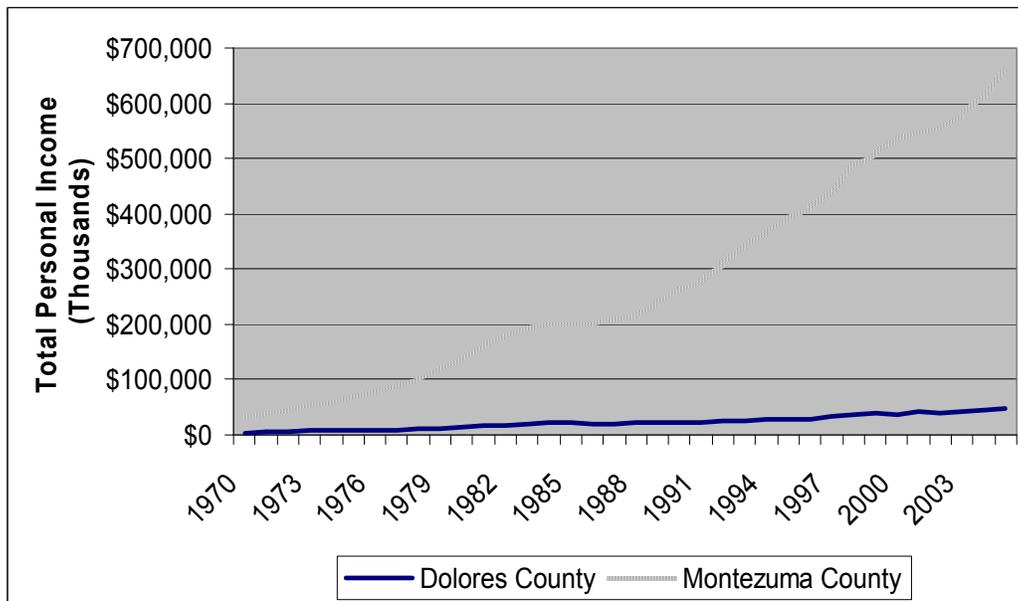


Table 3-36 Employment and Income Summary for Montezuma County 2005			
Category	Percent of Total Jobs	Average Wage	Percent of Total Income
Agriculture	7	\$8,500	2
Mining & Utilities	2	\$69,000	4
Construction	9	\$43,400	13
Manufacturing	4	\$29,400	4
Transportation & Warehousing	2	\$49,000	3
Trade	15	\$24,800	12
Finance, Insurance and Real Estate	5	\$31,400	5
Services	31	\$29,100	25
Government	25	\$37,600	32

(Source: CEDS 2007)

Total personal income is the sum of all income accruing to residents from sources such as employment income, transfer payments, dividends, interest and rent, and residency adjustments for commuters. Total personal income for Montezuma County was approximately \$687 million in 2005, and consists of employment earnings (55 percent), and payments to retirees (14 percent) (CEDS 2006). According to the AMS, the fastest growing income source is from retirees.

Dolores County's jobs and wages in 2005 are shown in Table 3-37. The unemployment rate in Dolores County in 2005 was 6.9 percent, considerably higher than the State and National rates (CEDS 2007). Total personal income in Dolores County amounted to approximately \$45.5 million in 2005. The majority of personal income comes primarily from government, service, and agriculture employment. As in Montezuma County, the fastest growing source of income is from retirees. In 2005, payments to retirees accounted for almost 17 percent of total personal income in Dolores County.

Category	Percent of Total Jobs	Average Wage	Percent of Total Income
Agriculture	27	\$4,100	5
Mining & Utilities	3	\$42,300	5
Construction	10	\$26,000	11
Manufacturing	1	\$68,200	2
Transportation & Warehousing	1	\$84,800	4
Trade	11	\$18,500	10
Finance, Insurance and Real Estate	3	\$50,000	8
Services	20	\$26,600	24
Government	24	\$29,000	31

(Source: CEDS 2007)

3.4.2.3. Economic Assessment and Key Planning Issues

There are three key planning issues that are specifically addressed in the socioeconomic analysis: oil and gas development, livestock grazing management, and recreation and transportation management. This discussion presents some of the evidence supporting the economic and social impact analysis for these key issues. Discussion of cultural resource management impacts and additional detail for other key topics is included in Appendix I.

Oil and Gas Development

McElmo Dome, one of the world's largest deposits of nearly pure CO₂, is located, in part, on Monument lands (K-M 2007). Kinder Morgan CO₂, Inc operates 44 wells that produce CO₂ from the McElmo Dome at a rate of about 1 billion cubic feet per day. This CO₂ is transported 650 miles in a pipeline to Denver City, Texas, where it is distributed for advanced oil recovery operations (BLM 2005c). In January 2007, Kinder Morgan CO₂ announced a \$200 million expansion project to increase CO₂ production and transport pipeline capacity to 1.35 billion cubic feet per day. The economic impacts associated with this project include from 150 to 200 construction jobs, five new permanent jobs, and an increase in county property tax revenues (Cortez Journal 2007).

About 90 percent of the oil and gas production in Montezuma County is from CO₂ production; therefore, oil and natural gas production have a relatively small economic impact on the study

area (Cortez Journal 2006). The relatively small oil and natural gas reserves inside the study area are mostly played out, with only three percent of estimated ultimate recovery remaining (Table 3-26). Notably, most of the land area in the Monument was leased prior to the Proclamation and is managed under existing lease agreements, although conditions of approval for new wells may change.

Jobs and income from oil and gas development are important to the study area because they increase employment diversity and offer some of the highest wages, as shown in Tables 3-36 and 3-37. In addition, Montezuma and Dolores Counties are highly dependent on tax revenues generated by CO₂ production from McElmo Dome to fund schools and other county services. In Montezuma County, property and severance tax revenues related to CO₂ production from McElmo Dome comprise almost half of all county revenues. In Dolores County, about one-quarter of total revenues are related to oil and gas development. These revenues are expected to grow significantly after 2007, when six new CO₂ production wells will be added inside Dolores County. Changes to CO₂ production or pricing have a direct impact on funding for county services and schools, comprising almost three-quarters of the counties' budgets. Therefore, management actions that would cause rapid changes to CO₂ production from McElmo Dome could have adverse socioeconomic impacts in the study area because the counties are so highly dependent on this resource. These production-related impacts could be mitigated or exacerbated by higher or lower CO₂ prices; which the BLM does not have any influence over.

Livestock grazing Management

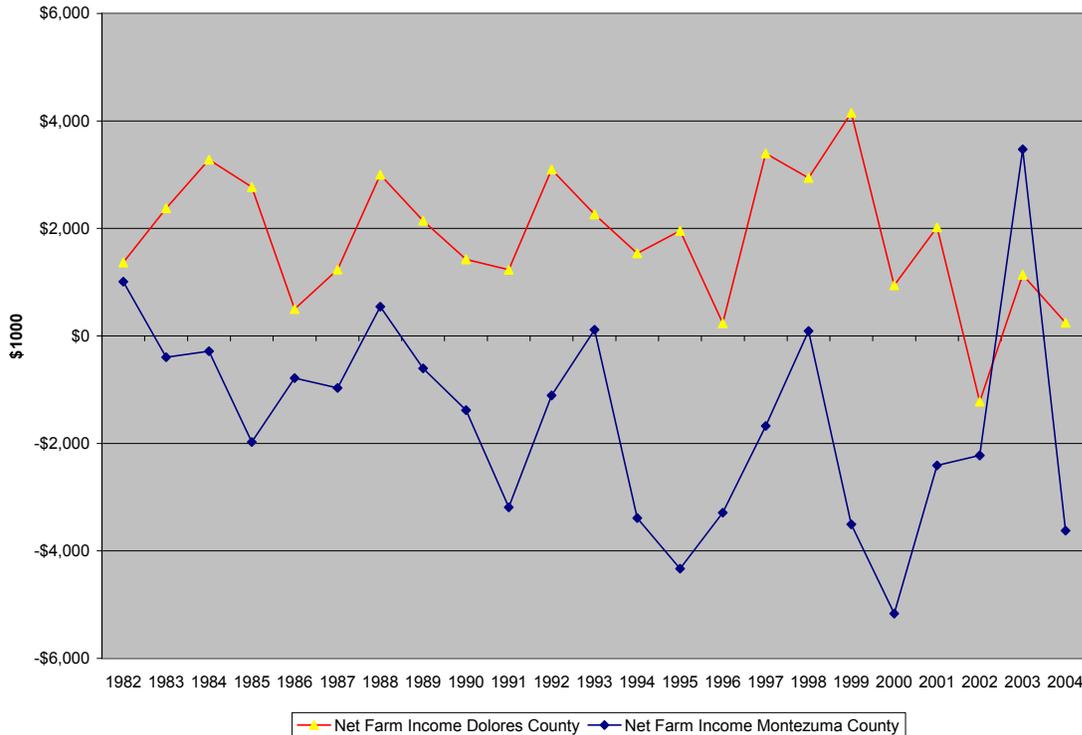
Agricultural employment and income for the study area are illustrated in Tables 3-35 and 3-36. The agriculture sector supplied over 1,000 jobs in the study area in 2005, comprising about eight percent of total employment. However, due to low average wages, agricultural jobs contributed only two percent of total income. The economic forecast for the study area predicts that the percentage of agricultural income will drop to less than one percent of total personal income during the next 20 years (CSDO 2006). Farm incomes have been trending toward the negative for the past 20 years in both counties, as shown in Figure 3-4 (CSDO 2006).

In terms of agricultural income in the study area, crops and livestock comprise about half of the total income, with government payments and other farm income, such as from custom tilling and other services, comprising the other half. In the economic analysis, management actions for livestock grazing are linked to employment, income, and population through the agricultural sector.

Recreation and Transportation Management

Recent studies of tourism employment in the study area found that 20 percent of total employment in Montezuma County and 11 percent in Dolores County are related to tourism (CEDs 2002). In Montezuma County, 12 percent of total employment is related to public lands (Colorado State Parks 2004). Furthermore, tourism generates tax income through sales and lodging taxes. In 2000, travel related sources generated six percent of State and local taxes in Dolores County, and 38 percent of these taxes in Montezuma County (Colorado State Parks 2004). Recreation and transportation management actions are linked to employment, income, and population through the tourism sector.

Figure 3-4 Net Farm Income for Dolores and Montezuma Counties



3.4.2.4. Social Assessment

The social assessment evaluates impacts to communities in the study area through changes to land use patterns and community resources. The study area is being affected by larger social trends that are changing settlement patterns and community groups throughout the study area and the southwestern United States. These include:

- **Amenity migration:** Newcomers are moving in to the area to take advantage of the unique natural resources, quality of life, and other amenities that the region offers. Many of these newcomers are retirees or second homeowners who bring along their pensions and other retirement benefits. This "new" money affects the local economy (primarily in the construction and real estate sectors) as it is spent on new homes and goods and services. As non-labor income, it also serves to diversify and stabilize total personal income in the area (CEDs 2002).
- **Land conversion:** Traditional ranching and agricultural lands are being converted to low-density rural residential subdivisions. In Dolores County, the average farm size has decreased from 1,266 acres in 1992, to 734 acres in 2002; a 42 percent reduction. Montezuma County experienced a 22 percent reduction in average farm size during the same time period, from 1,262 acres to 988 acres (Operation Healthy Communities [OHC] 2005).
- **Rising land values:** On one hand, rising land prices make it difficult for existing agricultural operations to expand and for a new generation of farmers and ranchers to get established. On the other hand, those who have land equity have seen it grow, providing forbearance and credit to ride out difficult economic times and the opportunity to sell off pieces of land when the need for cash dictates. However, land values tend to

have less impact on a family's choice to sell their ranch than retirement needs or a lack of interested heirs (Preston 2005).

In evaluating the social impacts of management actions, it is important to consider if a "tipping point" has been reached. A fundamental finding of the social landscape analysis for the study area was that open space benefits, such as unimpeded vistas, wildlife, and remote recreation are contingent, in part, on the economic viability of agriculture (Preston 2005). If farm and ranch operations remain viable, the open space benefits that they provide will be sustained. However, there are several factors that affect the rate at which privately owned agricultural lands are converted to other land uses. Some of the factors identified by ranchers and farmers include:

- increasing subdivision of surrounding agricultural land;
- residential subdivisions in agricultural areas generating conflicts with essential farm practices, such as night-time farming and aerial spraying;
- high land prices;
- negative farm income;
- uncertainty concerning potential changes in fees and stocking rates on Federal land; and
- private grazing lands for lease, which are becoming increasingly scarce (Preston 2005).

Different scenarios are possible for future land use of private agricultural properties: Scenario A) farms or ranches remain as agricultural enterprise; Scenario B) farms or ranches are sold to a buyer with the means to maintain the agricultural land use; and Scenario C) farms or ranches are subdivided into residential properties.

Scenario C is the least desirable in terms of open space, wildlife, and maintaining the rural lifestyle and quality of life in the study area. Additionally, the degradation of these amenities could reduce or reverse amenity migration. This can be documented by recent inter-regional migration from the southern part of La Plata County to Montezuma and Dolores Counties, resulting from coal-bed methane development accelerating in that area and changing the landscape. Scenario B supports open space and wildlife values, but detracts from the historical custom and culture represented by agriculture. Under this scenario, some of the enterprises and community groups supported by agriculture, such as the Farm Bureau, would fade away and erode the community resources that support the rural lifestyle. Scenario A would represent the best option for supporting both the open space amenities and the rural lifestyle because agricultural enterprises would continue to be viable and sustainable into the future.

In the study area, community resources, such as social services and community groups, are funded and organized through the counties. Montezuma and Dolores Counties are highly dependent on tax revenues generated by CO₂ production to fund schools and other county services. The quality and availability of social services in the study area are evaluated periodically by Operation Healthy Communities (OHC 2005). Results from the most recent analysis found that Montezuma and Dolores Counties are consistently below regional and State averages. These low scores are generally due to lack of services rather than to poor service quality. If CO₂ production from McElmo Dome were reduced, county social service programs would probably be cut, due to lack of funding, and would further degrade the level of social services in the study area.

3.4.2.5. Environmental Justice

As explained in the AMS, further analysis of minority and low-income populations is included in this section, identifying any proposed Federal actions that could have disproportionately high

and adverse human health and environmental effects on these populations. According to the AMS, the two types of data that must be reviewed to evaluate environmental justice effects are minority populations and income levels. Minority populations are documented in the AMS. Based on 2005 census data, the only minority population that is in a higher proportion in the area than in the rest of the State is the Native American population, which comprises 13 percent of the population of Montezuma County (CSDO 2006).

The Ute Mountain Ute Tribe has reservation lands throughout the Four Corners region, with the highest concentration of members living on the lands inside Montezuma County around Towaoc. The reservation inside Montezuma County has a population of about 1,500 people. The Ute Mountain Ute Tribe is one of the largest employers in the Four Corners area, with enterprises including the Ute Mountain Casino, Travel Center, Hotel, and RV Park; the Weiminuche Construction Authority; and the Farm and Ranch Enterprise. Recent infrastructure improvements on the reservation include a water settlement that brought irrigation water to the Farm and Ranch Project from McPhee Reservoir, as well as a major construction project to upgrade and expand the Hotel, RV Park, and Travel Center. In spite of these economic initiatives, unemployment and poverty rates on the reservation remain above those for the surrounding communities.

Income levels can be measured in a variety of ways, including the percentage of individuals living below the poverty threshold. In 2000, the entire study region had a higher rate of individual poverty than the average for Colorado, at 9.3 percent. The highest poverty level was found on the Ute Mountain Ute Reservation, where almost one-third of the population was living in poverty.